LINEMEN'S HANDBOOK

AERIAL LINES

Issue No. 4 1976

Issued to

(Name) [redacted]

(Station) [redacted]

ISSUED BY -
GENERAL MANAGER (ENGINEERING)
AUSTRALIAN TELECOMMUNICATIONS
COMMISSION

GOOD WORKMANSHIP

+

SAFETY

+

COURTESY

= GOOD SERVICE

TO ALL EXTERNAL PLANT STAFF

The Aerial Lines Handbook has been updated to help you in your work. It has been completely metricated and practices have been amended to meet the rationalisation of aerial lines materials.

It contains all the essential information you are likely to need in the construction and maintenance of aerial lines. If you require more detailed information you should consult the reference copy of Lines Engineering Instructions held in your area. EI references are included on the last page of each Section.

We have a vast investment in our skilled human resources in the external plant area. Industrial accidents take a heavy toll of our skills, cause substantial personal inconvenience and suffering, and reflect upon our operating efficiency. We all have a personal 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 particularly drawn to Section AA "Safety Precautions and Accidents." We must regard all industrial accidents as preventable and do our utmost to reduce the accident rate.

Do not regard your handbook as an ornament for display in a bookcase or as something fragile to be carefully stored in a cupboard or tool box. 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 be pleased to arrange for you to be issued with a new book.

C Taylor

General Manager, Engineering
Australian Telecommunications Commission

Issue 5, 1977

TO ALL LINEMEN

The Linemen's Handbook has been specially prepared to help you in your work as a Lineman.

It contains all the essential information you are likely to need in the construction and maintenance of aerial lines. If you require more detailed information you should consult the reference copy of Lines Engineering Instructions held at your Line Station.

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General Manager, Engineering
Australian Telecommunications Commission

Issue 4, 1976.

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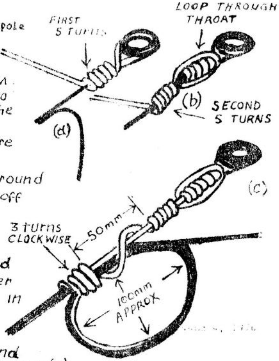
TERMINATING FITTINGS

2 mm Screw Hook S424/59 - Support up to four drop wires (See page M-3)
Drop wire Terminating Insulator (S65/19)
For attachment to steel or other non-wooden poles, a wooden block may be mounted on the pole or other locally designed fittings used.

BEARER WIRE TERMINATION

Separate steel Bearer wire from conductors for sufficient length to reach from the screw hook to the terminals in the box.
Allow 600 mm insulated Bearer wire for the termination.
Pass end of the Bearer wire around a Nylon insulator and make it off around itself with 5 tight turns as in drawing (A) then loop the running end through the throat space between termination and insulator and back for a further 5 turns as in (b) form a loop in conductor approx 100mm, Take the bearer wire back around the loop for one loose turn and complete termination with 3 turns as in (c)



SAFETY PRECAUTIONS

RESCUE PROCEDURES

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Issue 4, 1976

SAFETY PRECAUTIONS

REMEMBER!

NO JOB IS SO IMPORTANT

AND

NO SERVICE IS SO URGENT

THAT WE CANNOT TAKE TIME

TO DO IT SAFELY

SAFETY PRECAUTIONS

Safety precautions are given throughout this handbook and highlighted in footnotes on many pages.

Learn and apply these safety rules, particularly in regard to:

Erecting and dismantling poles (Section F)
Pole tests before climbing (Section F)
Loading and unloading poles (Section F)
Temporary supports for unsafe poles (Section G)
Support for poles when dismantling wire (Section E)

Use of Safety belt (Section F)
Safe use of ladders (Section F)
Erecting and dismantling wires (Section I)
Working near power wires (Section O)
Working in very hot country (Section AA)

Further safety precautions, rescue procedures and first aid practices are given in this Section.

WORK SAFELY AND MAKE SAFETY PRECAUTIONS 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 IN SAFETY.

HAZARDS WITH CUTTING TOOLS

Be careful to avoid injury when using sharp edged tools such as knives, chisels, saws, axes, adzes and brush hooks. Never cut towards your hand or body with a knife or chisel.

Store these tools with a guard over the cutting edge. This protects you from cuts and also protects the cutting edge from damage.

BEFORE USING AN AXE, ADZE, BRUSH HOOK OR HAMMER, EXAMINE IT FOR:

Loose Head.
Split, splintered or rough handle.
Split, nicked or blunt cutting edge.
Missing Wedge.
Spread or cracked eye.

IF A TOOL IS DEFECTIVE DON'T USE IT

LIFTING AND HANDLING OF MATERIAL AND EQUIPMENT

DEVELOP CORRECT PRACTICES TO AVOID INJURY - strained back muscles, slipped or ruptured spinal discs, hernia and other painful injuries result from incorrect lifting methods.

SEVEN STEPS FOR SAFE MANUAL HANDLING.

1. Position your feet correctly for balance.
2. Maintain a straight back.
3. Keep your head erect and your chin in.
4. Make the maxium use of your powerful leg muscles.
5. Obtain a proper hold on the object.
6. Keep your arms close to your body when lifting.
7. Use your body weight.

PUSHING
One foot forward to provide balance, rear foot gives thrust, back kept straight.

LIFTING
Feet apart with one foot advanced in direction of travel. Back kept straight. Lifting done with powerful leg muscles.

PULLING
Advanced leg with knee bent to give thrust, rear foot safeguards balance. Back kept straight.

WORKING IN HOT EXPOSED COUNTRY

PREVENTION OF HEATSTROKE, SUNSTROKE AND HEAT EXHAUSTION

1. ADEQUATE FLUIDS - When you are doing manual work in hot sun you need to drink 9 to 10 litres of water per day.

2. ADEQUATE SALT - Add salt tablets (S.540/46) to drinking water (Two 0.65 gram tablets or one teaspoon table salt per 2 litres).

3. SUITABLE CLOTHING - Wear a wide brimmed hat and loose light garments to allow good body ventilation.

SYMPTOMS

Heat Exhaustion

Headache, dizziness, nausea.
Muscular cramps.
General feeling of tiredness.
Profuse sweating and skin cold and clammy.
Drinking does not satisfy thirst.

Heatstroke and Sunstroke

Excitement, convulsion, delirium.
Face becomes flushed.
Skin becomes dry and hot.
Body temperature rises alarmingly.
Patient may become unconscious

TREATMENT

Heat Exhaustion

Remove to cool place and loosen clothing.
If cold, wrap in blankets.
Give plenty cool salted water to drink.

Heatstroke or Sunstroke

Remove to cool place and remove clothing.
Sponge body or spray with cold water or wrap in wet sheet and fan.
If conscious give cold water to drink.

SAFETY WHEN WORKING ON POLES

Provide a secure footing for the ladder. Tie the bottom rung to the pole if there is any danger of it slipping.
Place head of the ladder so that the chain straddles the pole.
Tie the head of the ladder to the pole immediately you climb it.

WEAR A SAFETY BELT AND HELMET WHENEVER YOU CLIMB A POLE. FASTEN IT AS SOON AS YOU REACH THE WORKING POSITION.

Don't stand on top of the ladder stiles. Get a longer ladder.

HAZARDS WITH HAND TOOLS.

HOT SOLDERING TOOLS CAN CAUSE SEVERE BURNS.

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.

Always solder with your face above the job. Falling molten solder can cause a severe burn. Don't flick solder off the tip of the tool.
Watch where you place a hot tool - it can set fire to combustible material.

SCREWDRIVERS CAN GIVE SERIOUS PUNCTURED WOUNDS.

Always use the correct size screwdriver for the job.
Make sure the blade is shaped correctly and the end blunt and square.
Don't use a screwdriver as a chisel or carry it in your pocket.
Keep your free hand away from the end of the blade so that there is no chance of injury if the screwdriver slips.

COLD CHISELS OR GADS WITH MUSHROOMED HADS ARE SAFETY HAZARDS.

Injuries are caused by hammers glancing off the head and by flying metal spinters.
Grind the head to a slight taper for safe work.

SAFETY WHEN WORKING ON POLES

A FILE OR RASP WITHOUT A HANDLE IS DANGEROUS.

The handle makes it much easier to use and prevents painful injuries.

AVOID INJURY WHEN USING CUTTING TOOLS.

Store sharp edged tools such as knives, chisels and saws with a guard over the cutting edge. This protects you from cuts and also protects the cutting edge from damage.

When handling lead (including lead covered cables) it is essential to prevent any trace of lead entering the body as it may cause lead poisoning.

DO NOT EAT, DRINK OR SMOKE WHILE HANDLING LEAD.

Wash your hands and face with soap and water and clean you finger nails with a nail brush before eating a meal 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.

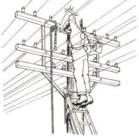
POLE TOP RESCUE

CUT AWAY WIRES TO FREE VICTIM IF NECESSARY. IF NOT WEARING RUBBER GLOVES INSULATE HANDLES OF PLIERS WITH DRY CLOTH OR PLASTIC. REGARD ALL WIRES AS BEING "LIVE" UNLESS YOU KNOW DEFINITELY THAT THEY ARE NOT.

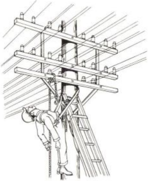
WHENEVER YOU CLIMB A POLE ALWAYS TAKE A SAFETY LINE AND ATTACH IT TO THE POLE IN ACCORDANCE WITH ENGINEERING INSTRUCTION - LINES AERIAL SP 4511 ISSUE 2.

POLE TOP RESCUE.

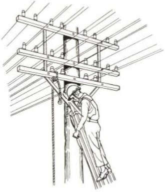
If a man is rendered unconscious by electric shock while working on a pole, his body is likely to slump against the pole and hang there by his safety belt. The belt may be prevented from slipping down the pole by a cross-arm, screw hook or other pole attachment or by the top of the ladder. These conditions are shown below.



(a) Tangled in Wires



(b) Suspended by Belt



(c) Collapsed on Ladder

POLE TOP RESCUE

His resuscitation is complicated by the problem of lowering him rapidly to the ground, bearing in mind that he may be entangled with wires which could be energised by contact with fallen power lines.

If he has fallen clear of contact with conductors which may be live, he can be safely handled and his body lowered to the ground as on Page AA-13 so that resuscitation treatment can be given as on page AA-21.

If he is still in contact with conductors it will be unsafe to attempt to lower him until the contact has been removed, or you are sure the conductors are not alive.

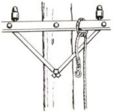
- If it is known that the contact is with Low Voltage wires, as for example where broken Low Voltage power conductors are obviously lying across the telephone lines, his body can be safely removed from contact by using suitable insulating material as shown on page AA-20.
- If the contact is seen to be with High Voltage conductors, such methods would be unlikely to protect the rescuer and it would be very dangerous to handle the body or the wires. Warn others of the danger, and contact the power authority to confirm that the High Voltage conductors have been de-energised. Only then can you safely proceed to lower him to the ground.
- If you are not sure of the source of the contact, as for instance where there are no obvious fallen or sagging power lines in sight along the route it is best to assume that the conductors are alive and make your judgement accordingly, bearing in mind that the contact may be High Voltage.

THE SAFETY LINE.

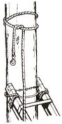
Before working on any pole the safety line (S116/38) must be secured to the pole in the manner described in this section. The procedure for lowering a body rapidly to the ground depends essentially on the safety line being secured to the pole at a suitable level above the victim so that the snap hook is supended at above chest level of the lineman in his working position. The safety line must be secured by such means that it will not slip down the pole.

Where there are crossarms on the pole to which the safety line can be secured, it should be passed over the arm and tied using a half hitch as indicated at a.

When there are no crossarms, or the crossarms are not at a suitable level, the safety line should be secured to the pole by a double turn and half hitch as indicated at b. Where practicable the safety line should be secured above a screw hook or fitting which would provide further security against the safety line slipping down the pole.



(a) SAFETY LINE TIED TO CROSSARM.



(b) SAFETY LINE TIED TO POLE.

ATTACHING SAFETY LINE TO POLE

POLE TOP RESCUE

LOWERING THE BODY.

If possible, the victim should be pushed off the ladder, giving the rescuer more freedom of movement to carry out the rescue procedure.

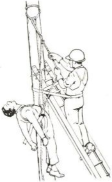
If the victim can be moved into a suitable position, commence artificial respiration at the pole top immediately he is freed from the "live" wires. As it is normally difficult to perform artificial respiration for long periods in this position, give him 4 quick breaths (mouth-to-mouth or mouth-to-nose) see page AA-15, lower him to the ground as quickly as possible. However, if the victim shows signs of recovery, resuscitation should be continued longer at the pole top if a safe comfortable position can be obtained.

After checking that the safety line has been correctly tied to the pole, force the fall of the safety line up under the victim's body belt. (If this is difficult, then the body belt can be loosened by pulling the body belt release tag on the body belt bar buckle). The loop should be pulled through the body belt until it can be clipped over the safety line snap hook, then pull the free end of the safety line, to start taking the victim's weight.

Either cut the pole strap of the victim's safety belt, or release the pole strap snap hook. (It is usually much easier to cut the pole strap).

Holding the free end of the safety line to support the weight of the victim, quickly but gently lower him to the ground as shown. This will be quite easy even with a heavy body owing to the mechanical advantage of 2.1, and the friction which results from passing the safety line through the safety belt.

Preparing Safety Line to Lower Victim



Lowering Victim

LOWERING VICTIM TO THE GROUND

- If the victim is not breathing when he reaches the ground, lay him on his back and continue artificial respiration by giving four more quick breaths. If he shows signs of recovery, continue artificial respiration at about 10-12 breaths per minute until natural breathing is restored.

- If there are no signs of recovery after four breaths check for heart-beat by feeling for pulse in his throat, if heart-beat can be detected, recommence artificial respiration at once; if not, apply heart resuscitation (Page AA-21).

- Send for medical assistance as soon as possible. Where necessary, continue artificial respiration and first-aid treatment until help arrives.

POLE TOP RESCUE

- If the victim has recovered sufficiently to breath unaided, lay him on him his side in the coma position and encourage him to rest until placed in the care of a doctor, or suitably trained medical staff i.e. ambulance staff.

Coma position - front view

Coma position - back view.

THE COMA POSITION

Do not leave live wires that may have fallen to the ground unguarded. Warn others of their presence and arrange with the power authority for their removal.

The rescue steps are shown pictorially on pages AA-15-17.

POLE TOP RESCUE

Lineman Unconscious on ladder after electric shock.

Clear him from "live" contact and remove victim's helmet if necessary and apply artificial respiration if he is not breathing.

Tilt victims head well back and give him four quick breaths mouth to mouth or mouth to nose artificial respiration. Give more breaths if in a safe comfortable position.

POLE TOP RESCUE

Force safety line under victims body belt and clip over safety line snap hook.

Take victims weight on safety line & either cut or unfasten the pole strap of the victims safety belt. If preparations for lowering take more than 1 minute give him four more quick breaths.

Lowering Victim

Continue Artificial Respiration
on the ground

If victim can breath unaided, place him in the coma position to rest until arrival of Medical Aid.

POLE TOP RESCUE

ASSISTANCE BY OTHER STAFF MEMBERS.

The rescue procedures outlined can be carried out single handed. When other men are available they can assist by:

- Erecting a ladder on the opposite side of the pole for another man to help free the victim and get him into a position for lowering.
- Taking the weight on the safety line from the ground and assisting to lower the victim.
- Sending for medical assistance.
- Warning other linemen who may be working on the route.
- Keeping the public clear of any fallen wires.
- Requesting the electricity authority to cut off the power.

Where necessary members of the public may be requested to help in the last four items.

REPORTING ACCIDENTS.

As soon as possible the accident must be reported to a supervising officer. In country districts it may be quicker to advise the nearest Postmaster or Technician. The supervising officer must immediately check that medical assistance has been despatched and then notify the electricity authority (where the accident was caused by power wires), the Police and the Senior Engineer.

PRACTICE DRILL.

To make a rescue satisfactorily, speed is essential and this will only be obtained with sufficient practice. Every lineman must therefore practice rescue drill as frequently as circumstances permit, to enable him to become proficient.

ELECTRICAL ACCIDENTS - RESCUE PROCEDURES

RESCUE STEPS

- FREE VICTIM FROM CONTACT WITH LIVE WIRE OR EQUIPMENT IF HE IS STILL TOUCHING IT. Switch off power if possible. Call for assistance from fellow linemen or the public. Every second of delay in freeing him greatly reduces the victim's chances of recovery.
- COMMENCE RESUSCITATION IMMEDIATELY IF VICTIM IS NOT BREATHING. Continue without interruption until he breathes naturally or a doctor declares life extinct.
- SEND FOR MEDICAL ASSISTANCE AS SOON AS POSSIBLE

WHEN FREEING VICTIM FROM LIVE WIRE INSULATE YOURSELF AGAINST ELECTRIC SHOCK.

- Wear rubber gloves or wrap your hands with several thicknesses of plastic or dry cloth, or:
- Wear rubber boots or stand on a rubber mat, dry timber, dry clothing or plastic.
- Push or pull victim away from wire or wire away from victim with dry rope, safety belt, plastic cable, drop wire, dry timber or other insulating material.

For low voltage use a combination of two items wherever possible. If the contact is seen to be with high voltage conductors, such methods would be unlikely to protect the rescuer and it would be very dangerous to handle the body or the wires. Warn others of the danger, and contact the power authority to confirm that the high voltage conductors have been de-energised.

FREE THE VICTIM BY THE QUICKEST MEANS USING AVAILABLE EQUIPMENT AND WITHOUT ENDANGERING THE RESCUER

HEART-LUNG RESUSCITATION

Electric shock, suffocation by smoke or gas, drowning or heart attack, can stop both breathing and heart action. Death may follow within a few minutes.

The rescuer must take over the role of lungs and heart in providing the two things necessary for life. AIR and BLOOD CIRCULATION. This is done by **EXPIRED AIR RESUSCITATION** and **HEART RESUSCITATION** without delay - **EVERY SECOND COUNTS.**

A good knowledge of heart-lung resuscitation may enable you to save the life of a workmate or even a member of your own family. Study the following pages so that you become familiar in every aspect of Heart-Lung Resuscitation.

TO INFLATE LUNGS

- CLEAR THE MOUTH AND THROAT. Lay victim on his back on a firm surface and quickly wipe any foreign matter from his mouth and throat.
- TILT HIS HEAD BACK. Lift his head and tilt it back as far as possible to open the airway to his lungs. If immediately available place a pad of clothing or similar material under the victim's shoulders to raise the approx 50 mm. Do not waste time looking for something.
- **INFLATE HIS LUNGS** Blow air into his lungs through his mouth or through his nose.
- MOUTH TO MOUTH METHOD. Pinch his nose between thumb and forefinger to seal it. Take a deep breath, open your mouth widely, Place it over his mouth and blow steadily.

CHECK AT REGULAR INTERVALS THAT YOUR SAFETY LINE IS IN GOOD CONDITION

HEART—LUNG RESUSCITATION

- MOUTH TO NOSE METHOD Hold his mouth closed; take a deep breath, open your mouth widely, place it over his nostrils and well on his nose and blow steadily.
- LET HIM BREATHE OUT Watch his chest, when it rises remove your mouth, listen to the air being exhaled. When the flow of air stops blow in again.
- RATE OF INFLATING LUNGS Give victim four deep breaths at a rapid rate then continue at about twelve breaths per minute until natural breathing is restored.

GAUGING AMOUNT OF BREATH REQUIRED.

Blow forcefully for adults, gently for children, use only cheek puffs for infants. Blow steadily until you see victim's chest expand. Don't blow too hard or force more air into him than is required to fully inflate his lungs, as it serves no useful purpose and may enter his stomach. Do not attempt to expel air from the stomach by pressing on the abdomen, as this may empty the stomach contents into his throat and block his air passage.

If chest does not rise when you blow.

If attempting mouth-to-nose resuscitation change to mouth-to-mouth, or vice versa. Increase backward head tilt. Place two fingers behind angle of lower jaw near lobe of the ear and push it forward so that lower jaw tends to overlap upper. If necessary hook a thumb over lower teeth or gum and lift jaw forward.

If still unsuccessful look for a foreign body in victim's throat. Attempt to dislodge it by shaking victim or slapping him firmly on the back.

HEART—LUNG RESUSCITATION

If patient is breathing faintly.
Assist natural breathing by blowing in at the moment he inhales and then take your mouth away to permit him to exhale. Even if heartbeat returns it may be necessary to assist breathing.

When victim commences to breathe naturally.
Keep him warm and quiet and under constant observation in case heart or breathing should stop again. (See Coma position Page No. AA-14).

TO CHECK VICTIMS HEARTBEAT

- FEEL FOR PULSE IN HIS THROAT Press Pads of fingers into groove between VOICE box and muscle of neck (either side) behind Adams apple
- EXAMINE PUPIL OF BOTH EYES If pupil is enlarged and does not contract when eyelid is raised, this indicates that the heart has stopped.
- CHECK THE COLOUR OF HIS SKIN Pink Skin indicates that blood is circulating, blue tinge indicates that blood circulation has stopped.
- WHEN HEARTBEAT DETECTED Commence Lung Resuscitation immediately.
  WHEN NO HEARTBEAT DETECTED Commence Heart Lung Resuscitation immediately.

FEELING FOR PULSE

EXAMING PUPIL

HEART–LUNG RESUSCITATION

HEART RESUSCITATION

Applying chest pressure.

Use heel and hand only. Raise fingers so that no pressure is exerted on the ribs. Remember, insufficient pressure will not pump blood but too much pressure or incorrect positioning of hand may break ribs and damage internal organs. Pressure of one hand is sufficient for children and for babies use two fingers only.

RETURN OF HEARTBEAT.

Check at intervals for return of heart beat and other signs of revival such as spasmodic breathing or body movements. Even if heart beat returns it may be necessary to assist breathing. When the rythm of heart-resuscitation is broken e.g. one operator applying heart-lung resuscitation, care must be taken not to re-apply heart resuscitation if the heart beat has returned.

HEART–LUNG RESUSCITATION

CHECK is the victim clear of electric current or any dangerous situation? If not, free him quickly without endangering yourself (see page No. AA-20).

CHECK if the victim is breathing and is his heart beating? If not COMMENCE HEART LUNG RESUSCITATION If the victims heart is beating COMMENCE LUNG RESUSCITATION SEND for medical assistance as soon as possible.

LUNG RESUSCITATION

1. CLEAR MOUTH AND THROAT

   LAY VICTIM ON HIS BACK ON A FIRM SURFACE. QUICKLY WIPE ANY FOREIGN MATTER FROM HIS MOUTH AND THROAT.

2. TILT HIS HEAT BACK

   LIFT HIS HEAD AND TILT IT BACK AS FAR AS POSSIBLE TO OPEN THE AIRWAY TO THE LUNGS.

RAISE SHOULDERS TO CLEAR AIRWAY

3. INFLATE HIS LUNGS

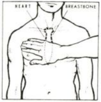
   GIVE HIM FOUR DEEP BREATHS AT A RAPID RATE THEN CONTINUE AT ABOUT TWELVE BREATHS PER MINUTE UNTIL NATURAL BREATHINS IS RESTORED.

4. APPLY HEART RESUSCITATION ONLY IF YOU ARE SURE THAT THE VICTIMS HEART HAS STOPPED BEATING.

HEART–LUNG RESUSCITATION

1. LOCATE HIS BREASTBONE

   FEEL FOR THE TOP OF THE BREASTBONE AT HIS THROAT AND THE BOTTOM AT THE "V" OF HIS RIBS. PUT THE HEELS OF YOUR HANDS ON TOP OF EACH OTHER OVER THE LOWER HALF OF THE BREASTBONE KEEPING YOUR FINGERS OFF HIS CHEST.



2A. APPLY HEART RESUSCITATION (ONE OPERATOR)

   LEAN OVER HIS CHEST KEEPING YOUR ARMS STRAIGHT. COMPRESS HIS CHEST FIFTEEN TIMES AT ONE SECOND INTERVALS. DEPRESS CHEST 35-50 mm.
   RETURN TO HIS FACE AND GIVE TWO BREATHS AFTER EVERY FIFTEEN COMPRESSIONS.

2B. APPLY HEART RESUSCITATION (TWO OPERATORS)

   AS ONE RESCUER COMMENCES ARTIFICIAL RESPIRATION THE OTHER CHECKS FOR HEART BEAT THEN APPLIES HEART RESUSCITATION IF NECESSARY. COMPRESS CHEST FIVE TIMES AFTER EACH INFLATION OF THE LUNGS WHILST THE VICTIM IS EXHALING.

3. CONTINUE HEART-LUNG RESUSCITATION UNTIL THE PATIENT REVIVES OR A DOCTOR PRONOUNCES LIFE EXTINCT.

TREATMENT FOR SNAKE BITE

ACT AT ONCE to prevent the venom spreading through the body.

If the bite is on a limb grasp the limb above the bite (above elbow or knee) by encircling the limb with your fingers and thumbs.

Do not relax your grip until a constrictive bandage has been applied above the grip. The constrictive bandage may be of rubber 75 mm wide (S.540/66) or a strip of cloth, hankerchief, tie, etc. folded to 50-75 mm wide. DO NOT USE STRING OR NARROW TUBING AS THESE MAY DAMAGE BLOOD VESSELS.

Apply the constrictive bandage to give light pressure. It must stop blood flowing back through the veins but not cut off blood flow to the limbs through the arteries. The bite will bleed freely and allow the venom to escape from the tissues with the bloodflow.

Wash or wipe the skin around the bite to remove venom. DO NOT SUCK THE BITE OR CUT IT OPEN.

Release the constrictive bandage after 30 minutes which allows fresh blood to flow to the limb. Re-apply the constrictive bandage after about ½ minute, 25 mm above or below the original position. Discard the constrictive bandage after 2 hours if antivenene has not been given.

KEEP THE PATIENT STILL. Movement helps to spread the venom through the body.

Keep him warm and give him warm tea sweetened with sugar.

Get him to a doctor as quickly as possible. If breathing fails apply artificial respiration.

YOU CAN HELP THE DOCTOR BY IDENTIFYING THE SNAKE.

If you have killed it and you are in doubt take it with you.

If the bite is elsewhere than on a limb treat the same as a bite on a limb except that a constrictive bandage cannot be applied.

FIRST AID - TREAMENT OF BURNS

TREATMENT OF BURNS.

Superficial Burns:

Where there is reddening of the skin and minor blister inflamation.

- Wash with cold running water.
- Apply cold compresses. This greatly reduces the pain and swelling.
- Cover with a clean dressing (preferably sterile) to prevent infection, and bandage firmly.

Deep Burns.

- Remove or cut away clothing over the burned area but leave any clothing that is stuck.
- Wash liberally with cold water.
- Cover the burned area with a sterile or clean dressing and bandage securely. Cover large burns with a clean sheet or towel. For burns of the face leave an adquate airway.

  NOTE: Do not apply lotions, ointments or oily dressings. Do not prick blisters.
- If the casualty is thirsty or if there is a long delay before the arrival of medical aid, give small amount of water or tea unless he is unconscious.
- Transport the casualty to medical aid without delay.

ACCIDENTS

REPORT ALL ACCIDENTS INVOLVING PERSONAL INJURY TO YOUR LINES SUPERVISOR OR LINE INSPECTOR AS SOON AS POSSIBLE AFTER THE OCCURRENCE.

An Accident Report, Form P.400, must be prepared for all accidents involving personal injury, damage to plant or equipment which could have caused injury or the contracting of a disease due to employment.

An injury which may appear only slight when it is sustained may develop into something more serious later. It is essential, therefore, that all injuries, however minor, be reported and placed on record. 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 prove that the injury was sustained on duty or when travelling to or from work by the usual route.

Treat minor cuts and abrasions immediately. What is a minor scratch today may become a major injury next week if it becomes infected.

Keep a portable First Aid Kit with your equipment and see that items used are replaced promptly.

Read your First Aid booklet and learn how to treat injuries correctly.

IT IS YOUR RESPONSIBILITY TO:

- Work safely and follow the safety rules made for your protection.
- Use the safety equipment provided by the Commission.
- Dress in a manner which will assist in protecting you from injury.
- REPORT ANY ACCIDENTS PROMPTLY.

PROTECTIVE CLOTHING

- OVERALLS AND APRONS: Overalls, bib and brace or combination are supplied in addition aprons should be worn when the load is wet, dirty or greasy. There is a tendency for loads to be held away from the body to protect the clothing. This posture results in increased loading of the back, arms and shoulder muscles causing strains.

- PROTECTIVE GLOVES. Should be worn when the materials being handled may cause injury to the hands. The gloves should be of a type suitable for the purpose.

Gloves should not be used where a critical sense of touch is required; they, should not have protruding tips which may catch on projections. GLOVES SHOULD NOT BE USED NEAR MOVING PARTS OF MACHINERY.

- PROTECTIVE PADS: To protect the palms of the hands protective pads should be used when handling heavy loads with narrow bearing surfaces which cause localised pressure on the hand.

- PROTECTIVE FOOTWEAR: Safety boots and shoes fitted with protective steel toe caps, should be worn in situations where there is a danger of foot injuries.

- PROTECTIVE GOGGLES: Used when working close to pneumatic tools especially where eye injuries can occur from flying particles.

- SAFETY HELMETS: Should be worn on all Line work operations with the exception of Cable Jointing. However, where jointers are working adjacent to other operations such as a drop-wire party, the jointer should also wear a safety helmet.

ENGINEERING INSTRUCTIONS

LINES GENERAL SP SERIES
LINES AERIAL SP SERIES

Issue 4, 1976

PLANNING POLE ROUTES

REFERENCES

PLANNING NEW POLE ROUTES

SELECTING ROUTE FOR POLE LINE.

Determine the most suitable route for the pole line along road, railway line or across private property, taking into account the following factors:-

(i) Purpose of the route, subscribers, minor trunks or major trunk lines.
(ii) Initial and subsequent cost of alternative routes.
(iii) Obstructions - swamps, rivers, etc.
(iv) Nature of country - hilly, rocky, etc.
(v) Location of power lines - crossings, paralleling, etc.
(vi) Number of lines required initially and probable development of route.
(vii) Location of exchanges.

INSPECTION OF ROUTE.

After selecting the approximate route, make a preliminary survey to decide the actual position for the pole line. Consider:-

(i) The best side of the road or railway line for the poles.
(ii) Extent of clearing necessary.
(iii) Nature of the ground for setting poles and stays.
(iv) Location of power lines. (The pole line must not cross the road from side to side. Leave one side clear for future power line construction where possible).
(v) Need for crossing private property to avoid obstructions, reduce clearing or to obtain adequate separation from power lines.
(vi) Access to route for maintenance.

Following the preliminary survey a detailed survey is necessary for trunk routes.

Take continuous measurement of the route in metres and record details of angles, obstructions etc., in a field book. Avoid angles of greater than 30° deviation of route.

SURVEYING POLE ROUTE.

Subscribers' and Minor Trunk Routes - Accurately locate the position of angles and measure distance between angle poles. Subdivide the section into spans as close as possible to the standard span length for the route (Determined by a responsible officer). Sight along route from angle to angle with a dumpy level, telescope or sighting rods to obtain correct alignment for intermediate poles. On straight routes take sights over about 400 metre sections. Drive in a wooden peg at the centre of each pole position. In built-up areas locate poles wherever possible on boundaries between allotments and not in front of gateways, doorways, directly in front of windows, or in a position where they would be a hazard to vehicular traffic.

Keep poles at least 3 metres back from the junction of property lines at street corners.

Major Trunk Routes for Multi-Channel Carrier Operation - The location of poles at equal spacing is extremely important and particular care is necessary in measuring and pegging the route. Irregularities in pole spacing result in crosstalk and must be avoided wherever practicable.

Wooden Pegs - Pegs are usually made of 50 × 50 mm hardwood 300 mm long and pointed at one end. Pegs for angle poles are painted red, transposition pole pegs yellow and other pole pegs white.

POLE SPACING.

40 metre spacing - 25 poles per kilometre - Major trunk routes.
50 metre spacing - 20 poles per kilometre - Trunk and Subscribers routes.
80 metre spacing - 12 poles per kilometre - Trunk and Subscribers routes.
100 metre spacing - 10 poles per kilometre - Subscribers' routes in rural areas carrying up to four pairs of wires. Intermediate poles at 50 metre spacing are inserted as route develops.

These standards may be varied by the responsible officer to suit local conditions and requirements or to conform with existing construction.

POLE SPACING - MAXIMUM SPAN LENGTHS.

To facilitate wire tensioning and to ensure the stability of the route, pole lines should be designed with uniform span lengths. However to avoid obstructions it will sometimes be necessary for isolated spans to exceed the normal length.

Where covered wire is erected, no special action is necessary except that where the ground clearance for wires in the isolated long span is inadequate, or the span length exceeds 100 metres, the wires should be tensioned separately and terminated at the poles on either side of the span.

The table below shows the maximum lengths for isolated spans in bare wire construction for the various wire spacings, so as to avoid wire contacts in span. Covered wire should be used for spans which exceed these lengths.

Type of Line Wire (INSULATED AND BARE)	Spacing Between Wires (Millimetres)	Normal Span Length (Metres)	Maximum Length for Isolated Spans (Metres)
All HDC wires and 2.18 and 3.07 mm CC	150 175 225 350	50 60 80 100	70 80 90 100
1.27 and 1.68 mm CC	175 350	70 100	70 100

MAXIMUM SPAN LENGTHS - ISOLATED SPANS IN BARE WIRE CONSTRUCTION.

Where 1.27 or 1.68 mm CC wires are erected beneath other sizes of wire on span lengths over 70 metres fit the arm carrying these wires 710 mm below the lowest arm carrying the larger wires.

POLE SPACING IRREGULARITIES, CALCULATION OF 'K' FACTOR. Refer E.I. LINES Aerial TN 3010.

GRADING POLE HEIGHTS.

The purpose of grading is to:-

(i) Reduce the stresses on wires, ties, arms and fittings.
(ii) Facilitate regulation of line wires.
(iii) Improve the appearance of the route.

Determine basic height of poles required taking into account any additional arms which may be required for future development of the route. Add additional height where necessary for clearance over roads, gateways, etc.

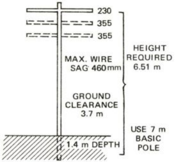
Provide Common Use poles where necessary to pick up existing power service leads. Where no power construction exists obtain requirements of common use poles from the Electricity Authority.

Adjust the height of poles so that there are no abrupt changes of grade in the route with sharp upward or downward angles in the wires. Aim for a maximum change of grade of 1 metre. In rugged country it may not be possible to achieve this, but no change of grade greater than 4 metres in 50 metre spans should be permitted.

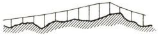
Where higher poles are required at gateways, or road crossings, grade adjacent poles with maximum change of 0.6 m per span.

Major routes are usually surveyed and a scale diagram of ground contours prepared to assist in determining correct pole heights.

Contour grading which consists of following the general contour of the country and distributing the change of grade evenly over all poles is used for all new trunk routes.



TYPICAL BASIC POLE. CALCULATION - SUBS ROUTE.



CONTOUR GRADING.

ADVICE TO STATE AND LOCAL AUTHORITIES.

Forward advice of the proposed construction to the Local Authority or State Government Department concerned, on Form E717B accompanied by a sketch (e.g. parish map tracing) of the route. Give details of the alignment proposed for the pole line and the extent of clearing intended.

Ascertain from the Authority details of any proposed future road deviations or other projects which may interfere with positioning of the pole line.

ADVICE TO POWER AUTHORITIES.

Forward advice of the proposed construction to the Power Authority concerned, on Form E717B accompanied by a sketch indicating any points at which the route crosses power lines.

CONSTRUCTION IN RAILWAY RESERVES.

Notify the Railway Authority on Form E717B on each occasion that it is desired to erect a new pole route or extend an existing one in a railway enclosure.

Where the alignment for the pole route has not been specified by the Railway Authority set poles close to the boundary fence (within 1.5 metres) if possible. If a pole must be erected close to the railway track ensure that the pole, arms, wires (Including stay wires) are at least 1 metre clear of the maximum width of loading of rolling stock permitted by the Railway Authority.

The minimum height of wires permitted on railway property is 2.4 metres. Across railway tracks a height of at least 6.7 metres should be maintained.

If necessary to open a railway fence obtain permission first if practicable. Secure the fence each day to prevent stock straying on to the line. Make permanent repairs on completion of job. See "Telecom. Wires Crossing Railway Lines", Page K-8.

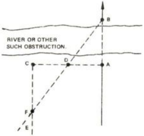
CONSTRUCTION ON PRIVATE PROPERTY.

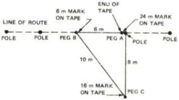
Where it is necessary to erect a pole line across private property, advise the owner of the Commission's intentions on Form E717C accompanied by a sketch plan of the route.

MEASURING DISTANCE ACROSS RIVER.

To measure distance across a river, gully etc:-

(1) Set off Line A-C, 20 metres at right angles to line of route A-B.
(2) Place a stake at D, midway on the line A-C.
(3) Set off line C-E at right angles to line A-C, F being the point at which the stake D comes in direct line with the point B.
(4) The distance C-F then equals the distance A-B.





SETTING OUT RIGHT ANGLE.

To set out a line at right angles to the route:-

(1) Place pegs in ground at A and B, 6 metres apart in line with the route.
(2) Place the end of the tape against the 24 metre mark on the tape and hold at peg A.
(3) Loop tape around peg B at the 6 metre mark.
(4) Holding tape at the 16 metre mark, draw the loop taut and insert peg C.
(5) Line A-C is then at right angles to line A-B.

AERIAL WIRES CLEARANCE ABOVE GROUND

Location	Minimum height in metres of lowest point of wire for ultimate capacity of route
Along a country road on poles not more than 1 metre from fence line.	2.4
Elsewhere along any road or across open country.	3.7
Crossing any road.	4.9
Inside railway reserve.	2.4
Crossing railway other than electric.	6.7 above rails (See Page K-8).
Crossing electric railway, tramway, or trolley bus route.	7.6 above rails or crown of road, but not less than 2 metres clearance between trolley wires and telephone wires. (See Page 0-27).
Navigable waterways.	4.9 (Subject to approval of Authority concerned).

NOTE: Minimum heights given are for maximum summer temperature and allowances should be made for variation in sag due to local seasonal temperature range (See Wire Sags, Section J).

AERIAL WIRES – CLEARANCE ABOVE GROUND

Location	Minimum height in metres of lowest point of wire for ultimate capacity of route
Above gateways, entrances, etc.:-	
(i) Not normally used by vehicles of high loading, e.g., suburban house driveways, paddock entrances for livestock, etc.	3.7
(ii) Used regularly by vehicular traffic, particularly trucks or other forms of high loading, e.g., entrances to stores, warehouse, etc., main entrances to farms or stations.	4.9

NOTES:

(i) In determining height of wires over entrances, gateways, etc., the governing factor should be, that the free use of the land is not obstructed more than is necessary

(ii) Where loading ramps for sheep and cattle are erected on farms and stations close to the boundary fence, a minimum clearance of 4.9 metres should be allowed.

(iii) For clearances from electric Light and Power Construction see Section O.

DEFINITIONS:

Wires - any form of aerial wire, stay wire or aerial cable.

Roads - formed roadways, or where no formed road exists, any track open to the public and regularly used for vehicular traffic.

PREPARATION OF FIELD BOOKS

NEW POLE ROUTES OR RECONSTRUCTION OF EXISTING ROUTES.

Survey Field Books (Form E97) to record:-

(1) Continuous measurement of route in metres. Section pole to Section pole for trunks. (Note: Form E63 should be used to record continuous route measurement when respacing pole routes).
(2) Position of angles in route.
(3) Position of obstructions (watercourses, bridges, roads, etc.) which would interfere with pole location.
(4) Position, height and voltage of power lines crossing or closely paralleling route.
(5) Distinguishing features which would assist in identifying location of poles, e.g. road and street names, kilometre posts, culverts and bridges, cuttings and embankments, exchanges, fences and gates, watercourses, survey marks.
(6) If portion of route is to be on private property, show points of entry and exit from property, if railway property show railway distance.

Where pole route exists show also:-

(7) Position of poles. Show angles and existing stays.
(8) Pole length and type.
(9) Pole plan of each transposition pole. Indicate position of inspan transpositions.
(10) Changes in pole plan at lead off points to subscribers or exchanges. (Show subscribers number or name of the exchange).
(11) Power wires attached to Telecom. poles, under crossings etc.

Working Field Book for Construction Party. Show in addition to above:-

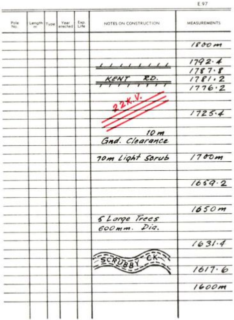
(1) Position for erection of poles.
(2) Length of each pole required.
(3) Plan of each transposition pole showing the position of transpositions.
(4) Extent of clearing required - i.e. light scrub, heavy scrub, large trees, etc. and distance from each side of pole route.

POLE ROUTE RECORD (E97).

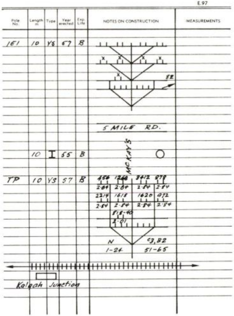
This field book is used in conjunction with the safety check field book (Form E87) by officers on route inspection or pole examination. Information to be recorded:-

(1) Summary. At back of book insert name of route or network, Lines Supervisor's district, pole plan (trunk routes), transposition scheme for each arm, total number poles, basic pole height, etc.
(2) Terminal Pole. Pole plan showing length of arms, braces, combiners, wire diameters and positions, trunk circuit numbers. Location and terminal box designation.
(3) Individual Line Poles. Appropriate symbol for each pole. Side of roadway occupied. Where pole plan changes, e.g. at subscribers lead off, give pole plan (show subs. number in rural areas). Insert length, type and year erected (if known) in columns provided. Use one page for 3 or 4 poles only.
(4) Stay poles and lead-in poles.
(5) Transposition Poles. Pole plan showing position of transposition and pole number. Transposition section number and type of section. Indicate position of inspan transpositions.
(6) Joint Use Poles. Indicate by special pole symbol. Insert E.L. pole number if known.
(7) Shored Poles. Write "shored" and year of erection of shore against pole symbol.
(8) Electric light and power attachments or crossings. Illustrate by appropriate symbol. If known, insert voltage or if voltage cannot be identified, show L.V. (low voltage) or H.V. (high voltage).
(9) Road and street names. Distinguishing features such as distance posts, bridges, rivers, survey marks etc.
(10) Where integral bearer cable or aerial cable is erected along the route, show start and finishing poles with the size of cable.

AVOID LOCATING POLES WHERE THEY MAY BE A HAZARD TO VEHICULAR TRAFFIC.

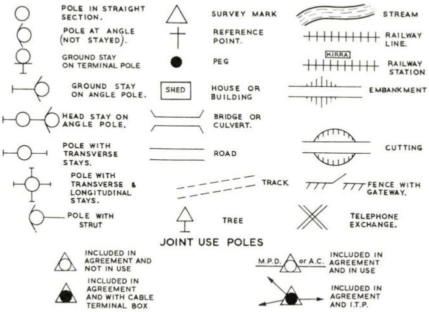


SURVEY FOR NEW ROUTE



EXISTING TRUNK ROUTE

PLAN AND FIELD BOOK SYMBOLS

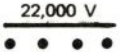


ELECTRIC POWER WIRE CROSSINGS

POWER WIRES ATTACHED TO TELEPHONE POLE.

POWER WIRES CROSSING UNDER TELEPHONE WIRES.

