SOUTH AFRICAN TRANSPORT SERVICES

ELECTRICAL SIGNALLING INSTALLATIONS

SPECIFICATION NO. CSE-504/7

JANUARY 1985

OUTDOOR SIGNALLING WORK

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1.0 SCOPE

This specification covers cable jointing and cable termination, installation of apparatus cases and the broad details of outdoor signalling work.

2.0 CABLES : GENERAL

2.1 All outdoor signalling cables carrying vital circuits shall be of the PVC insulated type to South African Transport Services' specification No. CSE-49E (latest amendment), except where special dispensation is given for particular applications.

The signal cables to be used shall be in accordance with the following Transport Services approved cable tabulation :

Armoured cable	Conductor size
2/3/6/9/12/16/21/27/37/52 and 61 multicore PVC cable	0,9 mm, 1,4 mm and 1,6 mm .
Four pair (twisted) star quad configuration PVC cable	0,9 mm (20 lbs)/mile) for axle counter heads.
One core multistranded (seven strands) PVC cable	2,5 mm^2 for track circuit jumpering.
2/3/6/9/12/16 and 21 multicore/multistranded PVC cable	4 mm^2 for power and DC points operation.
2/3/6/9 and 12 multicore/multistranded PVC cable	10 mm^2/16 mm^2 for power and DC points operation.
2 and 3 multicore/multistranded PVC cable	35 mm^2 for power.
2 core PVC cable	70 mm^2 for power.

Multistranded non-armoured cable	Conductor size
1 core multistranded PVC insulated (seven strands) 1 core multistranded bare.	16 mm^2 for earth feeds and earth.

2.2 The cross-section of conductors employed for the main multicore cables shall be subject to the requirement that a volt drop greater than 10% of the rated voltage shall not be permitted in any closed circuit except in the case of high voltage impulse track circuits where the line resistance forms part of the control circuit. In the case of points machines the 10% volt drop requirement shall apply with the machine running but with the points disconnected from the drive slide.

It must however, also be emphasised that excessively thick cable must be avoided for reasons of cost.

2.3 Generally a cable should not by-pass a relay room "en route", but be looped into such relay room over rail clip-on terminals.

All cables shall be sequentially counted as depicted on drawing CSE.504/7 Annexure 1.

2.4 Approximately 10% overall spare cores shall be provided on all outdoor main cable runs. This does not include cables for DC points machines or tail cable runs.

2.5 The Contractor shall test all conductors in the multi-core cables for continuity, and submit a certificate for each complete cable, detailing the test results which shall include megger tests in respect of conductor-to-conductor and conductor-to-earth with the cable ends not terminated. The intermediate junction boxes should not be disconnected. The Contractor shall prepare a record of tests for each cable showing cable number, location and type of cable, which shall be handed to the Engineer before submission of the certificate that the whole installation has been tested. The minimum cable insulation acceptable for a complete cable must be in accordance with specification No. CSE-49E (SABS 150 - 1970), using a 500 volt megger.

3.0 CABLE JOINTING

3.1 All jointing material (heat-shrink and/or resin type) must be approved by the Transport Services' Chief Engineer (Signals and Telecommunication) Research and Development section.

3.2 The jointing of cables shall only be undertaken by members of the Contractor's staff who have been certified by the suppliers of the material to be proficient in joint making.

3.3 The Contractor shall submit a certified copy of such a certificate to the Transport Services' Resident Engineer (Signals and Telecommunication) together with a written undertaking that only those members will be employed in the jointing of cables.

3.4 At cable joints the armouring shall be connected for electrical continuity throughout the length of the cable.

3.5 The armouring of the signalling power cable shall not be earthed except as laid down in specification CSE-505 (latest amendment).

3.6 At every joint and where the cable is connected to an apparatus case 3 metres of slack shall be left buried in the ground. Refer to drawing CSE.504/7 Annexure 2, sheets 1 and 2.

3.7 Where a multi-core cable has to be subdivided into smaller cables distributed to different functions either a cast iron watertight distribution box, a standard apparatus case, pothead or an approved junction case is to be used whichever is the more economical. In the case of the first, heavily nickel-plated brass terminal screws are to be used and in the latter two, rail clip-on terminals. For pothead cable termination refer to drawing CSE.504/7 Annexure 3.

3.8 Joints must be taped with scotchtape 50 or similar tape.

3.9 The crimping technique to joint individual cores, etc. is permitted but must be in accordance with drawing CSE.504/7 Annexure 4, sheet 2.

4.0 CTC CABLE

4.1 Unless otherwise specified, the CTC, block and axle counting cable will be supplied and installed by the Transport Services.

4.2 Where the CTC cable is supplied by the Transport Services ten pairs will be available and these will be terminated in a V/C - S/L box at each interlocking.

4.3 The cable will be star quad, 1,27 mm diameter with a capacity of 51 nanofarads per kilometre and balanced up to 50 kHz . Resistance is 28,26 ohms per kilometre.

4.4 The Contractor must state whether the equipment to be supplied by him will work satisfactorily over the cable mentioned in clause 4.3 and complies with the CCITT recommendations.

