SIGNAL MAINTENANCE HANDBOOK

Work Procedure: SHRI-004-WPST-02

Signal & Telegraph Section

CONTROLLED COPY NO: ☐

Issue date: 6th January 2016

Authorised by: Troy Barker, Signal & Telegraph Coordinator

Issued By:

[Uncontrolled unless numbered and signed in red]

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SIGNAL MAINTENANCE HANDBOOK
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CONTENTS

1. PURPOSE

To provide standard maintenance instructions to be followed by SteamRanger Heritage Railway's signal maintainers, in conjunction with work procedures and forms for maintenance of SteamRanger Heritage Railways signal and active level crossing installations. It is also used as a training handbook for workers to develop familiarisation on each maintenance instruction contained within and demonstrate competence through SHR competency record and assessment.

2. SCOPE

Signal and active level crossing installations, on the Mount Barker Junction to Victor Harbor railway, known as SteamRanger Heritage Railway.

3. REFERENCES

National Code of Practice for the Defined Interstate Network
Electrical Maintenance Manual (Australian National document)
Transport SA Operational Instructions Level Crossing Protection (Draft)
SteamRanger Heritage Railway Work Procedures

4. DEFINITIONS

SHR	SteamRanger Heritage Railways
Train Controller	A SteamRanger worker qualified and authorised to regulate and control all movements over the railway in accordance with the Train Order System of Safeworking.
Signal Maintainer	A SteamRanger qualified worker engaged on the installation, maintenance or repair of signals and safeworking apparatus.

PROCEDURES

5. Level Crossings

5.1 MI 01 – Level Crossing Wig Wag

1. OBJECTIVE

To provide an instruction for the maintenance of a Level Crossing Wig Wag Mechanism.

2. TOOLS

3. MATERIALS

Castrol Handy Oil or any suitable high grade bearing oil
Vaseline or anti-seize compound
Cloth
Glass Cleaner
10V, 13/3.5W signal precision lamps

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

1. Alignment

Wig Wag is adjusted to work correctly when mounted in a horizontal plane. When a mechanism is replaced, the Wig Wag must be levelled in both directions with aid of a spirit level, levelling pins and packing washers.

2. Service A

2.1 Ensure Wig Wag is securely attached to the mast with the banner at 90^{o} to the roadway.

2.2 Unlock and open side cover.

2.3 Lubrication – if required, the phosphor bronze springs in the contact assembly, where swinging roller makes contact, main ball race bearings.

2.4 Examine contacts for abnormal wear. The carbon contacts should be adjusted to make before and break after the main silver contacts. If phosphor bronze contact springs by the swinging roller bearing, appear worn, then the moving contacts may need changing.

2.5 Visually check there is little or no sparking at any contacts.

2.6 Check banner operation, first by hand, then by energising, and note gong beat.

2.7 Check operating voltage.

2.8 Check all screws and nuts for tightness.

2.9 Replace side panel and lock.

3. Service B

3.1 Perform Service A.

3.2 Wipe clean swinging roller and diamond shaped guides, and re-apply Vaseline.

3.3 Mark gong and remove. Inspect hammer and lubricate hammer arm.

3.4 Reassemble aligning reference marks.

3.5 Inspect brake. The spring tension should be such that it is impossible for a heavy wind to move banner away from its vertical position. The brake operating arms should engage fully against the brake.

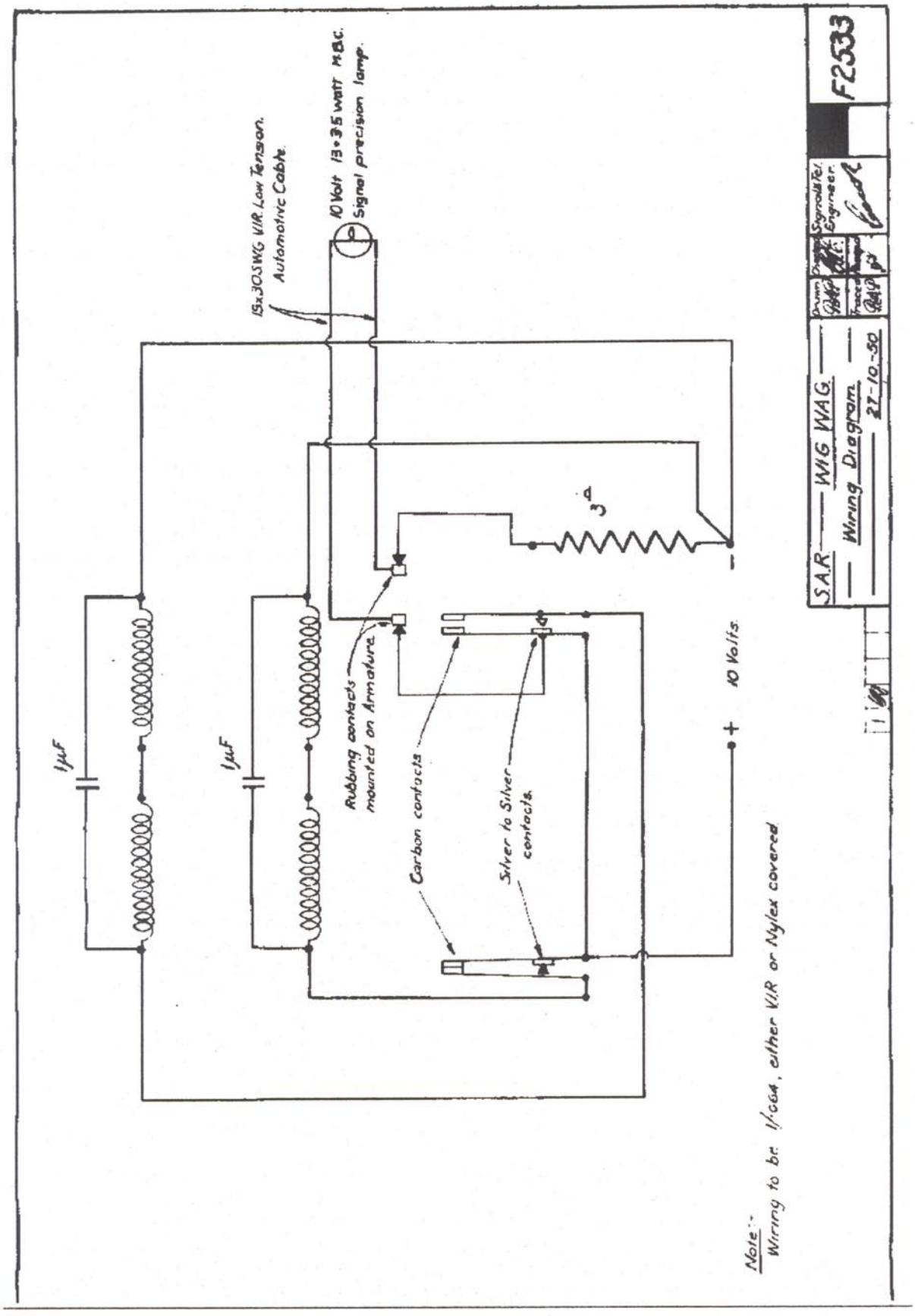
3.6 Ensure there is no oil or grease on the brake.

3.7 Check profile of drag lugs on brake band – if edges worn they must be refaced.

3.8 Ensure unit operates satisfactorily.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.


F2333
S.A.R.
WIG WAG.
Wiring Diagram.
27-10-30
15x30 SWG V/R Low Tension. Automotive Cable.
10 Volt 13·35 watt M.B.C. Signal precision lamp.
1µF
1µF
Rubbing contacts mounted on Armature.
Carbon contacts
Silver to Silver contacts.
10 Volts
+
-
Note:- Wiring to be V/G64, either V.I.R or Nylex covered

5.2 MI 02 – Level Crossing Flasher Light Unit

1. OBJECTIVE

To provide an instruction for the maintenance of a Level Crossing Flasher Light Unit

2. TOOLS

3. MATERIALS

Castrol Handy Oil/RP-7 Lubricant or any suitable high grade bearing oil
Vaseline or anti-seize compound
Cloth
Glass Cleaner
10V, 13/3.5W signal precision lamps

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

1. Clean and inspect roundel for signs of scratching or deterioration of shiny outer surface. Confirm correct type is fitted (see MI 03).
2. Clean and inspect side light glass.
3. Open unit and dust interior.
4. Clean inside of roundel with soft cloth.
5. Check condition of all gaskets and seals.
6. Clean reflector.
7. Check reflector for signs of deterioration of surface or cracking.
8. Check tightness of terminal studs and ensure the do not foul on lamp body when door is fully closed.
9. Check air vent mesh is in place, intact and allows the free flow of air.
10. Any heavy deposits of rust need to be investigated. The most likely source is corrosion of the supporting pipe work.
11. Check visible wiring for signs of insulation deterioration.
12. Ensure that any regulator fitted, is firmly attached to the body of the fitting.
13. Ensure the lamp contact area is clean and pin spring tension checked before replacing lamp.
14. Check lamp envelope for signs of discolouration, replacing as necessary, check voltage at lamp after replacing.
15. Lubricate if necessary, door hinge pin and the door locking bolt with anti-seize compound or petroleum jelly.
16. Check physical condition of hood and background.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

5.3 MI 03 – Level Crossing Roundels

1. OBJECTIVE

To provide an instruction to enable the correct replacement of Roundels as used at Level Crossings in Flasher Light Units.

2. TOOLS

3. MATERIALS

Soft Cleaning Cloth
Glass Cleaner

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

6.1 General

SteamRanger Heritage Railways uses two different types of roundels in flasher light units:

- 70^{o} Spread 200mm
- $30/15^{o}$ Spread 200mm

6.2 Uses

1. **$30/15^{o}$** roundels are used in the appropriate sized unit, forming front or long distance lights.

2. **70^{o}** roundels are used in the appropriate sized unit, where, due to their ability to optically spread light over a wider area, they are used as back or short distance lights.

   Their other uses are as sub-lights to cover traffic entering the crossing from side roads located adjacent to the crossing or in difficult curved approaches.

   Figure 1 shows the correct placement of roundels for a typical road / rail intersection.

6.3 Care

1. Roundels require cleaning at each maintenance cycle. This must be done by flooding the roundel with a quantity of NON ABRASIVE GLASS CLEANER and gently clean the roundel with a soft cloth. It is necessary to frequently turn the cloth to reduce scratching of the surface.

2. Roundels in good condition exhibit a smooth shiny surface. If this surface becomes scratched the roundel must be changed out.

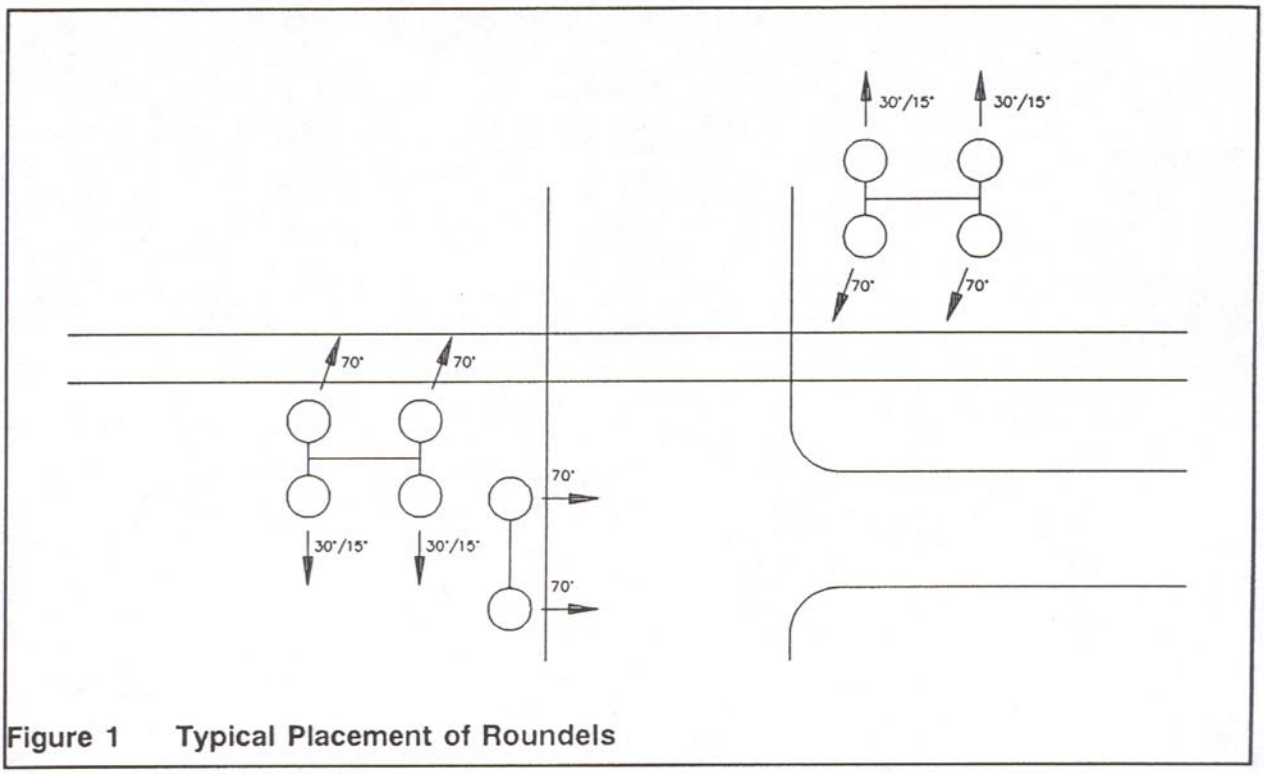


Figure 1 Typical Placement of Roundels

6.4 Installation

The roundel must be held firmly in the light unit by its retaining clips.

