Siemens Traffic Controls Limited
Sopers Lane
Poole
Dorset
BH17 7ER

# INSTALLATION AND COMMISSIONING

# HANDBOOK NO 2

# SIGNALS AND POLES

**THIS DOCUMENT IS ELECTRONICALLY HELD AND APPROVED**

PREPARED : Talbot Dickson/Kevin Maile
FUNCTION : Inst Project Manager/Senior Engineer
DATE : July 1999

## TABLE OF CONTENTS

# FIGURES

# 1. INTRODUCTION

## 1.1 Purpose

This handbook is the second of a series of General Traffic handbooks which cover common aspects of planning, installation and commissioning of SPCL traffic controllers and associated street equipment.

## 1.2 Scope

## 1.3 Related Documents

667/HE/20661/000 - Book 1 - General Principles

667/HE/20663/000 - Book 3 - Detectors and Cable Terminations

667/HE/20664/000 - Book 4 - Installation and Testing

667/HE/20665/000 - Book 5 - Above Ground Detectors

## 1.4 Glossary

| | |
|---|---|
| PI | Periodic Inspections |
| STS | Site to Scale (drawing) |
| IEE | Institute of Electrical Engineers |
| MVD | Microwave Vehicle Detector |

## 1.5 Issue State

| Pages | Current Issue | Type | Part ID |
|---|---|---|---|
| 1 to 29 | 7.00 | AMW | 667/HE/20662/000 |

# 2. SIGNALS AND POLES

## 2.1 Installation of High Intensity Signals

### 2.1.1 General Information

| | |
|---|---|
| 3 Aspect 200mm lantern | 13.6 kg |
| 2 Aspect 200mm lantern | 15.8 kg |
| 1 Aspect 300mm lantern (GA or RG man) | 5.9 kg |
| 1 Aspect regulatory sign | 5.4 kg |
| Pedestrian push button | 3.6 kg |
| Pole, complete with base plate | 68 kg |
| Pair of mounting brackets | 3.2 kg |

Note: Lantern weight includes hoods.

Optical Units

i. 200 mm Aspects for Vehicle

A pre-focused 12 volt 50 watt Tungsten Halogen lamp is mounted in a parabolic diffused reflector made of super purity aluminium, anodised and fitted behind a specially designed wide-angle lens of self-coloured acrylic material. Rear access is provided to the lamp holder to facilitate lamp changing without exposing the reflector to the elements and possible surface damage.

For high speed roads, where specified, 12 volt 100 watt Tungsten Halogen lamps are incorporated in the 200mm units to give higher light intensity.

The lamp voltage is derived from a small step-down transformer, one per signal aspect mounted in the lamp body.

ii. 300 mm Aspects for Pedestrian and Green Arrow Signals

A pre-focused 12 volt 50 watt Tungsten Halogen lamp is mounted in a parabolic specular reflector made of super purity aluminium, anodised. The lens consists of a 'sandwich' of glass, coloured acrylic sheet and a filter; the symbol being formed by a silk screening processes on one of the internal surfaces of this lens system. This provides a high transmittance coupled with excellent secrecy characteristics and physical strength.

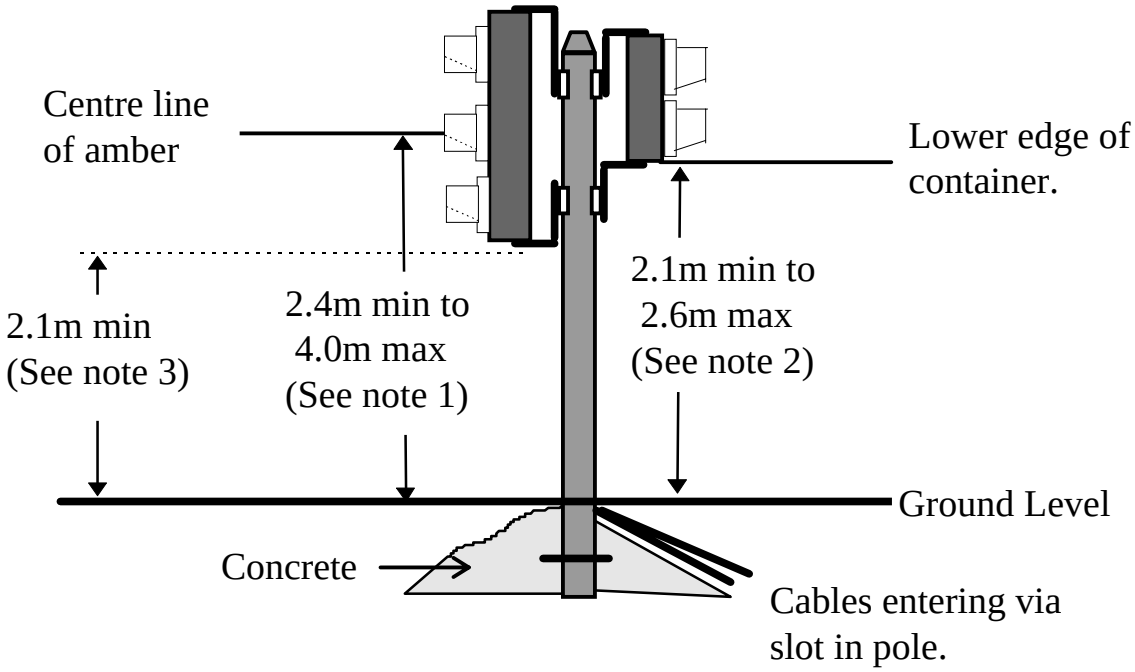
Rear access is again provided to the lamp holder to facilitate lamp changing.

iii. Regulatory Signs

Three 230mm (9") 6 watt fluorescent tubes are mounted in front of a white acrylic reflector; the three tubes being connected in such a way as to provide protection against total signal failure.

The lens is formed from a flat acrylic sheet upon which any of the mandatory signs may be printed in full colour.

**Figure 1 - Typical Signal Post Assembly showing heights for compliance with Traffic Signs Regulations**




Notes:

1. The dimensions on this drawing show the limits allowed where, 'Light signals for control of vehicular traffic at road junctions, at places where the headroom is permanently reduced or at places where pedestrians cross the road (other than Pelican crossings)'. [See Traffic Signs Regulations 1994, Schedule 8 and TR0102.]
2. The dimensions on this drawing show the limits allowed for 'Light signals for pedestrians and animal crossings. [See Traffic Signs Regulations 1994, Schedule 9 and TR0102.]
3. SAFETY NOTE!
   Signals that are installed where Pedestrians may cross the road must have no part of the Signal Head Installation less than 2.1m above ground level.

   See Figure 2 for further dimensions.

**Figure 2 - Signal Post Assembly showing useful dimensions for Pole Selection and planting depth**

The following information is provided to enable Pole length requirements and planting depths to be determined. This assumes a 667/2/01549/ETC Pole, a 3 aspect signal fixed using top bracket 667/2/10545/000, /003, /100, /103. Confirm dimensions using appropriate or latest drawings. Note that a 3.75m pole will only be used for Amber centres below about 2.6m.

Example 1 - Obtaining heights to amber centre line with nominal pole lengths by varying planting depth.

E.g. 2.8m centre -

- Pole length will be 4.0m (i.e. next size up after 3.75m)
- 4000 - 2800 - 477 = Planting depth in mm = 723mm.