4.5 The Contractor must extend the CTC cable from the V/C - S/L box provided by the Transport Services at each interlocking and terminate the cable with suitable earth protection in each relay room in such a manner as to be able to isolate individual relay rooms from the rest of the line. This should preferably be done by means of disconnection links.

4.6 Connections to line transformers should be either screw or plug-in in preference to soldering.

5.0 APPARATUS CASE INSTALLATION

5.1 Apparatus cases shall be erected, positioned and assembled as depicted on drawings CSE.504/7 Annexure 2, sheet 1 and CSE.504/7 Annexure 5 and must be in accordance with drawing CSE.U.916, and its associated drawings (latest amendment).

PVC trunking or extruded aluminium rails with ancillary fittings and guide rings shall be used for wiring the inner frame.

5.2 The distance from the track centre line to the closest point of an installed apparatus case with its doors closed, shall not be less than 3,2 m from C/L of track.

Should an apparatus case be positioned on an embankment or in a cutting such apparatus case shall be erected with the proviso to provide sufficient standing place (platform/niche) at a minimum of 1 metre from the outside edges of such an apparatus case and must meet the approval of the Transport Services' Engineer.

5.3 Both front (furthest away from track) and rear (nearest of track) of the case shall bear the number of the apparatus case in letters 100 mm high. The method of marking may be directly on the case, or by means of number plates, and the marking must

be extremely durable and clearly visible as depicted on drawing CSE.504/7 Annexure 2, sheet 1.

5.4 Cables entering and leaving the case are protected by means of 1 x 120 mm or 2 x 120 mm (5") galvanised pipes and shall be terminated on rail mounted clip-on type terminals with a hinged disconnect facility. After completion the cable entry pipes must be sealed by means of an approved sealing compound.

5.5 All cables shall be terminated in separately grouped rows (i.e. those from the relay room, those to the next case, power and tail cables). The rows shall be vertical, and each terminal shall be clearly labelled.

5.6 Standardisation of lay-out of equipment is encouraged, and equipment must be so grouped and installed that states of relays can easily be seen, whilst maintenance and replacement is also facilitated.

5.7 All relays, transformers, plug-in equipment, fuses and terminals must be clearly and permanently numbered or labelled. In the case of plug-in components and relays, the backboard or base must also be marked on the rear (i.e. the equipment must be identifiable from both front and rear). Embossing type labels are permitted subject to prior approval by the Transport Services' Resident Engineer (Signals and Telecommunication).

5.8 Internal wiring must be run vertically and horizontally only, and must be loose grouped by means of using correctly the provided open wiring guide ring facility or PVC trunking.

5.9 All internal wiring must be stranded, and when connected to a rail type terminal, the bared ends must be connected into bootlace ferrules to prevent "flaring" of the strands. When connected to transformers, lugs must be fitted.

5.10 No more than two wires may be connected to any one approved terminal.

5.11 All internal wiring and terminations shall be in accordance with drawing CSE.504/7 Annexure 4, sheets 1 and 2.

6.0 MISCELLANEOUS

6.1 The same requirements for cable termination, terminals, and labelling as for apparatus cases, apply in the case of junction boxes and potheads. A typical pothead termination is depicted on drawing CSE.504/7 Annexure 3.

6.2 Sirens shall be in accordance with specification No. CSE-100 (latest amendment). Approved range 1 km .

6.3 At every relay room and at the extreme ends of a station and where shown on the line plan, a siren shall be provided. Methods of fitting sirens are depicted on drawing CSE.504/7 Annexure 6.

6.4 These sirens shall operate for fifteen seconds at a time, when operated from the control station.

AS WITNESSES

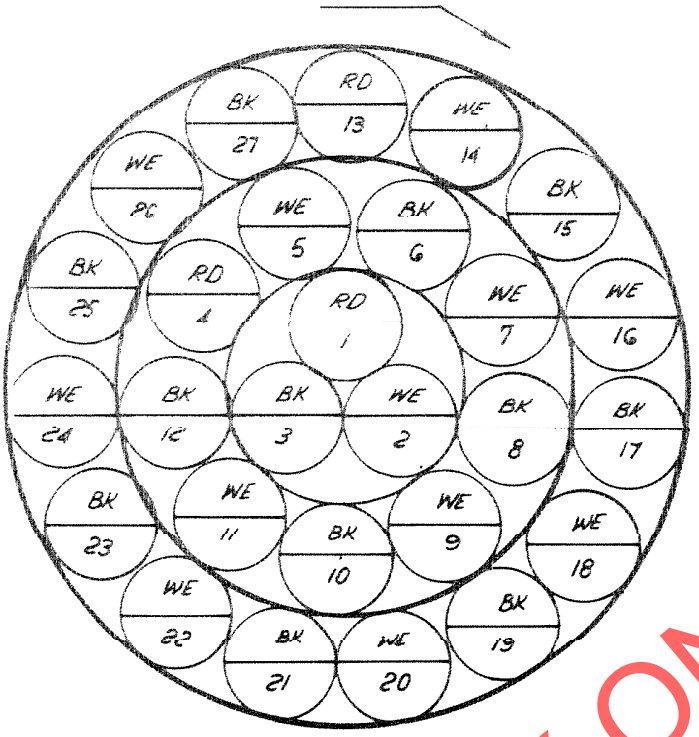
1. _____ _____
CONTRACTOR

2. _____ Date: _____

AS WITNESSES

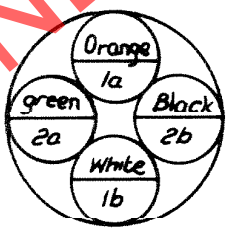
1. _____ _____
CHIEF ENGINEER
(Signals and Telecommunication)