All clips must exert equal pressure on the roundel.

Roundels are marked “TOP” . This must be located in the vertical position when the door of the fitting is in the fully closed position.

When replacing a roundel ensure that an effective weatherproof gasket is in place to prevent the ingress of water through the front of the fitting.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

5.4 MI 04 Level Crossing Alignment of Flasher Light Units

1. OBJECTIVE

To provide an instruction for the alignment of Level Crossing Flasher Lamp Units.

2. TOOLS

3. MATERIALS

Castrol Handy Oil / RP-7 or any suitable high grade bearing oil

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

6.1 General

1. The aligning of flasher light units in accordance with these instructions must not be commenced until adequate protection has been afforded to highway and pedestrian traffic.

   When aligning, care must be taken to ensure no unsafe conditions are created.

2. To obtain the range and efficiency intended, signal precision lamps must be used in the light units.

3. When alignment of light units has been completed, tests must be made immediately to determine that the equipment functions as intended.

4. Local conditions which limit speed of approach traffic, or the distance at which the signal can be seen by drivers of vehicles approaching the crossing will vary the point of alignment up to maximum of 300 metres.

6.2 Front Lights

1. Continuously light one lamp.

2. Open door wide so clear beam is displayed.

3. Adjust light unit vertically to align axis of beam 1675mm above pavement at selected alignment distance. Both lamps should be aligned to the same point.

4. Adjust light unit horizontally to align axis of beam to centre of the approach lane at the selected alignment distance (see 6.4), maintaining vertical alignment.

5. Tighten clamps and close door, check alignment.

6. Repeat instructions Parts 6.2.1 to 6.2.5 above, inclusive, on other front light units.

6.3 Back Lights

1. Continuously light one lamp.

2. Open door wide so clear beam is displayed.

3. Adjust light unit vertically to align axis of beam 1675 mm above pavement at a point 15 metres in approach to the signal on opposite side of track.

4. Adjust light unit horizontally to align axis beam to the point, with symmetric patterned roundels, maintaining vertical alignment as in instruction 6.3.3 above.

5. Tighten clamps and close door, check alignment.

6. Repeat instructions Parts 6.3.2 to 6.3.5 inclusive, on other back light units.

6.4 Alignment Checks

After units have been aligned, clamps tightened and doors closed, they must be checked with lights flashing and lamps operating at recommended voltage to ensure certain a flashing light aspect is visible within a range of 300 metres.

As a general rule the alignment point (Front Lights) for various road speeds are:

- 60 km/h road speed 100m
- 80 km/h road speed 200m
- 110 kmh road speed 300m

Alignment should be checked on completion by making approach runs in a road vehicle. On curved approaches lights should be aligned to adequately cover the safe braking zone of the approach.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

5.5 MI 05 Level Crossing Lamp Replacement

1. OBJECTIVE

To provide an instruction for the maintenance of a Lamp used in level crossing flasher light units.

2. TOOLS

3. MATERIALS

10V, 13/3.5W signal precision lamp

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

Crossing Lamps

1. Lamps used:
   10V, 13/3.5Watt, signal precision lamp

2. Lamp life rated at 1000 hours.
   Change out life 2 years.
   Voltage:

   Ideal 9.8 volts
   Min. 9.6 volts
   Max. 10.2 volts

3. Half of the lamps on a crossing will expire on the same day.

4. The date of the next lamp change out is to be written on a self adhesive label attached to the inside body of the light unit. (As yet, SHR does not use labels).

5. Old lamps which are removed, must be destroyed in an environmentally sound manner and not mixed with new lamps.

6. The centre pin retaining nut must be kept at its outer limit and not come in contact with the lamp holder.

7. Ensure the lamp contact area is clean and pin spring tension checked before replacing lamp.

8. The reflector unit is prefocussed and force must not be applied in an attempt to remove the lamp.

9. After replacing a lamp(s), a Function Test MUST be carried out to ascertain the correct operation of the crossing. Also, alignment of lamp units must be checked.

10. In the event of premature failure of a lamp, the lamp change-out date must not be altered but left to be replaced with the remaining half set.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance action is completed.

5.6 MI 06 - Level Crossing Gong (WRRS – Western Cullen)

1. OBJECTIVE

To provide an instruction for the maintenance of WRRS and Western Cullen Crossing Gongs.

2. TOOLS

Feeler Gauge .020”
Feeler Gauge .0625”

3. MATERIALS

Castrol Handy Oil or any suitable high grade bearing oil
Fine wet & dry sand paper
RP-7 Spray Lubricant

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

6.1 Service A

1. Ensure gong is securely attached to the mast with sounder facing and parallel with the roadway.

2. Unlock and open the door.

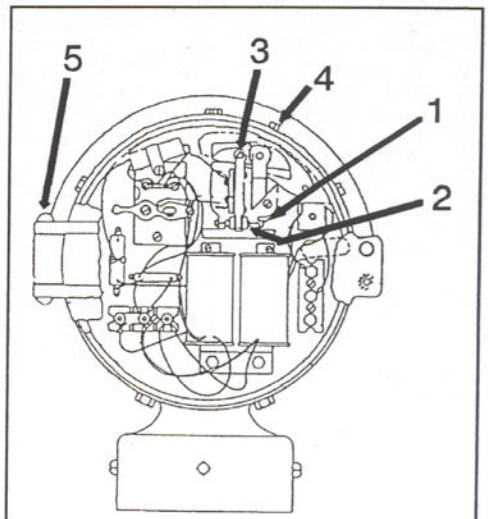


Figure 1 WRRS – Western Cullen Gong

3. Lubricate the following points:
(See Figure 1)
i Armature pin (No.1)
ii Operating link (No.2)
iii Operating Clevis pin (No.3)
iv Hammer shaft (Through hole)
Sealed plug (No.4)
v Hinge Pin (No.5)

4. Examine contacts for abnormal wear and burn marks, clean to a smooth surface.

If insufficient contact thickness replace Gong.

5. Check contact Gap 0.0625”

6. Check armature pole face gap (NOT less than 0.020”).

7. Check operating current (600/700 ma).

8. Check beats per minute:

IDEAL	**200**
MIN	**185**
MAX	**210**

9. Check all screws and nuts for tightness.

10. Check internal leads and terminations.

11. Close and lock door.

6.2 Service B

1. Perform Service A.
2. Mark sounder and gong body to assist in reassembly.
3. Remove sounder and clean inner surface.
4. Inspect hammer for abnormal wear in rivets.
5. Spray inner surface of sounder with "RP-7".
6. Reassemble aligning reference marks.
7. Ensure unit operates satisfactorily.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance action is completed.

5.7 MI 07 Level Crossing Function Test

1. OBJECTIVE

To provide an instruction for the function test of a level crossing controlled by conventional relay track circuits.

2. TOOLS

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

1. Test each track circuit for correspondence with the Track Plan regarding location and track polarity.

2. Shunt each track circuit to ensure that the respective relay responds in accordance with the box detail and track circuit diagram.

3. Sequentially de-energise track circuits using the track shunt and establish the operation of directional stick relays for each path.

   Sequence test (See Figure 1):-
   1. De-energise 1TR
   2. De-energise 2TR
   3. Restore 1TR
   4. De-energise 3TR
   5. Restore 2TR
   6. Restore 3TR

4. Ensure each function in XR circuit, when open circuited individually, fully de-energises XR. (Test with meter).

5. Ensure, with XR de-energised, that ER and X function operate.

6. On completion of tests ensure all relays have assumed their normal position as per circuit diagram.

7. Check power supply / charger circuit for correct operation.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

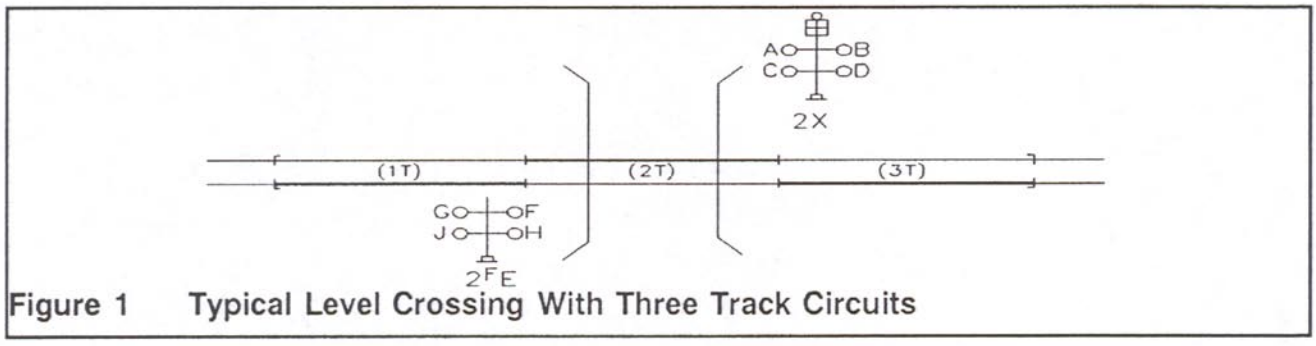


Figure 1 Typical Level Crossing With Three Track Circuits

5.8 MI 08 Level Crossing Operation Test

1. OBJECTIVE

To provide an instruction for the Operation Test of a Level Crossing.

2. TOOLS

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

Inspect all equipment for damage or vandalism.

Open test switch enclosure.

Check that the "POWER ON" indication is illuminated.

Operate test switch.

Observe function of lights, strobe and audible warning device.

Ensure that the lights are flashing and clearly visible from a vehicle driver's position on the roadway, the audible warning device emits a clear, loud note.

Restore test switch to normal or automatic position and ensure that all crossing warning devices restore to normal.

Record test in "on-site" record book.

Close and secure enclosure.

Report to Train Control any malfunction of crossing equipment.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

5.9 MI 09 Level Crossing Lamp Voltage

1. OBJECTIVE

To provide an instruction for the voltage testing of a Level Crossing Flasher Light unit lamp.

2. TOOLS

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

1. Open the light unit then activate the level crossing lighting circuit.

   Place meter on DC volt scale, then connect meter leads to lamp input terminals and measure voltage after one minute and three minutes, respectively, of operation.

   Lamp voltage specifications:-

   IDEAL 9.8 Volt.
   MIN 9.6 Volt.
   MAX 10.2 Volt.

   NOTE:
   1. Excessive lamp voltage shortens lamp life.
   2. Lower applied voltage reduces lamp output lumens.
   3. The centre pin of the lamp holder must be positive polarity (this reduces the possibility of positive earth leaks).

   Ensure centre pin locking nut is at the outer end of travel.

   Ensure all termination points are tight.

   Ensure termination studs do not foul on the light body when door is fully closed.

   Close the unit and secure.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

5.10 MI 10 Level Crossing Mast and Hardware

1. OBJECTIVE

To provide an instruction for the inspection of a Level Crossing Mast and associated Hardware.

2. TOOLS

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

1. Check foundation for horizontal and vertical alignment.
2. Check for signs of subsidence or erosion affecting foundation.
3. Check four foundation nuts are tight and fitted with washers.
4. Check mast base for cracks in casting.
5. Check four clamp bolts on split base.
6. Ensure terminal lid on split bases is weatherproof and secured with K9800 padlock if designed to be locked.
7. Check that signs are oriented to approaching traffic, and associated brackets and U-bolts are tight.
8. Ensure mast caps, strobe lights (if fitted) and gong(s) are firmly attached to mast top.
9. Ensure ladders are firmly attached.
10. Ensure cross arm is firmly bolted to mast and seated in the cut-out on the mast.
11. The lid must offer a weatherproof seal. Inspect for cracks in cross arm assembly.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance action is completed.

5.11 MI 47 Strobe Light Unit

1. OBJECTIVE

To provide an instruction for the maintenance of a Strobe Light Unit as utilised at level crossings.

2. TOOLS

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

Ensure unit is firmly secured to the mast top.

Check lens for cracks or other defects.

Clean lens by using glass cleaner and clean cloth.

If defective, the units are not field serviceable and should be returned to the Signals Workshop for attention.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance action is completed.

6 RELAYS

6.1 MI 11 Relay – NF2

1. OBJECTIVE

To provide an instruction for the inspection and on-site testing of an NF2 Relay.

2. TOOLS

Low Ohm Meter.

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

1. Two types of this relay are in use:-
    1. Balanced armature type.
    2. Weighted armature type. (As used on SHR)

    The visible difference being that the balanced armature type when de-energised, rests with the armature making on all four light circuit contacts, while the weighted armature type has a clearly visible weight attached to the armature plate, this weight forces that armature to rest on the side to which the relay is mechanically biased.

2. The inspection of both types is identical, visually inspect the contact wipe of each set of contacts (3 on each side) as the relay operates, check each contact for burn marks and excessive carbon deposited on the armature.

    This indicates wear or burning which will shorten reliable relay life.