POWER WIRES CROSSING OVER TELEPHONE WIRES.



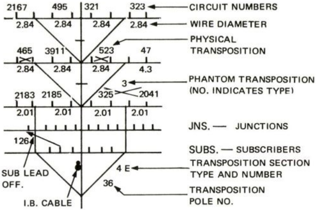
TELEPHONE WIRES ATTACHED TO POWER POLE.

STEEL POLES

STEEL BEAM

STEEL RAIL

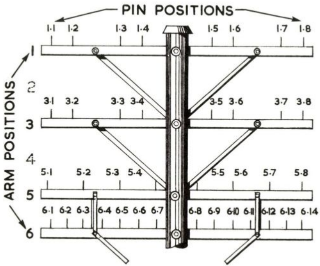
TUBULAR STEEL



POLE PLAN SYMBOLS

CIRCUIT NUMBERS & WIRE DIAMETERS SHOWN ON CABLE TERMINAL POLES ONLY

NUMBERING ARM AND WIRE POSITIONS



TRUNK ROUTES - LOOKING FROM CAPITAL CITY OR IN DIRECTION OF TRANSPOSING.
SUBSCRIBERS ROUTES - LOOKING FROM CABLE TERMINAL POLE.

WHEN WORKING ALOFT PLACE TOOLS IN A TOOL BAG, USE A HAULING LINE TO RAISE THE BAG AND ATTACH THE BAG TO AN ARM SO THAT THE TOOLS ARE ACCESSIBLE.

Issue 4, 1976.

ENGINEERING INSTRUCTIONS

LINES AERIAL A2600, 2601
2621

Issue 4, 1976

Linemens Handbook

AERIAL LINES

Amendment

Replace Section C Issue 4, 1976 with new Issue 5, 1980.

SECTION C

CLEARING TIMBER AND UNDERGROWTH

Contents:

Issue 5, 1980.

PREPARING ROUTE FOR POLE LINES

CLEARING TIMBER

Clearing of the route should be sufficient to prevent branches or leaves of trees or undergrowth contacting line wires and to avoid damage by trees or limbs falling across the route.

Where practicable the width of clearing on each side of the pole route should be :-

Major Trunk Routes (Intercapital and routes to provincial cities and large towns)- trees 12 metres, scrub and undergrowth 6 metres.

Minor Trunk Routes and Subscribers' Routes - trees 6 metres, undergrowth 3 metres,

Remove or lop tall trees (particularly dead trees) beyond the specified distance which are liable to fall and foul the wires. Avoid felling large trees which are not leaning towards the route. Careful lopping of limbs likely to interfere with the lines will often avoid the necessity to completely remove the tree.

DO NOT INTERFERE WITH BENCH MARKS OR WITH SURVEY REFERENCE MARKS ON TREES

Where there is objection to timber being felled the width of clearing may be reduced providing dangerous trees are removed and others lopped to adequately safeguard the route.

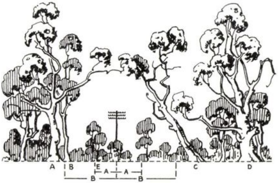
Avoid cutting ornamental trees but where this is necessary the property owner or the authority responsible for the trees should first be given the opportunity, and encouraged, to do the cutting or lopping.

Stack fallen timber clear of telephone lines, fences, standing timber and road side-drains Burn or dispose of timber to the satisfaction of the local authority or property owner as soon as possible.

KEEP CLEAR OF FALLING TREES, BRANCHES AND OF MOVING PARTS ON MACHINES.

ERECT WARNING SIGNS WHEN LOPPING OR FELLING TREES IN PUBLIC PLACES
KEEP ONLOOKERS AWAY FROM THE DANGER AREA, PARTICULARLY CHILDREN

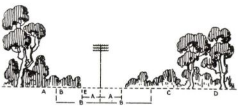
CLEARING TIMBER



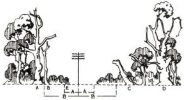
(a) Route Requiring Clearing. Trees A, B, C, D liable to fall across route.

A-A = Distance for removal of undergrowth and scrub.

B-B = Distance for removal of trees.



(b) Total Clearing
(Major trunk routes only)



(c) Partial Clearing by lopping when there is objection to extensive clearing.

CLEARING TIMBER

ADVICE TO AUTHORITIES AND PROPERTY OWNERS

Before clearing timber on a new route or widening the clearing of an existing route notify the state/local authority or property owner concerned, of the extent of felling and lopping necessary and obtain approval for the work. Use Form E717D for notice to local authorities, Road Boards, State Lands Department and Forestry Department, Form E717E for notice to proprietor or occupier of private land and where owner or occupier of private land has elected to cut trees and has failed to do so.

Preserve good public relations by meeting reasonable wishes of authorities and property owners.

SAFETY PRECAUTIONS

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 and other safety precautions used if your Supervisor considers it necessary.

CLEARING TIMBER

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 shall be given by the Lines Supervisor to alert new or less experienced party members to hazards particular to tractors and the work situation.

MANUAL FELLING

Before cutting, note the shape height and lean of the tree, the wind direction and the direction in which the tree should fall.

Make the undercut to 1/3 the diameter of the tree on the side and square with the direction in which it is desired to fell the tree.

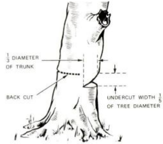
Make the back cut at least 50 mm higher than initial cut. If the tree is large use a crosscut or chain saw. Progressively drive wedges into the saw cut behind the saw if the tree is likely to settle on the saw.

With trees leaning away from the direction in which it is desired they should fall, use ropes and tackles (or winch) to ensure that the tree falls in the right direction. Where necessary use guy ropes fixed to anchors at angle points to prevent tree falling in the wrong direction.

WHEN USING MECHANICAL PLANT E.G. CRAWLER TRACTORS OR CHAIN SAWS TO CLEAR TIMBER TAKE PARTICULAR CARE TO AVOID ACCIDENTS.

Reference : LINES General SP 9142.

FELLING TREES



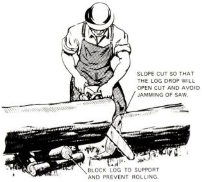
FELLING TREE UNDERCUT AND BACK CUT

Before felling tree clear work area of brush, fallen branches and other obstructions. Make sure your escape route is clear.

Make an undercut as shown above, knock the section out with the back of an axe before proceeding with the back cut.

While the tree is falling stand at the side of the butt at right angles to the direction of fall or retreat to at least 8 metres at an angle of 45° from the direction of fall.

Watch for falling branches.



CUTTING LOGS

When cutting logs block the tree to prevent it rolling.

If on a hill work on the uphill side.

Slope the cut so that the log drop will open the cut.

When stripping limbs work from the base towards the top. Watch for the spring of limbs being cut.

Don't cut limbs that are propping the log.

ALWAYS WORK SAFELY AND EFFICIENTLY AND IN THE LONG RUN THIS IS THE QUICKEST WAY.

TREE TRIMMING

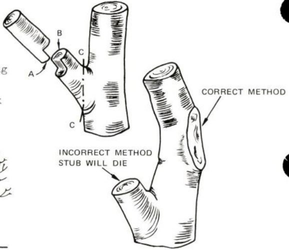
Preserve the natural appearance of trees by good trimming. When branches are removed from one side to clear telephone lines, restore the proper shape of the tree by trimming the opposite side.

Particular care should be taken when trimming ornamental trees along roadways.

Trim back the tree sufficiently so that work does not have to be repeated annually.

BEFORE TRIMMING

AFTER TRIMMING



TO REMOVE A HEAVY LIMB

When cutting large limbs care must be taken to prevent the bark and sapwood of the trunk being torn away when the branch falls.

First undercut the limb at A (see drawing above) until the saw binds. Then cut the top of the limb slightly further out at B until the limb falls. Remove the stump flush with the trunk at C. Paint or tar all cut surfaces.

CLEARING UNDERGROWTH

REMOVING SUCKERS

Remove suckers from stumps by bruising them off at their base with the back of an axe. This disturbs the bud clusters at the base of the suckers and prevents the rapid regrowth that occurs when suckers are cut off cleanly with the sharp edge of a tool.

To remove suckers at or just below ground level use a mattock (Serial 112/12).

Where suckers are bad they may be killed by first removing them in the autumn (say from February to June) and then again when they have regrown to about 300 mm in length.

CHEMICAL CONTROL OF UNDERGROWTH

The growth of scrub or undergrowth close to a pole route may be prevented or reduced by chemical spraying. Special equipment is required for spraying and the chemical used varies according to the species of undergrowth to be treated.

Do not spray close to orchards and crops. Areas that have been sprayed should not be burnt off for at least 6 months. Local authorities and property owners should be informed at the time of spraying. Generally re-spraying is desirable within 12 months.

WORKING ON PRIVATE PROPERTY

When you enter private property, identify yourself as a Telecom Lineman and explain the reason for your visit. Do not enter private property or do any work thereon in the absence of the owner or a responsible person.

Before cutting any trees ensure that proprietor or occupier of the land has been properly notified or that consent has been given.

WE MUST KNOW AND PUT INTO USE THE SAFETY PROCEDURES APPROPRIATE TO EACH JOB.
WE MUST WEAR AND USE THE SAFETY EQUIPMENT APPROPRIATE TO EACH JOB.

USE ONLY APPROVED CHEMICALS AS LISTED IN E.I. LINES GENERAL SP 9940. IF IN DOUBT REFER TO CABLE PROTECTION ENGINEER.

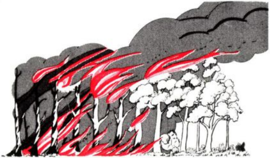
PREVENTION OF FIRE

Bush fires can cause loss of life and the destruction of stock and property, so every precaution must be taken to avoid causing them.

YOU MUST KNOW AND STRICTLY OBSERVE THE LAWS OF YOUR STATE RELATING TO LIGHTING OF FIRES PARTICULARLY DURING HIGH FIRE DANGER PERIODS. Don't throw down any lighted match, cigarette or live tobacco ash, particularly from a moving vehicle.

Don't smoke or use burning matter within 20 metres of any stable, hay stack or other flammable vegetable produce.

Don't light cooking fires closer than 8 metres to a log or stump. Use a properly constructed fireplace or other approved container and clear the ground around the fire of all flammable material to a distance of 4 metres. Extinguish all fires before leaving and cover the ashes with earth.



BURNING OFF

Before burning off undergrowth or felled timber check that, if required, a permit has been obtained and appropriate authorities notified. Observe the conditions of the permit.

Clear around undergrowth, scrub etc. for 5 to 8 metres before burning it. Always light fire on leeward side of scrub to be burn. Ensure that fire is always kept under control.

BUSHFIRES ARE USUALLY SOMEONE'S CARELESSNESS. DON'T LET IT BE YOURS.

PREVENTION OF FIRE

MECHANICAL AIDS

Tractors must be fitted with an efficient spark arrester and a hand chemical fire extinguisher. In fire danger periods a knapsack spray full of water should also be carried.

Avoid spilling fuel.

FIRE OUTBREAKS

On days of high fire danger line parties in affected areas should phone their headquarters 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. Where telephone lines are damaged give an estimate of the material required for repair work.

ASSISTANCE AT FIRES

Linemen already on the spot are authorised to assist in fire fighting for a short period to prevent serious damage to either private or public property. In other cases assistance may be given if the circumstances justify it and serious inconvenience will not be caused to Telecom.

Line staff should assist in establishing communication to nearby centres.

Telecom's mechanical plant may be used for bushfire fighting when requested by the responsible body subject to the approval of a responsible officer in Telecom or in dire cases when delay might be dangerous, by the Senior Lines Officer.

A Telecom operator is to accompany the machine in each instance.

When fighting fires expose as little skin as possible. Wear woollen clothes, long trousers, long sleeves rolled down, shirt buttoned to the neck, felt hat and leather boots.

Plan an escape route before entering the fire zone and arrange a withdrawal signal.

SURVIVAL IN A FIRE

FOLLOW THESE RULES IF TRAPPED IN A FIRE AREA:-

- Don't panic, as this seriously draws nervous and physical energy and clouds your judgement.
- Run only when absolutely necessary.
- Shield yourself from heat radiation by any means available e.g. woollen clothing, hessian bags, timber, metal etc. Do not use plastic materials.
- Take refuge in dug-outs, running streams and ponds, or elevated tanks only as a last resort.
- Limit your breathing rate when smoke is dense and await the arrival of the usually frequent small pockets of fresh air before filling your lungs. The air nearest the ground is freshest and coolest.
- Don't delay in front of flames when it is necessary to pass through them in order to escape. Cover yourself as best you can, take a few quick deep breaths and move quickly through onto the burnt area.
- Never enter flames whey they are more than 1.5 metres high or tending to "crown out" (enter the tree tops) or where the undergrowth is very dense. Most fatalities have occurred when men have attempted to enter such flame fronts.
- If you are trapped by a high wall of deep flames light a back-burn about 6 metres long and step on to the burned area. Then lie flat on the barest piece of ground, in a rut, behind a log, rocks or culvert, cover all exposed skin as best you can, if possible bury yourself, and stay there.
- Resist the temptation to run from an encircling fire front unless your chances of escape are good. If you do flee, run downhill since fire moves fastest uphill Try to work your way to the edge and rear of the fire front.
- Lungs can be partially protected by holding a wet handkerchief over your mouth and nose.

IF AT ANY TIME YOU REQUIRE ADVICE ON FIRE PROTECTION MATTERS CONTACT THE FIRE SAFETY OFFICER IN TELECOM BUILDINGS BRANCH IN EITHER HEADQUARTERS OR YOUR STATE.

Issue 5, 1980

WOODEN POLES, PRESSURE TREATED

WOODEN POLES, UNTREATED

REFERENCES

Issue 4, 1976

WOOD POLES

Wood poles are pressure treated. This treatment effectively protects the timber against attack by decay and termites. This protection lasts for long periods without any further treatment, thus increasing the life of the poles and reducing maintenance.

TYPES

Light Poles (Class Y) - For routes where the calculated wind load acting on an unstayed pole and wires will not exceed 1780 newtons.

Heavy Poles (Class Z) - For routes where the calculated wind load acting on an unstayed pole and wires will exceed 1780 newtons.

SIZES

Light Poles (Class Y)
Lengths 5 to 9 m - Supplied bored and scarfed to enable fitting of crossarms, also to be used for isolated terminal poles or stay poles.

Heavy Poles
Lengths 7 to 12 m - Supplied bored and scarfed.
Details of arm hole boring and serial and item numbers are given on page D-4.

FITTINGS

All poles are supplied with an Identification-Depth Marking Disc fitted 3 m from the butt (See page D-5).

Hardwood poles are supplied with pole caps fitted. Caps are not required on pine poles.

WOOD POLES

Determining whether Light (Class Y) or Heavy (Class Z) poles are required.

Calculate wind loading on poles as follows :

- Group conductors to their respective types and diameters.
- Find the wind load factor for each conductor grouping from the cable on page D-3.
- Multiply each conductor grouping by their respective factors and add totals together.
- Multiply the total obtained by the average length of span in metres. This value will be the wind loading on the pole in newtons (N).

If the calculated wind load exceeds 1780 N, a heavy (Class Z) pole is required.

Example : Loading under 1780 N

A pole route is to carry 4 pairs of uninsulated 2.84 HDC conductors, 4 pairs of uninsulated 2.01 HDC conductors plus 7 pairs of uninsulated 1.27 conductors.
Average span length is 50 metres.
Wind load on pole = 50 x (8 x 1.51) + (8 x 1.07) + (14 x 0.68)
= 50 x (12.08 + 8.56 + 9.52)
= 1508 N. Therefore light (Class Y) poles are suitable.

Example : Loading over 1780 N.

A pole route with 50 m Span Lengths is to carry 3 pairs of polyinsulated 2.84 HDC conductors, 2 pairs of polyinsulated 1.27 CC conductors one 1/0.90 dropwire plus one 70/0.90 IB Cable. Wind Load = 1907 N. Therefore heavy (Class Z) poles are required. Light poles are suitable for isolated terminal poles, common poles (up to 1335 N wind load), bollards provided back stays are fitted, angle poles up to 30° route deviation if correctly stayed.

FACTORS FOR CALCULATING WIND LOAD

Uninsulated Open Wire	Diameter	1.27	1.68	2.01	2.18	3.48	3.25	2.84	3.07
	Type	CC	CC	HDC	CC	HDC	HDC	HDC	CC
	Factor	0.68	0.89	1.07	1.07	1.42	1.36	1.51	1.51
Insulated Open Wire	Diameter	1.27	2.18	2.84	3.07	2.18	2.84	3.07	
	Type	CC POLY	CC POLY	HDC POLY	CC POLY	CC PVC	HDC PVC	CC PVC	
	Factor	0.89	1.51	1.81	1.92	1.92	2.29	2.29	
Drop Wire	Size/Dia.	1/0.90							
	Factor	2.38							
Integral Bearer Cable	Size/Dia.	10/0.40	20/0.40	30/0.40	50/0.40	70/0.40	100/0.40		
	Factor	5.9	6.92	8.18	9.32	10.71	13.19		
	Size/Dia.	10/0.64	20/0.64	30/0.64	50/0.64	70/0.64	100/0.64		
	Factor	7.3	9.68	10.62	13.42	15.66	18.31		
	Size/Dia.	10/0.90	20/0.90	30/0.90	50/0.90	70/0.90	100/0.90		
	Factor	9.19	12.25	14.77	18.23	21.34	24.74		

These factors are based on wind velocities of 110 kilometres per hour. In areas of extreme conditions such as cyclones, ice and snow, increase the factor by 50%.

Length	Light Poles Class Y		Heavy Poles Class Z	
Metres	Serial 120 Item	No. of Arm Holes	Serial 120 Item	No. of Arm Holes
5	73	4	-	-
6	74	4	-	-
7	75	6	93	9
8	76	8	94	11
9	77	8	95	12
10	-	-	96	14
11	-	-	97	14
12	-	-	98	14

POLE LENGTHS, SERIAL/ITEM NUMBERS AND BORING DETAILS

Poles are now purchased in metric lengths, refer to Serial List 120 for imperial lengths as some may still be in stock.

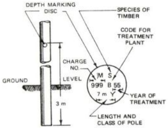
WHEN LOADING OR UNLOADING POLES, STAND WHERE YOU CAN GET CLEAR IF THE POLE SHOULD MOVE IN THE WRONG DIRECTION.

GENERAL

Do not shorten pressure treated poles as this exposes untreated timber. When attaching special fittings eg. cable boxes, remove as little treated wood as possible and treat all cut surfaces with creosote.

DEPTH MARKING DISC

Depth marking discs are set into wooden poles 3m from the butt. The disc enables the pole depth in ground to be checked and shows details of treatment.
Gold discs - indicate high temperature creosote preservative, silver discs indicate other types of preservatives.



DEPTH MARKING DISC

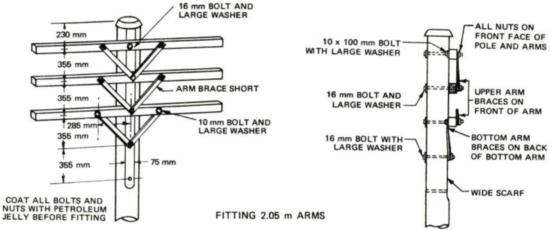
FITTING ARM BRACES AND COMBINERS

See pages D 6 & 7, for details of fitting braces and combiners. As no further purchases will be made of these items, requirements will be obtained from recoveries.

FITTING ARMS

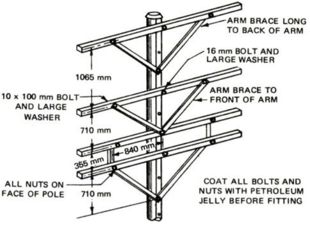
Bolt arm direct to the scarfed face of the pole (see pages D6 & 7). Fit large washers under the head and nut of all bolts. Coat all bolts with petroleum jelly before fitting. When attaching arms to a standing pole fit arms and braces from the bottom upwards. Do not support yourself on an arm unless it is secured by an arm brace or combiner.

FITTING WOOD POLES



<u>FITTING 2.05 m ARMS</u>

DO NOT SUPPORT YOURSELF ON AN ARM UNTIL IT IS SECURED BY AN ARM BRACE OR COMBINER.



FITTING 2.8 m ARMS MIXED SPACING

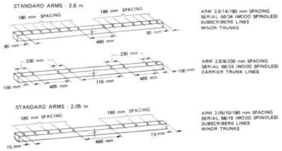
Fit Combiners only on :-

- Cable Terminal Poles.
- Poles where special attachments such as Line Protection Equipment are mounted on arms.
- Arms at 355 mm spacing.

Fit arm braces long in all other cases.

ARMS WOOD - TYPE AND SIZES

STANDARD ARMS - 2.8 m



Arm 2.8/14/180 mm Spacing.
Serial 66/34 Wood Spindles.
Subscribers Lines and Minor Trunks.

Arm 2.8/8/230 mm Spacing.
Serial 66/33 Wood Spindles.
Carrier Trunk Lines.

Arm 2.05/10/180 mm Spacing.
Serial 66/15 Wood Spindles.
Subscribers Lines and Minor Trunks.

GENERAL

All Arms are 75 x 75 mm dressed and pressure treated hardwood. They are bored for wood spindles only. When fitting steel spindles into arms use spindle bushes (S71/24-25).

TESTING ARMS

Before working on an arm, test as follows before trusting it to support you. Secure your safety belt around the pole, visually inspect the arm for decayed timber and bolts for excessive rust. Ensure arm is supported by braces or combiners. Then apply a downward pull to the arm with one hand, while safeguarding yourself with the other. If doubt exists, further test the arm by sounding it eg. striking top face of the arm with an engineers hammer or wooden mallet.

ARMS WOOD - SIDE OF POLE TO FIT

SUBSCRIBERS ROUTES - 2.05 m ARMS

Terminal Poles: Fit arms so that the terminated conductors pull arms against the pole.

Intermediate Poles: Fit arm on the side of pole away from the exchange.

TRUNK ROUTES - 2.8 m ARMS

Terminal Poles: Fit arms on side of pole away from exchange nearest the capital city and so that the terminated conductors pull arms against the pole.

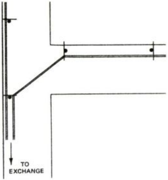
Intermediate Poles: Fit arm on the side of pole away from the exchange nearest to the capital city.

EXCEPTIONS

- Terminated Wires - Where three or more pairs of conductors terminate on the one arm, fit the arm so that the terminated conductors pull it against the pole.

- Long or Important Spans e.g. River Crossings, Deep Gullies, Railway Lines etc. Fit arms on the side of the pole away from the crossing. Terminate all conductors on each side of the span.

- Angles- Where two poles are used to take conductors around an angle, fit arms on the angle poles so that they face each other.



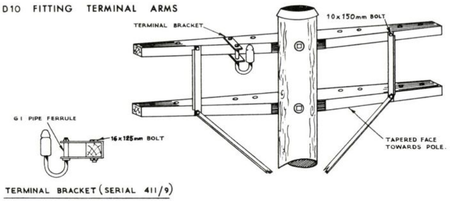
ARRANGEMENT OF ARMS AT ANGLES

ADDITIONAL ARMS ON EXISTING POLES

Fit additional arms on the same side as the existing arms.

Issue 4, 1976

ARMS WOOD – SIDE OF POLE TO FIT



TESTING ARMS.

When working on a pole, test each arm before trusting it to support you. See that the arm is supported by combiners or braces and look carefully for rusted bolts and dry rot. Secure your safety belt around pole and test arm by applying weight with one hand while safeguarding yourself with the other.

FITTING POLE STEPS

FITTING POLE STEPS (S424/1)*

Fit pole steps on cable terminal poles and poles where lowest arm cannot be reached from a ladder.

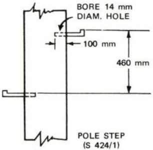
FITTING SWAN NECK SPINDLES (S71/11-20)*

Fit the top SN Spindle on the left hand side of the pole looking from the exchange, and the bottom SN Spindle on the right hand side. At transposition poles reverse the position of the SN Spindle (see Physical Transpositions Section K).

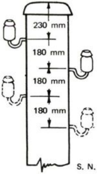
Before screwing metal fittings into a pole, apply a coating of Petroleum Jelly to the threaded portion.

* Note : No further purchase will be made of pole steps or swan neck spindles. Requirement should be met from recovered material.

DO NOT LEAVE POLES WHERE THEY WILL OBSTRUCT VEHICULAR OR PEDESTRIAN TRAFFIC.



POLE STEP
(S 424/1)



S. N. SPINDLES

ENGINEERING INSTRUCTIONS

LINES AERIAL PA1121, 3201
3202, 3601, 3621

Issue 4, 1976

STEEL BEAM POLES

STEEL RAIL POLES

TUBULAR STEEL POLES

REFERENCES

Issue 4, 1976

STEEL BEAM AND RAIL POLES

Length of Pole	STEEL BEAM POLES							STEEL RAIL POLES							
	100 x 75mm	125 x 112 mm	150 x 75mm	150 x 125 mm	175 x 88mm	175 x 100 mm	200 x 150 mm	MASS per Metre of Pole							
METRES								22kg	30kg	35kg	40kg	42kg	45kg	50kg	55kg
	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
6	1820	2050	3290	7160	4850	-	-	2000	3380	4140	5340	5520	6180	7740	8500
7	1500	1680	2720	5860	4000	-	-	1630	2780	3400	4370	4570	5060	6340	6980
8	-	-	2360	5120	3470	4760	9830	1420	2400	2980	3830	3960	4450	5560	6100
9	-	-	-	4360	2940	4000	8320	1200	2050	2540	3250	3340	3750	4720	5160
10	-	-	-	4150	-	3550	7400	-	-	-	-	-	-	-	-
11	-	-	-	-	-	3250	6720	-	-	-	-	-	-	-	-
12	-	-	-	-	-	2890	6000	-	-	-	-	-	-	-	-

MAXIMUM WIND LOAD (IN NEWTONS) PERMITTED FOR STEEL RAIL AND STEEL BEAM POLES

(See Page D-1 for method of calculating wind load)

WHEN ERECTING STEEL POLES TAKE CARE THAT POLE DOES NOT CONTACT ELECTRIC POWER WIRES

FITTING STEEL BEAM POLES

Size of Beam mm	Length of 16 mm Arm Bolt mm	Length of 16 mm Bolt for Braces mm	Steel Block for Attaching Braces	Size of Surface and Heel Plates mm	Size of Sole Plate mm	Size of U-Bolts mm
200 × 150	225	125	Large	460 × 300	225 × 225	16 × 150 × 240
150 × 125	175	125	(S424/39)	460 × 300	225 × 225	16 × 150 × 240
125 × 112	175	125	Small	460 × 300	225 × 225	12 × 120 × 150
175 × 100	175	125	(S424/38)	460 × 300	225 × 225	12 × 100 × 200
175 × 88	175	125	(S424/38)	460 × 300	225 × 225	12 × 100 × 200
150 × 75	175	125	(S424/38)	460 × 300	225 × 225	12 × 100 × 200
100 × 75	175	125	(S424/38)	460 × 300	225 × 225	12 × 100 × 130

POLE FITTINGS

The sizes of surface plates given are for good holding ground. A larger plate should be used in sand, swamp or other poor holding ground.

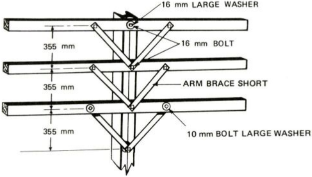
At any ground stayed pole the sole plate should be at least 225 × 225 mm. If the route is heavily loaded or in poor holding ground, use 300 × 300 mm plates.

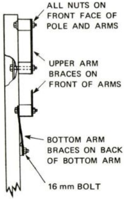
See page E-6 for heel plate details when hole is excavated by pole hole borer. Whenever practicable attach all fittings before erecting pole. If it is necessary to attach arms to a standing pole fit the bottom arm and braces first and work progressively upwards.

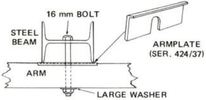
* Surface Plates 600 × 300 mm, 300 × 225 mm and Sole Plates 150 × 150 mm will no longer be purchased. If existing stocks are available they may be used.

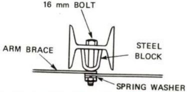
Attaching Stay Fittings - see Section G.

FITTING STEEL BEAM POLES - 2.05 m ARMS





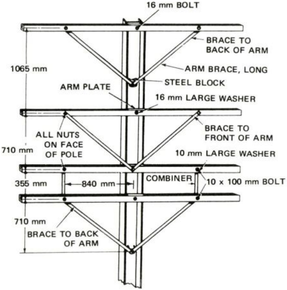




APPLY A LIBERAL COATING OF PETROLEUM JELLY TO ALL BOLTS AND NUTS BEFORE FITTING.

Fit combiners on cable terminal poles only.

FITTING STEEL BEAM POLES - 2.8 m ARMS



TYPICAL TRUNK POLE

Fit combiners only on:

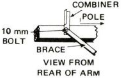
(i) Cable terminal poles.

(ii) Poles where special attachments such as Line Protection Plant are mounted on arms.

(iii) Arms at 355 mm spacing

Fit arm braces long in all other cases.

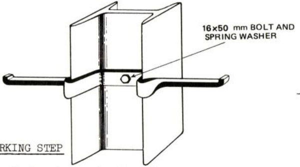
Apply a liberal coating of petroleum jelly to all bolts and nuts before fitting.



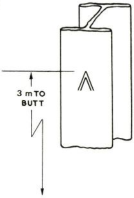
Rear of Arm

DO NOT SUPPORT YOURSELF ON AN ARM UNLESS IT IS FITTED WITH AN ARM BRACE OR COMBINER.

STEEL BEAM POLES - POLE STEPS & DEPTH MARK



FITTING WORKING STEP



Fit steps on cable terminal poles and poles where lowest arm cannot be reached from a ladder.
Where more than one step is required space at 460 mm and attach on same side of pole as crossarm.
Working steps will not be purchased in the future, but some stocks will become available from recoveries of dismantled routes.

Beam Size	Step Serial	Beam Size	Step Serial
150 x 75	424/2	125 x 112	424/4A
150 x 125	424/3	175 x 100	424/4B
175 x 88	424/4	200 x 150	424/5

POLE STEP DETAILS

DEPTH MARK 3 m FROM BUTT OF POLE

Mark poles before erection. Cut mark with cold chisel making double lines.

Make mark on side of pole most readily visible to an inspecting officer.

Issue 4, 1976.

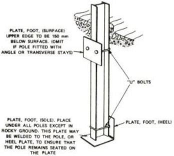
STEEL BEAM OR RAIL - POLES - FITTING FOOT PLATES

GOOD HOLDING GROUND

When excavating by pole hole borer set the pole 300 mm deeper than normal and omit the heel plate. Use the smallest auger available which will dig a hole large enough for the pole to be erected and allow for ramming.

POOR HOLDING GROUND

Use two surface plates in sand or swampy ground also fit a 460 x 300 mm heel plate (long side vertical) drill additional holes in plate for U Bolts.
At unstayed angle poles the heel plate is attached to the pole on the outside of the angle (i.e. side on which the stay would normally be fitted).
At any ground stayed pole the sole plate should be at least 225 x 225 mm. If the route is heavily loaded or in poor holding ground a 300 x 300 mm plate must be used.
On no account should the surface plate be welded to the pole, as this may weaken the pole.
See Tables page E 2 and E 7 for foot plate and U-bolt sizes for steel beams and rails.



DON'T CLIMB A POLE UNTIL ALL EARTH IS FILLED IN AND RAMMED

FITTING STEEL RAIL POLES

Rail Size Kg/metre	Length of 16 mm Arm Bolt mm	Length of 16 mm Bolt for Braces mm	Steel Block for Attaching Braces	Size of Surface and Heel Plates mm	Size of Sole Plate mm	Size of U-Bolts mm
15 Kg. Flat 20 Kg. Flat 22 Kg. Flat 25 Kg. Flat	175	125	Small (S424/38)	460 × 300	225 × 225	12 × 100 × 130
30 Kg. Flat 35 Kg. Flat	175	125	Small (S424/38)	460 × 300	225 × 225	12 × 120 × 150
37 Kg. Flat 40 Kg. Flat 45 Kg. Flat 55 Kg. Flat	175	125	Large (S424/39)	460 × 300	225 × 225	16 × 150 × 240
30 Kg. Bull. Hd. 37 Kg. Bull. Hd.	175	125)	Small	460 × 300	225 × 225	12 × 120 × 150
50 Kg. Bull. Hd.	175	) 125)	(S424/38)	460 × 300	225 × 225	12 × 120 × 150

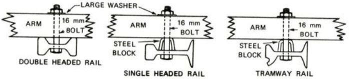
POLE FITTINGS

Surface Plates 600 × 300 mm and 300 × 225 mm and Sole Plates 150 × 150 mm will not be purchased in the future. If stocks are available they may be used. Some U-bolts have also been deleted.

Issue 4, 1976.

STEEL RAIL POLES FITTING CROSSARMS

FITTING CROSSARMS - When fitting crossarms to single headed rails and tramway rails a Steel Block is fitted between the rail and the crossarm. When a double headed rail is used, the Steel Block is omitted as the double head provides suitable seating for the crossarm. See table page E 7 for bolt and Steel Block sizes.



FITTING ARM BRACES AND COMBINERS - Similar to steel beam poles, see pages E 3 and E 4.

FITTING FOOT PLATES - See page E 6. U-Bolt and foot plate sizes see table page E 7.

DIRECTION OF RAIL WEB ON ERECTED POLES

Erected poles so that the web of the rail is at right angles to the line of route as (a) below. Wherever practicable the base of the pole should face the roadway or the direction from which markings on transposition poles are most commonly viewed. At angles the head of the rail must always face the stay.

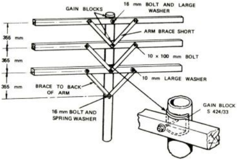
Do not erect rails with the web at an angle (b) as this reduces the strength of the pole to 1/2, or with the web in line with the route (c) which reduces the strength to 1/5 of rails erected with the web at right angles to the line of route as shown at (a).

(a) Correct. (b) Wrong. (c) Wrong.

TUBULAR STEEL POLES - DRILLED-FITTING - 2.05 m ARMS

FITTING CROSS-ARMS

To provide seating for cross-arms, a "Gain Block" (S424/33) is fitted between the cross-arm and the pole



FITTING 2.05 METRE ARMS.

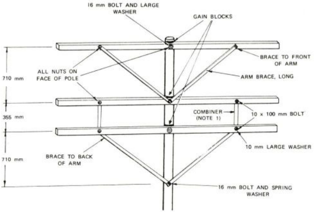
Fit combiners on cable terminal poles (8 way arm 600 mm from centre bolt, 10 way arm 675 from centre bolt).

PLACE MATERIAL AND TOOLS WHERE THEY WILL NOT OBSTRUCT VEHICLES OR PEDESTRIANS

TUBULAR STEEL POLES - DRILLED-FITTING 2.8 m ARMS

Length of 16 mm bolt for attaching arms.

Diam. of Pole	Length of Bolt
63 mm	175 mm
75 mm	225 mm
88 mm	225 mm
100 mm	250 mm



FITTING 2.8 M ARMS

Note 1. Fit combiners only on:

(i) Terminal poles.

(ii) Poles where special attachments such as Line-Protection Plant are mounted on arms.

(iii) Arms at 355 mm spacing.

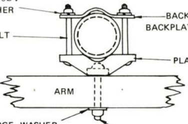
Use long arm braces in all other cases.

Apply a liberal coating of petroleum jelly to all bolts and nuts before fitting. No further purchase of arm braces and combiners will be made. Use existing stock or recoveries from dismantled routes.

WHEN ERECTING STEEL POLES TAKE CARE POLE DOES NOT CONTACT ELECTRIC POWER WIRES

TUBULAR STEEL POLES - UNDRILLED-FITTING CROSSARMS

Seating for crossarms is provided by an "Arm Seating Plate" which is clamped to the pole by a "Back Plate" and two 12 mm cup head bolts.



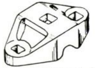


PLATE-ARM SEATING S 424/52.53.

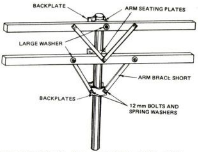
NOTE 1: Arm Seating Plates may also be used for attaching arms to drilled tubular steel poles.

ATTACHING ARM USING ARM SEATING PLATE

Use Backplate Extended where angle or transverse stays are to be attached.

Diam. of Pole where Arm Fitted	Arm Seating Plate		Backplate		Backplate Extended	
	Size	Ser/Item	Size	Ser/Item	Size	Ser/Item
Up to 80mm Diameter	Small	424/53	Small	424/19	Small	424/21
Over 80mm Diameter	Large	424/52	Large	424/18	Large	424/20

TUBULAR STEEL POLES – UNDRILLED FITTING CROSSARMS

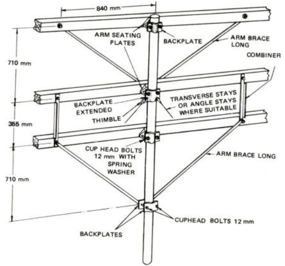


ATTACHING 2.05 m ARMS AND ARM BRACES SHORT

Check that all arms are in line before finally tightening arm and backplate clamping bolts.

NOTE 1. See page E 10 re-fitting combiners.

Coat all nuts and bolts with petroleum jelly.

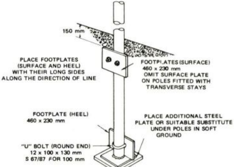


ATTACHING 2.8m ARMS AND LONG ARM BRACES AND COMBINERS

TUBULAR STEEL POLES - FOOT PLATES

In poor holding ground use a 460 x 300 mm surface plate and a 460 x 300 mm heel plate. Do not weld surface plate to pole. Use a sole plate at least 225 x 225mm where pole is fitted with a ground stay. When the hole is excavated by a pole hole borer in good holding ground, omit the heel plate and set the pole 300 mm deeper than normal. Use the smallest auger available which will dig a hole large enough for the pole to be erected and allow for ramming.

ERECT CAUTION SIGNS WHEN WORKING ON ROADWAY. PLACE MEN WITH RED FLAGS TO HALT TRAFFIC WHERE NECESSARY.



FITTING FOOT PLATES

ERECTING POLES

PRESERVATIVE TREATMENT OF POLES

LOADING AND UNLOADING POLES

REFERENCES

Issue 4, 1976

ERECTING POLES

DEPTH SETTING

Length of Pole	Depth in Soil Clay, Sand etc.	Depth in Solid Rock
Metres	Metres	Metres
5-6	1.4	1.05
7	1.4	1.05
8	1.5	1.1
9	1.6	1.15
10	1.7	1.2
11	1.8	1.25

This Table is based on the Formulae :

$$\text{Depth in Soil} = \frac{\text{Pole Length}}{10} + 700 \text{ mm}$$

$$\text{Depth in Rock} = \frac{\text{Pole Length}}{20} + 700 \text{ mm}$$

An exception to this rule is the 5-6m pole which is installed at a depth of 1.4 m in soil

For poles over 11 m, holes should be 100 mm deeper in soil and 50 mm in rock, for every metre over 11 m.

For existing imperial pole lengths the depth of setting shall be in accordance with the nearest whole metre pole length, e.g. 24 ft pole = 7.3 metres therefore the depth of hole = 1.4 m as for 7 metre pole.

Where there is a layer of soil over solid rock make the depth of the hole half the depth of the soil plus the depth shown for rock, provided this is not more than the depth for setting in soil.

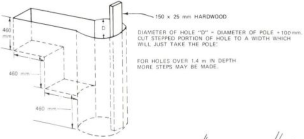
In poor holding ground set poles 150 to 300 mm deeper as necessary. Depth of setting may be further increased in areas subject to flooding, where directed by the Responsible Officer. At slight angles where heel and surface blocks would normally be fitted, the heel block may be omitted if the pole is set 150 to 300 mm deeper (see page E6).

EXCAVATING POLE HOLES

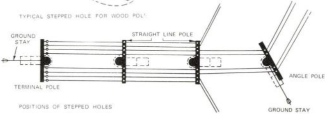
HOLES FOR MANUAL ERECTION OF POLES

Where poles are to be erected by hand excavate a stepped hole.

The steps facilitate digging and **assist in safe erection** of the pole.



TYPICAL STEPPED HOLE FOR WOOD POLE



POSITIONS OF STEPPED HOLES

USE OF POLE HOLE BORER

Pole hole borers may be truck or tractor mounted and are equipped with various sizes of augers (300,400 and 500 mm) for excavation in soil.

In some cases a smaller, 40 mm auger may be fitted for rock drilling where explosives are to be used.

The hole bored for the pole must be large enough to accommodate the pole plus space (minimum 50 mm) around the pole for refilling and ramming the earth.

Holes dug by a pole hole borer are suitable only where the poles are to be erected by mechanical means.

Where the poles are to be erected by hand a stepped hole must be prepared as illustrated on page F2 to facilitate lifting.

Keep well clear of moving parts on the pole hole borer while it is operating.

TYPICAL POLE HOLE BORER

WHEN WORKING IN THE VICINITY OF POWER LINES, POSITION THE POLE HOLE BORER SO THAT THERE IS NO POSSIBILITY OF ANY PART OF IT CONTACTING THE POWER WIRES WHILE OPERATING.

ERECTING AND DISMANTLING POLES

Where Mechanical Aids are to be used for the erection of poles, the poles should be fitted with crossarms and pole fittings provided that all safety precautions are adhered to and that the crossarms and fittings will not be a hindrance during erection.

When erecting poles by hand it would depend on the number of men available, the length of the pole, and the weight of the pole, as to whether the crossarms and fittings should be fitted prior to erection.

USE OF MECHANICAL AIDS

Use mechanical aids such as a pole Lifting Truck, Crane, Tirfor Winch etc., for erecting poles wherever practicable.

Make sure that all lifting gear, ropes, slings etc. are in good condition and of sufficient strength to handle the load. The Party Leader shall give all orders. CHECK THE LOCATION OF POWER WIRES AND TAKE PRECAUTIONS TO AVOID CONTACT WITH THEM.

ERECTING POLES BY HAND

Before lifting commences, clear the ground around the pole of everything except lifting gear. Place a backboard in position at the back of the hole. Once lifting starts, there must be NO IDLE TALK and every man must give **FULL ATTENTION** to the task in hand.

The Party Leader shall give all orders, the only others to speak being men with pikes when they require to move their pikes to a new position.

Keep the butt of the pike on the ground while lifting or supporting a pole with the arch of the rear foot behind the end of the pike to prevent it slipping.

Pike prongs must be sharp and both prongs must enter the pole.

The man handling the lifting jack or "deadman" must be experienced and reliable. Do not attempt to steady the pole against side movement by applying your shoulder to it.

Take care when a pole has a bend or bow in it as it is liable to turn thus causing the pikes to slip out with the danger of the pole falling.

Use guy ropes with poles over 11 m in length. Attach the ropes before raising the pole from the ground.

DISMANTLING POLES

Use Mechanical Aids for dismantling poles whenever practicable. Make sure all lifting gear, ropes, pikes, etc., are in good condition and of sufficient strength to handle the load.

CHECK THE POSITION OF POWER WIRES AND TAKE PRECAUTIONS TO AVOID CONTACT WITH THEM.

If Mechanical Aids are not available, the pole may be lowered by the use of Jacks and Chains, or by digging out. Guy ropes of 12 or 16 mm must be attached to the top of the pole to guide the pole down.

Do not commence digging out a pole while any workmen are on it. Support the pole by pikes while digging is in progress. Dig the manway in the direction in which it is desired to fall the pole.

