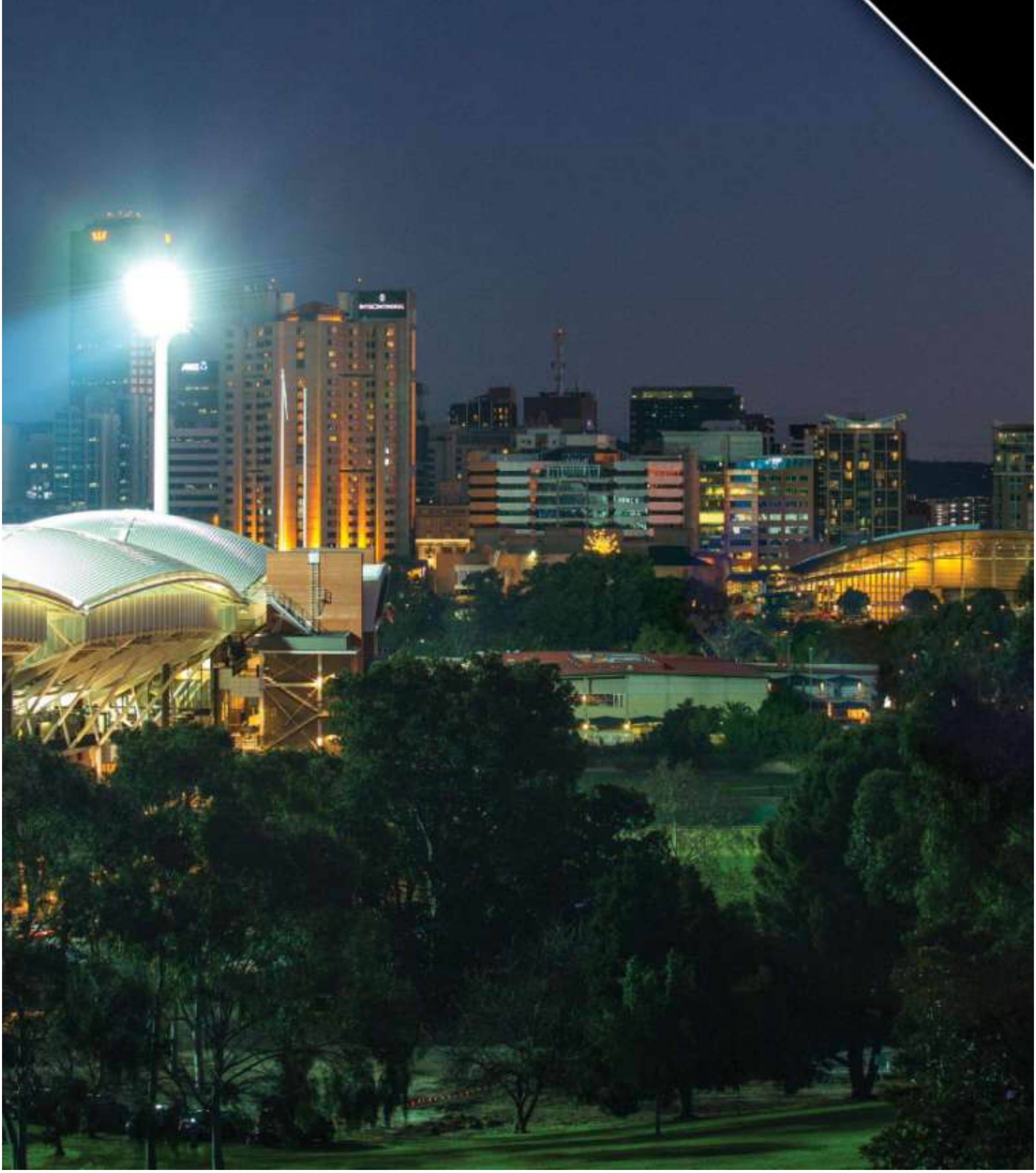
Attachment 20.11

SA Power Networks:
Line Inspection Manual (Manual 11)

October 2012



LINE INSPECTION MANUAL
Manual No. 11

Issued: October 2012
Including Amendments Issued: May 2014, June 2014 & September 2014

SA Power Networks
www.sapowernetworks.com.au

Contents

SA Power Networks ABN 13 332 330 749 a partnership of: Spark Infrastructure SA (No.1) Pty Ltd ABN 54 091 142 380, Spark Infrastructure SA (No.2) Pty Ltd ABN 19 091 143 038, Spark Infrastructure SA (No.3) Pty Ltd ABN 50 091 142 362, each incorporated in Australia. CKI Utilities Development Limited ABN 65 090 718 880, PAI Utilities Development Limited ABN 82 090 718 951, each incorporated in The Bahamas.

OWNERSHIP OF STANDARD

Name of Standard / Manual: Line Inspection Manual No. 11

Standard/Manual Owner - Title: Manager Network Asset Management

Name: Steven Wachtel

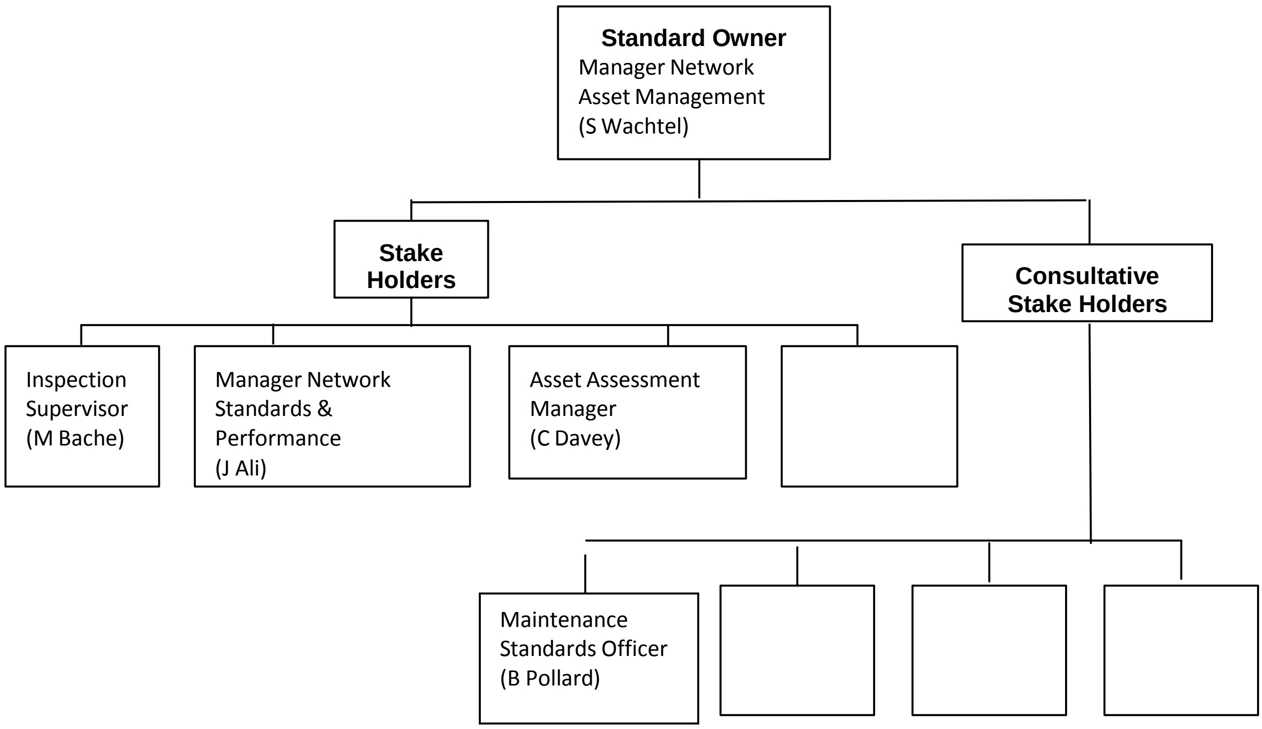
Standard Last Reviewed: April 2013

Standard Last Issued: May 2013

Review Period: 3 years

Next Review Due: June 2015 *(ie. When the next review process is due to commence)*

STANDARD/MANUAL OWNERSHIP STRUCTURE



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COMMENTS

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1. ABOUT THIS MANUAL

Contents

1.1 What this manual is about

This manual provides a detailed guide in assessing the condition, and assignment of Maintenance Risk values and priorities for rectification of defects commonly found in line assets, ground level transformer stations and switchgear. It embodies the knowledge, intent and experience of inspectors, coordinators, and maintenance engineering specialists.

It is a self-contained document except where it specifically refers to other related documents. It supersedes all previous line inspection instructions and manuals.

It provides the detailed technical support to the Network Directives Manual and Network Maintenance Manual.

1.2 Who is this manual for

This manual is designed for use by SA Power Networks employees and Contract personnel engaged in Line Inspections and patrols and their leaders, but also for reference by all staff engaged in the maintenance of Network assets. It details SA Power Networks Network line inspection procedures and is a detailed guide in assessing the condition, consideration of maintenance risk and assignment of priorities for rectification of defects commonly found in line assets, ground level transformer stations and switchgear.

1.3 How to use the manual

This manual is divided into 8 sections and appendix as follows:

- Section 1 - About this Manual
- Section 2 - Background
- Section 3 - Inspection Procedures
- Section 4 - Conductors
- Section 5 - Insulators
- Section 6 - Supports
- Section 7 - Service Equipment
- Section 8 - Other
- Section 9 - Appendices

In many photographs shown in this manual, the expert assessment of the condition, MRV and priority allocation is based on a specialised knowledge of mechanical and/or electrical loadings, material properties and strengths and Reliability Centred Maintenance (RCM) principles.

The manual does not preclude the need for inspectors, in assessing a particular situation, from being mindful of the functional context of the equipment being assessed, the properties and the failure modes and consequences. If there is any doubt, further assessment should be made by an appropriately qualified person.

Many of the photographs in this manual were obtained using specific equipment, (ie helicopter or EWP) or with equipment in a de-energised state to clearly illustrate a particular problem. Observation requirements and conditions may be critical in correctly assessing asset condition.

It is intended that sections of this manual will be reviewed periodically to provide up to date information on problems experienced.

1.4 Related Documents

Other manuals which have some relationship to this manual are:

- Network Directives Manual
- Network Maintenance Manual
- Substation Maintenance
- Substation Inspection
- High Voltage Switching Manual

2. BACKGROUND

Contents

2.1 Management Philosophy

SA Power Networks maintenance practices have traditionally been preventative maintenance regimes.

Assets have generally been inspected, overhauled and/or tested at pre-determined intervals with the aim of preventing failures from occurring.

As detailed knowledge of failure modes is developed, maintenance practices shall be refined to accommodate further Reliability Centred Maintenance (RCM) techniques with a Reliability / Service Standard focus.

Therefore, inspection and applying a fix, consistent recording of asset condition with an RCM focus, are key actions for SA Power Networks to successfully implement.

2.2 Network Directives

The procedures described in this manual are governed by the Inspection and Maintenance Network Directive – ND-M1.

Defects are allocated priorities in accordance with this manual and are required to be completed by Service Provider in accordance with current Service Level Agreement.

2.3 Roles and Responsibilities

2.3.1 Manager Network Asset Management

Manager Network Asset Management is responsible for:

Recommending the content of the manual.

2.3.2 Manager Network Standards & Performance

Manager Network Standards & Performance is responsible for:

- Issuing the manual.

2.3.3 Manager Network Asset management

Manager Network Asset Management is responsible for:

- Compliance with the manual.

2.4 Definitions

The following definitions are used.

2.4.1 Component Inspection (CI)

CI is a visual inspection of all assets. Stop at structures, examining ground level components (eg pole corrosion) and with visual (aided or unaided) observation of overhead components.

2.4.2 Inspection Planning Working Group (IPWG)

The role of the IPWG is to:

- review trends in high voltage equipment failures and determine future maintenance requirements including special inspections; and
- review specific high voltage equipment failures for trends on repeat occurrences as referred by the reliability committee.

2.4.3 Patrol

- A visual overview of overhead distribution assets. A patrol concentrates on obvious or fire start related defects. It can be undertaken from the ground or air.

2.4.4 Sampling

- Inspection of a representative sample of assets. Each annual sample is to cover differing assets until 100% of the assets have been inspected (ie 20% sample, requires 100% of the asset to be inspected every 5 years).
- If defects are found, then adjacent assets are to be sampled until no defects are found.
- Sampling regimes may be varied from time to time dependent on RCM analysis outcomes.

3. INSPECTION PROCEDURES

Contents

3.1 GROUND LEVEL DISTRIBUTION SWITCHGEAR - OVERVIEW

1. PURPOSE OF DOCUMENT

This document describes the types of ground level switchgear currently in operation within SA Power Networks' underground distribution system. It also contains information, which is common to all switchgear inspections. For type specific information refer to the appropriate inspection procedure as listed in the reference documents section.

Note: It does not include switchgear of the same types used in substations as these may be subject to different classifications of importance. For inspection and maintenance of equipment used in substations, refer to *Senior Substation Engineer.*

2. PURPOSE OF INSPECTION

Inspection of SA Power Networks' switchgear is conducted to assess the condition of accessible components of the switchgear to identify hazards and components that have deteriorated to the extent that failure of the switchgear is likely. Emphasis is placed on identification and management of known hazards and component failure modes which could jeopardise the:

- Safety of the Public, Employees and Operators
- Safety of SA Power Networks equipment
- Continuity of supply to customers

3. DEFINITION

Inspection - is a detailed visual assessment of the condition of the unit and specific components, to detect deterioration likely to lead to failure of the unit or pose a hazard to employees, operators or members of the general public.

4. SAFETY

4.1 Personal Protective Equipment

Personnel involved in the inspection of cubicles containing Live HV Ground Level switchgear MUST wear Personal Protective Equipment in accordance with the SA Power Networks Switching Manual.

5. SWITCHGEAR TYPES

The ground level switchgear used by SA Power Networks can broadly be grouped into four categories by their insulation medium they use as: Air, Cast Resin Epoxy, SF6 gas and Oil insulated. Within these four categories they can be further classified into their manufacturer types.

Table 1 summarised the switchgear types within SA Power Networks according to the above parameters.

6. MAINTENANCE MANAGEMENT PHILOSOPHY

With the SA Power Networks D type and ABB (air insulated) a live inspection as detailed below is able to determine the condition of the equipment without inconvenience to the customers. It is only necessary to proceed to dead inspection / maintenance operation if component condition is sufficiently deteriorated to justify such. Customer disruption may further be minimised by programming the dead inspection / maintenance to coincide with other planned interruption.

7. OPERATING STATUS

Table 1 **LIST OF SWITCHGEAR TYPES AND OPERATING STATUS**

Type	Rating (A)	Insulation	Indoor/Outdoor	Live Operation
SA Power Networks D Type	300	Air	Outdoor	No
ABB NAL-12	600	Air	Outdoor	Certified Units Only *
ABB FN-12	600	Air	Outdoor	Certified Units Only *
ABB FNL-12	600	Air	Indoor	Certified Units Only *
ABB RGB-12 RGB-F12	400	Air	Both	Certified Units Only *
Krone KES/10/3	400	Cast Resin	Outdoor	No
F&G GA24	600	Cast Resin	Outdoor	Yes
Merlin Gerin RM6	600	SF6 Gas	Both	Yes
F&G GC10	600	SF6 Gas	Outdoor	Yes
F&G GAC	600	SF6 Gas	Outdoor	Yes
Safelink	600	SF6 Gas	Outdoor	Yes
Safering	600	SF6 Gas	Outdoor	Yes
S&C Vista	600	SF6 Gas	Both	Yes
Eaton Xiria	600	Vacuum	Both	Yes
Statter Type 1 (T/F SW)	200	Oil	Both	No
Statter Type 2 (RMU)	400	Oil	Both	No
GEC	600	Oil	Indoor	No
Westinghouse	600	Oil	Indoor	No
Yorkshire	600	Oil	Indoor	Yes
South Wales	600	Oil	Indoor	Yes
English Electric	600	Oil	Indoor	Yes
Email	600	Oil	Indoor	No
Wilson Rotary Mk6	600	Oil	Outdoor	Yes
Wilson Rotary Mk7	600	Oil	Outdoor	Yes

Direct replacement for Krone, and fitted with operation counter.

* Restriction on live operation determined by inspector depending on condition of individual unit.

8. INSPECTION INSTRUCTIONS

The inspection information listed for each specific switchgear type points to the major items requiring attention and action if problems are identified. **A pro-forma inspection checklist for each type of switchgear is published on the intranet, refer 9.4.** These checklists capture all the requirements of live inspections in its Part A and B, and the dead inspection in Part C.

All of the results of inspection are to be recorded on the High Voltage Switchgear Checklist.

Any follow-up work required as a result of inspection must be recorded in SAP as a 'Distribution Defect'. A copy of the checklist is to be attached to the relevant 'IN' notification in SAP.

Additionally, all High Voltage Switchgear Checklists are to be individually stored in their respective categories at R:\Network\AssetOps\LineInspections\Maintenance Audit Tasks\HV GL Switchgear.

If any defects identified in the inspection process are deemed to be of a critical nature, the Network Management Maintenance Strategy Officer must be notified immediately.

9. REFERENCE DOCUMENTS

9.1 Network Maintenance Manual

6.6 Maintenance Strategy - Ground Level Distribution Switchgear

9.2 Switching Operators Handbook

Section 4, Ground Level Devices

9.3 Line Inspection Manual

3.2 SA Power Networks 'D' Type Switchgear

3.3 Brown Boveri NAL-12, FN-12, FNL-12 Switchgear

3.4 ABB RGB-12, RGB-F12 Switchgear

3.5 Krone Switchgear

3.6 F&G GA24, GC10, GAC Switchgear

3.7 Merlin Gerin RM6 Switchgear

3.7.1 ABB Safering RM6

3.7.2 ABB Safelink RM6

3.7.3 Vista RM6

3.7.4 Xiria RM6

3.8 Oil Filled Switchgear

9.4 QMS Form – NM-F-201

http://intranet/network/qms/Forms/f-201.xls

3.2 SA POWER NETWORKS 'D' TYPE SWITCHGEAR

1. PURPOSE OF DOCUMENT

This document details the procedures to be followed for the inspection of SA Power Networks 'D' TYPE switchgear.

2. SAFETY

2.1 Personal Protective Equipment

Personnel involved in the inspection of cubicles containing live HV ground level switchgear MUST wear personal protective equipment in accordance with the SA Power Networks Switching Operators Handbook.

3. EQUIPMENT REQUIRED

The following equipment will be required to conduct inspection of SA Power Networks 'D' Type cubicle mounted switchgear.

- Personal protective equipment as detailed above
- RF detector
- Shotgun stick
- Infra-red thermometer

4. SKILLS / RESOURCES REQUIRED

Inspections are to be conducted by Asset Inspectors who have completed formal training and demonstrated necessary competencies as determined by the Manager Network Asset Management.

Inspections are to be conducted by two Asset Inspectors working together. These inspectors shall have been accredited to inspect SA Power Networks D type switchgear. One Inspector is to conduct the Inspection, while the other shall act as the Safety Observer. In circumstances where two accredited inspectors are not available, it is permissible for a trained switching operator to act as the Safety Observer.

5. ACCESS PROCEDURE

One of the characteristic failure modes of air insulated (including SA Power Networks 'D') switchgear is deterioration of the insulation leading to tracking. This tracking results in generation of Radio Frequency Noise (detected with a RF detector 'Sniffer Stick').

6. INSPECTION PROCEDURE

	Inspection item	Action if problems identified
(a)	Using an infra-red thermometer, scan for hotspots paying special attention to bus work and terminations.	If temperature differential exceeds 60° C assign P1 and arrange for dead inspection and corrective maintenance. If temperature differential exceeds 40° C assign P2 and arrange for dead inspection and corrective maintenance. (Consideration needs to be given to signs of physical damage also when assigning priorities.)
(b)	Using RF detector and visually, check for evidence of tracking, discharge or flashover on the cable terminations.	If significant assign P1 and arrange for dead inspection and corrective maintenance.
(c)	Check cubicle for evidence of weeds, vermin, dust, condensation, rust, mechanical distortion.	Inspector to determine if condition warrants remedial action.
(d)	Check amount of dust and dirt on switch components and insulators.	If significant, plan for dead inspection to clean.
(e)	Check for signs of **new** corrosion (green deposits) or evidence of flashover on switch metal components.	Inspector to determine if condition warrants remedial action. Cubicles are now vented and are not as susceptible to corrosion as they have been in the past.
(f)	Check insulators for signs of flashover (burn marks, glazing).	Inspector to determine if condition warrants remedial action.

7. RECORDING OF RESULTS

All of the results of inspection are to be recorded on the High Voltage Switchgear Checklist, refer 8.4.

Any follow-up work required as a result of inspection must be recorded in SAP as a 'Distribution Defect'. A copy of the checklist is to be attached to the relevant 'IN' notification in SAP.

Additionally, all High Voltage Switchgear Checklists are to be individually stored in their respective categories at R:\Network\AssetOps\LineInspections\Maintenance Audit Tasks\HV GL Switchgear.

If any defects identified in the inspection process are deemed to be of a critical nature, the Network Management Maintenance Strategy Officer must be notified immediately.

8. REFERENCE DOCUMENTS

8.1 Network Maintenance Manual

Section 6.6 Maintenance Strategy - Ground Level Distribution Switchgear

8.2 Line Inspection Manual

Section 3.1 Ground Level Distribution Switchgear – Overview

8.3 Switching Operators Handbook

8.4 QMS Form – NM-F-201

http://intranet/network/qms/Forms/f-201.xls

3.3 BROWN BOVERI NAL-12, FN-12, FNL-12

1. PURPOSE OF DOCUMENT

This document details the procedures to be followed for the Inspection of BROWN BOVERI NAL-12, FN-12 and FNL-12 switchgear.

2. PURPOSE OF INSPECTION

In addition to those reasons noted in LIM 3.1 'Ground Level Distribution Switchgear Inspections – Overview', the results of inspections on the Brown Boveri NAL-12, FN-12 and FNL-12 are used to assess the suitability of the use of the switchgear for LIVE switching operations.

3. SAFETY

3.1 Personal Protective Equipment

Personnel involved in the inspection of cubicles containing Live HV Ground Level switchgear MUST wear Personal Protective Equipment in accordance with the SA Power Networks Switching Operators Handbook.

3.2 Dead Inspections

Personnel involved in the dead inspection of cubicles must ensure:

- A switching operator is on site to provide cubicle to be inspected is dead and earthed
- The switching operator satisfactorily test operates all air break switches, and further, remains on site as a Safety Observer in the absence of a 2nd Asset Management Officer. (Refer item 5).

4. EQUIPMENT REQUIRED

The following equipment will be required to conduct inspection of Brown Boveri cubicle mounted switchgear.

- Personal Protective Equipment as detailed above
- RF Detector (live inspection)
- Shotgun stick
- Infra Red thermometer (live inspection)

5. SKILLS / RESOURCES REQUIRED

Inspections are to be conducted by Asset Management Officers who have completed formal training and demonstrated necessary competencies as determined by the Manager Network Asset Management.

Inspections are to be conducted by two Asset Management Officers working together. These inspectors shall have been accredited to inspect the switchgear covered by this procedure. One Officer is to conduct the inspection, while the other shall act as the Safety Observer and Checker. In circumstances where two accredited inspectors are not available, it is permissible for a trained switching operator to act as the Safety Observer.

6. ACCESS PROCEDURE

Inspections should commence after the break of the season (ie after the first good opening rain) - typically between the months of May and July.

One of the characteristic failure modes of Air Insulated (including Brown Boveri) switchgear is deterioration of the insulation leading to tracking. Tracking results in generation of Radio Frequency Noise (detected with a RF detector 'Sniffer Stick').

In general, the natural air circulation around pad-mounted switchgear is sufficient to prevent the build-up of high concentrations of Ozone in the vicinity of the cubicle. However, as most cubicles are basically the same design, the level of Ozone gas detected either near or within the cubicle can give an indication of the relative degree of degradation present.

7. INSPECTION PROCEDURE

The following table should be used as a guide for Live Inspections.