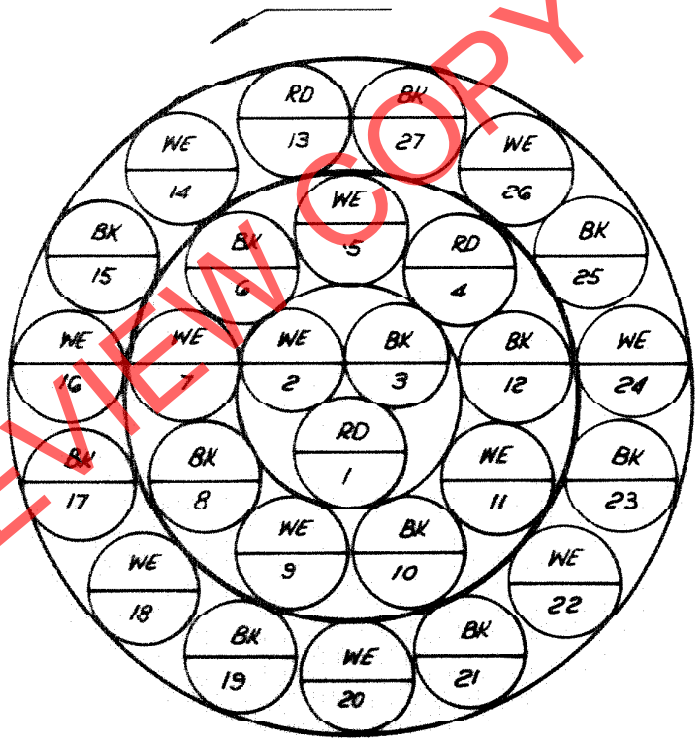
2. _____ Date: _____



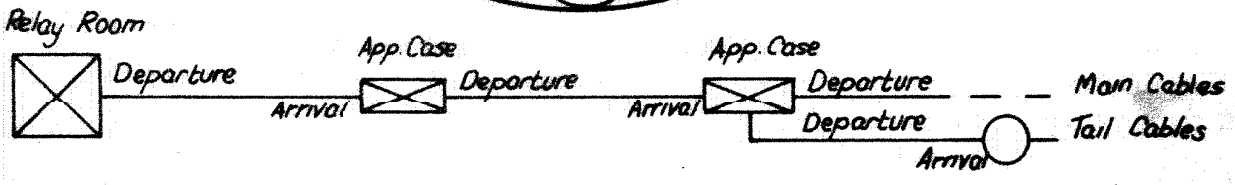
RELAY ROOM
CLOCK WISE
DEPARTURE

Typical Star-Quad of C.T.C. Cable





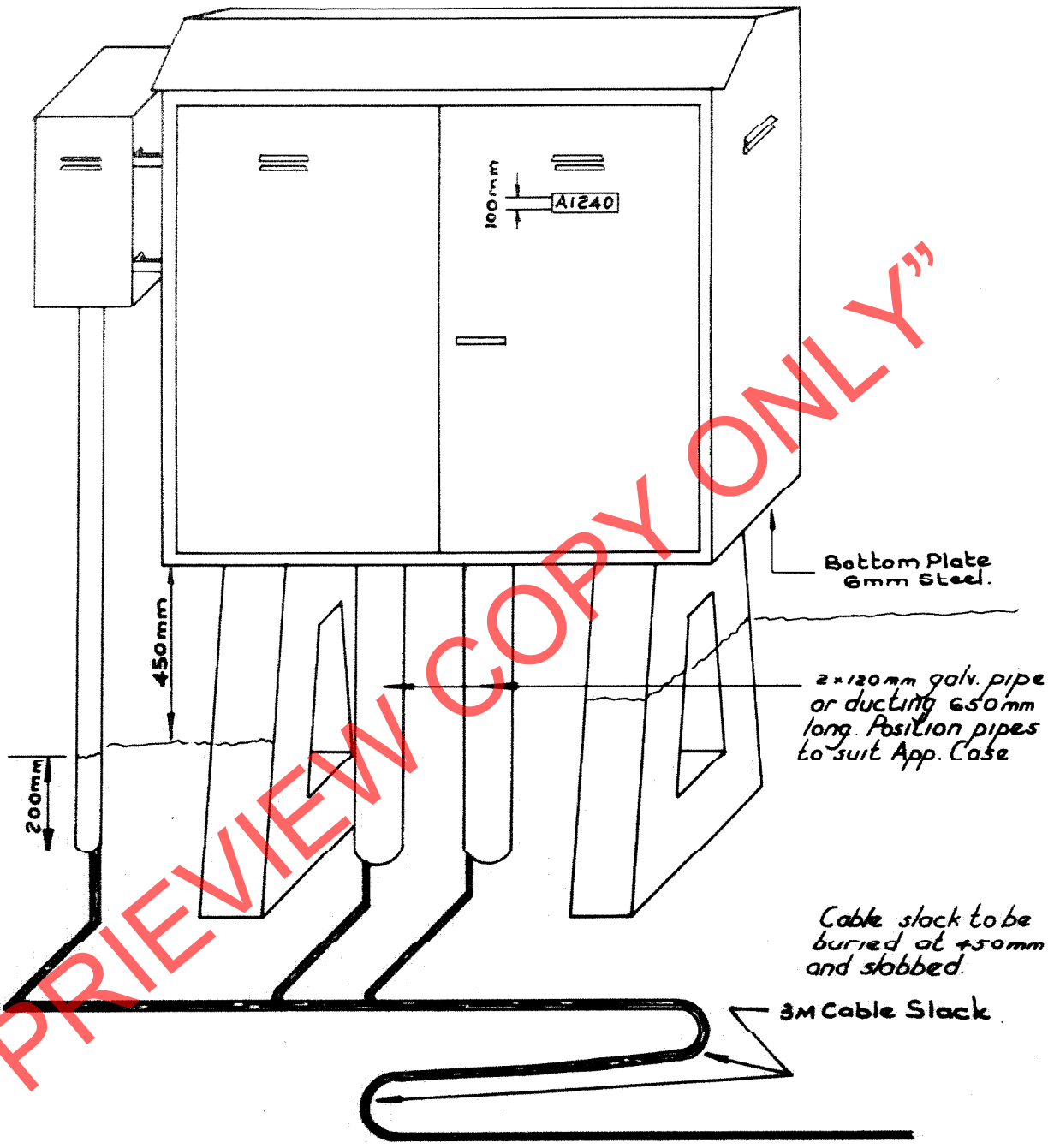
RELAY ROOM
ANTI - CLOCKWISE
ARRIVAL



SATS ~ SAVO