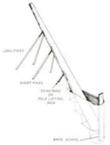
DO NOT CLIMB A POLE UNTIL IT HAS BEEN PROPERLY SET IN THE GROUND AND THE WHOLE OF THE EARTH FILLED IN AND RAMMED.

ERECTING AND DISMANTLING POLES

- THE PARTY LEADER SHALL GIVE ALL ORDERS.
- CLEAR GROUND AROUND HOLE.
- NO IDLE TALK.
- GIVE FULL ATTENTION ONCE LIFTING STARTS.
- PIKE PRONGS MUST BE SHARP.
- BOTH PIKE PRONGS MUST ENTER THE POLE.
- KEEP BUTT OF PIKE ON THE GROUND WHILE LIFTING.
- USE GUY ROPES WITH POLES OVER 11 M IN LENGTH.
- DO NOT APPLY YOUR SHOULDER TO STEADY A POLE.
- MAKE SURE ALL LIFTING GEAR IS IN GOOD CONDITION.

ERECTING POLES BY HAND

- PIKE PRINGS MUST BE SHARP AND BOTH MUST ENTER POLE.
- PLACE BACKBOARD IN POSITION AT BACK OF HOLE.
- REMOVE BACKBOARD IMMEDIATELY POLE REACHES UPRIGHT POSITION AND SECURE POLE WITH PIKES.



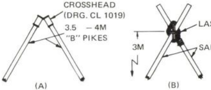
"DEAD-MAN" AND PIKES IN POSITION

POLE LIFTING JACK WITH "A" PIKE IN POSITION

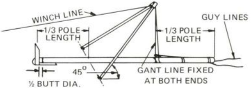
REPLACE SOIL AROUND POLE IN 150 mm LAYERS. RAM EACH LAYER TO OBTAIN PROPER COMPACTION AND LEAVE A SLIGHT MOUND AROUND POLE AND OVER MANWAY.

ERECTING POLES USING SHEER LEGS

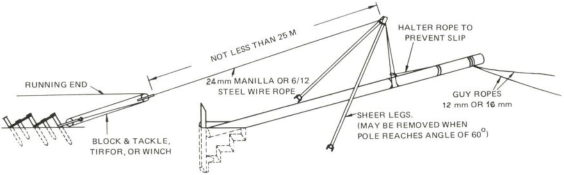
ERECTING POLE WITH SHEER LEGS



TWO TYPES OF SHEER LEGS.



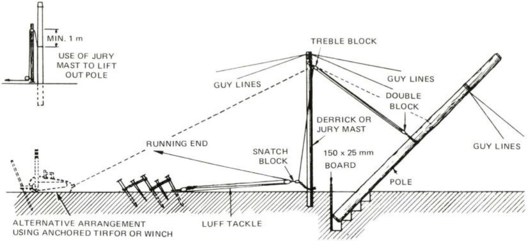
SHEER LEGS IN POSITION FOR LIFT.



POLE BEING LIFTED.

 TAKE CARE THAT THE POLE BEING ERECTED DOES NOT CONTACT POWER WIRES.

ERECTING POLE WITH DERRICK OR JURY MAST



JURY MAST IN POSITION FOR LIFTING

NOTE : 1. Suitable jury mast can be made from 5 m length 75 mm G.I. pipe fitted with 125 mm sheave block (see Dwg. CL.1019).

2. Use D shackle or snap hook at end of winch rope. Do not use an open hook unless it is properly moused. Use 12 or 16 mm manilla rope for guy lines.

DON'T CLIMB A POLE UNTIL ALL EARTH HAS BEEN FILLED IN AND RAMMED.

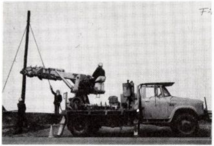
MECHANICAL POLE ERECTORS

Pole Hole borers are normally fitted with a winch to enable the boring boom to be utilised for erecting poles. Suitable mobile cranes may also be used for this purpose.

Place the winch rope around the pole just above the point of balance of the pole.

Attach guy ropes to the head of the pole to assist in controlling it during erection. Raise the pole by the winch until it is erect and guide the butt into the hole.

When the pole has been placed in the hole support it with 3 or 4 pikes spaced around the pole. Drive the prongs into the pole and set the butts firmly on the ground.



ERECTING POLE WITH POLE HOLE BORER

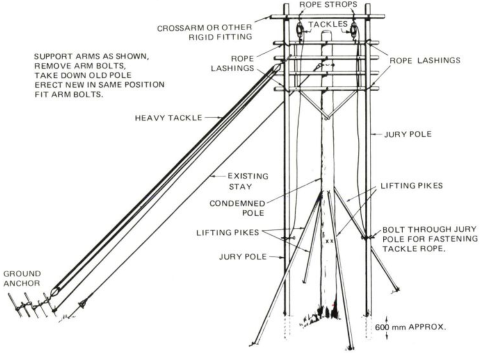
SETTING AND ALIGNING POLES

Before refilling the earth around the pole align it as follows :-

- Turn the pole so that the crossarms are at right angles to the route except at angles in the route where the crossarms should bisect the angle.
- Line up the butt of the pole in correct alignment with the route.
- Using a plumb bob in line with the route, then at right angles to the route straighten the pole until it is perpendicular.
- Replace soil around the pole in 150mm layers. Ram each layer to obtain proper compaction and leave a slight mound around the pole.

 LOOK UP AND LIVE. CONTACT WITH POWER WIRES CAN MEAN DEATH.

REPLACING ANGLE POLE USING JURY POLES



PRESERVATIVE TREATMENT OF POLES AND ARMS

TREATMENT DURING ERECTION OF POLES

Installation of wooden poles is now limited to pressure treated poles. These poles do not require the application of creosote or other timber preservative during erection.

Where a pole is cut for attachment of fittings, treat all cut faces, arm slots bolt holes etc. with creosote before attaching fittings.

Purchase of crossarms is limited to pressure treated timbers and preservative treatment is not required.

TREATMENT OF STANDING POLES

Preservative treatment of poles is the field has been shown to be an uneconimic practice which is only marginally effective in extending the service life of poles.

Creosote treatment of standing poles is therefore to be discontinued.

SAFETY PRECAUTIONS

Personnel using creosote should ensure that their eyes, skin and clothing are adequately protected by wearing overalls together with eyeshield and P.V.C. gloves. If accidentally splashed with creosote, wash off immediately with liberal quantities of water. Refer to your First Aid book for emergency treatment.

LINEMANS HANDBOOK - AERIAL LINES

PRESERVATION TREATMENT OF CROSSARMS.

Safety Precautions

Crossarms installed prior to July 1983 contained small amounts of the wood preservative Pentachlorophenol (P.C.P.). While PCP is hazardous in itself no danger exists to staff handling these crossarms if skin contact is avoided by taking the following precautions:

Handling Treated Crossarms

The following protective clothing is to be worn when work is being carried out on crossarms:-

- PVC gauntlet length gloves.
- Coverall type overalls buttoned at wrists and neck.
- Pair of boots.

Care to avoid overheating must be exercised when wearing this protective clothing in hot exposed country.

Sawing of crossarms should be avoided.

Protective Creams

The use of barrier cream is NOT recommended as PCP is oil and water soluble.

Hand Cleaning

Before eating/drinking/smoking or using the toilet staff who have handled treated poles should wash their hands and face thoroughly with soap and water. Hand cleansers should not be used.

Gloves should be washed with soap and water before removal.

Disposal of Crossarms

All crossarms removed from poles must not be burnt but buried at Council dumps.

END

MASS OF POLES

Y Class Hardwood

Length in Metres	Mass in Kilograms
5	110
6	150
7	200
8	250
9	350
10	400

Z Class Hardwood

Length in Metres	Mass in Kilograms
7	350
8	500
9	650
10	800
11	950
12	1200

Approximate Maximum Mass for Pressure Treated Hardwood Poles

Y Class Softwood

Length in Metres	Mass in Kilograms
5	80
6	110
7	150
8	190
9	250

Approximate Maximum Mass for Pressure Treated Softwood Poles.

Steel Beams

Dimensions Millimeters	Mass Per Metre
100 x 75	15 kg
150 x 75	18 kg
150 x 125	37 kg
200 x 150	52 kg

Mass Per Metre for Steel Beam Poles.

POLE TESTS BEFORE CLIMBING

DO NOT CLIMB CONDEMNED POLES UNTIL THEY ARE MADE SAFE.

Poles marked X are condemned and require replacement or shoring within 12 months. Poles marked XX are dangerous and require immediate attention. See Pages G21-22 for methods of temporarily securing condemned poles.

DO NOT CLIMB ANY OTHER POLE UNTIL YOU EXAMINE AND TEST IT.

- Check that the pole is secure in the ground. The height of the depth setting mark (3 m from base of pole) will show whether pole is set to the correct safe depth.
- Apply push or pull test to poles not fitted with transverse stays.

  Push Test - Push and rock pole as hard as you can across the line of the route with a ladder or pike (See page F15).
  Where there is only one arm of wires, or the wires or aerial cable are slack push along the line of wires also.

  Pull Test - Attach centre of rope to pole with a slip knot (clove hitch etc.). Push knot up pole as high as possible and pull on doubled rope across the line of the wires.

  If the pole is heard to crack do not climb it until it is made safe.

- Carefully examine poles fitted with angle or transverse stays

  Wooden Poles - Inspect pole at ground level and prod with a knife to detect external decay. Dig deeper if excess decay is suspected. Strike the pole with back of an axe to detect internal decay or pipes. (Drumlike sound indicates possible decay or pipes).

  Steel Poles - Examine pole for corrosion at ground level. Dig deeper if excess corrosion is suspected. Tap pole with a pointed tool to detect thin spots.

IF THERE IS ANY DOUBT REGARDING THE CONDITION OF A POLE SUPPORT IT WITH PIKES OR ROPES BEFORE CLIMBING. BE PARTICULARLY CAUTIOUS WHEN WIRES OR FITTINGS ARE TO BE DISMANTLED.

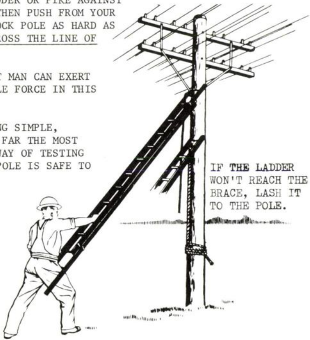
POLE TESTS BEFORE CLIMBING.

PUSH TEST

ENGAGE A LADDER OR PIKE AGAINST THE BRACE THEN PUSH FROM YOUR HIPS AND ROCK POLE AS HARD AS YOU CAN ACROSS THE LINE OF WIRES.

EVEN A LIGHT MAN CAN EXERT CONSIDERABLE FORCE IN THIS WAY

BESIDES BEING SIMPLE, THIS IF BY FAR THE MOST EFFECTIVE WAY OF TESTING WHETHER A POLE IS SAFE TO CLIMB.



IF THE LADDER WON'T REACH THE BRACE, LASH IT TO THE POLE.

REMEMBER!

PUSHING ALONG THE LINE OF WIRES IS USELESS IF THERE ARE SEVERAL ARMS BECAUSE THE WIRES ACT AS STAYS.

JUMPING ON THE LADDER ON YOUR WAY UP THE POLE IS USELESS - AND UNSAFE.

IF A POLE IS HEARD TO CRACK, DON'T CLIMB IT UNTIL IT IS MADE SAFE.

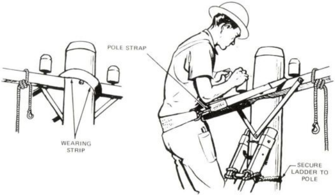
SAFETY BELTS

WEAR YOUR SAFETY BELT WHENEVER YOU CLIMB A POLE. FASTEN IT AS SOON AS YOU REACH THE WORKING POSITION.

Whenever possible fasten belt around pole, but if working at the end of a 2.8 m arm fasten it around the arm between the pole and the combiner or brace. When working near the top of a pole pass the belt around the pole so that the top arm is enclosed and belt cannot be pulled over top of pole.

Examine safety belts and ropes regularly to see that they are in good condition.

ALWAYS TAKE CARE OF YOUR SAFETY BELT - YOUR LIFE MAY DEPEND UPON IT.



SAFE USE OF LADDERS

Place ladder in line with the wires. Tie the bottom if there is any danger of it slipping.

¼ TO ⅜ LENGTH OF LADDER

See that the ladder chain straddles the pole.

DON'T PUT LADDER AGAINST AN ARM

Climb the ladder and immediately tie it to the pole.

DON'T STAND ON TOP OF THE STILES. GET A LONGER LADDER

STAND CLEAR OF MEN WORKING ALOFT TO AVOID ACCIDENTALLY DROPPED TOOLS ETC.

LOADING AND UNLOADING POLES

USE OF RAMPS AND SKIDS.

Gloves are to be worn whenever poles are being hand loaded onto or unloaded from vehicles or pole stacks, and, suitable ramps or skids must be used.

PARBUCKLING POLES.

The safest method of controlling the movement of a pole by hand is by parbuckling :-

(i) Pass a 24 mm rope twice around each end of the pole making sure that the rope does not cross over itself.

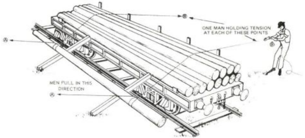
(ii) For unloading, man at end 'B' (see drawing) keeps tension on the rope while other party members pull on end 'A'.

(iii) For loading the procedure is reversed and the pole is rolled up onto the pole trailer or truck.

The rope must be long enough to allow workmen to keep at a safe distance.

USE OF MOBILE CRANE.

Inspect wire ropes, slings, lifting tongs, etc. to see that they are in good condition.
Fix slings at point of balance of pole for ease of handling.
Stand clear of the pole while the crane is operating. Fit guide ropes at each end of pole to control swings.



PARBUCKLING POLES OFF TRUCK

SECURE POLES ON TRAILER OR TRUCK WITH LOAD BINDERS

LOADING AND UNLOADING POLES

RAILWAY TRUCKS

Where poles will be laid out at pegged positions along a railway line, place them on the railway truck so that they can be unloaded in correct sequence i.e. first pole loaded on the truck is the last unloaded.

Do not unload poles in the way between sets of rails or on the side of the track where it will be necessary to drag them across the rails.

Before releasing the chains and stanchions holding the poles on the railway truck, securely wedge the poles on the bottom layer to prevent them moving or falling off.

STEEL BEAM AND RAILS

As these poles are basically square in section they cannot be rolled. If a crane is not available they must be lifted by pinch bars to enable skids to be placed under them and then moved over the skids.

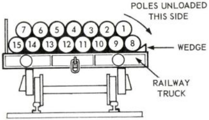
POLE STACKS

Use cant hooks and bars to handle poles on a stack. Work from the rear of butt or head of pole. Secure other poles with wedges to prevent movement.

Never walk or stand on unsecured stacked poles.

Avoid stepping or walking on poles which are wet and greasy or freshly treated with creosote.

When a crane is used, the wire ropes etc., must be checked before lifting commences. Ensure that the sling is attached at the point of balance.



UNLOADING POLES FROM RAILWAY TRUCK.
(Numbers indicate sequence for unloading.)

ENGINEERING INSTRUCTIONS

LINES AERIAL PA3005, 3110
3221, 3301
TE5350
SP9111, 9121
9411

Issue 4, 1976

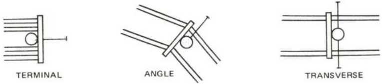
STAYING POLES

REFERENCES

Issue 4, 1976

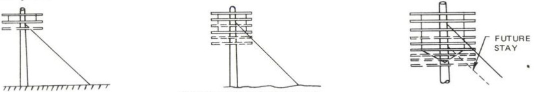
STAYING POLES

TYPES OF STAY.



POSITION FOR ATTACHING STAY TO POLE.

Attach stays as near as practicable to the centre of the load applied to the pole by the force of the wires, making allowance for the ultimate number of arms to be fitted to the pole. Point of attachment must not be closer than 460 mm to the head of the pole.



TYPICAL STAY ARRANGEMENTS

Fit terminal and longitudinal stays far enough above crossarm to permit its replacement without removing the stay.

Do not attach angle or transverse stays closer than 100 mm below the centre of the crossarm.

Keep stay wires at least 50 mm clear of all line wires.

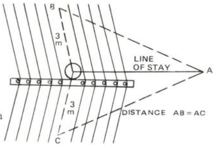
STAYING POLES

DIRECTION OF STAY.

Install stay so that it acts directly against and in line with the force of the line wires, except where two stays are fitted as transverse or longitudinal stays.

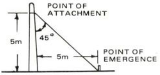
Determine the line for angle stays as follows :-

Place 2 pegs "B" and "C" in line with route 3 metre on either side of pole, Attach 2 ropes of equal length, or measuring tape, to pegs and stretch in approximate direction of stay. Place peg "A" where ropes meet. Line between this peg and centre of the pole shows the line of the stay.

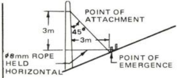


POSITION FOR GROUND STAY.

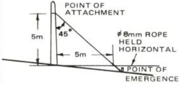
Normally the stay should form an angle of 45° with the pole, that is, on level ground the distance from ground level to the point of attachment on the pole equals the distance from the pole to the point of emergence of the stay rod from the ground.



OBTAINING 45° ANGLE ON LEVEL GROUND



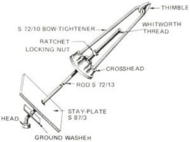
OBTAINING 45° ANGLE ON SLOPING GROUND



OBTAINING 45° ANGLE ON SLOPING GROUND

Test position with rope to ensure that stay wire will clear line wires by at least 50 mm.

STAY RODS - WIRE AND ACCESSORIES



BOW TIGHTENER, STAY ROD AND PLATE FOR GROUND STAY.

Serial/ Item	Stock Title	Details
72/13	Stay Rod, Plastic Coated 16mm x 1.84m	Rod, Washer, Nut.
72/10	Bow Tightener 16mm	with thimble.
87/3	Plate Stay 300x300mm	For 16mm x 1.84m Rod
109/4	Eyebolt 16 x 225mm	with thimble.
109/5	Eyebolt 16 x 300mm	with thimble.
447/6	Stay Guard Rigid PVC	Split spirally.

STAY FITTINGS.

Serial/ Item	Stock Title	Weight (Kg/M)	Minimum Breaking Load KN
62/26	Wire SS Galv.7/1.25mm	0.07	10.7
62/27	Wire SS Galv.7/1.60mm	0.12	19.0
62/28	Wire SS Galv.7/2.00mm	0.185	29.4

STAY WIRE.

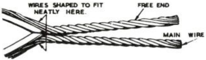
EYEBOLT LUGS. Serial 424/63. No further purchase is to be made of eyebolt lugs and stocks should be replenished from dismantled routes.

Fit an eyebolt lug at rear end of eyebolt when stays are required on both sides of a pole eg., transverse or longitudinal stays. Eyebolt lugs secured by a bolt through the pole may be used as an alternative to eyebolts except for head stays.

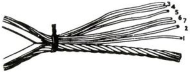
POOR HOLDING GROUND - Use a larger stay plate than shown in table or fit a log anchor.

LOG ANCHOR - Hardwood log 225mm x 1m (Min.) sapped and creosoted or section of treated pole.

STAY WIRE TERMINATION



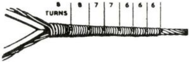
(1) Bend stay wire to fit closely around thimble.



(2) Unstrand and straighten out wires.

(3) Lay unstranded wires around and tie.

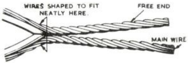
(4) Take first strand in free end and bind it tightly around as close as possible to the thimble for eight complete turns. Taking other loose strands in rotation bind them around main wire in same way.



(5) Completed termination.

NOTE : Use Stay Wire Termination Tool (S93/38) for shaping stay wire and binding strands.

STAY WIRE TERMINATION (ALTERNATIVE METHOD)



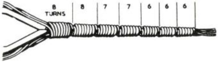
(1) Bend stay wire to fit closely around thimble and lay free end alongside main wire.

(2) Take first strand in free end that will hold its lay and bind tightly around main wire and free end close to thimble, for eight turns in direction of the lay of main wire. Use stay wire terminating tool (S93/38).

(3) Take second strand in the lay and lock first strand at end of the eight turns. Lay end of first strand between free end and main wire.

Bind second strand until second last (7th) turn and break off end of first strand.

Continue binding each strand in rotation to number of turns shown.



(4) Completed Termination.

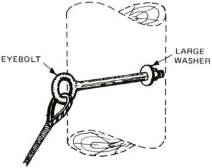
ATTACHING STAYS TO POLES

Bore 17 mm hole for eyebolt. Fit a large washer under nut. The bolt must engage full thread of the nut but not project more than 25 mm beyond the nut.

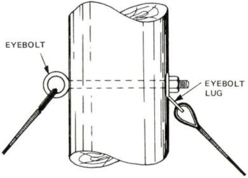
Eyebolt lugs with 16 mm bolts may be used instead of eyebolts except for head stays.

On pressure treated poles, cut a shallow scarf just sufficient to provide square seating for the lug or washer. Scarf untreated poles so that the lug or washer is seated firmly on truewood. Treat all cut surfaces with creosote.

Where two stays are fitted to the same side of the pole, terminate them on separate eyebolts.



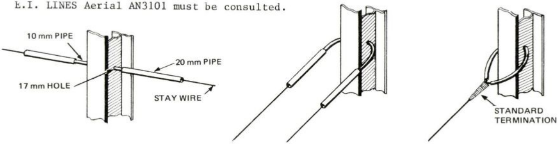
FITTING ANGLE OR TERMINAL STAY.



FITTING TRANSVERSE OR LONGITUDINAL STAY.

STAYS - STEEL BEAM AND RAIL POLES

Where Steel Poles are installed, or due to local arrangements will be installed, E.I. LINES Aerial AN3101 must be consulted.



(1) Thread stay wire through 10 mm pipe and insert through hole in pole. Use 600 mm lengths 20 mm pipe as levers to bend 10 mm pipe to form thimble.

(2) Make successive bends moving 20 mm pipes down 10 mm pipe.

(3) Remove 20 mm pipes and terminate stay wire.

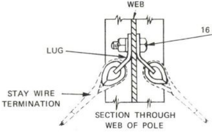
FORMING THIMBLE FROM 10 mm GI PIPE FOR ANGLE STAYS.

Size of Beam	Lgth. 10mm Pipe	Size of Beam	Lgth. 10mm Pipe
200 x 150	680	175 x 87	430
150 x 125	510	150 x 75	380
125 x 112	480	100 x 75	330
175 x 100	480		

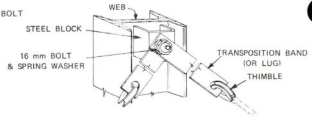
Size of Rail	Lgth. 10mm Pipe	Size of Rail	Lgth. 10mm Pipe
15 Kg	280	30, 35)	380
20 Kg	280	37 Kg)	
22 Kg	300	40 Kg	410
25 Kg	360	55 Kg	430

All dimensions in millimetres, ie. 200 x 150 mm.

G-8 ATTACHING STAYS TO STEEL BEAM AND RAIL POLES



FITTING TERMINAL OR
LONGITUDINAL STAYS.



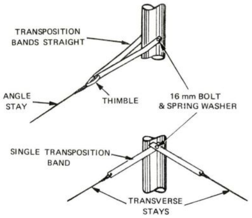
FITTING TRANSVERSE STAYS USING LUGS OR
OBSOLETE TRANSPOSITION BANDS.

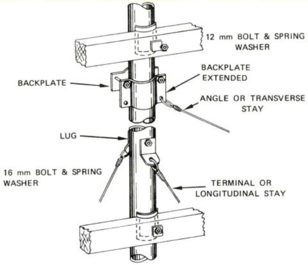
Attach stays on side of pole opposite
to crossarms.

Size of Pole	Size of Steel Block	Size of Bolt (mm)
mm100 x 75, 150 x 75, 175 x 88, 175 x 100, 125 x 112 Beam. 15 to 30 Kg Rails (Flat). 30 to 55 Kg Rails (Bull Head).	Small (S424/38)	16 x 125
mm150 x 125, 200 x 150 Beam. 30 Kg and heavier Rails.	Large (S424/39)	16 x 125

FITTINGS FOR ATTACHING TRANSVERSE STAYS.

ATTACHING STAYS TO TUBULAR STEEL POLES - DRILLED

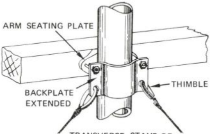




USE OF BACK PLATES OR EYEBOLT LUGS TO ATTACH STAYS.

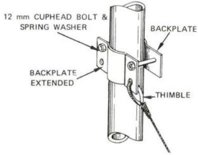
ALTERNATIVE METHOD USING OBSOLETE TRANSPOSITION BANDS.

ATTACHING STAYS TO TUBULAR STEEL POLES - UNDRILLED



(a) TRANSVERSE AND ANGLE STAYS.

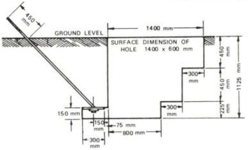
Where point of attachment is unsuitable for angle stay use the method shown for Terminal and Longitudinal stays.



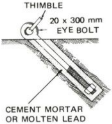
(b) TERMINAL AND LONGITUDINAL STAYS OR ANGLE STAYS WHERE POSITION SHOWN IN (a) IS UNSUITABLE.

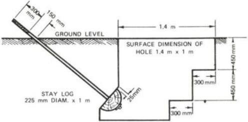
ERECT CAUTION SIGNS WHEN WORKING ON ROADWAY. • PLACE MEN WITH RED FLAGS TO HALT TRAFFIC WHERE NECESSARY.

GROUND STAYS

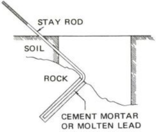


INSTALLING 1.84 m STAY ROD





INSTALLING STAY LOG



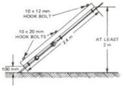
GROUND ANCHORS IN ROCK

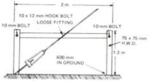
Ground stay fittings are listed on Page G-3.

KEEP CLEAR OF MOVING PARTS ON POLE HOLE BORERS AND OTHER MECHANICAL AIDS. Issue 4, 1976

GROUND STAY GUARDS

Fit stay guards in all locations where people or animals pass, to eliminate the danger of collision with the stay wire which otherwise might not be seen.





SLOPING GUARD (WOOD).   FRAME GUARD.   SLOPING GUARD (PVC).

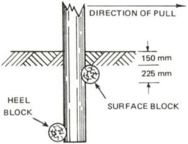
SLOPING GUARDS.

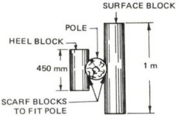
When fitted in built-up areas, use 1.84 m white plastic tubular guard (S447/6) or 2.5 m length 75 x 50 sawn hardwood, painted white and secured to upper side of stay wire with 9 mm hook bolts. In rural areas or where good appearance is not essential, use saplings or crossarms attached to stay wire by a lashing of 3.07 mm GI wire or hook bolts.

FRAME TYPE GUARD.

Install in built-up areas and also where animals use stay wire or sloping guards to rub against. Paint guard white to within 300 mm of the ground and treat lower portion with creosote to protect the timber from decay and termites.

HEEL AND SURFACE BLOCKS





Use heel and surface blocks where it is not practicable to arrange for normal stays and at slight angles on lightly loaded pole routes.

Cut blocks from timber approximately 225 mm diameter and scarf them to fit closely against pole. Apply a liberal coating of creosote to blocks and pole before installing.

A block of reinforced concrete 1 m x 225 mm may be used in lieu of the wooden block.

In good holding ground omit the heel block and set pole 150 mm deeper for poles up to 9 m and 300 mm deeper for longer poles. Set stay poles 600 mm deeper.

DON'T CLIMB A POLE UNTIL IT IS PROPERLY SET IN THE GROUND WITH EARTH RE-FILLED AND RAMMED.

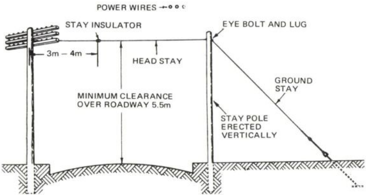
HEAD STAYS

Where head stays are erected across roadways, railways, etc., or near power wires, provide the same minimum clearance as for line wires.

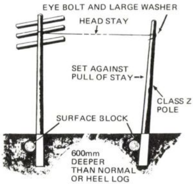
See page G-16 for details of Porcelain Stay Insulators to be fitted when stay wire crosses under power wires.

Install a ground stay on stay poles wherever possible.

Where necessary to improve footing in poor holding soils set stay pole on concrete base.

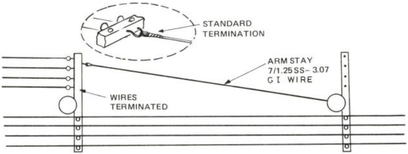


HEAD STAY WITH GROUND STAY FITTED.



STAY POLE WITHOUT GROUND STAY.

ARM STAYS



CROSSARM (OR WING) STAY.

Fit where wires on one side of an arm are terminated and there is a tendency for the pole to turn.

Terminate the arm stay on the arm between the outer spindle positions of the terminated wires and 100 mm below the arm braces of the next pole.

TO AVOID ACCIDENTS WHEN LIFTING MATERIAL OR EQUIPMENT :-

- Use mechanical equipment for heavy lifts.
- Don't attempt to lift weights beyond your physical capacity.
- Use the correct methods of lifting and carrying (see Section AA).

TELECOM STAYS CROSSING ELECT ELECTRIC POWER LINES

Stay wires from telephone poles must always cross under the power lines.

The stay wire must not pass within 2.4 m of a power pole unless attached to that pole.

Head and associated ground stays attached to power poles are to be fitted in accordance with the requirements of the power authority.

Sectionalise all stays by inserting a stay insulator in the stay wire at least 3 m but not more than 4 m, from the centre line of the telephone pole.

Use Porcelain Stay Insulator GY1 (S65/28) for wires up to 7/2.0 SS where the power line does not exceed 11,000 volts.

Use Porcelain Stay Insulator GY2 (S65/29) for 7/2.0 SS stay wires or where the power line voltage is between 11,000 and 22,000 volts.

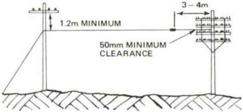
PORCELAIN STAY INSULATOR

Where the power line voltage is greater than 22,000 volts connect the stay wire on the power route side of the insulator to a good earth (less than 30 ohms). Use 7/0.6 stranded copper for earth wiring. If a head stay is fitted with a ground stay an additional earth connection will not be required unless the earth resistance is greater than 30 ohms.

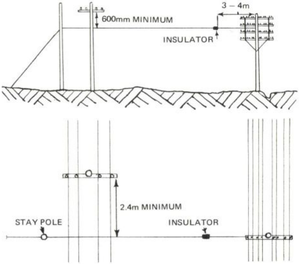
TREAT ALL POWER WIRES AND FITTINGS ON POWER POLES AS 'LIVE' AND DANGEROUS.

Report immediately on Form E71 any condition observed on a power line which is likely to endanger telecom plant or personnel, eg., inadequate clearances, dangerous location of poles, decayed or damaged poles, etc.

TELECOM STAYS CROSSING LOW VOLTAGE POWER LINES



TELEPHONE LINE STAY ATTACHED TO A LOW VOLTAGE POWER POLE.

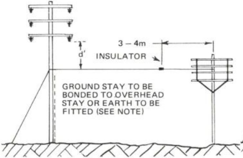


TELEPHONE LINE STAY PASSING UNDER A LOW VOLTAGE POWER LINE IN SPAN.

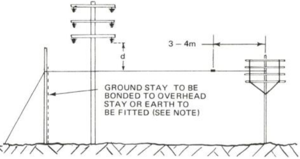
NOTE : Where stay would pass within 2.4 m of a power pole it must be attached to the pole.

See page G-16 for details of stay insulators.

TELECOM STAYS CROSSING HIGH VOLTAGE POWER LINES



TELEPHONE LINE STAY PASSING UNDER A HIGH VOLTAGE POWER LINE IN SPAN.



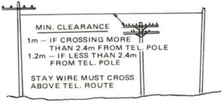
TELEPHONE LINE STAY ATTACHED TO A HIGH VOLTAGE POWER POLE.

Power Line Voltage	Min. Clearance 'd'
Over 650V up to 11,000V	1.2 m
Over 11,000V up to 66,000V	1.84 m
Over 66,000V up to 132,000V	2.4 m
Over 132,000V up to 220,000V	3.66 m
Over 220,000V	3.66 plus 328 mm for every 20,000V over 220,000V

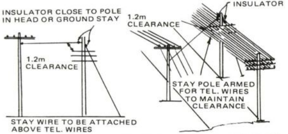
NOTES :
1. Where stay would pass within 2.4 m of a power pole it must be attached to the pole.
2. Stay wire to be earthed on power line side if power line voltage exceeds 22,000 volts.

Issue 4, 1976

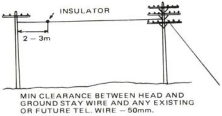
LOW VOLTAGE POWER LINE STAYS CROSSING TELECOM LINES

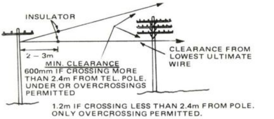


UNSECTIONALISED LV POWER STAY CROSSING TELEPHONE ROUTE



UNSECTIONALISED LV POWER STAY ATTACHED TO TELEPHONE POLE OR STAY POLE ERECTED IN ROUTE





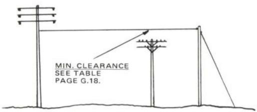
SECTIONALISED LV POWER STAY CROSSING UNDER OR OVER TELEPHONE ROUTE

SECTIONALISED LV POWER STAY ATTACHED TO TELEPHONE POLE OR STAY POLE ERECTED IN ROUTE

NOTE: A sectionalised power stay has a stay insulator 2 m to 3 m from the power pole.

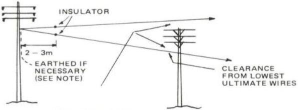
Issue 4, 1976

HIGH VOLTAGE POWER LINE STAYS CROSSING TELECOM LINES



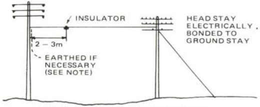
STAY WIRE MUST CROSS ABOVE TEL. ROUTE
ATTACHMENT TO TEL. POLE NOT PERMITTED

UNSECTIONALISED HV POWER STAY



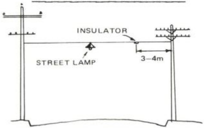
MIN. CLEARANCE
600mm – IF CROSSING MORE THAN 2.4m FROM TEL. POLE. UNDER OR OVERCROSSINGS PERMITTED 1.2m IF CROSSING LESS THAN 2.4m FROM POLE. ONLY OVERCROSSINGS PERMITTED.

SECTIONALISED HV POWER STAY CROSSING OVER OR UNDER TELEPHONE ROUTE



MIN. CLEARANCE BETWEEN HEAD AND GROUND STAY WIRES AND ANY EXISTING OR FUTURE TEL. WIRE – 50mm.

SECTIONALISED HV POWER STAY ATTACHED TO TEL. POLE OR STAY POLE ERECTED IN TEL. LINE



MIN. CLEARANCE BETWEEN SUSPENSION WIRE AND NEAREST EXISTING OR FUTURE TEL. WIRE – 150mm.

STREET LAMP SUSPENSION WIRE

NOTE: Stay wire to be earthed on power line side if stay insulator cannot withstand full power line voltage.

TEMPORARY SUPPORTS FOR UNSAFE POLES

CONDEMNED POLES.

Before climbing any pole which has been condemned, or push test has shown it to be unsafe, support it by one of the methods illustrated.

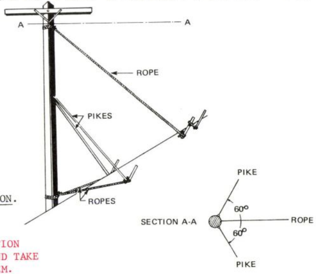
SUPPORT IRON POLES BY ROPES ONLY.

Where a pole is being replaced by a new pole erected alongside it, bind the old pole to the new pole at the head and base. Place ladder against new pole and do not climb the old pole until the binding has been completed.

TEMPORARY STAYS FOR LINE WIRE REGULATION.

See Section J.

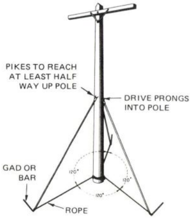
BEFORE LOWERING A POLE, NOTE THE POSITION OF ANY POWER WIRES IN THE VICINITY AND TAKE PRECAUTIONS TO AVOID CONTACT WITH THEM.



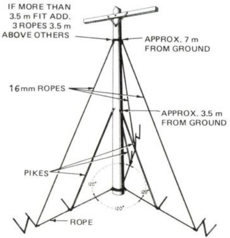
SUPPORTING POLE ON SLOPING GROUND.

DON'T CLIMB A POLE MARKED X OR XX UNTIL IT HAS BEEN MADE SAFE TO CLIMB.

TEMPORARY SUPPORTS FOR UNSAFE POLES



SUPPORTING POLE
(9 METRES OR LESS) WITH POLE PIKES.

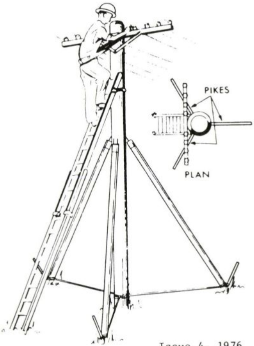


SUPPORTING POLES LONGER THAN 9 METRES
WITH POLE PIKES AND ROPES.

SUPPORTING POLE WHEN CUTTING AWAY WIRES

DO NOT CUT AWAY ALL OF THE WIRES FROM ONE SIDE OF, OR IN ONE DIRECTION FROM A POLE UNLESS IT IS PROPERLY SUPPORTED BY PIKES OR TEMPORARY STAYS.

MEN HAVE BEEN INJURED AND SOME KILLED BECAUSE THIS PRECAUTION WAS NOT TAKEN.



Where all of the wires are to be untied or cut away in both directions, thoroughly test pole and if necessary support it as shown on pages G-21 and G-22.

Support stayed angle or terminal poles if it is necessary to remove the stay or to dismantle the wires.

Keep work on poles to a minimum after all of the wires have been untied or dismantled as there is greater danger of the pole falling when the support provided by the wires has been removed.

ENGINEERING INSTRUCTIONS

LINES AERIAL AN2001, 3011
3101
SP9112

Issue 4, 1976

LINE WIRES AND FITTINGS

REFERENCES

Issue 4, 1976

LINE WIRES - TYPES AND USES

STANDARD ITEMS

Serial Item	Stock Title of Line Wire	Approx. Resistance per S.W. Km.	Minimum Breaking Load (N)	General Use
61/31	1.27 C.C. Poly. Ins.	16.2 ohms	860	Subscribers Lines with span lengths up to 60 metres.
61/61	2.18 C.C. Poly. Ins.	5.75 ohms	2350	Minor trunks and subscribers lines where greater strengths required.
61/62	2.84 H.D.C. Poly. Ins.	2.73 ohms	2800	Main trunk lines.

OBSOLESCENT ITEMS - To be used until stocks are exhausted.

Serial Item	Stock Title of Line Wire.	When Stock is Exhausted use Items shown below	Approx. Resistance per S.W. Km.	Minimum Breaking Load (N)
61/1	3.48 H.D.C.	Item 62	2.05 ohms	4100
61/14	3.25 H.D.C.	Item 62	2.05 ohms	3600
61/2	2.84 H.D.C.	Item 62	2.73 ohms	2800
61/4	2.01 H.D.C.	Item 61	5.45 ohms	1430
61/12	3.07 C.C.	Item 62	2.8 ohms	4400
61/13	2.18 C.C.	Item 61	5.75 ohms	2350
61/8	1.68 C.C.	Item 31 or 61	9.3 ohms	1450

Abbreviations - H.D.C. - Hard Drawn Copper, C.C. - Cadmium Copper, Poly. Ins. - Polythene Insulated.

Identification of Line Wire - Known by their diameter, i.e. 1.27 C.C. Poly. Ins. is 1.27 mm Cadmium Copper Polythene insulated.

LINE WIRES - SUPPLY INFORMATION

UNINSULATED COPPER LINE WIRE

Uninsulated Line Wire is stocked and issued by the kilogramme. Retain and use existing stocks and bare copper line wire for maintenance of aerial routes. All new routes to be constructed with insulated line wires.

INSULATED COPPER LINE WIRE

Insulated line wire is stocked and issued by the metre. 1.27 and 2.18 mm C.C. is supplied in coils of 100 metres and 2.84 mm H.D.C. in coils of 500 metres.

TIE WIRE

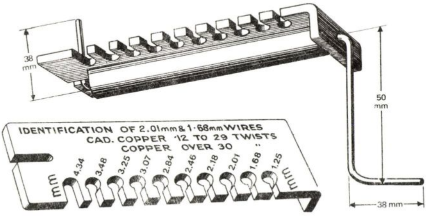
Wire ties consisting of insulated soft copper wire cut to the correct length for tying in line wires supersede 20, 50, 100 and 200 lb. soft copper binding wire formerly supplied in coils. They are stocked and issued in bundles of 100 ties. Full details of size, serial and item numbers etc., are given on page I-7.

STAY WIRES

Details of stay wires are given on page G-3.

AVOID SCRATCHES FROM OLD COPPER WIRE AS VERDIGRIS ON THE WIRE CAN CAUSE SEVERE BLOOD POISONING. TREAT ANY INJURIES IMMEDIATELY.

LINE WIRE IDENTIFICATION GAUGE



LINE WIRE IDENTIFICATION GAUGE
(SERIAL 93/36)

mm	lbs.
1.27	40
1.68	70
2.01	100
2.18	118
2.46	150
2.84	200
3.07	237
3.25	262
3.48	300
4.34	400

Check 2.01 and 1.68 mm wire by the Twist Test to determine whether they are copper or cadmium copper. Fit 200 mm length of wire in gauge and crank or twist until it breaks. It is cadmium copper if it takes less than 30 twists to break and copper if more than 30 twists are required.

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SPINDLES AND INSULATORS

TYPES AND USES.

STANDARD ITEMS

Location	Insulators		Spindles	
	Serial/ Item	Type	Serial/ Item	Type
For all new lines subs. and trunks. Use wood spindles where the pull on the spindle does not exceed 335N	65/15	Tk. P.L.S.	70/3 or 71/21	Tk. Wood 50 mm L.S. / Tk. 16 mm L.S.
Inspan transposition plate.	65/27	Spool	71/23	Insp. Transp.

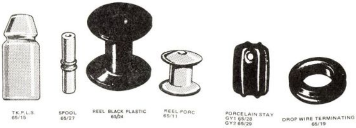
OBSOLETE ITEMS - To be used until stocks are exhausted or when stocks are replenished from recovered routes.

Location	Insulators		Spindles	
	Serial/ Item	Type	Serial/ Item	Type
Subs. lines - Straignt line.			70/2	Sub. Wood
Subs. lines - Angles & lead off.	65/3	Sub. P.	71/6	Sub. 12 mm
Subs. lines - Terminal & lead off.			71/17	Sub. J. 16 mm
Sub. Premises - Terminating.			71/11	Sub. S.N. 12 mm
Lead-in wires on walls, etc.			71/16	Sub. Bracket 12 mm
Tree sling lines.	65/5	Ins. Barrel	424/6	Spike Tree
For leads along walls.	65/6	Ins. Button		

NOTE: Use steel spindles at severe angles for 1.27 wire and on all angles for heavier types of wire.

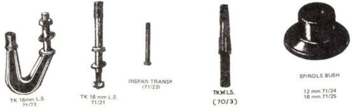
INSULATORS AND SPINDLES

INSULATORS - Standard Items.



Strain Insulators No. 1 (S65/13) and No. 2 (S65/14) have been replaced by porcelain stay insulator GY1 (S65/28) and GY2 (S65/29).