3. Relay speed needs to be monitored at each inspection:

    IDEAL 40-42 FPM
    MIN. 38 FPM
    MAX. 46 FPM

4. For reliable operation the relay must be securely mounted in an approved bracket, and tied in using large cable ties or secured to a timber shelf with screws.

    The relay must be secured in both vertical and horizontal alignment and restrained from excessive movement.

5. All wiring to this type of relay, unless otherwise previously installed, must be 2.5mm^2 (50/0.25mm) conductors, terminated with appropriate lugs.

6. Meter test specifications (Using Low Ohm Meter):

    Carbon / Metal 0.05ohms
    Metal / Metal 0.03ohms

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

6.2 MI 12 Relay (Level Crossing) – XR and XP

1. OBJECTIVE

To provide an instruction for the inspection of XR and XP relays, used in level crossing control circuits.

2. TOOLS

Low Ohm Meter

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

6.1 General

1. Check external condition of relay.
2. Ensure relay seal is intact.
3. Check armature for free operation. As the relay coil(s) is de-energised, the armature should not display any hesitation in releasing.
4. Check relay is securely mounted to backboard or mounting bracket. Ensure relay is secured with cable ties.

6.2 XR (Modified GRS 960ohm)
(Used in conjunction with NF2 Relays)

Visually inspect relay contacts for burn marks, wipe and pressure.
CARBON / CARBON contacts must make before and break after the SILVER / SILVER contacts. Observe the contacts for burn marks.

Meter Test:

Disconnect parallel contact links, with relay de-energised, test contact resistance using LOW OHM METER.

Contact Resistance

Carbon / Carbon 0.4ohms
Metal / Metal 0.03ohms

Replace contact links on completion of test.

7 REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

6.3 MI 48 Relay – Shelf Type

1. OBJECTIVE

To provide an instruction for the inspection and on-site testing of a Shelf Type Relay.

2. TOOLS

Low Ohm Meter.

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

Verify from plans that coil resistance matches design criteria.

Verify from box detail that installed relay contact configuration is equivalent to design criteria.

Ensure capacitor or diode connected across the coils is the correct rating and is securely mounted.

Ensure relay is firmly seated in spring base mounting and is retained by cable ties to prevent accidental displacement.

Ensure that the backboard and mounting screws afford adequate support for weight of relay.

Visually inspect exterior of relay for the following:
-Cracks of breaks in casting
-Condition of coils, coil insulation and leads
-Check magnetic flux path for signs of rust or corrosion.
-Check termination area for signs of corrosion of terminals or any contamination which may cause tracking on insulating material.
-Ensure all terminations are tight and nuts on unused terminals are firm
-Check for foreign items, particularly metallic objects laying in termination area.
-Ensure relay seal is in place and there are no signs of unauthorised interference.

Visually inspect interior of the relay for the following:

1. Loose contacts, fingers or tails
2. Burn marks on contacts or carbon deposits on inside of case indicating possible high resistance contacts
3. Any sign of corrosion.

FIELD TEST SPECIFICATIONS
Energise and de-energise relay and ensure armature operates freely with no sign of mechanical hesitation. Contact resistance acceptable in a field situation is as follows:

Carbon - Metal	**0.18ohms**
Carbon - Carbon	**0.4ohms**
Metal – metal	**0.03ohms**

Measured with a low ohm meter.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

6.4 MI 49 Relay – Q Type

1. OBJECTIVE

To provide an instruction for the inspection and on-site testing of a Q Type Relay.

2. TOOLS

Meter

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

1. Inspect exterior of relay for damage

   Inspect plug board, ensure it is securely mounted to frame and is not cracked or deformed.
   Inspect interior of relay for signs of contact burning, loose components or corrosion.

   Ensure relay is firmly seated in the plug board and an effective clip retains the relay unit.

2. Inspect rear of realy base ensuring that all components are fully seated in the plug board position indicated on appropriate plans.

   A reliable field measurement of contact resistance is not possible on this type of relay. Any relay suspected of high resistance must be replaced and the defective relay returned to the Signal & Telegraph Depot for repair.

   Only approved crimping tools are to be used to terminate connectors

   When changing relays ensure the replacement relay is identical, utilise relay-releasing tool to lift locking pin. Do not use excessive force to remove or replace relays. The relay base is pin coded as a safeguard to prevent the insertion of an incorrect relay; therefore it must not be tampered with under any circumstance.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

7. Power Supply Equipment

7.1 MI 13 Rectifiers – RX and RT types

1. OBJECTIVE

To provide an instruction for the maintenance and inspection of RX and RT type Rectifiers.

2. TOOLS

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

Examine physical condition of rectifier.

Ensure rectifier is securely mounted in a dry, vermin proof environment.

Ensure rectifier has a free circulation of air.

Do not crowd other apparatus against it.

Check all wiring and connections.

Check that AC terminals are insulated.

Check that AC and DC voltage and DC charging current does not exceed specifications as stated on nameplate.

To adjust the charging current, loosen the large nut on top of reactive choke and shift the laminated iron block endways, moving the block outwards increases the charging current. Hold the adjustment by re-tightening the large nut.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

7.2 MI 14 Transformer

1. OBJECTIVE

To provide an instruction for the maintenance inspection and test of a Transformer.

2. TOOLS

Megger

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

Note:
This equipment is connected to voltage that may cause personal injury and therefore appropriate safety precautions must be in place to avoid an incident.

6.1 Physical Inspection

1. Ensure unit is free of mechanical damage, firmly mounted to base board and clean.

2. Inspect unit for damage caused by vermin or water. Seal enclosure to prevent further damage, if necessary.

   Ensure all cable terminations are tight. Isolate primary input voltage, if necessary.

3. Terminals exceeding 32V must be fully shrouded to prevent accidental physical contact.

6.2 Electrical Tests

1. Measure output voltage of secondary windings.

2. If below expectations measure primary input voltage.

3. Measure secondary output current and ensure connected load does not exceed transformer capacity.

4. Megger testing, if necessary, should only be carried out with mains isolated and all external wiring disconnected.
   All readings should show high values of insulation.
   1. Primary to frame or earth
   2. Secondary to frame or earth
   3. Primary to secondary windings

5. Re-terminate any wires removed for testing and restore power.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

7.3 MI 15 Power Supply RZ100 and RZ100T units.

1. OBJECTIVE

To provide an instruction for the maintenance inspection and test of RZ100 and RZ100T Power Supply Units.

2. TOOLS

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

6.1 Type Description

1. RZ 100:

   AC input 20-25V
   DC output 2.3V – 18.4V
   DC output 2.5A max.

2. RZ 100T:

   AC input 110V or 240V
   DC output 2.3V – 18.4V
   DC output 2.5A max.

6.2 Set up RZ 100 and RZ100T

For lower DC voltage, tap transformer secondary at 6V for one cell.
For two of more cells, use 15V output.

6.3 Set up RZ 100T

Set primary of transformer to match AC input of 110V or 240V.

6.4 Setting Final Adjustment

Once AC input is set and secondary output tapping is correct, connect analogue meter or digital meter with 600ohm load to output terminals and using trimpot set output to 2.3V per cell.

6.5 Electrical Inspection

1. Ensure all terminations are tight.
2. Measure and record output voltage and charge current.
3. Conduct Earth Leakage Test as required by MI 37.
4. Ensure voltage warning label is attached to exterior of equipment enclosure, where voltages exceed 32 Volts.

6.6 Physical Inspection

1. Ensure unit is firmly attached to baseboard.
2. Check unit for vermin or water damage, if detected, seal enclosure.
3. Ensure case lid is firmly attached.
4. Ensure all units where output exceeds 2.5V are mounted on insulating channel in aluminium enclosures.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

7.4 MI 46 Power Supply TRI 300 units

1. OBJECTIVE

To provide an instruction for the maintenance inspection and test of TRI 300 Power Supply Units.

2. TOOLS

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

6.1 Type Description

1. TRI 300 OLC:

   AC input 110V
   DC output 13.8V
   DC output 20A current limited.

6.2 Set up TRI 300 OLC

Observe output connectors labelled "Positive and Negative Output". Observe correct polarity.
Connect line input accordingly to ACTIVE, NEUTRAL and EARTH. Switch on at outlet. Power ON is indicated by the "Line" green LED on "O/P" green LED on the front panel.

6.4 Setting Final Adjustment

Measure voltage across DC Output. Adjust to desired voltage using through hole adjust potentiometer marked "V" (Volts adjust).
Short circuit power supply across "Postive and Negative OUTPUT" with in line current meter, set up maximum current. Adjustment marked "I" is used for this requirement. Remove short.
Recalibrate output voltage to desired volts. Connect load to output terminals and recheck voltage.

6.5 Electrical Inspection

1. Ensure all terminations are tight.

2. Measure and record output voltage.

6.6 Physical Inspection

1. Ensure unit is firmly attached to baseboard.

2. Check unit for vermin or water damage, if detected, seal enclosure.

3. Ensure case lid is firmly attached.

4. Ensure all units where output exceeds 2.5V are mounted on insulating channel in aluminium enclosures.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

7.5 MI 50 Power Supply RZ42 Unit

1. OBJECTIVE

To provide an instruction for the maintenance and inspection of RZ42 Power Supply Unit.

2. TOOLS

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

6.1 Maintenance Procedure for RZ42 Revision 5 Units

RZ42 units are a constant potential battery charger.

The unit has a trim pot mounted on the front panel; this is used to adjust the open circuit output (maximum battery voltage).

The optimum voltage per cell is 2.3volts.

6.2 Inspection Procedure

Match AC input voltage and transformer input voltage.

Secondary output of transformer is tapped at 16 and 20 Volts.

The 20 volt tapping is only used in eight cell applications.

6.3 RZ42 Setup

Securely attach unit to backboard

In aluminium boxes, insulating channel must be installed between unit and mounting rails, a cover plate must be fitted to the back of the unit to prevent vermin damage or accidental personal contact with high voltage terminals.

Connect AC supply to input terminals. If the input is 240 Volt, ensure requirements of AS3000 regarding earthing are met and a Class A licensed tradesperson is used to perform this task.

Before connecting either output wire, set output as specified earlier using trimpot.

Note: Output wire must be a 2.5mm2 flexible conductor

Connect output to load and measure charge current.

The LED mounted on the front panel indicates charge current is available.

(Terminals are provided for the connection of a remote LED, this facility must be used in place of existing neon indicator and be clearly visible from the external inspection position).

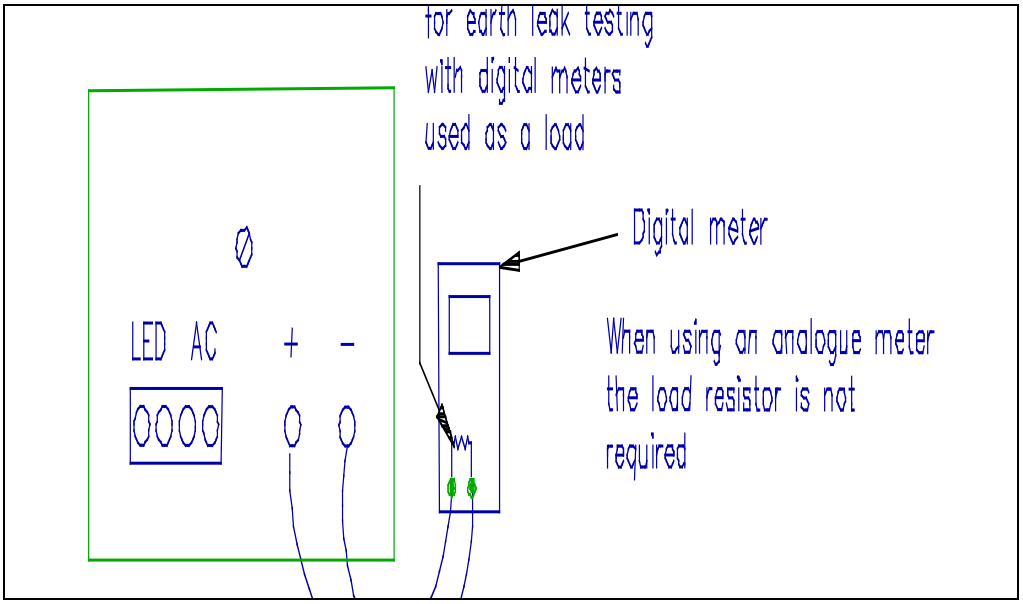
NOTE: ONLY REVISION 5 UNITS ARE TO REMAIN IN SERVICE.

See next page for RZ42 Meter Setup

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

RZ 42 Meter Setup



8. BATTERIES

8.1 MI 16 Battery – Secondary (YCP-11)

1. OBJECTIVE

To provide an instruction for the maintenance and inspection of a YCP-11 Secondary Battery as used in level crossing and signal applications.

2. TOOLS

Immersion Thermometer.

3. MATERIALS

Distilled Water

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

Precaution:

As batteries on charge generate explosive gases care must be taken to prevent any cause of ignition by sparks either from electrical, static discharge or smoking.
Allow adequate ventilation for battery.

5. PREPARATION

1. Comply with appropriate safeworking instructions and Train Controllers requests.

6. TASK DESCRIPTION

Visually inspect the following:

1. Sediment level is well below bottom of the plates.

2. The plates are parallel with each other for their entire length.

3. The plate stack is one solid assembly and does not contain any which have slipped or fallen.

4. The plates are firmly attached to their terminals.

   Terminal posts emerge from the battery cases vertically in all planes.