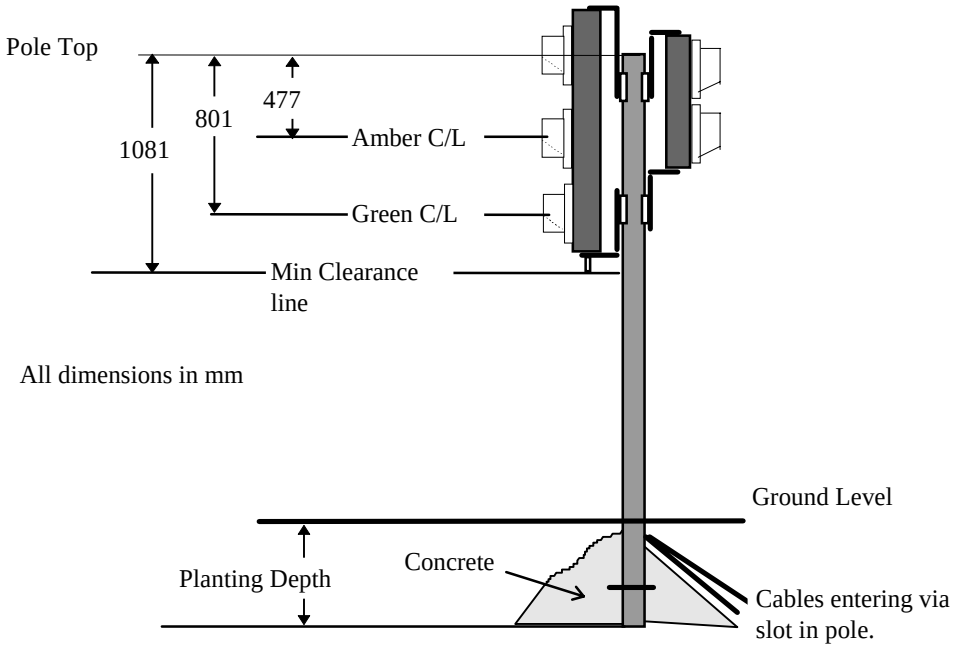
Example 2 - Using common pole lengths, and a planting depth of 700mm, the centre of the amber would be:

| Pole Length (m) | Planting Depth (mm) | Amber centre line |
|---|---|---|
| 4 | 700 | ~2.82m |
| 5 | 700 | ~3.82m |
| 5.5 | 700 | ~4.32m |
| 6 | 700 | ~4.82m |

Example 3 - To obtain the pole length required for a given centre of the amber, green or the clearance height:

- Pole length required = (Height to Amber C/L + 477mm + Planting Depth)
- Pole length required = (Height to Green C/L+ 801mm + Planting Depth)
- Pole length required = (Clearance Height + 1081mm + Planting Depth)

Therefore, if the height of the Green C/L is to be 2.5m, the pole needs to be at least 2.5m + 0.8m + 0.61m = 3.91m




Note - The planting depth must be a minimum of 610mm to cover the cable entry slot. Install under direction from the Civil Engineer.

General - PVC covered poles, 667/2/01459/ETC

Galvanised Poles, 667/2/03686/ETC

## 2.2 Assembling and Terminating a Signal Pole

### 2.2.1 Wiring Pole prior to erection

The pole assembly may be completed to the point of having drawn up the cables an fitted at least the brackets prior to erection. Alternatively assembly may follow erection. In this case see Section 2.2.2.

Transport lantern bracket assemblies, top cap assembly, pole draw rope, ladders and all necessary tools to the first pole location.

It is recommended that the assembly and wiring should be carried out in the order listed below.

Fit upper and lower bracket assemblies as shown in drawing 667/1/10547/etc and 667/1/02299/etc (see Figure 4 and Appendix A) taking care to ensure that the correct variant of arm assembly is used.

Each cable can now be fed through the base aperture to the top of the pole using the draw rope if necessary to pull the cable up.

Unpack and dismantle the top cap assembly and fit the terminal block assembly to the pole with nuts, bolts and washers supplied with the assembly (drawing 667/1/10735/000, in Appendix A refers).

Secure all cable(s) to the lug(s) on the terminal block assembly using the worm drive hose clip as shown in drawing 667/DG/13012/000 sheet 1 (see Appendix A). (Reference only Figure 8). Note that a suitable allowance must be made for the amount of cable at the bottom of the pole.

The pole is now ready for erection. Once this operation is completed the excavation at the base of the pole may be back-filled.

Note that Lanterns are not terminated until after the cables have been tested.

On completion of all post top terminations, the tests described in Handbook 4 are to be completed.

### 2.2.2 Wiring Pole after erection

Transport lantern bracket assemblies, top cap assembly, pole draw rope, ladders and all necessary tools to the first pole location.

It is recommended that the assembly and wiring should be carried out in the order listed below.

Fit upper and lower bracket assemblies as shown in drawing 667/1/10547/etc and 667/1/02299/etc (see Figure 4 and Appendix A) taking care to ensure that the correct variant of arm assembly is used.

Each cable can now be fed through the base aperture to the top of the pole using the draw rope if necessary to pull the cable up.

This operation is then repeated for each pole at the intersection.

Unpack and dismantle the top cap assembly and fit the terminal block assembly to the pole with nuts, bolts and washers supplied with the assembly. (Drawing 667/1/10735/000 in Appendix A refers.)

Secure all cable(s) to the lug(s) on the terminal block assembly using the worm drive hose clip as shown in drawing 667/DG/13012/000 sheet 1 (see Appendix A). (Reference only Figure 8).

Measure off wires to length, cut, strip, terminate necessary cores to terminal block, terminate two cables cores in earthing block for test purposes as described in Section 2.6.

Once this operation is completed the excavation at the base of the pole may be back-filled.

Note that Lanterns are not terminated until after the cables have been tested.

On completion of all post top terminations, the tests described in Handbook 4 are to be completed.

## 2.3 H.I.T.S. Arm Assemblies

See 667/1/10547/ETC in Appendix A.

## 2.4 Arm Assembly Pedestrian Signal

See 667/1/02299/ETC in Appendix A.

## 2.5 Top Cap Assembly

See 667/1/10735/000 in Appendix A.

## 2.6 Pole Neutral Connections and Terminations

On long neutral runs during Red/Amber, the current can cause large voltage drops. This contravenes the IEE Regulations which only allow a 2.5% voltage drop overall. In addition, the voltage drops can affect the operation of the green voltage monitor and/or lamp monitors. The length of the neutral feeds must not exceed the length shown below. The number of bulbs is the total number of bulbs which can be illuminated at any one time, e.g. phase A and phase AB will both have 2 (two) bulbs lit during the Red/Amber period. Where 2 (two) poles are fed on 1 (one) cable, the length of cable should taken as the mid point between the 2 (two) poles.

The cable inside a pole is approximately 3.25 metres. So, for normal runs, the length of run shown on the STS should be approximately 6 (six) metres shorter than the maximum allowable length of cable.

Where a cable run exceeds the figures shown, 2 (two) cores of the cable can be used as the neutral feeds, then the distances shown can be increased by a factor of 1.5.

| Number of Lamps Lit | Current | Total Length of Cable | Typical Cable run on STS |
|---|---|---|---|
| 1 | 0.27 | 370 | 364 |
| 2 | 0.54 | 185 | 179 |
| 3 | 0.81 | 123 | 117 |
| 4 | 1.08 | 93 | 87 |
| 5 | 1.35 | 74 | 68 |
| 6 | 1.62 | 62 | 54 |
| 7 | 1.89 | 53 | 43 |
| 8 | 2.16 | 46 | 40 |
| 9 | 2.43 | 41 | 35 |
| 10 | 2.70 | 376 | 31 |

| Number of Lamps Lit | Current | Total Length of Cable | Typical Cable run on STS |
|---|---|---|---|
| 11 | 2.97 | 34 | 28 |
| 12 | 3.24 | 31 | 25 |
| 13 | 3.51 | 28 | 22 |
| 14 | 3.78 | 26 | 20 |
| 15 | 4.05 | 25 | 19 |
| 16 | 4.32 | 23 | 17 |
| 17 | 4.58 | 22 | 16 |
| 18 | 4.86 | 21 | 15 |
| 19 | 5.13 | 19 | 13 |
| 20 | 5.40 | 18 | 12 |

If there is a danger of neutral connectors being disconnected it is recommended that separate neutrals are used for:

1. Signals and green arrows
2. Wait indicators
3. Box Signs, Solar Cell and MVD Detectors
4. Sonalert on Pelican Controllers.

When terminating the armoured cable conductors into the post terminal block, if it is necessary to connect two or three conductors of the same function, then the conductors should all be connected into one side of the connector, leaving the other side clear for the connection of lantern conductors.