	Inspection item	Action if problems identified
(a)	Check external condition as per check list Part 1 'External & Housing Inspection'. If any of the mandatory failure conditions are evident, do not proceed. If none, continue with procedure in accordance with current 'High Voltage Switchgear Inspection Checklist'.	Create and assign DD notification with MRV >190 noting inspection incomplete, failure condition and severity if possible. Notify responsible Officer OAM group.
(b)	Using an infra-red thermometer, scan for hotspots paying special attention to fuse caps and terminations.	If temperature differential exceeds 60° C create and assign DD notification with MRV >190 for corrective maintenance. If temperature differential exceeds 40° C create and assign DD notification with MRV 90-189 for corrective maintenance. (Consideration needs to be given to signs of physical damage also when assigning priorities.)
(c)	Using RF detector and visually, check for evidence of tracking, discharge or flashover on the cable terminations.	Inspector to determine if condition warrants remedial action.
(d)	Check cubicle for evidence of weeds, vermin, dust, condensation, rust, mechanical distortion.	Inspector to determine if condition warrants remedial action.
(e)	Check amount of dust and dirt on switch components and insulators.	If significant, plan for corrective maintenance to clean.
(f)	Check for signs of **new** corrosion (green deposits) or evidence of flashover on switch metal components and fuse caps	Inspector to determine if condition warrants remedial action. Since cubicles have been vented they are not as susceptible to corrosion.
(g)	Check insulators for signs of damage (flashover, burn marks, glazing, tracking, cracking).	Inspector to determine if condition warrants remedial action.
(h)	Check for mechanical damage to operating mechanism and driving components.	If significant assign appropriate priority for corrective maintenance.

Dead inspections are only applicable to NAL-12 switches commissioned and installed into the network for the first time from full workshop refurbishment and certified HV testing. Therefore, presence of HV certification sticker including test date and initials of test technician to be verified before proceeding with dead inspection procedure *(existing live inspection procedure for FN-12 and NAL-12 switches to remain in all other situations)*.

The following table should be used as a guide for Dead Inspections with any significant defects to be immediately reported to responsible OAM officer:

	Inspection item	Action if problems identified
(a)	Check external condition as per check list Part 1 'External & Housing Inspection'. If any critical or unsafe conditions are found do not proceed.	Assign DD Notification for failure condition and severity noting inspection incomplete. Notify responsible officer OAM group
(b)	Check amount of dust and dirt on switch components and insulators.	If significant, get Linesmen to rectify while on site or create and assign DD Notification for corrective maintenance to clean.
(c)	Check for signs of **new** corrosion (green deposits) or evidence of flashover on switch metal components and fuse caps	Inspector to determine if condition warrants remedial action. Since cubicles have been vented they may not be as susceptible to corrosion.
(d)	Check insulators for signs of damage (flashover, burn marks, glazing, tracking, cracking)	Inspector to determine if condition warrants remedial action.
(e)	Check for mechanical damage to operating mechanism and driving components.	If significant create and assign DD notification with appropriate MRV for corrective maintenance.
(f)	When installation work is near completion, linesmen are to be requested to operate all switches in the cubicle to check operation of switches and watch each operation to ensure each switch operates correctly.	If significant create and assign DD notification with appropriate MRV for corrective maintenance.
(g)	Check that all switchblades are correctly aligned on contacts.	If significant create and assign DD notification with appropriate MRV for corrective maintenance.
(h)	After operation of all switches check that pushrods circlips and washers are still intact and have not been displaced during operation.	If significant create and assign DD notification with appropriate MRV for corrective maintenance.
(i)	Check all bolted connections on termination and cable screens for tightness and that they have been greased correctly.	If significant, get Linesmen to rectify while on site.
(j)	Check bus work and bolted connections on bus work and switches for tightness.	If significant create and assign DD notification with appropriate MRV for corrective maintenance.
(k)	Carry out close inspection of all insulators, pushrods and associated components for any damage or other issues that may have happened in transit from workshop or during installation.	If significant create and assign DD notification with appropriate MRV for corrective maintenance.
(l)	Check cubicle cabinet and internal barrier boards.	If significant create and assign DD notification with appropriate MRV for corrective maintenance.

8. RECORDING OF RESULTS

All of the results of inspection are to be recorded on the High Voltage Switchgear Checklist, refer 9.4.

Any follow-up work required as a result of inspection must be recorded in SAP as a 'Distribution Defect'. A copy of the checklist is to be attached to the relevant 'IN' notification in SAP.

Note: Dead inspections are only applicable to NAL-12 switches commissioned and installed into the network for the first time from full workshop refurbishment and certified HV testing. Therefore, presence of HV certification sticker including test date and initials of test technician to be verified before proceeding with dead inspection procedure (existing live inspection procedure for FN-12 and NAL-12 switches to remain in all other situations).

Additionally, all High Voltage Switchgear Checklists are to be individually stored in their respective categories at R:\Network\AssetOps\LineInspections\Maintenance Audit Tasks\HV GL Switchgear.

If any defects identified in the inspection process are deemed to be of a critical nature, the Network Management Maintenance Strategy Officer must be notified immediately.

9. REFERENCE DOCUMENTS

9.1 Network Maintenance Manual

Section 6.6 Maintenance Strategy - Ground Level Distribution Switchgear

9.2 Line Inspection Manual

Section 3.1 Ground Level Distribution Switchgear – Overview

9.3 Switching Operators Handbook

9.4 QMS Form – NM-F-201

http//intranet/network/qms/Forms.f-201.xls

3.4 ABB RGB-12, RGB-F12

1. PURPOSE OF DOCUMENT

This document details the procedures to be followed for the Inspection of ABB RGB-12 and RGB-F12 Switchgear.

2. SAFETY

2.1 Personal Protective Equipment

Personnel involved in the inspection of cubicles containing Live ABB RGB-12 or RGB-F12 switchgear MUST wear Personal Protective Equipment in accordance with the SA Power Networks Switching Manual.

3. EQUIPMENT REQUIRED

The following equipment will be required to conduct inspection of ABB RGB-12 or RGB-F12 switchgear.

- Personal Protective Equipment as detailed above
- RF Detector
- Infra Red thermometer

3.1 Skills / Resources Required

Inspections are to be conducted by Asset Inspectors who have completed formal training and demonstrated necessary competencies as determined by the Manager Network Asset Management.

Inspections are to be conducted by two Asset Inspectors working together. These inspectors shall have been accredited to inspect ABB RGB-12, RGB-F12 switchgear. One Inspector is to conduct the Inspection, while the other shall act as the Safety Observer. In circumstances where two accredited inspectors are not available, it is permissible for a trained switching operator to act as the Safety Observer.

4. ACCESS PROCEDURES

One of the characteristic failure modes of Cast Resin Air Disconnects (including Brown Boveri) switchgear is deterioration of the insulation leading to tracking. Tracking, results in generation of Radio Frequency Noise (detected with a RF detector 'Sniffer Stick').

5. INSPECTION PROCEDURE

	Inspection item	Action if problems identified
	EXTERNAL:	
(a)	Prior to opening cubicle, check surrounds for evidence of tracking, discharge an RF detector.	If significant RF discharge is indicated, ABANDON INSPECTION and arrange for dead inspection (P1).
	INTERNAL:	
(a)	Using RF detector, check for evidence of discharge on the cable terminations.	Inspector to determine if condition warrants remedial action.
(b)	Check cubicle for evidence of vermin, dust, condensation, rust, mechanical distortion.	Inspector to determine if condition warrants remedial action.
(c)	Check gas level.	Notify the Inspection Operations Manager that the unit is unsuitable for LIVE operation if the needle is FULLY in the red. Raise Notification (P1) to initiated remedial action.

6. RECORDING OF RESULTS

All of the results of inspection are to be recorded on the High Voltage Switchgear Inspection Checklist, refer 7.4.

Any follow-up work required as a result of inspection must be recorded in SAP as a 'Distribution Defect'. A copy of the checklist is to be attached to the relevant 'IN' notification in SAP.

Additionally, all High Voltage Switchgear Checklists are to be individually stored in their respective categories at R:\Network\AssetOps\LineInspections\Maintenance Audit Tasks\HV GL Switchgear.

If any defects identified in the inspection process are deemed to be of a critical nature, the Network Management Maintenance Strategy Officer must be notified immediately.

7. REFERENCE DOCUMENTS

7.1 Network Maintenance Manual

Section 6.6 Maintenance Strategy - Ground Level Distribution Switchgear

7.2 Line Inspection Manual

Section 3.1 Ground Level Distribution Switchgear - Overview

7.3 Switching Operators Handbook

7.4 QMS Form – NM-F-201

http://intranet/network/qms/Forms/f-201.xls

3.5 KRONE

1. PURPOSE OF DOCUMENT

This document details the procedures to be followed for the Inspection of KRONE switchgear.

2. PURPOSE OF INSPECTION

In addition to those reasons noted in LIM 3.1 'Ground Level Distribution Switchgear Inspections - Overview', the results of inspections on Krone switchgear are used to assess the suitability of the switchgear for replacement and other asset management functions.

3. SAFETY

SA Power Networks currently has in place a ban on working in any Ground Level switching cubicle containing KRONE switchgear while that switchgear is alive.

3.1 Personal Protective Equipment

Personnel involved in the inspection of cubicles containing Live HV Ground Level switchgear MUST wear Personal Protective Equipment in accordance with the SA Power Networks Switching Operators Handbook.

4. EQUIPMENT REQUIRED

The following equipment will be required to conduct inspection of Krone cubicle mounted switchgear.

- Personal Protective Equipment as detailed above
- RF Detector

5. SKILLS / RESOURCES REQUIRED

Inspections are to be conducted by an Asset Inspector who has completed formal training and demonstrated necessary competencies as determined by the Manager Network Asset Management.

Inspections are to be conducted by an Asset Inspector; the inspector shall have been accredited to inspect the switchgear covered by this procedure.

6. ACCESS PROCEDURES

Inspections should commence after the break of the season (ie after the first good opening rain) - typically between the months of May and July.

One of the characteristic failure modes of switchgear (including Krone) is deterioration of the insulation leading to tracking. Tracking, results in generation of Radio Frequency Noise (detected with a RF detector 'Sniffer Stick').

7. INSPECTION PROCEDURE

7.1 Live Inspection

Refer also Inspection and Maintenance recommendations of the Brown Boveri Switching Cubicle Working Group, dated 25 November 1992 (DSM Ref: 621/92)

	Inspection item	Action if problems identified
(a)	Check external condition as per check list Part (A). If any of the mandatory failure conditions are evident, do not proceed.	Assign P3, noting inspection incomplete, failure condition and severity if possible. Plan for dead inspection
(b)	Test externally for RF detection.	If RF is detected raise P1 notification for cubicle replacement as per Maintenance strategy replacement program.

7.2 Dead Inspection

	Inspection item	Action if problems identified
(a)	Check the fuse cap for discolouration. (Discolouration is caused by overheating fuse &/or condensation plus tracking)	Inspector to determine if condition warrants remedial action.
(b)	Visually check for evidence of tracking on the epoxy switch and fuse bodies near the top of the cable termination shroud.	Inspector to determine if condition warrants remedial action.
(c)	Visually check for evidence of tracking, discharge or flashover on the cable termination below the shroud.	Inspector to determine if condition warrants remedial action.
(d)	Check inside cubicle for evidence of weeds, vermin, dust, condensation, rust, mechanical distortion.	Inspector to determine if condition warrants remedial action.
(e)	Check the vault for evidence of water.	If subject to flooding record defect to initiate remedial action.
(f)	Check vents are clear of obstruction.	Clear if accessible

8. RECORDING OF RESULTS

All of the results of inspection are to be recorded on the High Voltage Inspection Checklist, refer 9.4.

Any follow-up work required as a result of inspection must be recorded in SAP as a 'Distribution Defect'. A copy of the checklist is to be attached to the relevant 'IN' notification in SAP.

Additionally, all High Voltage Switchgear Checklists are to be individually stored in their respective categories at R:\Network\AssetOps\LineInspections\Maintenance Audit Tasks\HV GL Switchgear.

If any defects identified in the inspection process are deemed to be of a critical nature, the Network Management Maintenance Strategy Officer must be notified immediately.

9. REFERENCE DOCUMENTS

9.1 Network Maintenance Manual

Section 6.6 Maintenance Strategy - Ground Level Distribution Switchgear

9.2 Line Inspection Manual

Section 3.1 Ground Level Distribution Switchgear – Overview

9.3 Switching Operators Handbook

E3090 11kV Krone Switchgear

9.4 QMS Form – NM-F-201

http://intranet/network/qms/Forms/f-201.xls

3.6 F&G, GA24, GC10, GAC

1. PURPOSE OF DOCUMENT

This document details the procedures to be followed for the Inspection of F&G Type GA24, GC10, and GAC switchgear.

2. SAFETY

2.1 Personal Protective Equipment

Personnel involved in the inspection of cubicles containing Live HV Ground Level switchgear MUST wear Personal Protective Equipment in accordance with the SA Power Networks Switching Manual.

3. EQUIPMENT REQUIRED

The following equipment will be required to conduct inspection of F&G Type GA24, GC10, and GAC cubicle mounted switchgear.

- Personal Protective Equipment as detailed above
- RF Detector, Skills / Resources Required

4. SKILLS / RESOURCES REQUIRED

Inspections are to be conducted by an Asset Inspector who has completed formal training and demonstrated necessary competencies as determined by the Manager Network Asset Management.

Inspections are to be conducted by an Asset Inspector; the inspector shall have been accredited to inspect the switchgear covered by this procedure.

5. INSPECTION PROCEDURE

	Inspection item	Action if problems identified
	EXTERNAL:	
(a)	Prior to opening cubicle, check surrounds for evidence of tracking, discharge using an RF detector.	If significant discharge is indicated, ABANDON INSPECTION and arrange for dead inspection (P1).
	INTERNAL:	
(a)	Using RF detector, check for evidence of discharge on the cable terminations.	Inspector to determine if condition warrants remedial action.
(b)	Check cubicle for evidence of weeds, vermin, dust, condensation, rust, mechanical distortion.	Inspector to determine if condition warrants remedial action.
(c)	Check gas level.	Notify the Inspection Supervisor that the unit is unsuitable for LIVE operation if the *gas indicator needle is in the red range for the current ambient temperature, it should be considered as low gas pressure.* Raise Notification (P1) to initiate remedial action.

6. RECORDING OF RESULTS

All of the results of inspection are to be recorded on the High Voltage Switchgear Checklist, refer 7.4.

Any follow-up work required as a result of inspection must be recorded in SAP as a 'Distribution Defect'. A copy of the checklist is to be attached to the relevant 'IN' notification in SAP.

Additionally, all High Voltage Switchgear Checklists are to be individually stored in their respective categories at R:\Network\AssetOps\LineInspections\Maintenance Audit Tasks\HV GL Switchgear.

If any defects identified in the inspection process are deemed to be of a critical nature, the Network Management Maintenance Strategy Officer must be notified immediately.

7. REFERENCE DOCUMENTS

7.1 Network Maintenance Manual

Section 6.6 Maintenance Strategy - Ground Level Distribution Switchgear

7.2 Line Inspection Manual

Section 3.1 Ground Level Distribution Switchgear – Overview

7.3 Switching Operators Handbook

7.4 QMS Form – NM-F-201

http://intranet/network/qms/Forms/f-201.xls

3.7 MERLIN GERIN RM6

1. PURPOSE OF DOCUMENT

This document details the procedures to be followed for the Inspection of MERLIN GERIN TYPE RM6 switchgear.

2. SAFETY

2.1 Personal Protective Equipment

Personnel involved in the inspection of cubicles containing Live HV Ground Level switchgear MUST wear Personal Protective Equipment in accordance with the SA Power Networks Switching Manual.

3. EQUIPMENT REQUIRED

The following equipment will be required to conduct inspection of MERLIN GERIN TYPE RM6 cubicle mounted switchgear.

- Personal Protective Equipment as detailed above
- RF Detector

4. SKILLS / RESOURCES REQUIRED

Inspections are to be conducted by an Asset Inspector who has completed formal training and demonstrated necessary competencies as determined by the Manager Network Asset Management.

Inspections are to be conducted by an Asset Inspector; the inspector shall have been accredited to inspect switchgear covered by this procedure.

5. INSPECTION PROCEDURE

	Inspection item	Action if problems identified
	EXTERNAL:	
(a)	Prior to opening cubicle, check surrounds for evidence of tracking, discharge an RF detector	If significant discharge is indicated, ABANDON INSPECTION and arrange for dead inspection (P1).
	INTERNAL:	
(a)	Using RF detector, check for evidence of discharge on the cable terminations.	Inspector to determine if condition warrants remedial action.
(b)	Check cubicle for evidence of weeds, vermin, dust, condensation, rust, mechanical distortion.	Inspector to determine if condition warrants remedial action.
(c)	Check gas level.	Notify the *Inspection Supervisor* that the unit is unsuitable for LIVE operation if the needle is FULLY in the red. Raise Notification (P1) to initiate remedial action.

6. RECORDING OF RESULTS

All of the results of inspection are to be recorded on the High Voltage Switchgear Checklist, refer 7.4.

Any follow-up work required as a result of inspection must be recorded in SAP as a 'Distribution Defect'. A copy of the checklist is to be attached to the relevant 'IN' notification in SAP.

Additionally, all High Voltage Switchgear Checklists are to be individually stored in their respective categories at R:\Network\AssetOps\LineInspections\Maintenance Audit Tasks\HV GL Switchgear.

If any defects identified in the inspection process are deemed to be of a critical nature, the Network Management Maintenance Strategy Officer must be notified immediately.

7. REFERENCE DOCUMENTS

7.1 Network Maintenance Manual

Section 6.6 Maintenance Strategy - Ground Level Distribution Switchgear

7.2 Line Inspection Manual

Section 3.1 Ground Level Distribution Switchgear – Overview

7.3 Switching Operators Handbook

E3081 Merlin Gerin RM6

7.4 QMS Form – NM-F-201

http://intranet/network/qms/Forms/f-201.xls

3.7.1 ABB SAFERING RM6

1. PURPOSE OF DOCUMENT

This document details the procedures to be followed for the Inspection of ABB Safering RM6 switchgear.

2. SAFETY

2.1 Personal Protective Equipment

Personnel involved in the inspection of cubicles containing Live HV Ground Level switchgear MUST wear Personal Protective Equipment in accordance with the SA Power Networks Switching Manual.

3. EQUIPMENT REQUIRED

The following equipment will be required to conduct inspection of ABB Safering RM6 cubicle mounted switchgear.

- Personal Protective Equipment as detailed above
- RF Detector

4. SKILLS / RESOURCES REQUIRED

Inspections are to be conducted by an Asset Inspector who has completed formal training and demonstrated necessary competencies as determined by the Manager Network Asset Management.

Inspections are to be conducted by an Asset Inspector; the inspector shall have been accredited to inspect the switchgear covered by this procedure.

5. INSPECTION PROCEDURE

	Inspection item	Action if problems identified
	EXTERNAL:	
(a)	Prior to opening cubicle, check surrounds for evidence of tracking, discharge an RF detector	If significant RF discharge is indicated, ABANDON INSPECTION and arrange for dead inspection (P1)
	INTERNAL:	
(a)	Using RF detector, check for evidence of discharge on the cable terminations.	Inspector to determine if condition warrants remedial action.
(b)	Check cubicle for evidence of weeds, vermin, dust, condensation, rust, mechanical distortion.	Inspector to determine if condition warrants remedial action.
(c)	Check gas level.	Notify the *Inspection Supervisor* that the unit is unsuitable for LIVE operation if the needle is FULLY in the red. Raise Notification (P1) to initiate remedial action.

6. RECORDING OF RESULTS

All of the results of inspection are to be recorded on the High Voltage Switchgear Checklist, refer 7.4.

Any follow-up work required as a result of inspection must be recorded in SAP as a 'Distribution Defect'. A copy of the checklist is to be attached to the relevant 'IN' notification in SAP.

Additionally, all High Voltage Switchgear Checklists are to be individually stored in their respective categories at R:\Network\AssetOps\LineInspections\Maintenance Audit Tasks\HV GL Switchgear.

If any defects identified in the inspection process are deemed to be of a critical nature, the Network Management Maintenance Strategy Officer must be notified immediately.

7. REFERENCE DOCUMENTS

7.1 Network Maintenance Manual

Section 6.6 Maintenance Strategy - Ground Level Distribution Switchgear

7.2 Line Inspection Manual

Section 3.1 Ground Level Distribution Switchgear – Overview

7.3 Switching Operators Handbook

E3081 Merlin Gerin RM6

7.4 QMS Form – NM-F-201

http://intranet/network/qms/Forms/f-201.xls

3.7.2 ABB SAFELINK RM6

1. PURPOSE OF DOCUMENT

This document details the procedures to be followed for the Inspection of ABB Safelink RM6 switchgear.

2. SAFETY

2.1 Personal Protective Equipment

Personnel involved in the inspection of cubicles containing Live HV Ground Level switchgear MUST wear Personal Protective Equipment in accordance with the SA Power Networks Switching Manual.

3. EQUIPMENT REQUIRED

The following equipment will be required to conduct inspection of ABB Safelink RM6 cubicle mounted switchgear.

- Personal Protective Equipment as detailed above
- RF Detector

4. SKILLS / RESOURCES REQUIRED

Inspections are to be conducted by an Asset Inspector who has completed formal training and demonstrated necessary competencies as determined by the Manager Network Asset Management.

Inspections are to be conducted by an Asset Inspector; the inspector shall have been accredited to inspect the switchgear covered by this procedure.

5. INSPECTION PROCEDURE

	Inspection item	Action if problems identified
	EXTERNAL:	
(a)	Prior to opening cubicle, check surrounds for evidence of tracking, discharge an RF detector	If significant RF discharge is indicated, ABANDON INSPECTION and arrange for dead inspection (P1)
	INTERNAL:	
(a)	Using RF detector, check for evidence of discharge on the cable terminations.	Inspector to determine if condition warrants remedial action.
(b)	Check cubicle for evidence of weeds, vermin, dust, condensation, rust, mechanical distortion.	Inspector to determine if condition warrants remedial action.
(c)	Check gas level.	Notify the *Inspection Supervisor* that the unit is unsuitable for LIVE operation if the needle is FULLY in the red. Raise Notification (P1) to initiate remedial action.

6. RECORDING OF RESULTS

All the results of inspection are to be recorded on the High Voltage Switchgear Checklist, refer 7.4.

Any follow-up work required as a result of inspection must be recorded in SAP as a 'Distribution Defect'. A copy of the checklist is to be attached to the relevant 'IN' notification in SAP.

Additionally, all High Voltage Switchgear Checklists are to be individually stored in their respective categories at R:\Network\AssetOps\LineInspections\Maintenance Audit Tasks\HV GL Switchgear.

If any defects identified in the inspection process are deemed to be of a critical nature, the Network Management Maintenance Strategy Officer must be notified immediately.

7. REFERENCE DOCUMENTS

7.1 Network Maintenance Manual

Section 6.6 Maintenance Strategy - Ground Level Distribution Switchgear

7.2 Line Inspection Manual

Section 3.1 Ground Level Distribution Switchgear – Overview

7.3 Switching Operators Handbook

E3083 ABB Safelink RM6

7.4 QMS Form – NM-F-201

http://intranet/network/qms/f-201.xls

3.7.3 VISTA RM6

1. PURPOSE OF DOCUMENT

This document details the procedures to be followed for the Inspection of Vista RM6 switchgear.

2. SAFETY

2.1 Personal Protective Equipment

Personnel involved in the inspection of cubicles containing Live HV Ground Level switchgear MUST wear Personal Protective Equipment in accordance with the SA Power Networks Switching Manual.

3. EQUIPMENT REQUIRED

The following equipment will be required to conduct inspection of VISTA RM6 cubicle mounted switchgear.

- Personal Protective Equipment as detailed above
- RF Detector

4. SKILLS / RESOURCES REQUIRED

Inspections are to be conducted by an Asset Inspector who has completed formal training and demonstrated necessary competencies as determined by the Manager Network Asset Management.

Inspections are to be conducted by an Asset Inspector; the inspector shall have been accredited to inspect the switchgear covered by this procedure.