   Cells on which posts are twisted or warped must be changed.

5. Check for electrolyte leakage, clean if required.
   Earth leaks can be caused by voltage tracking down the side of battery jars.

6. Measure Specific Gravity (if considered necessary) (1210 at 15^{o}C electrolyte temperature), adjust reading by +4 points for each 5^{o} below 15^{o}C, -4 points for each 5^{o} above 15^{o}C.
   Adjust electrolyte level, if required, using distilled water from a clean container.

7. Check condition of intermediate leads, battery leads and connections. These should be clean, tight and lightly smeared with Vaseline, prior to assembly.

   Battery terminals are to be scraped clean at 12 monthly intervals on crossing installations and 24 monthly intervals on signal installations. The date on which cleaned is to be recorded on battery history cards.

8. Cells forming BL's should be of equal voltage. If voltage variations greater than 5% are noted, it must be investigated and cured or the battery changed out.

9. Recording of Voltage

   When entering individual cell voltages of a BL on the record card, the following sequence must be used:-

   First enter the voltage reading of the cell connected to the positive (+ve) output lead, then enter the remaining in consecutive order.

   This system enables comparison of individual cell voltages over a period of time.

10. Measurements:

- Individual Cell Voltage:
  Volts Max.
  1.98 Volts Min. on load.

- Total BL Voltage
- Total BL Voltage on load
  (CHARGER OFF – ONLY TRI 300 units).
  Load to be equal to normal duty.
  (For RT & RX rectifiers 3min load)
  (When using a load bank = 15 Mins)

- Charge Current
- Specific Gravity (if necessary)

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

8.2 MI 17 Battery (Watchman and Automotive Type)

1. OBJECTIVE

To provide an instruction for the maintenance, inspection and testing of Watchman and Automotive Type batteries.

2. TOOLS

Hydrometer.

3. MATERIALS

Distilled Water
Vaseline

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

Precaution:

As batteries on charge generate explosive gases, care must be taken to prevent any cause of ignition by sparks either from electrical, static discharge or smoking.
Allow adequate ventilation for battery.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

1. Check Specific Gravity of individual cells. Fully charged cells should be 1240 at 25°C and correction for temperature variation of +7 for each 10°C below 25°C and –7 for each 10°C above 25°C.

2. Check and adjust electrolyte levels correcting if necessary using distilled water.
Electrolyte should be 6 mm above the cell plates. Do not overfill.

3. Check voltage of battery (on load).

   If in a bank of batteries check individual battery voltage.

   Normal cell voltage for batteries on float charge is 2.3V to 2.4V per cell ie 13.8V to 14.4 per six cell battery.

4. Check connections are clean and tight, if necessary scrape terminals and connections and lightly recoat with Vaseline.

5. Clean exterior of battery.

6. Battery should be mounted on timber base or plinth and should not be located directly on a cement floor.

7. Any battery which becomes fully discharged due to fault conditions should receive a full charge as soon as possible to reduce the impact of sulphation.

8. When recording individual cell voltages of a battery on the record card, enter the voltage of the cell connected to the positive output lead first, then enter the remaining cells in order.
This enables comparison of individual cell voltages over a period of time.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

MI43 Battery – Gell Cell Type (UXL-220)

1. OBJECTIVE

To provide an instruction for the inspection, testing and maintenance of a UXL-220 VRLA battery

2. TOOLS

3. MATERIALS

Vaseline

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

Precaution:

As batteries on charge generate explosive gases, care must be taken to prevent any cause of ignition by sparks either from electrical, static discharge or smoking.
Allow adequate ventilation for battery.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

1. **General**

This type of battery, by design and manufacture, requires a low level of maintenance.

Inspection

2. Inspect case for signs of distortion (indicating over-charging), cracking or leakage of electrolyte; ensure pressure relief caps are intact. Clean casing.

Inspect terminations for mechanical strength and electrical continuity.

NOTE: Do not open circuit battery from chargers, as the rise in voltage applied to the equipment from some types of charger will cause irreparable damage.

If necessary, isolate solid-state equipment before commencing any operation, which may endanger the equipment.

Measure and record individual cell and total battery voltages “on-load”, (with TRI 300 charger isolated) after 3 minutes of being "on-load". Measure individual cells as well as total BL voltage.

Cells forming BL’s should be of equal voltage. If voltage variations greater than 5% are noted, it must be investigated and cured or the battery changed out

Cell’s forming BL’s are not seen as separate entities, when a BL is changed out **ALL** cells are to be replaced.

Recording of Voltage

When entering individual cell voltages of a BL on the record card, the following sequence must be used:

First enter the voltage reading of the cell connected to the positive (+ve) output lead, and then enter the remaining in consecutive order.

This system enables comparison of individual cell voltages over a period of time

Measurements:
Total BL on load, (CHARGER OFF TRI300), Load to be equal to normal duty load for 3 minutes.

a. Individual Cell Voltage:

2.3 Volts Max

1.98 Volts Min. on load

b. Total BL Voltage

d. Charge Current

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

9 Track Circuits

9.1 MI 18 Track Circuit (Primary) – Adjustment

1. OBJECTIVE

To provide an instruction for the adjustment of a Primary Battery Powered Track Circuit.

2. TOOLS

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

1. **Shelf Type (4ohm) Relay**

   At the relay end, connect an 8 ohm variable resistor in the R1 leg and connect to positive rail (as indicated on Track Plan) via track leads.

   At the battery end, connect a fixed value resistor (2.2ohm, 5W) in the positive leg between the battery and the track lead.

   Check battery voltage is 1.4V nominal before it is connected to the track.

   Connect battery to track observing track polarity as detailed on Track Plan.

   Connect ammeter in coil circuit, adjust variable resistor at relay end until reading is 20% above stated working current compensated to allow for local climatic and track conditions.

   Remove ammeter from circuit and ensure terminations are secure.

   Shunt Test track circuit in accordance with MI 38.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

9.2 MI 19 Track Circuit (Secondary) – Adjustment

1. OBJECTIVE

To provide an instruction for the adjustment of Secondary Battery Powered Track Circuits.

2. TOOLS

Track Shunt 0.5 Ohm.

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

1. At the relay end, connect a 30 Ohm variable resistor in the R1 leg and connect to positive rail (as indicated on Track Plan) via track leads.
2. At the battery end, connect a 4 Ohm variable resistor with approximately 3 Ohm in circuit in the positive leg between the battery and the track lead.
3. Check that open circuit battery voltage is between 2.0V and 2.4V.
4. Connect ammeter in series with the positive lead of the track relay.
   Adjust variable resistor so that current reading is 20% above the stated working current of the relay, compensated to allow for local climatic and track conditions.
   Tighten feed resistor.
5. Remove ammeter from circuit and ensure terminations are secure.
6. Shunt test track relay as in accordance with MI 38.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

9.3 MI 20 Track Circuit (Lucas Pulse SW 50) - Adjustment

1. OBJECTIVE

To provide an instruction for the inspection and maintenance of Lucas Girling SW 50 Pulse track circuit equipment.

2. TOOLS

Digital Multimeter

3. MATERIALS

Copper Jumper Wire & Lugs

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

6.1 **Feed End**

1. Connect the transmitter "RAILS" terminals to the rails, noting which rail is positive and which is negative. The connecting leads should be short and of low resistance.

2. Connect the battery to the 12 volt "INPUT" terminals observing polarity. A warbling sound will be emitted. The input voltage must be between 10-16 volts.

   N.B A germanium diode is included in the internal power supply lead so that no damage occurs due to inadvertent connection of the battery with incorrect polarity. However damage could result from connecting the battery to the transmitter "RAILS" terminals and also by connecting either of the rail terminals to the positive input terminal.

6.2 **Relay End**

1. Connect 1000ohm relay to the receiver "RELAY" terminals.

.

2. Connect the receiver "RAILS" terminals to the rails. The positive receiver terminal must be connected to the same rail as the transmitter positive terminal. If the polarity is incorrect the relay voltage will be zero.

3. Connect the voltmeter to the receiver rail terminals with the capacitor and diode connected as shown in Lucas manual. Voltage shown should be greater the 40 volts.

4. Remove capacitor and diode from voltmeter, connect the voltmeter to the relay terminals. To energise the relay, increase the voltage by shorting out the appropriate terminals marked A-E on the receiver. The resistance across the terminals are:
   A-B 2.2ohms; B-C 4.7ohms; C-D 10ohms; D-E 20ohms.

   Using a relay with a maximum drop out of 3-4V and a minimum of 4.5-5.5V, a suitable setting would be about 8 volts.

   Once the relay has been energised it can be de-energised by shorting out the "RAILS" terminals.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

NOTE: FOR DETAILED INSTALLATION, MAINTENANCE AND REPAIR, REFER TO DOCUMENT SHRI-004-WPST-06.

9.4 MI 21 Track Circuit – Rail Bonds

1. OBJECTIVE

To provide an instruction for the inspection and maintenance of Rail Bonds.

2. TOOLS

3. MATERIALS

Bond Wires (Galvanised or Copper Earthing Wire)
Cad Weld Bond Kit
Channel Pins
Brass Thread Pins
16mm^2 Cable
Lugs to suit 16mm^2 Cable
Crimp Tool

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

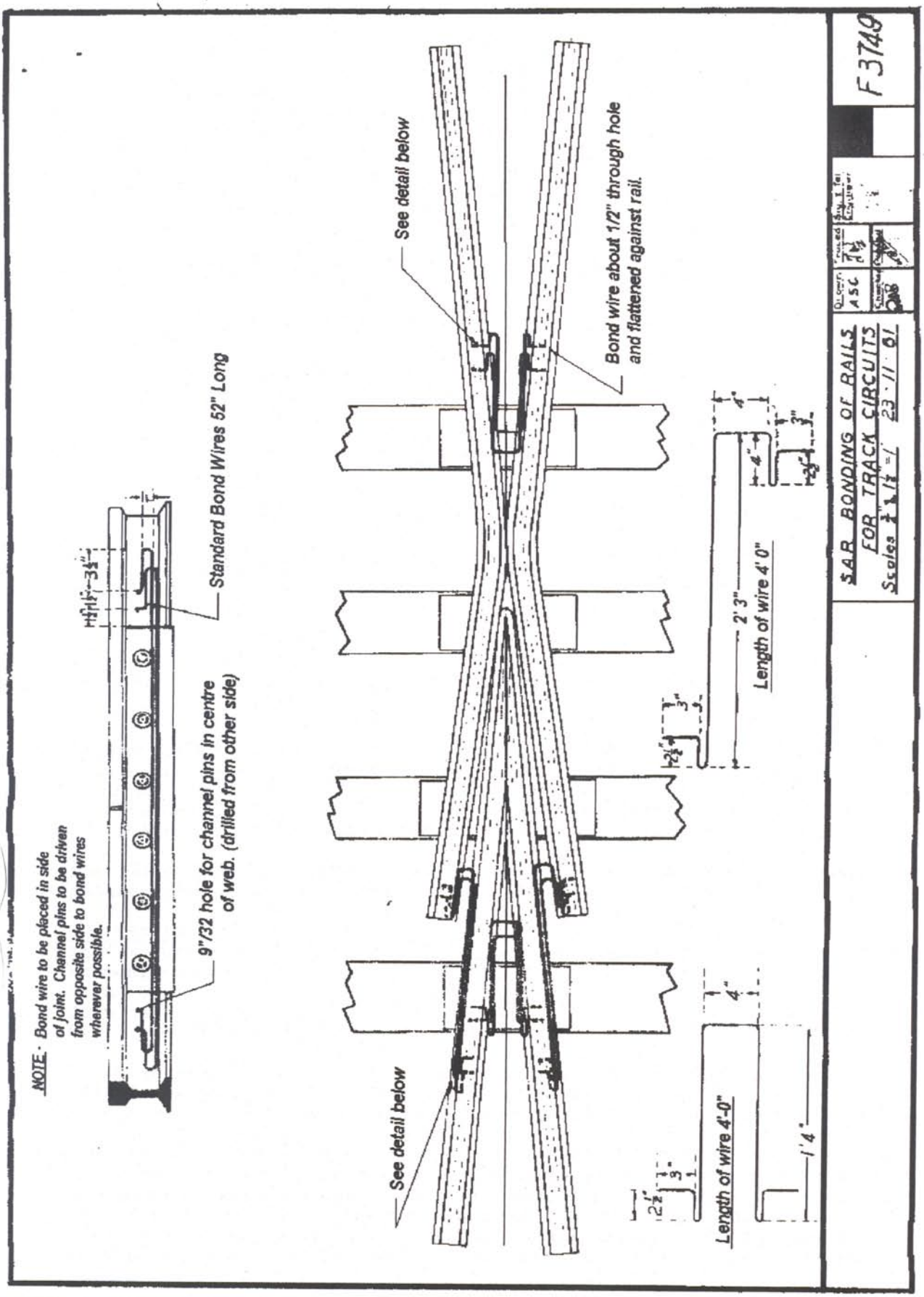
1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

1. Ensure all mechanical joints installed in the track circuited area are effectively bridged by a bond wire.
2. Ensure bond wire is firmly attached to rail by either weld, bond pins or bond plugs and nuts.
3. All bond wires must be kept clear of ballast to allow easy inspection and reduce corrosion – where appropriate.
4. Any broken, corroded or badly frayed bond conductors must be replaced immediately.
5. Nuts on bond terminals must be checked for tightness.
6. Bonds on switch layouts must be installed as shown on typical plans.
7. Typical bond plan is located on next page.
8. Any loose joints detected must be reported to the Track Manager.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.