## 2.7 Controller Neutral Connection

Minimum wire size to be 24/ .2 mm (1.5 sq. mm) and colour to be black for neutrals. Length required approximately 1.5 metres maximum.

Cut lengths of wire 60mm long and bare each end for 10mm.

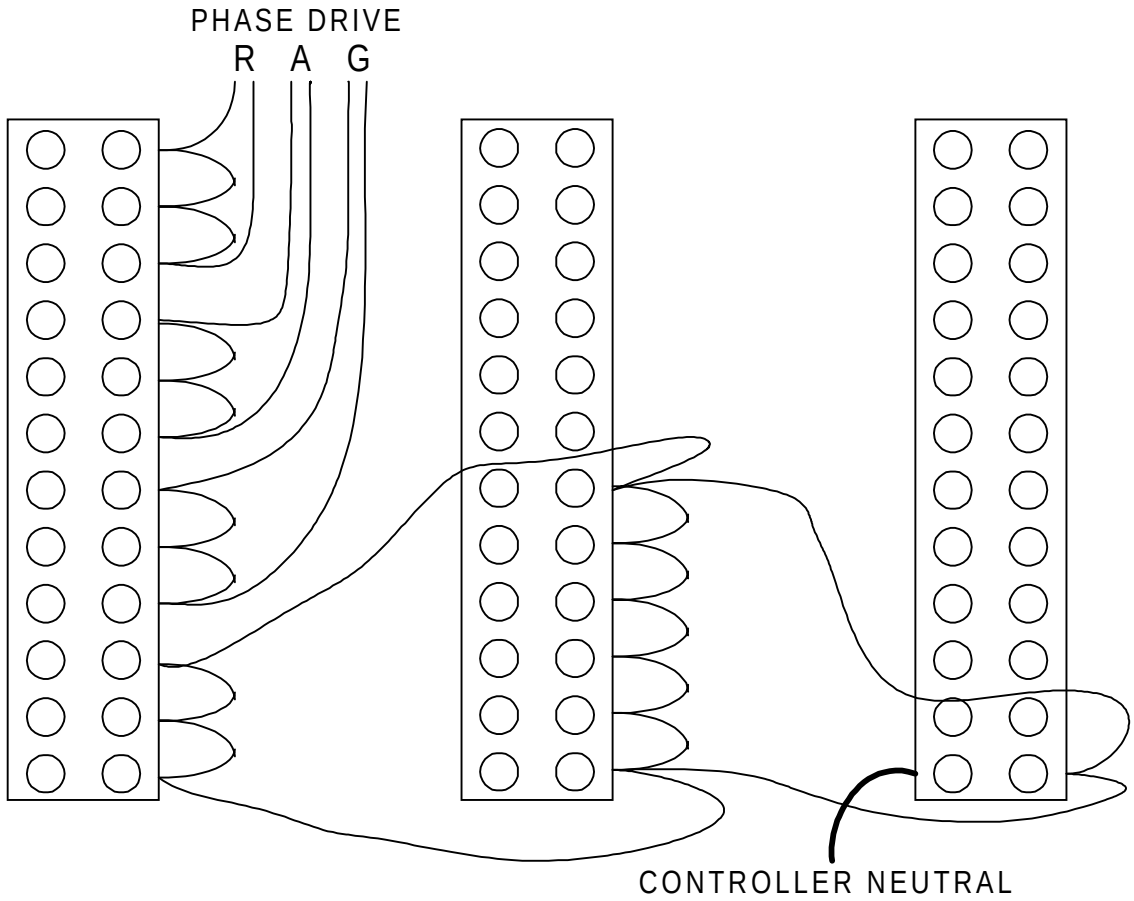
Starting at the appropriate terminal block insert two separate ends into the block and screw down tightly. Take each loose end and loop around to the next position. Continue in this fashion for as many neutral terminal points as are required. Two lengths of wire approximately 250mm long (with bare ends for 10mm) can be used to loop around to other terminal block positions.

Terminal blocks may be used for both neutral looping and phase live output looping that may require more than the single screw terminal provided. See Figure 3. Note that no bare strands should be exposed when the looping is complete.

Consult the appropriate controller installation manual for details of the terminal blocks designated for such use.

It is important that all of these connections are checked for tightness during periodic inspections (PI).

**Figure 3 - Wiring of the Neutral Terminal Block**




## 2.8 Lanterns, Box Signs Installation

### 2.8.1 Lantern Assembly and Installation

1 Drawing 667/AA/13012 (see Appendix A) illustrates the various lantern configurations that could be used on an intersection.

The following assembly guideline is for standard three aspect lanterns.

2 Lanterns are assembled in accordance with the requirements of the STS for primary and secondary signals.

The two types of lantern differ in assembly by the type of hoods fitted to these aspects. Drawing 667/DG/13012/000 sheet 1, reference 3-EH in Appendix A refers.

3 Step 1

Remove red, amber and green lenses from lantern body. Care is to be taken when removing the red lenses, for in this lens the plastic screws for the backing boards and the lantern securing split pins are contained in a small plastic box.

Step 2

When more than one lantern is fixed to a post, it will be necessary to connect together aspect neutrals within the lantern assembly. Remove the red lamp reflector. Unravel all

wire and gather together the blue neutral conductors and shorten them to a length for crimping within the lantern body. For crimping preparation refer to Section 3.2 (Figure 6).

Step 3

Prepare by stripping the insulation of one end of the lantern neutrals, and an extra length of wire to connect from the lantern to the post terminal block. See Section 3.2 (Figure 6).

Lay together the stripped ends of the wires, ensuring that the end of the insulations are in line and tightly twist together the wire conductors as in Section 3.2 (Figure 7). Cut the ends of the twisted wires to 3/8 as in Section 3.2 (Figure 6).

Step 4

Insert the twisted ends of the wires into a 4-6mm (yellow) connector, and using a ratchet type crimp tool, crimp all wires into the crimp connector. Following each crimp operation give each wire a sharp pull to ensure that the crimp is satisfactorily completed. See Section 3.2 (Figure 7).

Following the combining together of the lantern neutrals, gather together the red, amber and green transformer primary wires and pass these wires and the combined neutral through the hole in the back of the lantern body. Replace the red lamp reflector.

Fit the backing boards and white plastic strips delivered with the lantern to the lantern body using the plastic screws contained in the bag removed from the red aspect.

Fit the primary and secondary cowls to the lenses with the small Rokut rivets. The method usually adopted for this is to fit the ends of the cowls with rivets to locations ‘a’ and ‘b’ shown on the 200mm lens drawing (667/DG/13012/000, A17-19 in Appendix A) then to push the cowl over the rim of the lens. As cowls are fitted to the lens, the lens are to be fitted to this respective aspect position.

Following the complete assembly of lanterns, they are then fitted to their post brackets. 667/DG/13012/000 in Appendix A, item 24, is the bolt head which slides into the channel section attached to the lantern body, thereby holding the lantern to the bracket. When the bolt (item 24) has been tightened the split pins contained in the small plastic bag from the red aspect are to be fitted through the holes in the channel section at the back of the securing bolt.

667/1/02299/ETC (IN Appendix A) shows the bracket fixing for a pedestrian lantern.

Cut a piece of Kopex tubing to length (approximately 9”/230mm). Pass through the length of Kopex all the lantern, box sign wires etc., feeding them through the large hole through the post top bracket into the post. Fit the ends of the Kopex tubing into the hole in the lantern body, and the hole in the lantern top bracket. Terminate lantern wires into the post terminal block, observing the procedures mentioned in Section 2.6.

### 2.8.2 Extension Arms

Where signal heads are mounted away from the pole using extension arms, refer to 667/1/13599/ETC in Appendix A. To ensure that the arms are mounted the correct way up, the mounting plate on the arm should be examined. It will be apparent that the lip is longer in one direction an the longer lip must be mounted toward the top of the pole.

## 2.9 Fitting the Solar Switch

A solar switch is fitted when the customer requires the signals on the intersection to be dimmed at night.