5. INSPECTION PROCEDURE

	Inspection item	Action if problems identified
	EXTERNAL:	
(a)	Prior to opening cubicle, check surrounds for evidence of tracking, discharge an RF detector	If significant RF discharge is indicated, ABANDON INSPECTION and arrange for dead inspection (P1)
	INTERNAL:	
(a)	Using RF detector, check for evidence of discharge on the cable terminations.	Inspector to determine if condition warrants remedial action.
(b)	Check cubicle for evidence of weeds, vermin, dust, condensation, rust, mechanical distortion.	Inspector to determine if condition warrants remedial action.
(c)	Check gas level.	Notify the *Inspection Supervisor* that the unit is unsuitable for LIVE operation if the needle is FULLY in the red. Raise Notification (P1) to initiate remedial action.

6. RECORDING OF RESULTS

All of the results of the inspection are to be recorded on the High Voltage Switchgear Checklist, refer 7.4.

Any follow-up work required as a result of inspection must be recorded in SAP as a 'Distribution Defect'. A copy of the checklist is to be attached to the relevant 'IN' notification in SAP.

Additionally, all High Voltage Switchgear Checklists are to be individually stored in their respective categories at R:\Network\AssetOps\LineInspections\Maintenance Audit Tasks\HV GL Switchgear.

If any defects identified in the inspection process are deemed to be of a critical nature, the Network Management Maintenance Strategy Officer must be notified immediately.

7. REFERENCE DOCUMENTS

7.1 Network Maintenance Manual

Section 6.6 Maintenance Strategy - Ground Level Distribution Switchgear

7.2 Line Inspection Manual

Section 3.1 Ground Level Distribution Switchgear – Overview

7.3 Switching Operators Handbook

E3087 Vista RM6

7.4 QMS Form – NM-F-201

http://intranet/network/qms/Forms/f-201.xls

3.7.4 XIRIA RM6

1. PURPOSE OF DOCUMENT

This document details the procedures to be followed for the Inspection of Xiria RM6 switchgear.

2. SAFETY

2.1 Personal Protective Equipment

Personnel involved in the inspection of cubicles containing Live HV Ground Level switchgear MUST wear Personal Protective Equipment in accordance with the SA Power Networks Switching Manual.

3. EQUIPMENT REQUIRED

The following equipment will be required to conduct inspection of Xiria RM6 cubicle mounted switchgear.

- Personal Protective Equipment as detailed above
- RF Detector

4. SKILLS / RESOURCES REQUIRED

Inspections are to be conducted by an Asset Inspector who has completed formal training and demonstrated necessary competencies as determined by the Manager Network Asset Management.

Inspections are to be conducted by an Asset Inspector; the inspector shall have been accredited to inspect the switchgear covered by this procedure.

5. INSPECTION PROCEDURE

	Inspection item	Action if problems identified
	EXTERNAL:	
(a)	Prior to opening cubicle, check surrounds for evidence of tracking, discharge an RF detector	If significant RF discharge is indicated, ABANDON INSPECTION and arrange for dead inspection (P1)
	INTERNAL:	
(a)	Using RF detector, check for evidence of discharge on the cable terminations.	Inspector to determine if condition warrants remedial action.
(b)	Check cubicle for evidence of weeds, vermin, dust, condensation, rust, mechanical distortion.	Inspector to determine if condition warrants remedial action.
(c)	Check gas level.	Notify the *Inspection Supervisor* that the unit is unsuitable for LIVE operation if the needle is FULLY in the red. Raise Notification (P1) to initiate remedial action.

6. RECORDING OF RESULTS

All of the results of inspection are to be recorded on the High Voltage Switchgear Checklist, refer 7.4.

Any follow-up work required as a result of inspection must be recorded in SAP as a 'Distribution Defect'. A copy of the checklist is to be attached to the relevant 'IN' notification in SAP.

Additionally, all High Voltage Switchgear Checklists are to be individually stored in their respective categories at R:\Network\AssetOps\LineInspections\Maintenance Audit Tasks\HV GL Switchgear.

If any defects identified in the inspection process are deemed to be of a critical nature, the Network Management Maintenance Strategy Officer must be notified immediately.

7. REFERENCE DOCUMENTS

7.1 Network Maintenance Manual

Section 6.6 Maintenance Strategy - Ground Level Distribution Switchgear

7.2 Line Inspection Manual

Section 3.1 Ground Level Distribution Switchgear – Overview

7.3 Switching Operators Handbook

E3073 Xiria RM6

7.4 QMS Form – NM-F-201

http://intranet/network/qms/Forms/f-201.xls

3.8 OIL FILLED SWITCHGEAR

1. PURPOSE OF DOCUMENT

This document details the procedures to be followed for the Inspection of various types of oil filled switchgear.

2. SAFETY

2.1 Personal Protective Equipment

Personnel involved in the inspection of cubicles containing Live HV Ground Level switchgear MUST wear Personal Protective Equipment in accordance with the SA Power Networks Switching Manual.

3. EQUIPMENT REQUIRED

The following equipment will be required to conduct inspection of oil filled switchgear.

- Personal Protective Equipment as detailed above
- RF Detector ('Sniffer Stick')
- Infra Red thermometer

4. SKILLS / RESOURCES REQUIRED

Inspections are to be conducted by Asset Inspectors who have completed formal training and demonstrated necessary competencies as determined by the Manager Network Asset Management.

Inspections in CBD are to be conducted by two Asset Inspectors working together. These inspectors shall have been accredited to inspect oil filled switchgear. One Officer is to conduct the Inspection, while the other shall act as the Safety Observer. In circumstances where two accredited inspectors are not available, it is permissible for a trained switching operator to act as the safety observer.

Inspections in outer metro area may be conducted by a single Asset Inspector in accordance with above instructions.

5. LIVE INSPECTION

	Inspection item	Action if problems identified
(a)	Check oil level.	If low or not visible assign P1 and raise defect for corrective maintenance.
(b)	Using an infra-red thermometer, scan accessible parts of switchgear for hotspots.	If absolute temperature exceeds 60º C assign P1 and raise defect for corrective maintenance. Consider ringing NOC for immediate action.
(c)	Using RF sniffer, scan accessible parts of switchgear for evidence of tracking or discharge. Check also for presence of ozone.	If significant assign P1 and raise defect for corrective maintenance.
(d)	Visually check condition of operating mechanism, particularly evidence of excessive corrosion or mechanical damage and oil leaks.	If significant assign P1 and raise defect for corrective maintenance.

	Inspection item	Action if problems identified
(e)	Check tank for evidence of condensation, rust and mechanical distortion.	Inspector to determine if condition warrants remedial action. If necessary raise defect for corrective maintenance.

6. RECORDING OF RESULTS

All of the results of inspection are to be recorded on the High Voltage Switchgear Checklist, refer 7.4.

Any follow-up work required as a result of inspection must be recorded in SAP as a 'Distribution Defect'. A copy of the checklist is to be attached to the relevant 'IN' notification in SAP.

Additionally, all High Voltage Switchgear Checklists are to be individually stored in their respective categories at R:\Network\AssetOps\LineInspections\Maintenance Audit Tasks\HV GL Switchgear.

If any defects identified in the inspection process are deemed to be of a critical nature, the Network Management Maintenance Strategy Officer must be notified immediately.

7. REFERENCE DOCUMENTS

7.1 Network Maintenance Manual

Section 6.6 Maintenance Strategy - Ground Level Distribution Switchgear

7.2 Line Inspection Manual

Section 3.1 Ground Level Distribution Switchgear – Overview

7.3 Switching Operators Handbook

7.4 QMS Form – NM-F-201

http://intranet/network/qms/Forms/f-201.xls

3.9 GROUND LEVEL TRANSFORMERS/REGULATOR STATIONS

1. PURPOSE OF DOCUMENT

This document details the procedures to be followed for the inspection of ground level transformer and regulator stations.

2. PURPOSE OF INSPECTION

Inspection of transformer and regulator stations is conducted to assess the condition of equipment located within them. The inspection is to identify those components that have deteriorated to the extent that failure of that component is likely. Emphasis is placed on identification and management of known hazards and failure modes which could jeopardise the:

- Safety of the Public, Employees and Operators; and
- Continuity of supply to customers.

3. DEFINITIONS

A ***substation*** is an electrical installation typically comprising of high voltage power transformers, circuit breakers, switching and control equipment and busbars, and has been allocated a System Switching Diagram (SSD) Number.

A ***ground level station*** is an electrical installation which may comprise one or more transformers (other than a padmounted type) or switchgear, exposed bus bars and an enclosure into which a person can enter, and which has not been allocated a Switching System Designation (SSD) number. A key distinction between substations and ground level transformer stations is that the latter do not have high voltage switching and control equipment (ie circuit breakers).

An ***enclosed type ground level transformer station*** is a ground level transformer station which is enclosed by walls and a roof normally supplied by the customer to SA Power Networks requirements.

An ***open type ground level transformer station*** is a ground level transformer station, which is open to the sky and enclosed by a chain wire mesh fence supplied by SA Power Networks, or other suitable fencing supplied by the customer to SA Power Networks requirements.

Substation Access Licence (Level 2) provides authority to a person who has been instructed in the identification of high and low voltage overhead conductors and the safety aspects of work near live powerlines as specified in the Regulations under the Electricity Act 1996 part 4 subdivision 3.

4. SAFETY

4.1 Personal Protective Equipment

Personnel involved in the inspection of cubicles containing Live HV Ground Level switchgear MUST wear Personal Protective Equipment in accordance with the SA Power Networks Switching Manual.

5. EQUIPMENT REQUIRED

The following equipment will be required to conduct inspection of Ground Level Transformer Stations.

- Personal Protective Equipment as detailed above.

6. SKILLS / RESOURCES REQUIRED

Inspections are to be conducted by Asset Inspectors who have completed formal training and demonstrated necessary competencies as determined by the Manager Network Asset Management.

Generally, inspections will be conducted by a single Asset Inspector accredited to carry out inspections in Ground Level transformer stations.

Should two inspectors be required for safety reasons (eg in CBD), one officer is to conduct the inspection, while the other shall act as the Safety Observer and Checker. In circumstances where two accredited inspectors are not available, it is permissible for a trained switching operator to act as the safety observer.

6.1 Access Procedure

No person, employee of SA Power Networks, or otherwise, may enter a ground level transformer station without authorisation from SA Power Networks and the approval of the Network Operations Centre. Complete access procedures for transformer stations are available in the SA Power Networks "Substation Instructions" section 2.

1. The minimum authorisation level for SA Power Networks employees to gain access to ground level transformer stations is a "Substation Access Licence" Level 2.
2. The authorisation for contractors to gain access to ground level transformer stations is provided by NOC (Network Permit Access) or his nominated delegate following the successful completion of prescribed training and accreditation.
3. The authorisation of contractors without accreditation is provided by a site induction carried out by a suitably qualified SA Power Networks Officer in accordance with the relevant instructions in the Substation Induction & Checklist as per the Substation Instructions, Section 2.1. The proposed work must be discussed with the contractor to ensure that he/she is aware of the potential hazard(s) involved. **The contractor will be required to work on site under the supervision of a Safety Observer (SA Power Networks accredited officer) at all times who will have complete authority over the contractor and/or their personnel regarding movements in danger areas.**
4. All ground level transformer stations must be secured with an SA Power Networks P1 lock. Sites currently secured with an "All Gates" lock must either have the lock (padlock) replaced at the time of inspection, or identified for replacement by a locksmith at a later date. (Identify location on checklist).

7. ENTRY RESTRICTIONS

Do not enter live ground level transformer stations where signage indicates that entry is not permitted.

Signage which does not permit entry indicates that entry when energised would compromise regulatory requirements. (Electrical clearances may not be to current construction standards).

8. APPROACH LIMITS

The approach limits and clearances of new ground level transformer stations conform to current design regulations. However, older stations may be built to imperial standards and may not provide approach limits to be expected in new stations.

The approach limits, set out in Table 1 and illustrated in Figure 1, must be complied with at all times. Table 1 has been reproduced (up to 66kV) from Substation Maintenance, Section 2, "Safe Working and Operational" - Preparation (sub-section 2.5, "Minimum High Voltage Clearances") and requires that:

"No person shall come or bring any part of his/her body or anything he/she wears, or cause any conducting object (including green or damp timber) to be brought within the following distance of any exposed live high voltage conductor. These clearances are the basic factor around which the working procedures are built. Only under approved circumstances shall anyone work closer to exposed high voltage conductors than these clearances allow".

Voltage	Approach Limit
Up to and including 11 kV	300 mm
33 kV	450 mm
66 kV	700 mm

Table 1: APPROACH LIMITS

Note, in some circumstances (eg long lengths of conducting material, a tall person), it will be necessary to exercise extra caution to ensure that approach limits are complied with.

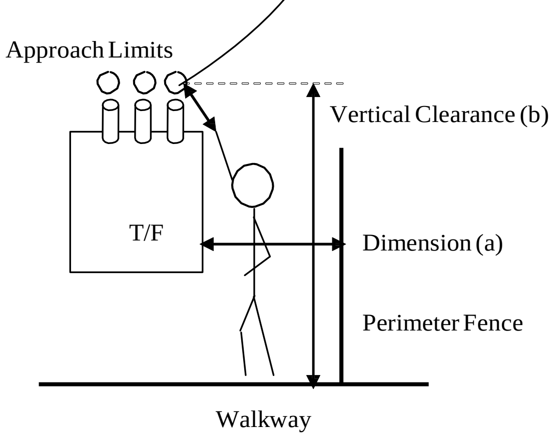


Figure 1

9. INSPECTION PROCEDURE

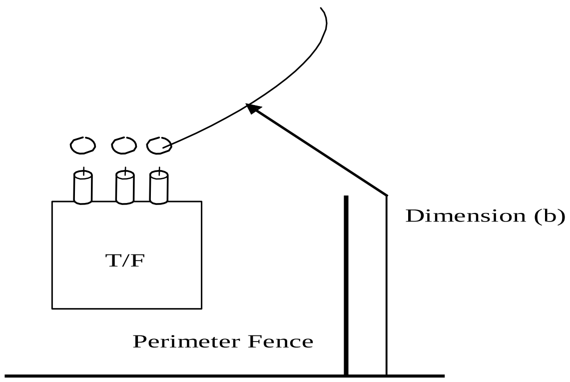


Figure 2

Clearance Requirement (Refer to Figure 2)	Dimension	Priority
Dimension (b), clearance to live conductors measured from ground over the T/F station perimeter fence.	b < 3.0m	2

Table 2: EXTERNAL CLEARANCE FOR 11kV & 33kV GROUND LEVEL TRANSFORMER AND REGULATOR STATIONS

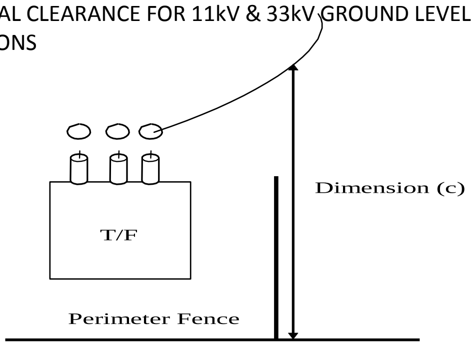


Figure 3

Existing vehicular application in the vicinity of the Ground Level Transformer Station	Requirement for Dimension (c), clearance to bare conductor outside of perimeter fence (Refer to Figure 3)	Priority
Road or vehicle loading area adjacent to perimeter fence.	c < 6.7m	2
Yard accessed by vehicles, but road or vehicle loading area is not adjacent to perimeter fence.	c < 6.0m	2
No vehicular access possible in the vicinity of the perimeter fence.	c < 4.5m	2

Table 3: VEHICULAR ACCESS CLEARANCES FOR 11kV & 33kV GROUND LEVEL TRANSFORMER AND REGULATOR STATIONS

9.1 Signage Requirements

Consider the process of entering an energised ground level TF station while standing in an upright position (arms at side). Signage shall be installed in accordance with Table 4 below where the **minimum horizontal clearance**, dimension (a), and the **minimum vertical clearance**, dimension (b) from exposed HV buswork / conductors is not achieved (refer Figure 1).

Clearance Requirement (Refer to Figure 1)		**Voltage**	**Signage Requirement (refer Drawing 184/KS/DS00646)**	**Priority**
a < 900mm	b < 2591 mm (8' 6")	11 kV	LOW CLEARANCES. ISOLATE AND EARTH HIGH VOLTAGE BEFORE ENTERING.	2
a < 1050mm	b < 2743 mm (9')	33 kV	AS ABOVE.	2
a < 1300mm	b < 3048 mm (10')	66 kV	AS ABOVE.	2

Table 4: SIGNAGE REQUIREMENTS

10. WEED CONTROL

Weed control is considered to be a restricted activity as defined in the Substation Maintenance, Section 2, "Safe Working and Operational" - Preparation (sub-section 2.6.2, "Requirements of a Work Area"). Consequently, roped off work areas are not required.

- These duties may only be carried out by authorised persons using appropriate approved equipment.
- Approach limits must be observed at all times. **Under the circumstances of weed control, the approach limit for LV will be 300 mm**.
- Such work must only be carried out at ground level, or on work platforms designed to give the required clearance to live equipment.

11. RECORDING OF RESULTS

All follow-up work required as a result of inspection MUST be recorded in SAP as a "Distribution Defect".

The results of inspection are to be recorded on the "High Voltage Switchgear Inspection Checklist" - and **results attached to the relevant IN inspection notification in SAP.** Results are stored in SAP for analysis and initiation of any follow-up or remedial action.

12. REFERENCE DOCUMENTS

The Electricity Act 1996.

Australian Standard AS 2067.

SA Power Networks Substation Maintenance.

SA Power Networks Substation Design.

Network Directives Manual.

Network Maintenance Manual:

- 6.7 Maintenance Strategy - Ground Level Transformer and Regulator Stations - Visual Inspection Only.

SA Power Networks Switching Operator Handbook.

SA Power Networks Substation Instructions.

SA Power Networks Substation Inspection Manual

GROUND LEVEL TRANSFORMER STATION - Inspection Check List

TF NUMBER	LOCATION	DATE	INSPECTOR/S	TYPE
				Enclosed ( ) Open ( )
AIR TEMP °C=		TIME		DEAD INSPECTION REQUIRED
HUMIDITY % =	Feeder No.			Yes ( ) No ( )

ITEM / COMPONENT	INSPECTION	CHECK TICK	PRIORITY	COMMENT
SAFETY.				
Clearances.	Safe working clearances. T.S.I No.11.Sect. 3.9A & B.			Meets SA Power Networks standard. Yes ( ) No ( )
Access barriers	Required / Condition.			
Signage	Correct & legible.			
SECURITY				
Locks	Correct type / Operational.			
Gates / Doors / Fences / Buildings.	Condition / integrity / overhangs / Operational.			
ENCLOSURES / GENERAL				
Location.	Access			
Footings / Base	Secure / cracked / erosion / *corrosion*			
Doors / Gates	Operational / Access / Exits.			
Numbering	Correct / Legible.			
Ventilation	Unobstructed..			
Cabling	Condition / Joints / Markings.			
Insulators	Damaged / Polluted / Flashed over / Tracking.			
Busbars	Connections / Clamps.			
Clah / Arcing horns	Condition / Gap settings.			
Earthing	Cables / Joints / Leads.			
Weeds / Rubbish / Vermin / Spiders / Pollution	Growth / build up / Excessive amount.			
TRANSFORMER				
Bushings	Condition / Oil leaking.			
Tank	Condition / Oil leaking / Rust.			
Oil level	Sight glass.			
SWITCHGEAR				
HV Switchgear	Condition RMU / DFs / Fuses / Ods / Ads etc.			
LV switchgear	Condition Isolators / Fuses / CBs.			
ANCILLARY EQUIPMENT				
Vent / Fan / Lighting	Operational.			
Power outlets	Operational / RCD stickers req,d.			
Sumps / Drains	Clear / Seepage.			
Fire protection	Alarms / Extinguishers within test date.			

13. GROUND LEVEL TRANSFORMER DEFECT PRIORITY GUIDE FOR LOW OIL LEVEL AND OIL LEAKS

OIL LEVEL		OIL LEAK RATE					COMMENT
		NO LEAK	DRY STAIN	WEEPING	DRIPPING (< 2 drops/min)	DRIPPING (> 2 drops/min)	
Very Low	**Top up oil**	B	B	B	B	B	• Oil level not visible • Oil level < 15 C or minimum oil mark • Oil level near zero or bottom of gauge
	Fix Leak	NA	4	3	3	2	
Low	Top up oil	2	2	1	1	B	Oil level below normal *
	Fix Leak	NA	4	3	3	2	
Normal	Top up oil	3	3	3	2	1	Oil level at correct level taking into account transformer operating temperature
	Fix Leak	NA	4	3	3	2	
High	Top up oil	NA	NA	3	3	2	Oil level above normal *
	Fix Leak	NA	4	3	3	2	
Cannot Read Gauge	Top up oil	B	B	B	B	B	Same as "Very Low"
	Fix Leak	NA	4	3	3	2	

DEFECT PRIORITY	RESPONSE TIME
B	IMMEDIATE
1	4 weeks
2	6 months
3	2 years
4	Review

For **Priority B jobs**, please contact NOC to raise FM Notification for immediate action.

***Normal oil level**

- The oil level in a transformer varies with the temperature of the oil, which in turn is dependent on the ambient temperature and the load on the transformer.
- The correct (or normal) oil level corresponds with the average temperature of the oil – for a transformer, which has been off load for some time (ie > 12 hrs) this should correspond with the ambient temperature (approximately).
- For loaded transformers the temperature of the oil can be estimated by using the WTI temperature as follows:

  Approx transformer oil temp = WTI reading – 15ºC
- For example; WTI reads 65ºC, then approx oil temperature is 50ºC and therefore normal oil level will correspond with conservator approximately 50% full.

3.10 OVERHEAD DISTRIBUTION EARTHING

1. PURPOSE OF DOCUMENT

This document describes the types of inspections required for earthing systems currently in operation within SA Power Networks' overhead distribution system.

2. PURPOSE OF INSPECTION

Inspection of SA Power Networks earthing systems is conducted to assess the condition of accessible components and to identify hazards and components that have deteriorated to the extent that failure of the equipment is likely. Emphasis is placed on identification and management of known hazards and component failure modes which could jeopardise the:

- Safety of the Public, Employees and Operators;
- Safety of SA Power Networks equipment; and
- Continuity of supply to customers.

3. DEFINITIONS

The **Inspection Planning Working Group (IPWG)** brings together personnel from the Network Asset Management & Network Standards & Performance Groups on a regular basis to manage asset inspections.

4. CMEN AREAS

Visual check only is required as part of inspection procedures to ensure that the neutral is bonded to the pole.

5. MEN AREAS

Earth systems, including earth resistance, must be checked and maintained in accordance with E1003 sheet 2 table 1.

6. SWER

Earth systems, including earth resistance, must be checked and maintained in accordance with E1450, E1451, E1452, and E1453.

Two earth (HV bonded to pole) and aluminium installations (constructed generally between 1972 and 1986) should be checked in the first instance.

Sample inspections as determined by the *Inspection Planning Working Group* are required each year, with sample locations selected taking failures and operational experience into account. Where a high level of defects is identified in the sample, the Network Asset Management group should be consulted to determine what further action may be necessary.

7. REFERENCE DOCUMENTS

7.1 Network Maintenance Manual

6.9 Maintenance Strategy Distribution System Earths.

7.2 SA Power Networks E Drawings

3.11 UNDERGROUND DISTRIBUTION EARTHING

1. PURPOSE OF DOCUMENT

This document describes the types of inspections required for earthing systems currently in operation within SA Power Networks' underground distribution system.

2. PURPOSE OF INSPECTION

Inspection of SA Power Networks earthing systems is conducted to assess the condition of accessible components and to identify hazards and components that have deteriorated to the extent that failure of the equipment is likely. Emphasis is placed on identification and management of known hazards and component failure modes which could jeopardise the:

- Safety of the Public, Employees and Operators;
- Safety of SA Power Networks equipment; and
- Continuity of supply to customers.

3. DEFINITIONS

The **Inspection Planning Working Group (IPWG)** brings together personnel from the Network Asset Management & Network Standards & Performance Groups on a regular basis to manage asset inspections.