METHOD OF SEQUENTIAL CABLE-CORE COUNTING

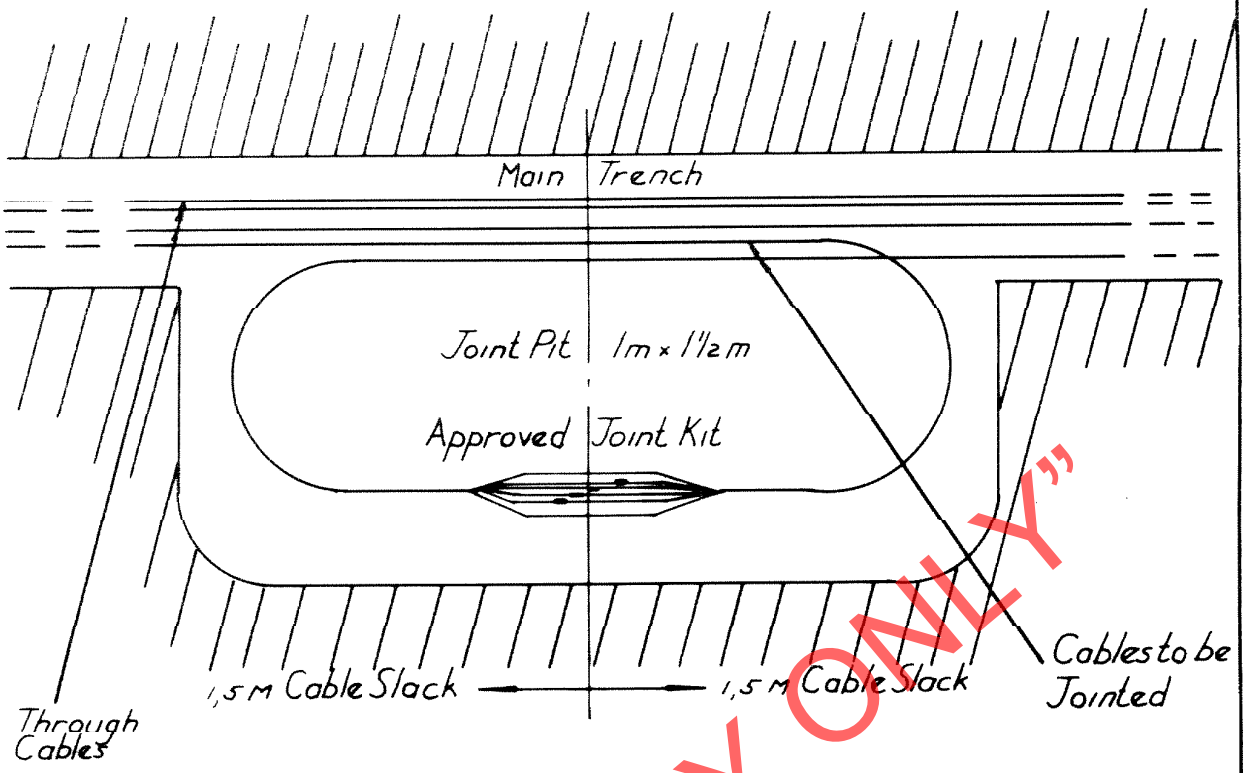
SPECIFICATIONS
CE (S&T)
504/7
Annexure I Sh. 6



SATS – SAVD

ERECTION & FITTING OF APPARTUS CASES

SPECIFICATIONS
CE (S & T)
504/7
ANNEXURE 2 SPEC VOL 1 OF VOL 6



Approved Jointing Kits.