The solar switch is mounted on the top of a 3 aspect case, as shown on the STS (see Handbook 1) where it will receive a non-interrupted northern light.

The solar switch used is a Royce Thompson Electric Ltd type RTE/P5 (55 Lux) or equivalent, which plugs into a Rotaloc Socket mounted on the top of the 3 aspect case, through a 20mm diameter hole. The STCL part number is 506/4/97891/000.

There are three terminals on the socket to be connected as follows:

Socket terminal L - Live

Socket terminal N - Neutral

Socket terminal Lo - to Controller dim input

Each terminal is wired to the terminal block mounted on the top of the pole by 24/0.2 wire using the following colours:

Line - Brown

Neutral - Blue

Load - White

The solar switch is connected to its socket by locating the terminals in their slots and pushing down, then twisting the unit clockwise when looking down on the socket.

This twist completes the circuit and, if not done correctly, the solar switch will not function.

During daylight the solar switch should give the signal bright condition. To test it, cover the unit for approximately 1 minute and check that the signals go to the dim condition. Uncovering the unit should then result in the signals going to the bright condition after approximately 1 minute.

## 2.10 Installation Procedures for Pedestrian Push Button

There are two variants of push buttons currently in use in the United Kingdom:

667/1/01487/007 - Standard push button with no Sonalert

667/1/01487/008 - Pedestrian push button fitted with Sonalert

All push buttons are delivered pre-wired ready for connection to the post terminal block and are connected as follows:

The pedestrian push button unit comes complete with its fixing kit and with seven wires coming out of the grommeted hole in the rear of the unit.

The connections to these wires are as follows:

| | | |
|---|---|---|
| Green/Yellow | Earth | 30/0.25 wire |
| Orange | Push button 1 | 24/0.2 wire |
| Orange | Push button 2 | 24/0.2 wire |
| Red | Aud. Signal + | 24/0.2 wire |
| Black | Aud. Signal - | 24/0.2 wire |
| Blue | Wait Ind N | 24/0.2 wire |
| Brown | Wait Ind. L | 24/0.2 wire |

The wires within the Pedestrian push button should be arranged and cable tied such that the wiring cannot come into contact with the push button microswitch housing.

Each wire is 3 metres long and should be taken to the terminal block in the top cap assembly, as described in Section 2.2.

The unit can then be fastened to the pole using the 'U' bolt provided as shown in drawing 667/1/01478/etc (see Appendix A).

## 2.11 Installation of Dual Level Push Button

See sheet 2 of 667/1/01478/ETC in Appendix A.

## 2.12 Installation of Warden Key Box

The Warden Key Box (667/1/13950/000) is supplied able to operate from either 240v or 12v AC. When delivered, the unit is configured for 240v operation, i.e. has 240v bulbs fitted and a 240v voltage warning label attached. The 12v bulbs and voltage warning label are supplied in a polythene bag inside the unit.

On installation as a low voltage unit, the 240v warning label should be removed and replaced with the 12v label. The 240v bulbs should be replaced with the 12v bulbs and, if unused, returned to stores. If used, the 240v bulbs should be discarded.

The transformers, 2 off 667/4/00977/000, supplying the warden box should be mounted in the controller cabinet on the 3U 19" blank panel, along with 2 off panel mounted fuse holders fitted with 500mA fuses. A 12-way terminal block should be fitted in a spare position available on the terminal block mounting panel at the rear of the cabinet and wiring should be completed as per the Works Specification and the example shown in Figure 5. Any additional wire required should be 24/0.2 gauge of the appropriate colour.

The unit should be fastened to the pole using the 'U' bolt provided, and wired as shown in Figure 5 and drawing 667/DA/13950/000 in Appendix A. Any unused cores should be insulated and secured.

## 2.13 Conversion of Wait Indicators to Low Voltage Operation

This is an option which may be retro-fitted to a STCL Wait indicator box. It consists of a transformer feeding a 48 volt lamp which is fitted into the normal holder. The transformer is fitted into a spare position in the nearest 3 aspect lantern.

Note: This kit is suitable for driving only one wait indicator box per transformer.

### 2.13.1 Fitting Instructions

1 Fit transformer into nearest 3 aspect lantern using screws and shake-proof washers (items 15 and16). Mounting position is under 'Green' transformer, similar to existing 'Amber'.

2 Sleeve blue and brown flying leads as existing transformers using 6mm sleeving (item 25). Identify loose ends with white ident sleeves (item 26). Connect to existing bulb live and neutral top cap (replacing connections to wait indicator bulb).

3 Sleeve green and orange flying leads as existing transformers using 6mm sleeving (item 25). Identify loose ends with white ident sleeves (item 26). Connect to spare terminals in top cap.

4 Connect brown and blue wires from lamp-holder to terminals in point 3 above with brown going to orange.

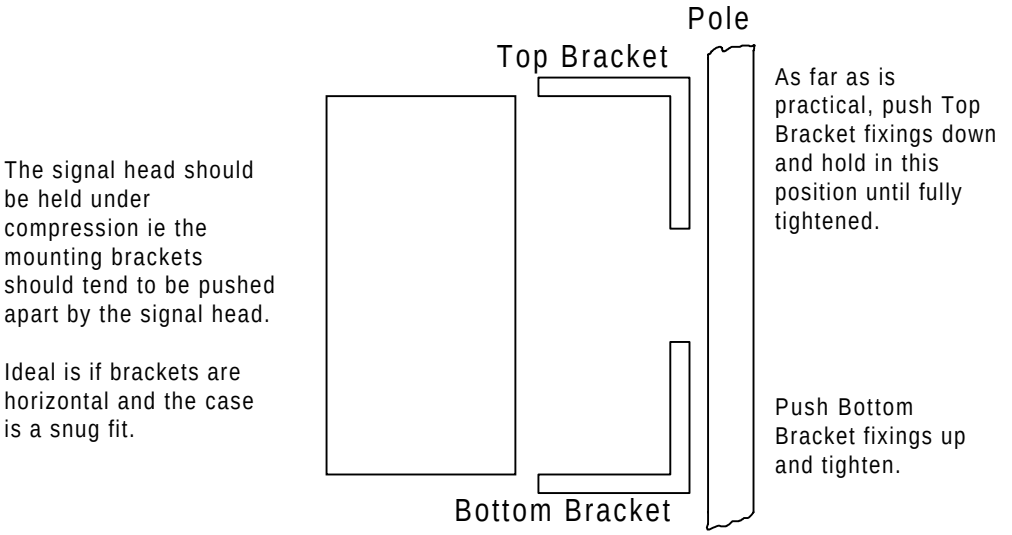
5 Remove 240v bulb from wait indicator and replace with 50v bulb (item 5).

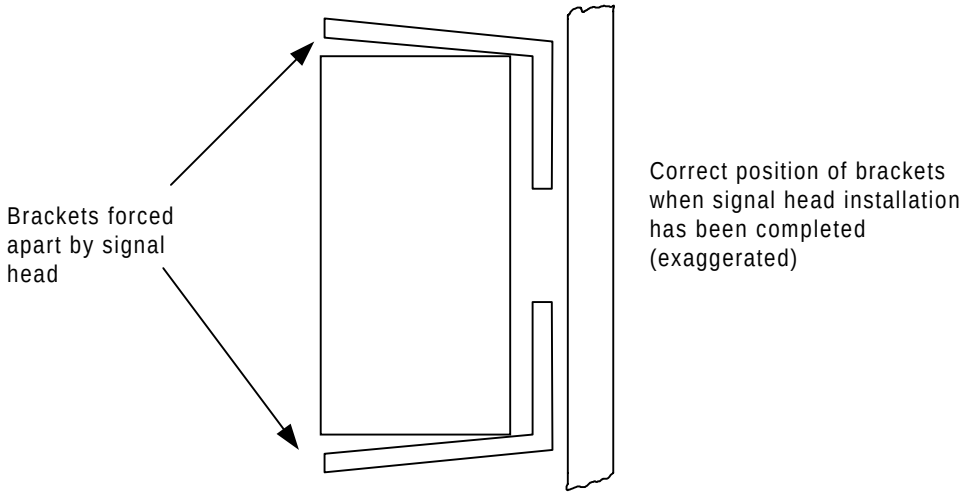
6 Clean internal surface of Wait Indicator body to the left of the lamp-holder and below the reflector. Attach label (item 10).