4. CMEN AREAS

Check that all earthing conductors are connected to an earth bar and/or an earth stake.

5. MEN AREAS

Test resistance to earth of:

- Padmount Transformer: - (earth resistance less than 10 ohms).
  Installations are to be tested when the padmount transformer is inspected.

- At any location: - (neutral earth resistance less than 10 ohms).
  Some sample locations in each area are to be checked when the adjacent underground equipment is inspected.

6. HV SINGLE PHASE TO NEUTRAL SYSTEMS

Prove Neutral continuity.

Testing a 15 % minimum sample of neutral cable segments is required annually for single phase systems on the basis of a different one sixth of the systems each year, with sample locations selected taking failures and operational experience into account. Where a high level of defects is identified in the sample, the *Network Asset Management group* should be consulted to determine what further action may be necessary.

7. PUBLIC LIGHTING

Problem locations for public lighting columns with two wire systems are to be checked as directed by the *Inspection Planning Working Group* and upgraded where the column earth resistance is greater than 10 ohms.

8. REFERENCE DOCUMENTS

8.1 Network Maintenance Manual

6.9 Maintenance Strategy Distribution System Earths.

8.2 SA Power Networks E Drawings

3.12 NON STANDARD POLES

1. PURPOSE OF DOCUMENT

This document details the processes to be followed for the inspection of Non Standard Poles.

2. PURPOSE OF INSPECTION

Inspection of poles is conducted to assess the condition of poles to identify those components that have deteriorated to the extent that failure of the pole is likely. Emphasis is placed on identification and management of known hazards and failure modes which could jeopardise the:

- Safety of the Public, Employees and Operators; and
- Continuity of supply to customers.

3. DEFINITIONS

Railway Section Steel Pole means a single length of steel railway track used as a pole to support an overhead power line.

4. GENERAL

Inspection of Non Standard Poles may be requested by the IPWG.

For constructions not covered in this document, consult with the *Network Asset Management Group*.

5. SAFETY

5.1 Disposal of Pole Waste Products

CCA impregnated timber poles or part of a pole must never be burnt due to the dangerous residual chemicals retained in the ash.

Waste products from testing and chips from scarfing an impaired or condemned pole must be collected and either disposed of at the nearest earth fill municipal tip or buried in the bottom of the excavation.

5.2 Sterilisation of Equipment

All equipment that comes in contact with soft rot decay waste shall be sterilised upon completion of testing a pole. Use either Methylated Spirits or Hypo-chlorite of which White King household detergent is a typical example.

6. EQUIPMENT REQUIRED

SKILLS / RESOURCES REQUIRED

ACCESS PROCEDURE

6.1 Inspection and Testing Procedure on Wooden Poles

Wooden poles are to be inspected in accordance with the instructions given below.

The rate of wood pole deterioration depends on the species of timber, the initial preservative treatment, installation location and soil conditions. Decay occurs when both moisture and oxygen are present, typically in conditions from the ground level to approximately 300 mm below ground level.

Basic inspection above ground line consists of two parts: a visual inspection and a sound test.

6.1.1 Visual inspection above ground line

A visual inspection of the pole above ground shall be carried out to determine if there is excessive splitting of the pole or obvious signs of white ant attack. Check for fungal fruiting bodies growing on the outside surface of the pole, as this usually indicates significant decay below the surface. Clear and inspect around the base of the pole for obvious signs of soft rot or diminished diameter.

6.1.2 Sound test of pole above the ground line

The pole may be sounded by striking it with a hammer, from the ground line to as high as can be reached. Check if the sounding indicates a hollow pole.

These two inspections will aid the pole inspector to decide if further investigation of the pole is required. If this is the case, carry out a full inspection. Otherwise, the pole is serviceable.

If a full inspection is required then proceed as follows.

6.1.3 Full inspection

1. Open up the ground around the pole to a depth of 300mm, avoiding damage to kerbs, drains, paved surfaces, etc. as far as possible.
2. Scrape but DO NOT CHOP all dirt, decayed and useless wood until sound timber is exposed all round the pole from 300mm above ground line to 300mm below ground line.
3. Measure minimum diameter of sound timber. If this measurement is found to be less than 30% of the original diameter the pole should be replaced.
4. Reinstate ground around the pole. Report any damage to kerbing, drains or pavement so that prompt arrangements may be made to repair this damage.

6.1.4 Telstra Poles

These structures are to be visually checked at the time of inspecting the adjacent distribution system. In HBFRAs, insulated conductor must be used to attach to these poles. Any substandard pole must be replaced, or the SA Power Networks equipment removed. The relevant authority is to be urgently notified by telephone and should be followed up by a written confirmation. Management of the condition of a Telecom pole and associated liability is addressed within the commercial agreements covering joint use. This agreement will be reviewed to ensure that SA Power Networks' interests are adequately protected.

6.2 Inspection and Testing Procedure of Railway Iron Poles

Second hand railway steel sections have been used for service poles, crossover poles and private poles in different parts of Australia for many years. While the section and strength would appear to be strong enough for some applications, experience shows that second hand rail may not be safe due to an unpredictable degree of crystallisation of the steel caused by work hardening effects of rail traffic over many years.

The effect of the crystalline changes is to make the steel brittle. Around Australia, there have been a number of incidents of brittle fracture when rail sections have been subjected to additional shock loading. For example, failure when a ladder is placed against a pole, and when making changes to pole top arrangements.

A rail section also has a relatively thin bottom flange that is more susceptible to corrosion (particularly near ground level) than other parts of the section. Any significant corrosion leads to some reduction in cross section of the flange that reduces the strength of the pole.

Some rail sections were manufactured with notches at intervals along the bottom flange. These notches were used to facilitate breaking the rail into lengths and as a consequence are a weak spot.

Welding of railway section steel poles can cause a reduction in the cross-sectional area similar to a notch. Welding can also make the steel more brittle.

Most existing railway section steel poles support older, lighter service conductor, often with a wooden raiser to increase ground clearances. They may be of inadequate strength for the heavier services now used.

6.3 Inspection Procedure

6.3.1 Minimum Railway Section Steel Poles Dimensions

The manufactured cross section of a *railway section steel pole*, needs to be sufficiently large to adequately meet wind and tension loading of the standard service conductors now used.

A *railway* section less than 110mm (rail height) x 105mm (flange width) shall be given a defect priority of P4. (*Record for location only.*)

6.3.2 Test for Corrosion

A rail section has a relatively thin bottom flange that is more susceptible to corrosion than other parts of the section. Any significant corrosion leads to some narrowing of the flange that reduces the strength of the pole, particularly when corrosion occurs near ground level.

An acceptable test developed in Victoria to determine significant corrosion, is to tap the flange with a hammer. Any severe corrosion is dislodged, while sound metal remains intact.

If rust is dislodged from the flange so that narrowing occurs, a railway section steel pole can be judged as having impaired strength.

Any reduction of 5mm or more at each edge of the flange in the area from just below ground level (approx 100mm) to approximately 2m above ground should be recorded for replacement.

6.3.3 Notches in, or Narrowing of, the Pole Cross Section

Some rail sections were manufactured with notches at intervals along the bottom flange. These notches were used to facilitate breaking the rail into lengths and as such are weak spots.

Similarly, notches or narrowing in other parts of the pole are weak spots.

Notches in the bottom flange in the area from just below ground level (approx 100mm) to approximately 2m above ground of the pole, P4. (*Record for location only.*)

Notches or narrowing of the cross section in the area from just below ground level (approx 100mm) to approximately 2m above ground of the pole, P4. (*Record for location only.*)

6.3.4 Evidence of Welding

Welding of *railway section steel poles*, or welding attachments to *railway section steel poles*, can cause a reduction in the cross-sectional area similar to a notch and consequently create a weak spot. The welding process can also make the steel more brittle.

The pole is to be inspected for welded sections from just below ground level (approx 100mm) to the top of the pole.

The pole is to be inspected for welded attachments from just below ground level (approx 100mm) to approximately 2m above ground.

Poles that are made-up of welded sections in the area from just below ground (approx 100mm) level to the top of the pole, P4. (*Record for location only.*)

Poles that have attachments welded to it in the area from just below ground level (approx 100mm) to approximately 2m above ground, P4. (*Record for location only.*)

6.3.5 Leaning Poles

Check that the pole is not leaning at more than the allowable angle of 15 degrees. (1000:268)

The process of straightening a leaning pole could cause the pole to fail. Poles that are leaning more than 15º are to be given a defect priority of P3.

6.4 Inspection and Testing Procedure on NON Railway Iron Poles

Steel and steel concrete poles have been used in Australian distribution networks for over fifty years. The following types of poles are currently in use in the distribution network, including customer services, customer private powerline*s* and street lighting:

- Steel lattice poles;
- Steel lattice towers;
- Round steel poles, including tramways poles; and
- RHS section steel poles.

Deterioration of steel occurs mainly due to corrosion and depends on the installation location and footing conditions. Corrosion occurs when both moisture and oxygen are present, typically in conditions from the ground level to approximately 300 mm below ground level.

6.5 Inspection Procedure

6.5.1 Steel Poles

Observe the general condition of the part of the pole above ground, with attention to the vertical alignment, rust, loose or missing bolts, nuts and fittings, condition of earths and other ancillary fittings.

Clear and inspect pole at ground line and check for metal fatigue by tapping with a hammer. Corrosion can be detected by rust particles being dislodged, while sound metal remains intact. Excavate to a depth of 200mm around the pole or tower base. Scrape off any external rust to expose the extent of rust penetration.

Look for signs of metal fatigue (cracking), especially around holes, section changes and welded seams on poles. Examine any outreach arm for metal fatigue at welds and connection points.

Steel poles set in concrete generally have a minimum thickness of 100mm concrete around the pole down to 25mm below the pole depth. Check for cracks or spalling of the concrete. If wide cracks (3mm) are detected, inspect below ground level by digging around the concrete to a depth of 300mm.

Refer to Stobie Pole ground Line corrosion assessment **Section 3:25** and apply similar methodology.

Damage from vehicles can cause high stress at impact area. In round section material, small dents are acceptable, but large deformations over a third of the diameter may cause serious structural damage. For rectangular or angle sections, if the depth of the dent is more than 50mm the pole is to be considered P2. If more than 100mm, the pole is to be P1 for replacement.

Steel poles that have a lean of more than 15º should be recorded as P2.

7. OTHER ACTIVITIES RELATED TO POLE INSPECTION

7.1 Reinstatement of Ground Surface

After completion of the inspection and maintenance treatment, the ground surface around the pole shall be reinstated as neatly as possible.

In bitumen and concrete pavements, reinstatement shall be done as agreed with the concerned local council.

8. RECORDING OF RESULTS

All follow-up work required as a result of inspection MUST be recorded in SAP as a "Distribution Defect".

8.1 References

8.1.1 Network Maintenance Manual

6.3 Maintenance Strategy – Overhead Distribution Assets.

3.13 SERVICES

FOR FUTURE DOCUMENTATION

3.14 CUSTOMER WIRING INSTALLATION

1. PURPOSE OF DOCUMENT

This document details the procedures to be followed for the Inspection of Customers installations.

Refer to QA pro cedure 11 7 ‘ Procedures for Dealing with Defective electrical Installations.”

2. EXTENT OF INSPECTION

SA Power Networks has **no** statutory duty to inspect customer’s premises.

3.15 SUB-TRANSMISSION LINE COMPONENT INSPECTION (CI)

1. PURPOSE OF DOCUMENT

This document details the procedures to be followed for the Component Inspection (CI) of Sub Transmission Lines

2. PURPOSE OF COMPONENT INSPECTION

Component Inspection (CI) of overhead Sub Transmission Lines is conducted, as a supplement to either a Thermographic Inspection (TI) or ground based Pre-Fire Danger Season Patrols, to assess the condition of the asset to identify components that have deteriorated to the extent that failure is likely. Obvious hazards that may lead to Injury to members of the public, potential bushfire start or supply interruption are also identified and recorded.

In particular, emphasis is placed on identification and management of hazards and potential failures which jeopardise the:

- Safety of the Public, Employees and Operators;
- Protection of the Environment (particularly Bushfire Start Potential); and
- Achievement of required reliability / availability criteria.

3. DEFINITIONS

A **Component Inspection** is defined as a methodical, detailed, visual examination of the condition of SA Power Networks Power Delivery Asset concentrating on all identified failure modes and hazards associated with that asset.

Ground Based Component Inspections are carried out from a ground based vehicle. A truck, four wheel drive, motor bike car or by foot.

Aerial Based Component Inspections are carried out from a helicopter.

Ground Components are defined as poles, towers, footings and guywires.

Overhead Components are defined as everything other than Ground Components.

Sub Transmission Lines are all lines energised at 33kV and 66kV, but excluding those 33kV lines where the primary function is to provide supply directly to customers.

4. SCOPE

Component Inspections are conducted on all Sub Transmission Lines, owned and operated by SA Power Networks, in accordance with the Network Maintenance Manual.

5. SAFETY

The requirements to ensure that CIs are conducted in a manner that minimises the risk of injury to SA Power Networks personnel and the general public are detailed in this Line Inspection Manual, Section 3.20 (ground).

6. EQUIPMENT REQUIRED

The equipment required to conduct and report the results of CIs are detailed in this Line Inspection Manual, Section 3.20 (ground).

7. SKILLS / RESOURCES REQUIRED

CIs are to be conducted by Asset Inspectors who have completed formal training and demonstrated necessary competencies as determined by **Manager Network Asset Management**.

CIs are to be conducted by accredited (refer above) Asset Inspectors. When carrying out a ground based inspection the Inspector may work alone utilising a suitable vehicle.

8. REQUIREMENTS

8.1 General

Component Inspection may be carried out from either a ground based vehicle or a helicopter.

For all lines a 100% overhead component and 100 % ground component inspection is required either on a 5 year or 10 year cyclic inspection as per section 6.2 in Network Maintenance Manual.

When doing a ground based CI, the inspector should stop the vehicle at each pole or structure and carefully inspect overhead components, eg Crossarms, Conductor Attachments, Insulator Assemblies, with the aid of binoculars. (If necessary, by leaving the vehicle).

When carrying out an aerial based inspection, at each target pole or structure the helicopter should slow, or hover, to enable the inspector to carefully inspect overhead components with the aid of binoculars.

If, during inspection, any significant defects (ie Priority B, 1, 2 or Z) are identified, adjacent structures should be checked for the same type of defect until no further defects are found.

8.2 Conductors

The condition of conductors is to be determined by inspection, achieved by traversing the entire line route by vehicle at a speed sufficiently low to enable the entire range of potential faults to be identified (refer checklist below) to be detected with the naked eye.

If necessary, binoculars can be used to confirm the state of deterioration of components.

Generally inspections are conducted at an approximate ground speed of 10 km/h within 50 metres of the centre-line of the line when travelling on the ground or 20-30 knots and 5-10 metres from the centre line when airborne.

Where access via ground vehicle is limited, the inspector should leave the vehicle and conduct the inspection on foot.

In some cases, such as overhead suspension arrangements, it is a **mandatory requirement** to examine the equipment at eye level. This requires the use of an EPV or helicopter.

8.3 Structures

When the condition of poles / structures at ground level is to be determined the inspector needs to expose the steel work by digging around the base and scraping away any scale.

Then using a needle profile gauge & the Ground Line Corrosion Assessment Procedure (section 3-25) an assessment of steel loss can be determined.

8.4 Switching / Isolating Devices

At all poles / structures where Switching / Isolating Devices are installed, the vehicle should stop or hover as necessary, to enable a visual assessment of the device to be conducted to identify potential faults and hazards. (Refer checklist below).

8.5 Transformers

At all poles / structures where Transformers are installed, the vehicle should stop or hover as necessary, to enable a visual assessment of the transformer to be conducted to identify potential faults and hazards. (Refer checklist below).

9. CHECKLIST

Item:	Assess:	Criteria:
Pole / Structure:	Mechanical Integrity	Check for indications that the mechanical integrity of the structure has been compromised: • Level of corrosion of channels, • Concrete spalling, • Ground-Line corrosion, • Missing structural members, • Vehicle or Third Party damage.
	Footing Integrity	Check for cracking, bearing failure or soil subsidence / erosion that could lead to: • Reduction in mid-span clearances, or • Pole collapse.
	Vegetation	Vegetation impeding access to structures, raise a VG notification.
Guy Wires:	Mechanical Integrity	Check for indications that the mechanical integrity of any Guy Wires and associated anchor has been compromised: • Anchor buried, • Signs of corrosion at ground Level, • Condition / presence of marker shield.
Crossarm:	Mechanical Integrity	Check for indications that the mechanical integrity of the crossarm has been compromised: • Bowed or bent due to uneven tensions, • Level of corrosion, • Loose / rusted nuts / bolts, • Elongated holes. Check for, and identify for removal, bird's nests or debris that present a risk of flashover, supply interruption or fire start.
Insulators:	Mechanical Integrity	Check for indications that the mechanical integrity of the insulator/s has been compromised: • Broken, cracked, missing, tilted, • Worn or corroded socket tongues, caps, pins hooks, shackles, • Missing "W" clips or split pins, • Identified for replacement. (ie Buller, DIA, LAPP).

Item:	**Assess:**	**Criteria:**
	Electrical Integrity	Check for indications that the electrical integrity of the insulator/s has been compromised: • Flashed over, tracking, • Pollution, • Punctured. Check condition of Rod Air Gaps and CLAHs: • Incorrect clearance or gap, • Damaged CLAHs.
Conductors:	Mechanical Integrity	Check for indications that the mechanical integrity of the conductor has been compromised: • Broken strands, • Corroded, rusted, bulging, • McIntire sleeves in Aluminium conductors, • Tension sleeves installed within 10m of suspension / Attachment point.
	Clearances	Check for indications that the electrical clearances have been compromised: • Conductor to earth, • Conductor to ground, • Conductor to structure / building, • Between circuits, • To trees in the Clearance Zone. Check for, and identify for removal any debris that presents a risk of public safety, supply interruption or fire start.
Conductor Connections:	Mechanical Integrity	• Check for indications that the mechanical integrity of any connection has been compromised: • Corrosion / rust / electrolysis, • Inappropriate joints (ie single crosbies.)
	Electrical Integrity	Check for indications that the electrical integrity of any connection has been compromised: • Signs of physical damage, discolouration, overheating. (*Can be confirmed by thermographic survey.)*
Conductor Attachments:	Mechanical Integrity	Check for indications that the mechanical integrity of any attachments has been compromised: • Damaged, loose, incorrect size seizing clamps, • Broken or damaged tie wires, suspension/ strain clamps, trunnion clamps.
Earth Bonds:	Bonds:	Check for indications that the mechanical or electrical integrity of the earthing system has been compromised: • Bonds missing, • Broken strands, • Pole earth missing, damaged.
Vibration Dampers:	Mechanical Integrity	Check for worn, damaged, loose or missing Vibration Dampers.

Item:	Assess:	Criteria:
Cables / Terminations:	Mechanical Integrity	Check for signs of physical damage to cable sheath or guard, which may lead to failure of the cable or a hazard to the public.
Cables / Terminations:	Electrical Integrity	Check for indications that the electrical integrity of the termination has been compromised: • Flashed over, tracking, • Pollution, • Overheating.
Switching / Isolating devices:		Check DFs, Isolating Switches & fuses for: • Seating / engagement of contacts, • Damaged flicker blades, • HV liquid fuse fluid colour and level, • Damaged / broken HV liquid fuses. Check mechanical integrity of recloser and sectionaliser tanks for rust and oil leaks.
Signage	Switching Devices	Check switching device numbering Correct / Legible.
	Warning Signs.	Check warning signs Installed / Correct / Legible.
	Pole Numbering.	Check Pole / Structure numbering Correct / Legible. *(Re-number on site)*
Transformers		• Check mechanical integrity of tank for rust and oil leaks, • Check integrity of LV protection ie LV fuses installed, • Check for, and identify for removal, bird's nests or debris that present a risk of flashover, supply interruption or fire start, • Report locations where bushing shields are required on flat top T/Fs.

10. RECORDING OF RESULTS

All follow-up work required as a result of inspection MUST be recorded in SAP as a "Distribution Defect".

A permanent record of the Inspection is to be initiated by "signing off" the SAP Works Order that initiated the Inspection.

11. REFERENCE DOCUMENTS

11.1 Line Inspection Manual

3.20 Ground Patrol – General Requirements.

11.2 Network Maintenance Manual

6.2 Maintenance Strategy – Overhead Sub transmission Lines.

11.3 SA Power Networks Switching Operators Handbook

11.4 Reference to applicable contractors operating procedures manual and guidelines.

3.16 DISTRIBUTION LINE COMPONENT INSPECTION (CI)

1. PURPOSE OF DOCUMENT

This document details the procedures to be followed for the Component Inspection (CI) of **Distribution Lines**.

2. PURPOSE OF COMPONENT INSPECTION

Component Inspection of Distribution Lines is conducted to determine the condition of those components of the asset so as to identify components that have deteriorated to the extent that failure is likely. Hazards that may lead to Injury to members of the public, supply interruption or bushfire start are also identified and recorded.

3. DEFINITIONS

Component Inspection	is defined as a 100% methodical, detailed, visual examination of the condition assessment of SA Power Networks distribution assets with emphasis on identifying failure modes and hazards associated with that asset.
Ground Based Component Inspection	carried out from the ground utilising a suitable vehicle or by foot.
Aerial Based Component Inspection	carried out from a helicopter or unmanned aerial vehicle (UAV).
Ground Components	include but are not limited to poles , towers, footings, guywires, padmount transformers, junction pits, service pits/lids.
Overhead Components	are defined as everything other than ground components.
Distribution Lines	are all lines energised up to and including 33kV where the primary function is to provide supply to customers.
EWP	Elevated Work Platform.

4. SCOPE

CI's are conducted at various times on each section of those Distribution Lines owned and operated by SA Power Networks.

5. SAFETY

The requirements to ensure that CIs are conducted in a manner that minimises the risk of injury to SA Power Networks personnel, contractors and the general public are detailed in this Line Inspection Manual, Section 3.20 (pre-departure checklist).

6. EQUIPMENT REQUIRED

The equipment required to conduct, and **report the results** of CIs are detailed in this Line Inspection Manual, Section 3.20.

7. SKILLS / RESOURCES REQUIRED

CIs are to be conducted by Line Asset Inspectors who have completed accredited training and demonstrated necessary competencies as determined by **Manager Network Asset Management**.

CIs are to be conducted by accredited (refer above) Asset Inspectors. When carrying out a ground based inspection the Inspector may work alone utilising a suitable vehicle.

8. REQUIREMENT

8.1 General

A 100% Component Inspection will be carried out as per Network Maintenance Manual Section 6.3.

8.2 Conductors

The condition of conductors *(including size)* is to be determined by inspection, achieved by traversing the entire line route by vehicle at a speed sufficiently slow enough to enable the entire range of potential faults to be identified (refer checklist below) to be detected with the naked eye.

Binoculars must be used to confirm the state of deterioration of components.

Where access via ground vehicle is limited, the inspector should leave the vehicle and conduct the inspection on foot.

On Sub-Transmission line overhead suspension arrangements, it is a **mandatory requirement** to examine the equipment at eye level. This will require the use of an EWP, UAV or helicopter.

8.3 Structures

When the condition of poles / structures at ground level is to be determined, the inspector needs to expose the steelwork by digging around the base and remove all scale. Then, using the Ground Line Corrosion Assessment Procedure (section 3-25) an assessment of steel loss can be determined.

8.4 Switching / Isolating Devices

At all poles / structures where Switching / Isolating Devices are installed, the vehicle shall stop or hover as necessary, to enable a visual assessment of the device to be conducted to identify potential faults and hazards. (Refer checklist below).

8.5 Transformers

At all poles / structures where Transformers are installed, the vehicle shall stop or hover as necessary, to enable a visual assessment of the transformer to be conducted to identify potential faults and hazards. (Refer checklist below).