F3749
S.A.R. BONDING OF RAILS
FOR TRACK CIRCUITS
Scales 1" = 1'
23 · 11 · 61
ASC
See detail below
Bond wire about 1/2" through hole and flattened against rail.
Standard Bond Wires 52" Long
9"/32 hole for channel pins in centre of web. (drilled from other side)
NOTE - Bond wire to be placed in side of joint. Channel pins to be driven from opposite side to bond wires wherever possible.
Length of wire 4' 0"
2' 3"
Length of wire 4'-0"
1' 4"
See detail below

9.5 MI 22 Track Leads and Termination

1. OBJECTIVE

To provide a procedure for the maintenance inspection of Track Leads and Rail Terminations.

2. TOOLS

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

1. Examine track leads for physical damage.

   Examine cable insulation for damage under rail or between sleepers and box anchors.

2. Examine rail connections.

   Check bond pins, bond plugs and rail connectors are tight and free from corrosion.

3. Ensure track leads are correctly crimped and free from corrosion.

4. Ensure track lead terminations are tight and not touching any part of the bootleg body.

5. Ensure track leads are secured to sleepers.

6. Ensure correct track polarity as per Track Plan.

7. Placement of Track Connections.

   i A basic requirement of all track circuits is to prove track occupancy and/or rail continuity.

   Track lead connections should be located to maximise the total length of rail detected. For this reason track leads must be positioned within 900mm of the insulated joint endpost.

   ii If epoxy joints are used, track leads must be attached on the end post side of the weld.

8. Terminations.

   i Steel wire rope track leads are to be terminated directly into the rail using channel pins.

   ii When reterminating threaded bond pins a new nut should be used. Nyloc nuts are not reusable with the same locking effect.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

9.6 MI 23 Insulated Rail Joint

1. OBJECTIVE

To provide an instruction for inspection and maintenance of an Insulated Rail Joint.

2. TOOLS

Triangular File.

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

1. Examine mechanical components of joint.

   Check for cracked or broken plates or filler blocks.

   Ensure all bolts are tight.

2. Ensure joint is adequately supported by sleepers and secure against lateral movement, if not advise Track Manager.

3. Check that joint endpost is not shorted out by baseplates, rail anchors, dogspikes, rail fasteners or resilant pads.

4. Check condition of insulating material and ensure it is captive within joint components.

5. Examine rail ends, remove any burrs or rolled over metal that may bridge endpost insulation.

6. Ensure endpost is lower than head of rail.

7. Ensure shims on Vulcabond joints have not detached from joint and are likely to bridge end post insulation.

   NOTE: Only qualified perway workers are permitted to open rail ends on insulated joints.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance action is completed.

2. Advise Station Master that maintenance action is complete.

9.7 MI 24 Insulation – Switch and Rod Line

1. OBJECTIVE

To provide an instruction for the inspection of switch and rod-line insulation.

2. TOOLS

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

1. Clean area to allow detailed visual inspection.
2. Examine physical condition of all metal components of joint.
3. Ensure all bolts are in place and tight.
4. Check all insulating material is present and captive within metal work.
5. Change out defective insulation as required, installing all insulation components as detailed in appropriate plans.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

10. Signals

10.1 MI 25 Signal – Searchlight Type

1. OBJECTIVE

To provide an instruction for the inspection of a Searchlight Signal.

2. TOOLS

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

6.1 External

Examine signal mast and hardware, check vertical alignment, terminal base, mast ladders, platform, mast cap, all bolts and fastenings.

Examine condition of signal housing, background, hood and paintwork.

Clean signal lens, examine for cracks or chips, replace if necessary.
Ensure correct orientation of any secondary lens fitted.

Inspect signal number, clean if required.

6.2 Internal

1. Check unit is weather and vermin proof.

2. Examine lamp, lamp base and measure voltage.

IDEAL 9.5 volt
MIN. 9.3 volt
MAX. 9.8 volt

Replace if glass envelope is discoloured or lamp expiry date has been exceeded, see MI 26.

3. Examine reflector – when replacing reflector unit in retaining ring ensure 'Top' marking is in appropriate position.

4. Examine and clean inner lens (Compound type), as necessary.

5. Visually inspect relay for contact condition or damage.

Ensure service is not overdue and relay is held securely in housing.

6. Test relay voltage.

7. Check all connections and wiring, ensuring plug blocks are fully engaged on relay pins.

8. Oil hinge and padlock.

9. Check door seal and hose fitting.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

10.2 MI 26 Signal (Searchlight) – Alignment

1. OBJECTIVE

To provide an instruction for the alignment of a mast mounted Searchlight Signal.

2. TOOLS

Two Hand Held Radios

3. MATERIALS

Non-corrosive glass cleaner

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

6.1 Light Output Checks

Before attempting to align the signal, ensure there is sufficient light output by checking the following:

- Correct lamp is installed.
- Lamp envelope is not discoloured
- Reflector and lenses are clean.
- Check reflector unit orientation in retaining ring. Position of 'Top' marking is in appropriate position.
- Lamp voltage is correct:

Ideal 9.5 V
Min. 9.3 V
Max. 9.8 V

6.2 Alignment

Ensure the signal housing is fitted with a sighting device.

1. Position a target of sufficient size to be seen clearly on the track (1675mm above left hand rail) at the prescribed distance from the signal.

2. Loosen the horizontal position holding bolts.

3. Using the sighting device, swivel the unit until part of the target can be seen clearly through the alignment aid.

4. Tighten the horizontal alignment bolts.

5. Loosen the vertical alignment nuts and adjust until the whole target appears centred in the sighting device.

6. Lock the vertical adjustment and reconfirm horizontal adjustment.

7. Slight errors in signal optics or lamp filament position can cause noticeable displacement of the beam when observed from the prescribed distance.

   Final verification and, if necessary, adjustment must be made be an observer located at the target point and in radio contact with the person on the mast.

8. On completion of adjustment, the signal output must be inspected from the target distance and observed that a satisfactory result is achieved throughout the approach distance.

9. Alignment distances on straight approaches are:

Main line	1,000m
Loop	500m

6.2 Alignment (Cont.)

10. Performance of signals on curved approaches can be improved by the use of deflecting lenses.

    Each case should be individually assessed and the appropriate lens selected.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

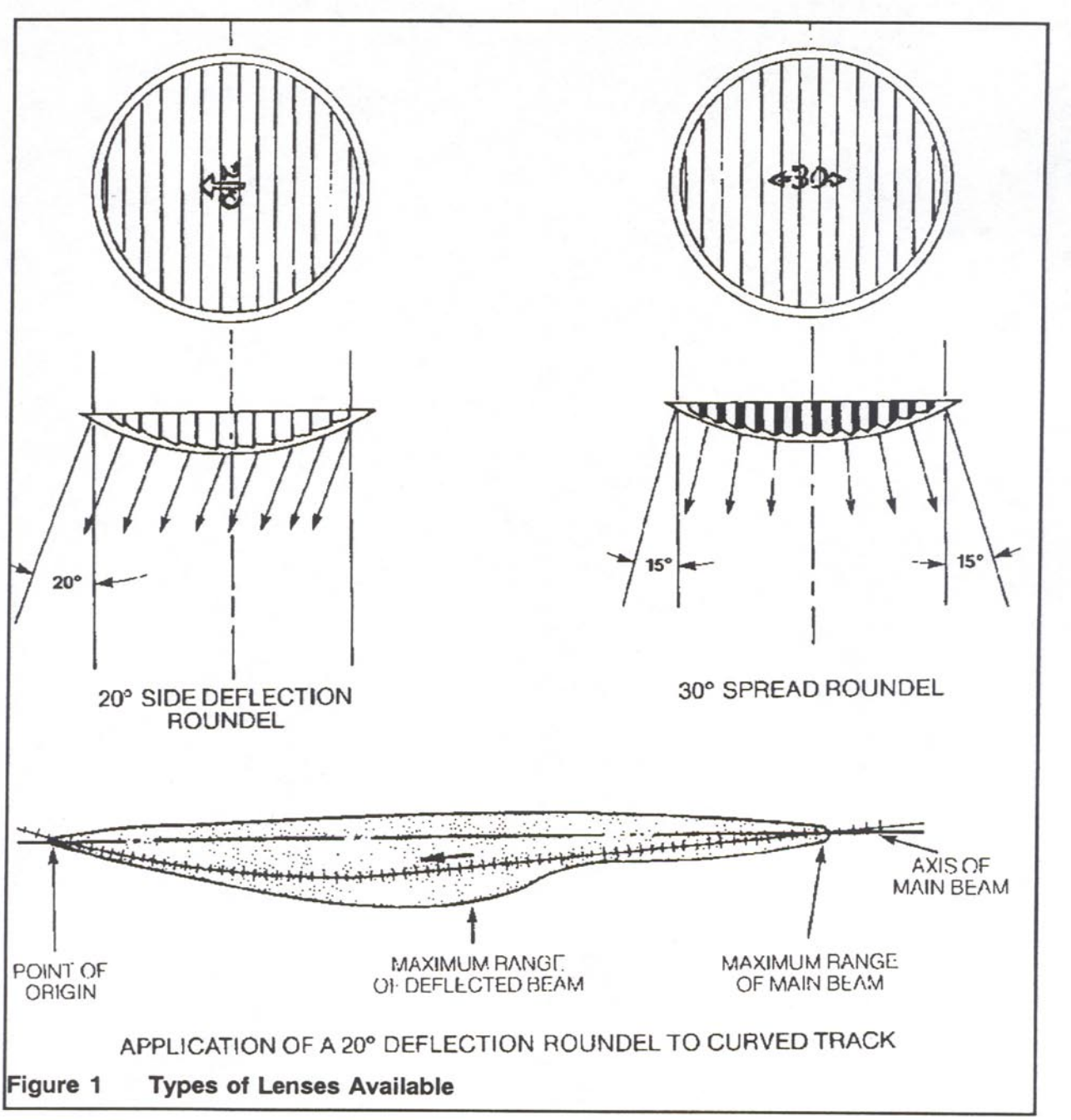


Figure 1 Types of Lenses Available

10.3 MI 27 Signal Lamp Replacement

1. OBJECTIVE

To provide an instruction detailing the replacement of lamps used in Signal applications.

2. TOOLS

3. MATERIALS

18 Watt, 10 Volt S11 Signal Precision Lamp.
5 Watt, 10 Volt S11 Signal Precision Lamp.

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

Lamps used : 18 watt 10 volt single contact S11 Signal Precision.

6.1 Lamp Replacement Signal Lights

1. Check that the printing on the base of the new lamp is 18 Watt, 10 Volt Signal Precision.

2. The date of the next lamp change out is to be written on a self adhesive label attached to the inside of the signal unit body.

3. Old lamps which are removed must be destroyed in an environmentally sound manner and not mixed with new lamps.

4. The centre pin retaining nut must be kept at its outer limit and not come into contact with the lamp holder.

5. Ensure the lamp contact area is clean and pin spring tension checked before replacing lamp.

   Check lamp voltage AC/DC:
   IDEAL 9.5 Volt
   MIN. 9.3 Volt
   MAX. 9.8 Volt

6. After replacing lamp/s a test must ascertain correct operation.

7. In the event of premature failure of a lamp, the lamp change out date is not altered but left to be replaced as determined by lamp renewal roster.

6.2 Marker Lamps

The only approved BC Marker Lamp is 5 Watt, 10 Volt S11 Signal Precision.

18 Watt 10 Volt LAMPS MUST NOT BE USED.

These lamps are changed when the filament has open circuit or the glass envelope becomes discoloured.

The instructions covered in Parts 3, 5, 6 and 7 above, must be observed.

Inspection on continuously lit signals at twelve weekly intervals.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

11 Pole Line

11.1 MI 28 Signal Aerial Termination

1. OBJECTIVE

To provide an instruction for the inspection of pole mounted terminations of Signal Aerials.

2. TOOLS

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

Inspect solder joint to ensure it is electrically and mechanically sound.

Check that drip point is not long enough to form a short circuit with adjoining terminations.

Ensure line wire has not pulled through whipping, causing excessive strain on joint area.

Check that drop wire insulation is intact continuously sleeved, with particular attention given to the area where conductors separate near the cable gland.

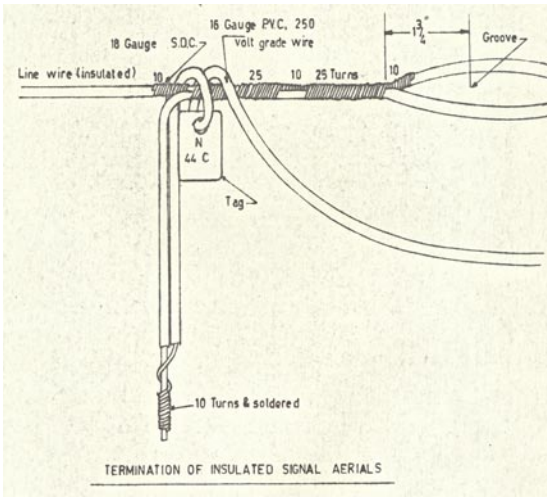
Ensure drop wire is adequately supported by bridle rings on cross arm.