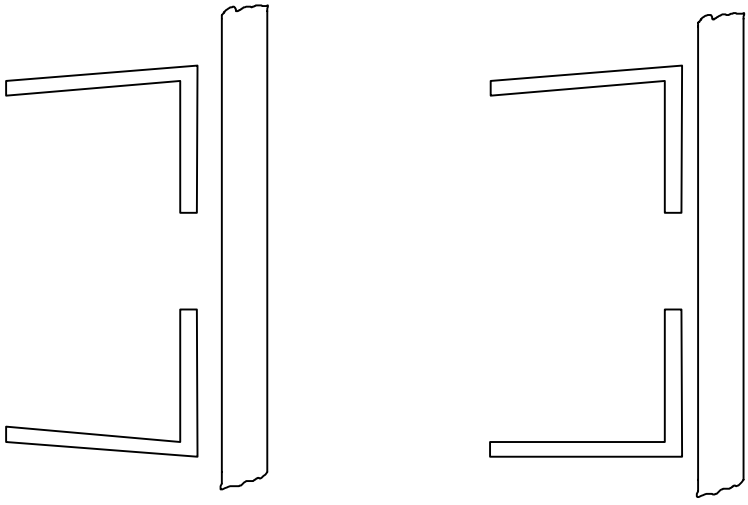
7 If the wait indicator is fitted to a pole which does not carry a 3 aspect lantern, cable pole to pole using armoured cable, earthing as per normal practice.

8 If 240v bulb is unused return to stores, otherwise scrap.

**Figure 4 - Fitting of Signal Head**



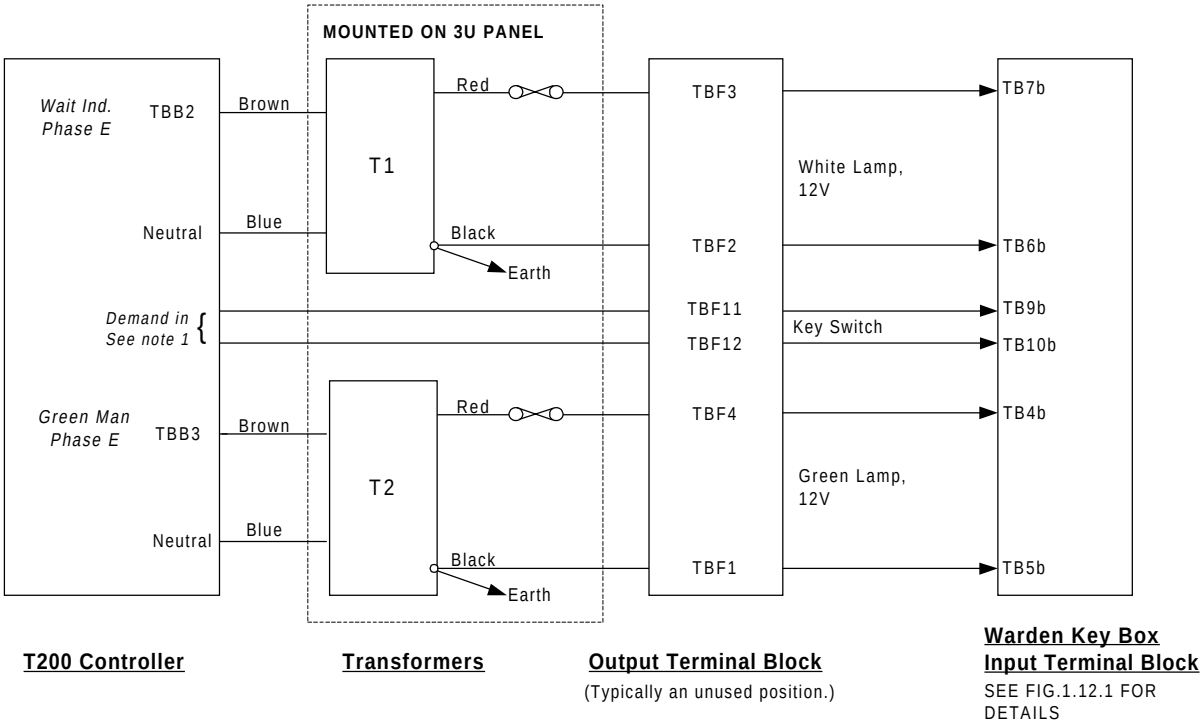



INCORRECT INCORRECT

## Figure 5 - Installation Wiring Example

This is an example configuration.




**KEY: *Italics* - Example sign only. Refer to works Specification for original signals and terminal blocks.**

**Note 1 - The keyswitch signal would be connected to a normally unused terminal block connection. For a Large Controller, the return signal may be connected to any of TBE 7 - 12, for a Small Controller, the return may be connected to any of TBC 10 - 12. See Works Specification for details**

## 3. CABLING

This section applies to paired loop feeder cable and multi-core cable to signal heads and detector pole boxes.

### 3.1 Cabling and Preparation of Cables for Termination

1 Traffic signal intersections are cabled in accordance with the point to point cable schedule shown on the STS drawing (refer to example STS36012 in Handbook 1).

2 Prior to commencing cabling, the operation should be planned such that, as far as possible, cable drums are handled as little as possible and the number of cable drums transported to site is reduced to a minimum. During the laying of cable, cable jacks or drum rollers should be used to advantage, especially during the laying of long cable runs.

3 A suggestion for the cabling of STS36012 is as follows (refer to flow chart at the end of this section):

i. From the STS drawing determine the longest cable runs. Referring to STS36012 the 12C and 4pr cables to the AS and BS SD loops are the longest cable runs. To cable these, 2 drums of 12 core and one drum of 4 pair cable is required. 2 pair cable on a drum is required for the AZ, BZ, CZ2 approach, and could be used to cable the CZ3 approach (see note a at the end of the section). The lengths of 16 core and 8 core cable and 4 core cable where less than 40m should be measured off and cut to length at the Service Centre to reduce the number of drums transported to site. Alternatively, 12 core cable can be used instead of 8 core.

ii. Using a measuring wheel, measure the distance from the controller to the AS1/2, BS1/2 locations, also recording the distances of the AS3/4 and BS3/4 locations. During the measurement of AS1/2 record the distance from post 2 to post 4 via post 3. Include in the measured distance of post 2 to post 4, 5 metres for posts 2 and 4 and 10 metres for post 3. Add this total measurement to both SD1/2 measurements. The 12 core drum with the combined length of post 2 to 4, plus the SD1/2 measurement that is nearest to, and less than, the drum length, should be used to cable posts 2 to 4.

iii. Cabling to SDE phase B approach

Place on the cable jacks or drum rollers adjacent to the controller position, one drum of 12 core cable (drum a) and one drum of 4 core cable.

Draw both the 12 core and the 4 pair through ducts to the selected SD approach leaving the 4 pair cable at its 91 metre location from the stop line.

iv. Cabling to SDE phase A approach

Replace the 12 core cable drum with the second 12 core drum (drum ‘b’).

Draw both 12 core and 4 pair to the other SD1/2 location.

v. Cable Controller to Posts 2 - 4 and AZ Loops

Remove drum of 4 pair and replace with a drum of 2 pair cable.

Draw 12 core cable and 2 pair cable through duct network via post 1 to post 4, leaving the 2 pair cable at post 3.

At post 4 leave a 4 metre tail for installing up post 4.

Return to post 3 and pull from the cable drum a 5 metre loop.

At post 2 cut the 12 core cable leaving a 5 metre length for installation up post 2.

The remaining 12 core length can be either drawn back through the duct to the drum or,. if the cable end has been pulled from the drum, pull the remaining length out of duct at post 2. (This length of cable may be long enough to use from controller to post 8.)

vi. Cabling Controller to posts 7, 6 and 5 and CZ3 loops

Remove the 12 core drum 'b' and replace with the 12 core drum 'a'.