8.6 Checklist

Item:	**Assess:**	**Criteria:**
Pole / Structure:	Mechanical Integrity	Check for indications that the mechanical integrity of the structure has been compromised: • Level of corrosion of channels, • Concrete spalling, • Ground-Line condition, • Missing structural members, • Vehicle or Third Party damage.
	Footing Integrity	Check for evidence that the integrity of the footing has been compromised, ie: • Reduction in mid-span clearances, or • Pole leaning > 15deg.
	Vegetation	Vegetation impeding access to structures, raise a DD notification (refer Section 3.23 part 9.3).
Guy Wires:	Mechanical Integrity	Check for evidence that the integrity of any Guy Wires has been compromised. ie: • Guy wires anchor buried / excavate and check for corrosion on stay wire attachment. • Condition / presence of marker shield.
Crossarm:	Mechanical Integrity	Check for indications that the mechanical integrity of the crossarm has been compromised: • Bowed or bent due to uneven tensions, • Level of corrosion, • Loose / rusted nuts / bolts, • Elongated holes. Check for, and identify for removal, bird's nests or debris that present a risk of flashover, supply interruption or fire start.
Insulators:	Mechanical Integrity	Check for indications that the mechanical integrity of the insulator/s has been compromised: • Broken, cracked, missing, tilted, • Worn or corroded socket tongues, caps, pins hooks, shackles, • Missing 'W' clips or split pins, • Identified for replacement. (ie Buller, DIA, LAPP).

Item:	Assess:	Criteria:
	Electrical Integrity	Check for indications that the electrical integrity of the insulator/s has been compromised: • Flashed over, tracking • Pollution, • Punctured. Check condition of Rod Air Gaps and CLAHs: • Incorrect clearance or gap, • Damaged CLAHs.
Conductors: (Including MEN / CMEN conductors)	Mechanical Integrity	Check for indications that the mechanical integrity of the conductor has been compromised: • Broken strands, • Corroded, rusted, bulging, • McIntire sleeves in Aluminium conductors, • Tension sleeves installed within 10m of suspension / attachment point, • *Undersized conductors on backbone of feeder.*
	Clearances	Check for indications that the electrical clearances have been compromised: • Conductor to earth, • Conductor to ground, • Conductor to structure / building, • Between circuits, • To trees in the Clearance Zone. Check for, and identify for removal any debris that presents a risk of public safety, supply interruption or fire start.
Conductor Connections:	Mechanical Integrity	Check for indications that the mechanical integrity of any connection has been compromised: • Corrosion / rust / electrolysis, • Inappropriate joints (ie single crosbies).
	Electrical Integrity	Check for indications that the electrical integrity of any connection has been compromised: • Signs of physical damage, discolouration, overheating. (*Can be confirmed by thermographic survey)*

Item:	Assess:	Criteria:
Conductor Attachments:	Mechanical Integrity	Check for indications that the mechanical integrity of any attachments has been compromised: • Damaged, loose, incorrect size seizing clamps, • Broken or damaged tie wires, suspension/ strain clamps, trunnion clamps, • Aluminium Tee clamps and Live Line clamps installed on 3/12 steel conductor, • Live Line clamps installed on 3/10-alumoweld conductor, • Live Line clamps and tee clamps installed on 3/10 – 3/12 grips, • Flexible taps with missing or inadequate heat shrink missing, • Check for broken Wraplock and or adjacent worn/broken conductor strands. **Especially where line guards are not installed.**
Earth Bonds:	Bonds:	Check for indications that the mechanical or electrical integrity of the earthing system has been compromised: • Bonds missing, • Broken strands, • Pole earth missing, damaged, • Non Standard.
Vibration Dampers:	Mechanical Integrity	Check for worn, damaged, loose or missing Vibration Dampers.
Cables / Terminations:	Mechanical Integrity	Check for signs of physical damage to cable sheath or guard which may lead to failure of the cable or a hazard to the public.
	Electrical Integrity	Check for indications that the electrical integrity of the termination has been compromised: • Flashed over, tracking, • Pollution, • Overheating.

Item:	Assess:	Criteria:
Switching / Isolating Devices:		Check DFs, Isolating Switches & Fuses for: • Seating / engagement of contacts, • Damaged flicker blades, • HV liquid fuse fluid colour and level, • Damaged / broken HV liquid fuses. Check mechanical integrity of recloser and sectionaliser tanks for rust and oil leaks. • Check for corrosion adjacent enclosed HV Load Switch tanks and indicator gauges.
Signage	Switching Devices	Check switching device numbering Correct / Legible.
	Warning Signs	Check warning signs Installed / Correct / Legible.
	Pole Numbering	Check Pole / Structure numbering Correct / Legible. *(Re-number on site)*
Transformers pole top and URD.		• Check mechanical integrity of tank for rust and oil leaks. • Check integrity of LV and HV protection ie LV and HV fuses if installed. • Check for, and identify for removal, bird’s nests or debris that present a risk of flashover, supply interruption or fire start. • Check Transformer numbering Correct / Legible. Report locations where bushing shields are required on flat top T/Fs.
Services		Visually assess condition of service lines and equipment, paying particular attention to broken attachments (raisers, pre-formed grips): • Missing/damaged PTJB and fuse box lids. • Clearances to ground / structures. • Trees rubbing against service mains. Plus include: • Access to service point DEI. • Damage to neutral screen services, corrosion, bird damage, vegetation rubbed through covering. • Damage to over/under services and taps not secured to pole. • Crotched joints damaged, neutral screen or over/under services. • Condition of service pits/lids and junction boxes/pits. (Note: service pits and junction pits are expected to be visually inspected where accessible).

Item:	Assess:	Criteria:
Vegetation impeding access to structures		• Vegetation impeding on access to or base of structures.
Public Lighting		• Check light fixed and not hanging, • Check brackets not broken.

9. RECORDING OF RESULTS

All follow-up work required as a result of inspection **MUST** be recorded in SAP as an *informative* 'Distribution Defect'. *See section 3-23.*

A permanent record of the Inspection is to be initiated by 'signing off' the SAP Works Order that initiated the Inspection.

10. REFERENCE DOCUMENTS

10.1 Line Inspection Manual

3.20 Ground Patrol – General Requirements.
3.23 Recording of Maintenance Information.

9.8 Line Inspection Guidelines for Determining MRV Score.

10.2 Network maintenance Manual

6.3 Maintenance Strategy – Overhead Distribution Assets.

10.3 SA Power Networks Switching Operator Handbook

10.4 Reference to applicable contractors operating procedures manual and guidelines.

3.17 PRE FIRE DANGER SEASON PATROL (PFDSP)

1. PURPOSE OF DOCUMENT

This document details the procedures to be followed for the Pre Fire Danger Season Patrols of overhead **Sub Transmission and Distribution Lines**.

2. PURPOSE OF PATROLS

The object of the patrol is to identify and record obvious faults or hazards that may pose a risk of injury to members of the public, supply interruption or potential bushfire start, and all vegetation that is currently in the clearance zone or may bend or grow into the clearance zone during the fire danger season.

3. DEFINITIONS

Aerial Based Component Inspections/Patrols are carried out from an aircraft. This is typically performed using a Helicopter or an Unmanned Aerial Vehicle (UAV).

Ground Based Component Inspections/Patrols are carried out from a suitable ground based vehicle or on foot.

A **Flown Feeder** is a feeder deemed capable of being safely aerial patrolled by the Chief Pilot of the aerial service provider in accordance with Civil Aviation Regulations and/or the 'National guidelines for aerial surveillance of overhead electricity networks' published by Energy Networks Association.

A **Non Flown Feeder** is an entire feeder that is deemed unsuitable for an aerial patrol by the Chief Pilot of the aerial service provider or Contract Governance Manager of SA Power Networks after taking into consideration:

- known hazards that may adversely impact on members of the public or the safety of the aircraft whilst performing aerial patrols (eg unsuitable terrain, proximity to built up areas, customer requests, sensitive areas, livestock)
- Energy Networks Association - National guidelines for aerial surveillance of overhead electricity networks
- Civil Aviation Regulations

Non Flown feeders require a ground based Pre Fire Danger Season patrol.

A **No Fly Zone** is a section of a Flown Feeder deemed unsuitable for an aerial patrol by the Chief Pilot of the aerial service provider, Contract Governance Manager of SA Power Networks, property owners/occupiers or a member of the public due to any of the circumstances outlined for a 'Non Flown Feeder'.

A list of known 'No Fly Zones' is maintained by the aerial service provider and updated during each aerial patrol season.

During the course of an aerial patrol, the pilot or aircraft crew may declare any section of line as being unsafe or unsuitable for aerial patrolling and suspend operations.

A Ground based Pre Fire Danger Season patrol is required for any sections of a feeder or line that was not aerial patrolled.

A **Pre Fire Danger Season Patrol** is a ground or air based visual overview of the condition of SA Power Networks Power Delivery Asset for the purposes of identifying and reporting faults and potential fire hazards. It is conducted in the period immediately prior to the declared Fire Danger Season. They are also known as "Pre Bushfire Patrols".

4. SAFETY

The requirements to ensure that PFDSPs are conducted in a manner that minimises the risk of injury to Inspection personnel and the general public are detailed in this Line Inspection Manual, Section 3.20 (ground) and/or specific aerial operating procedures.

5. ASSETS COVERED

Pre Fire Danger Season Patrols are conducted on each section of those Sub Transmission Lines and Distribution Lines that are owned and operated by SA Power Networks and located in either High Bushfire Risk Areas (HBFRAs) or Medium Bushfire Risk Areas (MBFRAs).

Pre Fire Danger Season Patrols are to be conducted annually during the period 1 May - 15 November and prior to the commencement of the declared fire seasons.

6. EQUIPMENT REQUIRED

The equipment required to conduct the results of PFDSPs are detailed in this Line Inspection Manual, Section 3.20 (ground).

7. SKILLS / RESOURCES REQUIRED

Pre Fire Danger Season patrols are to be conducted by Asset Inspectors who have completed formal training and demonstrated necessary competencies as determined by **Manager Network Asset Management**.

When carrying out a ground based inspection the Inspector may work alone utilising a suitable vehicle. For aerial based inspections refer to relevant operating procedures.

8. REQUIREMENTS

The condition of assets is to be determined by traversing the line at a speed sufficiently low to enable the identification of faults and fire hazards (refer checklist below).

8.1 Checklist

Item:	Assess:	Criteria:
Pole / Structure:	Mechanical Integrity	Check for signs of: • Missing structural members • Vehicle or Third Party damage
	Footing Integrity	• Check for excessive leaning of pole
Guy Wires:	Mechanical Integrity	• Check for broken Guy Wires
Crossarm:	Mechanical Integrity	• Check for broken cross arms • Check for, and identify for removal, bird's nests or debris that present a risk of flashover, supply interruption or fire start
Insulators:	Mechanical Integrity	• Check for broken or missing insulators.
	Electrical Integrity	Check for indications of: • Flash over • Missing or Damaged CLAHs

Item:	Assess:	Criteria:
Conductors: (Including MEN / CMEN conductors)	Mechanical Integrity	Check for indications that the mechanical integrity of the conductor has been compromised: • Broken strands • Corroded, rusted, bulging
	Clearances	Check for indications that the electrical clearances have been compromised: • Conductor to earth • Conductor to ground • Conductor to structure / building • Between circuits • To trees in the Clearance Zone • LV spacers required Check for, and identify for removal any debris that presents a risk of public safety, supply interruption or fire start.
Conductor Connections:	Mechanical and Electrical Integrity	Check for indications of broken, discoloured or overheated connections.
Conductor Attachments:	Mechanical Integrity	• Check for indications that any attachments are damaged or loose, incorrect size seizing clamps • Broken tie wires, suspension/ strain clamps trunnion clamps • Aluminium Tee clamps and Live Line clamps installed on 3/12 steel conductor • Live Line clamps installed on 3/10-alumoweld conductor • Live Line clamps and tee clamps installed on 3/10 – 3/12 grips • Flexible taps with missing or inadequate heat shrink missing
Vibration Dampers:	Mechanical Integrity	Check for missing Vibration Dampers.
Cables / Terminations:	Mechanical Integrity	Check for physical damage to cable sheath or guard which may lead to failure of the cable or a hazard to the public.
Switching / Isolating devices:		Check DFs, Isolating Switches & fuses for: • HV liquid fuse fluid level • Damaged / broken HV liquid fuses Check mechanical integrity of recloser and sectionaliser tanks for rust and oil leaks.
Transformers		• Check mechanical integrity of tank for obvious oil leaks • Check for, and identify for removal, bird's nests or debris that present a risk of flashover, supply interruption or fire start • Report locations where bushing shields are required on flat top T/Fs (High bird activity area only)

Item:	Assess:	Criteria:
Services		Visually assess condition of service lines and equipment, paying particular attention to: • broken attachments, (Raisers, Pre-formed grips) • Missing / damaged PTJB and Fuse box lids • Clearances to ground / structures • Trees rubbing against service mains
Vegetation		All vegetation that is currently in the clearance zone or may bend or grow into the clearance zone during the fire danger season.

9. RECORDING OF RESULTS

All follow-up work required as a result of inspection/patrol **MUST** be recorded in SAP as a 'Distribution Defect'.

A permanent record of the inspection/patrol is to be initiated by 'signing off' the SAP Works Order that initiated the inspection/patrol.

10. REFERENCE DOCUMENTS

10.1 Line Inspection Manual

3.20 Ground Patrol – General Requirements

Relevant aerial operating procedures

10.2 Network Maintenance Manual

6.2 Maintenance Strategy – Overhead Sub Transmission Lines

6.3 Maintenance Strategy – Overhead Distribution Assets

10.3 SA Power Networks Switching Operator Handbook

10.4 Electricity Industry of SA Acts & Regulations

10.5 ENA NENS 08-2006 National guidelines for aerial surveillance of overhead electricity networks

3.18 THERMOGRAPHIC INSPECTION (TI)

1. PURPOSE OF DOCUMENT

This document defines the roles and responsibilities of Network personnel in managing thermographic surveys.

It also defines the procedures to be followed for Thermographic Inspections (TI) of Distribution Assets.

2. PURPOSE OF THERMOGRAPHIC INSPECTIONS

Thermographic inspections of distribution assets are conducted to identify, using thermal imagery, those components that have deteriorated due to a combination of corrosion and high load current to the extent that failure is likely. These defects have the potential for supply interruption or bushfire start.

Obvious hazards that may lead to injury to members of the public or supply interruption are also identified and recorded.

3. DEFINITIONS

A **Thermographic Inspection** is defined as a methodical, detailed examination (through the use of a thermographic camera and binoculars) of the condition of SA Power Networks' Power Delivery Asset, concentrating on those failure modes and hazards most readily identified through the use of thermography.

A feeder **backbone** is defined as the conductors bearing the significant proportion of feeder load, generally including Tee offs where four or five overhead transformers or 2 Padmount transformers and / or a major customer exist.

The **Inspection Planning Working Group (IPWG)** brings together personnel from the Network Management Operations and Technical Standards Groups on a regular basis to manage asset inspection considerations.

The Network Operations Centre (NOC) is responsible for the coordination of field crews in response to planned and unplanned network interruptions.

A feeder is defined as being in an **abnormal configuration** when:

- significant load has been transferred between two metropolitan feeders

4. ASSETS COVERED

TIs are conducted on power delivery assets owned and operated by SA Power Networks eg Substation switch yards, Distribution lines 415V to 66kV and associated equipment.

Scheduled TIs will be as per Network Maintenance Manual Section 6.

Abnormal TIs will be conducted upon request on targeted feeders typically when they are in an abnormal configuration eg when loads are abnormally high. This will include those locations, such as feeder tie points, that are experiencing excessive thermal stress due to the increased load.

5. SAFETY

The requirements to ensure that TIs are conducted in a manner that minimises the risk of injury to SA Power Networks personnel and the general public are detailed in the OH&S Manual, Switching Manual and Switching Operators hand book.

6. EQUIPMENT REQUIRED

The equipment required to conduct and report the results of TI inspections includes a Thermal Imager, feeder plans, circuit diagrams, digital camera, binoculars, laptop computer for analysing images of identified defects, creating reports of confirmed defects via SAP and production of standard thermal reports.

7. SKILLS / RESOURCES REQUIRED

TI's are to be conducted by Asset Management Officers who have completed formal training and demonstrated necessary competencies as determined by the Network Asset Management Manager.

8. REQUIREMENT

8.1 General

The selection and prioritisation of feeders for TIs will be undertaken by Network Management Operations. The selection process will consider:

- Network Maintenance Manual
- Annual Inspection program
- Specific thermal survey requests

All TIs should be undertaken during periods of high feeder loading where possible to ensure optimum results.

8.2 Scheduled Thermographic Inspections

A scheduled thermographic inspection will include:

- an inspection of every overhead joint along the feeder backbone
- an inspection of overhead joints on other major load bearing spurs emanating from the backbone; unless otherwise directed.

8.3 Abnormal Thermographic Inspections

Where requested, an abnormal thermographic inspection will include:

- an inspection of every overhead joint on the feeder backbone (including the tied feeder) unless otherwise directed; or
- targeted assets as directed

To accomplish this, it is essential that the NOC notify the Network Asset Management Group for requested surveys prior to feeder being placed in an abnormal configuration and it is anticipated that the abnormal state will extend long enough for a thermographic survey to be organised and completed (at least 5 hours).

9. INSPECTION PROCEDURE

Consideration should be given to feeder history prior to commencing Scheduled TIs, this should include feeder load peaks, GSL, ESCOSA and Critical line considerations etc.

The Infra Red survey should include a scan or scans of the infrastructure designated to be surveyed according to the requirements that have been requested eg, if a Substation Switch yard has been requested to be scanned, all visible electrical connections should be scanned whilst on site.

All TIs must be undertaken only when feeder load is greater than 50% of the recorded last 12 month average, if below this load, inspection must be rescheduled to achieve this criteria or actual survey priorities be reprioritised to account for anticipated loads via the 'Hot Joint Correction Factor Chart.'

When scanning Feeders all switching points and connections within the parameters of the request should be scanned eg when only a feeder backbone has been requested, ensure that the sections carrying the more significant loads are scanned.

Efficient scanning of a feeder must be achieved by exiting the vehicle and viewing various sides of the component being inspected with the Thermal Imaging camera and binoculars. Effective scanning in a substation or similar is best done from foot within the site.

Binoculars must be used to asses the condition of all joints to confirm the physical state of all feeder components in the backbone (refer checklist below).

9.1 Checklist

Item:	Assess:	Criteria:
Insulators:	Visual Mechanical Integrity	Check for indications that the mechanical integrity of the insulator/s has been compromised: • Broken, cracked, missing, melted • Discoloured / blackened • Signs of overheating • Flashed over, tracking
	Thermal Image of Electrical Integrity	Check for indications that the electrical integrity of the insulator/s has been compromised: • Temperature rise on insulators • Pinpoint source of component/s affected
Conductors:	Visual Mechanical Integrity	Check for indications that the mechanical integrity of the conductor has been compromised: • Broken strands • Corroded, rusted, bulging • Discoloured / blackened • Signs of overheating • McIntyre sleeves in Aluminium conductors • Sleeves & Splices

Item:	Assess:	Criteria:
	Thermal Image of Electrical Integrity	Check for indications that the electrical integrity of the conductor/s has been compromised. • Temperature rises on conductors • Pinpoint source of component/s affected
Conductor Connections:	Visual Mechanical Integrity	Check for indications that the mechanical integrity of any connection has been compromised: • Corrosion / rust / electrolysis • Signs of overheating • Discoloured / blackened
	Thermal Image of Electrical Integrity	Check for indications that the electrical integrity of any connection has been compromised: • Temperature rises on connections • Pinpoint source of component/s affected
Cables / Terminations:	Mechanical Integrity	Check for signs of physical damage to cable sheath or guards that may lead to failure of the cable or a hazard to the public: • Signs of overheating • Discoloured / blackened • Flashed over, tracking
	Electrical Integrity	Check for indications that the electrical integrity of the termination has been compromised: • Temperature rises on terminations • Pinpoint source of component/s affected
Switching / Isolating Devices:	Mechanical Integrity	Check all switching devices for: • Deteriorated contacts • Damaged flicker blades • Flashed over, tracking • Visual signs of damage
	Electrical Integrity	Check for indications that the electrical integrity of the devices has been compromised: • Temperature rises on Devices • Pinpoint source of component/s affected
Transformers	Electrical Integrity	• Check electrical integrity of HV & LV connections & protection devices. • Overheating. • Pinpoint source of component/s affected.
Switching Boards & panels	Electrical Integrity	Scan the exterior of enclosures to be surveyed and where safe to do so scan internal connections for: • Overheated contacts and components. • Pinpoint source of component/s affected.

10. RECORDING OF RESULTS

All follow-up work required as a result of a TI must be recorded in SAP as a 'Distribution Defect' or 'Substation Defect'.
A survey summary report should be produced with a copy delivered to the responsible officer/s concerned and a copy kept on file.

A permanent record of the Inspection is to be initiated by 'signing off' the SAP Works Order that initiated the Inspection.

If during scans, significant defects are detected, each defect shall be recorded for rectification according to the current Maintenance Risk Value definitions.

Current Maintenance Risk Value Definitions for Distribution Lines:

- Ring NOC (PB) if there is over 200°C rise above reference with visible damage.
- MRV 190+ (P1) or PZ if there is over 60°C rise above reference temperature with no visible damage.
- MRV 190+ (P1) or PZ if there is over 40°C rise above reference temperature with visible damage or signs of heat damage.
- MRV 190+ (P1) if there is a 40°C - 60°C rise above reference temperature with no visible damage, on the backbone of the feeder (including any spur that has an open point that can be used as a feeder tie).
- MRV 90 – 189 (P2) if there is 40°C - 60°C rise above reference temperature with no visible damage, not on the backbone of the feeder.

Summary for HV Lines:

MRV/Priority	Temperature Increase above Reference °C	Visible Damage	Backbone of the Feeder
PB	> 200	N/A	N/A
P1 or PZ / 190+	> 60	N/A	N/A
P1 or PZ / 190+	40 - 60	Yes	N/A
P1	40 - 60	No	Yes
P2	40 - 60	No	No

- For LV hot joints, only report defects above 60°C above reference temperature, unless visual damage is evident. Assign MRV of 190+ (P1).

Significant visual deterioration would normally indicate a higher MRV allocation; therefore more emphasis should be placed on physically deteriorated components when allocating the appropriate MRV and via the 'Hot Joint Correction Factor Chart.'

The Correction Chart is to be used as a guide only to indicate potential joint temperatures for increased load situations, where recorded joint temperatures are between 40 – 50° Celsius rise above reference temperature; this is the optimum usage range for the Chart.

Defect Recording:

Each defect location is to be identified and physically determined by Functional location, switching point number (where applicable), conductor phase, Incoming or Outgoing side and the hardware that is affected eg 'DF 6969 G phase outgoing side terminal lug.'

MDT **Description Field** standard data entry is, **046C DF15510 Hot Joints.**

Record the differential between the Defect temperature and the reference temperature, the amount of component damage, the rectification options, the current feeder load at the time of the inspection and the previous 10 day maximum load and 12 month Average load should be recorded similar to following example:

Standard data entry must be recorded in this format to assist NOC with their analysis.

LS1533 (Sht3 X-8) Brodie Road North Lonsdale
J phase incoming terminal lug. 46'C above reference temperature.
Replace J phase lugs & DF base.
G & H phases at DF blade contacts 42'C above ref temperature.
G & H phases clean up, reset and regrease blades / contacts, if pitted or damaged replace DF base.
Ensure all connections including switch mechanisms are cleaned & greased
Feeder load at time of inspection was 233A, previous 10 day Max is 285A, 12 month average is 199A

A digital photo and Thermal image report of components affected must be attached to DD or SD notifications (with degradation).

Thermal image reports are to be attached to all DD and SD notifications raised.

Thermal images to be retained by the operator.

Additional survey data required:

The survey results should also include ambient temperature, prevailing weather conditions, and time of the survey, any readily identifiable circuit loads and any other relevant information.

11. REFERENCE DOCUMENTS

11.1 The Electricity Act 1996

11.2 Australian Standard AS 2067

11.3 SA Power Networks Substation Inspection Manual

11.4 SA Power Networks Substation Design Manual

11.5 Network Directives Manual

11.6 Network maintenance Manual

5.5 Maintenance Strategy – Sub Station Disconnector & Switches

6.2 Maintenance Strategy – Overhead Sub Transmission Lines

6.3 Maintenance Strategy – Overhead Distribution Lines

6.6 Maintenance Strategy – Ground Level Distribution Switchgear

11.7 SA Power Networks Switching Operator Handbook

11.8 SA Power Networks Substation Instructions

Table 1 Note the Matrix is only a guide to indicate potential joint temps for increased load situations; values are predicted and therefore not necessarily accurate, especially for recorded joint temperatures 50 degree rise above reference temperature, hence Matrix values shouldn't be relied on!