Check that drop cable is adequately supported in cable gland and weight of dropper is not held by cable terminations.
Ensure drop cable is adequately secured to pole.

Ensure pole line fittings are tight and cross arm is in good condition.

Line wires to be clear of trees, foreign feeds, earth potential and foreign bodies.

Further information relating to pole line construction and maintenance, can be obtained from the SAR Linesman's Handbook, a copy of which is held by the S&T Manager.

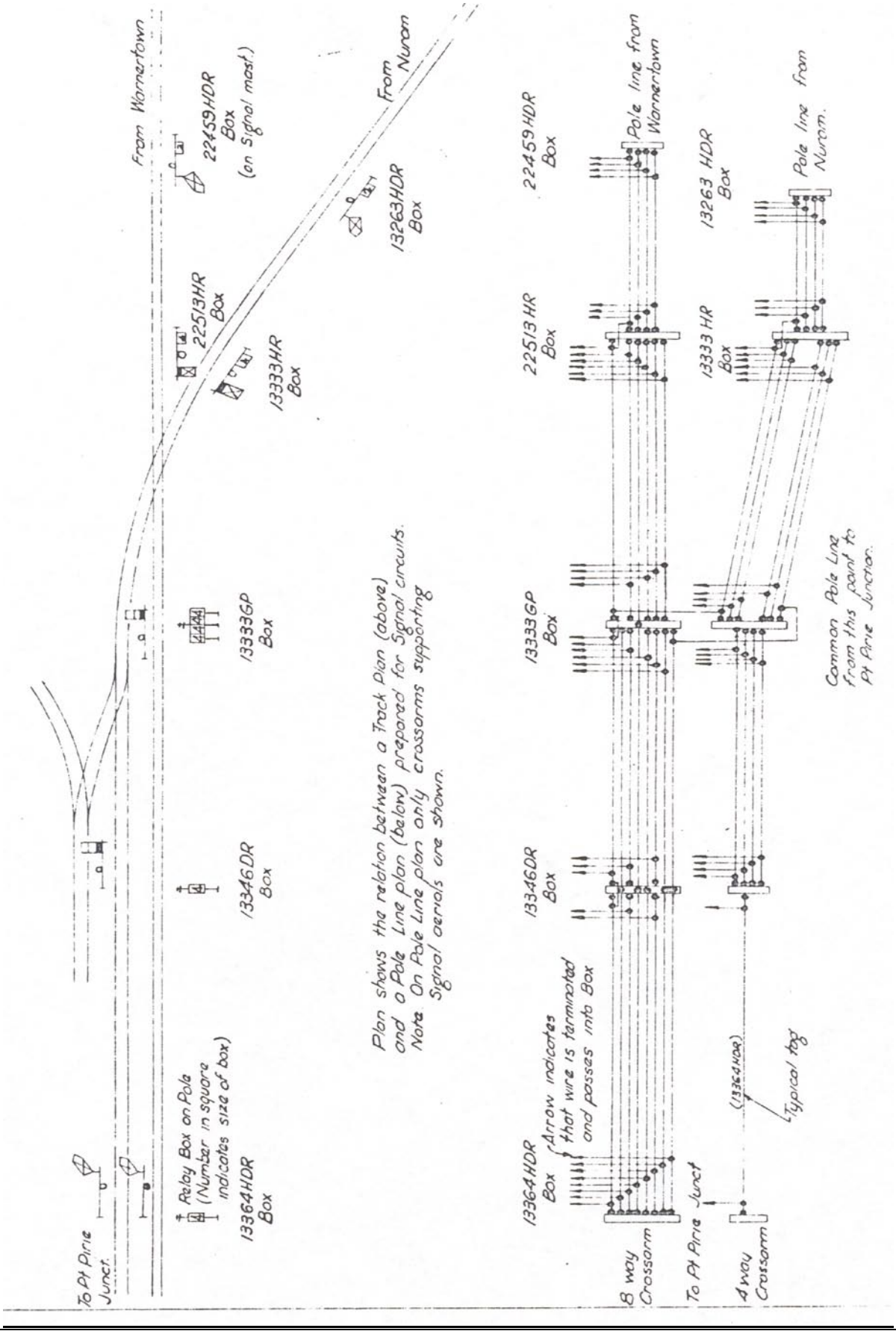


TERMINATION OF INSULATED SIGNAL AERIALS

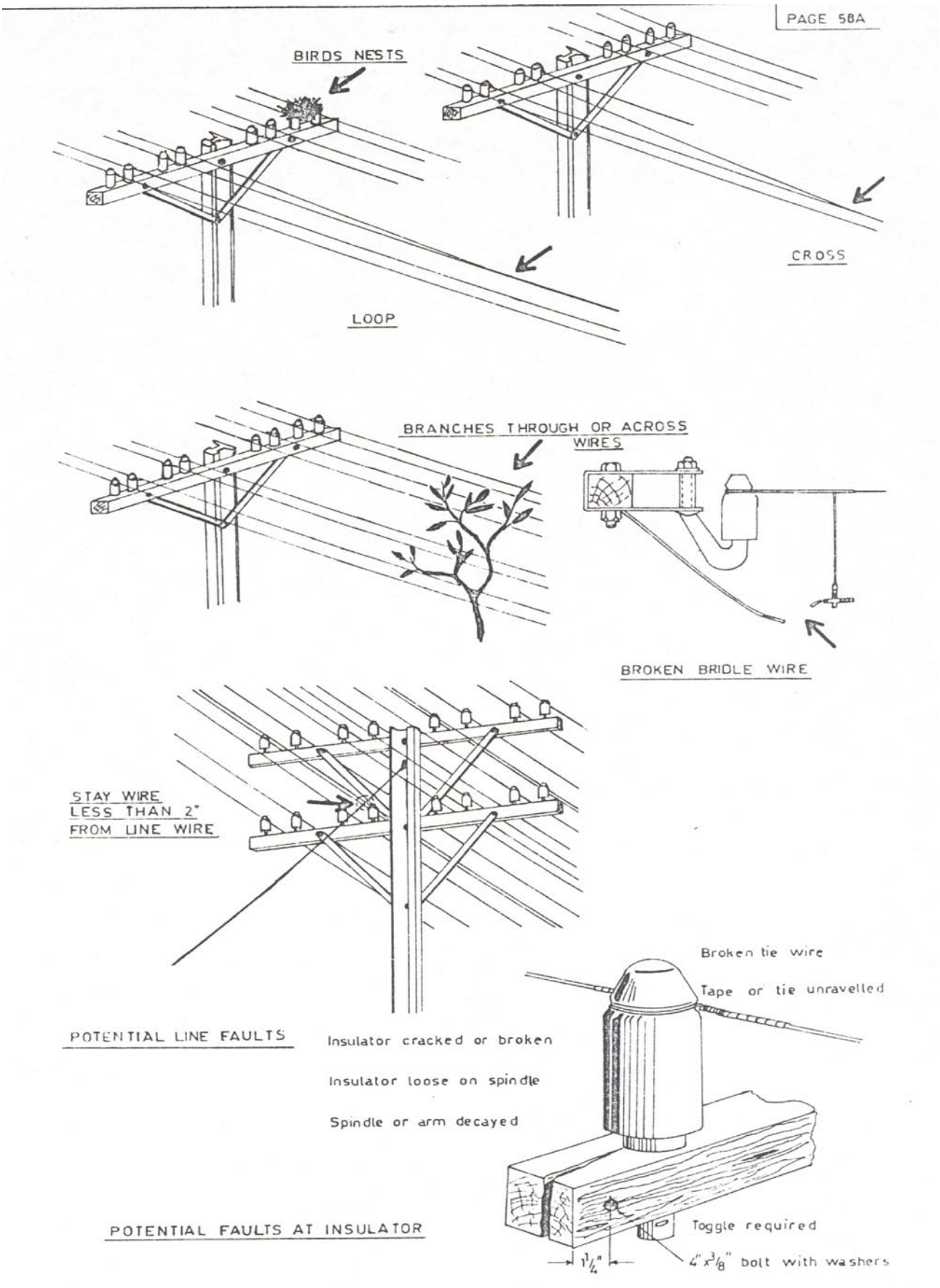
7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance action is completed.

11.2 MI 29 Typical Pole Line Plan



11.3 MI 30 Pole Line Faults



12 Points

12.1 MI 31 Pointstand

1. OBJECTIVE

To provide a maintenance instruction for a Pointstand layout and associated equipment.

2. TOOLS

3. MATERIALS

Rocol
Multi-purpose E.P. Grease
Suniso 3GS Oil

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

6.1 Inspect and lubricate point layout.

6.2 Inspection

1. Examine the pointstand and layout for damage caused by "runthrough".

2. Check that the pointstand legs are straight, not twisted, and that the pointstand shaft is not twisted, there is no damage to the yoke, table or handle and that the actuating rod is correctly aligned and not deformed.

3. After noting the position of the points, unlock the pointstand.

4. **If the point has been, or is suspected of having been, "runthrough", the pointstand must be replaced with a new or reconditioned unit. The points must not be used for train movements unless clamped in the required position.**

Lubrication

Grease the table bearing, actuating rod pin, main shaft pivot and the handle pivot on the pointstand.

Check targets for condition, and correct indication. Clean if necessary.

Adjustment

To adjust the blade to fit to stockrail:

Loosen the TWO thin lock nuts securing the thimble furthest from the blade to be adjusted.

Rotate the thick nut until the blade nose touches the stockrail. Rotate the thick nut an extra one half turn to apply a light pressure.

Check the blade fit by operating the pointstand. If the fit is correct, tighten the TWO thin lock nuts.

Repeat the procedure for the opposite blade.

Layout With Rodline and Derail

The rodline and derail should operate smoothly through its full travel, the derail ramp is clear of the flange path in Reverse, and a shoulder on the derail that mates flush to the gauge face of the stockrail in the Normal position.

Adjustment is by the adjustable sleeve crank and adjustable jaw at the derail.

On Completion of Maintenance Action

Return the pointstand to the original position (Normal) and secure with an Abloy padlock.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

12.2 MI 32 Cheese Knob

1. OBJECTIVE

To provide a maintenance instruction for a Cheese Knob.

2. TOOLS

3. MATERIALS

Multi-purpose E.P. Grease
Suniso 3GS Oil

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

6.1 Service the Point Layout.

6.2 Mechanism Inspection

Ensure the mechanism is restrained against lateral movement.

Check the lever, mechanism, pins and cranks for wear; the lever arm for damage; the counterweight is securely fastened to the lever arm; and that the actuating rod is correctly aligned and not deformed.

6.3 Adjustment

Check that the blade pressure is the same in Normal and Reverse positions.

If the blade pressure in Normal and Reverse positions varies:
Check that the problem is not blade fit or a binding heel.

With the lever at half travel, the blades should also be at half travel. Reset if this is incorrect and causing the problem.

Note: The point of blade opening should be **115 millimetres.** If it is more than this, the spreader bars should be reset, renewed or redrilled.

6.4 Lubrication

Grease and/or oil the lever pin and crank.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

13 Enclosures

13.1 MI 33 Enclosure – Lightning Arrestor

1. OBJECTIVE

To provide an instruction for the inspection and maintenance of a Lightning Arrestor Enclosure.

2. TOOLS

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

1. Examine enclosure for external damage.
2. Ensure enclosure is securely mounted.
3. Ensure enclosure is weather and vermin proof.
4. Ensure inside of enclosure is clean.
5. Ensure arrestor cartridges are clean and intact.

   Change out if glass envelope is cracked or electrode/contact area is burnt or corroded.
6. Ensure all cartridges are effectively earthed and correctly connected to earth stake.
7. Ensure earth wire is secured to conduit.
8. Ensure earth wire is as short as possible and is routed directly to the termination point.
9. Examine all cable insulation and terminations.
10. Check arrestor blocks for defects.
11. Ensure cable glands are tight and aerial droppers are securely attached to pole and underground conduit is securely clamped.
12. Ensure HIGH VOLTAGE sticker is visible on exterior of enclosure. (If applicable).
13. Secure with padlock.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance action is completed.

13.2 MI 34 Enclosure and Environ – Battery Well

1. OBJECTIVE

To provide a procedure for the maintenance inspection of a Battery Well enclosure and environ.

2. TOOLS

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

Precaution:

As batteries on charge generate explosive gases, care must be taken to prevent any cause of ignition by sparks from electrical equipment, static discharge or smoking.

Allow adequate ventilation for battery.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

1. Examine exterior of Battery Well for damage.
2. Ensure the Battery Well is weather and vermin proof.
3. Ensure Battery Well can be locked securely with chain passing through both handles.
4. Ensure the Battery Well is level and surrounds are clear of weed growth.
5. Examine internal lid liner.
6. Ensure lid liner is securely fixed to the lid.
7. Ensure timber grid is in good condition.
8. Ensure cable entry conduit and termination board are secure.
9. Ensure Battery Well clearly displays “Corrosive Warning” label. (If appropriate).

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

13.3 MI 35 Enclosure – Telephone Shelter

1. OBJECTIVE

To provide an instruction for the inspection of a Telephone Shelter enclosure and the testing of associated equipment.