Draw together from the controller position the 12 core cable and the 2 pair cable to post 5 through ducts via posts 8, 7, 6 and 5.

The 2 pair cable is left at post 6 for connection to CZ3 detectors.

At post 5 leave 5 metres of 12 core cable for installation into the post.

At posts 6 and 7 draw 5 metre loops from the 12 core drum (10 metres of cable).

Cut the 12 core cable at the drum location leaving enough cable length to extend to the controller position.

(See note 'a' at the end of the Section.)

vii.Cabling Controller to post 8 and BZ loops

Use either the 12 core residue of drum 'b' or serve the 12 core cable from drum 'a' together with the pre-cut 4 core cable length and 2 pair cable to post 8.

Leave 5 metre tails of 12 core and 4 core cable at post 8 for post installation.

Extend the 2 pair cable to the BZ1/2 joint location.

Cut and lay all cables to controller positions as necessary.

viii.Cabling Controller to posts 1, 2 and CZ1/2 loops

Using the pre-cut 16 core cable length and 2 pair cable, draw cables into the duct at controller location to post 1.

Leave the 2 pair cable at the loop joint location and extend 16 core cable to post 2, leaving a 5 metre tail for installation in the post.

Return to post 1 and draw a 5 metre loop (10 metres of cable) for future installation in the post.

Cut cables as necessary and lay to controller position.

**Note 'a'**

Observing from STS36012 single lengths of 1 pair 4 core, 8 core and 16 core cables are required. The actual lengths of these one-off lengths must be measured by the installation supervisor on his/her pre-installation inspection prior to work commencing. If these lengths are less than 40 metre, one of two decisions could be taken:

1. Short lengths of 40 metres or less should be measured and cut at the Service Centre to reduce the number of drums transported to site. At larger depots perhaps these could be prepared by the storeperson.
2. Referring to ST36012, a single run of 1 pair cable is required from controller to CZS3 joint location, length approximately 25 metres. Because the 2 pair cable is set on the cable rollers, this could be used in lieu of 1 pair without any cost disadvantage.

Difference in cost between 1 and 2 pair = £0.851 - £0.548 = 30p per metre. 25 metres @ 30p per metre = £7.50.

£7.50 is approximately 0.5 hr of installer's rate. Using 2 pair cable in lieu of 1 pair cable would incur no cost disadvantage because of preparation time to use 1 pair cable. Posts 6 and 5 have been cabled with 12 core cable. These posts being fed by 12 core cable as an extension to the cabling of post 7. Cable distance post 7 to post 45 is approximately 36 metres, and the difference in cost between 8 core and 12 core cable is 63p. Total cost loss by using 12 core cable is approximately £23. However, net loss will be less than this because of the double handling of the 8 core cable.

**Cable Laying Schedule for STS36012**

All cables installed from the controller position.

| Pre-cut cable lengths | Sequence of cable installation | Cable drums set on drum rollers | |
|---|---|---|---|
| | Site visit to measure cable routes | | |
| | Cable SD Approach BS1/2a | 12 core drum 'a' | 4 pair |
| | Cable SD Approach AS1/2a | 12 core drum 'b' | |
| | Cable Posts 2 to 4 and AZ1/2 Approach | 12 core drum 'b' | 2 pair |
| | Cable controller - posts 7 6-5 and CZ3 approach | 12 core drum 'a' | 2 pair |
| 4 core cut length | Cable controller - post 8 and BZ1/2 approach | 12 core drum 'a' | 2 pair |
| 16 core cut length | Cable controller - posts 1 and 2 and CZ1/2 approach | | 2 pair |

## 3.2 Cable Jointing

In traffic signal installation work there are two types of cable joints which have to be made. These are armoured cable to armoured cable and armoured cable to detector loop tails.

All jointing of armoured cable to armoured cable should use the BICC MPJ series (MPJ1 or MPJ2) resin filled torpedo joint.

Jointing of armoured cable to detector loop tails will use the same joint, unless the Authority specifies a heat-shrink joint.

### 3.2.1 Armoured Cable to Armoured Cable using the BICC MPJ Series Joint

Assumes MPJ1 or MPJ jointing kit used. See Figure 7 and Figure 8. The following additional items are also required:

PVC insulat4ed wire - green/yellow 6 sq. mm.
Earthing bands - 2 off
Worm drive clips - 2 off

Cut the earth wire to length and bare the ends.

Using the hacksaw provided in the installation tool kit cut through the outer insulation of one cable approximately 120mm from the end ensuring that the armour is well scored.

Remove the outer insulation.

Break off the armour by repeated bending.

Cut through the outer insulation 50mm from the end of the armour without cutting into the armour.

Remove the outer insulation.

Terminate the bedding so that 10mm projects beyond the armour.

Slide a worm drive hose clip over the cable. Open the armour and position the earthing band underneath. Lay the earthing wire end with the armour and bring the work drive hose clip forward to secure the earthing wire and armour down onto the earthing band. Tighten the clip to achieve a good mechanical and electrical joint.

Repeat for the other cable end,.

Cut cable cores to length ensuring that the joints will be staggered and crimp using blue crimps.

Insulate each crimped joint as required.

Cut the stepped ends of the shell halves so that they fit over the outer insulation of the cable without interference but, at the same time, giving minimum clearance to avoid eccentricity.

Check, and adjust as necessary, the clearances between the joint components an the joint components and the shell.

Clean the outer insulation at the box entry positions with a dry cloth. Position the box shells centrally round the joint and secure them together by hand, tightening the cable ties provided, ensuring that the tightening does not distort the half shells and thus destroy the resin seal. Remove the backing tape from the sealing tape provided and wrap the sealing tape round each stepped and stretching it sufficiently to for a seal between shells and outer insulation. Mix the resin in accordance with the instructions given in section 3.2.2 and pour into the box through the central opening until the box is full.

Fit the central filling cover plate by bending it slightly along its length and snapping it into position.

If the joint is not positioned at its final location prior to pouring the resin, it must be left to cure before being placed in its final location.

### 3.2.2 Preparation, Mixing and Pouring of BICC Bi-Cast Acrylic Resin

**Caution: Certain individuals are susceptible to sensitisation, and if a skin rash develops medical advice should be sought. Any resin splashes on the skin should be removed before the resin hardens.**

The resin is provided as a two part mix. The powder component I in a plastic bag and the liquid component in a tin.

Check that the last two digits of the style reference number are identical, e.g. BC 73190 - 57 (powder) and BC 73195 - 57 (liquid).

If the last two digits are not the same **on no account** should they be mixed together.

Check that the use by date on the powder label has not been exceeded.

Mixing must take place away from naked lights. Avoid exposure of the tin to hot sun as heat could cause a pressure build up in the tin. In the event of such exposure the tin should be pierced at arms length to guard against a jet of wet vapour onto the face.

Carefully unfasten the bag, unroll the free end and remove the clip.

Allow air into the bag and re-roll the open end several times round the clip to effect a seal and entrap air.

Grip the bag securely at each end and up-end it four or five times to disturb the powder settlement, paying particular attention to the bag corners.

Open the tin of liquid, unroll and open the bag. Pour all the contents of the tin into the bag ensuring spillage of liquid does not occur.

Fold the corners of the bag to the middle and roll around the clip several times to effect a seal and entrap air.

Grip the bag securely at each end and thoroughly mix the liquid and powder. This is best achieved by holding the bag vertically for ¼ minute to allow the powder to settle into the liquid, shaking the bag top to dislodge powder from the corners and repeatedly oscillating the4 bag through 180 degrees with a tumbling action (speeding up as mixing progresses) for ½ minute. Finish off with a more vigorous end to end shaking of the bag for a further ¼ minute.

Remove the clip and re-wrap it diagonally across the corner of the open end of the bag to provide a convenient sized pouring hole and handle to assist the pouring operation. The resin should be poured through the filling port immediately after mixing. Top up if necessary.