SPINDLES - Standard Items.



INSULATORS AND SPINDLES

INSULATORS - OBSOLESCENT ITEMS - No further purchase.

TK.G.L.S. 65/2A | SUB. G. 65/4 | SUB. P. 65/3 | STRAIN. Nº1-65/13 Nº2-65/14 | BARREL 65/5 | BUTTON 65/6

SPINDLES - OBSOLESCENT ITEMS - No further purchase.

SUB.W. (70/2) | SUB. 12mm (71/6) | SUB.J 16mm (71/17) | SUB.DOUBLE 16mm (71/7) | SUB.BRACKET 12mm (71/16) | SUB.SN 12mm (71/11) | TK.SN. 19mm L.S. (71/20)

The insulators and spindles on this page are to be used until stocks are exhausted. Replacement of stocks can be made from recovered routes.

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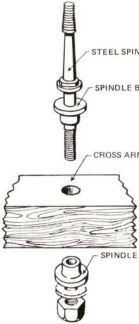
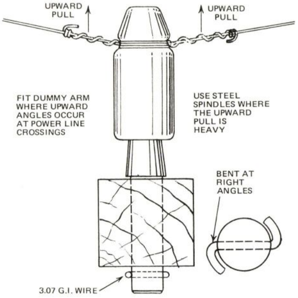
FITTING SPINDLES



FITTING STEEL SPINDLE IN WOOD SPINDLE ARM



SECURING WOOD SPINDLE AGAINST UPWARD PULL ON LINE WIRE

ERECTING LINE WIRES

REFERENCES

Issue 4, 1976

ERECTING LINE WIRES

Handle line wire carefully. Do not throw or drop coils to the ground because even a slight dent, nick or kink will seriously weaken the wire. If damage does occur cut out the damaged piece and rejoin the wire.

Do not use pliers for pulling or bending copper wire as the jaws will damage the wire.

Use the correct reel or barrow for the wire and maintain it under tension as it is being run out. Do not "flake" wire off the coil.

Where possible, the wire reel barrow should be carried along the route either on a motor vehicle or by hand, depending on the locality. The "free" end of the wire should be secured to the starting pole and the wire laid out along the ground. The wire is then lifted into its position on the arm with a light pike.

Where there are working circuits below the crossarm on which wires are being erected, run the wires out close to the pole to prevent wires sagging and contacting the lower wires.

If wires are to be transposed insert the crosses as the wire is being drawn out.

Do not leave wires run out on the ground or sagging from poles in locations where they could cause injury to persons or animals or interfere with traffic.

Fit plastic wire vibration dampers as directed on page J8-9.

WIRES MUST HAVE AT LEAST THE MINIMUM CLEARANCE ABOVE GROUND SHOWN IN SECTION B, AND CLEARANCE FROM POWER WIRES IN ACCORDANCE WITH SECTION O.

ERECTING AND DISMANTLING WIRE - SAFETY PRECAUTIONS

HANDLING WIRES ON POLES

CARELESSLY HANDLED WIRE ENDS CAN BE DANGEROUS AND COULD COST SOMEONE AN EYE.

Keep wire under control by holding it close to its end, tying it to some object or tying a length of rope to the free end. Never pull wires towards your face.

AVOID WORKING AT EYE LEVEL; KEEP ABOVE YOUR WORK.

Make sure wires are held securely by wire grips and there is no danger of the wire slipping. Do not use faulty grips. Beware of wire ends when wires are held in grips.

When wires are untied at an angle pole, work on the side away from the pull of the wires to avoid being struck if a wire slips from an insulator. TREAT ANY INJURIES IMMEDIATELY.

OLD COPPER WIRE

Avoid scratches or pricks from old copper wire. Verdigris on the wire can cause severe blood poisoning so handle old copper wire carefully.

WIRE OVER ROADWAYS

When erecting or dismantling wires over roadways, post men with red flags at suitable locations to warn oncoming traffic. If necessary stop all traffic temporarily.

If traffic is likely to be delayed for a considerable time, Police should be advised or Local Road Regulations applied if applicable.

Place warning signs or red flags in prominent positions when it is necessary to leave material or equipment on a roadway.

Secure wires at the poles on each side of the road crossing immediately after erecting wires so that they cannot slip through and sag down over the roadway.

CONTACT WITH POWER WIRES CAN MEAN DEATH. TAKE EVERY PRECAUTION TO AVOID TOUCHING POWER WIRES OR FITTINGS ON POWER POLES.

TERMINATING LINE WIRES - PRESS TYPE TERMINATING SLEEVE

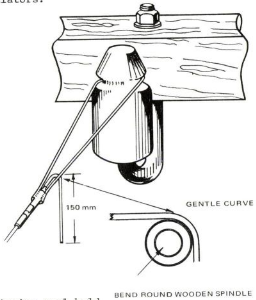
Use press type terminating sleeves for terminating all line wires. Wire must be terminated only on porcelain insulators.

STANDARD ITEMS

Wire Size	Serial/Item
1.27 C.C.	64/60
2.18 C.C.	64/63
2.84 H.D.C.	64/65

OBSOLESCENT ITEMS

Wire Size	Serial/Item
1.68 C.C.	64/61
2.01 H.D.C.	64/62
3.07 C.C.	64/66
3.25 H.D.C.	64/67
3.48 H.D.C.	64/68
3.07 G.I.	64/69



METHOD OF TERMINATING WIRE

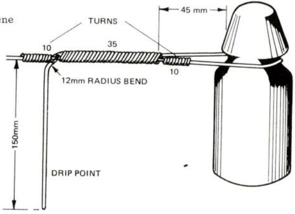
(1) Pass wire through the sleeve. Remove insulation where necessary.

(2) Crimp the sleeve twice with handles of jointing tool held on opposite sides of the sleeve for the two crimps.

(3) Carefully bend wire downwards at right angles to form 150 mm drip point.

TERMINATING LINE WIRES - WRAPPED TYPE TERMINATION

Use the WRAPPED TYPE TERMINATION for terminating 1.27 mm C.C., polyethylene insulated wire when the line wires are extended to the protector.
Make the termination with a piece of scrap 0.90mm drop or bridle wire 600mm in length.



WRAPPED TERMINATION

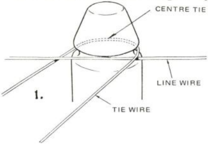
METHOD OF TERMINATING WIRE

- Pass line wire around insulator in anticlockwise direction. The pull of the wire tends to tighten the insulator.
- Commencing at point 45 mm from insulator groove, bind the free end to the main wire with 35 turns of binding wire.
- Bend free end downwards to form 150 mm drip point.
- Continue binding along main wire for 10 turns.
- Bind other end of binding wire along main wire for 10 turns towards insulator.

BEWARE - A CARELESSLY HANDLED WIRE END COULD COST YOU AN EYE.

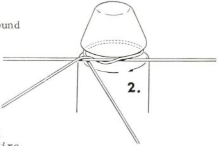
TYING-IN LINE WIRES - STANDARD TIE

Use the STANDARD TIE for all diameters of bare or insulated copper wire on straight line poles with span lengths up to 100 metres.



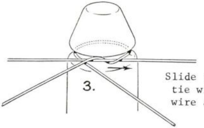
STEP 1.

Centre tie wire around insulator.



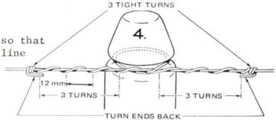
STEP 2.

Make sure complete turn of right hand tail around line wire.



STEP 3.

Slide the wire back so that tie wire separates line wire and insulator.



STEP 4.

Make tie off with 3 full turns 12 mm apart and 2 close turns. Leave 12 mm and turn ends back.

TYING-IN LINE WIRES - HEAVY DUTY TIE

Use the HEAVY DUTY TIE for - Bare and insulated line wires at all angle poles; all transpositions; poles where change of grade causes an upward or downward pull on the tie; span lengths greater than 100 metres. Use the same tie wire as for Standard tie.

TIE STARTED. Tie wire diameter and length as for Standard tie.

STRAIGHT TIE. Use where there is no change in grade of route.

UNDER TIE. Use where wire has a downward pull.

OVER TIE. Use where wire has an upward pull.

NOTE : Where galahs or cockatoos are prevalent cut off turned back ends of ties (Standard and Heavy Duty).

TYING-IN LINE WIRES - TIE WIRES, TYPES AND DIAMETERS

STANDARD ITEMS

LINE WIRE	TIE WIRE			
Insulated	Size Insul.	Serial/Item	Length	Supplied
1.27 C.C.	1.42 S.C.	61/32	500 mm	Bundle of 100
2.18 C.C.	2.01 S.C.	61/33	600 mm	Bundle of 100
2.84 H.D.C.	2.84 S.C.	61/34	750 mm	Bundle of 100

OBSOLESCENT ITEMS

LINE WIRE	TIE WIRE			
Bare	Size Insul.	Serial/Item	Length	Supplied
1.27 C.C.	1.42 S.C.	61/32	450 mm	Bundle of 100
1.68 C.C.	1.42 S.C.	61/32	450 mm	Bundle of 100
2.18 C.C.	2.01 S.C.	61/33	500 mm	Bundle of 100
3.07 C.C.	2.84 S.C.	61/34	600 mm	Bundle of 100
2.01 H.D.C.	2.01 S.C.	61/33	500 mm	Bundle of 1(
2.84 H.D.C.	2.84 S.C.	61/34	650 mm	Bundle of 100
3.48 H.D.C.	2.84 S.C.	61/34	650 mm	Bundle of 100
3.07 G.I.	3.07 G.I.	62/2	600 mm	Bundle of 100

Obsolescent items to be used until stocks are exhausted. Then only insulated ties will be supplied.

JOINTING LINE WIRES - PRESS TYPE SLEEVES

USE PRESS TYPE SLEEVES - for jointing all diameters of wire up to and including 3.07 mm G.I. and 3.48 mm H.D.C. wire.

PRESS TYPE JOINT - 1.27 C.C. WIRE

Three crimps on each half of sleeve for bare wire.
Four crimps for insulated wire, outer crimps to enclose insulation.

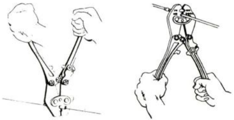
PRESS TYPE JOINT - OVER 1.27 C.C. WIRE

Two crimps on each half of sleeve.

MAKING JOINTS

- CLEAN WIRES THOROUGHLY WITH EMERY CLOTH OR SIMILAR ABRASIVE CLOTH.
- Insert wires and pinch sleeve lightly with cutting pliers on each side of centre to hold wire in position.
- Using correct jointing clamp make inner crimps.
- Make adjacent crimps with handles of jointing clamp on opposite sides of sleeve to prevent bending sleeve.

ADJUST AND LUBRICATE JOINTING CLAMPS REGULARLY. (SEE PAGE R6).



On one Side. On the Adjacent Side.

MAKING THE CRIMP.

STANDARD ITEMS.

WIRE	SLEEVE			CLAMPING TOOL	
	Ser./Item	Description	Ext.Diam.	Ser./Item	Description
1.27 CC Poly.	64/79	Press Type CC 1.27 Insul.	3.2	93/23	Clamp jointing Press Type 1.27
2.18 CC Poly.	64/85	Press Type CC 2.18 Insul.	5.5	93/24	Clamp jointing Press Type 1.68/2.84
2.84 HDC Poly.	64/86	Press Type HDC 2.84 Insul.	6.35	93/21	Clamp jointing Press Type 2.18/3.48

OBSOLESCENT ITEMS- To be used until stocks are exhausted.

1.27 CC	64/41	Press Type CC 1.27	3.2	93/23	Clamp jointing Press Type 1.27
1.68 CC	64/42	Press Type CC 1.68	4.75	93/24	Clamp jointing Press Type 1.68/2.84
2.01 HDC	64/43	Press Type C 2.01	4.75		
2.18 CC	64/43	Press Type CC 2.18	5.5	93/24	Clamp jointing Press Type 1.68/2.84
2.84 HDC	64/46	Press Type C 2.48	5.5	93/21	Clamp jointing Press Type 2.18/3.48
3.07 CC	64/48	Press Type CC 3.07	6.35)	93/21	Clamp jointing Press Type 2.18/3.48
3.25 HDC	64/49	Press Type C 3.25	6.35)		
3.48 HDC	64/50	Press Type C 3.48	6.35)		
3.07 GI	64/52	Press Type GI 3.07	6.35)		

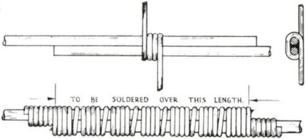
PRESS TYPE SLEEVES AND CLAMPING TOOLS USED TO JOINT LINE WIRES.

LOCATION OF JOINTS.

Make wire joints as far as practicable within reach of a workman on the pole but not within 450 mm of an insulator.

JOINTING LINE WIRES - BRITANNIA JOINTS

Use BRITANNIA JOINTS for jointing all diameters of G.I. wire when jointing sleeves are not available or surface of wire is corroded.



Line Wire	Binding Wire	
	Length (mm)	Type
3.07 G.I.	1100	1.67 G.I.
4.34 G.I.	1400	1.67 G.I.
5.25 G.I.	1500	1.67 G.I.

BRITANNIA JOINT

Before binding, thoroughly clean G.I. wire with an abrasive cloth or a wire brush.

Lay 1.67 G.I. filler wire in grooves between line wires when jointing 5.25 wire. Bind 5 turns around the centre of the joint leave a gap equal to the diameter (1.67) of the binding wire. Commence next 5 turns and continue as shown on drawing.

Use soldering solution and solder the joint by placing a hot soldering tool under the joint and applying 50/50 solder to the top of the joint.

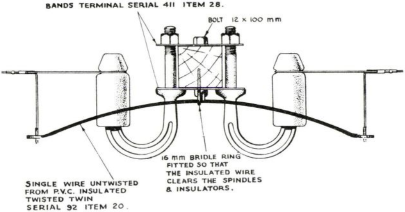
(Never use resin core solder on GI wire).

CLEAN LINE WIRES AND BINDING WIRE THOROUGHLY WITH EMERY CLOTH OR A WIRE BRUSH BEFORE MAKING A JOINT.

JOINTING LINE WIRES OF DIFFERENT TYPE OR DIAMETER

Where it is necessary to joint wires of different diameters or materials, terminate wire on J spindles on terminal bands. Bridge terminations with a length of bridle wire. Joints between different wire diameters must not be made in the span.

Joints between wires of closely related sizes may be made on one straight steel spindle and the wire jointed directly as shown on page I-12.



JOINTING WIRES OF DIFFERENT TYPE OR DIAMETER

JOINTING INSULATED LINE WIRES

INSPAN JOINTS IN INSULATED WIRE OR BETWEEN INSULATED WIRE AND BARE WIRE OF SAME DIAMETER

Use press type jointing sleeves as for bare wire.

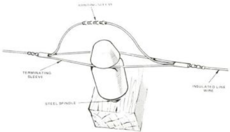
JOINTS WHERE LINE WIRES ARE TERMINATED

This type of joint is required where insulated line wire is erected in power line crossing spans and also at lead off points to subscribers' (See pages I-14 to 16). Terminate wires on a porcelain insulator fitted to a straight steel spindle. Remove sufficient insulation from the line wire to enable it to pass through the terminating sleeve leaving sufficient length for jointing. The insulation should butt against the end of the sleeve.

Form a small loop with wire ends and joint with press type jointing sleeve (see Table).

Wires Jointed	Sleeve
1.27 C.C.-1.27 Poly.	C.C. 1.27
1.27 C.C.-1.68 C.C. P.V.C.	C.C. 1.68
1.68 C.C.-1.68 C.C. P.V.C.	C.C. 1.68
2.01 H.D.C.-2.18 C.C. P.V.C.	C.C. 2.18
2.84 H.D.C.-2.18 C.C. P.V.C.	C. 2.84
2.84 H.D.C.-2.18 C.C. P.V.C.	C. 2.84
2.84 H.D.C.-3.07 C.C. P.V.C.	C.C. 3.07
3.48 H.D.C.-3.07 C.C. P.V.C.	C. 3.48

JOINTING SLEEVES FOR INSULATED WIRES
(Use jointing tool slot for sleeve diameter, not wire diameter).

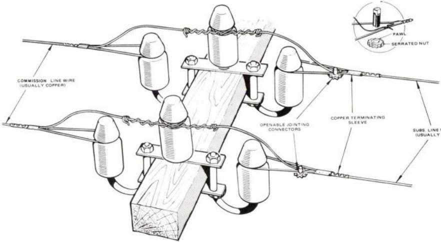


JOINTING INSULATED LINE WIRE TO BARE COPPER LINE WIRE.

JOINTING LINE WIRES - OPENABLE JOINTS

Use Openable Wire Jointing Connectors (S64/78) at the junction between Telecom and Part Privately Erected (PPE) Lines.

Terminate both lines using standard terminating sleeves. Extend Telecom's wires across via an insulator and connect to the loop of the terminating sleeve on the subscribers side. Place slot on connector over line wire and loop of sleeve and tighten nut firmly by hand. Turn end of Telecom's wire back through serrations into bottom of slot in connection to lock the nut.



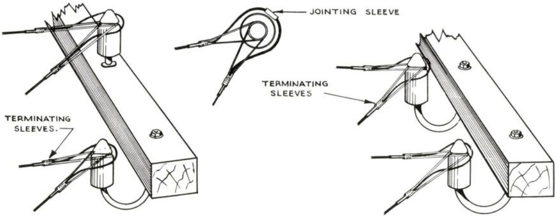
FITTING OPENABLE WIRE JOINTING CONNECTIONS

LEAD-IN AND BRANCHING ARRANGEMENTS - TRUNK AND SUBSCRIBERS

Terminate both main and lead-in wires at the lead-off pole. Use steel spindles when terminating any diameter of wire.

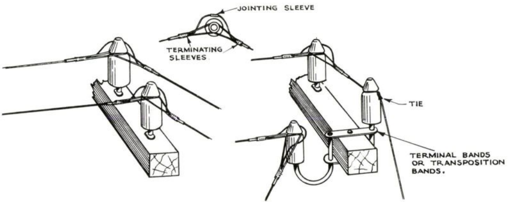
Pull up wires between lead-off pole and subscribers premises or trunk line office just tight enough to remove excess slack.

This prevents undue strain on the building and reduces "humming" of the wires due to wind vibration. Use insulated wire for all lead-ins to subscribers.



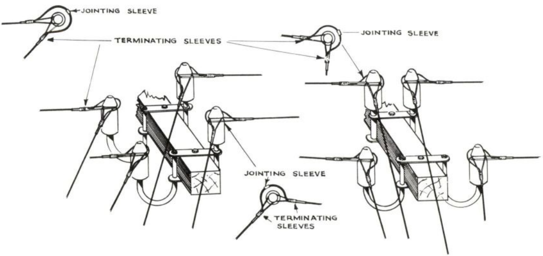
TYPICAL LEAD-IN TO SUBSCRIBERS PREMISES OR TRUNK LINE OFFICE

LEAD-IN TO SUBSCRIBERS PREMISES OR TRUNK OFFICE - ALTERNATIVE METHODS



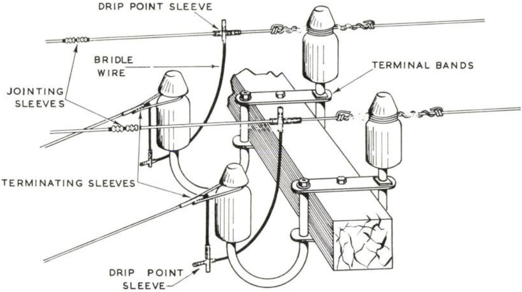
OBTAIN PERMISSION BEFORE CUTTING TREES OR DOING ANY WORK TO WHICH OBJECTION COULD BE RAISED.

LOOP-IN TO SUBSCRIBERS' DUPLEX SERVICE OR TRUNK LINE OFFICE - ALTERNATIVE METHODS



A NEAT INSTALLATION BRINGS CREDIT TO THE COMMISSION AND TO YOURSELF.

TAP OFF TO TRUNK LINE OFFICE OR SUBSCRIBERS PARTY SERVICE



DON'T REMAIN ALOFT OR HANDLE WIRES DURING A THUNDERSTORM.

ENGINEERING INSTRUCTION

LINES AERIAL TE4821,
W1201, 1202,
1221, 1251, 1252,
3401, 3402, 3501,
3611, 3620,
PP0001, 3021,
SP9211

TENSIONING AERIAL WIRES

REFERENCES

Issue 4, 1976

TENSIONING AERIAL WIRES

METHODS

- Weights Method - (Newtons force/kilograms mass).
- Beat Method - (Seconds for 15 beats).
- Measurements of Sag - (Millimetres).

Span lengths are measured in metres.

USE OF TENSIONING TABLES

Apply the correct tension given in the tensioning tables for each method (see pages J-10) to J-28) according to the temperature, average span length and each type and diameter of wire.

Tension occasional long spans to the same tension as the remainder of the route provided that maximum span length for the particular wire spacing is not exceeded.

When using sag or beat method measure length of the span being checked and read the correct sag or time for beats from the column for the span length nearest the actual measurement. Select a span for checking which is about average length for the route.

MEASUREMENT OF TEMPERATURE

The tables show the correct tension for temperatures ranging from 5° to 50°C. To obtain the wire temperature suspend a thermometer from the end of the crossarm and make frequent checks during the course of the work.

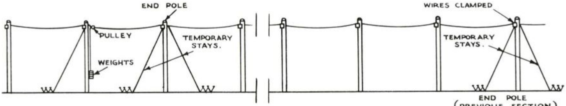
PRE-STRESSING

Press-stress only copper wire of 2.84 mm H.D.C. or heavier. Use the tension shown at the end of each table. Pre-stress smaller diameters only when advised by a responsible officer. Apply the pre-stressing tension for one minute, remove then apply again for one minute.

WHEN WORKING ALOFT, PLACE TOOLS IN A TOOL BAG, USE A HAULING LINE TO RAISE THE BAG AND ATTACH THE BAG TO AN ARM SO THAT THE TOOLS ARE ACCESSIBLE.

LENGTH OF TENSIONING SECTION

- Where run of wire is straight and level - 1 kilometre.
- Where light angles occur - 1 kilometre but no more than two angles in section.
- Where heavy angles occur - make angle pole end of section.



TENSIONING SECTION

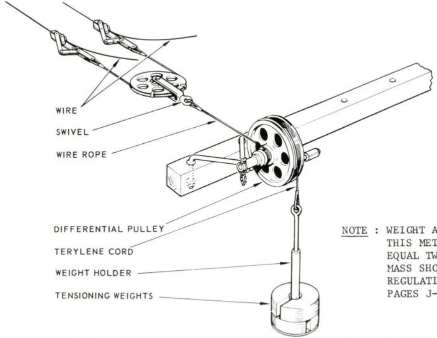
END POLES FOR TENSIONING SECTION

Use transposition poles, angle poles and longitudinally stayed poles as end poles for the tensioning section. Where end poles are not longitudinally stayed fit temporary stays whilst the wires are being tensioned.

USE OF WEIGHTS

Apply weights for pre-stressing and tensioning in accordance with the tensioning tables for the type and diameter of wire being erected see pages J-10 to J-28.

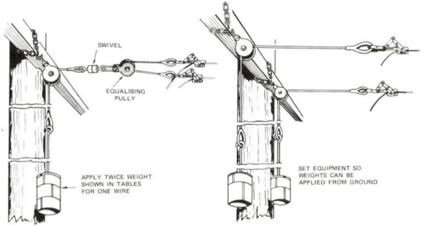
TENSIONING AERIAL WIRES - WEIGHTS METHOD



NOTE : WEIGHT APPROX. IN THIS METHOD WILL EQUAL TWO FIFTHS MASS SHOWN IN REGULATING TABLES PAGES J-10 TO J-28.

USE OF WIRE TENSIONING UNIT (DWG. CL-1114) TO TENSION TWO WIRES SIMULTANEOUSLY.

J-4 TENSIONING AERIAL WIRES - WEIGHTS METHOD

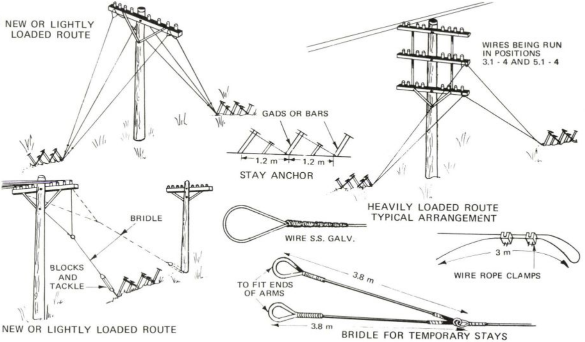


ALTERNATIVE ARRANGEMENTS OF WEIGHTS FOR TENSIONING

Use wire grip No. 4 (S.92/42) or rope 'snotters' when tensioning insulated line wire to avoid damage to the insulation.

Where insulated line wire connects to bare wire, e.g. at the end of a power line crossing span, both wires are to be terminated on a single porcelain insulator and straight steel spindle as shown on page I-12.

TEMPORARY STAYS



TENSIONING AERIAL WIRES - BEAT METHOD

METHOD OF CHECKING TENSION.

- Where a number of spans are being tensioned, check the tension at a span which is:-
  - as close as possible to one of the span lengths shown in the tensioning tables,
  - at or near the centre of the section being tensioned,
  - free from wire joints or vibration dampers.
- Measure the length of span accurately in metres.
- Suspend thermometer from end of the arm and check temperature in degrees C.
- Strike wire sharply 300 - 450 mm from the arm and check the time with a stop watch for 15 return beats to be felt by hand lightly resting on the wire. Ensure that the wire is resting on the arm at each end of the span.
- Adjust tension to agree with the values shown in the tensioning tables. When time taken for 15 beats exceeds that set down, the wire is too slack and vice versa.

BEAT METHOD OF COMPARING TENSION.

To compare the tension of two wires :-

- Strike both wires simultaneously.
- Place hands lightly on both wires and check for 5 beats. If the beats are felt simultaneously in both wires, the tensions are equal. If tensions are not equal, the beat from the wire of higher tension will be felt first.

TENSIONING TABLES - See tables on pages J-10 to J-28.

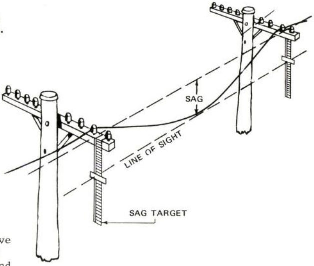
THE BEAT METHOD SHOULD NOT BE USED ON WIRES FITTED WITH VIBRATION DAMPERS.

AVOID LEAVING WIRES RUN OUT ON THE GROUND OR SAGGING FROM POLES WHERE THEY COULD CAUSE INJURY TO PERSONS OR ANIMALS.

TENSIONING AERIAL WIRES - SAG METHOD

SETTING SAG BY SAG TARGET

- Set Target Markers to required sag for the temperature, length of span and wire size concerned.
- Sight between poles (use telescope where very accurate measurements are required).
- Adjust the wire sag until the lowest point is directly in line between markers.
- Tension other wires to the same sag and compare tensions by the Beat Method.



USE OF SAG TARGET

TENSIONING TABLES

See tables of sags on pages J-10 to J-28.

Clearances for insulated line wire above ground level and away from power line construction are shown in Section B and Section O respectively.

SECURE THE LADDER TO THE POLE AND FASTEN YOUR SAFETY BELT BEFORE COMMENCING WORK.

WIRE VIBRATION DAMPERS

USE

To reduce wire breakage due to wind vibration.

DESCRIPTION

1200 mm length plastic tubing approximately 9 mm diameter slit spirally (S.447/i).

WHERE USED

New Wires

Fit vibration dampers on all spans of new wire except 1.27 and 1.68 mm C.C. wires.

Existing Wires

Fit vibration dampers when wires are retensioned, re-arranged, retransposed or inspan transpositions fitted, when poles are replaced and also on any lines where incidence of faults due to wire breakage is high.

Other Uses for Vibration Dampers

Leads to subs. premises - Where humming is experienced fit 600 mm length of vibration damper on wires.

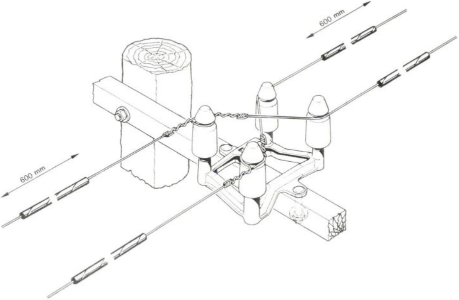
Transpositions - To insulate wires where faults are caused by birds nests.

METHOD OF INSTALLATION

Spiral the vibration damper on to the line wire near the pole. Make sure that it is free to move along the wires.

Fit a half damper (600 mm) on spans up to 80 metres and a full damper (1200 mm) on spans of 80 metres and over. Where a half damper does not completely damp out vibrations fit a full damper (1200 mm).

FITTING WIRE VIBRATION DAMPERS



VIBRATION DAMPERS INSTALLED ON LINE WIRES.

Issue 4, 1976

TENSIONING 3.48 MM HDC WIRE

Temp °C	Mass Kg	Sag in Millimetres: Span Length in Metres 30	35	40	45	50	55	Time in Seconds For 15 Beats: Span Length in Metres 30	35	40	45	50	55
5	110	90	120	155	195	245	295	8.0	9.3	10.7	12.0	13.3	14.7
10	101	95	130	170	215	265	320	8.3	9.7	11.1	12.5	13.9	15.3
15	92	105	140	185	235	290	350	8.7	10.2	11.6	13.1	14.6	16.0
20	84	115	155	205	255	315	385	9.2	10.7	12.2	13.7	15.3	16.8
25	76	125	170	225	285	350	420	9.6	11.2	12.8	14.4	16.0	17.6
30	69	140	190	250	315	385	465	10.1	11.8	13.5	15.2	16.8	18.5
35	62	155	210	275	345	425	515	10.6	12.4	14.2	15.9	17.7	19.5
40	56	170	230	300	380	470	570	11.2	13.0	14.9	16.8	18.6	20.5
50	47	205	280	365	460	570	685	12.3	14.3	16.4	18.4	20.4	22.5
Pre-Stress	138	70	95	125	155	195	235	7.1	8.3	9.5	10.7	11.9	13.1

Temp °C	Mass Kg	Sag in Millimetres: Span Length in Metres 60	65	70	75	80	85	Time in Seconds For 15 Beats: Span Length in Metres 60	65	70	75	80	85
5	108	355	415	485	555	630	710	16.2	17.5	18.8	20.2	21.5	22.9
10	100	380	445	520	595	675	765	16.7	18.1	19.5	20.9	22.3	23.7
15	93	410	480	555	640	725	820	17.3	18.8	20.2	21.7	23.1	24.6
20	87	440	515	600	685	780	880	18.0	19.5	21.0	22.5	24.0	25.5
25	81	470	555	640	735	840	945	18.6	20.2	21.7	23.3	24.8	26.4
30	75	505	595	690	790	900	1015	19.3	20.9	22.5	24.1	25.7	27.3
35	71	540	635	735	845	960	1085	20.0	21.6	23.3	24.9	26.6	28.3
40	66	575	675	785	900	1025	1155	20.6	22.3	24.0	25.8	27.5	29.2
50	59	650	765	885	1015	1155	1305	21.9	23.7	25.5	27.4	29.2	31.0
Pre-Stress	138	280	325	380	435	495	555	14.3	15.5	16.7	17.9	19.0	20.2

TENSIONING 2.84 MM HDC WIRE

Temp °C	Mass Kg	Sag in Millimetres: Span Length in Metres 30	35	40	45	50	55	Time in Seconds For 15 Beats: Span Length in Metres 30	35	40	45	50	55
5	73	90	120	155	200	245	295	8.0	9.4	10.7	12.0	13.4	14.7
10	67	95	130	170	215	265	320	8.4	9.8	11.2	12.6	13.9	15.3
15	61	105	145	185	235	290	350	8.8	10.2	11.7	13.1	14.6	16.0
20	56	115	155	205	260	320	385	9.2	10.7	12.2	13.8	15.3	16.8
25	51	125	175	225	285	350	425	9.6	11.2	12.8	14.4	16.0	17.7
30	46	140	190	250	315	385	470	10.1	11.8	13.5	15.2	16.9	18.6
35	41	155	210	275	345	430	520	10.6	12.4	14.2	16.0	17.7	19.5
40	37	170	230	305	385	475	570	11.2	13.1	14.9	16.8	18.6	20.5
50	31	205	280	365	460	570	690	12.3	14.3	16.4	18.4	20.5	22.5
Pre-Stress	91	70	95	125	160	195	235	7.2	8.3	9.5	10.7	11.9	13.1
		Span Length in Metres 60	65	70	75	80	85	Span Length in Metres 60	65	70	75	80	85
5	71	355	420	485	555	635	715	16.2	17.5	18.9	20.2	21.6	22.9
10	67	385	450	520	595	680	765	16.8	18.2	19.6	21.0	22.4	23.8
15	62	410	480	560	640	730	825	17.4	18.8	20.3	21.7	23.2	24.6
20	58	440	520	600	690	785	885	18.0	19.5	21.0	22.5	24.0	25.5
25	54	475	555	645	740	840	950	18.7	20.2	21.8	23.3	24.9	26.4
30	50	505	595	690	790	900	1015	19.3	20.9	22.5	24.2	25.8	27.4
35	47	545	635	740	845	965	1085	20.0	21.6	23.3	25.0	26.6	28.3
40	44	580	680	785	905	1025	1160	20.6	22.4	24.1	25.8	27.5	29.2
50	39	650	765	885	1020	1160	1305	21.9	23.7	25.6	27.4	29.2	31.0
Pre-Stress	91	280	325	380	435	495	560	14.3	15.5	16.7	17.9	19.1	20.3

TENSIONING 2.01 MM HDC WIRE

Temp °C	Mass Kg	Sag in Millimetres						Time in Seconds for 15 Beats					
		Span Length in Metres						Span Length in Metres					
		30	35	40	45	50	55	30	35	40	45	50	55
5	36	90	120	160	200	245	300	8.1	9.4	10.8	12.1	13.5	14.8
10	33	100	130	170	220	270	325	8.4	9.8	11.2	12.6	14.0	15.4
15	30	105	145	190	240	295	355	8.8	10.3	11.7	13.2	14.7	16.1
20	27	115	160	205	260	320	390	9.2	10.8	12.3	13.8	15.4	16.9
25	25	130	175	230	290	355	430	9.7	11.3	12.9	14.5	16.1	17.8
30	23	140	195	250	320	390	475	10.2	11.9	13.6	15.3	17.0	18.7
35	20	155	215	275	350	435	525	10.7	12.5	14.3	16.1	17.8	19.6
40	19	175	235	305	385	475	575	11.2	13.1	15.0	16.9	18.7	20.6
50	15	205	280	370	465	575	695	12.3	14.4	16.4	18.5	20.5	22.6
Pre-Stress	45	70	95	125	160	195	240	7.2	8.4	9.6	10.8	12.0	13.2
		Span Length in Metres						Span Length in Metres					
		60	65	70	75	80	85	60	65	70	75	80	85
5	35	360	425	490	565	640	725	16.3	17.7	19.0	20.4	21.7	23.1
10	33	390	455	530	605	690	775	16.9	18.3	19.7	21.1	22.5	23.9
15	31	415	490	565	650	740	835	17.5	19.0	20.4	21.9	23.3	24.8
20	28	445	525	610	695	795	895	18.1	19.6	21.1	22.7	24.2	25.7
25	27	480	560	650	750	850	960	18.8	20.3	21.9	23.5	25.0	26.6
30	25	515	600	700	800	910	1030	19.4	21.0	22.7	24.3	25.9	27.5
35	23	550	645	745	855	975	1100	20.1	21.8	23.4	25.1	26.8	28.4
40	22	585	685	795	910	1035	1170	20.7	22.5	24.2	25.9	27.6	29.4
50	19	655	770	895	1025	1165	1315	22.0	23.8	25.7	27.5	29.3	31.2
Pre-Stress	45	285	330	385	440	500	565	14.4	15.6	16.8	18.0	19.2	20.4

TENSIONING 3.07 MM CC WIRE

Temp °C	Mass Kg	Sag in Millimetres						Time in Seconds for 15 Beats					
		Span Length in Metres						Span Length in Metres					
		30	35	40	45	50	55	30	35	40	45	50	55
5	80	95	130	165	210	260	315	8.3	9.7	11.1	12.5	13.8	15.2
10	74	105	140	180	230	285	345	8.7	10.1	11.5	13.0	14.4	15.9
15	68	110	150	200	250	310	375	9.0	10.6	12.1	13.6	15.1	16.6
20	62	125	165	215	275	340	410	9.5	11.0	12.6	14.2	15.8	17.4
25	56	135	185	240	300	370	450	9.9	11.6	13.2	14.9	16.5	18.2
30	51	150	200	265	330	410	495	10.4	12.1	13.9	15.6	17.4	19.1
35	46	165	220	290	365	450	545	10.9	12.7	14.6	16.4	18.2	20.0
40	42	180	245	315	400	495	600	11.5	13.4	15.3	17.2	19.1	21.0
50	35	215	290	380	480	590	715	12.5	14.6	16.7	18.8	20.8	22.9
Pre-Stress	101	75	100	135	170	210	250	7.4	8.6	9.9	11.1	12.3	13.6
		Span Length in Metres						Span Length in Metres					
		60	65	70	75	80	85	60	65	70	75	80	85
5	79	385	450	520	600	680	770	16.8	18.2	19.6	21.0	22.4	23.8
10	73	410	480	560	640	730	820	17.4	18.8	20.3	21.7	23.2	24.6
15	69	440	515	600	685	780	880	18.0	19.5	21.0	22.5	24.0	25.5
20	64	470	550	640	735	835	940	18.6	20.2	21.7	23.3	24.8	26.4
25	60	505	590	685	785	895	1010	19.2	20.8	22.4	24.0	25.6	27.2
30	56	535	630	730	840	955	1075	19.9	21.5	23.2	24.8	26.5	28.2
35	53	570	670	775	890	1015	1145	20.5	22.2	23.9	25.6	27.3	29.1
40	50	605	710	825	945	1080	1215	21.1	22.9	24.7	26.4	28.2	29.9
50	44	680	795	925	1060	1205	1360	22.4	24.2	26.1	27.9	29.8	31.7
Pre-Stress	101	300	350	405	465	530	595	14.8	16.0	17.3	18.5	19.7	21.0

TENSIONING 2.18 MM CC WIRE

Temp °C	Mass Kg	Sag in Millimetres						Time in Seconds for 15 Beats					
		Span Length in Metres						Span Length in Metres					
		30	35	40	45	50	55	30	35	40	45	50	55
5	43	90	120	160	200	245	300	8.1	9.4	10.8	12.1	13.5	14.8
10	39	100	130	170	220	270	325	8.4	9.8	11.2	12.6	14.0	15.4
15	36	105	145	190	240	295	355	8.8	10.3	11.7	13.2	14.7	16.1
20	33	115	160	205	260	320	390	9.2	10.8	12.3	13.8	15.4	16.9
25	30	130	175	230	290	355	430	9.7	11.3	12.9	14.5	16.1	17.8
30	27	140	195	250	315	390	475	10.2	11.9	13.6	15.3	17.0	18.7
35	24	155	215	275	350	430	525	10.7	12.5	14.3	16.0	17.8	19.6
40	22	175	235	305	385	475	575	11.2	13.1	15.0	16.9	18.7	20.6
50	18	205	280	365	465	575	695	12.3	14.4	16.4	18.5	20.5	22.6
Pre-Stress	53	70	95	125	160	195	240	7.2	8.4	9.6	10.8	12.0	13.2
		Span Length in Metres						Span Length in Metres					
		60	65	70	75	80	85	60	65	70	75	80	85
5	42	360	425	490	565	645	725	16.3	17.7	19.0	20.4	21.8	23.1
10	39	390	455	530	605	690	780	16.9	18.3	19.7	21.1	22.5	23.9
15	36	415	490	565	650	740	835	17.5	19.0	20.4	21.9	23.3	24.8
20	34	445	525	610	700	795	895	18.1	19.6	21.2	22.7	24.2	25.7
25	31	480	565	650	750	850	960	18.8	20.3	21.9	23.5	25.0	26.6
30	29	515	600	700	800	910	1030	19.4	21.1	22.7	24.3	25.9	27.5
35	28	550	645	745	855	975	1100	20.1	21.8	23.4	25.1	26.8	28.5
40	26	585	685	795	910	1040	1170	20.7	22.5	24.2	25.9	27.7	29.4
50	23	660	770	895	1025	1170	1320	22.0	23.8	25.7	27.5	29.3	31.2
Pre-Stress	53	285	330	385	440	500	565	14.4	15.6	16.8	18.0	19.2	20.4

TENSIONING 1.68 MM CC WIRE

Temp °C	Mass Kg	Sag in Millimetres						Time in Seconds for 15 Beats					
		Span Length in Metres						Span Length in Metres					
		30	35	40	45	50	55	30	35	40	45	50	55
5	26	90	120	155	195	245	295	8.0	9.3	10.7	12.0	13.3	14.7
10	24	95	130	170	215	265	320	8.3	9.7	11.1	12.5	13.9	15.3
15	22	105	140	185	230	285	345	8.7	10.1	11.6	13.0	14.5	15.9
20	20	115	155	200	255	315	380	9.1	10.6	12.1	13.6	15.2	16.7
25	18	125	170	220	280	340	415	9.5	11.1	12.7	14.3	15.9	17.4
30	17	135	185	240	305	375	455	10.0	11.6	13.3	14.9	16.6	18.3
35	15	150	200	265	335	410	500	10.4	12.2	13.9	15.7	17.4	19.1
40	14	165	220	290	365	450	545	10.9	12.7	14.6	16.4	18.2	20.0
50	12	195	265	345	435	535	645	11.9	13.9	15.9	17.8	19.8	21.8
Pre-Stress	31	70	100	125	160	200	240	7.2	8.4	9.6	10.8	12.0	13.2
		Span Length in Metres						Span Length in Metres					
		60	65	70	75	80	85	60	65	70	75	80	85
5	25	360	420	485	560	635	715	16.2	17.6	18.9	20.3	21.6	23.0
10	23	385	450	520	600	680	770	16.8	18.2	19.6	21.0	22.4	23.8
15	22	410	485	560	640	730	825	17.4	18.8	20.3	21.7	23.2	24.6
20	20	440	520	600	690	785	885	18.0	19.5	21.0	22.5	24.0	25.5
25	19	475	555	645	740	840	950	18.7	20.2	21.8	23.3	24.9	26.4
30	18	505	595	690	790	900	1015	19.3	20.9	22.5	24.1	25.8	27.4
35	16	540	635	735	845	960	1085	20.0	21.6	23.3	25.0	26.6	28.3
40	15	580	680	785	900	1025	1160	20.6	22.3	24.1	25.8	27.5	29.2
50	14	650	765	885	1015	1155	1305	21.9	23.7	25.5	27.4	29.2	31.0
Pre-Stress	31	285	335	385	445	505	570	14.4	15.7	16.9	18.1	19.3	20.5