2. TOOLS

Digital Multimeter
Analog Multimeter

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

1. Inspect the exterior of the shelter.
2. Ensure that it provides weather and vermin proof protection and stands vertical in all planes.
3. Ensure structure is not endangered by earth subsidence or soil erosion.
4. Ensure locking system is operative and padlocks operate freely.
5. Examine external earth connection (if required).
6. Clean interior of enclosure.
7. Check batteries if fitted, using a multimeter, and enter details onto inspection card contained within battery compartment of telephone cabinet.
8. Battery Voltages:
   1.5 Volts per cell
9. Ensure method of cable entry and degree of protection inside shelter is appropriate and cable is fastened to wall a necessary.
10. Establish contact with Train Control or local Depot/Station, and verify clarity of transmission and reception.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

13.4 MI 36 Enclosure – Power Supply (Signal / Level Crossing)

1. OBJECTIVE

To provide a procedure for the maintenance of a Signal/Level Crossing Power Supply Enclosure.

2. TOOLS

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

Examine enclosure for external damage.

Ensure enclosure is securely mounted.

Inspect earthing equipment. If in doubt, contact an SHR 'A' class electrician to assess installation to AS 3000.

Check that enclosure is weather and vermin proof.

Ensure backboard is in good condition.

Ensure all cable terminations are tight and free of corrosion.

All crimp lugs used in this application are to be of an approved type and applied with the appropriate crimp tool.

Ensure all high voltage terminations are effectively shrouded to prevent accidental contact.

Ensure all fuse holders are clean and free from defects.

Ensure fuse links are clean, free of defects and of correct current rating.

If a "POWER ON" indication is required ensure that it is clearly visible from external inspection position.

Ensure that all equipment in the enclosure is clean (within reason) and in safe operating condition.

Ensure padlocks are effective and operate freely.

Secure enclosure, ensure correct padlock orientation ie K9800 / SK98 to SHR equipment and EM to metering enclosure.

Ensure high voltage label is attached to exterior of enclosure door.

Report any damage to meter or other supply authority equipment directly to the appropriate supply authority.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance action is completed.

13.5 MI 37 Enclosure – Cable Pit and Junction Point

1. OBJECTIVE

To provide an instruction for the inspection and maintenance of a Cable Pit or Cable Junction Point enclosure.

2. TOOLS

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

6.1 Cable Junction Point

1. Clear area around pillar, box or pot of weeds.
2. Ensure adequate drainage exists and under normal conditions location is not prone to flooding.
3. Ensure unit is secured with a serviceable approved lock.
4. Ensure unit provides a weather and vermin proof environment for enclosed junction.
5. Inspect terminations and associated blocks for damage, corrosion and tightness.
6. Ensure termination blocks are firmly secured to the body of the junction point.
7. Ensure any jumpers installed are kept clear of lids or covers, and tied in to prevent movement.
8. Clean inside of junction point.
9. Ensure all gaskets form effective seal.
10. Reassemble and lock. Inspect for vertical alignment.

6.2 Cable Pit

1. Clear surrounding area of weeds.
2. Inspect lid. Ensure lock is approved type.
3. Check metal lids for corrosion.
4. Check pit walls for damage.
5. Refit lid/s and secure if necessary.
6. In an area where road traffic presents a threat of damage to the installation, the use of protective markers is encouraged.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance action is completed.

13.6 MI 38 Enclosure – Push Button and Test Switch

1. OBJECTIVE

To provide an instruction for the maintenance, inspection and testing of Push Buttons, Test Switches and associated Enclosure.

2. TOOLS

3. MATERIALS

RP-7 or similar

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

1. Inspect physical condition of enclosure, to ensure it offers a weather and vermin proof environment. If not, seal the unit.

2. Check that free standing push button boxes are vertical and have not been damaged.

   Ensure that any signs attached are appropriate, clean, in good condition, correctly orientated and firmly mounted.

3. Ensure unit is secured with appropriate lock, the hinges and catches operate freely. Lubricate if necessary.

4. Open unit and ensure buttons/switches are securely mounted and clearly marked with name and/or function.

5. Clean cable termination area, inspect condition of cable insulation and tightness or terminations and that the correct lug size has been used where appropriate.

6. Ensure terminations on push buttons/test switches are tight.

7. Ensure switch/button mechanism operates freely and is not subject to mechanical binding.

   Spring loaded buttons must release to their normal position without mechanical hesitation.

8. Test operation of each function initiated/cancelled by the button switch.

9. Test switches are to have contacts wired in parallel to reduce failure rate.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance action is completed.

13.7 MI 39 Enclosure – Bootleg

1. OBJECTIVE

To provide an instruction for the maintenance inspection of a Bootleg enclosure.

2. TOOLS

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

1. Ensure Bootleg is upright, above ground level and free from ballast and weeds.
2. Check Bootleg for external damage.
3. Ensure Bootleg head is securely attached to mounting pipe.
4. Ensure Bootleg is internally clean and weather and vermin proof.

   Track lead entrance holes can be sealed with rubber grommets or silicon sealant.
5. Ensure terminal blocks are free from defects and securely mounted to Bootleg base.
6. Ensure track lead terminations are tight, free from corrosion and clear of Bootleg wall.
7. Ensure Bootleg terminations correspond to the position of the track lead connections.
8. Secure Bootleg lid (padlock / bolt).

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance action is completed.

13.8 MI 44 Enclosure – Enclosures and Environment (relay/battery)

1. OBJECTIVE

To provide an instruction for the inspection of a Relay/Battery Enclosure and Environ

2. TOOLS

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6 TASK DESCRIPTION

1. Ensure surrounding area is free of weeds
2. Ensure box is securely mounted and vertical in all planes
3. Ensure enclosure is in no danger from subsidence of surrounding area
4. Ensure the enclosure provides a clean, weather and vermin proof housing for enclosed equipment

   Louvres fitted to boxes must be intact and be fitted with an effective insect screen.
   - In aluminum enclosures the cable entry duct must be sealed with a concrete slurry to prevent vermin entry.
   - Fiberglass boxes are to have a silicon seal around mounting bolts to prevent water entry causing the backboard to rot.
5. Ensure enclosure locking systems effective and secured with an operational, approved key operated lock.
6. Ensure hinges are intact and lubricated.
7. Ensure backboard provides a solid base and is securely attached to box.
8. Ensure all equipment rails in aluminum enclosures are securely mounted.
9. Ensure earthing, if necessary, conforms to AS 3000 or ARTC Standard as appropriate.
10. Ensure all cable entry chutes are intact and provide protection continuously between ground level and interior of the box.

7 REINSTATEMENT ACTION

1. Advise Train Control that maintenance action is completed.

13.9 MI 45 Enclosure – Wiring and Fittings

1. OBJECTIVE

To provide an instruction for the inspection of wiring and fittings in Relay/Battery Enclosures.

2. TOOLS

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

1 **General**

Ensure all relays are securely mounted.

Plug-in relays:

i. "Q" Type – fitted with retaining strap.

ii. "B" Type – locking pin and contact terminations fully engaged.

Shelf Type Relays:

Ensure relay is retained in mounting bracket by cable ties.

6 Other Equipment And Cables

1. Ensure all other equipment is firmly secured to backboard or equipment rails.

2. Ensure the rails/boards are in satisfactory condition and held secure.

3. Examine terminal blocks and fuses, for cracks and flaws.

- Bare metal bridging straps on 2BA blocks must be kept clear of equipment mounting rails in metal enclosures.
- Fuse holders should be fitted with one piece contact springs and not the soldered or riveted type, check fuse cartridges for correct rating as per box detail and that no corrosion is present on contact surfaces.

4. Ensure any required earthing is in place and complies with AS 3000 or ARTC Standards as applicable.

5. Ensure all cables are terminated correctly and appropriate size lugs have been fitted with an approved crimp tool to all flexible conductors.

6. Ensure all terminations are double nutted and tight.

7. Ensure all non-working wires are fully insulated and tied off or cut off. This does not prevent termination of spare conductors as shown on plans.

8. All plans are to be neatly stored.

9. Record cards are to be kept in a cardholder appropriately mounted on the enclosure.

10. Ensure all equipment is kept clean.

11. Check all cables and wiring insulation for damage and deterioration.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance action is completed.

14 Miscellaneous

14.1 MI 40 Earth Leakage Test

1. OBJECTIVE

To provide an instruction to enable field staff to test the insulation value of an installation – Earth Leakage Test.

2. TOOLS

Digital Multimeter with load resistor
Western Analog Meter 100ohm/Volt DC.

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

6.1 General

NOTE: The action of testing for earth leakage can in adverse circumstances cause false feeds on vital control circuits, and therefore this test must not be undertaken when train movements are expected.

1. Place positive (+) lead of voltmeter on BL terminal. Negative (-) lead on earth termination. Note reading (if any).
This reading is “Negative Earth”.

2. Place negative (-) lead of voltmeter on NL terminal. Positive (+) lead on earth termination. Note reading (if any).
This reading is “Positive Earth”.

3. If reading is greater than :-
2 Volt on 10 Volt installation.

It must:-
i Be cleared if possible immediately.

ii If it cannot be cleared or isolated, the SHR S&T Coordinator must be notified.

6.2 Clearing Detected Earth Leaks

When an earth leakage is detected, proceed as follows:

With meter connected as in 6.1.1 or 6.1.2 depending on polarity of earth leak detected, disconnect each wire from link, one at a time, while watching meter reading for a decrease in value.

The wire disconnected which causes a lowering of meter reading is the circuit to earth, further testing of this circuit at various points will result in the location of the breakdown in insulation resistance.

It may be possible to detect a characteristic of the defect by observing the meter reading for polarity reversal, or pulsing at approx 40 or 200 per minute which may refer to ER or X operation, this may reduce the time taken to clear defective circuits.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance action is completed.

14.2 MI 41 Shunt Test

1. OBJECTIVE

To provide an instruction to conduct a Track Shunt Sensitivity Test.

2. TOOLS

Track Shunt Unit:
0.5ohm Shunt
British Standard.
Used for all equipment designed to conform to BS.
This includes all types of DC Track Circuits excluding Coded Track
NOTE: Lucas Girling pulse circuits to be tested, when required, in accordance with instruction contained in MI 21.

3. MATERIALS

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

Test relay current and / or voltage to determine if the relay is not over energised and voltage / current complies with relay data label.

Test track polarity of adjoining track circuits to ascertain compliance with Track Plan.

Securely clamp shunt across rails and confirm the track relay assumes it most restrictive state. If this does not occur, the circuit must be adjusted immediately.

Test both feed and relay end of circuit, and ascertain relay assumes its most restrictive state.

Test should be conducted during dry weather when relay current is maximum.

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance action is completed.

14.3 MI 42 Approach Warning Signs

1. OBJECTIVE

To provide an instruction for the inspection, maintenance and change out procedure for signage owned and maintained by S.H.R. Also information on advanced warning signs installed and maintained by road authority.

2. TOOLS

3. MATERIALS

NON ABRASIVE/NON CORROSIVE CLEANING FLUID.

Cleaning Rags.

4. SAFETY

Comply with relevant SteamRanger WH&S instructions, as issued.

5. PREPARATION

1. Comply with appropriate safeworking authority and Train Controllers instructions.

6. TASK DESCRIPTION

6.1 Inspection

1. Ensure:

"STOP ON RED SIGNAL"
"TRACK SIGN" (if fitted)
RAILWAY CROSSING X BUCKS

are securely attached to crossing Mast.

2. Check signs for vandalism or defacement.

3. Ensure sign is clean, if required clean off road grime using cleaning fluid. Rinse with clean water.

4. Inspect signs for deterioration of reflective material or separation of material from backboard.

6.2 Change out Procedure

1. General:

All bolts, U bolts and nuts must be galvanised.

Ensure a washer is placed between the nut and sign face.

Care must be taken when tightening nuts to prevent damage to sign.

6.3 Railway Crossing X Bucks

1. Ensure filler block is placed between the two sign components.

6.4 Track Signs (If Necessary)

1. Ensure correct numeral is used.

6.5 Sign Orientation

1. Signs should be oriented at approximately right angles to, and facing, the traffic they are intended to serve. At curved alignments, angles of placement should be determined by the courses of approaching traffic rather than by the road edge at the point where the sign is located.

2. To avoid possible and undesirable reflection from the surface of the sign, it should be turned about 5^{o} away from the normal headlight beam (See figure 1, next page).