Fit the cover plate.

Adequately support the joint both underneath and at each end before back-filling the joint hole. Back-filling may take place immediately or be delayed until the resin has set hard.

### 3.2.3 Use of Crimp Tools in Jointing

The following procedure is to be adopted when preparing cables for jointing in BICC or similar joint kits and for joining wires in lanterns.

Prepare the feeder cable as detailed for the type of joint and the joint kit to be used.

Cut the conductors to length ensuring that the joints will be staggered within the joint shell. The outer sheath must project at least 50mm into the joint shell in the finished joint and no crimp joint should be closer than 75mm to the end of the shell.

Remove 12mm of insulation from each core.

Slide a rubber grommet over the core.

Prepare loop tail ends or neutral wire ends as in Figure 6. If one end only is to be crimped in a crimp sleeve, remove 24mm of insulation from the tail and double the end back prior to crimping. This will ensure that a secure crimp is made.

Insert the prepared core and wire end(s) into opposite ends of the crimp sleeve, allowing a 2mm protrusion at each end, and crimp both ends of the sleeves using the correct crimping tool. The crimps must be made in the same plane.

Position the rubber grommet in the centre of the crimped sleeve and visually inspect the completed crimp to ensure that no loose strands are present.

Apply a pull test to each crimp joint.

Complete the assembly of the joint in accordance with the appropriate section.

Note: Following the completion of either joint, the joint must be left to cure in the case of a resin joint, or cool in the case of a heat-shrink joint, BEFORE any strain is placed upon the joint by whatever means.

## 3.3 Cable Identification

### 3.3.1 Cable sheath Identification

All cables entering controllers shall be identified by a ‘Pull-Tite’ tag fixed around the inner sheath immediately above the steel wire armouring termination gland.

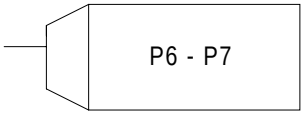
The tag shall be marked using a waterproof indelible, black marker pen in the following manner:

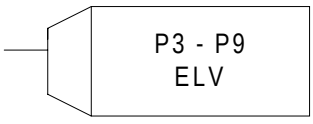
A Low voltage signal cables - The tag shall be red and marked with the numbers of all posts in the run.

B Extra low voltage cables (Pedestrian push buttons, etc) - The tag shall be yellow and marked with the numbers of all posts in the run. In addition the letters ‘ELV’ shall be added.

C Extra low voltage cables (linking cables) - The tag shall be yellow and marked with the site reference number of the linked equipment, and in addition the letters ‘ELV’ shall be added.

Examples:

A 


B 


C 


Note: The post numbers referred to above are as shown on the site layout drawing.

D Loop feeder cables - The identification of these cables is detailed in the Customer’s Works Specification, and is generally as follows:

One side of the tag shall be marked with the arm and detector designation; the other side shall be marked with the street or road name.

Example:


**Figure 6 - Preparation of Wires for Crimping (a)**

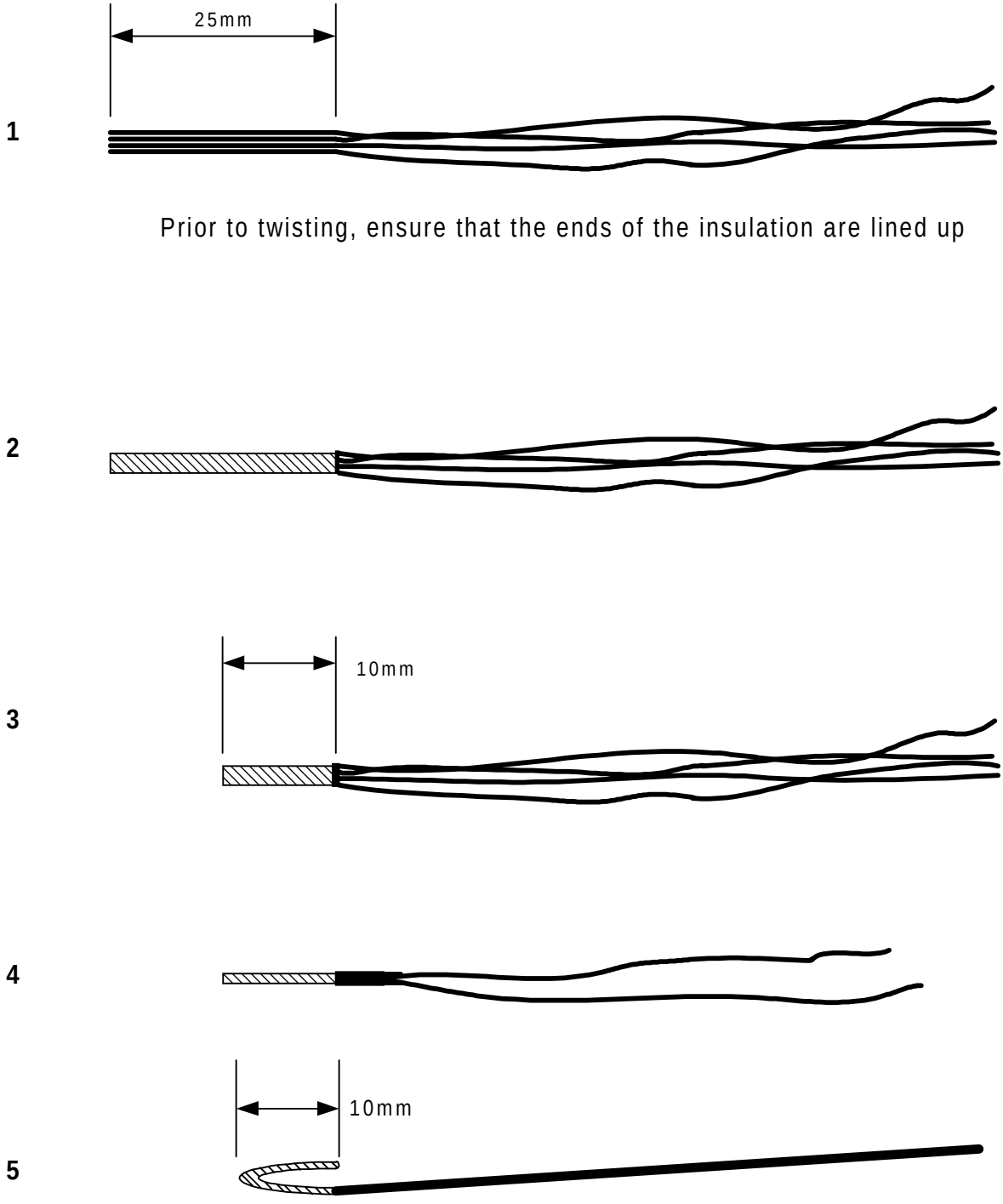
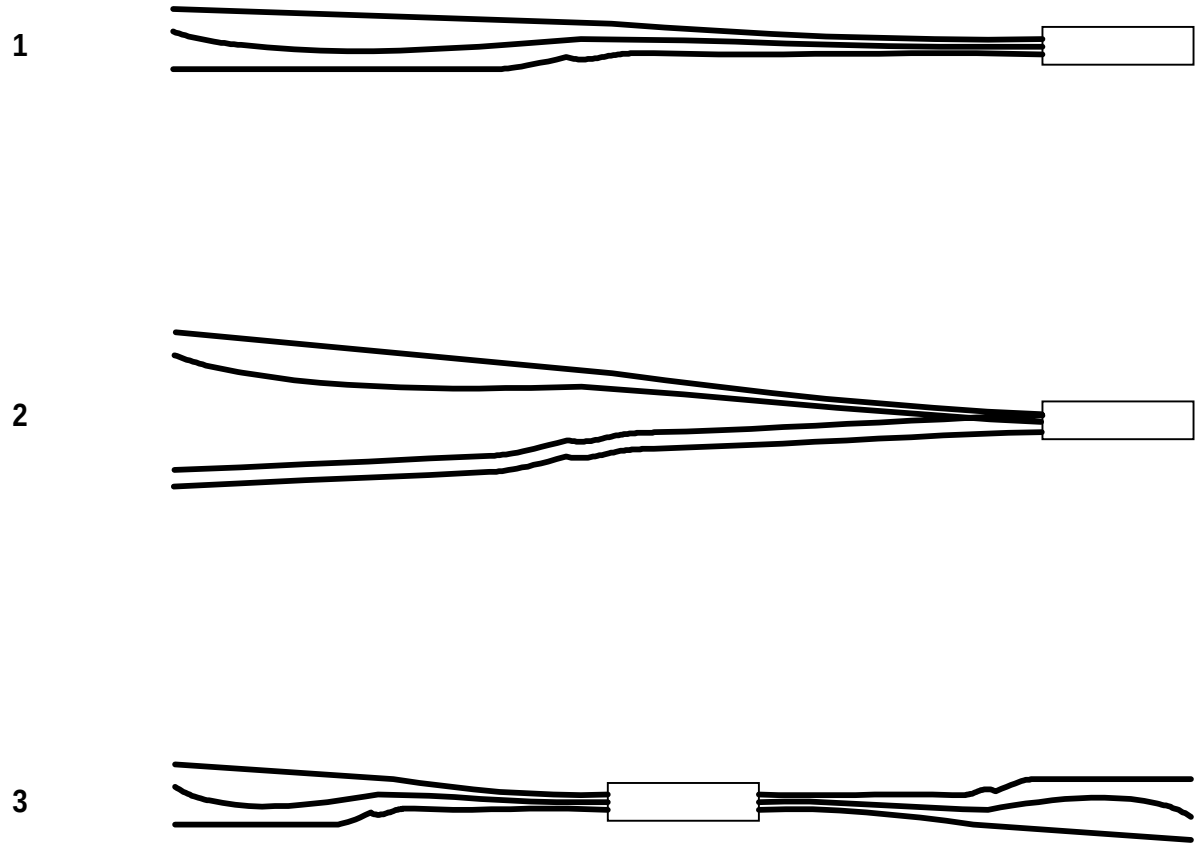