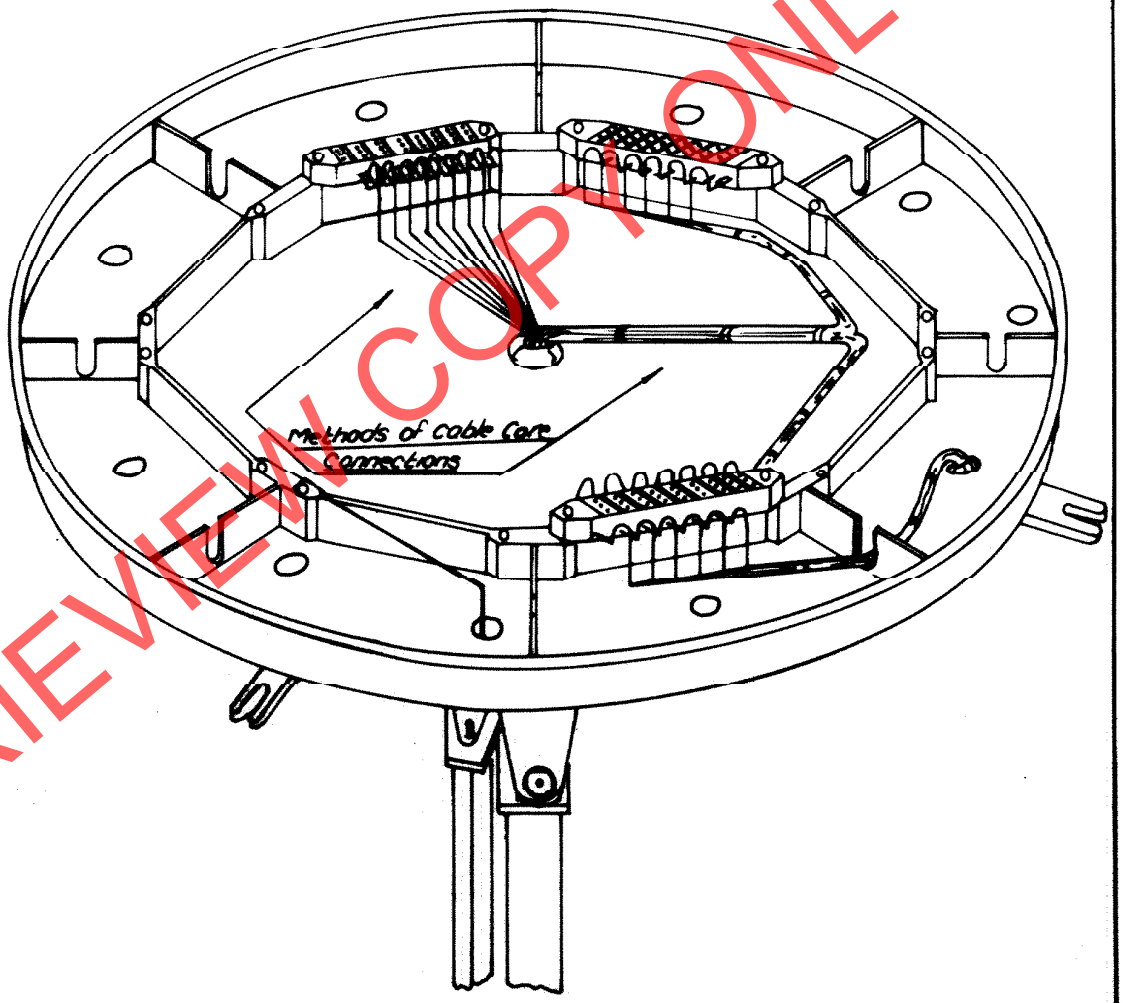
- Scotch Cast 3M
- Cellpack M3
- Jointmaster
- Heatshrink System Joint

Resin to be of the cold, quickset and clear type.