3. After signs are installed it is good practise to test them by trial approach in a motor vehicle.

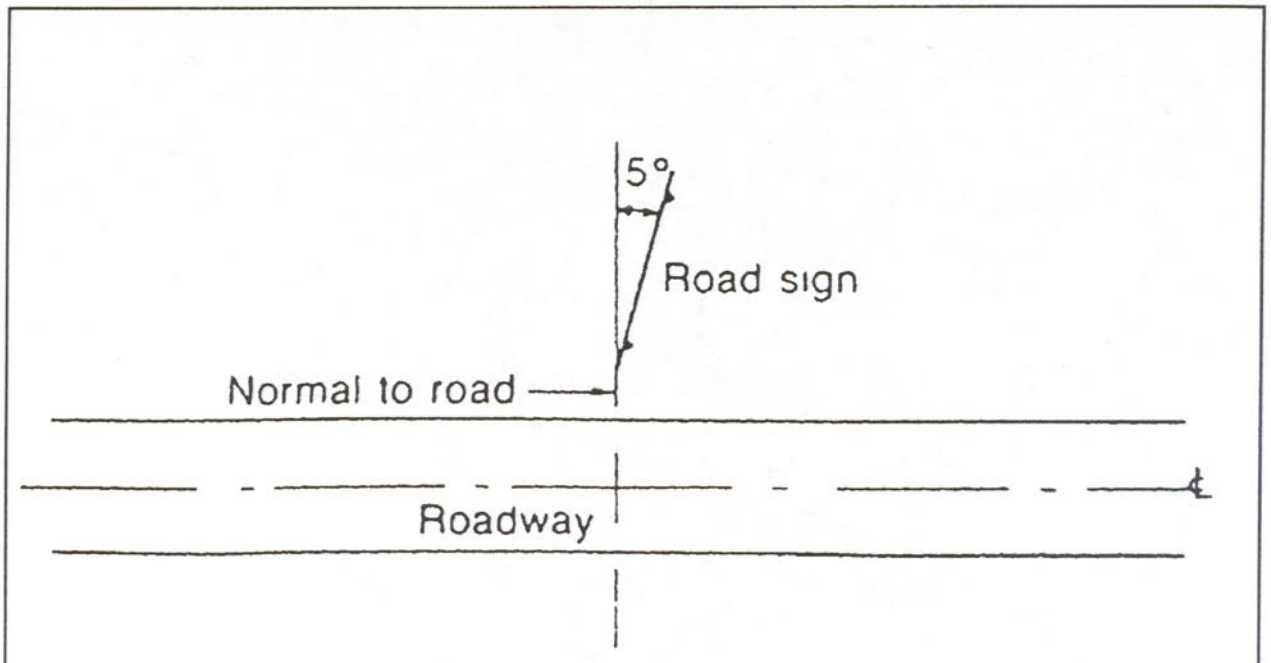


Figure 1 Method of Avoiding Specular Reflection on a Road Sign

7. REINSTATEMENT ACTION

1. Advise Train Control that maintenance is completed.

8. ADVANCE WARNING SIGNS

All signs are under the care and maintenance of the controlling Road Authority, with the exception of signs located on SteamRanger property.

As these signs contribute to the overall safety of the crossing, regular checks to ascertain their presence should be made.

9. STANDARD APPROACH SIGNS

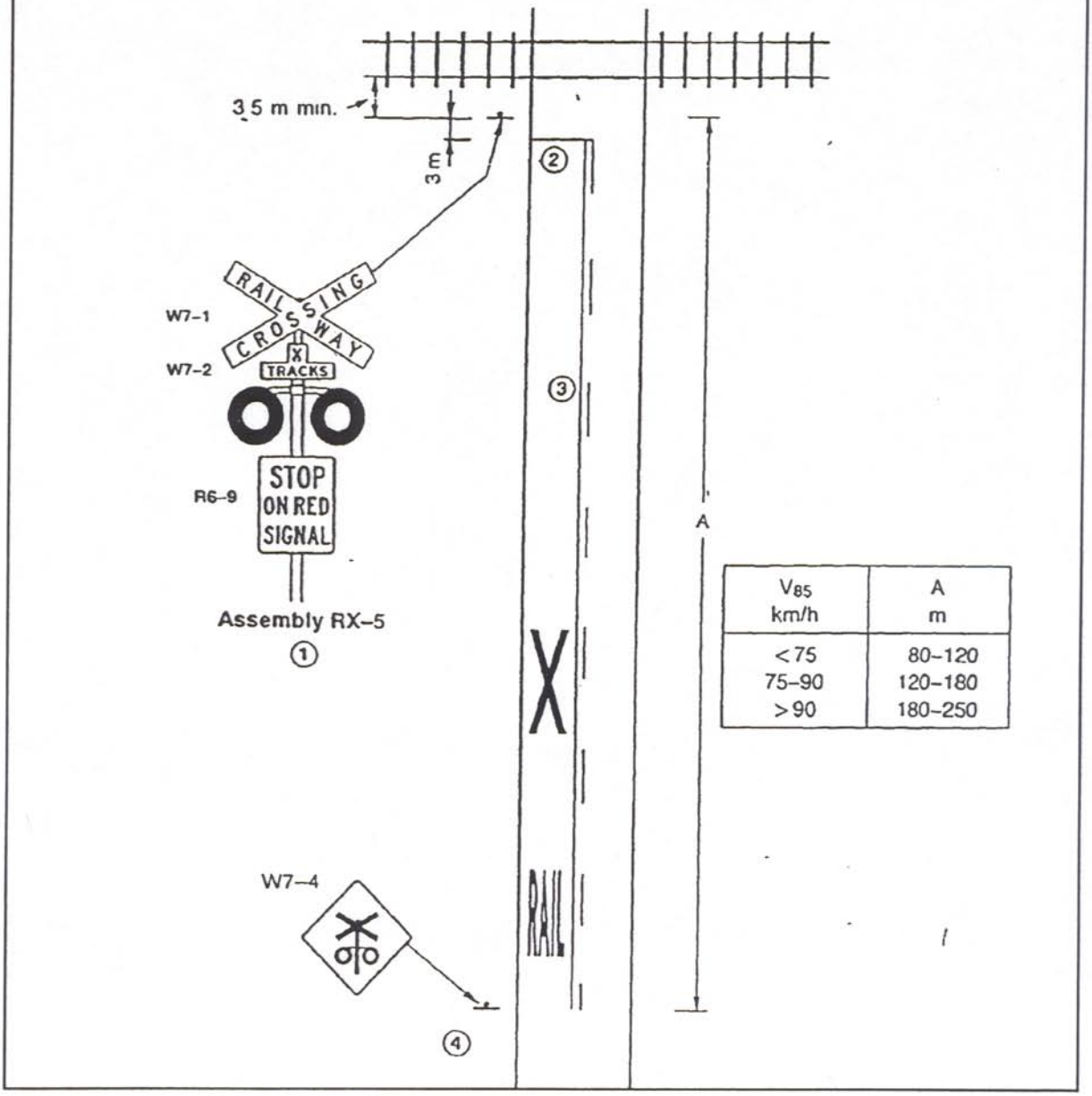
1. The Appendix pages show requirements for installations AS 1742, Part 7 – 2007.

2. Any non compliance should be reported to to the S&T Manager for corrective action.

APPENDIX

STANDARD APPROACH WARNING SIGNS

Figure 10 Level Crossing with Straight Approach Controlled by Flasing Lights (Active Control)



V_{85} km/h	A m
< 75	80–120
75–90	120–180
> 90	180–250

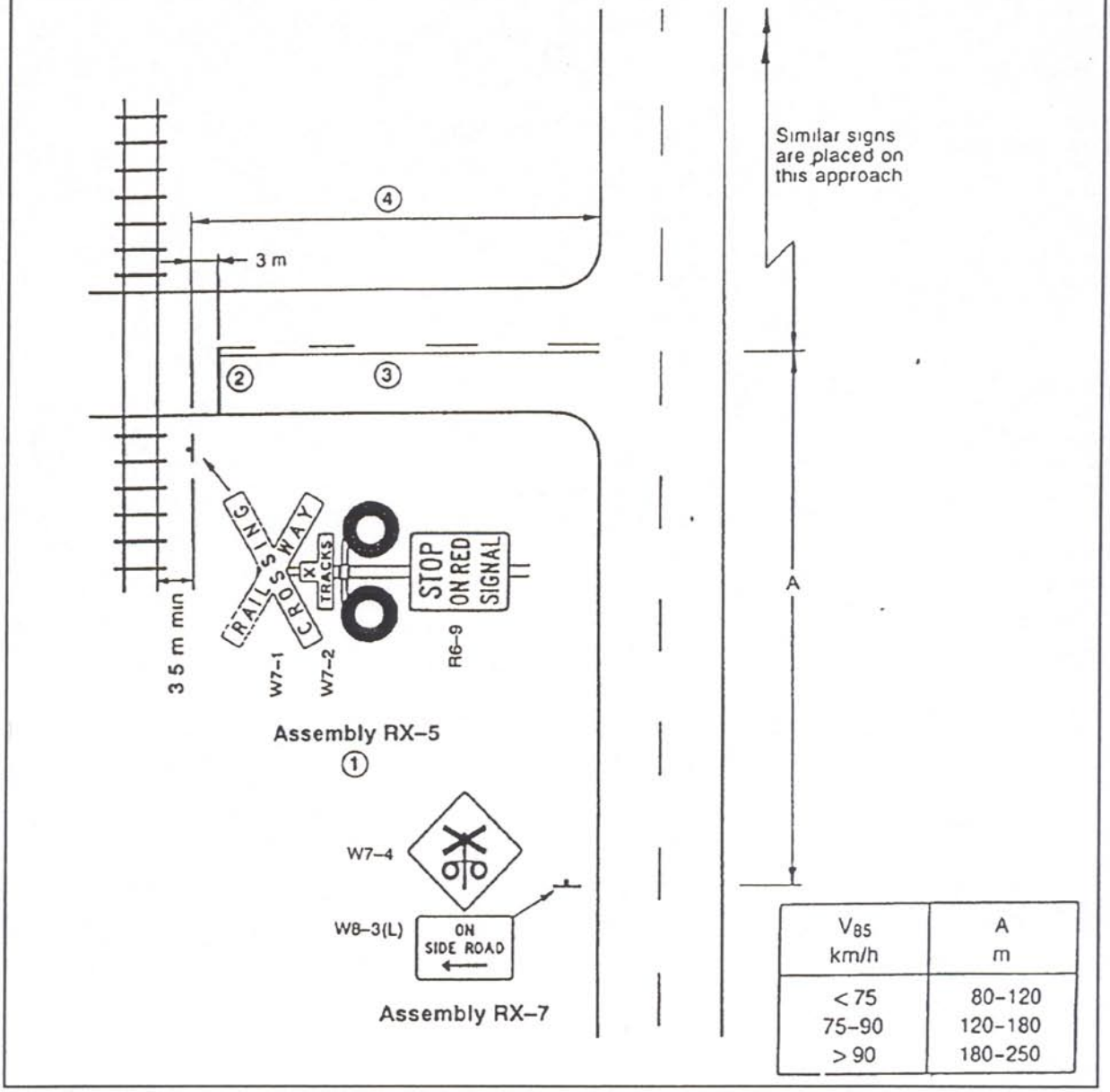
NOTES

1. If more than one track, the TRACKS sign W7–2 is added below W7–1.
2. Stop lines are required on sealed roads at level crossings controlled by flashing lights.
3. The barrier line should extend at least to the W7–4 sign.
4. The W7–4 sign may need to be repeated on the right–hand side of the carriageway.

APPENDIX

STANDARD APPROACH WARNING SIGNS

Figure 11 Level Crossing on a Side Road Controlled by Flashing Lights (Active Control)



V_{85} km/h	A m
< 75	80–120
75–90	120–180
> 90	180–250

NOTES

1. If more than one track, the TRACKS sign W7–2 is added below W7–1.
2. Stop lines are required on sealed roads at level crossings controlled by flashing lights.
3. A half–boom barrier may be provided.
4. The W7–4 sign may need to be repeated on the right–hand side of the carriageway.

APPENDIX

STANDARD APPROACH WARNING SIGNS

RAILWAY LEVEL CROSSING WIDTH MARKER ASSEMBLY

Figure 12 RX-9

The RX-9 assembly is used where basic signs at the crossing are considered inadequate. It is located immediately in advance of the RX-5 assembly and one each side of the railway level crossing.

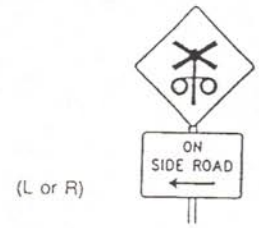
Alternatively, if the road approach to the railway level crossing is on a sharply curved alignment, it may be desirable to erect both the RAILWAY and CROSSING signs together on one side of the carriageway on the outside of the curve at the end of the approach straight.

In either of the above installations, care needs to be taken that the signs or assemblies do not obstruct sight lines to trains for road users, including pedestrians, or other road traffic at any crossing.

If a STOP sign is required in conjunction with this assembly, an oversize sign or a second sign on the right side of the carriageway, or both, may be required to ensure that the STOP sign is conspicuous.

RAILWAY LEVEL CROSSING FLASHING LIGHT AHEAD ON SIDE ROAD ASSEMBLY

Figure 13 RX-7



The RX-7 assembly shall be used to give advance warning on a through road of a level crossing which is controlled by flashing lights when the level crossing –

(a) is on a side road; and

(b) is too close to the intersection to provide the appropriate distance required for erection of the W7-4 sign on the side road.

The assembly is positioned on the left side of each approach to the intersection, on the through road as indicated in Figure 11.

RAILWAY LEVEL CROSSING FLASHING LIGHT AHEAD SIGN

Figure 14 W7-4

The W7-4 sign shall be used to give advance warning of a crossing controlled by flashing lights, including those where boom barriers are installed in conjunction with the lights.

This sign may be repeated on the right-hand side of the carriageway for added emphasis, e.g. on high volume roads. It may also need to be repeated at a long distance (e.g. 500m) in advance of the crossing, in which case Distance plate, is mounted below the sign.