TENSIONING 2.84 MM HDC PVC WIRE

Temp °C	Mass Kg	Sag in Millimetres: Span Length in Metres 30	35	40	45	50	55	Time in Seconds for 15 Beats: Span Length in Metres 30	35	40	45	50	55
5	65	120	160	210	265	325	395	9.3	10.8	12.4	13.9	15.5	17.0
10	60	130	175	230	290	355	430	9.7	11.3	12.9	14.5	16.1	17.8
15	55	140	190	250	315	385	470	10.1	11.8	13.5	15.2	16.9	18.6
20	50	155	210	270	345	425	510	10.6	12.3	14.1	15.9	17.6	19.4
25	46	165	225	295	375	460	560	11.1	12.9	14.8	16.6	18.4	20.3
30	42	185	250	325	410	505	610	11.6	13.5	15.4	17.3	19.3	21.2
35	39	200	270	350	445	550	665	12.1	14.1	16.1	18.1	20.1	22.1
40	36	215	290	380	485	595	720	12.6	14.7	16.7	18.8	20.9	23.0
50	31	250	340	440	560	690	835	13.5	15.8	18.0	20.3	22.5	24.8
Pre-Stress	91	85	115	150	190	235	280	7.8	9.1	10.5	11.8	13.1	14.4
		Span Length in Metres 60	65	70	75	80	85	Span Length in Metres 60	65	70	75	80	85
5	65	470	550	635	730	830	940	18.6	20.1	21.7	23.2	24.8	26.3
10	61	500	585	680	780	885	1000	19.2	20.8	22.4	23.9	25.5	27.1
15	58	530	620	720	830	940	1065	19.8	21.4	23.1	24.7	26.3	28.0
20	54	565	660	765	880	1000	1130	20.4	22.1	23.8	25.4	27.1	28.8
25	51	595	700	810	930	1060	1195	21.0	22.7	24.5	26.2	27.9	29.7
30	48	630	740	860	985	1120	1265	21.6	23.3	25.1	26.9	28.7	30.5
35	46	665	780	905	1040	1180	1335	22.1	24.0	25.8	27.7	29.5	31.4
40	44	700	820	955	1095	1245	1405	22.7	24.6	26.5	28.4	30.3	32.2
50	40	770	905	1045	1200	1365	1540	23.8	25.8	27.8	29.8	31.7	33.7
Pre-Stress	91	335	395	455	520	595	670	15.7	17.0	18.3	19.6	20.9	22.2

Temp °C	Mass Kg	Sag in Millimetres						Time in Seconds for 15 Beats					
		Span Length in Metres						Span Length in Metres					
		90	95	100	105	110	120	90	95	100	105	110	120
5	66	1040	1160	1285	1415	1555	1850	27.7	29.2	30.8	32.3	33.8	36.9
10	63	1090	1215	1345	1480	1625	1935	28.3	29.9	31.5	33.0	34.6	37.8
15	60	1140	1270	1405	1550	1700	2020	29.0	30.6	32.2	33.8	35.4	38.6
20	58	1185	1325	1465	1615	1775	2110	29.6	31.2	32.9	34.5	36.2	39.4
25	55	1235	1380	1525	1685	1845	2200	30.2	31.9	33.6	35.2	36.9	40.3
30	53	1285	1435	1590	1750	1920	2285	30.8	32.5	34.2	35.9	37.6	41.1
35	51	1335	1490	1650	1820	1995	2375	31.4	33.1	34.9	36.6	38.4	41.9
40	50	1385	1545	1710	1885	2070	2465	32.0	33.7	35.5	37.3	39.1	42.6
50	46	1485	1655	1830	2020	2215	2635	33.1	34.9	36.7	38.6	40.4	44.1
Pre-Stress	91	750	835	925	1020	1120	1335	23.5	24.8	26.1	27.4	28.8	31.4

TENSIONING 2.84 MM HDC POLY WIRE

Temp °C	Mass Kg	Sag in Millimetres						Time in Seconds for 15 Beats					
		Span Length in Metres						Span Length in Metres					
		30	35	40	45	50	55	30	35	40	45	50	55
5	66	105	145	185	235	290	350	8.8	10.2	11.7	13.1	14.6	16.0
10	60	115	155	205	255	315	385	9.1	10.7	12.2	13.7	15.2	16.8
15	55	125	170	220	280	345	420	9.6	11.2	12.8	14.4	16.0	17.6
20	50	140	185	245	310	380	460	10.0	11.7	13.4	15.1	16.7	18.4
25	45	150	205	270	340	420	505	10.5	12.3	14.0	15.8	17.6	19.3
30	41	165	225	295	375	460	560	11.0	12.9	14.7	16.6	18.4	20.3
35	38	185	250	325	410	505	610	11.6	13.5	15.4	17.4	19.3	21.2
40	34	200	270	355	450	555	670	12.1	14.1	16.1	18.2	20.2	22.2
50	29	235	320	415	530	650	790	13.1	15.3	17.5	19.7	21.9	24.1
Pre-Stress	91	75	105	135	170	210	250	7.4	8.7	9.9	11.1	12.4	13.6
		Span Length in Metres						Span Length in Metres					
		60	65	70	75	80	85	60	65	70	75	80	85
5	66	415	485	565	645	735	830	17.5	18.9	20.4	21.8	23.3	24.7
10	62	445	520	605	695	790	890	18.1	19.6	21.1	22.6	24.1	25.6
15	58	475	555	645	740	845	950	18.7	20.3	21.8	23.4	24.9	26.5
20	54	510	595	690	790	900	1015	19.3	20.9	22.5	24.2	25.8	27.4
25	51	540	635	735	845	960	1085	20.0	21.6	23.3	25.0	26.6	28.3
30	47	575	675	785	900	1025	1155	20.6	22.3	24.0	25.7	27.5	29.2
35	45	610	720	830	955	1085	1225	21.2	23.0	24.8	26.5	28.3	30.1
40	42	650	760	880	1010	1150	1300	21.8	23.7	25.5	27.3	29.1	30.9
50	38	720	845	980	1125	1280	1445	23.0	24.9	26.9	28.8	30.7	32.6
Pre-Stress	91	300	350	410	470	530	600	14.8	16.1	17.3	18.5	19.8	21.0

TENSIONING 2.84 MM HDC POLY WIRE

Temp °C	Mass Kg	Sag in Millimetres						Time in Seconds for 15 Beats					
		Span Length in Metres						Span Length in Metres					
		90	95	100	105	110	120	90	95	100	105	110	120
5	67	920	1025	1135	1250	1375	1635	26.0	27.5	28.9	30.4	31.8	34.7
10	63	970	1080	1195	1320	1445	1720	26.7	28.2	29.7	31.2	32.7	35.6
15	60	1020	1135	1255	1385	1520	1810	27.4	28.9	30.4	32.0	33.5	36.5
20	57	1070	1190	1320	1455	1595	1900	28.1	29.6	31.2	32.7	34.3	37.4
25	55	1120	1250	1385	1525	1675	1990	28.7	30.3	31.9	33.5	35.1	38.3
30	52	1170	1305	1445	1595	1750	2085	29.4	31.0	32.7	34.3	35.9	39.2
35	50	1225	1365	1510	1665	1830	2175	30.0	31.7	33.4	35.0	36.7	40.0
40	48	1275	1420	1575	1735	1905	2265	30.7	32.4	34.1	35.8	37.5	40.9
50	45	1380	1535	1700	1875	2055	2450	31.9	33.6	35.4	37.2	38.9	42.5
Pre-Stress	91	675	750	830	915	1005	1195	23.3	23.5	24.7	26.0	27.2	29.7

TENSIONING 3.07 MM CC PVC WIRE

Temp °C	Mass Kg	Sag in Millimetres						Time in Seconds for 15 Beats					
		Span Length in Metres						Span Length in Metres					
		30	35	40	45	50	55	30	35	40	45	50	55
5	86	105	140	185	230	285	345	8.7	10.2	11.6	13.1	14.5	16.0
10	80	110	150	200	250	310	375	9.0	10.5	12.1	13.6	15.1	16.6
15	74	120	165	215	270	335	405	9.4	11.0	12.5	14.1	15.7	17.2
20	68	130	180	235	295	365	440	9.8	11.4	13.1	14.7	16.3	18.0
25	62	145	195	255	320	395	480	10.2	11.9	13.6	15.3	17.0	18.8
30	57	155	210	275	350	430	520	10.7	12.5	14.2	16.0	17.8	19.6
35	53	170	230	300	380	470	570	11.1	13.0	14.9	16.7	18.6	20.4
40	48	185	250	325	415	510	620	11.6	13.6	15.5	17.4	19.4	21.3
50	41	215	295	385	485	600	725	12.6	14.7	16.8	18.9	21.0	23.1
Pre-Stress	123	75	100	130	165	200	245	7.3	8.5	9.7	10.9	12.1	13.4
		Span Length in Metres						Span Length in Metres					
		60	65	70	75	80	85	60	65	70	75	80	85
5	83	425	500	580	665	755	855	17.7	19.2	20.6	22.1	23.6	25.1
10	79	455	530	615	705	805	905	18.2	19.8	21.3	22.8	24.3	25.9
15	74	480	565	655	750	855	965	18.8	20.4	22.0	23.5	25.1	26.7
20	70	510	600	695	800	910	1025	19.4	21.0	22.6	24.2	25.9	27.5
25	66	540	635	740	845	965	1085	20.0	21.6	23.3	25.0	26.6	28.3
30	62	575	675	780	895	1020	1150	20.6	22.3	24.0	25.7	27.4	29.1
35	58	610	715	825	950	1080	1220	21.2	22.9	24.7	26.4	28.2	30.0
40	55	640	750	870	1000	1140	1285	21.7	23.5	25.4	27.2	29.0	30.8
50	50	710	830	965	1110	1260	1420	22.9	24.8	26.7	28.6	30.5	32.4
Pre-Stress	123	290	340	395	450	515	580	14.6	15.8	17.0	18.2	19.4	20.6

Temp °C	Mass Kg	Sag in Millimetres						Time in Seconds for 15 Beats					
		Span Length in Metres						Span Length in Metres					
		90	95	100	105	110	120	90	95	100	105	110	120
5	81	985	1100	1220	1345	1475	1755	27.0	28.5	30.0	31.5	33.0	36.0
10	77	1035	1150	1275	1405	1545	1835	27.6	29.1	30.7	32.2	33.7	36.8
15	74	1080	1205	1335	1470	1615	1920	28.2	29.8	31.4	32.9	34.5	37.6
20	71	1130	1260	1395	1535	1685	2000	28.8	30.4	32.1	33.7	35.3	38.5
25	68	1180	1310	1455	1605	1760	2095	29.5	31.1	32.7	34.4	36.0	39.3
30	65	1225	1365	1515	1670	1830	2180	30.1	31.7	33.4	35.1	36.7	40.1
35	63	1275	1420	1575	1735	1905	2265	30.7	32.4	34.1	35.8	37.5	40.9
40	60	1325	1475	1635	1800	1980	2355	31.2	33.0	34.7	36.5	38.2	41.7
50	56	1420	1585	1755	1935	2125	2525	32.4	34.2	36.0	37.8	39.6	43.2
Pre-Stress	123	650	725	800	885	970	1155	21.9	23.1	24.3	25.5	26.7	29.1

TENSIONING 3.07 MM CC POLY WIRE

Temp. °C	Mass Kg	Sag in Millimetres						Time in Seconds for 15 Beats					
		Span Length in Metres						Span Length in Metres					
		30	35	40	45	50	55	30	35	40	45	50	55
5	87	95	125	165	210	260	310	8.3	9.6	11.0	12.4	13.8	15.1
10	80	100	135	180	225	280	335	8.6	10.0	11.4	12.9	14.3	15.7
15	74	110	150	195	245	305	365	8.9	10.4	11.9	13.4	14.9	16.4
20	68	120	160	210	265	330	400	9.3	10.9	12.5	14.0	15.6	17.1
25	62	130	175	230	290	360	435	9.8	11.4	13.0	14.6	16.3	17.9
30	57	145	195	255	320	395	475	10.2	11.9	13.6	15.3	17.0	18.7
35	52	155	215	275	350	435	525	10.7	12.5	14.3	16.1	17.8	19.6
40	47	170	235	305	385	475	575	11.2	13.1	14.9	16.8	18.7	20.5
50	40	205	275	360	455	565	685	12.2	14.3	16.3	18.3	20.4	22.4
Pre-Stress	123	65	90	115	150	180	220	6.9	8.1	9.2	10.4	11.5	12.7
		Span Length in Metres						Span Length in Metres					
		30	65	70	75	80	80	60	65	70	75	80	85
5	84	380	450	570	595	680	765	16.8	18.2	19.6	20.9	22.3	23.7
10	79	410	480	555	635	725	815	17.3	18.8	20.2	21.6	23.1	24.5
15	74	435	510	590	680	775	870	17.9	19.4	20.9	22.4	23.9	25.3
20	69	465	545	630	725	825	930	18.5	20.0	21.6	23.1	24.6	26.2
25	65	495	580	675	775	880	995	19.1	20.7	22.3	23.9	25.5	27.1
30	61	530	620	720	825	935	1060	19.7	21.4	23.0	24.6	26.3	27.9
35	57	560	660	765	875	995	1125	20.3	22.0	23.7	25.4	27.1	28.8
40	54	595	700	810	930	1060	1195	20.9	22.7	24.4	26.2	27.9	29.7
50	48	665	780	905	1040	1185	1335	22.1	24.0	25.8	27.7	29.5	31.4
Pre-Stress	123	260	305	355	410	465	525	13.9	15.0	16.2	17.3	18.5	19.6

Temp °C	Mass Kg	Sag in Millimetres						Time in Seconds for 15 Beats					
		Span Length in Metres						Span Length in Metres					
		90	95	100	105	110	120	90	95	100	105	110	120
5	82	885	985	1090	1205	1320	1570	25.5	26.9	28.4	29.8	31.2	24.0
10	78	930	1035	1150	1265	1390	1650	26.2	27.6	29.1	30.5	32.0	34.9
15	74	980	1090	1205	1330	1460	1735	26.8	28.3	29.8	31.3	32.8	35.8
20	70	1025	1145	1265	1395	1530	1825	27.5	29.0	30.6	32.1	33.6	36.7
25	67	1075	1200	1330	1465	1605	1910	28.2	29.7	31.3	32.8	34.4	37.5
30	64	1125	1255	1390	1530	1680	2000	28.8	30.4	32.0	33.6	35.2	38.4
35	61	1175	1310	1450	1600	1755	2090	29.4	31.1	32.7	34.4	36.0	39.3
40	59	1225	1365	1515	1670	1830	2180	30.1	31.7	33.4	35.1	36.8	40.1
50	54	1330	1480	1640	1805	1985	2360	31.3	33.0	34.8	36.5	38.2	41.7
Pre-Stress	123	585	655	725	800	875	1045	20.8	21.9	23.1	24.3	25.4	27.7

TENSIONING 2.18 MM CC PVC WIRE

Temp °C	Mass Kg	Sag in Millimetres: Span Length in Metres 30	35	40	45	50	55	Time in Seconds for 15 Beats: Span Length in Metres 30	35	40	45		55
5	46	100	140	180	230	280	340	8.6	10.1	11.5	12.9	14.4	15.8
10	42	110	150	195	245	305	365	9.0	10.5	11.9	13.4	14.9	16.4
15	39	120	160	210	265	330	400	9.3	10.9	12.4	14.0	15.5	17.1
20	36	130	175	230	290	355	430	9.7	11.3	13.0	14.6	16.2	17.8
25	33	140	190	250	315	390	470	10.1	11.8	13.5	15.2	16.9	18.6
30	30	155	210	270	345	425	515	10.6	12.4	14.1	15.9	17.7	19.4
35	28	170	230	295	375	465	560	11.1	12.9	14.8	16.6	18.4	20.3
40	25	180	250	325	410	505	610	11.6	13.5	15.4	17.3	19.3	21.2
50	22	215	290	380	480	595	720	12.5	14.6	16.7	18.8	20.9	23.0
Pre-Stress	65	70	100	125	160	200	240	7.2	8.4	9.6	10.8	12.0	13.2
		Span Length in Metres 60	65	70	75	80	85	Span Length in Metres 60	65	70	75	80	85
5	44	420	490	570	650	740	835	17.5	19.0	20.5	21.9	23.4	24.8
10	42	445	520	605	695	790	890	18.1	19.6	21.1	22.6	24.1	25.6
15	39	475	555	645	740	840	950	18.7	20.2	21.8	23.3	24.9	26.4
20	37	505	590	685	785	895	1010	19.2	20.8	22.4	24.0	25.6	27.2
25	35	535	625	725	835	950	1070	19.8	21.5	23.1	24.8	26.4	28.1
30	33	565	665	770	885	1005	1135	20.4	22.1	23.8	25.5	27.2	28.9
35	31	600	705	815	935	1065	1200	21.0	22.8	24.5	26.3	28.0	29.8
40	29	635	745	860	990	1125	1270	21.6	23.4	25.2	27.0	28.8	30.6
50	26	700	825	955	1095	1245	1405	22.7	24.6	26.5	28.4	30.3	32.2
Pre-Stress	65	285	335	385	445	505	570	14.4	15.7	16.9	18.1	19.3	20.5

Temp °C	Mass Kg	Sag in Millimetres						Time in Seconds for 15 Beats					
		Span Length in Metres						Span Length in Metres					
		90	95	100	105	120	120	90	95	100	105	110	120
5	43	970	1080	1195	1315	1445	1720	26.7	28.2	29.7	31.2	32.6	35.6
10	41	1015	1130	1250	1380	1515	1805	27.3	28.9	30.4	31.9	33.4	36.5
15	39	1060	1185	1310	1445	1585	1885	28.0	29.5	31.1	32.6	34.2	37.3
20	37	1110	1235	1370	1510	1660	1975	28.6	30.2	31.8	33.4	35.0	38.1
25	36	1160	1290	1430	1575	1730	2060	29.2	30.9	32.5	34.1	35.7	39.0
30	34	1210	1345	1490	1645	1805	2145	29.8	31.5	33.2	34.8	36.5	39.8
35	33	1260	1400	1550	1710	1880	2235	30.4	32.1	33.8	35.5	37.2	40.6
40	32	1305	1455	1615	1780	1950	2320	31.0	32.8	34.5	36.2	37.9	41.4
50	30	1405	1565	1735	1910	2100	2495	32.2	34.0	35.8	37.5	39.3	42.9
Pre-Stress	65	640	710	785	870	950	1135	21.7	22.9	24.1	25.3	26.5	28.9

TENSIONING 2.18 MM CC POLY WIRE

Temp °C	Mass Kg	Sag in Millimetres						Time in Seconds for 15 Beats					
		Span Length in Metres						Span Length in Metres					
		30	35	40	45	50	55	30	35	40	45	50	55
5	46	90	125	160	205	250	305	8.2	9.5	10.9	12.2	13.6	15.0
10	42	100	135	175	220	275	330	8.5	9.9	11.3	12.7	14.1	15.6
15	39	110	145	190	240	295	360	8.8	10.3	11.8	13.3	14.7	16.2
20	36	115	160	205	260	325	390	9.2	10.8	12.3	13.9	15.4	16.9
25	33	130	175	225	285	355	425	9.7	11.3	12.9	14.5	16.1	17.7
30	30	140	190	250	315	385	470	10.1	11.8	13.5	15.2	16.9	18.6
35	27	155	210	270	345	425	515	10.6	12.4	14.1	15.9	17.7	19.4
40	25	170	230	300	380	465	565	11.1	13.0	14.8	16.7	18.5	20.4
50	21	200	275	355	450	555	675	12.1	14.2	16.2	18.2	20.2	22.3
Pre-Stress	65	65	90	115	145	180	215	6.9	8.0	9.1	10.3	11.4	12.6

Temp °C	Mass Kg	Span Length in Metres						Span Length in Metres					
		60	65	70	75	80	85	60	65	70	75	80	85
5	45	375	440	505	580	660	745	16.6	17.9	19.3	20.7	22.1	23.5
10	42	400	465	540	620	705	800	17.1	18.5	20.0	21.4	22.8	24.2
15	39	425	500	580	665	755	855	17.7	19.2	20.6	22.1	23.6	25.1
20	37	455	535	620	710	810	910	18.3	19.8	21.3	22.9	24.4	25.9
25	34	485	570	660	760	865	975	18.9	20.5	22.1	23.6	25.2	26.8
30	32	520	610	705	810	920	1040	19.5	21.2	22.8	24.4	26.0	27.7
35	30	550	645	750	860	980	1105	20.1	21.8	23.5	25.2	26.9	28.5
40	28	585	690	795	915	1040	1175	20.8	22.5	24.2	26.0	27.7	29.4
50	25	655	770	895	1025	1165	1315	22.0	23.8	25.7	27.5	29.3	31.2
Pre-Stress	65	255	300	350	400	455	510	13.7	14.8	16.0	17.1	18.3	19.4

Temp °C	Mass Kg	Sag in Millimetres						Time in Seconds for 15 Beats					
		Span Length in Metres						Span Length in Metres					
		90		100	105	110	120	90	95	100	105	110	120
5	43	865	960	1065	1175	1290	1530	25.2	26.6	28.0	29.4	30.8	33.6
10	41	910	1010	1120	1235	1355	1615	25.9	27.3	28.7	30.2	31.6	34.5
15	39	955	1065	1180	1300	1430	1700	26.5	28.0	29.5	31.0	32.4	35.4
20	37	1005	1120	1240	1365	1500	1785	27.2	28.7	30.2	31.7	33.3	36.3
25	35	1055	1175	1300	1435	1575	1875	27.9	29.4	31.0	32.5	34.1	37.2
30	34	1105	1230	1365	1505	1650	1965	28.5	30.1	31.7	33.3	34.9	38.0
35	32	1155	1285	1425	1570	1725	2055	29.2	30.8	32.4	34.0	35.7	38.9
40	31	1205	1345	1490	1640	1800	2145	29.8	31.5	33.1	34.8	36.4	39.8
50	29	1310	1460	1615	1780	1955	2325	31.1	32.8	34.5	36.2	38.0	41.4
Pre-Stress	65	575	640	710	780	855	1020	20.6	21.7	22.8	24.0	25.1	27.4

TENSIONING 1.27 MM CC POLY WIRE

Temp °C	Mass Kg	Sag in Millimetres						Time in Seconds for 15 Beats					
		Span Length in Metres						Span Length in Metres					
		30	35	40	45	50	55	30	35	40	45	50	55
5	16	95	125	165	210	255	310	8.2	9.6	11.0	12.4	13.7	15.1
10	14	100	135	180	225	280	335	8.6	10.0	11.4	12.9	14.3	15.7
15	13	110	150	195	245	300	365	8.9	10.4	11.9	13.4	14.9	16.4
20	12	120	160	210	265	330	400	9.3	10.9	12.4	14.0	15.5	17.1
25	11	130	175	230	290	360	435	9.8	11.4	13.0	14.6	16.3	17.9
30	10	145	195	255	320	395	475	10.2	11.9	13.6	15.3	17.0	18.7
35	9	155	210	275	350	430	520	10.7	12.5	14.3	16.0	17.8	19.6
40	8	170	235	305	385	475	570	11.2	13.1	14.9	16.8	18.7	20.5
50	7	205	275	360	455	565	680	12.2	14.3	16.3	18.3	20.4	22.4
Pre-Stress	22	65	90	115	150	180	220	6.9	8.1	9.2	10.4	11.5	12.7
		Span Length in Metres						Span Length in Metres					
		60	65	70	75	80	85	60	65	70	75	80	85
5	15	380	445	520	595	675	765	16.7	18.1	19.5	20.9	22.3	23.7
10	14	405	475	555	635	720	815	17.3	18.7	20.2	21.6	23.1	24.5
15	13	435	510	590	680	770	870	17.9	19.4	20.8	22.3	23.8	25.3
20	12	465	545	630	725	825	930	18.5	20.0	21.5	23.1	24.6	26.2
25	12	495	580	675	770	880	990	19.1	20.7	22.3	23.8	25.4	27.0
30	11	525	620	715	820	935	1055	19.7	21.3	23.0	24.6	26.3	27.9
35	10	560	655	760	875	995	1125	20.3	22.0	23.7	25.4	27.1	28.8
40	10	595	700	810	930	1055	1190	20.9	22.7	24.4	26.2	27.9	29.6
50	9	665	780	905	1040	1180	1335	22.1	24.0	25.8	27.7	29.5	31.3
Pre-Stress	22	260	305	355	405	465	525	13.8	15.0	16.1	17.3	18.5	19.6

ENGINEERING INSTRUCTIONS

LINES AERIAL TE5850
W3010
W3551

Issue 4, 1976

TRANSPOSITIONS

WIRES CROSSING RAILWAY LINES

TREE LINES

REFERENCES

TRANSPOSITIONS

Crosstalk between open wire pairs on a route may be reduced by insertion of transpositions. Transposition schemes may be applied over various section lengths as follows :

Transposition Sections - Types

Section	Maximum Length in Kilometres		Number of Transposition Intervals		
	Group 1 (Pole Spacing of 40 or 80m)	Group 2 (Pole Spacing of 50 or 100m)			
E	10.24	12.8	128	or	256
L	5.12	6.4	64	or	128
R	2.56	3.2	32		
Short $\overline{R}$	1.28	1.6	32		
X	0.64	0.8	16		
Short $\overline{X}$	0.32	0.4	8		

Group 1 lengths are to be used on all new routes required for multi-channel carrier working. Where existing routes are to be retransposed for carrier working, the nominal pole spacing largely determines the Section lengths. In such instances Group 2 lengths are satisfactory for routes required for 3 channel and V.F. operation.

Details of standard transposition schemes are given in EIs LINES Aerial TN3010, 3020, 3021 and 3022.

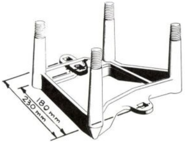
PHYSICAL TRANSPOSITIONS

TRANSPOSITIONS IN TRUNK LINES

Use transposition fitting (S411/43) for physical transpositions in trunk lines made at poles. Where transpositions must be installed between poles, install inspan transposition fittings. See Page K5.

TRANSPOSITION FITTING (S411/43)

This transposition fitting is designed to be mounted on crossarms with either 180 or 230mm spacings.



CAST ALUM. ALLOY

OBSOLESCENT ITEMS - TO BE USED UNTIL STOCKS ARE EXHAUSTED.

Serial/Item	Transposition Fitting
411/14	Plate Transp. PL. 150 mm
411/42	Transp. Fitting PL. 230 mm
411/12	Plate Transp. PL. 230 mm
71/18	Spindle Transp.

Mounting Transposition Fitting on Crossarm

Straight Line Poles - Place transposition fitting on arm so that the single lug side points away from the pole.

Angle Poles - Reverse transpositoon fitting at pin positions 1-2 and 7-8 so that the single lug side is nearest to the pole. Fit transposition fitting at pin positions 3-4 and 5-6 in the normal manner.

Tying in Wires at Transpositions

Wires at all transpositions are tied-in with heavy duty type ties on each wire at the two insulators on the side of the pole nearest to the working positions. If there is a change of grade make the ties at the insulators on the side of the transposition with the angle in the wires.

Tie-in wires, progressively working from the fixed end of the regulating section towards the weights.

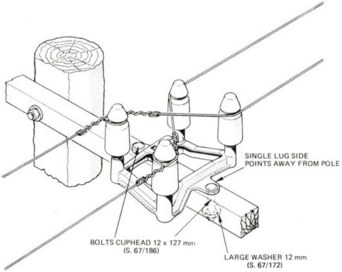
To ensure that correct regulation is maintained as transpositions are pulled in, compare the tensions in each wire on both side of the transposition fitting by the beat method (see page J6) and adjust if necessary so that the beats agreee.

Where insulated line wire is connected to bare wire at a transposition fitting (e.g. at end of power line crossing span) terminate both wires on the insulator on the bare wire side so that the wire within the transposition is insulated. Joint the wires as shown on Page I 12.

Use of Inspan Transposition Fittings

Inspan Transpositions are installed only where crosstalk reduction is necessary for operation of the line and it is not practicable to erect a pole in a suitable position e.g. river crossing, hilly country etc.

MOUNTING PHYSICAL TRANSPOSITION FITTINGS (S411/43)



NOTE: Requisition separately two 12x127 mm bolts (S67/186) and two round washers large. (S67/172).

PHYSICAL TRANSPOSITIONS

Inspan Transposition Components

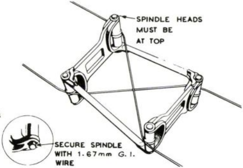
1 - Plate, Inspan Transposition (230 mm wire spacing S.411/39).

4 - Spindles, Inspan Transposition, S.71/23.

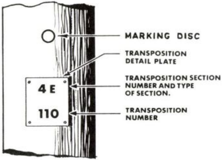
4 - Insulators, Spool S.65/27 (Check that insulators turn freely on spindles before fitting.

Installing Fittings

- Place peg in ground below correct position for transposition.
- Slacken off wires of pair concerned.
- Install inspan transposition from a work basket or pole platform if available.
- Alternatively insert transposition plate in wires at nearest pole and draw into position by ropes from the next pole.
- Square plate to line of route and re-tension wires. Check position of plate.
- Stencil transposition details on nearest pole.



MARKING TRANSPOSITION POLES



TYPICAL TRANSPOSTION MARKING
PRESSURE TREATED WOODEN POLE

Transposition Poles

Mark poles in each transposition section with the consecutive section number, a letter indicating the type of section and the transposition number, e.g. 4E110, 4E111, 4E112, etc. Indicate short X and R sections by $\bar{X}$ or $\bar{R}$.

Section Poles

Mark "S" poles in each repeater section with the consecutive number of the transposition section, the type of section, the letter S and a number indicating :-

- E sections - total number of E sections between the S pole and the previous repeater station.
- Shorter sections - include number only where two or more identical sections are adjacent.

Typical Section Numbering :- 1ES, 2ES1, 3ES2, 4RS1, 5RS2, 6ES3, 7ES4, etc. On main routes, number transpositions consecutively within the repeater sections in the direction away from the capital city. Interstate routes are numbered in the same direction throughout. Number branch routes from the turn-off point on the main route.

Intermediate or Non-Transposition Poles

These poles are not marked but are identified by adding the letters A, B, C, ... in alphabetical order to the transposition, number for example :-

Poles after S pole 4ES2 :- 5EA, 5EB, 5EC, 5EI ......
Poles after transposition pole 5EI :- 5E1A, 5E1B, 5E1C, 5E2, 5E2A ......

Marking Wooden Poles

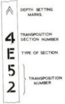
Use yellow pole designation plates (S.424/49), attach to pole, on sound wood with 40 mm flat head galvanised nails. Stencil designation in black with 40 mm high letters and figures.

Attach plate to pole approximately 1.5 m from ground level on the side most readily visible to an inspecting officer. Plates must not obscure the depth setting marks.

Marking Steel Poles

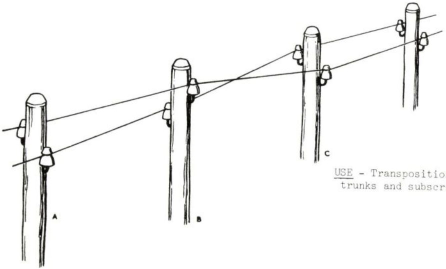
Black iron poles - clean surface thoroughly with wire brush and apply one coat of metal primer containing zinc chromate. Paint yellow background and stencil transposition details in black.

Galvanised iron poles - stencil the designation in black, directly on to the pole.
Arrange letters and figures vertically on narrow poles.



TYPICAL TRANSPOSITION MARKING - STEEL POLE

PHYSICAL TRANSPOSITIONS - SWAN NECK SPINDLES



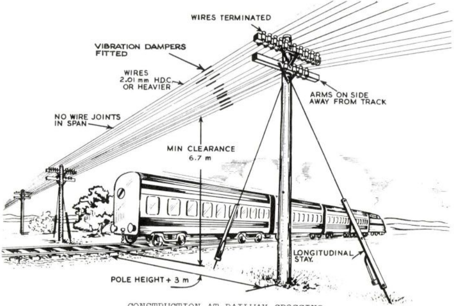
USE - Transpositions in minor trunks and subscribers lines.

TELECOM WIRES CROSSING RAILWAY LINES

Observe the following standard practices except where special conditions are specified by the railway authorities :-

- Make the crossing as nearly as possible at right angles and not less than 45° to the railway track.
- Erect poles on either side of the track. Leave a distance equal to the pole height plus 3 metres, between each pole and its nearest rail so as if the pole should fall, it would be clear of the rails.
- Set poles at the crossing an extra depth of 0.3 to 0.6 m in the ground beyond the standard depth or fit longitudinal stays to both sides of the pole.
- Fit arms to the crossing poles on the side away from the railway track.
- Terminate wires crossing the railway lines on each side of the track.
- Wire clearance above the track must not be less than 6.7 metres.
- Wires must be 2.01 mm H.D.C. or heavier.
- There must be no wire joints in the crossing span.
- Fit wire vibration dampers on all wires in the crossing span.

TELECOM WIRES CROSSING RAILWAY LINES



CONSTRUCTION AT RAILWAY CROSSING

KEEP A SHARP LOOKOUT FOR TRAINS WHEN WORKING ALONG RAILWAY LINES

ENGINEERING INSTRUCTIONS

LINES AERIAL A2901
PA0041
TN1110, 3010
3020, 3021, 3022,
3110 - TN1110
TN1110

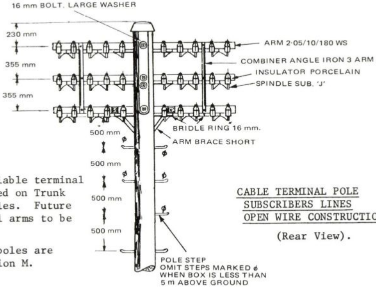
Issue 4, 1976

CABLE TERMINAL POLES

PROTECTION EQUIPMENT

REFERENCES

CABLE TERMINAL POLES



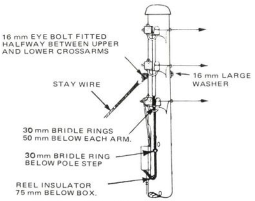
CABLE TERMINAL POLE
SUBSCRIBERS LINES
OPEN WIRE CONSTRUCTION

(Rear View).

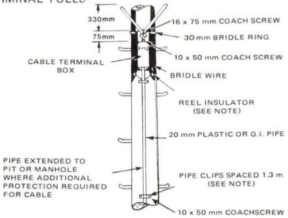
NOTE :-

1. If stocks are available terminal arms will be fitted on Trunk Cable terminal poles. Future policy of terminal arms to be determined.
2. Isolated terminal poles are described in Section M.

CABLE TERMINAL POLES



Side View



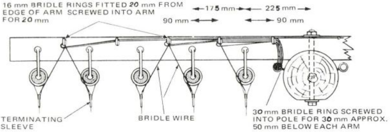
Front View

CABLE TERMINAL POLE - SUBSCRIBERS LINES

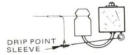
NOTES :

1. Fit Reel Insulator, Polyethylene (S65/24) with 10 x 75 mm Coachscrew (S68/15) or Reel Insulator, (S65/11) with 16 x 125 mm Coachscrew (S68/11).
2. Pipe may be attached to pole with conduit saddles and G.I. clouts instead of pipe clips and coachscrews.

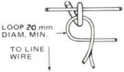
CABLE TERMINAL POLE - ARRANGEMENT OF BRIDLE WIRE



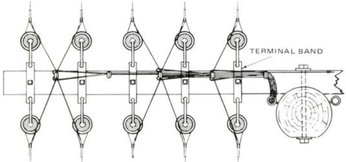
ONE WAY DISTRIBUTION - UNDERSIDE VIEW OF ARM



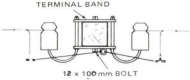
END VIEW



BRIDLE WIRE LOOP AROUND BRIDLE RING



TWO WAY DISTRIBUTION - UNDERSIDE VIEW OF ARM



END VIEW

Issue 4, 1976

L-4 INSTALLING BRIDLE WIRE ON TERMINAL POLE

Run bridle wires from open wire drip points to the cable terminal box without joints. Use drip point connecting sleeves to connect to open wire.

Provide adequate support for bridle wires on poles by bridle rings as shown on pages L-2 and L-3. Do not leave loose bridle leads which may flap around in the wind and cause a wire break inside the insulation.

Strip insulation from wire ends carefully to avoid nicking the conductors.

Tighten terminal screws and nuts in the cable terminal box to hold wire firmly.

Many faults occur as a result of damage to the insulation on conductors during erection. Keep bridle wire on the reel until required for use. Do not drag it over the ground or metal pole fittings. Do not install damaged wire.

JOINTING BRIDLE WIRES

Avoid joints in bridle wires wherever practicable. Make joints only in protected locations at subscribers' premises.

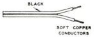
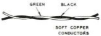
Where jointing is necessary use :-

- Insulated Jointing Sleeve 0.90 mm (S64/76) - for jointing 0.90 mm bridle wire. Identify by black plastic inner sleeve.
- Insulated Jointing Sleeve 1.12 mm (S64/77) - for jointing 1.12 mm bridle wire and joints between 0.90 and 1.12 mm wires. Identify by green plastic inner sleeve.

ALWAYS WEAR A SAFETY BELT AND TAKE A SAFETY LINE WHEN YOU CLIMB A POLE.

CONNECTING BRIDLE WIRE TO LINE WIRE TERMINATIONS

BRIDLE WIRES

Serial/ Item No.	Stock Title	Description	Use	Reel Size
92/19	Bridle Wire Twin Flat 0.90 mm (P.V.C. Insulated)		With 1.27 and 1.68 mm open wire between drip points and cable terminal box. Not to be used in Span.	250 m
92/20	Bridle Wire Twin Twisted 1.12 mm (P.V.C. Insulated)		With 2.01 mm and heavier open wire, between drip points and cable terminal box. Not to be used in span.	250 m

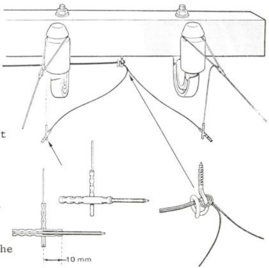
DRIP POINT CONNECTING SLEEVES

Serial Item	Drip Point Sleeve Size	Used to Connect		
		Line Wire mm	Bridle Wire	
			Old Type Sleeves	New Type Sleeves
64/74	1.27 CC	1.27 CC	0.90 mm	0.90 and 1.12 mm
64/75	1.68 CC	1.68 CC	0.90 mm	0.90 and 1.12 mm
64/57	2.01 HDC	2.01 HDC	1.12 mm	0.90 and 1.12 mm
64/58	2.84 HDC	2.18 CC, 2.46 HDC, 2.84 HDC	1.12 mm	0.90 and 1.12 mm
64/59	3.48 HDC	3.07 CC, 3.25 HDC, 3.48 HDC 3.07 GI.	1.12 mm	0.90 and 1.12 mm

FITTING DRIP POINT SLEEVE - NEW TYPE

- Slip line wire sleeve over drip point until wire is seen at bottom of sleeve. Turn sleeve so that counterbored end points towards covered wire. Crimp sleeve lightly with pliers to stop it falling off.
- Crimp line wire sleeve three times with jointing clamps.
- Separate legs of covered wire pair back to crossarms or house. Curve each leg direct to drip point sleeve and cut to length.
- Remove 20 mm of insulation and insert the bare wire plus 10 mm of insulated wire into the counterbored end of the sleeve. Crimp counterbored end once and other end of sleeve three times with 1.27 mm jointing clamp.

NOTE: Sometimes it is necessary to trim off the fin of plastic remaining on drop wire after separation of the legs so that the insulation may be inserted a full 10 mm into the sleeve.



FITTING DRIP POINT SLEEVE

WORK SAFELY AND MAKE SAFETY PRECAUTIONS PART OF THE JOB.

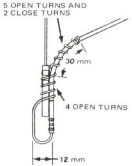
FITTING DRIP POINT SLEEVE - OLD TYPE

Insert drip point in line wire sleeve and crimp twice with jointing tool.

Remove 230mm insulation from end of covered wire and insert into covered wire sleeve until insulation is hard down on sleeve.

Crimp covered wire sleeve three times with 1.27 mm jointing tool.

Wrap bare end of wire around covered wire and sleeve and then around covered wire only.

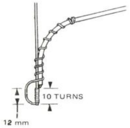


FITTING OLD TYPE SLEEVE

DRIP POINT CONNECTION - WIRE LARGER THAN 3.48 mm HDC

Clean 25mm on end of drip point with emery cloth. Remove 400mm insulation from bridle wire and bind 10 turns around drip point, starting 12 mm from end of drip point and leaving 12 mm bare wire between binding and insulation. Solder 10 turns around drip point.

Wrap remainder of bared wire around covered wire and drip point and then around covered wire only.

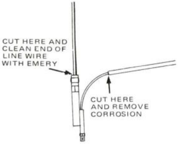


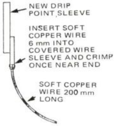
DRIP POINT - OVER 3.48 mm HDC

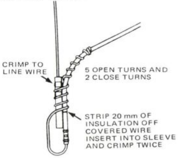
RENEWING DRIP POINT CONNECTIONS

NEW TYPE SLEEVES

Cut away old sleeve and fit new type drip point sleeve as described on Page L-6. If necessary extend drip point as described for old type sleeves below.







(i) Cut away existing sleeve and if drip point is less than 75 mm long extend to 150 mm using a straight sleeve.

(ii) Take 200mm of 0.90mm S.C. wire and insert one end 6mm into lower end of covered wire sleeve and crimp once. Connect drip point to line wire sleeve.

(iii) Strip 20 mm insulation from covered wire, insert fully into sleeve and crimp twice. Wrap tail wire around sleeve and covered wire.

WHERE BRIDLE WIRE IS TOO SHORT TO REACH DRIP POINT RENEW FULL LENGTH BACK TO CABLE BOX.

CABLE TERMINAL BOXES

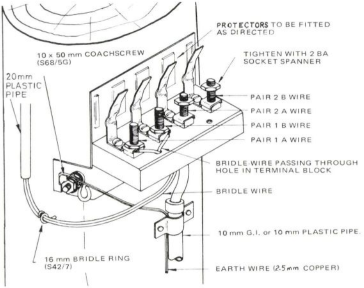
PROTECTED BOXES - For use on all trunk lines, and on subscribers and junction lines in areas subject to a high exposure to electrical storms, or high voltage power lines, or as directed by the responsible officer.

UNPROTECTED BOXES For subscribers and junction lines where protection is not required.

Serial/ Item	Box Size and Type	Use
77/76	2 pr Protected	For connecting one or two pairs of aerial wires to cable e.g. in rural areas where aerial lead-ins are provided in conjunction with buried distribution cable.
77/81	2 pr Unprotected	For connecting bridle or drop wire to cable conductors.
77/75	10 pr Unprotected	For 3-10 lines where protection is not necessary.
77/78 77/79	10 pr Protected 15 pr Protected	Where protection is required for subs or junction lines or for trunk lines not carrying 12 channel carrier circuits.
77/82 83,84	12 pr Untailed	For isolated cable terminal poles, joint use poles and open wire routes where protection is not necessary. Boxes assembled in field from items 82, 83 and 84.
77/70	24 pr Protected Carrier Trunk	For 12 channel carrier circuits. Fitted with 24/40 pr carrier quad cable tail.

Note : Requisition protectors for protected boxes separately. There will be no further purchases of cable terminal boxes S77/75 and S77/79. Use until existing stock is exhausted then use items S77/82,83,84 and S77/78 respectively.

CABLE TERMINAL BOX - 2 PAIR - PROTECTED



FITTING 2 PR. PROTECTED TERMINAL BOX (S77/76).

CABLE TERMINAL BOX - 2 PAIR - UNPROTECTED

FIELD OF USE

The 2 pair unprotected terminal box is used for the following :-

- On poles to connect one or two aerial lines to underground cables.
- At subscribers' premises where a bridle or drop wire or a plastic lead-in cable must be terminated before reaching the telephone.

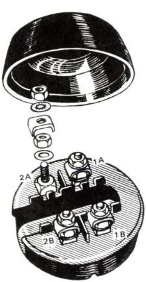
The box is constructed of plastic and is supplied without a cable tail.