SATS ~ SAVD

JOINTING OF CABLES

SPECIFICATION
CE (S&T)
504/7
ANNEXURE 2 JNT VOL 2 SECN 6

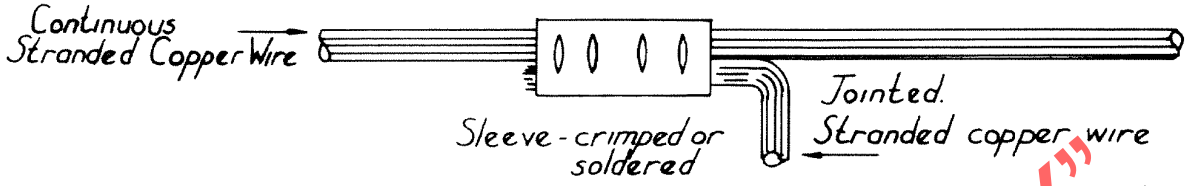


SATS – SAVO

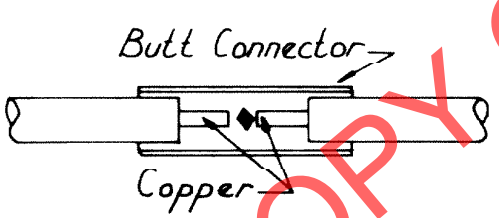
TYPICAL WIRING OF POTHEAD

SPECIFICATIONS
CE (SET)
504/7
Annexure 3 of Van 6

Sleeve Ferrule Joint

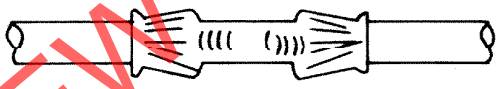


Butt Connector



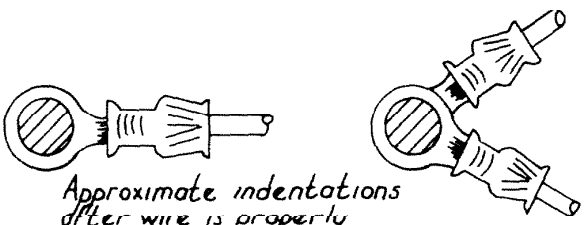
Wire Size	
Red Ferrule	- 0,9 mm
Blue Ferrule	- 2 mm
Yellow Ferrule	- 2,7 - 6 mm

Use correct Crimping Tool



Expected indentations of a correctly crimped Ferrule

Lugs:-

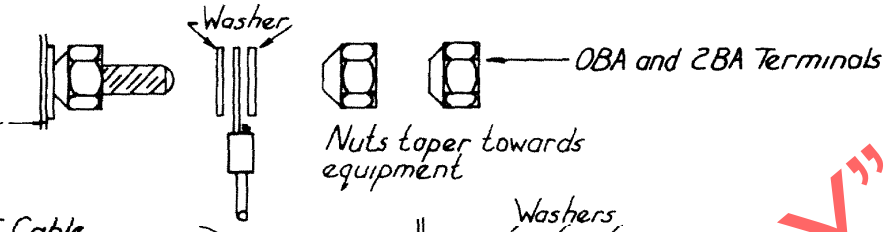


Approximate indentations after wire is properly crimped in lug.

Red	3/031 mm	Wire Size
Blue	20/031 mm	
Yellow	4 mm²	
Utilux	(not illustrated)	

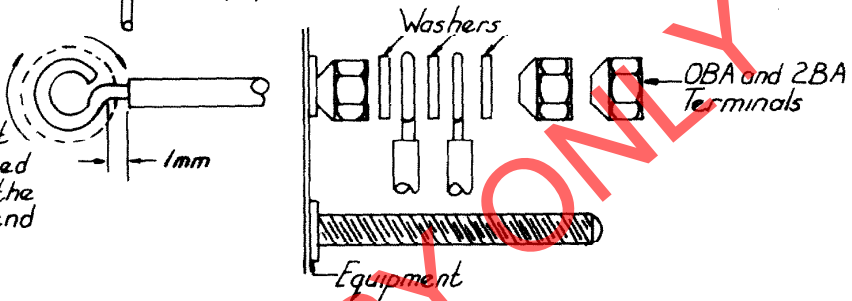
Use correct Crimping Tool

Nuts on Studs:-

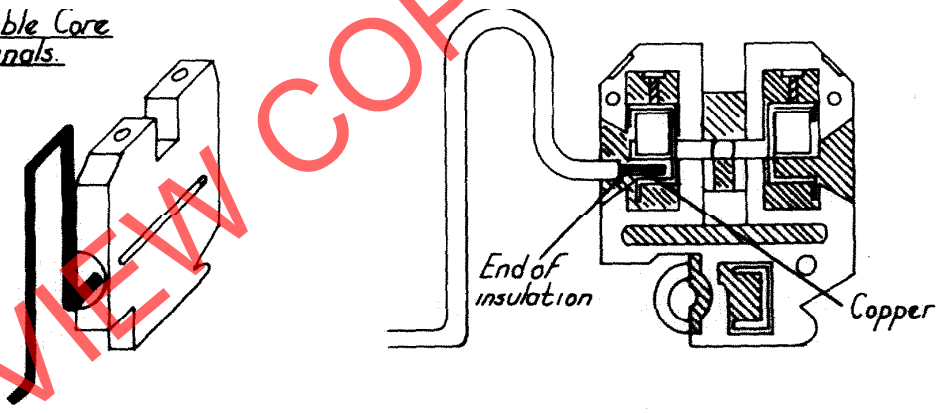


Termination of Cable Core to Studs:-

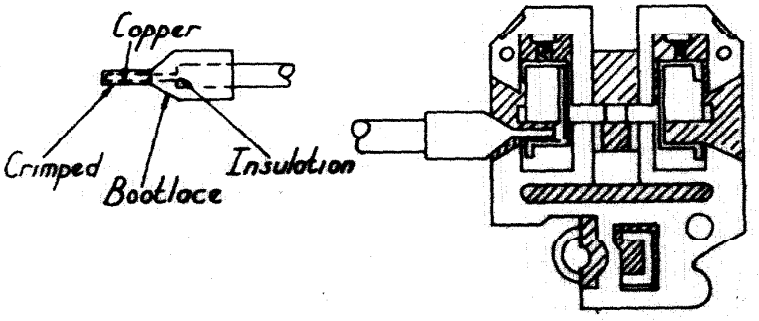
Note: taper of nuts towards equipment Eyelet must be inserted that by tightening the nut, the gap will tend to close.