Hot Joint Correction Factor Chart

Recorded 12 Month Average Feeder Load

500 A							15	13	11.2	9.8	8.6	7.7	6.9	6.2	5.6	5.2	4.7	4.4	4	3.7	3.4	3.2	3	2.8	2.6	2.5	2.4
490 A							14.6	12.5	10.8	9.6	8.4	7.5	6.7	6	5.4	5	4.5	4.3	3.8	3.5	3.3	3.1	2.9	2.7		2.4	2.3
480 A							14.3	12	10.5	9.3	8.2	7.2	6.5	5.8	5.2	4.8	4.4	4.1	3.7	3.4	3.2	3	2.8	2.6	2.5		2.2
470 A							14	11.6	10.1	8.9	7.8	6.9	6.2	5.6	5	4.6	4.3	4	36	3.3	3.1	2.9	2.7		2.4	2.3	2.1
460 A						N/A	13.6	11.2	9.6	8.5	7.6	6.7	6	5.4	4.9	4.5	4.1	3.8	3.4	3.2	3	2.8	2.6	2.5	2.3	2.2	2
450 A						15	13	10.9	9.4	8.3	7.4	6.5	5.7	5.2	4.7	4.4	3.9	3.7	3.3	3.1	2.9	2.7		2.4	2.2	2.1	
440 A						14.5	12.4	10.5	9.2	8	7	6.2	5.5	5	4.5	4.2	3.7	3.5	3.2	3	2.8	2.6	2.5	2.3	2.1	2	1.9
430 A						14	11.8	10.1	8.6	7.7	6.8	5.9	5.3	4.8	4.4	4	3.6	3.3	3.1	2.9	2.7	2.5	2.4	2.2	2	1.9	1.8
420 A						13.5	11.3	9.6	8.3	7.4	6.5	5.7	5.1	4.6	4.2	3.8	3.5	3.2	3	2.8	2.6	2.4	2.3	2.1			1.7
410 A					N/A	13	10.9	9.2	8	7.1	6.1	5.5	4.9	4.4	4	3.6	3.4	3.1	2.9	2.7	2.5	2.3	2.2	2	1.9	1.8	
400 A					15	12.5	10.5	8.9	7.7	6.7	5.9	5.2	4.7	4.3	3.8	3.5	3.2	3	2.7	2.5	2.4	2.2	2.1		1.8	1.7	1.6
390 A					14.6	12	10.1	8.5	7.4	6.5	5.7	5	4.5	4.1	3.6	3.4	3.1	2.9	2.6	2.4	2.3	2.1	2	1.9	1.7	1.6	1.5
380 A					14	11.5	9.6	8.1	7.1	6.1	5.5	4.8	4.3	3.9	3.5	3.2	3	2.7	2.5	2.3	2.2	2		1.8			
370 A					13.5	11	9.1	7.8	6.7	5.8	5.2	4.6	4.1	3.7	3.4	3.1	2.8	2.6	2.4	2.2	2.1		1.9	1.7	1.6	1.5	1.4
360 A				N/A	13	10.5	8.6	7.5	6.5	5.6	5	4.4	3.9	3.5	3.2	2.9	2.7	2.5	2.3	2.1	2	1.9	1.8	1.6	1.5	1.4	
350 A				15	12.4	10	8.3	7.2	6.1	5.4	4.7	4.2	3.7	3.4	3.1	2.8	2.6	2.4	2.2	2	1.9	1.8	1.7				1.3
340 A				14.5	11.7	9.5	7.9	6.9	5.8	5.2	4.5	4	3.6	3.2	2.9	2.6	2.5	2.3	2.1		1.8	1.7	1.6	1.5	1.4	1.3	1.2
330 A				13.9	11	9	7.6	6.5	5.6	5	4.3	3.8	3.4	3.1	2.8	2.5	2.4	2.2	2	1.9	1.7	1.6	1.5	1.4	1.3	1.2	
320 A				13.2	10.5	8.5	7.2	6.2	5.3	4.7	4.1	3.6	3.2	2.9	2.6	2.4	2.2	2	1.9	1.8	1.6	1.5	1.4				1.1
310 A			N/A	12.5	9.9	8	6.9	5.8	5	4.4	3.8	3.4	3	2.7	2.5	2.3	2.1	1.9	1.8	1.7		1.4		1.3	1.2	1.1	
300 A			15	11.8	9.5	7.6	6.5	5.5	4.7	4.1	3.6	3.2	2.9	2.6	2.4	2.2	2	1.8	1.7	1.6	1.5		1.3	1.2	1.1		
290 A			14.3	11.2	8.9	7.3	6	5.2	4.5	3.9	3.4	3.1	2.7	2.4	2.2	2	1.8	1.7	1.6	1.5	1.4	1.3	1.2	1.1			
280 A			13.7	10.5	8.4	6.9	5.6	4.9	4.3	3.6	3.2	2.9	2.5	2.3	2.1	1.9	1.7	1.6	1.5	1.4	1.3	1.2	1.1				
270 A			12.9	9.8	7.9	6.5	5.3	4.6	4	3.4	3.1	2.7	2.4	2.2	2	1.8	1.6	1.5	1.4	1.3	1.2	1.1					
260 A		N/A	12	9.2	7.4	6	5	4.3	3.7	3.2	2.9	2.6	2.2	2	1.9	1.7	1.5	1.4	1.3		1.1						
250 A		15	11.2	8.5	6.9	5.6	4.7	4	3.4	3	2.7	2.4	2.1	1.9	1.7	1.6				1.2							
240 A		14.2	10.5	8	6.4	5.3	4.4	3.7	3.2	2.9	2.5	2.2	1.9	1.8	1.6	1.5	1.4	1.3	1.2	1.1							
230 A		13.3	9.7	7.5	5.8	4.9	4.1	3.5	3	2.7	2.4	2	1.8	1.6	1.5	1.4	1.3	1.2	1.1								
220 A		12.4	9.1	7	5.5	4.5	3.8	3.2	2.8	2.5	2.2	1.9	1.7	1.5	1.4	1.3	1.2	1.1									
210 A	N/A	11.5	8.4	6.5	5.1	4.2	3.5	3	2.6	2.3	2	1.7	1.6	1.4	1.3	1.2	1.1										
200 A	15	10.5	7.5	5.9	4.7	3.9	3.2	2.7	2.4	2.1	1.8	1.6	1.4	1.3	1.2	1.1											
190 A	14	9.6	6.9	5.4	4.4	3.6	3	2.5	2.2	1.9	1.7	1.5	1.3	1.2	1.1												
180 A	12.9	8.9	6.5	5	4	3.3	2.7	2.3	2	1.7	1.6	1.3	1.2	1.1													
170 A	12	7.9	5.8	4.5	3.6	3	2.4	2.1	1.8	1.5	1.4	1.2	1.1														
160 A	10.5	7.2	5.1	4	3.2	2.6	2.2	1.9	1.6	1.4	1.2	1.1															
150 A	9.4	6.5	4.7	3.6	3	2.3	2	1.7	1.4	1.2	1.1																
140 A	8.4	5.6	4.3	3.2	2.6	2.1	1.7	1.5	1.3	1.1																	
130 A	7.5	5	3.7	2.9	2.3	1.9	1.5	1.3	1.1																		
120 A	6.5	4.4	3.2	2.5	2	1.6	1.4	1.1																			
110 A	5.5	3.7	2.9	2.1	1.7	1.4	1.2																				
100 A	4.7	3.2	2.4	1.8	1.5	1.2																					
90 A	4	2.7	2	1.5	1.2																						
80 A	3.2	2.2	1.6	1.3																							
70 A	2.5	1.7	1.3																								
60 A	2	1.4																									
50 A	1.5																										
40 A																											
30 A																											
20 A																											
10 A																											
	40 A	50 A	60 A	70 A	80 A	90 A	100 A	110 A	120 A	130 A	140 A	150 A	160 A	170 A	180 A	190 A	200 A	210 A	220 A	230 A	240 A	250 A	260 A	270 A	280 A	290 A	300 A

Feeder Loading at time of Survey. Multiply hot joint temperature rise above reference temperature by correction factor

3.19 AERIAL OPERATIONS – GENERAL REQUIREMENTS

1. PURPOSE OF DOCUMENT

This document details the procedures to be adopted when undertaking Aerial Inspections, Assessments and Patrols on Transmission Lines and Distribution Feeders by helicopter.

This procedure will be issued to any new Aerial Operations personnel and will be re-issued to existing air crew at the annual pre flying season briefing.

This document, supersedes Aerial Operations General requirements 3-19 issued 1/2002, Distribution Instruction 3M2, issued November 1993, and Distribution Instruction 3M1, Appendix 2, Inspection / Assessment / Patrol Pre-Departure Checklist, issued March 1997.

2. SAFETY PRECAUTIONS

2.1 Helicopter Main Rotor

- A helicopter is referred to as a Rotary Wing Aircraft; it has a fixed motor and a rotating wing (blade) which pivots from a central axis.
- The speed of the rotating blade provides the necessary downdraft for flight and by varying the blade angle (pitch), provides the direction. Under normal circumstances, the blade rotates on a level plane and is approximately three metres from the ground. The blade height may be reduced to approximately (1.70 metres (5' 6")) from the ground, in circumstances where:
  - The engine is running up or down (this takes over 3 minutes to occur);
  - The engine is idling and the pilot is away from the controls (this may happen during short stopovers);
  - The aircraft is on uneven ground; and
  - The conditions are windy.

Therefore, it is important that anyone approaching or departing from the helicopter must do so in a semi-crouched manner. Only when next to the aircraft body is it safe to stand upright.

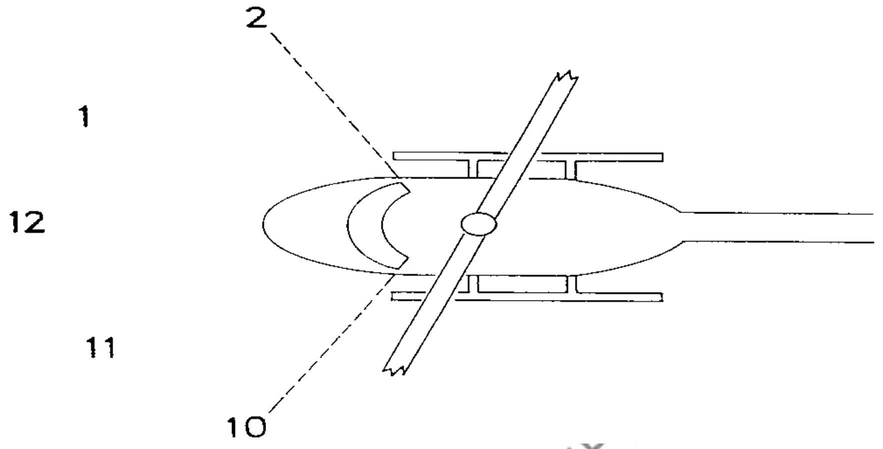
2.2 Tail Rotor

The tail rotor is a propeller which acts as a stabiliser. The tail rotor blade is approximately 1.5 metres in diameter, but it is only 1 metre from the ground. The blade operates at a speed of 2250 revolutions per minute (about 4 times the speed of the main rotor) and despite its colourful markings, it becomes virtually invisible to the naked eye.

THE TAIL ROTOR IS UNPROTECTED, AND ON SOME MODELS THE EXHAUST COMES OUT FROM THE BACK OF THE CABIN. THEREFORE, MOVEMENT REAR OF THE HELICOPTER'S CABIN OR BAGGAGE COMPARTMENT WHILST THE MOTOR IS STARTING, IDLING, RUNNING OR RUNNING DOWN (ie ANY MOVEMENT FROM EITHER ROTOR AND NOISE FROM MOTOR) IS STRICTLY PROHIBITED.

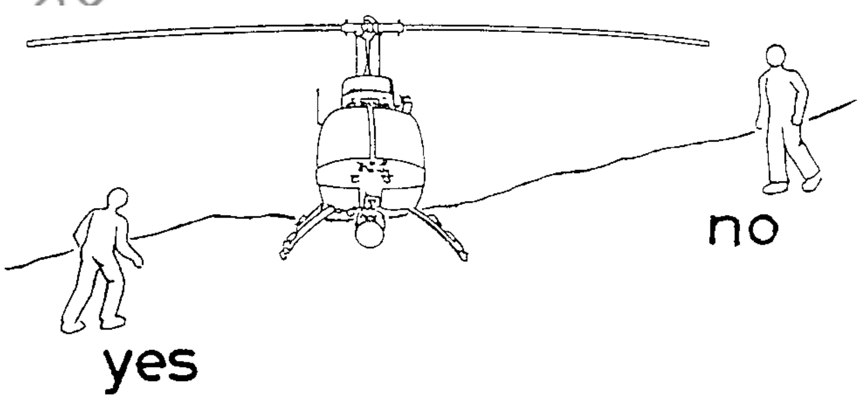
2.3 Moving in the Vicinity of a Helicopter on the Ground

- Hats or any other loose clothing should not be worn near the helicopter. Wind drafts may cause these items to be blown off and the natural tendency to retrieve the item could place the person in extreme danger.
- All approaches must be made within the 10 o'clock to 2 o'clock position in front of the helicopter. (Because of the restricted vision of the pilot).



- All Inspectors and Observers shall obey the pilot's instructions regarding entry to and exit from the helicopter. No Inspector or Observer shall enter or exit from the helicopter while the engine is running unless advised by the pilot that it is safe to do so.
- To obtain permission to approach the helicopter, stand directly in front of the helicopter (about 12 metres away) and extend one arm at shoulder height with the fist clenched and thumb pointed upward. Only when the return thumbs-up signal is given by the pilot is it permissible to approach, and then only in a semi-crouched position.

WHEN THE AIRCRAFT HAS LANDED ON SLOPING GROUND, UNDER NO CIRCUMSTANCES MUST APPROACH OR DEPARTURE BE MADE FROM THE UPHILL SIDE, DUE TO THE EXTREME DANGER BECAUSE OF THE REDUCED MAIN ROTOR GROUND CLEARANCE.



- Any equipment such as route maps, camera, binoculars, radios etc. must be carried in a low horizontal position whenever approaching or departing from the aircraft.

2.4 Requirements during Landing or Take-off of Helicopter

When the helicopter is about to land or depart, it can cause stones, dust or dry grass to be blown about. To avoid possible eye injury, it is recommended that ground support staff wear safety glasses or turn away from the helicopter during the take-offs and landings.

2.5 Aircraft Safety Precautions during Fuelling Operations

- Pilots are responsible for ensuring that Fuelling operations are in accordance with Civil Aviation Safety Authority Order's.
- Participants in aircraft operations will be briefed on fuelling procedures prior to the commencement of aircraft refuelling by the pilot.
- All footwear worn by employees engaged in fuelling operations shall be of a non-spark type (e.g. no studded or steel tread boots).
- Matches and cigarette lighters are not to be carried during fuelling duties.
- No person shall smoke or use a naked flame within 15 metres (50ft) of the aircraft or fuel supply point during fuelling operations.
- Photographic flash bulbs or electronic flash equipment are not to be used within 15 metres (50ft) of aircraft or fuelling equipment during fuelling operations.
- Fire fighting equipment (which should be provided by the contractor) shall be placed not less than 6 metres (20ft) from the aircraft and fuelling equipment before fuelling commences.
- All employees involved shall familiarise themselves with the operating instructions of the fire extinguishers prior to the commencement of fuelling operations.
- Vehicles (other than those performing aircraft servicing functions) are <u>not permitted</u> within 15 metres (50ft) of the aircraft during fuelling operations.
- Non essential personnel are <u>not permitted</u> within 15 metres of the aircraft or fuelling equipment during fuelling operations.

2.6 Requirements for Flying over Water

- When traversing a substantial stretch of water, all occupants of the helicopter shall wear a life-jacket.
- Due to the composition of most life-jackets, smoking shall not be permitted during over-water flights. (Ash or sparks can cause 'pinhole' burns in the jacket fabric).

3. REQUIREMENTS OF PARTICIPANTS IN AERIAL OPERATIONS

3.1 Aircraft Service Providers

All aircraft companies engaged by SA Power Networks shall observe and comply with all requirements of the Civil Aviation Safety Authority.

The contractor shall provide for the Inspector:

Inspector's Seating

- fitting of a sliding door at the Inspector's seating position if possible or an **acceptable alternative**.
- suitable approved seating.
- an approved safety harness and an approved attachment point.
- an approved footrest if not part of the seat where appropriate.

3.2 Helicopter Pilot

- Pilots must give safety briefings to all new crew members of the safety aspects of the helicopter prior to commencing aerial operations. The briefing should include the use of the Emergency Locator Beacon (ELB), Fuel switch and master cut off switch.
- Will be responsible for ensuring that aerial operations are conducted safely and in accordance with all relevant Civil Aviation Safety Authority's Regulations, their Company's Aerial Operations Manual and ESAA Guidelines and any other applicable Standards.
- Whilst aerial operations are active the agreed search and rescue (SAR) procedure shall be adhered to.
- Will obtain daily Bureau of Meteorology reports and is responsible for the assessment of weather conditions and determining safe flight conditions.
- Will observe all minimum clearances between any part of the helicopter, any man-made structures and natural vegetation and landscape objects. Generally the safe working clearance for the helicopter will be a minimum of five metres from any structure or natural object.
- Generally the decision to commence or cease aircraft operations shall be by mutual agreement between the pilot and the inspectors/observers. The final decision always rests with the pilot.
- Brief inspector and observer on seat belt operation prior to departure and on fuelling procedures prior to the commencement of aircraft refuelling.
- Advise when it is safe to approach the helicopter on the ground, or undo seat belts and disembark.

3.3 Inspectors Role

The primary role of the Inspector is to identify line defects and possible vegetation infringements during flying operations and to input into the overall team operation.

Key Functions include:

- Participate in pre flight briefings with Pilot and Crew to facilitate safe, efficient and effective daily operations. The Inspector should discuss the type of operation (i.e. whether it is an inspection or patrol), if there are any special requirements that will assist him in carrying out his duties, any known hazards such as livestock or 'no fly zones', weather conditions and refuelling opportunities.
- Identify line defects as per current instructions.
- Identify possible vegetation infringements.
- Assist with hazard identification.
- Assist with SAR operations.

3.4 Observers Role

The primary role of the Observer is to assist the Pilot during the Aerial Operations with hazard identification and assist in the navigation to and from the lines being flown, using maps, feeder plans & GPS points. The Observer is also required to actively input into the overall team operation. The Observer is required to be seated next to the pilot.

Key Functions include:

- Produce Feeder plans indicating No fly Zones, other line crossings.
- Conduct pre flight briefings with Pilot and Crew to facilitate safe, efficient and effective daily operations taking into consideration weather conditions and refuelling opportunities.
- Navigate route to and from Line operations using maps, feeder plans, local knowledge and GPS points.

- Continually update Pilot of Line construction / direction, hazards, No Fly zones/ Sensitive areas and changing conditions.
- SAR monitoring.
- Recording defects as identified by the Inspector.
- Plotting flown sections onto the feeder plan.

Whilst traversing feeders all significant **features, construction type** and **direction of travel** are to be indicated to the pilot **concisely and with sufficient time for the pilot to react.** Hazards on both sides of the powerline should be communicated to the pilot.

3.5 Using Two Person Crew (pilot and combined inspector/observer)

On certain feeders, aerial operations may be conducted using a two person crew, consisting of the pilot and another person acting as both the Inspector and Observer. Agreement for this type of operation shall be obtained from both Aeropower and the flight crew involved. The Inspector/Observer must be aware of their dual role as both the Inspector and assisting the pilot to avoid known hazards.

The following factors must be considered prior to undertaking this type of operation:

- Weather conditions;
- Terrain;
- Direction of flight;
- Line length & Construction;
- No over crossings or other structures above line height; and
- Flight speed.

3.6 Standard Terminology and Phraseology

Standard Terminology is to be utilised when calling line configuration and directions to pilots. The following standard terms are to be used where possible.

Examples of Construction Types

T Junction, Y Junction, 4 way crossover, Line over crossing.
Line under crossing, Low Voltage sections, Tee Off, Angle.

Examples relating to Direction of Travel

Left, Right, hard, slight, Straight ahead, go, veer left, veer right, pull out, stop.

e.g. "Two ***poles angle slight right followed by an in line TF***"
"Two ***poles to Tee Off left go left***"*.*

When Flying Tee- Offs wind direction will often dictate the direction of travel. The ***navigator should suggest which direction the tee off should be flown*** *i.e. patrol out and ferry back or ferry out and patrol back. It is also useful to indicate how many TF's exist on the tee off.*
Indicating direction by ***hand pointing, Clock faces*** *(e.g. 3 o'clock) and* ***compass points*** can be useful in many situations.

Pilots are to acknowledge directions either verbally or by microphone activation.

The Observer is to ensure at least one copy of the feeders plans are marked **with No Fly Zones & other line crossovers or known hazards.** As the flight progresses, the Observer is to **mark the feeder plan with a highlighter to indicate the completed line sections.**
Pilots generally refer to the navigator's feeder plan from time to time **to confirm flight progression and assessment.**

UNDER NO CIRCUMSTANCES IS AN INSPECTOR OR OBSERVER PERMITTED TO ACT AS THE PILOT OF AN AIRCRAFT BEING OPERATED FOR SA POWER NETWORKS PURPOSES.

3.7 Crew Selection

- Flight crew involved in aircraft operations shall be selected on a **voluntary** basis. Those suffering with non-controllable motion nausea or poor eyesight shall be precluded from participating in Aerial Operations.
- New crew members shall be subject to an assessment flight under the observation of the Maintenance Operations Manager (or a suitably qualified and experienced delegate). Assessment of suitability shall include the following;
  - Understanding of roles and responsibilities as detailed in the Aerial Operation Procedure.
  - Compliance with pre flight helicopter safety briefing by Pilot.
  - Assessment flight to determine suitability to flying.
  - Fly with an experienced crew member until both agree that a satisfactory level of confidence and competence has been achieved.
- If any of the crew are first time fliers or inexperienced, this fact shall be declared during pre-flight briefings so they can be observed by an experienced member of the crew for any adverse reaction and consequent deterioration in the performance of their duties.
- All members of the crew must be fit for duty; otherwise they must disqualify themselves from aerial operations. The effects of fatigue on any member of the crew should also be taken into account. If any of the following danger signs are occurring, it will be considered not safe to continue;
  - eyes closing or going out of focus;
  - trouble keeping your head up;
  - yawning non-stop;
  - wandering, disconnected thoughts; and
  - not remembering flying the last few minutes.

4. GENERAL REQUIREMENTS

4.1 Fuel

If helicopter flights are required at short notice that are not in accordance with the normal inspection or patrol programme, Aeropower will be responsible for ensuring that sufficient fuel is available on any of the usual inspection or patrol routes. In particular, fuel should be held at designated fuel sites at Murray Bridge, Brinkworth, Wudinna, Cleve and Kadina.

No fuel will be stored at SA Power Networks depots. All fuel drums shall be removed from the locality or stored at registered fuel depots within two weeks of completion of operations in that locality, advise the Helicopter Contractor/Service provider of circumstances where drums remain longer than necessary.

4.2 Program Liaison

Maintenance Operations Manager and Works Coordinator Vegetations Services are to be kept informed of events and program compliance.

4.3 Working Hours / Programming

The Pilot, Inspector and Observer shall, by mutual agreement, decide on the most suitable times to carry out flights throughout any particular day. Day to day flying will vary according to weather conditions; however consideration should be given to operating in a safe, cost and time effective manner.

Flight times are usually programmed for a **max of 3 hours** after which rest breaks and refuelling should occur. The flight crew should take a lunch break of at least 30 minutes. The program is based on an estimated 5 hours per day total flying time, but longer hours may be flown after taking into account conditions, programming and safety requirements.