FITTING BOX

Attach box to wooden surfaces with 25mm x 8 wood screws.

CONNECTING BRIDLE OR DROP WIRE AND CABLE

Insert cable conductor under the lower round washer without removing the insulation. Connection is made by crushing the insulation when the lower nut is tightened.
Remove 10 mm of insulation from drop and bridle wire before terminating under the lipped washer.

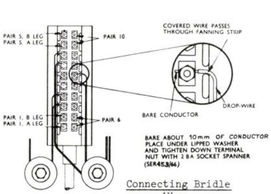


BOX CABLE 2 PAIR UNPROTECTED
(S77/81)

1PR PROTECTED. SUB. BLOCK. NO 1.
USED ON END OF TRANSP. LINE SEE 1-28

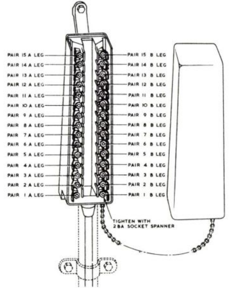
Issue 4, 1976

CABLE TERMINAL BOXES 10 AND 15 PAIR



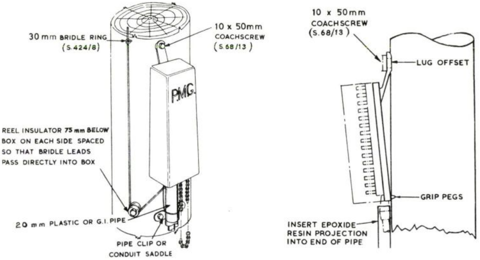
Connecting Bridle Wire.

TERMINAL ASSEMBLY 10 PAIR
UNPROTECTED BOX (S77/75)



TERMINAL ASSEMBLY - 10 AND 15
PAIR BOX, PROTECTED (S77/89 AND 79)

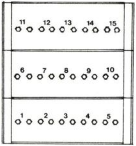
NOTE : DIFFERENT ARRANGEMENT OF PAIR NUMBERING IN BOXES.



FITTING 10 AND 15 PAIR CABLE BOXES, PROTECTED. (S77/78, AND 79).

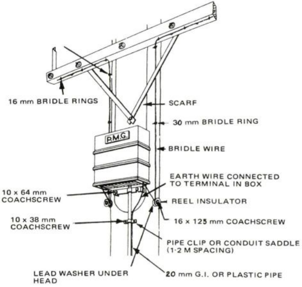
ACCIDENTS DON'T JUST HAPPEN - THEY ARE CAUSED

CABLE TERMINAL BOX - UNIT TYPE

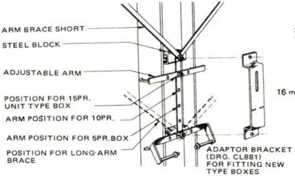


NUMBERING OF TERMINALS

This box is made up of 5 pair units to provide 5, 10, 15, 20 or 25 pairs of terminals. It is now obsolete except for the Carrier Trunk Box (S77/70) but a large number remain in service.



FITTING UNIT TYPE TERMINAL BOX (OBSOLETE)

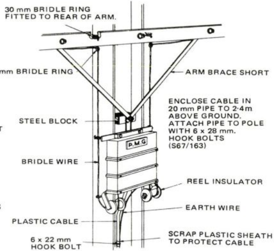


FITTING ADJUSTABLE MOUNTING BRACKET

(S424/50)

Mount bracket above braces where 2.75 m arms and long arm braces are fitted.

Fit adaptor bracket, Drawing CL.881, (manufactured locally as required) when installing new type protected boxes.



FITTING UNIT TYPE BOX

FITTING CABLE TO STEEL BEAM AND RAIL POLES.

CABLE TERMINAL BOX - UNTAILED

FIELD OF USE

The untailed terminal box is used with either underground or aerial polyethylene cable where protection is not required. The cable is terminated directly on three-pair terminal strips mounted in the box.

The box may also be used as an enclosure for jointing polyethylene cables on poles. Some of the jointed pairs may be terminated. In most installations the cable is looped through the box and some of the pairs terminated.

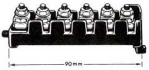
COMPONENTS

The box is assembled in the field using :

Frame, Untailed Box (S77/83) - 1

Cover, Untailed Box (S77/84) - 1

Strip, Untailed Box (S77/82) - 1 to 4 depending upon the number of pairs to be terminated.



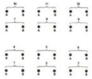
TERMINAL STRIP (S77/82)

LOCATION OF BOX ON COMMISSION POLES

- Underground Cable - 3.56m above ground to the top bolt hole normally on the property side of the pole.
- Aerial Cable - as close to the level of the cable as practicable (above or below) and on the same side of the pole.

LOCATION OF BOX ON JOINT USE POLES

In accordance with the local agreement with the electricity authority. Normally installed on the property side of the pole. Boxes on underground cable are mounted 3.56 m above ground, to the top bolt hole.



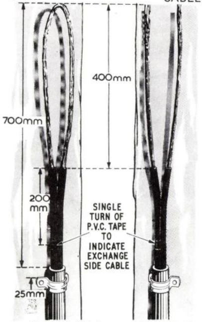
PAIR NUMBERING OF TERMINAL STRIPS

FITTING BOX TO POLE

- Underground cable is looped up and down each terminal pole through protecting PVC pipe so that cable projects 700 mm above end of pipe. Arrange free ends of cable similarly for entry into box for jointing.
- For aerial cables provide sufficient slack cable to loop into the box or for entry of free ends.
- Remove sheath of cable for 400 mm from the top of the loop or end of cables.
- Place a single turn of PVC tape around cable on the exchange side 200 mm from the sheath end.
- Holding the frame on the cable with the top 20 mm below the end of sheath, mark position for screws through holes in the mounting bracket.
- Attach the frame with two 10 x 50 mm coachscrews (treated poles) or 10 x 65 mm (untreated poles).
- Attach cover chain with galvanised clout (S633/2) or a staple (S633/14).
- Fit cable through slot in base of frame and secure it in position by binding it with scrap 0.64 or 0.90 mm insulated wire to the posts in the base and top horizontal cross-member so that the sheath protrudes 20 mm above the cross-member.
- If integral bearer cable is installed, the aluminium foil electrostatic screen must be connected through each joint so that it continues throughout the cable.
- Where cable is not jointed, fold conductors so that they do not project more than 75 mm above the top of the frame.

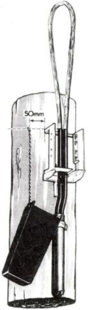
GOOD SAFETY RECORDS ARE MADE WHEN SAFETY BECOMES PART OF THE JOB.

CABLE TERMINAL BOX – UNTAILED

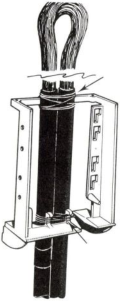


Looped Cable   Free Ends

REMOVING CABLE SHEATH



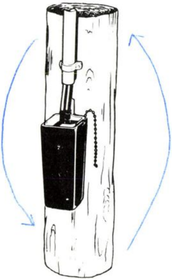
Marking Coach-screw Positions



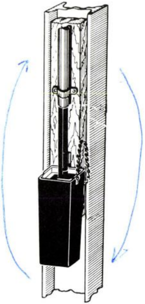
Securing Cables to Frame

CABLE TERMINAL BOX — UNTAILED

Attaching Cover Chain
MOUNTING BOX ON POLE

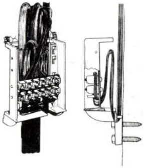


Wooden Pole
COMPLETED INSTALLATION



Steel Beam Pole

CONNECTING DROP WIRES



TERMINATING DROP WIRE

- Pass end of drop wire (bearer removed) down behind the frame, through the entry slot, in the base and up in front of the terminal strips.
- Take up slack and cut drop wire about 300mm above the top of the frame.
- Form all of the drop wires into a loop behind the right hand side of the frame.
- Pass wires to be terminated on bottom strip along shelf at bottom of the box and up through lower fanning slots in the strip.
- Pass conductors to be terminated on 2nd, 3rd and 4th strips around the pin in lower right hand corner of the frame and up the channel between terminal strips and the side of the box. On the 2nd and 4th strips pass conductors through the upper fanning slots and, on the 3rd strip, pass conductors through the lower fanning slots.
- Cut drop wire to length required, separate conductors for 50mm and remove 10mm insulation.
- Place bared end under two-lipped washer and tighten terminal nut to hold wire firmly.
- Do not leave any unecessary slack drop wire in the box.

TERMINATING AND JOINTING CABLE CONDUCTORS

Refer Linemans Handbook, "Cable Jointing No.1".

DO NOT CLIMB ANY POLE UNTIL YOU EXAMINE IT AND ARE SURE THAT IT IS SAFE.

PROTECTION EQUIPMENT IN TERMINAL BOXES

The type of protectors fitted in protected boxes depends on the type of circuit and the degree of exposure to electrical storms and high voltage power lines. The protectors to be used in each Lines Supervisor's district will be advised by the Engineer or Technical Officer. Standard types and their normal use are shown below.

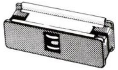
Item No.	Description	Details of Use
442/1	Protector, Silicon Carbide 450-950 V.	For protection of lines from the effects of over voltages due to atmospheric discharges in areas of high isoceraunic levels (greater than 25). Not to be used for protection from effects of A.C. induction.
442/2	Protector, Gas Filled, Type 1, 350 V.	For protection of cables, open wire lines and transmission equipment from effects of over voltages due to atmospheric discharges and A.C. induction.
442/19	Protector, Gas Filled Button Type 350 V, complete with adaptor.	For protection of telephone exchange lines and customer equipment from effects of over voltages due to atmospheric discharges and A.C. induction.
442/22	Protector, Gas Filled, Button Type 230V unmounted	
442/23	Holder, Protector, Gas Filled Button Type.	Siemen's code A1-A1. Used for mounting Item 22.

PROTECTING EQUIPMENT - PROTECTORS

Failure of Protector

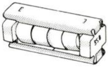
If frequent failures of one type of protector occurs, replace by higher performance type, for example, replace S442/2 type protector with S442/19 type protector. Bridge fuse clips in old type protected boxes with copper wire, soldered to the clips.

UNMOUNTED (S442/22)

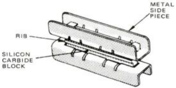


MOUNTED (S442/19)

BUTTON TYPE PROTECTOR



PROTECTOR GAS FILLED
(S442/2)



TYPICAL SILICON CARBIDE
PROTECTOR (S442/1)

FIT ONLY ONE TYPE OF PROTECTOR IN ANY CABLE TERMINAL BOX

EARTHING CABLE TERMINAL BOXES

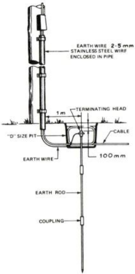
EARTH RESISTANCE LIMITS

All protected cable terminal boxes must be connected to a low resistance earth (Less than 5 ohms where practicable) to ensure efficient operation of the protectors.

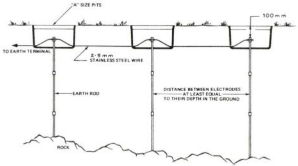
METHODS OF PROVIDING EARTH CONNECTION

- Buried Wires (Trench earth). Used where the earth wire can be installed in conjunction with cable laying or where rocky conditions make deep driven rods impracticable. Bury 2.5 mm stainless steel wire (S62/30) in the trench dug for the cable, at a depth of 610 mm, for a distance of not less than 30 m, with a maximum of 100 m. Install wire in a continuous length without joints.
- Earth Rods. Used where the measured resistance of a buried wire earth exceeds 5 ohms, where a protected box is installed on an existing cable route or where soil conditions favour deep driving. Sectional earth rods (S446/16) consist of of 1.2 m lengths of stainless steel rod (see page L25) which are connected together with couplings (S446/17) for deep driving. Drive the rods vertically into the ground, adding rods until the required resistance is achieved. Measure the earth resistance after each section of rod is installed. Where rock is encountered it may be necessary to install several earth rods connected together and separated by a distance at least equal to their depth in the ground.
- Cable Sheath. Used where bare lead sheathed or armoured cable is laid. As the cable sheath and armouring wires are mechanically connected to the body of the terminal box during manufacture no further electrical connection is required except that the armouring should be bonded to the cable sheath at the first jointing pit or manhole from the terminal pole and on both sides of each joint where the length of armoured cable exceeds 800 m.

EARTHING CABLE TERMINAL BOXES



SINGLE ROD ELECTRODE



MULTIPLE ROD ELECTRODE

REMEMBER - RUBBER GLOVES PROTECT YOU FROM ELECTRIC SHOCK AND EVERY PRECAUTION YOU TAKE HELPS PROTECT YOU AND YOUR WORKMATES.

EARTH WIRE

Use 2.5 mm stainless steel wire (S62/30) for earth wiring. Run the earth wire without joints between terminating points avoiding sharp bends. Cleat exposed wire neatly to poles or structures. Enclose it in small diameter PVC pipe where protection against damage is necessary.

Where several electrodes are installed connect them together by 2.5 mm stainless steel wire buried at a depth of at least 300 mm between rods.

Connecting Wire to Earth Rod. Drive rod head to 100 mm below ground level and fit Terminating Head (S446/18). Insert wire in press type sleeve and crimp twice with Wire Jointing Clamp (S93/21).

Where more than one rod is installed, thread sufficient terminating heads along the earth wire to enable all rods to be connected without cutting the wire. If necessary the press type sleeve on the terminating head may be used to joint the earth wire.

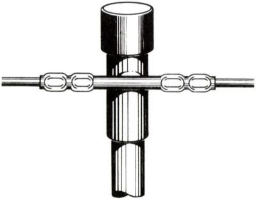
Fit polyethylene cap over the terminating head.

Fit Jointing Pit over the rod end to permit subsequent inspection and to indicate position of the electrode.

Connecting Wire to Earth Terminals. Fit press type Sleeve Terminating Type A, (S64/82) for cable terminal boxes or Type B, (S64/83) for larger terminals up to 10 mm diam, to the end of the earth wire and crimp twice with Clamp Wire Jointing (S93/21).

Connecting Groups of Electrodes to Equipment. Use Connecting Sleeve (S64/81) to joint wires from groups of electrodes to a single wire to the earth terminal.

CONTACT WITH POWER WIRES CAN MEAN DEATH. TAKE EVERY PRECAUTION AND AVOID TOUCHING POWER WIRES OR FITTINGS ON POWER POLES.



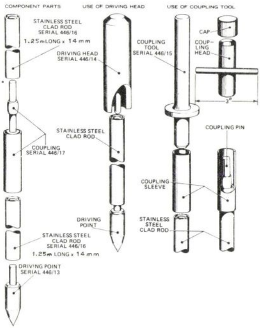
CONNECTING EARTH WIRE TO ROD

ROD DRIVING JIG (S446/8)
FITTED WITH "COBRA" HAMMER

EXTENDABLE EARTH RODS

EARTH ROD COMPONENTS

S 446/16 - Rod, Stainless Steel Clad Steel.
S 446/19 - Polyethylene Cap.
S 446/13 - Driving Point.
S 446/14 - Driving Head.
S 446/15 - Coupling Tool.
S 446/17 - Coupling, stainless steel clad steel.
S 446/18 - Terminating Head.



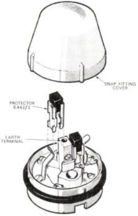
INSTALLING EARTH RODS

- Fit driving point and driving head to rod.
- Drive first rod and remove driving head.
- Using the coupling tool, drive coupling sleeve on to the head of the driven rod.
- Remove tool and insert coupling pin.
- Insert next rod into coupling sleeve.
- Fit driving head and continue driving.
- Measure earth resistance after each rod is driven into the ground.
- When required resistance is obtained or rod cannot be driven further, cut rod to 100 mm below surface of ground.
- Fit terminating head on end of rod using coupling tool and connect earth wire.
- Fit polyethylene cap over the head.
- Install a Jointing Pit over end of rod.

PROTECTION EQUIPMENT AT SUBSCRIBERS PREMISES

Fit Substation Protector No. 1 (S11/80) on subs. aerial lines over 180 m in length in those areas subject to severe lightning as specified by a responsible officer.

The Protector No.1 is a circular moulded block with a snap fitting cover and can accommodate two protectors but has no provision for fuses. These protectors are supplied separately, S442/2, 19, 20 and 21.



PROTECTOR (S11/80)

LOCATION FOR INSTALLATION

Mount protector in an external position which is :-

- Close to the point of attachment of line wires to the building.
- Readily accessible for maintenance without entering the building.
- Protected from the weather and away from dampness or flammable material.

A position under the eaves, verandah or sheltered porch is ideal for the purpose.

CONNECTION TO LINE WIRES

Use Bridle Wire (S92/19) between open wire drip points and the protector. Secure wire neatly to the building with stapling machine or cable locking clips.

Where a protector is not required extend the bridle wire to the telephone or if this is not practicable it may be terminated on a 2 pair unprotected Box fitted in a suitable position for connection to internal cabling.

Where the protector is installed close to lead-in wires the insulated line wire may be extended without drip points and terminated in the protector.

EARTHS FOR PROTECTION PURPOSES

Use 7/0.736 mm stranded copper wire (S192/181) for earth wiring from the Protector.

Run the wire as straight as possible without sharp bends or joints.

Connect the earth wire to a metallic water pipe where available, by means of Earth Clip (S425/16) or an electrical type earth clip. Clean pipe all round before fitting the earth clip.

UNDER NO CIRCUMSTANCES SHOULD AN EARTH WIRE BE CONNECTED TO A GAS PIPE OR ELECTRIC LIGHT CONDUIT OR TO A WATER PIPE WHICH IS NON-METALLIC (PLASTIC, ASBESTOS CEMENT, ETC.) OR WHICH DOES NOT EXTEND UNDERGROUND FOR AT LEAST 8 m.

If a suitable water pipe is not available, drive a 2.5 m earth rod (two 1.2 m sections) into the ground preferably in a damp location leaving the top of the rod 150 mm above ground level. Connect wire to earth rod as described in L25.

EARTHS FOR OPERATION OF CIRCUITS

Earth connections necessary for the operation of circuits e.g. earth circuit lines, duplex services etc. must not exceed an earth resistance of 5 ohms.

Aerial Lead-in - Connect to a water service pipe or use deep driven earth rods.

Underground Lead-in - Install 2.5 mm stainless steel wire (S62/39) in the trench dug for the lead-in cable (depth to be 610 mm). Where earth resistance of 5 ohms is exceeded install deep driven earth rods.

WE MUST WORK SAFELY AND ENCOURAGE OTHERS TO WORK SAFELY.

TRANSFORMERS ON TELEPHONE LINES

TELEPHONE LINE TRANSFORMERS (S5/101)

This equipment may be used for the following purposes :-

To connect part privately erected (PPE) Lines to Telecom Lines.

To derive an additional V.F. circuit from two existing pairs of wires (Phantom).

To superimpose a telegraph, switching or signalling circuit on an existing pair of wires.

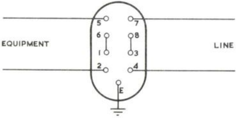
Transformers for the last two items are normally installed in the exchange, but in some cases may be mounted on the cable terminal pole.

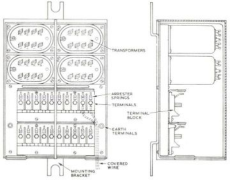
Transformers for pole mounting are installed in a weather-proof metal box attached to the pole by coachscrews.

Boxes accommodate up to four transformers and protectors and are normally wired in the Workshops for the particular purpose required.

PROVISION OF EARTH CONNECTION

Transformer Boxes must be connected to a good earth (See page L-23). Where boxes are fitted on cable terminal poles connect the earth terminals of both boxes together.





TELEPHONE LINE TRANSFORMER BOX

CONNECTIONS FOR PPE LINES
(Magneto exchanges only)

ENGINEERING INSTRUCTIONS

LINES GENERAL P0010, P0001,
P3001

LINES AERIAL W3616

DROP WIRE DISTRIBUTION

M

ISOLATED TERMINAL POLES

ERECTING

TERMINATING AT TERMINAL POLES

ATTACHING TO INTERMEDIATE POLES

TERMINATING AT CUSTOMERS PREMISES

JOINTING

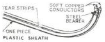
REFERENCES

Issue 4, 1976

DROP WIRE DISTRIBUTION

DROP WIRE

Drop wire is an insulated one pair cable with an integral bearer wire. It is used for aerial leads from isolated terminal poles to customers premises or between two buildings or for lead-ins from open wire.

Serial 92 Item No.	Stock Title	Description	Bearer Wire		Reel Size m
			Dia. mm	Breaking Load	
10	Drop Wire 1 pr. 0.90mm Polyethylene insulated.	Trefoil Shape as below	1.2	1957 Newtons	500
11	Drop Wire 1 pr. 0.90 mm PVC insulated. NOTE: Items 10 and 11 are interchangeable.		1.2	1957 Newtons	500

IDENTIFYING POLYETHYLENE AND PVC INSULATION

PVC - Appearance gloosy and smooth. With conductor removed, pvc insulation sinks in water.

HD Polyethylene - Appearance dull and waxy. With the conductor removed, HD polyethylene floats in water.

KEEP WELL CLEAR OF POWER WIRES AND FITTINGS ON JOINT USE POLES.

DROP WIRE DISTRIBUTION ISOLATED TERMINAL POLES

POSITION FOR ISOLATED TERMINAL POLE (ITP)

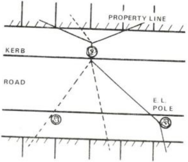
Isolated terminal poles may be served by either underground or aerial cable.

Select position for the pole which will permit the required number of houses to be served.

Erect poles of sufficient height to maintain adequate ground clearance for wires. Provide extra pole height where necessary to attach electric service leads to the head of the pole.

Use Joint Use power poles as isolated terminal poles where directed. See conditions for Joint Use construction Section P.

Where it is necessary to attach drop wire to a single power pole to cross beneath power lines, the conditions of Common Use apply. See Section O.

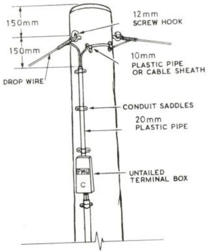


DISTRIBUTION FROM IT POLE

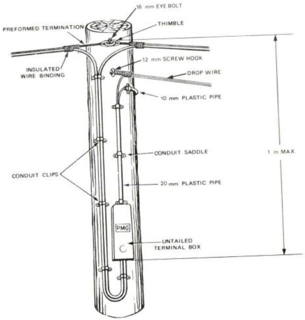
HOUSING DROP WIRE ON TERMINAL POLE

Protect drop wire on terminal pole between termination and cable terminal box by enclosing it in plastic pipe as shown on page M-3. On existing poles where bridle rings have been fitted, see that drop wire is adequately supported. There must be no loose loops of wire which can flap in the wind as this causes wire breakages within the insulation, which are difficult to locate.

ISOLATED CABLE TERMINAL POLES



UNDERGROUND CABLE INSTALLATION



AERIAL CABLE INSTALLATION

ERECTING DROP WIRE

ERECTING AND TENSIONING

Erect drop wire with the minimum tension necessary to maintain adequate ground clearance. Sags at erection **must** not be less than those shown in the following table :

Span Length	23 m	24-30 m	31-38 m	39-45 m	46-53 m	54-69 m
Minimum Sag	300 mm	450 mm	600 mm	750 mm	900 mm	1200 mm

At low temperatures below 10°C reduce sag by 150 mm
At high temperatures above 32°C increase sag by 150 mm

MINIMUM SAGS FOR DROP WIRE

Where a road crossing is involved, two men are required for installation of drop wire, one to act as flagman to prevent vehicles running over the drop wire or carrying it away while it is being hoisted by the other man. Additional flagmen may be necessary at busy roads.

HANDLE DROP WIRE WITH CARE TO AVOID DAMAGE TO CONDUCTORS AND INSULATION.

The small diam. soft copper conductors are easily broken if proper care is not used. The plastic insulation though relatively tough and long lasting with normal treatment, is easily damaged by sharp edges or by crushing.

Do not drag the wire along the ground, over fences, crossarms or other sharp edged objects. Do not allow vehicles to pass over the wire.

DROP WIRE DISPENSER

The use of a Drop Wire Dispenser (S93/41) to accommodate reels greatly facilitates handling and reduces the risk of damage to drop wire during erection.

TERMINATING DROP WIRE AT CABLE TERMINAL POLE

TERMINATING FITTINGS

12 mm Screw Hook (S424/59) - Supports up to four drop wires (See page M-3).
Drop wire Terminating Insulator (S65/19).
For attachment to steel or other non-wooden poles, a wooden block may be mounted on the pole or other locally designed fittings used.

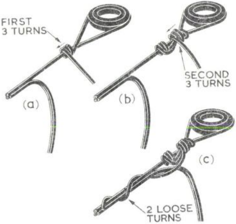
BEARER WIRE TERMINATION

Separate steel bearer wire from conductors for sufficient length to reach from the screw hook to the terminals in the box.

Allow 530 mm insulated bearer wire for the termination.

Pass end of the bearer wire around a nylon terminating insulator and make it off around itself with 3 tight turns as in drawing (a), followed by 3 turns close to the insulator as in drawing (b). Finally make 2 loose turns to secure the conductor as in drawing (c).

Cut off surplus bearer wire.



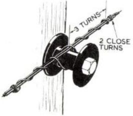
TERMINATING BEARER WIRE

ATTACHING DROP WIRE TO INTERMEDIATE POLES

Where it is necessary to attach drop wire to an intermediate pole between the cable terminal pole and the customer's premises tie in the drop wire to a plastic reel insulator (S65/24) mounted horizontally on the pole with 10 x 75 mm coachscrew. Make a heavy duty type tie using 1.52 mm covered tie wire (S434/21).

If there is an angle in the lead, use an aerial cable spindle and porcelain reel insulator (S65/11).

Where drop wire is attached to a common use power pole to support a lead-in crossing the road, mount the fitting on an in-line face of the pole (See Section 0).



(a) Straight Line Pole.

(b) Angle Pole.

ATTACHING DROP WIRE TO INTERMEDIATE POLES

TERMINATING DROP WIRE AT CUSTOMERS PREMISES

POSITION FOR ATTACHMENT TO BUILDING

Attach drop wire to customers premises at least 2.7 m above ground. Choose a position on the building which provides suitable access for extending drop wire to the telephone and gives adequate clearance from power wires, trees and other obstructions.

Avoid positions where the drop wire would detract from the appearance of the house e.g. crossing in front of windows or low over driveways. A suitable location for attachment is the fascia board preferably on a side face rather than the front of the house. Normally 300 mm from the corner of the house nearest to the pole is satisfactory.

TERMINATING BEARER WIRE.

Terminate the bearer wire on a 30 mm Bridle Ring (S424/8) inserted into the fascia board or other suitable wooden section of the building (See Page M-8). Bore a 5 mm hole and screw in the bridle ring to the full depth of the thread.

On certain types of houses, attachment to the fascia may not be practicable and special terminating fittings may be necessary. A bracket designed to provide additional height on low set houses, and fittings for use on houses with combined metal gutter and fascia are shown on Page M-8. These are not standard items and are produced locally as required.

Cut the web at the end of the drop wire and tear the bearer away.

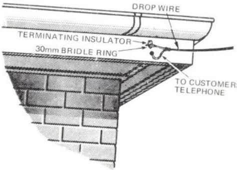
Remove sufficient length of bearer wire from drop wire conductors to reach the telephone.

Leave about 530 mm of bearer wire separated from the conductors to make the termination. (Cut away excess bearer wire).

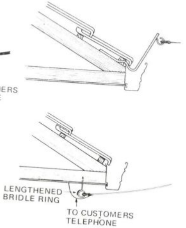
Terminate the bearer wire around a Drop Wire Terminating Insulator as described on Page M-5

Place the insulator in position on the bridle ring.

TERMINATING DROP WIRE AT CUSTOMERS PREMISES



ATTACHMENT OF DROP WIRE TO BUILDING



FITTINGS FOR COMBINED FASCIA/GUTTER (NON-STANDARD)

FITTING FOR OBTAINING HEIGHT (NON-STANDARD)

Issue 4, 1976

After separating bearer and conductors, check whether any defects in the tear strip have damaged the conductor insulation. Do not install any damaged sections.

Where the lead to the telephone is taken through the ceiling, drill a hole for the drop wire through the fascia board about 25 mm below the bridle ring. Drill the hole at an upward angle to prevent ingress of water. Form a small goose neck in the drop wire to act as a drip point and fix the wire to the fascia with a staple or cable locking clip to prevent it being pulled into the eaves. Leave a short length of slack wire in the eaves for jointing if replacement of the external lead should ever become necessary.

Where possible conceal internal wiring, eg run through ceiling, wall cavities or under the floor. Secure drop wire to the building using machine driven staples or cable locking clips (S89/65) spaced approximately 225 mm apart. Do not use hand driven insulated stapes as the insulation and conductors may be damaged if struck by the hammer. Use staples S54/12 with Titan stapling machine S54/11 or staples S54/10 with Celco stapling machine S54/9.

If cable is used for internal wiring, a 2 pair Unprotected Terminal Box (S77/81) may be fitted at the junction of internal and external wiring. Fit the box in a sheltered position eg under the eaves, where it is readily accessible as a test point. Use of terminal boxes should be avoided wherever possible. (Leave slack in eaves).

Use insulated sleeves (S64/76) where it is NECESSARY to joint drop wire (See Page M-10). NEVER joint drop wire in a span.

DO NOT ENTER OR DO ANY WORK ON PRIVATE PROPERTY UNLESS THE CUSTOMER OR A RESPONSIBLE PERSONS IS PRESENT.

JOINTING DROP WIRE

NEVER JOINT DROPWIRE IN SPAN - REPLACE IT.

INSULATED JOINTING SLEEVES

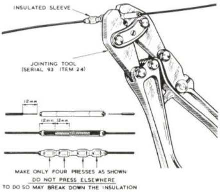
Use 0.90 mm insulated sleeves (S64/76) for joints in all covered wire with 0.64 mm or 0.90 mm conductors (Drop, multi-pair and bridle wires). Use these sleeves also to joint 0.64 mm drop wire to 0.90 mm wires. The 0.90 mm sleeves have a black plastic inner sleeve.

FITTING SLEEVES

1. Cut wires to length and remove 12 mm of insulation from the ends.
2. Push conductor into sleeve so that 12 mm of insulation passes into sleeve.
3. Crimp sleeve between the guide lines with 5 mm groove of Tool(S93/24) Make inner crimp first, then outer crimp.
4. Repeat on other end of sleeve.

DO NOT WRAP THE JOINT WITH INSULATION TAPE.

Do not make joints in drop wire bearers.
Repair damaged drop wire by replacing the affected span.



INSULATED JOINTING SLEEVE 0.90 mm

ENGINEERING INSTRUCTIONS

LINES AERIAL W3201, 3202

Issue 4, 1976

AERIAL CABLE

ERECTING INTEGRAL BEARER AERIAL CABLE

ERECTING AERIAL CABLE WITH SEPARATE BEARER WIRE

REFERENCES

Issue 4, 1976

ERECTING INTEGRAL BEARER IB AERIAL CABLE

This Section describes practices for erecting IB aerial cable on the Telecom poles. The use of power poles to support aerial cable is covered in Section O for Common Use construction and Section P for Joint Use construction.

METHODS OF INSTALLATION

Span by Span Erection. The bearer is terminated at each pole where a cable terminal is required immediately or in the future and a loop of cable is left for connection to an untailed terminal box. The method is used for customer's distribution in urban areas where a cable terminal box is required on almost every pole.

Multispan Erection. The cable is erected and tensioned over a number of spans. Loops of cable are provided only at poles where a terminal box is to be fitted. If terminal boxes are required subsequently at intermediate poles, they may be connected via a short cable tail to an inspan joint adjacent to the pole. The method is applicable to outer urban and rural areas where the number of intermediate cable terminal boxes is limited or where future terminal box locations are uncertain.

SIDE OF POLE TO ATTACH CABLE

IT Pole Distribution :- The property side is generally preferred. Cable boxes on the property side are more accessible and avoids placing ladders on roads.

Cable Erected in Long Lengths :- The road side is preferred because this allows the cable to be laid out along the ground as the drum is drawn along the route.

Where mobile work baskets are used :- The road side is preferred for all types of construction.

At the beginning and end of the cable route :- Fit terminating fittings on the in-line face of the pole.

CABLES MUST HAVE AT LEAST THE MINIMUM CLEARANCE ABOVE GROUND.

ERECTING INTEGRAL BEARER AERIAL CABLE

PREPARATION OF POLE ROUTE. Poles to which aerial cable is attached must provide sufficient height to provide at least the minimum statutory ground clearance for the cable. Before erection of the cable, the poles must be checked for soundness and adequately stayed to support the additional load imposed by the cable.

POINT OF ATTACHMENT ON POLES. Select a position which will provide the required ground clearance (See Page B7) and clearance from power lines (See Section O). In areas subject to grass fires, erect the cable as high as practicable. Do not locate the cable where it may be damaged by rubbing against arm braces or other pole fittings.

FITTINGS FOR TERMINATING BEARER WIRE ON WOOD POLES.

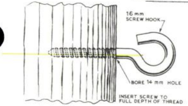
Single Strand Bearer	:-	Preformed Termination 1/2.5 mm (Blue) (S434/15) on bearer, attached to 16 mm Screw Hook (S424/61) on pole.
Multistrand Bearer	:-	Preformed Termination 7/1.25 mm (Green) (S434/12), 7/1.60 mm (S434/13) Black, 7/2.00 mm (S434/14) (Yellow) on bearer, attached to 16 mm Eyebolt on pole.
16 mm Eyebolt Sizes	:-	75 mm (S109/1), 150 mm (S109/2), 225 mm (S109/4), 300 mm (S109/5), 450 mm (S198/7).

FITTINGS FOR SUPPORTING CABLE AT INTERMEDIATE POLES (WOOD)

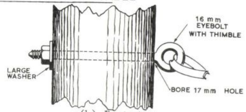
Straight Line Poles	:-	Reel Insulator (S65/11) fitted horizontally on the pole by a 16 x 125 mm Coachscrew (S68/11).
Angle Poles up to 45°	:-	Reel Insulator (S65/11) fitted vertically on the pole by an Aerial Cable Spindle (S434/20).
Angles over 45°	:-	Terminate aerial cable bearer.

FITTINGS FOR STEEL AND OTHER NON WOOD POLES. The above fittings may be used by attaching them to crossarms or wood blocks mounted on the pole face or by adapting steel pole fittings.

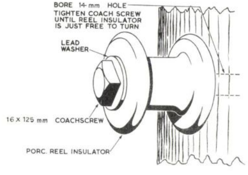
ERECTING INTEGRAL BEARER AERIAL CABLE



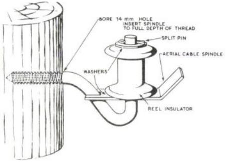
(a) 16mm Screw Hook



(b) Eyebolt



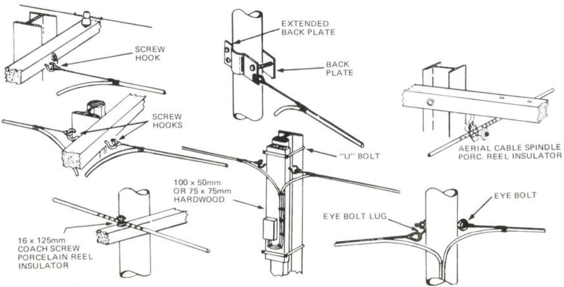
(c) Reel Insulator Fitted Horizontally



(d) Reel Insulator Fitted Vertically

FITTINGS FOR WOOD POLES

ERECTING INTEGRAL BEARER AERIAL CABLE



TYPICAL METHODS OF ATTACHING I B CABLE TO STEEL AND NON WOODEN POLES.

ERECTING INTEGRAL BEARER AERIAL CABLE

LAYING OUT AND ERECTING CABLE

Before erecting cable complete all permanent staying and fit temporary stays where necessary at intermediate terminating points. Ensure that all poles are safe to climb

Note the location of all power wires crossing the route and take the necessary precautions to ensure safe working conditions during erection of the cable (See Section O).

Where cable is erected below arms or on poles without arms, lay it out along the ground from a cable trailer drawn along the route between terminating points. Lift the cable to the intermediate supports prior to tensioning and terminating.

Where there are obstructions, road crossing etc. draw the cable off a stationary drum passing the free end over the reel insulator supports on each pole.

Where cable is drawn over arms, bag edges of arms to protect the cable during erection

At each pole where a cable terminal box is required, terminate bearer and leave a loop of cable to reach the box. (Terminal box normally fitted 1 m below cable).

Fit plastic end caps over all exposed ends of cable to prevent entry of moisture.

Handle cable with care to avoid damaging the insulation. Entry of moisture may cause faults on conductors and corrosion of bearer wire. DO NOT pull cable over rough ground fences, arms or metal pole fittings or tread on it or run over it with vehicles.

Repair slight damage to the sheath by applying butyl putty (S433/9) to the affected area and binding it with PVC tape. Prevent tape unravelling in service by binding the end with several turn of insulated wire. Where severe damage occurs it may be necessary to cut out the damaged section and joint the cable at the nearest pole.

A NEAT INSTALLATION BRINGS CREDIT TO TELECOM AND YOURSELF

INSERTING TWISTS IN CABLE TO REDUCE VIBRATION

Integral bearer cable in subject to "dancing" under certain wind conditions which can damage the bearer wire. To reduce vibration, a complete twist should be inserted in the cable about every 10 m, that is five twists per 50 m span.

For span-by-span erection insert twists at each pole before terminating the bearer.

Where more than one span is involved twist the cable at each alternate pole prior to tying in. (See Page N-13).

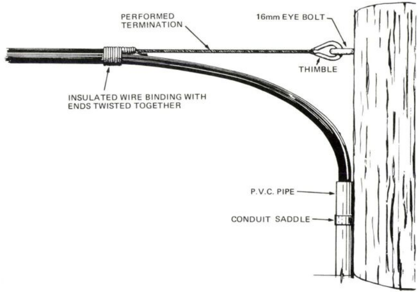
TERMINATING POINTS FOR BEARER WIRE

. Beginning and end of route (dead-end poles).
. Angle poles where deviation of the route is greater than 45°.
. Poles where two sections of cable are jointed e.g. end of drum or change in cable size.
. Poles where a loop of cable is left for installation of an untailed terminal box.
. Each end of isolated long spans greater than 100 m.
. All river and railway crossings.
. The last Telecom pole, where aerial cable is extended to joint use power poles.

TERMINATING SINGLE STRAND BEARER

Cut bearer wire to the length required. Remove enough insulation from the bearer wire to fit the preformed termination.

Pass the loop of the preformed termination around the thimble of the 16 mm eye bolt or screw hook fitted on the in-line face of the pole. Make off the legs of the termination around the end of the bearer wire.



TERMINATING MULTI-STRAND BEARER AT DEAD END POLE

TENSIONING CABLE

Small sized cable with single strand bearer may be tensioned over short sections with Wire Grip No. 1 (S93/10) attached to the IB cable grip, Wire Grip No. 4 (S93/42).

Tension long cable sections and the heavier multistrand bearer cables with a winch, ratchet type chain puller, Tirfor lifting device or blocks and tackle.

On straight routes or where there are only a few slight angles in the pole route IB cables may be tensioned over distances up to 460 m.

IB cable may be tensioned around angles up to 45° route deviation provided it is run in the groove of a reel insulator mounted vertically on an aerial cable spindle.

On straight sections the cable should run freely over horizontally mounted reel insulators (See Page N-14).

Tables on Pages N-9 to 10A show the maximum tension at which IB cable may be erected for various lengths of span and temperature conditions. The cable sag corresponding to the tension is also shown. Tensions for longer spans and larger cables will be advised by the responsible officer. Cable on power poles should match the sag of the LV. power wires.

Lower tensions than those shown in the table should be used wherever sufficient ground clearance can be obtained provided the sag is consistent with good appearance.

When tensioning long sections of cable, apply an initial tension slightly greater than the required final erecting tension. Maintain tension for a few minutes until it has equalised throughout the section, then gradually release the tension until the required sag is obtained.

BEWARE. A CARELESSLY HANDLED WIRE GRIP COULD COST YOU AN EYE.

Cable Size	Temp. °C	Span Length (M) 40 TENS N	40 SAG MM	50 TENS N	50 SAG MM	60 TENS N	60 SAG MM	70 TENS N	70 SAG MM	80 TENS N	80 SAG MM	90 TENS N	90 SAG MM
10/0.4	5	1110	240	1030	400	950	620	890	900	850	1240	810	1640
	25	880	300	840	490	800	740	780	1040	760	1390	740	1800
	40	740	360	720	570	710	830	710	1140	670	1500	690	1910
20/0.4	5	1070	340	1000	570	940	870	900	1230	870	1670	840	2170
	25	880	410	850	660	830	980	810	1360	800	1800	790	2300
	40	770	470	770	730	760	1060	760	1450	760	1890	760	2400
30/0.4	5	1010	410	940	700	890	1060	850	1510	830	2020	810	2610
	25	860	490	830	790	810	1170	790	1620	780	2140	780	2730
	40	760	550	760	860	760	1250	760	1700	750	2230	750	2820
50/0.4	5	1020	570	970	930	930	1390	910	1930	900	2570	890	3290
	25	900	640	980	1020	880	1480	870	2030	870	2660	860	3390
	40	830	690	840	1080	840	1550	840	2100	840	2740	840	3460
70/0.4	5	2550	330	2530	520	2510	750	2490	1020	2480	1350	2460	1710
	25	2220	380	2240	580	2260	830	2270	1120	2290	1460	2300	1840
	40	2000	420	2050	640	2090	900	2130	1200	2160	1540	2190	1930
100/0.4	5	2530	410	2510	640	2490	930	2470	1270	2460	1670	2440	2130
	25	2240	460	2260	710	2280	1010	2290	1370	2310	1780	2320	2240
	40	2040	500	2100	770	2140	1080	2180	1450	2210	1860	2230	2330

MAXIMUM PERMISSIBLE TENSIONS AND EQUIVALENT SAGS

ERECTING INTEGRAL BEARER AERIAL CABLE

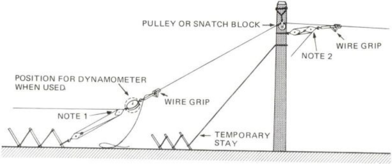
Cable Size	Temp. °C	Span Length (M) 40 TENS N	40 SAG MM	50 TENS N	50 SAG MM	60 TENS N	60 SAG MM	70 TENS N	70 SAG MM	80 TENS N	80 SAG MM	90 TENS N	90 SAG MM
10/0.64	5	1050	350	970	600	910	910	870	1300	840	1760	820	2280
	25	870	430	840	690	810	1020	800	1420	790	1880	780	2410
	40	760	490	760	760	750	1110	750	1510	750	1980	750	2510
20/0.64	5	1010	560	950	930	920	1390	900	1930	880	2570	870	3290
	25	890	640	870	1010	860	1480	860	2030	850	2660	850	3390
	40	820	690	820	1080	830	1540	830	2100	830	2740	830	3460
30/0.64	5	2540	340	2520	530	2510	770	2490	1050	2470	1380	2460	1750
	25	2220	380	2240	590	2260	850	2270	1150	2290	1490	2300	1880
	40	2000	430	2050	650	2090	920	2130	1230	2160	1580	2190	1970
50/0.64	5	2510	470	2490	740	2470	1070	2460	1470	2440	1930	2430	2450
	25	2250	520	2270	810	2290	1150	2310	1560	2320	2030	2330	2560
	40	2070	570	2130	860	2170	1220	2210	1630	2230	2110	2260	2640
70/0.64	5	4160	390	4120	610	4090	890	4060	1220	4040	1600	4020	2040
	25	3670	440	3710	680	3740	980	3760	1320	3780	1710	3800	2160
	40	3340	490	3430	740	3500	1040	3560	1390	3610	1800	3650	2250
100/0.64	5	4110	530	4070	840	4040	1210	4010	1660	4000	2180	3980	2770
	25	3720	590	3750	910	3780	1290	3810	1750	3820	2280	3840	2870
	40	3460	630	3540	960	3610	1360	3670	1820	3710	2350	3740	2950

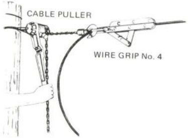
MAXIMUM PERMISSIBLE TENSIONS AND EQUIVALENT SAGS

Cable Size	Temp. °C	Span Length (M)											
		40		50		60		70		80		90	
		TENS N	SAG MM	TENS N	SAG MM	TENS N	SAG MM	TENS N	SAG MM	TENS N	SAG MM	TENS N	SAG MM
10/0.9	5	1020	550	970	910	930	1360	910	1890	890	2520	880	3220
	25	900	630	880	1000	870	1450	870	1990	860	2620	860	3320
	40	830	680	830	1060	830	1520	840	2060	840	2690	840	3400
20/0.9	5	2530	390	2510	610	2490	890	2470	1220	2460	1600	2450	2040
	25	2230	440	2260	680	2270	970	2290	1320	2300	1710	2310	2150
	40	2030	480	2090	740	2130	1040	2170	1390	2200	1790	2220	2240
30/0.9	5	2500	550	2480	860	2460	1250	2440	1710	2430	2240	2420	2850
	25	2270	600	2290	930	2310	1330	2320	1800	2330	2340	2340	2950
	40	2110	650	2160	980	2200	1390	2240	1870	2260	2410	2280	3030
50/0.9	5	4110	530	4070	840	4040	1210	4010	1660	4000	2180	3980	2770
	25	3720	590	3750	910	3780	1300	3810	1750	3820	2280	3840	2880
	40	3460	630	3540	960	3610	1360	3670	1820	3710	2350	3740	2950
70/0.9	5	6460	470	6400	740	6350	1080	6310	1480	6270	1940	6250	2470
	25	5780	530	5840	810	5890	1160	5930	1570	5960	2040	5980	2580
	40	5340	570	5470	870	5580	1230	5670	1640	5740	2120	5800	2660
100/0.9	5	6370	670	6310	1050	6260	1530	6230	2090	6210	2740	6190	3480
	25	5870	720	5930	1120	5970	1600	6000	2170	6020	2820	6040	3560
	40	5540	770	5670	1170	5770	1660	5840	2230	5890	2890	5930	3630

MAXIMUM PERMISSIBLE TENSIONS AND EQUIVALENT SAGS

ERECTING INTEGRAL BEARER AERIAL CABLE





CABLE TENSIONING EQUIPMENT

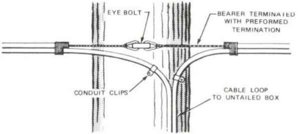
TENSIONING LONG SECTIONS OF CABLE

Note 1 Apply tension at this point. Cable puller or winch may be substituted for blocks and tackle.