**Figure 7 - Preparation of Wires for Crimping (b)**

**NOTE - All crimp connectors are 4mm to 6mm (yellow)**



## Figure 8 - Termination of Armoured Cable (b)

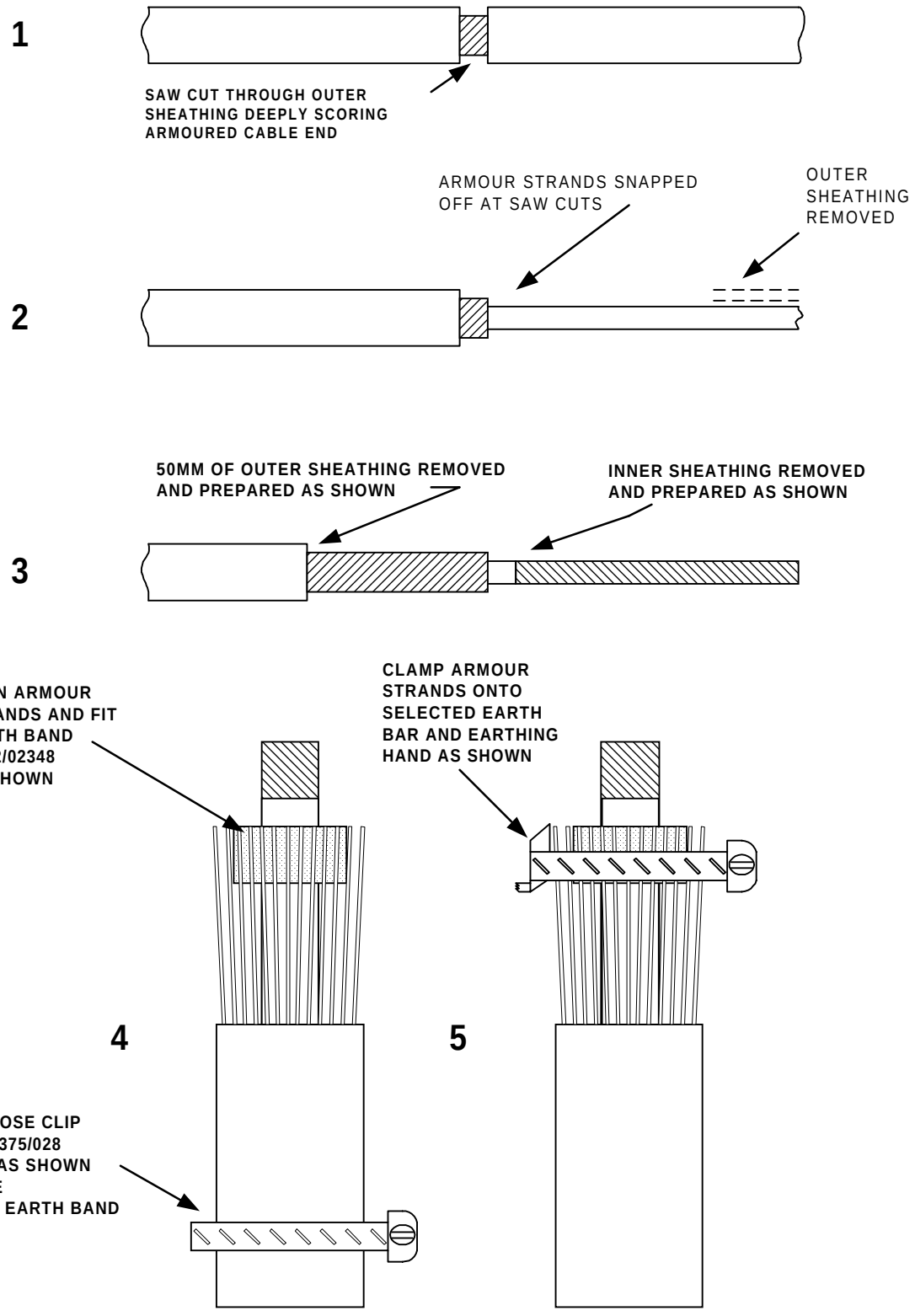
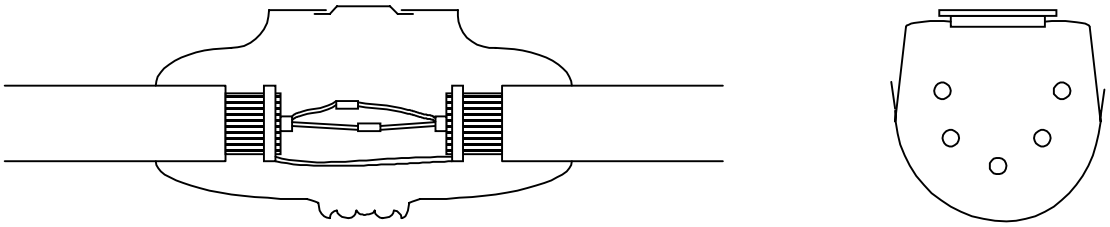


**Figure 9 - Armoured Cable to Armoured Cable Joint**



## 4. TESTING

Carry out testing as described in 667/HE/20664/000. See Section 1.3 for further details.

## APPENDIX A - DRAWINGS

The drawings listed below, which are referenced in the text of this handbook, are included after this page:

| | | |
|---|---|---|
| 667/1/10547/ETC | | Arm Assemblies General |
| 667/1/02299/ETC | | Arm Assembly Pedestrian Signal |
| 667/DG/13012/000 | Sheets 1 to 4 | Typical Assemblies of Road Traffic Signals |
| 667/1/10735/000 | | Top Cap Assembly |
| 667/AA/13012 | Sub-Assemblies | |
| 667/DA/01478/ETC | | Wiring Details Pedestrian Push Button |
| 667/GA/01478/ETC | | Pedestrian Push Button Unit |
| 667/GA/01478/700ETC | | Pedestrian Demand Push Button |
| 667/DA/13950/001 | | Wiring Details Warden Key Box |
| 667/1/13599/ETC | | Installation of Extension Arms |