4.4 Helicopter Type

The helicopter shall be turbine powered.

4.5 Meals and Accommodation

Contractors are responsible for payment of their living away expenses e.g. meals & accommodation etc.

5. EQUIPMENT

Note: all equipment & objects must be suitably secured / tethered during all aircraft operations, to avoid objects falling or being dislodged from the aircraft either during flight or whilst on the ground.

- **Gyroscopic Binoculars;** should be used wherever possible. Remember to focus eyepieces and cage / uncage images. **Ensure the binoculars are <u>uncaged after each use</u>** otherwise the bearing life will be significantly reduced & turned off during helicopter start up.
- **GPS;** where practicable **SA Power Networks GPS units are also to be used** for identifying and recording feeder locations.
- **Cameras;** photos should be taken of significant and unusual defects. Flight crews should be conversant with camera operations prior to commencement of flights.
- **Helmets & extension cords;** are provided for your protection and must be used, ensure correct fitment prior to commencement of flying. Helmets and Helmet liners are to be cleaned prior to use. Clean with damp cloth or commercially available hand wipes. Ensure moisture is kept clear of the microphones. Helmets have been fitted with Volume controls and use of ear plugs is encouraged.
- **Overalls;** each crew member shall wear outer clothing having fire retarding properties, e.g. inesman overalls and boots or approved Fire Retarding Flying suits.
- **Log Book;** all flight times are to be recorded (and be Legible) in the log book, noting line ID and flight time inclusive of ferry time except where the ferry is a separate flight from one location to another.
- **Feeder plan;** a copy of the feeder plan to be flown shall be pre-prepared with the following information:
  a. 'No Fly Zones' and/or hazard areas including type of hazard; and
  b. Other line cross overs (To be highlighted).
- **Line Inspection Manual;** for reference to defect types and prioritising.

Note

1. ***Equipment shall be secured when left unattended, especially the GPS, Camera & Gyro's due to their expensive nature.***
2. ***Report all equipment issues and problems to ensure timely response or rectification and to avoid continued impacts.***
3. ***Ensure at the end of the week all necessary paper work and information is forwarded onto the Maintenance Operations Manager.***

6. SEARCH AND RESCUE

Whilst Aerial Operations are active Search & Rescue procedures shall be adhered to (Refer to Search & Rescue procedure Section 3.19A). It is preferred that only Asset Operations personnel be utilised.

7. FLYING CONDITIONS AND RESTRICTED HELICOPTER MOVEMENTS

- All aerial operations shall be undertaken in appropriate meteorological conditions with sufficient visibility. The wind direction and location of the sun should be taken into account when planning the flight route. It may be necessary to suspend operations during periods of low visibility such as rain, fog or smoke.
- It is a requirement of the Civil Aviation Safety Authority that any aircraft shall not in any event be flown within 100 metres horizontally of a building which forms a part of a town, city or populous area during low level operations.
- Lines must not be flown where, in the event of an engine failure, members of the public would be put at risk.

8. ROUTE HAZARD MARKING

8.1 SA Power Networks Assets

In addition to no fly zones and hazards being marked on feeder plans, line markers are installed to indicate to the aircraft crew that they are approaching a four way line crossing, other line crossings or other known hazards. Line markers comprise orange coloured oval shaped marker balls of approximately 300mm diameter. Marker balls are installed either side of a line crossing or tee off.

8.2 ElectraNet SA Assets

ElectraNet SA have recently commenced a program of replacing the orange marker balls, as used on SA Power Networks assets, with yellow coloured discs of approximately 300mm diameter on their Transmission Lines to indicate an approaching line crossing or hazard. These indicators are installed at the top of the structure on the 2nd and 3rd poles either side of the crossover.

9. ADVERTISING

It is the responsibility of the Maintenance Operations Manager/ Works Coordinator to advise all media. Assistance is available from Manager Public Relations.

10. RECORIDNG OF RESULTS

10.1 Maintenance Recording

All follow-up work required as a result of aerial operations MUST be recorded in SAP as a “DD” for Distribution Defect or “VG” for Vegetation Infringement.

Defects identified shall be uploaded into SAP via MDT as soon as practicable. Records should be viewed to ensure the transfer was successful and checked for accuracy.

10.2 GPS Points

Any new GPS points should be provided to Line Maintenance Coordinator as soon as practicable.

10.3 Work Orders

A permanent record of the Inspection is to be initiated by “signing off” the SAP Works Order that initiated the Inspection.

10.4 Aerial Operations Assessment Sheets

Aerial Operations Assessment Sheets must be completed for each aircraft and/or pilot and returned to Maintenance Operations Manager as follows:

- At the end of each week, if there have not been any problems or issues;

or

- Immediately, if a problem is encountered.

Information will be recorded on a database and a copy of the Aerial Operations Assessment Sheets will be faxed to Aeropower.

10.5 No Fly Zones

The records must indicate the following:

- Reason section has been classified as a No Fly Zone.
- Boundary between No Fly Zone and Fly Zone.

Locations that are not examined by aerial patrols **MUST be covered by a ground level patrol** within the period 1 May to 15 November.

No Fly Zone details **must be recorded** in the **SAP Functional Location Class field called “*No Fly Zone*”**. The Maintenance Operations Manager is responsible for the identification and recording of boundaries for No Fly Zones and for the boundaries between aerial and ground based examinations.

In addition, there must be an overlap of one span inspected/patrolled by the ground based crew beyond the boundary.

Updates to No Fly Zones shall be communicated as soon as practicable to facilitate timely SAP amendments.

10.6 Flight Dockets

The Inspector will record on a docket:

- the name(s) of the line(s) patrolled and/or inspected;
- the flying hours spent patrolling and/or inspecting each line for each day on which patrols and/or inspections are performed;
- the flying hours spent ferrying;
- the number of nights of pilot accommodation on daily log sheets;
- hours will be “**engine on” “engine off”** to the **nearest 0.1 of an hour** (ie 6 mins.);
- on emergency patrol flights include “emergency patrol” on top of Log sheet; and
- do not record Transmission Line flights on the same docket as Distribution line flights.

The Pilot will sign the docket and the original docket **(blue copy) will be provided to the Pilot**. The original docket or a duplicate copy of it will be evidence of the flying hours spent patrolling and/or inspecting for that day. The first duplicate **(Green Copy) will be sent at the end of the week to Maintenance Operations Manager.**

11. BRIEFING SESSIONS

11.1 Pre Flying Season Briefing

Prior to the commencement of Programmed Aerial Operations, the Maintenance Operations Manager will conduct a briefing session with all participants. This session will allow discussion of the proposed Aerial Program, Inspection procedures, review of the Aerial Operations Procedure, safety aspects of the operation.

11.2 Post Flying Season Briefing

At the completion of the Aerial Operations Program, a debriefing session will be held with participants. The agenda should include feedback and general comments in regard to the progress of operations, Service providers’ performance, safety issues, and recommendations for improvements.

12. ADDITIONAL INFORMATION

Additional information regarding Aircraft Operations can be obtained from Manager network Performance- Contract Administration, or the Maintenance Operations Manager, who are familiar with the above procedures.

13. REFERENCE DOCUMENTS

13.1 Line Inspection Manual

3.15 Sub Transmission Lines – Component Inspections

3.16 Distribution Lines – Component Inspections

3.19A Helicopter Patrol – Search and Rescue Procedures

3.20 Ground Patrol – General Requirements

13.2 Drug & Alcohol Directive

13.3 Long Distance Driving Procedure

Appendix A

Aerial Assessment/Feedback Form

MAL COOPER	P SMYTH	AEROPOWER Fax 07 3204 1260 Roy Conomis David Salmon		

This form is to be **completed & signed** at the **end of each week** **OR immediately if problems/issues arise.**
Send the original directly to Mal Cooper via Fax 08 84045370 or Internal Mail DX11104.
Please tick the appropriate box and complete details at the bottom of the page when indicated.

LOCALITY .... **REGO**.................... **PERIOD** ....

PILOT & CREW NAMES ....

OPERATIONS: SEACH AND RESCUE CALLS — ON TIME ☐ / MISSED ☐details required below

PILOT:

EFFICIENT USE OF AIRCRAFT
(Inspector able to carry out duties efficiently, flew at suitable speed/height) — GOOD ☐ / ADEQUATE ☐details required below / POOR ☐details required below

NOISE IMPACT & VISUAL DISTRACTION
(Averted upsetting or unsafe effect on **public** and/or **livestock**) — GOOD ☐ / ADEQUATE ☐details required below / POOR ☐details required below

COMMUNICATION WITH NAV/INSPECTOR
(Able to operate as a part of team, complies with directions, cooperative) — GOOD ☐ / ADEQUATE ☐details required below / POOR ☐details required below

PUNCTUAL
(Flying commences at planned time) — YES ☐ / NO ☐details required below

NEAR MISSES/INCIDENTS
(Including any & all instances) — NO ☐ / YES ☐details required below plus Incident Report

PROBLEMS/FAULTS WITH AIRCRAFT
(Include details of downtime/time for repairs to be made) — NO ☐ / YES ☐details required below

FUEL SUPPLY AVAILABLE ☐ / UNAVAILABLE ☐details required below / DELAYS ☐details required below

ANY COMMENTS

NC

....
....
....
....
....

SA Power Networks Crew: Signature/s ....

See Back page for Aerial Operations requirements, refer to Line Inspection Manual Aerial Operations General Requirements 3 -19.

Daily/Weekly Aerial Operations Briefing Checklist

1. Crew considerations
   - a. Personnel rostered (Pilot, Inspector & Navigator).
   - b. Local Knowledge and previous experience in local area.
   - c. Confirm individual's health, wellbeing & ability to perform daily duties eg look for signs of fatigue.
   - d. Assign operational roles & responsibilities.
   - e. All participants to input into the team operation.
   - f. Confirm qualifications, sufficient training& competency levels attained.
2. Aircraft
   - a. Serviceability and appropriate equipment and communications fitted.
   - b. Crew configuration/s and seating positions & operational flight direction.
   - c. Fuel locations & constraints.
   - d. Aircraft safety briefings conducted.
   - e. Seating positions and harness provided and utilised eg (MHE, PLJ).
   - f. Conduct safety briefings with all participants.
   - g. EPIRB Location (can vary from Aircraft to Aircraft).
3. Weather
   - a. Consider daily BOM charts and forecasts (including internet access).
   - b. Projected weekly weather patterns.
   - c. What weather impacts might be encountered & any subsequent reactions?
4. Programs
   - a. Consider local program, set daily and weekly targets.
   - b. Consider current program status i.e. behind or ahead of schedule and what initiatives may or may not be required.
5. Flight Plan(including any alternatives)
   - a. Feeder/s & lines to be flown
   - b. No Fly zones
   - c. Contact requirements: Army, Prisons, caution area's & landowners requesting contact etc.
   - d. Fuel constraints.
   - e. Feeder Plans appropriately marked up.
   - f. Primary direction of travel with regard to wind direction, sunlight etc.
   - g. Consider efficiencies and potential cost saving benefits.
   - h. Proximity of other lines and any consequential direction of operation.
   - i. Direction of travel due to sun, wind & Aircraft configuration
6. Hazards
   - a. Discuss listed No Fly areas, local known hazards eg tall masts, Prohibited areas, local stock considerations etc.
   - b. Other aircraft operating in the locality.
7. Tools & Equipment
   - a. All equipment stowed correctly, equipment serviceable, sufficient and appropriate equipment, correct PPE, maintenance and cleaning of all equipment.
   - b. Appropriate competency level with equipment operation.
   - c. Survival Kit.
   - d. All equipment is serviceable.
8. Final preparations
   - a. Load all necessary equipment into aircraft.
   - b. Ensure security& safety arrangements @ landing zone have been met.
   - c. Contact NOC with SAR details by phone if possible.
   - d. All relevant and associated participants have been briefed and are aware of their responsibilities.
9. Ongoing safe & efficient operations.
   - a. Be aware of signs of fatigue.
   - b. Continually monitor progress and weather conditions.
   - c. Compliance with all associated procedures, methodologies & authorisations.
   - d. Unanimous agreement on conduct of aerial operations at all times, if not operations to cease until agreement is reached or alternative available.
   - e. Continual hazard identification, plan progress updating, SAR monitoring, stock considerations.
   - f. Defect recording including photographs.
   - g. Compliance to regulations, procedures and minimum clearances.
   - h. Compliance with SAR reporting.
10. End of session / end of day considerations.
    - a. Has SAR been cancelled?
    - b. Secure aircraft, equipment and fuel site.
    - c. Report any equipment failures and concerns and arrange repair.
    - d. Complete logs, report sheets and upload defects into SAP.
    - e. Confirm any program or operation issues & advise any program progress when appropriate.
    - f. Reporting of events and incidents.
    - g. Sufficient rest prior to next days operations.

3.19A HELICOPTER SEARCH AND RESCUE (SAR) PROCEDURE

1. PURPOSE OF DOCUMENT

This document details the Aerial Operations Search and Rescue (SAR) Procedures to be followed whilst Aerial Inspection & Patrol operations are in progress.

2. GENERAL

It is imperative that aircraft crews provide accurate information to NOC and that scheduled calls are made immediately they become due. All aircraft crew members are responsible for ensuring that SAR calls are cancelled promptly.

To ensure that all means of communication are available in case of a missed SAR call, aircraft crew members must carry their mobile phones with them at all times.

3. CONTACTS

1. The Network Operations Centre (NOC) is the preferred contact for SAR calls.
2. If the NOC are unavailable, the Aircraft crew must make alternative arrangements with either an Asset Operations Group Asset Inspector or Line Clearance Officer.
3. If an Asset operations Group person is not available, the Aircraft crew should arrange an alternate contact (ie Field Services personnel).
   Mal Cooper must then immediately be contacted with the Name and phone number of the alternative contact person so that a current 'Aerial Operations Search & Rescue Procedure' can be issued.
4. AirServices Australia should only be used as a last resort and then not without prior approval from Mal Cooper. If they are utilized, they must be informed of the current Feeder number with each SAR call.

4. SAR CALL PROCEDURE (FOR AIRCRAFT CREWS & NOC)

NB: Where a person other than the NOC is utilised for SAR calls, the NOC responsibilities detailed in this procedure can be taken as then being the alternate contact persons responsibilities.

1. The Aircraft crew must establish contact with the NOC prior to commencing aerial operations. The NOC should be contacted preferably via **phone 08 8404 4443** or alternatively via **Selcall 95** (or as a last resort 1 800 018 253).

2. The NOC will record the following details on the SAR Call Log sheet:
   - the Helicopter registration as the call sign;
   - crew members names;
   - radio channel;
   - the current feeder being patrolled;
   - time commenced;
   - time of next scheduled call (usually every hour (on the hour) or every half hour (on the half hour) from commencement;
   - direction of travel along the feeder;
   - GPS coordinates; and
   - fuel site locations for that day.

3. At each scheduled SAR call change of feeder or ferry flight, the Aircraft crew must provide the NOC with:
   - the Helicopter registration as the call sign;
   - the current feeder being patrolled;
   - time of next scheduled call;
   - direction of travel along the feeder;
   - the position on the feeder; and
   - GPS coordinates.

4. SAR calls must be cancelled in the presence of all other Aircraft crew members.

Note: If communications are lost, Aircraft crews must make every effort to re-establish contact with the NOC, e.g. by Aircraft radio or by landing and using a phone etc.

5. MISSED SAR CALL PROCEDURE (FOR NOC)

5. If an aircraft has not made contact by the Scheduled time, the NOC shall immediately commence Selcall and radio calls to the helicopter;

Selcall # (91) for Helicopter **MHE** **mobile** **0427 654 420**
Selcall # (**92**) for Helicopter **HWD** **mobile** **0419 872 934**
Selcall # (**93**) for Helicopter **PLU** **mobile TBA**
Selcall # (94) for Helicopter **PLJ** **mobile 0429 899 272**
Selcall # (**63**) for Helicopter **PLX** **mobile 0427 868 566**
Adelaide Pilot/Base Manger 0419 731 859 *(usually also flying)*

6. If still no contact has been made within **15 minutes** of a scheduled call, the NOC shall hand over to Asset Operations Branch.

FIRST CALL	MAL COOPER	Int phone **45425** Ext Phone: **08 84045425** Mob **0428 836 369** Pager ph **132 222** & quote number **60534**
1st ALTERNATIVE	PAUL SMYTH	Int phone **45656** Ext Phone: **08 84045656** Mob **0403 582 091**
2nd ALTERNATIVE	LEE ADAMS	Int phone **42865** Ext Phone: **08 85328865** Mob **0427 013 715**
3rd ALTERNATIVE	JEFF BOERTH	Int phone **45321** Ext Phone: **08 84045321** Mob **0427 011 814**

If after handover to Asset Operations, the aircraft subsequently makes contact with the NOC, the operator must immediately inform the Asset Operations contact.

6. ASSET OPERATIONS PERSONNEL SAR PROCEDURE

Do the following in order & proceed to the next action when appropriate:

A copy of the Aerial Programme & current SAR procedure is located on a hook attached to Mal Coopers divider or office door.

1. Attempt to contact Crew members via their Mobile Phone or Pager. If no answer, leave a voicemail message advising the reason for calling and a return phone number (preferably other than the phone you are using and one that is unlikely to be engaged).

2. Phone relevant landing/refueling sites as recorded on the SAR Call Log Sheet and/or Aerial Programme.

3. Phone either the Motel where overnight accommodation is booked or the home phone number of the local Navigator or Inspector. *Tact should be used to ensure that family members are not unduly alarmed.*

4. Call one of the following organizations and request that they attempt radio contact on the relevant Aircraft VHF radio frequency

   - **Flight Watch** on **1800 814 931**

   or

   - **If operations are within Approx 80kms of Adelaide --** phone **Adelaide Approach** on **8238 7992**
   - **If operations are more than Approx 80kms from Adelaide --** phone **Melbourne Centre 03 923 57402**

   Inform them that "Helicopter (Aircraft Type Hughes 500), VH (*call sign*) needs to be contacted, and the last known locality eg 30km radius of Riverton in South Australia".

5. Phone Local property owners around the feeder being flown, (phone #'s from feeder plans etc) to ascertain if a Helicopter has been in the vicinity recently

6. Phone the local Police Station to check fuel sites, or any reports from the general public etc

7. Commence a search of the last known feeder using either local Asset Operations or Field Services personnel.

8. Inform Aeropower on any of the following numbers;

HEAD OFFICE	07 3204 1280	ROY CONOMIS	0417 760 720
DAVID SALMON	0419 645 491	PARAFIELD	08 8285 8788

9. Contact **AIRSERVICES AUST - AVIATION SEARCH & RESCUE** on **1800 815 257** to enquire if the helicopters emergency beacon has been activated and to request that a coordinated Search & Rescue operation be commenced.

SAR CALL LOG SHEET

Helicopter Registration/callsign…………………Selcall…………………....Date……...………...

Radio Channel………..........

Personnel aboard. 1 .... 2 .... 3 ....

Feeder	**Time commenced**	**Next Scheduled call**	**Direction Of Travel**	**GPS Coordinates**
eg *GA15.*	*0800*	*0900*	*TF25 heading south*	

Daily Fuel site locations used are

1.___________________2.____________________3.__________________4. __________________

3.20 GROUND PATROL/INSPECTIONS GENERAL REQUIREMENTS

1. PURPOSE OF DOCUMENT

This document details the procedures to be followed for the Ground Patrol/Inspections of Overhead **Distribution and Sub Transmission Lines**.

2. PURPOSE OF GROUND PATROL/INSPECTIONS

Ground Patrol/Inspections of Overhead Distribution and Sub Transmission Lines is conducted to assess the condition of the asset to identify components that have deteriorated to the extent that failure is likely. Hazards that may lead to Injury to members of the public, supply interruption or bushfire start are also identified and recorded.

3. DEFINITIONS

Ground Patrol/Inspections are defined as a ground vehicle or foot based, visual assessment of the condition of SA Power Networks Power Delivery Asset, concentrating on those failure modes and hazards most readily identified from the ground.

4. ASSETS COVERED

Ground Patrols are conducted on each section of the Distribution and Sub Transmission Lines owned and operated by SA Power Networks that can be accessed by ground.

5. EQUIPMENT REQUIRED

The following equipment will be required to conduct Ground Based Patrols/inspections.

- Personal Protective Equipment.
- Equipment as listed below.

6. SKILLS / RESOURCES REQUIRED

Ground Patrols are to be conducted by Asset Inspectors who have completed formal training and demonstrated necessary competencies as determined by the **Manager Network Asset Management**.
Ground Patrols may be conducted by one accredited Asset Inspector.

7. PRE-DEPARTURE CHECKLIST

Before commencing an inspection or patrol, check:

1. Specific details (name and voltage level(s)) of assets to be inspected or patrolled, including inspection limits/boundary interfaces to ensure appropriate overlap.
2. Type of inspection or patrol, ie whether a methodical detailed examination or general overview for a specific purpose.
3. Bushfire risk area (HBFRA and BFRA maps in vehicle), fire danger, and any fire laws imposed.

3a. Understanding of, and compliance to, Seasonal fire precautions including Corporate Directives/Policy and the CFS Fire Danger rating system.

4. Knapsack sprays, shovel, and water containers full and on vehicle.
5. List of known locations of pest-weeds or diseases (animal or vegetation), or sensitive sites for aerial/helicopter inspection.

6 Measures required to control, and avoid spreading of pest-weeds or vegetation or animal diseases. Ensure any water containers and chemicals or antiseptics required for disease containment are carried as required.
7. Route plan, pole/tower schedule(s), SD/Feeder Plan(s) and current access maps on hand.
8. Current Feeder plan/s, E drawings, Network Directive Manual, Line Inspection Manual plus SA Power Networks Acts and Regulations and current guidelines for Bushfire Survival Action plan.
9. Binoculars of suitable type for inspection of line fittings from ground level on hand.
10. Laser-scope, extendable height stick and Abney level or inclinometer.
11. Notifying cards for entering private property.
12. Valid switching accreditation as necessary.
13. Outstanding SAP maintenance defect reports and works orders relevant to the feeder /asset being inspected.
14. Diaries, note paper, brochures and reference letters etc. for issue to public.
15. Suitable computer and/or software to interface defect data into SA Power Networks SAP, with attached GPS waypoints.
16. Suitable GPS device to record defect location waypoints.
17. Suitable digital camera.
18. Suitable digging tools for ground line assessment and a needle profile gauge.
19. Handsaw and hand pruners for minor vegetation control around poles.
20. Inspectors are to review and update existing SAP DD notifications when conducting inspections, so must ensure they have checked the current list of notifications pertaining to the area of inspection.

8. RECORDING OF RESULTS

All follow-up work required as a result of inspection MUST be recorded in SAP as a "Distribution Defect". The inspector must check the MRV score for new notifications and update all existing notifications pertaining to the area of inspection.

A permanent record of the Inspection is to be initiated by "signing off" the SAP Works Order that initiated the Inspection.

9. REFERENCE DOCUMENTS

9.1 The Electricity Act 1996

9.2 SA Power Networks Substation Inspection

9.3 SA Power Networks Substation Design

9.4 Network Directive Manual

9.5 Network Maintenance Manual

5.5 Maintenance Strategy – Sub Station Disconnector & Switches
6.2 Maintenance Strategy – Overhead Sub Transmission Lines
6.3 Maintenance Strategy – Overhead Distribution Assets
6.6 Maintenance Strategy – Ground Level Distribution Switchgear.

9.6 SA Power Networks Switching Operator Handbook

9.7 SA Power Networks Substation Instructions

9.8 Current guidelines for Bushfire Survival Action Plan.

3.21 SWER ISOLATING TRANSFORMER POLE EARTH TEST

1. PURPOSE OF DOCUMENT

This document details the procedures to be followed for Pole Earth Testing of SWER Isolating Transformers.

2. PURPOSE OF TESTING

Testing of the pole earth of SWER Isolating Transformers is conducted to ensure that the pole earthing system is operating within specification, to identify hazards and components that have deteriorated to the extent that failure of the earthing system is likely. Emphasis is placed on identification and management of known hazard and component failure modes which could jeopardise:

- Safety of the Public, Employees and Operators; and
- Continuity of supply to customers.