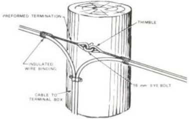
Note 2 Hold tension at this point while terminating bearer.

Note 3 All hooks must be moused.

ERECTING INTEGRAL BEARER AERIAL CABLE

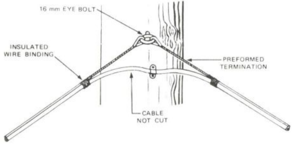


(a) Single Strand Bearer

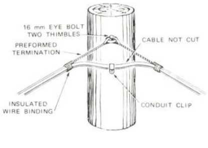


(b) Multi Strand Bearer

TERMINATION AT INTERMEDIATE POLE WHERE CABLE IS JOINTED OR TERMINAL BOX FITTED



(a) Single Strand Bearer



(b) Multi Strand Bearer

 TERMINATION AT ANGLE POLE WHERE ROUTE DEVIATION IS GREATER THAN 45°

SECURING CABLE TO INTERMEDIATE SUPPORTS

At intermediate through poles wnere the bearer wire is not terminated, tie in the cable to the reel insulators with two 1 m lengths of 1.52 mm GI PVC covered Aerial Cable Tie Wire (S434/21) as follows :-

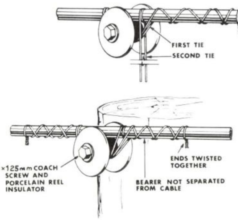
- Insert twist in the cable to reduce vibration (See Page N-6) at every alternate pole after the cable has been tensioned and before it is secured to the insulator.
- Set the cable snugly between the flanges of the insulator with the bearer wire against the centre of the insulator. Do not separate the bearer wire from the cable.
- Lay the centre of a length of binding wire across the cable at one side of the insulator and make two close turns around the cable.
- Using the second length of binding wire, make a similar binding around the cable on the other side of the insulator.
- Push each set of turns as close as possible towards the insulator.
- Pull each pair of wires tight and take then around the underside of the insulator.
- Bind the two ends of each pair of wires around the cable in opposite directions for four turns, then twist the wire ends together.

JOINTING IB CABLE

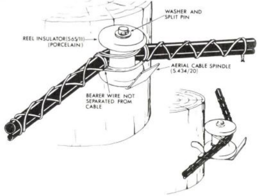
Jointing of cable ends is best carried out in an untailed terminal box where the box will be required for distribution purposes. Terminate bearer wire and leave cable ends of sufficient length to reach the box. See cable arrangements Page M-3.

In cases where a terminal box is not required, leave cable ends of sufficient length to enable the joint to be made on the bearer wire adjacent to the pole.
See Cable Jointing Handbook No. 1 for full details of IB cable jointing practices.

ERECTING INTEGRAL BEARER AERIAL CABLE



TYING-IN CABLE AT STRAIGHT LINE POLE



TYING-IN CABLE AT ANGLE POLE

(Less than 45° route deviation)

EARTHING

Earth the bearer wire and aluminium foil screen only where directed by a Responsible Officer.

Earths for Protection Against Lightning

Earthing of the bearer wire at frequent intervals may be necessary in bad lightning areas. An earth resistance less than 5 ohms at each earthing point is desirable.

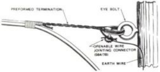
Earths for Protection Against Electrostatic Induction from Parallel Power Lines

These are provided only at the beginning of the route and points where the continuity of the bearer wire or screen is broken. A low resistance earth is not essential and a single earth stake at the foot of the pole connected to the bearer wire and screen by plastic insulated 7/.735 mm copper wire (S192/97) will provide a satisfactory earth.

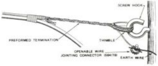
Connecting Earth Wire

When terminating bearer at earthing points pass the wire through the terminating sleeve or preformed termination so that 63 mm of bare wire projects beyond the end of the termination. Bend this away from the termination and connect the earth with an Openable Wire Jointing Connector (S64/78).

At untailed terminal boxes connect the earth wire to the aluminium screen by unstranding the wires and binding them tightly around the screen where it is made off at the entrance to the box.



SINGLE STRAND BEARER CONNECTION



MULTI STRAND BEARER CONNECTION

N-16 ERECTING AERIAL CABLE WITH SEPARATE BEARER WIRE

This method is primarily intended for cables outside the range of normal integral bearer sizes, for long span construction or other circumstances where IB cable is unsuitable. It consists of lashing standard polyethylene cable to an erected and tensioned steel stranded bearer wire. As the cable spinning machine is drawn along the bearer wire, it applies a continuous spiral of light gauge GI binding wire around the cable and bearer wire.

Two cables may be erected simultaneously and lashed to the one bearer wire. Short sections of cable may be lashed by hand before erection by passing the cable and bearer through the centre of a coil of lashing wire, or lashing wire holder, so that the wire is spiralled around the cable.

The preparation of the pole route before erecting cable, side of poles to attach the cable and point of attachment to poles are similar to IB cable (See pages N-1 and N-2).

FITTINGS FOR TERMINATING BEARER WIRE

Preformed Terminations-Sizes :- 7/1.25 mm SS Wire Termination (Green) - S434/12
7/1.60 mm " " " (Black) - S434/13
7/2.00 mm " " " (Yellow) - S434/14
1/2.50 mm Single Wire Termination (Blue) - S434/15

16 mm Eyebolts-Sizes :- 16 mm x 75 mm Eyebolt (S109/1) 16 x 300 mm Eyebolt (S109/5)
16 mm x 150 mm " (S109/2) 16 x 450 mm Eyebolt (S109/7)
16 mm x 225 mm " (S109/4)

16 mm Eyebolt Lugs (S434/63)

FITTINGS FOR SUPPORTING CABLE AT INTERMEDIATE POLES

Aerial cable suspension bracket (S434/10)

LASHING WIRE FOR AERIAL CABLE SPINNING MACHINE

Lashing wire (S434/11) - 1.25 mm MS galvanised wire - supplied in coils of approx. 395 m.

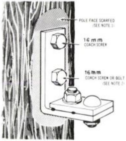
STANDARD POLYETHYLENE INSULATED CABLE SHOULD NOT BE USED ON JOINT USE POLES.

ERECTING AERIAL CABLE WITH SEPARATE BEARER WIRE

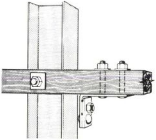
FITTING AERIAL CABLE SUSPENSION BRACKET (S434/10).

Mount suspension brackets on each pole on which the bearer wire is not to be terminated. (See Page N-19). Note that Suspension Brackets should not be fitted where there is an angle in the route greater than 15°.

Where cable is erected between crossarms fitted with short arm braces, mount the bracket so that the bearer will not be more than 25 mm below the crossarm.



BRACKET ON WOODEN POLE.



BRACKET ON STEEL POLE CROSSARM.

NOTE

1. Scarf pressure treated poles just sufficiently to provide flat seating for the bracket.
2. At angles where the pull is away from the pole replace lower coachscrew with 16 mm bolt.

ERECTING AERIAL CABLE WITH SEPARATE BEARER WIRE

DETERMINING BEARER WIRE SIZE

The maximum size of cable which each bearer wire size can safely support in span lengths up to 90 m is given in the table below. Two cables up to the total weight shown in the table may be supported by the one bearer wire. For long span construction or abnormal loading conditions eg high winds, ice, snow etc. the bearer wire size will be determined by a responsible officer.

Bearer Wire	Length of Span	Maximum load per 1000 m	Maximum Available Cable sizes within loading capacity		
			0.4	0.64	0.9
7/1.25 S.S.H.T.	Up to 60 m	670 kg	100	50	30
	60 - 100 m	450 kg	100	30	20
7/1.6 S.S.H.T.	Up to 60 m	1290 kg	100	100	50
	60 - 100 m	890 kg	100	70	30
7/2.0 S.S.H.T.	Up to 60 m	1980 kg	100	100	100
	60 - 100 m	1340 kg	100	100	70

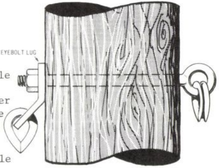
CABLE LOADS WITHIN CARRYING CAPACITY OF BEARER WIRES.

ERECTING AERIAL CABLE WITH SEPARATE BEARER WIRE

ERECTING BEARER WIRE

Erect bearer wire in full coil lengths terminating :-

- With eyebolt on "in line" face of pole at beginning and end of cable route.
- With eyebolt and lug on in line" face of pole (Double termination) at end of wire coil, isolated long spans over 100 m, crossings over railways or navigable waterways, and at angle poles where the route deviation is between 15° and 45°.
- With two eyebolts "in line" with route at angle poles where the route deviation exceeds 45°. (Fit separate eyebolts for termination of bearer in each direction.)



EYEBOLT AND LUG FOR DOUBLE TERMINATION

Take care to prevent the bearer sagging low over roadways, vehicular entrances and other locations where it may endanger traffic.

Place bearer loosely in brackets at angles where the pull is away from the pole so that the wire is free to pass through the bracket as it is being tensioned.

When tensioning at unstayed intermediate poles eg. angles, end of coil etc, fit temporary stays to hold pole vertical while bearer on each side is tensioned.

The maximum erecting tension for bearer wire and the sags after erection of cable are shown in the Tables on pages N20 and 21.

Bearer Wire Size	Max. erection tension (N)			
	Temperature °C.			
	5	15	30	45
7/1.25	1110	950	760	610
7/1.6	1310	1210	1000	860
7/2.0	2410	2100	1700	1430

MAX ERECTION TENSIONS FOR BEARER WIRE

	Sag in Millimetres												
Length of Span (M)	Temp°C	5			15			30			40		
	load kg/1000	250	450	670	250	450	670	250	450	670	250	450	670
40		450	580	690	480	610	740	530	660	760	560	710	790
50		560	740	890	630	790	940	680	840	960	710	860	1020
60		760	990	1190	840	1070	1240	910	1120	1290	960	1170	1320
75		1090	1400		1190	1470		1270	1550		1350	1630	
90		1470	1830		1570	1939		1680	2030		1800	2130	

SAG IN 7/1.25 BEARER WIRE WHEN LOADED.

ERECTING AERIAL CABLE WITH SEPARATE BEARER WIRE

Length of Span (M)	Temp °C	Sag in Millimetres											
		5			15			30			40		
	load kg/1000	495	890	1290	495	890	1290	495	890	1290	495	890	1290
40		530	660	760	560	710	790	580	740	810	610	760	840
50		680	840	960	710	860	1020	760	910	1040	790	960	1070
60		910	1120	1290	960	1170	1320	1020	1370	1370	1070	1270	1400
75		1270	1570		1320	1630		1400	1700		1500	1780	
90		1680	2050		1800	2130		1900	2230		2030	2340	
		990	1340	1980	990	1340	1980	990	1340	1980	990	1340	1980
40		560	640	760	610	690	790	640	710	810	660	740	840
50		710	810	960	760	860	990	810	890	1040	840	940	1070
60		960	1090	1270	1020	1140	1320	1070	1190	1370	1120	1240	1400
75		1170	1520		1190	1570		1240	1651		1320	1730	
90		1780	1980		1880	2080		1980	2160		2060	2260	

SAG IN 7/1.6 AND 7/2.0 BEARER WIRE WHEN LOADED

Where available ground clearance will not permit the sags shown or spans exceed 90m, or conditions are abnormal eg. windy locations, snow and ice etc. the size of bearer and the tension will be determined by a responsible officer. (E.I. LINES Aerial W2010).

ERECTING AERIAL CABLE WITH SEPARATE BEARER WIRE

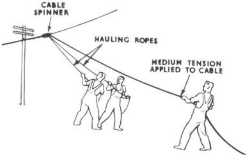
ERECTING CABLE BELOW ARMS

Erecting the cable and lashing it to the bearer wire is carried out in the one operation. The cable may be fed to the bearer wire direct from a cable trailer towed along the route, or it may first be laid out along the ground.

Lash cable temporarily to bearer at starting point allowing sufficient length of free end for joint where required. Fit cable spinning machine over bearer wire and cable close to pole and adjust machine to start lashing. Make about two spirals. of lashing wire around the cable and bearer wire by hand them terminate it close to end of the preformed termination. Draw spinning machine along route by hauling lines.

When conditions permit, the bearer wire may be detached from two poles so that it is hanging free for three spans thus allowing the spinning machine to be drawn along 1.2m from the ground. This will simplify change-over of coils of lashing wire.

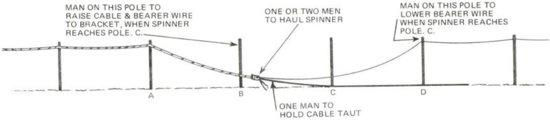
When erecting two cables it is necessary to use a special cable feeding device (eg. double block) to prevent the cables crossing over each other as they are being lashed.



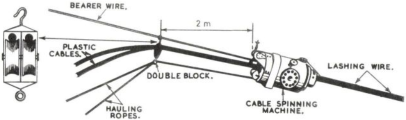
LASHING CABLE ALOFT

TERMINATION LASHING WIRE

Bind 2 close turns around cable and bearer followed by 10 close turns around the bearer wire only.



LASHING CABLE CLOSE TO GROUND

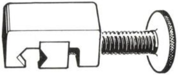


USE OF DOUBLE BLOCK TO FEED TWO CABLES TO SPINNING MACHINE.

ERECTING AERIAL CABLE WITH SEPARATE BEARER WIRE

The coil of lashing wire will normally be sufficient to lash several spans of cable. Connect new coils with a twist joint and cover the joint with PVC tape to prevent damage to the cable sheath. Where the cable is being lashed aloft, make the joint at the pole or terminate the lashing wire close to the suspension bracket. To prevent slack wire running back into the spun cable while jointing or terminating the lashing wire, always clamp it to the bearer wire before releasing the tension applied by the spinning machine.

Where cable terminal boxes are required at intermediate poles leave a loop of cable sufficient to reach the box. Terminate lashing wire on each side of the pole.



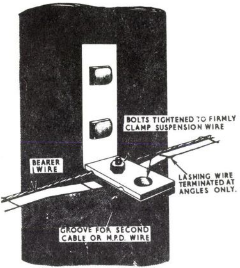
LASHING WIRE CLAMP (S434/2)

On completion of lashing, place bearer wire in the groove of cable suspension brackets with the cable beneath the bracket and tighten clamping bolts. When clamping is being done progressively as the cable is lashed allow the spinning machine to get about two poles ahead before tightening bolts so that tension in each span is even.

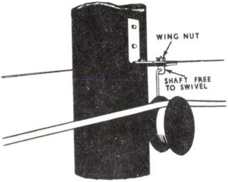
Terminate the lashing wire at angle poles and allow a little slack in the cable so that it does not bear heavily against the clamping bolts.

Where it is necessary to protect the cable from abrasion against arm braces or other pole fittings slip a length of approx. 150 mm of split plastic tubing over the affected section and secure with a binding of insulated wire.

ERECTING AERIAL CABLE WITH SEPARATE BEARER WIRE



FITTING CABLE TO SUSPENSION CLAMP



TYPICAL PULLEY FOR ERECTING CABLE

ERECTING AERIAL CABLE WITH SEPARATE BEARER WIRE

ERECTING CABLE BETWEEN ARMS

This will normally occur where it is necessary to erect the cable as high as possible to obtain sufficient ground clearance, or where it is proposed to dismantle some of the lower open wires after insulation of the cable. Erection above the top arm will sometimes be suitable.

Shift the wires close to the pole out along the crossarm and tie in position to avoid faults due to wire contacts when the bearer wire and cable are being erected and to provide adequate working space for the spinning machine while lashing the cable. Run out the cable over the complete section feeding it between the crossarms. Fit pulleys or rollers at each pole to avoid damaging the cable during erection. Take special precautions at road crossings to prevent the cable sagging across the road. Lash the cable to the bearer wire as described for erecting cable below crossarms. In some cases it may be of advantage to prelash the cable to the bearer wire, by spinning machine or by hand, at the job site and to erect it as IB cable.

JOINTS IN AERIAL CABLE

Where a cable terminal box is required for distribution purposes, leave cable ends of sufficient length for the joint to be made in an untailed terminal box. Where a terminal box is not required leave cable ends for the joint to be made on the bearer wire close to the pole.

Set up the cable with an even sweep from the bearer wire taking care, particularly with the larger cables, to avoid sharp bends or kinks. Secure cable to the pole with conduit clips.

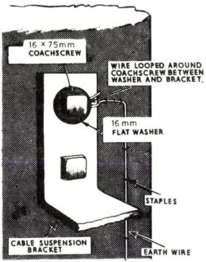
See cable arrangement Page M3.

EARTHING BEARER WIRE

In areas subject to severe lightning, earthing of the bearer at frequent intervals may be necessary (Determined by a responsible officer. An earth resistance lower than 5 ohms is desirable at each earthing point.) Use stainless steel earth wire (S62/25) and clamp it under the head of one of the coachscrews used to attach the suspension bracket to the pole or under the nut of the eye bolt where the bearer wire is terminated.

Where a ground stay is fitted to the pole, this may be utilised to provide the earth connection by terminating the earth wire under the nut of the eyebolt. If a ground stay is not fitted, connect the earth wire to an earth rod driven into the ground at the foot of the pole.

WATCH OUT FOR TRAINS WHEN WORKING ALONG RAILWAY LINES. USE A FLAGMAN WHEN THERE IS ANY DANGER TO WORKMEN OR TO TRAINS.



FITTING EARTH WIRE.

ENGINEERING INSTRUCTIONS

LINES AERIAL AC1001, 3001, 3002
3003, 3012
W3010

POWER LINE CROSSING
COMMON USE CONSTRUCTION

REFERENCES

Issue 4, 1976

POWER LINE CROSSINGS

LOW VOLTAGE SUPPLY MAINS AND STREET LIGHT MAINS

A Supply Main is a power line not exceeding 650 volts, usually erected along roadways to which Service Leads to electricity consumers are connected.

Low voltage Street Light Mains are normally erected on supply main poles and the same construction standards and clearances apply at crossings.

INSPAN CROSSINGS - CONSTRUCTION STANDARDS FOR SUPPLY MAINS AND STREET LIGHT MAINS

Normally, all supply main and street light conductors should cross above the telecom conductors and cable bearer wires.

The minimum separation permitted between supply mains or street light mains and telecom wires is shown in the table on page 0-3.

Power wires shall not normally cross telecom wires in span within a distance of 2.5 m from the vertical projection of the telecom support (pole, crossarm or fitting). Where this is not practicable the power conductors should be attached to the head of the telecom pole in accordance with Common Use construction practice (See Page 0-8).

Telecom conductors and bearer wires may cross beneath power conductors in span provided they are not closer than 2.5m from any power support. Where this is not practicable the telecom wires should be attached to the power pole as Common Use construction.

New telecom wires erected under existing power lines shall normally be insulated. New telecom wires must always be insulated where the power conductors are bare. (See Page 0-13).

LOW VOLTAGE POWER LINE CROSSINGS
SERVICE LEADS

SERVICE LEADS

Service Leads are the low voltage conductors from the Supply Main to the consumers premises.

Where separate active and neutral conductors are erected the active conductor is normally insulated.

In neutral screened conductor the active conductor is insulated and concentrically enclosed by the neutral conductor.

INSPAN CROSSINGS - CONSTRUCTION STANDARDS

Service Leads should normally cross above telecom wires. Where this is not practicable permission may be given by the Responsible Officer for neutral screened cable to cross beneath the telecom wires.

Where a Service Lead would cross telecom lines within 2.5 m of the telecom pole it must be attached to the head of the telecom pole in accordance with Common Use practice.
Where a Service Lead crosses to an intermediate power pole before the consumers premises the power pole (including crossarms and fittings) should be at least 2.5 m clear of the nearest telecom wire. Where this is not practicable the telecom wires may be attached to the power pole as in Common Use construction.

Pin Type LV
(About same size as telecom subscribers insulator).

Shackle LV

LV POWER INSULATORS

LOW VOLTAGE POWER LINE CROSSINGS - CLEARANCES

Type of Construction	Minimum Separation
Where either the active power conductors or the telecom conductors or cable bearer wires are insulated.	0.6m at point of crossing.
Where both the active power conductors and the telecom conductors or cable bearer wires are uninsulated.	1m at point of crossing.
Where neutral screened cable service leads cross beneath telecom wires.	0.6m below lowest telecom wire likely to be erected.
Where EL service leads and telecom subscribers leads terminate on a building.	0.6m between points of attachment on the building.

MINIMUM SEPARATION BETWEEN LOW VOLTAGE POWER WIRES AND TELECOM WIRES

Note : Clearance between high voltage power lines and telecom lines are given on page 0-5.

Where the minimum clearance does not exist at a power crossing, do not proceed with work in this span until the proper clearance has been provided or the power has been disconnected. Methods of measuring clearance are described on page 0-27.

HIGH VOLTAGE POWER LINE CROSSINGS

DEFINITION

High voltage power lines are aerial lines used for the transmission and distribution of electrical power where the nominal design voltage exceeds 650 volts.

INSPAN CROSSINGS - CONSTRUCTION STANDARDS

In all cases HV power conductors must cross above telecom conductors and bearer wires.

Attachment of HV power conductors to telecom poles is not permitted.

Joints in the power conductors in the crossing span should be avoided where practicable.

All new telecom conductors erected under HV power lines must be insulated (See Page 0-13).

The angle of crossing must be as near as practicable to a right angle and shall normally be not less than 45° unless by agreement with the Senior Engineer in each case.

CONTACT WITH POWER WIRES CAN MEAN DEATH. TAKE EVERY PRECAUTION TO AVOID TOUCHING POWER WIRES OR FITTINGS ON POWER POLES.

Normal line pin insulator

Fog line pin insulator

Disc type insulator

HV POWER INSULATORS

SEPARATION BETWEEN POWER WIRES AND TELECOM WIRES AT CROSSINGS.

The separation between HV power conductors and telecom conductors or bearer wires where they cross must not be less than the limits shown in column 2 of the following table.

NOMINAL VOLTAGE OF POWER CONDUCTORS	MINIMUM SEPARATION IN METRES (See Notes 1 and 2)	
	From Telecom Conductors or Bearer Wires.	From Telecom Support (See Note 3)
Over 650V to 11kV	1.2 m	3.6 m
Over 11kV to 66kV	2.1 m	3.9 m
Over 66kV to 132kV	3.0 m	4.6 m
Over 132kV to 220kV	3.6 m	6.0 m
Over 220kV to 330kV	4.0 m	7.6 m
Over 330kV to 500kV	6.0 m	9.0 m
Over 500kV	9.0 m	10.5 m

NOTE 1 : The limits shall apply when the power conductors are in closest proximity to the telecom conductors, bearer wires and supports, through swing and sag of the conductors under the worst combination of weather conditions and current loading for which the wires of either party are designed to operate.

NOTE 2 : Where the power line carries more than one voltage the limiting separations appropriate to voltage of each power conductor shall apply.

NOTE 3 : The separations in column 3 apply where the power conductors are within a horizontal distance of 2.5 m from the vertical projection of the nearest point of a telecom support. (See Page 0-7).

HIGH VOLTAGE POWER LINE CROSSINGS

SEPARATION BETWEEN POWER POLE AND TELECOM WIRES

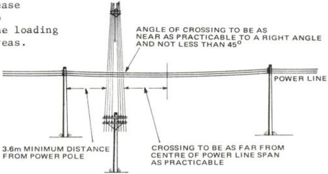
The point of crossing shall be as far as practicable from the centre of the power line span, provided the telecom wires are not within 3.6 m of any power support (pole, crossarm or fitting).

Where the separation of 3.6 m cannot be obtained, the telecom wires may be attached to the power pole as Common Use construction.

Attachment to Common Poles is often the safest solution when the prescribed inspan clearances cannot be met because of possible increase in sag in the power lines due to unpredictable hazards such as the loading caused by birds in some rural areas.

Attachment to power poles carrying circuits of nominal voltages greater than 66 kV is not permitted.

ERECT ONLY INSULATED WIRES IN THE CROSSING SPAN.



CONSTRUCTION SPECIFICATIONS FOR HV POWER LINE CROSSING.

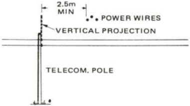
SEPARATION BETWEEN TELECOM POLES AND POWER LINES

The power conductors in the crossing span shall normally be separated horizontally by at least 2.5 m from the vertical projection of the nearest telecom support (pole, crossarm or fitting).

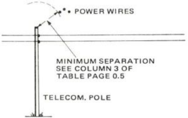
Where this is not practicable a lesser horizontal separation may be permitted provided the separation between the nearest power conductor and the nearest point of any telecom support is not less than the limits shown in Column 3 of the table on page 0-5.

TREAT ALL POWER WIRES AND FITTINGS ON POWER POLES AS 'LIVE' AND DANGEROUS

Report immediately on Form E71 any condition observed on a power line which is likely to endanger telecom plant or personnel for example inadequate clearances, dangerous location of poles, decayed or damaged poles, fittings etc.



MINIMUM HORIZONTAL SEPARATION BETWEEN POWER WIRES AND TELECOM SUPPORT



SEPARATION REQUIRED WHEN POWER WIRES ARE WITHIN HORIZONTAL DISTANCE OF 2.5 m

ATTACHING POWER LINES TO "COMMON USE" TELECOM POLES

GENERAL CONDITIONS

Low voltage supply or lighting mains or service leads may be attached to the head of a single telecom pole to cross the telecom route. Telecom approval is required in each instance. High voltage power lines must not be attached to telecom poles.

Additional height is to be provided on new poles where requested by the Power Authority.

On existing poles the necessary clearance may be obtained by lowering the telecom attachments on the pole, replacing the pole by a taller pole or fitting a 100 x 100 mm hardwood raiser to the head of the existing pole. The use of raisers is generally undesirable and they should be avoided wherever practicable.

POWER AUTHORITY'S ATTACHMENT	TELECOM ATTACHMENTS				
	Insulated			Uninsulated	
Description	Subscribers Drop Wire Lead	Aerial Cable & Bearer	Open Wire	Aerial Cable & Bearer	Open Wire
	MINIMUM SEPARATION				
Service Leads (Covered or Insulated).	0.6 m	0.6 m	0.6 m	1.2 m	1.2 m
Supply or lighting main (Insulated or sleeved).	0.6 m	0.6 m	0.6 m	1.2 m	1.2 m
Supply or lighting main (Uninsulated).	1.2 m	1.2 m	1.2 m	2.5 m	2.5 m

MINIMUM SEPARATION BETWEEN TELECOM AND POWER ATTACHMENTS ON COMMON USE TELECOM POLES

ATTACHING LV SUPPLY OR LIGHTING MAINS TO COMMON USE TELECOM POLES

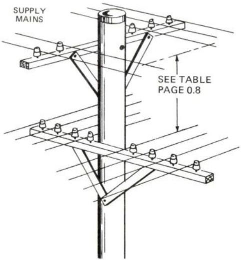
CONDITIONS FOR ATTACHMENT

- Supply or street light mains attached to common use poles shall consist of open wire conductors, neutral screened cable, or multicore cable. The actives of open wire conductors shall be insulated or covered with at least 1.2m of insulated sleeving on each side of the common use pole.
- Uninsulated actives are undesirable but may be permitted if additional clearance is provided (See table of clearances page 0-8).
- Not more than 5 separate open wire conductors may be attached to a common use pole. Conductors should cross almost at a right angle if possible.
- Conductors are to be secured to insulators on steel spindles on a braced crossarm attached to the head of the pole or to a raiser. (Page 0-10).
- Multicore or neutral screened conductor shall be secured to the pole face by suitable clamps.
- Power conductors are to be erected to normal tensions, provided the resultant load on the pole does not exceed the limits specified by Telecom.
- Clearances between power and telecom wires are shown in table on page 0-8.

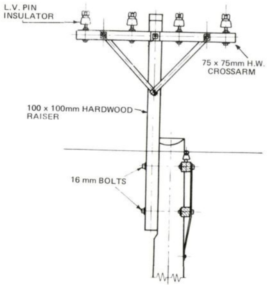
PROVIDING SAFE WORKING CONDITIONS

Treat all power wires and fittings, stay wires, street light fittings etc attached to common poles as 'live' and dangerous.

Before climbing a power pole inspect it visually and by sounding but do not bore the pole or remove any earth from around the footings. Do not climb the pole if you consider it unsafe. Report unsafe poles to your Supervisor.



CROSSARM FITTED TO HEAD OF POLE.

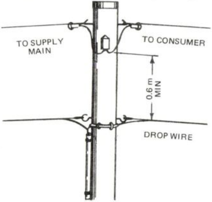


CROSSARM FITTED TO RAISER.

ATTACHING SERVICE LEADS TO COMMON USE TELECOM POLES

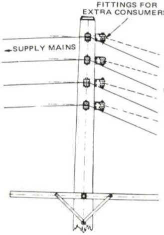
CONDITIONS

- Service Leads shall consist of covered or insulated active conductors with a bare, covered or insulated neutral, or multicore conductor or neutral screened conductor.
- Not more than 3 service leads shall be attached between the common use pole and the consumers premises. Not more than 4 open wire conductors or a single multicore or neutral screened conductor shall be attached between the power pole and the common use pole.
- Open-wire conductors may be arranged in vertical formation, secured to the pole face or raiser by shackle type insulators on steel brackets of a type which will ensure that the wires will not fall if a tie breaks. Alternatively, they may be in a horizontal formation secured to pin insulators on steel spindles on braced crossarms.
- Neutral Screened or multicore conductor must be secured by suitable clamps.
- Normal tension should be applied to power conductors but the resultant load on the telecom pole must not exceed limits specified by Telecom in each case.
- Minimum clearances are shown on page 0-8.

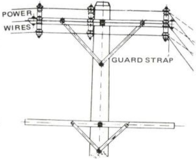


NEUTRAL SCREENED CONDUCTOR SERVICE LEAD ATTACHED TO HEAD OF ISOLATED TERMINAL POLE

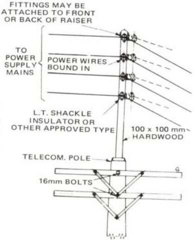
ATTACHING SERVICE LEADS TO COMMON USE TELECOM POLES



SERVICE LEADS ATTACHED DIRECTLY TO HEAD OF POLE



CROSSARM FITTED TO OBTAIN EXTRA CLEARANCE



SERVICE LEADS ATTACHED TO POLE RAISER

MINIMUM CLEARANCE BETWEEN TELECOM AND POWER WIRES - 0.6 m if telecom wires insulated,
1.2 m if not insulated.

ERECTING TELECOM WIRES AT POWER LINE CROSSINGS

PROVISION OF INSULATED CONSTRUCTION

Where telecom lines cross power lines, only insulated construction, (insulated line wire, drop wire or integral bearer aerial cable) is erected in the crossing span except in the following circumstances :-

- Where the power wires are insulated, for example, service leads consisting of neutral screened conductors or individual conductors with insulated active, the telecom lines need not necessarily be insulated.

- Where telecom lines consist of polyethylene aerial cable lashed to a separate bearer wire the bearer and lashing wires need not necessarily be insulated. (See Page 0-21).

Telecom wires and cables must always cross below the power lines.

New wires at existing crossings should be insulated, but existing uninsulated wires should not necessarily be replaced unless they require renewal for other reasons.

At each end of the crossing span, terminate insulated and bare line wires on insulators with straight steel spindles (See Page I-12). Regulate insulated line wire to the same tension as the bare wire to which it is connected. This will result in a slightly greater sag in the insulated wire than in adjacent bare wire spans.

The use of insulated wires or cable will provide adequate protection against low voltages and will improve the chance of survival in the event of accidental contact with a high voltage power line up to 33kV. Insulation does not entirely remove the hazard - it may be damaged by rough handling or contact with a high voltage power line or it may deteriorate with age or exposure.

PRELIMINARY INSPECTION

Before any job is commenced, a preliminary inspection must be made of the section of pole route on which work will be carried out, to detect any potential electrical hazards and to determine the precautions necessary to ensure the safety of all workmen.

Insulated construction must be regarded as an additional safeguard and none of the prescribed safety precautions are to be relaxed merely because wires are insulated.

PRECAUTIONS WHEN POWER SERVICE LEADS CROSS BENEATH TELECOM OPEN-WIRE ROUTE

Erect only insulated wire in the crossing span and terminate at each end of the span. Except where insulated telecom wires are erected over neutral screened cable service leads, arrangements should be made for the power to be disconnected whilst the wire is being erected. Where this is not practicable, take the following additional precautions :-

- Erect the wire in the span containing the undercrossing separately.
- Tie a long hauling line, at least equal to the length of the span, to the end of the wire and erect it between the two poles to draw out the wire. To ensure that the wire does not sag and contact the power wires, maintain tension continuously at the wire barrow or pole until the wire is secured.
- Wear rubber gloves and stand on a rubber mat when operating the wire barrow.

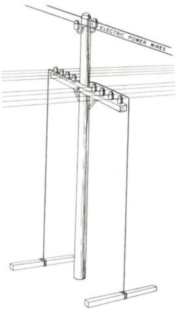
TAKE CARE NOT TO TOUCH ANY POWER WIRES OR FITTINGS ON POWER OR TELECOM POLES.

PRECAUTIONS WHEN POWER WIRES CROSS ABOVE TELECOM WIRES

- Erect only insulated wire in spans crossed by power lines. Terminate at each end of the span.
- Fit rope guards over the telecom wires immediately beneath each power wire crossing. Pass the new wire through the guard when running it out.
- Lay out new wire on ground if possible and lift to crossarm at intermediate poles with a pike.
- Do not pull or jerk wire to free it from an obstruction, particularly when it is being pulled over crossarms. If wire is caught, free it by lifting it clear with a pike or stick or by climbing the pole.

  JERKING MAY BREAK THE WIRE CAUSING THE BROKEN ENDS TO FLY UPWARDS AND CONTACT THE POWER WIRES OF IF THE WIRE IS RELEASED SUDDENLY IT MAY SPRING UP IN THE CENTRE OF THE SPAN TO CONTACT THE POWER WIRES.
- Wear rubber gloves when working close to power wires or fittings and when handling wires in any location where they could contact power wires.

ALWAYS TAKE A SAFETY LINE WHEN YOU CLIMB A POLE, IT MAY BE THE MEANS OF SAVING YOUR LIFE.



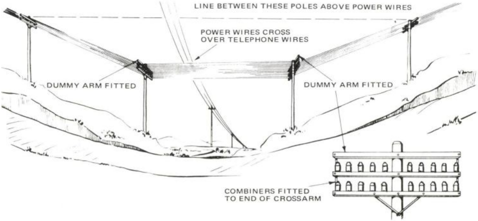
ROPE GUARD

FITTING GUARD OR DUMMY ARMS AT POWER LINE CROSSINGS

EXISTING CONSTRUCTION

Where uninsulated wires cross beneath power lines and it is not possible to grade the pole route to avoid an upward pull on the telephone wires, fit dummy arms on the pole or poles where the upward lift occurs.

NEW CONSTRUCTION :- Terminate wires on steel spindles at poles on each side of crossing. Erect insulated wires in the crossing span. Dummy arm not required.



ATTACHING TELECOM LINES TO COMMON USE POWER POLES

GENERAL CONDITIONS

With the approval of the Power Authority, Telecom wires or cables may be attached to a single power pole solely for the purpose of crossing beneath the power wires. Where attachment to more than one pole is required the conditions for Joint Use will apply.

POWER CONSTRUCTION

Power poles used for attachment of telecom wires must be in sound condition, of adequate height and must not carry voltages exceeding 66 kV. Transformer poles are not to be used for common use.

The active conductors of service leads must be covered or insulated.

Street light leads affixed to the pole shall be insulated to min. 250V grade.

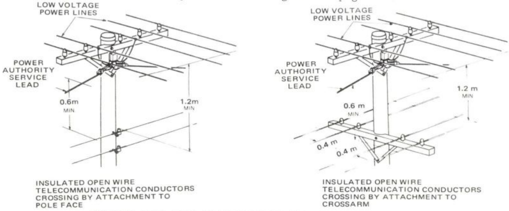
Earth wires shall be encased in non-conducting material between ground and a point on the pole at least 0.6 m above the telecom attachments.

CONDITIONS FOR ATTACHMENT OF OPEN-WIRES TO POWER POLE

- Erect only plastic insulated line wire from an open-wire route.
- Attach a single pair of wires to insulators on SN spindles fitted on an in-line face of the pole. (SN spindles can be recovered from dismantled routes).
- Alternatively, and in all cases where more than two wires are erected, fit a braced wood crossarm and secure the wires to insulators on straight steel spindles. Leave a clear climbing space of at least 810 mm between the inner wires.

ATTACHING OPEN WIRES TO COMMON USE POWER POLES

- On non wood poles the insulators attached directly to the pole face, or where a crossarm is fitted, the combined insulation of the timber and insulator must be capable of withstanding the highest voltage carried on the pole.
- Wires should cross at right angles if possible.
- Use normal telecom tensions except where the load on the power pole would exceed limits imposed by the power authority.
- Minimum clearances from power wires are given on page 0-22.

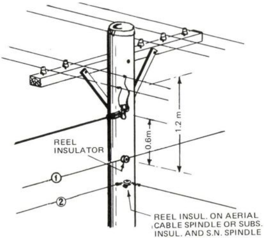


TYPICAL OPEN WIRE CROSSINGS ON COMMON USE POWER POLES

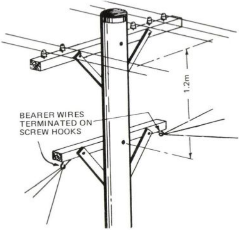
ATTACHING DROP WIRES TO COMMON USE POWER POLES

CONDITONS FOR ATTACHMENT OF DROP WIRE SUBSCRIBERS LEADS

- No more than three drop wire leads should be attached to the one common pole.
- Attach the drop wire leads to an in-line face of the power pole.
- Attach drop wire to a plastic reel insulator mounted horizontally on the pole with a 10 x 75 mm coachscrew. Where there is an angle in the lead, secure drop wire to a porcelain reel insulator mounted vertically on an aerial cable spindle or to a subscribers insulator fitted on a swan neck spindle.
  Tie in drop wire with 1.27 mm polyethelene insulated tie wire (S61/27).
  Do not remove the insulation from the bearer wire on the power pole or connect the bearer to earth.
- Where required by the power authority, provide a 1 m crossarm on the same side of the pole as the power crossarms if there are more than 2 drop wire leads. Attach drop wires to ends of crossarm. Bridge the pole by attaching the drop wire to the underside of the arm.
- Drop wires on non-wood poles (Steel or Stobie poles) must be separated from the pole face by insulation which will withstand the phase to earth voltage of the highest voltage power line on the pole, for example a reel insulator mounted on a wood crossarm or special bracket designed to suit the type of pole.
- Tension drop wire to normal Telecom practice but do not exceed limits which may be set by the Power Authority.
- A table of clearances is given on page 0-23 and typical common use arrangements shown on page 0-20.



Subscribers leads crossing :-
(1) In a straight line. (2) At angle.



More than two subscribers leads crossing by attachment to crossarm.

TYPICAL ARRANGEMENTS FOR DROP WIRE CROSSINGS ON WOOD POLES

ATTACHING AERIAL CABLE TO COMMON USE POWER POLES

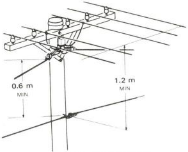
CONDITIONS FOR ATTACHMENT OF AERIAL CABLE

- Use IB aerial cable wherever practicable. If cable with uninsulated bearer is erected, additional clearance is necessary. See Table, page 0-23.
- Not more than one aerial cable may be attached to a common pole unless approval is given by the Power Authority.
- Make crossings at right angles if possible. Avoid acute angles.
- Where possible spans on either side of the power pole should not exceed 50 m.
- Tension cable to normal Telecom standards but do not exceed any limit imposed by the Power Authority.
- Attach cable to an in-line face of the pole.
- Use insulated tie wire to secure IB cable to reel insulator on power pole.
- Where the bearer of IB cable is terminated on the power pole all exposed bearer and metal fittings must be shrouded. Otherwise increased minimum clearances for cables with uninsulated bearers will apply. (See page 0-23).
- On non wood poles, cable and bearers are to be separated from the pole face by insulation which will withstand the highest voltage on the power pole.

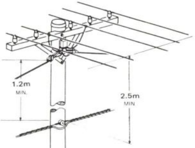
A Table gives clearances for aerial cables with insulated and uninsulated bearers on page 0-23.

Typical pole arrangements are shown on page 0-22.