Termination of Cable Core to Clip-on Terminals.



Termination of Stranded Wire to Clip-on's with Bootlace ferrules:

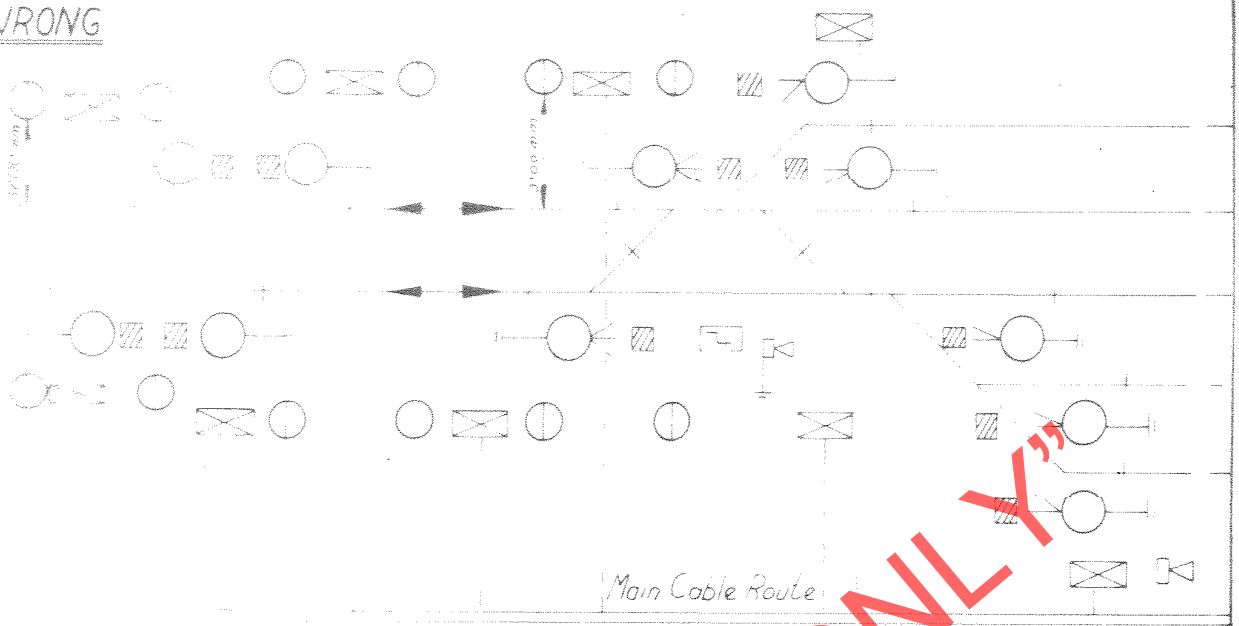


SATS - SAVD

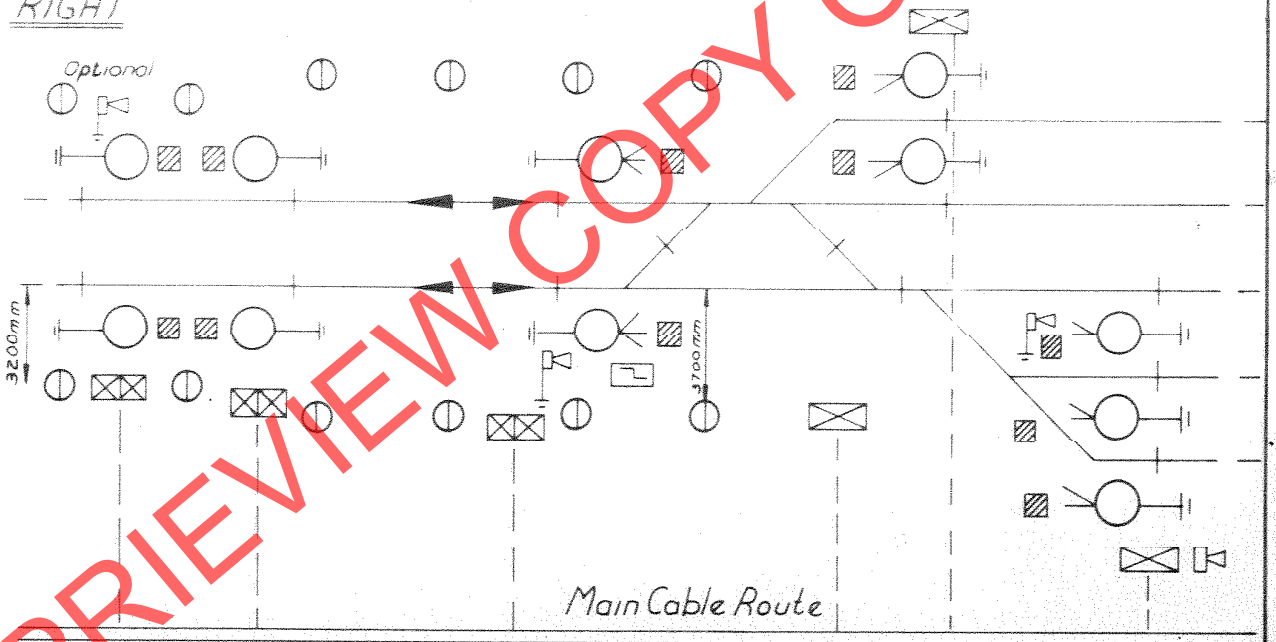
TERMINATION CODE OF PRACTICE

SPECIFICATION
CE (SAT)
5047
Annexure 4 Vol 1 Sec 6

WRONG



RIGHT



KEY:

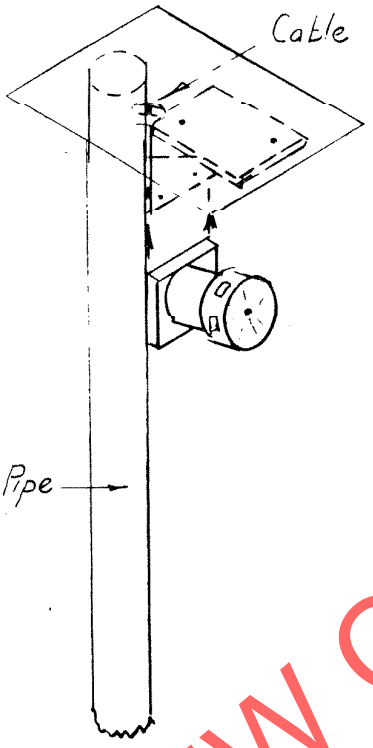
- 1 off Apparatus Case
- 2 off Apparatus Case
- Electric Mask
- Siren