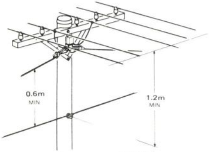
ATTACHING AERIAL CABLE TO COMMON USE POWER POLES



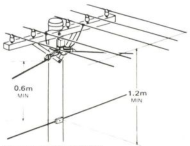
AERIAL CABLE (INSULATED BEARER)
CROSSING AT SLIGHT ANGLE



AERIAL CABLE CROSSING WITH
INSULATED BEARER



AERIAL CABLE (INSULATED BEARER)
CROSSING IN STRAIGHT LINE



AERIAL CABLE CROSSING WITH
UNINSULATED TERMINATING FITTING
SHROUDED BY INSULATING COVER

ATTACHING TELECOM LINES TO COMMON USE POWER POLES

TYPE OF TELECOM ATTACHMENT	TYPE OF POWER AUTHORITY'S ATTACHMENT					
	Supply Main Conductor	Street Light Main Conductor (Note 1)	Service Lead Conductor	High Voltage Conductors		Street Light Leads Fittings and Stays
				Above 650V to 33 kV	Above 33 kV to 66 kV	
Subscribers' drop wire leads	1.2 m	1.2 m	0.6 m	2.4 m	3 m	50 mm
Aerial cable with insulated bearer or insulated or shrouded fitting.	1.2 m	1.2 m	0.6 m	2.4 m	3 m	50 mm
Insulated open wire conductors	1.2 m	1.2 m	0.6 m	2.4 m	3 m	50 mm
Insulated Terminal Box	1.2 m	1.2 m	0.6 m	2.4 m	3 m	50 mm
Aerial cable with uninsulated bearer or bearer on uninsulated or unshrouded fitting.	2.4 m	2.4 m	1.2 m (Note 2)	3.6 m	4.2 m	50 mm
Metal Terminal Box	2.4 m	2.4 m	1.2 m	3.6 m	4.2 m	50 mm

MINIMUM SEPARATION BETWEEN TELECOM AND POWER ATTACHMENTS ON COMMON USE POWER POLES

NOTE 1 : Where a street light main erected beneath a supply main is insulated to 250 volt grade, the minimum clearances in this column may be reduced by 0.6 m.

NOTE 2 : The clearance from service leads is normally fixed by the minimum permitted clearance of 2.4 m from the supply mains above and will usually exceed 1.2 m.

DISMANTLING TELECOM WIRES AT POWER LINE CROSSINGS

TAKE EXTREME CARE WHEN DISMANTLING WIRES UNDER POWER LINES. BEFORE COMMENCING ANY DISMANTLING, JOB CHECK THE LOCATION OF EACH POWER LINE CROSSING ALONG THE SECTION OF ROUTE WHERE WIRES WILL BE DISMANTLED.

Treat sections of the route containing power wire crossings separately and dismantle wires in these spans first. Support poles on each side of the section being dismantled by pikes or temporary stays. Support any other poles which tests have shown to be unsafe.

Fit a rope guard over the telecom wires beneath each power wire crossing to prevent wires flicking upwards when being dismantled. Anchor rope guards securely where there is an upward angle in the wires.

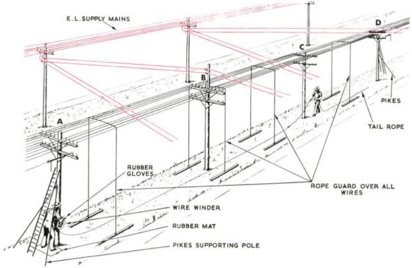
AVOID PULLING WIRES OVER CROSSARMS - LOWER THE WIRES AND REEL THEM IN ALONG THE GROUND.

Maintain tension on wires by wire grips on each side of the poles in the crossing span before cutting the wires. Lower wires to the ground by rope.

Tie a long rope (eg. hauling line) to the free end of the wire to prevent it flicking upwards as it is being wound in. Hold the end of the rope while the wire is in motion so that sleeves etc. which catch in trees or other obstructions can be quickly dislodged. Do not jerk wire to free it from an obstruction (See page 0-15).

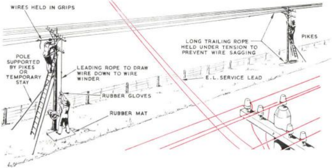
Wear rubber gloves and stand on a rubber mat when operating the wire winder. Secure the wire winder to a telecom pole.

Reel in wires on each side of power crossing in the direction away from crossing span.



TYPICAL DISMANTLING JOB AT POWER CROSSING

1. Units wires at poles B and C.
2. Progressively cut away wires at poles A and D and lower to ground by rope.
3. Reel wire in along ground. Hold tail rope to free wire from obstructions.



IT IS NECESSARY TO HAVE POWER DISCONNECTED FROM SERVICE LEAD UNDER CROSSINGS BEFORE COMMENCING WORK.

DISMANTLING WHERE SERVICE LEAD CROSSING UNDER TELECOM, WIRES CANNOT BE DISCONNECTED

- Hold wires in grips on both sides of poles at each end of the crossing span.
- Cut wire and attach a long dry rope to each end. Rope at trailing end must be equal to length of span.
- Release wire from grips and pull it over the crossarm by means of the leading rope until it can be attached to the wire winder. Hold the wire under continuous tension with trailing rope so that it cannot sag down and contact power wires.
- When recovering the rope take care not to short circuit the power wires.

MEASURING CLEARANCE BETWEEN POWER LINES AND TELECOM LINES

MEASURING CLEARANCE BETWEEN POWER WIRES AND TELECOM WIRES OR HEIGHT OF POWER WIRES.

Low Voltage Supply Mains, Street Light Mains and Service Leads

Use only an optical height measuring instrument (S241/1) or an approved type of insulated measuring rod (fibre glass rod) to measure the separation between wires or to measure the height of power wires above the ground.

Except when using an optical height measuring instrument, wear rubber gloves or stand on a rubber mat for additional protection against electric shock.

High Voltage Power Lines

Use only an optical height measuring instrument to measure clearance from high voltage power lines or their height above ground.

Insulated measuring rods, cords or tapes must not be used for this purpose.

If in doubt regarding clearance, refer to the electricity authority.

Statutory Clearances

Inspan crossings, low voltage supply mains, street light mains and service leads - See page 0-3.

Inspan crossings, High Voltage Power Lines - See page 0-5.

Power wires attached to common use Telecom poles - See page 0-8.

Telecom wires and cables attached to common use power poles - See page 0-23.

Joint Use construction - See pages P-15-16.

TELECOM LINES CROSSING TRAMWAY OR RAILWAY OVERHEAD CONTACT WIRES

CONSTRUCTION STANDARDS

Wherever practicable telecom construction should be constructed to avoid crossing over tramway or railway overhead contact wires. Where a crossing has to be provided both Authorities must agree with the crossing design before work starts. Construction specifications must include the following :-

Crossing Low Voltage Contact Wires

- Only insulated open-wire, drop wire or IB aerial cable will be erected in the crossing span.
- The crossing should be at right angles or not less than 45° to the contact wire.
- There must be no wire joints in the crossing span.

  Wires must be terminated at poles on each side of the crossing.
- A separation of at least 2 m must be maintained between the telecom wire or cable and the contact wire. For tramway or trolley routes, a clearance of at least 1 m above the maximum reach of the trolley pole must be provided.

Crossing High Voltage Contact Wires

- Details of any special construction and safety precautions required in addition to those for LV contact wires above will be advised by the Engineer after consulation with the Railway or Tramway or Trolley Authority.
- Separation between telecom lines and contact wires must not be less than shown for power line crossings on page 0-5.

CROSSING RAILWAY COMMUNICATION POLE ROUTES - Refer page K-9.

ENGINEERING INSTRUCTIONS

LINES AERIAL SP0501, 2501,
4501, 4511, 9005,
9006

Issue 4, 1976

JOINT USE CONSTRUCTION

JOINT USE SCHEME 1

JOINT USE SCHEME 2

CLEARANCES

REFERENCES

Issue 4, 1976

JOINT USE CONSTRUCTION

AGREEMENTS WITH POWER AUTHORITIES.

The following pages give details of the arrangement between Telecom and the Electricity Supply Association of Australia (ESAA) for the joint use of power or Telecom poles. As individual agreements are made with each power authority, there may be some local variations in the types of construction necessary. Generally, the conditions set out in the arrangement with the ESAA will apply.

TYPES OF JOINT USE CONSTRUCTION.

Normal Joint Use.

This covers construction on Low Voltage (LV) power poles where a cable terminal box with radiating customers leads is installed on each pole where distribution is required. The terminal box may be served by a plastic aerial cable suspended between poles or by underground cable attached vertically to the pole face.

Special Joint Use.

This comprises special applications such as :-

Attachments to exclusive High Voltage (HV) power poles.

Large size or heavily tensioned aerial cables on LV or HV power poles.

Plastic covered open wire telecom lines on LV or HV power poles or on Telecom poles.

Low Voltage attachments for power distribution.

Street light attachments.

Application of Special Joint Use will normally require special construction standards. Such construction standards will be determined by the responsible Telecom officer after consultation with the Power Authority. Normal Joint Use practices only are included in this Handbook.

CONDITIONS FOR JOINT USE OF POWER POLES

- Poles must be in sound condition and of adequate strength to support the load of Telecom attachments. Additional staying may be necessary.
- Poles must be of sufficient height to obtain the necessary separation from power wires and fittings (See Pages P-15&16 and statutory ground clearance).
- Only LV poles or poles on which LV wires are erected below HV wires may be used for normal joint use construction. The following poles must not be used :-
  - Exclusive HV construction, that is no LV wires erected beneath HV lines.
  - Combined LV/HV construction where the HV exceeds 66kV.
  - Poles carrying series street lighting.
  - Poles fitted with pole mounted transformer.
- On Joint Use poles the active conductors of service leads shall be covered or insulated.
- Street light leads shall be insulated to a minimum 250V grade.
- Earth wires shall be covered with non-conducting material between ground and a point at least 0.6 m above the uppermost telecom attachment.

TYPES OF TELECOM CONSTRUCTION

Agreements with power authorities may provide for either of the following standardised forms of construction :-

Scheme 1 : All telecom attachments on a joint use pole are fixed directly to the pole.

Scheme 2 : A wood crossarm is secured to the pole. The customers leads, and in certain cases, the aerial cable and terminal box are attached to the arm.

Standard construction practices and fittings should be used wherever practicable.

SHARED USE OF ETSA POLES SE LO 2/2

Under the agreement between ETSA and Telecom SA each party may use each others poles for attachments, crossovers and lead-ins provided the standards of separation and workmanship are observed. The cost of this arrangement is subject to review every three years. The following restrictions apply :-

1. Poles carrying voltages in Excess of 11kV exclusively
   i.e. no distribution voltages. These must not have Telecom boxes, open wire or drop wire because of the risk of pole potential under power fault conditions.

2. Poles carrying distribution voltages (240/415V)
   May also carry voltages up to 66kV
   (a) Transformer Poles - no boxes or drop wire.
   (b) Power Factor correction condenser poles - no boxes. Drop wire attachments may be fitted and used.
   (c) Ganged Air Break Switch AB Poles - no boxes but Drop wire attachments may be fitted and used provided the operating rod or pipe is not affected.

Contd.

(d) Disconnect fuse DF Poles - no boxes but Drop wire attachments may be fitted and used provided this does not unduly restrict ETSA access by ladder or work basket.

February 1983

JOINT USE - SCHEME 2 - CONSTRUCTION PRACTICES

CABLE TERMINAL BOXES

- Terminal boxes shall normally be located on the property side of the pole, not less than 3 m above ground and below the lead off level to Telecom subscribers. Only one box may be fitted on any pole.
- Boxes may be untailed or tailed with plastic cable up to 12 mm diameter.
- Boxes without insulating covers must be mounted at least 2.5 m below the lowest uninsulated active power conductor.
- The box framework must not be earthed unless the box is mounted at least 2.5 m beneath the lowest uninsulated power conductor. The metal frame must not be connected to the bearer of the aerial cable. If erected on a non-wood pole the frame must be insulated from the pole face.

CUSTOMERS LEADS

- Customers leads shall consist of polyethylene insulated drop wire.
- Not more than 6 leads are attached to any one pole (unless otherwise agreed).
- Leads shall lead off from the property and roadside faces at the same level, bridging the pole at the lead off level.
- On wood poles where more than one lead is involved, drop wire shall be enclosed in a plastic pipe or insulated capping.
- A single lead may be cleated to the pole but enclosed in an insulated pipe where it bridges the pole.
- On non-wood poles all customers leads shall be protected from contact with the pole face by insulated pipe.
- Insulated bearer of drop wire shall be made off on nylon terminating insulators.

JOINT USE - SCHEME 1 - CONSTRUCTION PRACTICES

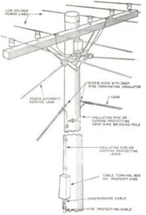
CUSTOMERS LEADS (CONTD)

- The bearer wire shall NOT be earthed.
- On wood poles, terminating insulators shall be attached to screw hooks.
- On non-wood poles, terminating insulators shall be attached to wood blocks or to a bracket approved by the power authority.
- Drop wire shall be erected to normal Telecom tensions.

UNDERGROUND CABLE

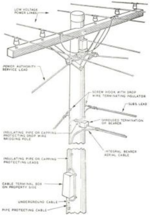
- Cable fixed to the pole shall not exceed 25 mm diameter and not more than 3 cables may be attached at any one position.
- Cables will normally have an outer polyethylene sheath.
- Cables with metallic sheath may be installed on wood poles provided the exposed sheath is not within 2.5 m of the lowest uninsulated power conductor on the pole. Metallic sheathed cables are not permitted on non-wood poles.
- A single cable may be secured direct to the face of the pole or protected by suitable pipe or capping.
- Where more than one cable is used they must be enclosed in a pipe or capping. Such pipe or capping shall be of suitable insulated material except that it may be metallic up to 3 m above ground.
- Where pole preservation by charring is practised, the cable shall be enclosed in a GI pipe set out at least 25 mm from the pole for a distance of 460 mm above and below ground.

TREAT ALL POWER WIRES AND FITTINGS ON POWER POLES AS LIVE AND DANGEROUS.



Left : Typical Intermediate Terminal Pole fed by underground cable. Terminal box approx 4 m above ground. (See Page M-3).

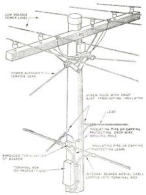
Right : Typical arrangement of underground cable, terminal box, aerial cable and customers leads on pole. Aerial cable may be above drop wire lead off where necessary.



AERIAL CABLE

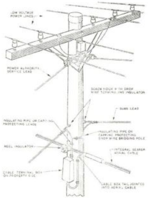
- Only integral bearer polyethylene aerial cable shall be used.
- The maximum cross section of the cable, including bearer, shall not exceed 30 mm.
- Not more than one aerial cable shall be suspended between consecutive poles.
- Unless otherwise agreed, aerial cable shall be attached to the property side of the pole. Branching cables shall feed off from either the property or road side at the same level as the main cable and shall bridge the pole at this level. Dead-end terminations of bearer are to be on the in-line face of the pole.
- Cable attached to the pole may be protected by an insulated pipe or capping.
- On wood poles the bearer wire or any metallic fitting in electrical contact with it must not be exposed. This requirement can be met by shrouding the terminating fitting with an insulated cover. (See Page P-9). Some Power Authorities accept a wood block fixed to the pole immediately above the metal fitting.
- On non-wood poles the bearer wire must be protected from electrical contact with the pole by mounting the terminating fitting on a wood block or short crossarm. Shrouding is not required.
- The bearer wire shall NOT be earthed.
- Maximum resultant load on a pole due to aerial cable tension must not exceed 2210 N acting on the pole 2/3 of its height above ground. Transverse load on any pole due to wind pressure on aerial cable shall not exceed 890 N at 2/3 pole height. Lower limits may be set by power authority. (Checked by the responsible officer).
- On HV poles, earthing of the screen may be necessary to limit effects of induction. (Determined by the responsible officer).
- Tension cable so that the sag matches the sag of the LV power wires above.

JOINT USE – SCHEME 1 – CONSTRUCTION PRACTICES

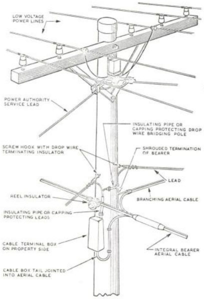


Left : Aerial cable installation with cable looped into untailed box. Bearer wire termination shrouded. Cable terminal box is normally fitted 1 m below cable with screw hook for drop wires directly beneath cable termination. (See Page M-3).

Right : Typical installation showing tail cable from terminal box jointed to aerial cable in span.

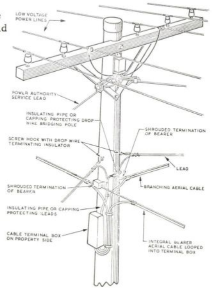


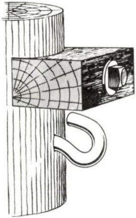
JOINT USE — SCHEME 1 — CONSTRUCTION PRACTICES



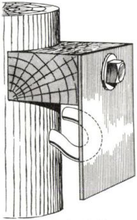
Left : Aerial cable branching from joint in span. Bearer wire terminated on pole and shrouded.

Right : Aerial cable branching from joint in untailed terminal box.

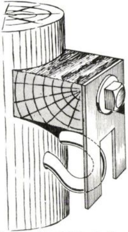




(a) Wood Block Shroud.



(b) Shielded Block for Intermediate Termination.



(c) Shielded Block for Dead-End Termination.

TYPICAL DEVICES FOR SHROUDING TERMINATIONS ON WOOD POLES

Wood Block - 150 x 100 x 50 mm hardwood "veed" to fit pole.
Shield - 150 x 150 mm black plastic sheet 3 mm thick.

JOINT USE - SCHEME 2 - CONSTRUCTION PRACTICES

CROSSARMS.

- Arms 900 x 75 x 75 mm hardwood secured to wood pole by 16 mm bolt and two short arm braces.
- Method of attaching arms to non-wood poles must be approved by Power Authority.
- Fit cross arm to pole on same face as arm for supply main and at least 1.2 m below the lowest uninsulated active conductor and at least 0.6 m below the lowest service lead or insulated street light main.
- Fixing bolts and any metallic fittings attached to the arm must be at least 12 mm below the level of the top face of the crossarm.

CABLE TERMINAL BOXES.

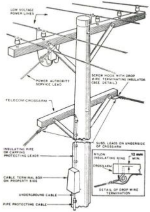
- Terminal boxes shall normally be fitted as described for Scheme 1 construction but must not project above the level of the upper face of the crossarm.
- Alternatively, boxes may be mounted on a crossarm at least 300 mm from centre line of pole and below the level of the upper face of arm.

UNDERGROUND CABLE.

Underground cable shall be installed as described for Scheme 1.

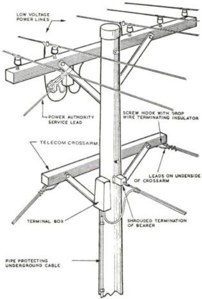
AERIAL CABLE.

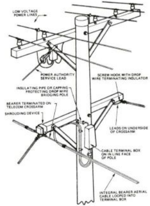
- Aerial cable shall conform to Scheme 1 except that it will normally be suspended from the underside of the crossarm 300 mm from the centre line of the pole.
- The bearer wire or any metallic fitting in electrical contact with it must not be exposed on either side of the crossarm.
- Bearer wires may be dead-ended on the pole face or on the crossarm below its upper face.
- Bearer wires of branch cables shall feed off the end of the crossarm, or off the pole face so that the termination is below the level of the crossarm and the cable protected by the arm.



<u>Left</u> : Typical Scheme 2. Intermediate Terminal Pole fed by underground cable. Customers leads attached to underside of arm.

<u>Right</u> : Aerial cable jointed to underground cable in untailed box. Bearer wire of pole and termination shrouded.

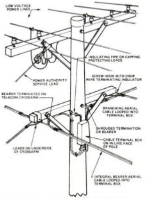




SCHEME 2: TYPICAL ARRANGEMENT OF TERMINAL BOX ON NORMAL JOINT USE WOODEN POLE WITH AERIAL CABLE AND LEADS ATTACHED TO CROSSARM, SHOWING AERIAL CABLE LOOPED INTO TERMINAL BOX AND BEARER TERMINATED ON CROSSARM.

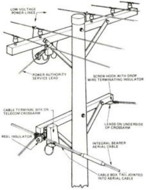
Left : Typical arrangement showing aerial cable looped into untailed terminal box and bearer terminated under arm. Box may be on same side of pole as cable.

Right : Branching aerial cable terminated on pole face and jointed to main cable in terminal box. Bearer termination shrouded.



SCHEME 2: TYPICAL ARRANGEMENT OF TERMINAL BOX ON NORMAL JOINT USE WOODEN POLE, WITH AERIAL CABLE AND LEADS ATTACHED TO CROSSARM, SHOWING AERIAL CABLE BRANCHING FROM ROAD-SIDE POLE FACE.

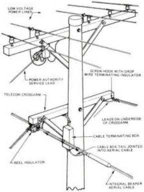
JOINT USE – SCHEME 2 – CONSTRUCTION PRACTICES



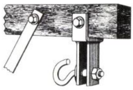
SCHEME 2: TYPICAL ARRANGEMENT OF TERMINAL BOX, AERIAL CABLE ANDLEADS, ON CROSSARM OF NORMAL JOINT USE WOODEN POLE, SHOWING TAIL CABLE JOINTED IN SPAN.

Left : Typical aerial cable installation showing tail cable from terminal box jointed to main cable in span. Terminal box attached to arm by special bracket.

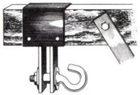
Right : Terminal box attached to pole with cable tail jointed to aerial cable in span.



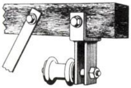
SCHEME 2: TYPICAL ARRANGEMENT OF TERMINAL BOX ON POLE, WITH AERIAL CABLE ANDLEADS ON CROSSARMS, SHOWING CABLE JOINTED IN SPAN.



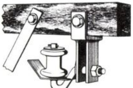
(a) Saddle and Hook Bolt.



(b) Polyethylene Shroud Over Saddle.



(c) Saddle with Reel Insulator Mounted Horizontal.



(d) Saddle with Reel Insulator Mounted Vertical.

TYPICAL FITTINGS FOR ATTACHING AERIAL CABLE TO UNDERSIDE OF CROSSARMS

Note : Fittings to Drawing CL-1130. These are not standard stock items.
Plastic shroud made from 100 mm flexible black polyethylene strip 40 mm thick.

JOINT USE - SCHEMES 1 AND 2 - CLEARANCES

Telecom Attachments	MINIMUM SEPARATIONS BETWEEN TELECOM & POWER AUTHORITY ATTACHMENTS					
	On Joint Use Pole				In-Span	
	Supply Main Conductor	Street Light Main Conductor (Note 1)	Service Lead Conductor	Street Light Leads, Fittings, Conduits and Stay Fittings	Supply Main, Street Light Main, or Service Lead	Street Light Fittings, Stay Wires
Underground Cable						
Polyethylene sheathed	1.2m	1.2m	0.6 m	50mm	-	-
Metal sheathed	2.4m	2.4m	1.8m	50mm	-	-
Terminal box						
Insulated cover	1.2m	1.2m	0.6m	50mm	-	-
Metal cover	2.4m	2.4m	1.8m	50mm	-	-
Bearer terminations (shrouded or insulated)	1.2m	1.2m	0.6m	50mm	-	-
Pipe or Capping (insulated)	1.2m	1.2m	0.6m	50mm	-	-

Note 1 : Where a street lighting main, erected beneath a supply main is insulated, the clearances in this column may be reduced by 0.6m.

JOINT USE — SCHEMES 1 AND 2 — CLEARANCES

Telecom Attachments	MINIMUM SEPARATIONS BETWEEN TELECOM & POWER AUTHORITY ATTACHMENTS					
	On Joint Use Pole				In-Span	
	Supply Main Conductor	Street Light Main Conductor (Note 1)	Service Lead Conductor	Street Light Leads, Fittings, Conduits and Stay Fittings	Supply Main, Street Light Main, or Service Lead	Street Light Fittings, Stay Wires
Wood crossarm	1.2m	1.2m	0.6m	50mm	-	-
Aerial cable	1.2m	1.2m	0.6m	50mm	0.6m	150m
Customers lead	1.2m	1.2m	0.6m	50mm	0.6m	150mm
Terminal box or bearer	1.2m	1.2m	0.6m	50mm	0.6m	150mm

Note 1 : Where a street lighting main, erected beneath a supply main is insulated, the clearance in this column may be reduced by 0.6m.

ENGINEERING INSTRUCTIONS

LINES GENERAL L0101, 0102

Issue 4, 1976

MAINTENANCE INSPECTIONS

SHORING POLES

REFERENCES

Issue 4, 1976

MAINTENANCE INSPECTIONS

Maintenance inspections are designed to ensure staff safety, public safety and to obtain satisfactory performance from aerial plant. They consist of Pole Examination, Safety Check Inspection, Maintenance Inspection and Incipient Fault Clearance.

POLE EXAMINATION.

Pole Inspectors must be Line Inspectors, Lines Supervisors in charge of the area or Lines Supervisor Grade 2 Pole Inspectors. In exceptional circumstances, Lines Supervisor Grade 1 may be authorised to inspect poles.

Frequency of pole inspections :-

Untreated Wood Poles shall be inspected at intervals of two years.

Treated Wood Poles shall be inspected at intervals of six years. Treated wood poles are those which have been treated for their full length with a suitable preservative. All treated poles are fitted with an aluminium identification and depth setting disc. Poles which do not have such a disc must be considered untreated.

Sectional Steel Poles shall be inspected annually. Sectional poles are those assembled from three or more tapering oval shaped tubular steel sections. Poles with a cast iron base and a tapered tubular steel top section are included below.

Steel Poles Other than Sectional (tubular, tubular with cast iron, I beam, rail etc.) shall be inspected at intervals not greater than six years.

The method of examining poles is described on pages Q-6-9. For further information refer to the Pole Inspectors Handbook.

SAFETY INSPECTION.

This inspection is carried out every two years to :-

- Report on unstandard power construction and clearances, and conditions likely to cause deterioration of clearances (See Section O).
- Check Common Use and Joint Use Construction.
- Report any items likely to affect the safety of the route within the next two years eg. unsound crossarms, inadequate or defective stays etc.
- Report unstandard Telecom clearances over roads or property entrances.

The inspection is made by a Lines Supervisor. In the years when it is due, the Pole Examination will normally be done in conjunction with the Safety Check Inspection.

The Safety Check Inspection consists of a visual inspection from the ground of arms, wires and fittings (poles climbed where necessary to check defective arms, fittings etc.), a check of items affecting the safety of staff, the public or the route itself. All plant considered dangerous or likely to become dangerous is recorded in the Pole Examination/Safety Inspection Field Book (Form E87) for attention. These items should be regarded as urgent and receive attention as soon as possible after the inspection is completed.

Incipient Fault conditions are removed by the inspector or reported on Form E71. On completion of the inspection, the inspecting officer makes a summary of dangerous items on the Inspection Report (Form E68) and forwards it with the Field Book (Form E87) and Pole Route Record Book (Form E97) to the Section Office via the Line Inspector.

MAINTENANCE INSPECTION

This inspection is carried out when directed by the responsible officer having regard to the importance of the route and its fault performance.

The Maintenance Inspection is designed to :-

- Report any items likely to affect the fault performance of the route, for example, scrub or undergrowth clearing required.
- Report on any maintenance work necessary to arrest plant deterioration, for example, termite attack.
- Report unstandard Telecom clearances over roads and property entrances.
- Attend to minor maintenance and remove potential fault causes.

Where possible the Maintenance Inspection is done in conjunction with the Safety Check Inspection.

INCIPIENT FAULT CLEARANCE

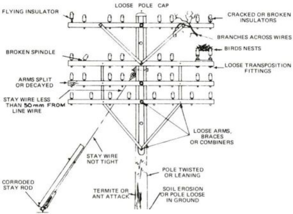
During the course of their normal duties, all staff are required to keep a look out for any conditions which could cause a fault, for example, branches over lines, broken insulators, birds nests, fires, flying spindles, slack wires, soil erosion or pole movement. On detecting a likely fault condition, the officer concerned must remove the condition immediately or note details on Form E71 (Report of Attention Required to Aerial Route), and forward the original copy to the Lines Supervisor.

Where clearance of incipient faults is unsatisfactory and causes poor service to subscribers, the responsible officer will arrange for special maintenance inspections.

FIELD ORGANISATION AND RECORDING PROCEDURES

Full details are given in EI LINES Aerial A5102.

INCIPIENT FAULT CLEARANCE



Incipient faults are plant defects which are likely to cause faults at a later date. Watch for the conditions shown. Rectify them or advise the Lines Supervisor on Form E71.

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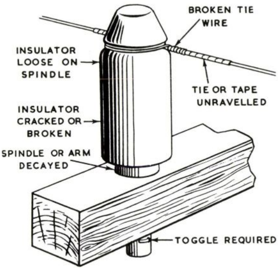
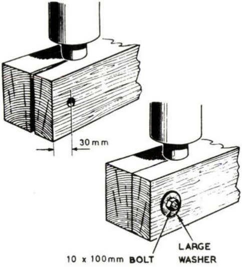


POTENTIAL FAULTS AT INSULATOR.



FITTING STITCH-BOLT TO SPLIT CROSSARM.

EXAMINATION OF WOOD POLES

The method of examination depends on the type and age of pole eg. untreated poles do not require close examination for 2-3 years after erection. Pressure treated poles are unlikely to be attacked by decay or termites for a number of years and prod and sounding tests are normally adequate. Inspecting Officers must be aware of those timbers in their districts which show peculiar defects eg., brittleness of Jarrah.

EXAMINATION OF POLE AND FITTINGS ABOVE GROUND LEVEL.

Inspect pole for splitting at the head, termite attack, decayed sapwood, knot holes etc., and defective arms. Make examination from ground. If this indicates a more thorough examination is required, complete examination below ground before climbing pole. Sound pole by striking with hammer or back of axe from ground line to as high as can be conveniently reached. A good pole will give a solid ring, whereas one containing decay or advanced termite attack will give a hollow dull thud.

EXAMINATION AT AND BELOW GROUND LINE.

Opening Up Ground. Remove soil around pole for a depth of 150 mm. If pole is old or if decay is evident, open up ground to a depth of at least 300 mm.

Prod Test at Ground Level. Prod surface of pole near the ground line with heavy knife or screwdriver to detect any softness of wood. If test shows decay, remove sapwood and test on truewood. Scrape away any decayed truewood and determine whether sufficient sound wood remains to give the pole adequate strength.

Do not remove sound sapwood from pressure treated poles because the sapwood is impregnated with preservative and forms a protective barrier against decay and termites.

EXAMINATION AT AND BELOW GROUND LINE. (cont'd.)

Sounding Test. Sound pole below ground level with hammer to detect hollowness due to termites, pithiness or serious piping. Don't condemn a pole merely because of a small pipe as this does not greatly reduce strength of pole. It is important to ascertain not only how much sound wood is in a pole, but also where it is situated - outside or centre.

The sounding test cannot be relied upon for Jarrah poles.

Auger Test. If sounding test indicates hollowness or pithiness, determine extent by boring with 14mm auger. Estimate by carefully noting any change in resistance to entry of the auger and by examining shavings removed. Plug hole with creosoted softwood plug (S70/11). If extensive internal decay or termite attack is detected, make an assessment (after allowing for possible extension of attack) as to whether pole will be safe until the next annual inspection.

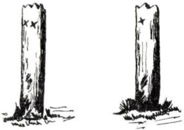
Push Test. If there is still doubt as to soundness of the pole after these tests, apply the Push Test.

MARKING CONDEMNED POLES.

X - Unsound - requires renewal or shoring within next 12 months.

XX - Dangerous - requires immediate attention.

Cut marks into pole on side most readily visible, about 1.2 m above ground.



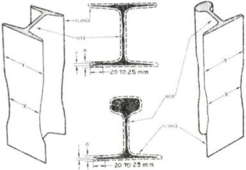
CONDEMNED POLE MARKINGS.

Q-8 EXAMINATION OF STEEL BEAM AND RAIL POLES

- Dig hole 300 mm deep around pole.
- If pole is corroded, hit edges of flanges with a hammer where corrosion is heaviest or reduction in width of flanges is greatest, to remove the loose scale.
- Measure the width across the flange of the pole at :-
  - an uncorroded section above ground = Y
  - the most corroded point = X

  Where the difference in width across the flange (ie. Y-X) is 6 mm or more, condemn the pole.
- Measure the thickness of the flange 20 mm to 25 mm from edge at :-
  - an uncorroded section above ground = W
  - at most corroded point = V

  Where the difference in thickness of the flange (ie. W-V) is 3 mm or more, condemn the pole.
- Carefully examine welds for signs of cracks eg. where surface plate is welded to pole.
- Apply push or pull test to unstayed poles.



CHECKING EXTENT OF CORROSION.

EXAMINATION OF STEEL POLES - OTHER TYPES

TUBULAR STEEL POLES.

Corrosion generally occurs internally, and is more difficult to detect than on rail and beam poles.

To test poles :

- Dig hole 300 mm deep around pole.
- Check extent of external corrosion.
- Tap pole with ball pein hammer to assess amount of internal corrosion. Note indents made in pole. If indents can be made in one quarter or more of the circumference, condemn the pole.
- Apply push or pull test to unstayed poles.

CAST IRON BASED POLES.

Make a thorough visual examination and condemn pole if :-

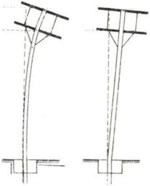
- There are cracks in the cast iron base at the collar and barrel section below.
- There is severe corrosion where the galvanised upper section seats in the base.

Dig around the pole and check for corrosion of the base.

Apply push or pull test to unstayed poles.

MARKING CONDEMNED POLES.

Mark condemned poles X or XX as for wood poles. Use white or yellow paint on black steel poles and black paint on galvanised poles.



Good Pole. Weak Pole.
HOW STEEL POLES BEND WHEN PUSH TESTED.

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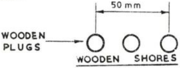
SHORING CONDEMNED POLES

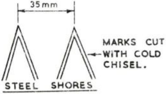
TYPES OF SHORES.

- Wood eg. portion of recovered pole.
- Steel Beam or Rail.

DEPTH SETTING MARK.

Where shore poles are less than 3 m in length, make special Depth Setting Mark 1.7 m from butt.





DEPTH OF INSTALLATION.

Wood Shores - Depth of pole.

Steel Shores - Depth of pole plus 300 mm (if heel plate not fitted).

MATERIAL FOR FITTING SHORES.

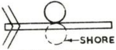
Material	Serial/Item
Band Shore 1.2 m	424/54
Band Shore 2 m	424/56
Band Shore 2.6 m	424/57
Turnbuckle	424/58
Block Shore	66/30

Use turnbuckle only when shoring wood poles with steel shores.
Use shore band of nearest length to circumference around pole and shore plus 200 mm.

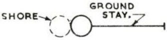
SECURE POLE WITH PIKES OR TEMPORARY STAYS BEFORE COMMENCING EXCAVATION

POSITION FOR SHORES.

STRAIGHT LINE POLE.



ANGLE POLE.



STAY OR BOLLARD POLE.

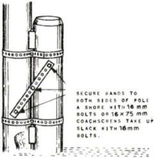
WOOD SHORES.

Length of Pole m	Length of Shore m	Diameter of Shore
5-6	2	At least equal to standard diameter of the length of pole being shored.
7	2.5	
8-9	3	
10-12	5	

Remove loose sapwood from pole and treat with creosote before installing shore.

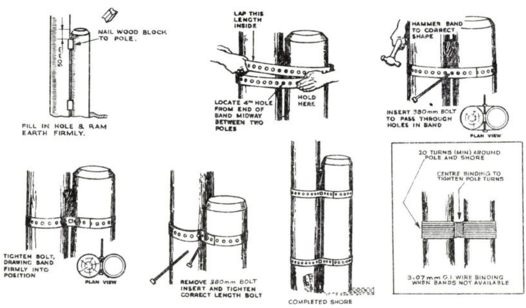
SHORING GROUND STAYED POLE.

Use only wood shores when shoring ground stayed poles. Fit bands around circumference as for unstayed pole. Attach additional bands diagonally between shore and pole on each side of pole and secure with 16 mm bolts or 16 x 75 mm coachscrews.



SHORING GROUND STAYED POLE.

WOOD SHORES - METHOD OF FITTING



SHORING CONDEMNED POLES - STEEL SHORES Q-13

SIZE AND TYPE OF SHORE
The shore to be fitted shall be the same size and type as the steel pole to be shored.

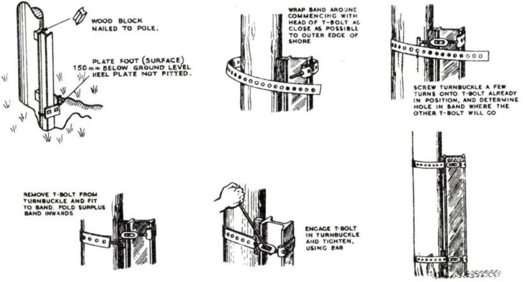
LENGTH OF SHORE
The length of shore will be governed by the depth of steel pole being shored.

Example : Steel Pole to be shored is 1.5m in ground and fitted with heel plate.
∴ Length of Shore = 1.5 m + 2 m = 3.5 m.
If no heel plate add 300 mm for extra depth = 3.5 mm + 0.30 m = 3.80 m.

Length of Pole Metres	Maximum Number Crossarms	Size of Steel Shore Pole to be Used			
		Length	Rail/Beam		Serial 85/
		m	Kg/m	Size mm	Item
5	4	2.4	22-27	100 x 75	180
6	5	2.4	30-37	150 x 75	181
	4	2.4	30-37/22-27	150 x 75/100 x 75	180/181
	2	2.4	22-27	100 x 75	180
7	7	3.0	40-50	175 x 85	182 *
	6	3.0	40-50/30-37	175 x 85/150 x 75	182 *
	5	3.0	30-37	150 x 75	181
	2	3.0	30-37	150 x 75	181
8	8	3.6	53	200 x 150	183
	7	3.6	53	200 x 150	183
	5	3.0	40-50	175 x 85	182 *
	4	3.0	40-50	175 x 85	182 *
	2	3.0	30-37	150 x 75	181
9	8 5	3.6	53	200 x 150	183

*Serial 85/182 - 3 m Shore includes 175 x 85, 175 x 100, 150 x 125, or 125 x 110 mm steel beams.

STEEL BEAM OR RAIL SHORES - METHOD OF FITTING



ENGINEERING INSTRUCTIONS

LINES AERIAL PA5011, 5012,
5101, 5110, 5202
PP5001

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ROPES, KNOTS AND TACKLE

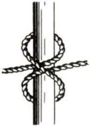
REFERENCES

Issue 4, 1976

ROPES - KNOTS AND TACKLES

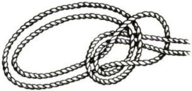
REEF KNOT

SHEEP SHANK



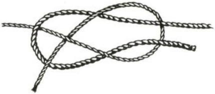
GLOVE HITCH

ROLLING HITCH

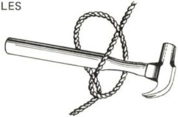


BOWLINE ON THE BIGHT

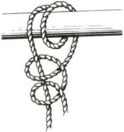
USE ONLY ROPE IN GOOD CONDITION AND OF ADEQUATE SIZE FOR THE JOB.



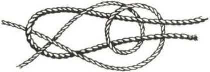
SINGLE SHEET BEND



BOAT KNOT OR MARLINE SPIKE HITCH

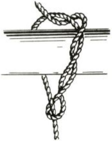


ROUND TURN AND TWO HALF HITCHES

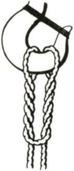


DOUBLE SHEET BEND

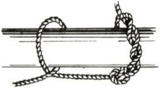
BOWLINE



TIMBER HITCH

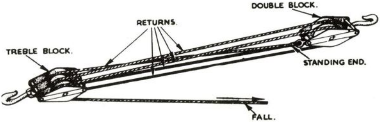


CATSPAW



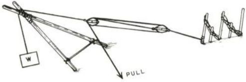
TIMBER HITCH AND HALF HITCH

ARM HITCH



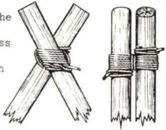
REEVING TREBLE AND DOUBLE BLOCKS

ROPES – KNOTS AND TACKLES



SHEERS

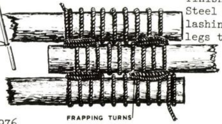
<u>To form sheers</u>, lay the legs side by side and about 50mm apart. Pass a clove hitch around one spar and then lash the spars together with six or eight turns without riding. Bind the lashing with two frapping turns between the spars and finish with two half hitches around the second spar.



GYN

<u>To form a Gyn</u> lay the three legs side by side and about 50mm apart, with the centre leg in the opposite direction to the others. Pass a clove hitch around one outside leg and lash the three legs alternatively over and under the legs (six times loosely). Bind the lashing frapping turns between each pair of legs and finish with two half hitches on one leg.

Steel chain is superior to rope for a gyn lashing, as the fewer turns required allow the legs to be more easily opened.



JOINTING CLAMPS - ADJUSTMENT AND MAINTENANCE

JOINTING CLAMPS PRESS TYPE 1.68/2.84 AND 2.18/3.48

Adjustment - To determine extent of wear and need for adjustment of tool, check the compressed portion of a sleeve, at right angles to the fins, with the appropriate grooves of the "GO" and "NO GO" gauge. It should pass through the "GO" slot freely but not through the "NO GO" slot. If it does not pass through the "GO" slot adjust the tool as follows:

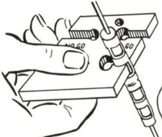
(i) Open handles of tool fully.

(ii) Loosen LOCKING SCREW one or two turns with adjusting key.

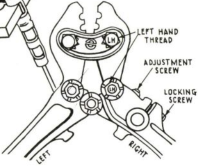
(iii) Screw in ADJUSTMENT SCREW a fraction of a turn.

(iv) Make compression on a sleeve and test with gauge. Continue adjusting until compressed part of sleeve will pass through "GO" slot but not through "NO GO" slot.

(v) Tighten LOCKING SCREW.



GAUGING



ADJUSTING

ADJUST AND LUBRICATE TOOLS REGULARLY.

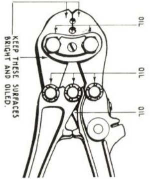
LUBRICATION

Clean and lubricate tool at all pivots and between the side plates and jaws regularly.

TOOL BINDING OR STIFF TO OPERATE

If tool is binding, clean thoroughly and lubricate.

If it continues to bind after lubrication, this will be due to one of the hexagon headed bolts. Loosen bolt slightly then relock by bending up one of the pivots of the locking washer. Note, the two bolts marked "LH" have left hand threads.



LUBRICATION POINTS

JOINTING CLAMP PRESS TYPE 1.27

This clamp cannot be adjusted, but its condition can be checked by means of the "GO" gauge supplied with the tool. If the clamp is in satisfactory condition the compressed portion of a sleeve will fit in the groove of the "GO" gauge. When it will not fit into the groove in the gauge it is an indication that the tool is worn and should be replaced.

SAFE WORK DEPENDS ON WELL KEPT TOOLS, USING THE RIGHT TOOL FOR THE JOB, AND USING IT CORRECTLY.

CASH AWARDS

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

THE SECRETARY,
STAFF SUGGESTIONS BOARD,
TELECOM AUSTRALIA,
COMMUNICATIONS HOUSE,
199 WILLIAM STREET,
MELBOURNE, VIC, 3000.

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

To avoid disappointment and waste of the Commission's time in investigating the suggestion make sure that your ideas are practical. Discuss them with your Supervisory officers or if possible try them out before submitting the suggestion.