- Crank handle Box
- Sign. Transf. Box 4M in the rear and in line with the signal

SATS ~ SAVD

POSITIONING OF APP. CASES. - SIGN. TRANSF. BOXES - SIGNALS - SIRENS & C/h BOXES

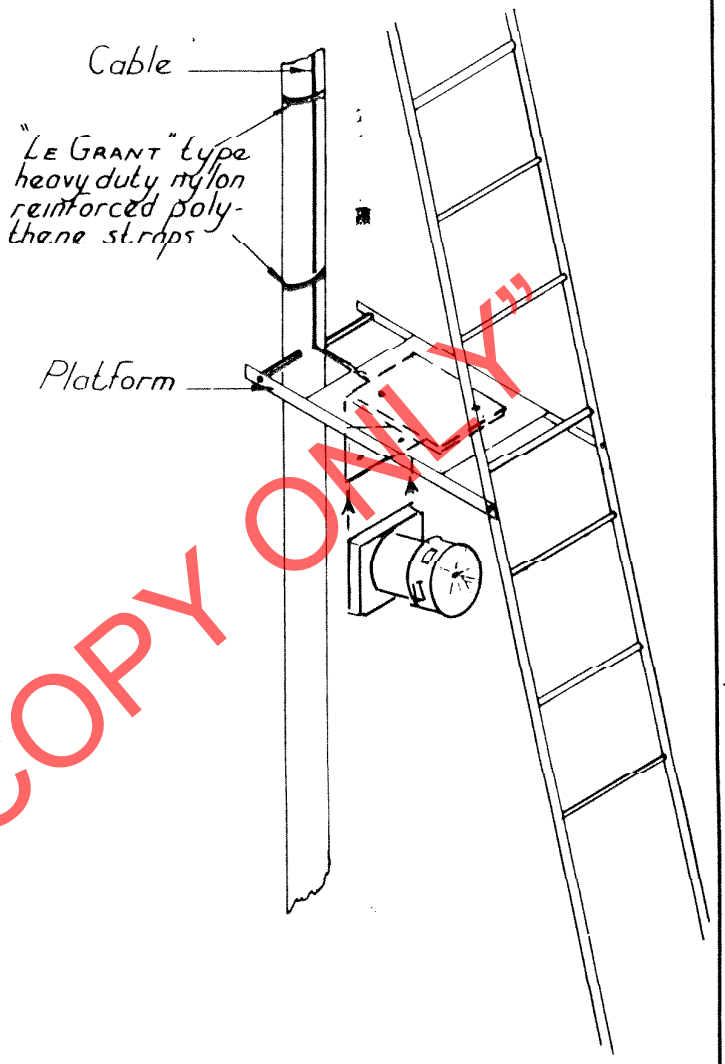
SPECIFICATIONS
CE (S&T)
504/T
ANNEXURE 5 OF Vol 6

Siren Post.



Range of Siren - 1 KM

Signal Post.



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METHOD OF FITTING SIRENS

SPECIFICATIONS
CE (S&T)
504/7
ANNEXURE 6 OF VAN 6