3. DEFINITIONS

Testing is usually defined as a detailed electrical assessment of the operating specifications of the equipment and specified components, to detect deterioration likely to lead to failure of the equipment or pose a hazard to employees, operators or members of the general public.

4. SAFETY

4.1 Earthing System Deterioration

Deterioration of the HV earthing system can cause a potentially hazardous voltage on the steel of the pole and associated metal. The use of a Modiewark and Multi-meter (FSWM 136) is essential to ensure that the pole is not live and that the voltage on the pole is within standards to perform earth testing while the transformer is energised. The Modiewark must be proven to be operating correctly before and after verification that the pole is not live. The Multi-meter must also be used to measure voltage on a known source to confirm correct operation.

4.2 Visual Inspection of Area

A visual inspection of the area should be carried out before proceeding with testing to identify hazards such as snakes, lizards, spiders and beehives within the test box. An inspection of the exterior of the test box for signs of HV faults, such as blackening of the box should also be carried out.

5. EQUIPMENT REQUIRED

The following equipment will be required to conduct testing of pole earths of SWER Isolating Transformers.

- Modiewark (including fibreglass switching stick);
- Multi-meter;
- Auxiliary earthing stake (remote earth); and
- Kyoritsu 4105 Digital Earth Tester (temporary earth stakes and red, yellow and green connecting leads included with earth tester).

6. SKILLS / RESOURCES REQUIRED

Earth testing is to be conducted by Asset Inspectors or Field Services personnel who have completed formal training and demonstrated necessary competencies as determined by the **Manager Network Asset Management.**

The test procedure has been designed to be conducted safely by one accredited (refer above) Asset Inspector / Field Services Linesman.

7. TEST PROCEDURE

1. Test the pole with a Modiewark to ensure the pole is not live (Field Services Job Safe Work Method FSWM 136). Check the Modiewark for correct operation before and after testing of the pole. If the pole is found to be live the pole earth cannot be tested with the Isolating Transformer energised and a defect notification is to be raised.
2. Install a remote earth and with a Multi-meter test the voltage on the steel of the pole ensuring it is less than 32 volts (Field Services Job Safe Work Method FSWM 136). If the voltage is greater than 32 volts, the pole earth cannot be tested with the Isolating Transformer energised and a defect notification is to be raised.
3. The pole earth stake must be bonded to the pole. If the pole earth stake is not bonded to the pole, the pole earth can not be tested and the test must be abandoned. Raise a defect notification for the pole earth to be repaired by Field Services.
4. Install two temporary earth stakes, supplied with the Digital Earth Tester, aligned and at an interval of 5 to 10 meters from the pole earth under test, as specified in the Digital Earth Tester instruction manual.
5. Connect the red and yellow leads supplied with the Digital Earth Tester to the temporary earth stakes and the green lead supplied to the pole earth. Ensure that the red, yellow and green leads are connected to the red, yellow and green inputs of the Digital Earth Tester respectively.
6. Measure the resistance of the pole earth following the instructions given in the Digital Earth Tester instruction manual. Record the measurement.
7. If the pole earth is not less than 10Ω raise a defect notification for the pole earth to be repaired by Field Services.

8. RECORDING OF RESULTS

- Pole earth resistance value to be recorded in SAP.
- If pole earth resistance value is outside of specification (> 10 ohms), raise a defect notification in SAP.

9. REFERENCE DOCUMENTS

9.1 FSWM 136

Field Services Job Safe Work Method: High Voltage Earth Testing - 19kV SWER Isolating Transformer.

9.2 E2778

Modiewark Live Line Indicator.

9.3 E1451

Earthing Arrangement, SWER Isolating Transformer.

3.22 SWER ISOLATING TRANSFORMER HV EARTH TEST

1. PURPOSE OF DOCUMENT

This document details the procedures to be followed for High Voltage Earth Testing of SWER Isolating Transformers.

2. PURPOSE OF TESTING

Testing of the HV earths of SWER Isolating Transformers is conducted to ensure that the HV earthing system is operating within specification, to identify hazards and components that have deteriorated to the extent that failure of the earthing system is likely. Emphasis is placed on identification and management of known hazard and component failure modes which could jeopardise:

- Safety of the Public, Employees and Operators; and
- Continuity of supply to customers.

3. DEFINITIONS

Testing is usually defined as a detailed electrical assessment of the operating specifications of the equipment and specified components, to detect deterioration likely to lead to failure of the equipment or pose a hazard to employees, operators or members of the general public.

4. SAFETY

4.1 Earthing System Deterioration

Deterioration of the HV earthing system can cause a potentially hazardous voltage on the steel of the pole and associated metal. The use of a Modiewark and Multi-meter (FSWM 136) is essential to ensure that the pole and HV earths are not live and that their voltage is within the standard to perform earth testing while the transformer is energised. The Modiewark must be proven to be operating correctly before and after verification that the pole and HV earths are not live. The Multi-meter must also be used to measure the voltage on a known source to confirm correct operation.

If during testing, any earth resistance values are found to be outside of specification, the test should be stopped immediately and a defect notification raised.

In normal operation, the HV earthing system carries current. Open-circuiting this system while the transformer is energised can result in a potentially hazardous voltage. To prevent this, the left hand and right hand HV earth isolating switches should never be open simultaneously while the transformer is energised. The test box of the Isolating Transformer earthing system has an interlock to prevent this happening. If the SWER Isolating transformer earthing system does not have a test box, the test can not be carried out and a defect notification is to be raised.

4.2 Elevated Test Box

The test box required to be accessed to perform the HV earth testing is mounted at a height of 2.7m above ground level. A ladder is needed to access the test box and appropriate safety precautions are to be observed while working at an elevated level.

4.3 Visual Inspection of Area

A visual inspection of the area should be carried out before proceeding with testing to identify hazards such as snakes, lizards, spiders and beehives within the test box. An inspection of the exterior of the test box for signs of HV faults, such as blackening of the box should also be carried out.

5. EQUIPMENT REQUIRED

The following equipment will be required to conduct testing of the HV earths of SWER Isolating Transformers.

- Modiewark (including fibreglass switching stick);
- Multi-meter;
- Auxiliary earth stake (remote earth);
- Temporary earth lead (KL0818 - pole clamp; KL3532 - cable 70 mm^2 Alum, 8000A fault current; KL0810 – Insulated screw connection);
- Kyoritsu 4105 Digital Earth Tester (temporary earth stakes and red, yellow and green connecting leads included with earth tester); and
- Short ladder and associated protective equipment.

6. SKILLS / RESOURCES REQUIRED

Earth testing is to be conducted by Asset Inspectors or Field Services Personnel who have completed formal training and demonstrated necessary competencies as determined by the **Manager Network Asset Management.**

The test procedure has been designed to be conducted safely by one accredited (refer above) Asset Inspector / Field Services Personnel.

7. TEST PROCEDURE

At any time during testing, if a defect notification is to be raised, the test must be ceased immediately and the system returned to its original state.

1. Test the pole and HV earthing cables below the test box with a Modiewark to ensure neither is live (Field Services Job Safe Work Method FSWM 136). Check the Modiewark for correct operation before and after testing the pole and HV cables. If either is shown to be live a defect notification is to be raised.
2. Install a remote earth and with a Multi-meter test the voltage on the steel of the pole ensuring it is less than 32 volts (Field Services Job Safe Work Method FSWM 136). If the voltage is greater than 32 volts a defect notification is to be raised
3. Test the pole earth in accordance with the pole earth test procedure (section 3.20). Record the measurement.
4. If the pole earth is within specification (< 10Ω) proceed with the HV earth test. If the pole earth is not less than 10Ω the HV earth cannot be tested with the isolating transformer energised and a defect notification is to be raised.
5. Open the test box and test the voltage on the earth conductor in the test box using the remote earth previously installed and a Multi-meter. If the voltage is greater than 32 volts a defect notification is to be raised.
6. Temporarily bridge an earth lead between the top lug of the CT shorting switch in the test box (HV earthing point) and the pole. Use the same pole joist as the earth bond at the base of the pole.

7. Install two temporary earth stakes, supplied with the Digital Earth Tester, aligned and at an interval of 5 to 10 meters from the HV earth stake under test, as specified in the Digital Earth Tester instruction manual.
8. Open the left hand HV earth isolating switch in the test box
9. Connect the red and yellow leads supplied with the Digital Earth Tester to the temporary earth stakes and the green lead supplied to the left hand HV earth. Ensure that the red, yellow and green leads are connected to the red, yellow and green inputs of the Digital Earth Tester respectively.
10. Measure the resistance of the left hand HV earth following the instructions given in the Digital Earth Tester instruction manual. Record the measurement. If the left hand HV earth resistance is outside of specification (> 3Ω a defect notification is to be raised.
11. Remove the green lead while leaving the red and yellow leads connected and close the left hand earth isolating switch.
12. Open the right hand earth isolating switch and connect the green lead to the right hand HV earth.
13. Repeat step (J) to obtain the resistance of the right hand HV earth. If the right hand HV earth resistance is greater than 3Ω, raise a defect notification.
14. Remove the green lead, close the right hand earth isolating switch and remove the temporary earth lead between the pole and the CT shorting switch.

8. RECORDING OF RESULTS

- Earth resistance values to be recorded in SAP.
- If any earth resistance value is outside of specification, raise a defect notification in SAP.

9. REFERENCE DOCUMENTS

9.1 FSWM 136

Field Services Job Safe Work Method: High Voltage Earth Testing - 19kV SWER Isolating Transformer.

9.2 E2778

Modiewark Live Line Indicator.

9.3 E1451

Earthing Arrangement, SWER Isolating Transformer Technical Standard.

9.4 Line Inspection

3.21: Pole Earth Test Procedure - SWER Isolating Transformer.

3.23 RECORDING & MANAGING MAINTENANCE INFORMATION

1. PURPOSE OF DOCUMENT

This document describes the standards for terminology and formatting of maintenance defect for the creation of SAP notifications.

2. DEFINITIONS

MDT – Maintenance Data Terminal

Contractor SAP Portal – Web based page to interface into SAP.

3. DATA ENTRY REQUIREMENTS

Maintenance Defect data may be recorded via:

- MDT
- SAP
- Contractor SAP Portal

SAP Data Entry deadlines are specified in the following table:

PRIORITY	PERIOD	DATA ENTRY REQUIREMENT
Z	During the FDS	Inspector notifies SA Power Networks immediately. Record in SAP within 24 hours of defect identification.
Z	Outside the FDS	Record in SAP within 3 working days of completing the Inspection/Patrol
1, 2, 3, 4	At all times	

Maintenance information needs to be retained in archives for at least 7 years.

4. NOTES ON SPECIFIC ITEMS

4.1 Creating Notifications

Individual Notifications must be created for each defect (failure mode).

4.2 SAP Dates

The SAP Notification date format is dd.mm.yyyy (eg 12.05.2002 or 04.12.2001).

4.3 Photographs

Digital photos must be 'in focus' and correctly exposed and shall be attached to each DD/SD Notification in accordance with the requirements specified in the Priority Guidelines (LIM Section 9.8).

At least one photo shall be a close-up clearly showing the component defect, another showing the complete pole and pole top construction/site. Avoid use of excessive photos; where possible use a logical photo file name.

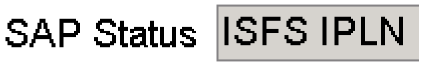
4.4 USER Status – Field

Existing SAP Notifications contain a user status and prior to editing, consideration must be given to the attached status, for example if ISFS is attached editing of Functional Location and/or Budget codes will adversely affect the attached and released Work Order. Do not make these changes; instead follow up with Network or Field Services.

SAP Status definitions and associated actions:

SAP Status	Definition	Action	EDIT
ISFS	Issued To Field Svs	Notification scheduled for remediation	Escalate to Network / Field Svs for consideration
RFND	Refer for Network Design	Notification referred to NPO for design input	OK for edit.
NDCO	Network design complete	Design complete, job ready for ISFS	OK for edit if ISFS not attached
RBNW	Refer back to Network for consideration	Referred back to Network for review	OK for edit
PROG	Project rebuild	Notification flagged for completion via a Project	Escalate to Network / F Svs for consideration
IPLN	In Plan (Field Svs)	Scheduled in Field Svs Work plan	Escalate to Network / Field Svs for consideration
INIT	Initial	Initial notification with an unassigned Status.	OK for edit

SAP Noti: 

MDT noti: 

4.5 Defective Electrical Installations

Customers Electrical Installation/Service: defective customer installations (DEI process)
Where customer installations are considered to be defective ie, the customer installation is considered not to meet standard Conditions of Supply or Regulatory Wiring Rules, action should be in accordance with **Network QA Procedure 117 – Dealing with Defective Electrical Installations**. Refer to Network Quality Procedure 117 for appropriate actions when situations are identified in accordance with the content of Procedure 117. Situations include customer meter box enclosures, service points, private wiring, defective or dangerous customer wiring and access or restrictions to service points.

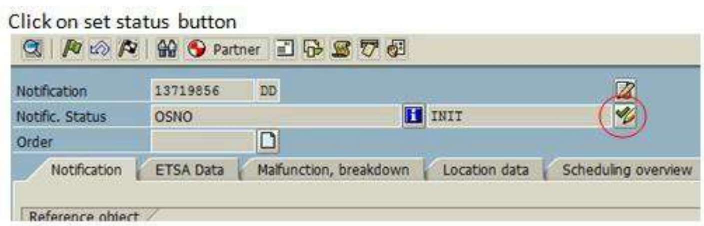
5. REVIEWING EXISTING NOTIFICATIONS

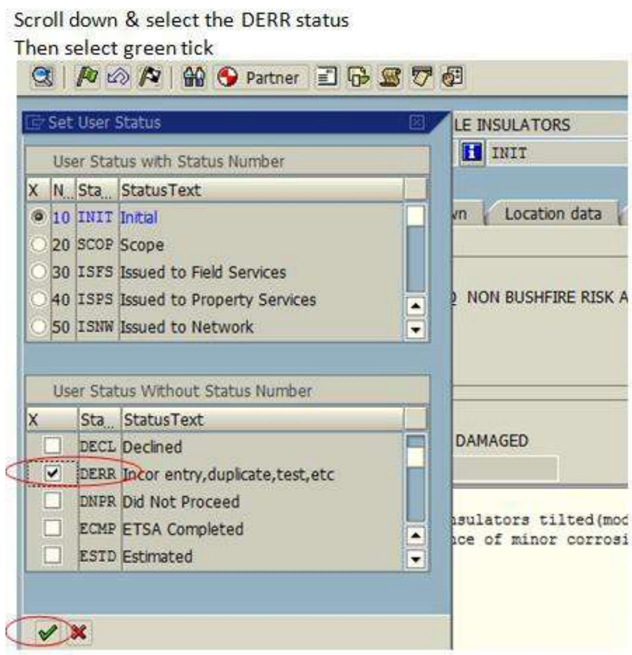
5.1 Inspection Dates

Where an existing notification has been re-assessed and modified by the Inspector, the original notification date must be changed to the date it was reinspected (as long as it has not been issued to Field Services) to ensure that Start / Finish dates are appropriate. Details of amendments made or new photos attached along with inspector's name and reason for change must be added to the Notes field.

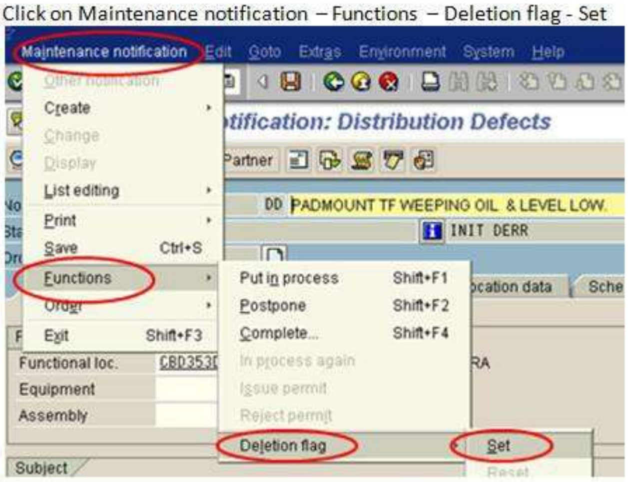
5.2 Setting DERR (Duplicate / Error Entry)

Prior to starting this process, ensure the DD Noti has notes added to describe why the Noti will have the DERR Status (duplicate job/job completed etc) applied and have inspectors name and date also entered in notes. It is important not to DERR a defect that has the status ISFS attached; these must be referred to the Maintenance Standards Officer.

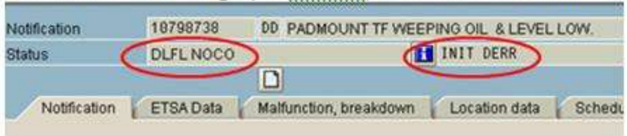




Click on Maintenance notification – Functions – Deletion flag - Set



The Notification is now greyed out with Status DLFL NOCO- INIT DERR – now Save



6. MDT DATA ENTRY

Reported: Inspector name

SAP user identification is recorded automatically.

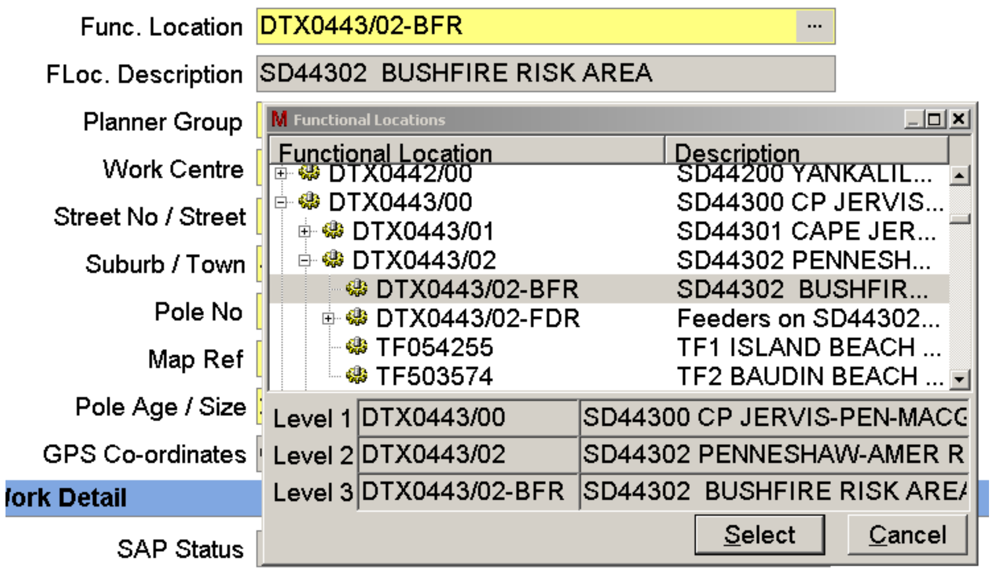
Func. Location

Entry of the Functional location including appropriate **Risk Area** is **mandatory**. Use Substation number or personnel access hole number etc where asset is not a line.

Note: For pole related defects, the highest voltage functional location must be used.

Planner Group & Work Centre

Planner Group and Work Centre values are automatically populated according to the selected Feeder ID (Functional Location), **however, for Pole Plating defects this should be manually replaced with PCN Planned Group and PC-Weld for Work Centre**.



Refer to:

- Section 9-1 for maps of (H)BFRA boundaries
- Feeder plan
- Electricity Act & Regulations

Planner Group & Work Centre

Default values will populate following entry of the Functional Location. However, in some instances the default value may need to be over-written by selection from the drop down menu.

Type	Planner Group	Work Centre
Pole plating defect	PCN	PC-Weld
Sub Maint Defect's (G/L oil leaks , LV Isolator replacements)	SUB	WP-SUB-M
Sub Maint Property Services	PSP	WP-SUB-P

Street No / Street

For urban locations, a street number and street name should be recorded in the appropriate fields.

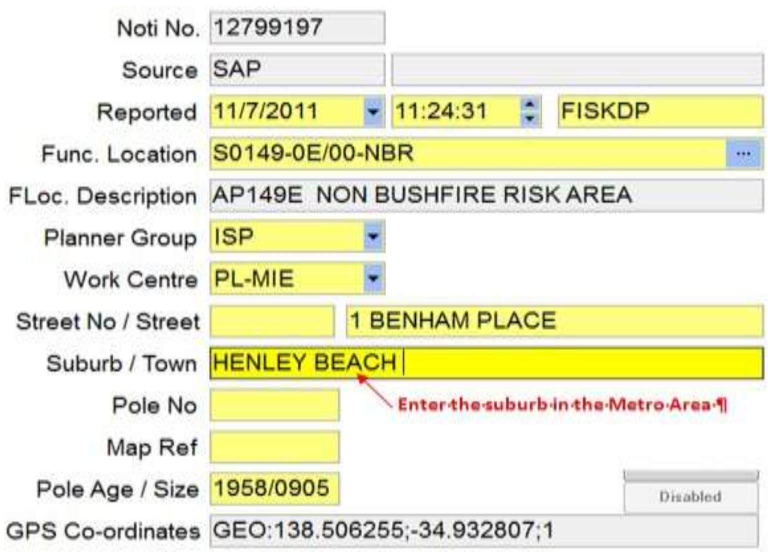
For rural/other locations, in the Street field, insert number of the transformer pole, disconnect Fuse, Air Break, Recloser, Sectionaliser, pole or tower as physically numbered on the structure. **Alternatively, an electrical address as described** below in *Part 6 – Identification* should be recorded. Note that the Street field is restricted to 29 characters.

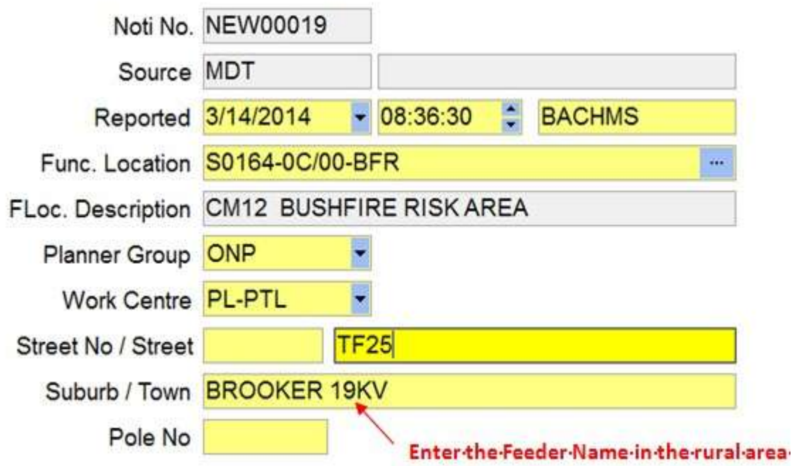
Suburb / Town

Overwrite the Suburb/Town (which defaults with the Functional Location description) with the Suburb/Town or feeder name.

Note:

Suburb/Town is only required in the metropolitan area or large regional centres.
Feeder Name to be populated for rural areas.





Pole No.

Sub Transmission pole numbering must be a minimum of 3 digits. (eg 001, 010)

Map Ref

Enter relevant Feeder Plan coordinates for Country areas. Map reference is not required for Metro areas.

Pole Age / Size

For all poles, enter the relevant pole age and size.

GPS Co-ordinates

Enter a valid GPS Waypoint when prompted in the MDT application.

If using an external GPS device other than the MDT, ensure that the device has been set to the correct format (ie Degrees.degrees hddd.ddddd)

If recording a Waypoint to an existing Notification in SAP manually type entry format as follows: GEO:138.582033;-34.942143;1 as per screen dump example below:

Work Detail

SAP Status	ISFS IPLN
Quick Code	ARMOUR RODS/LINE GUARDS
Description	CORRODED ARMOUR RODS & CONDUCTOR*
Priority	Z
Inspection Method	IB
Voltage	33

Quick Code

Select the most appropriate failure Mode Quick Code from the drop down list. The Inspector must select the correct Quick Code to ensure Notifications are issued to the relevant Maintenance Group with appropriate Budget Unit Costing.

Description

Enter a brief description of defect details to assist job filtering and planning. Enter details and descriptive text in Long Text field; refer to standard text inputs in annexure. Link to master file: R:\Network\AssetOps\LIM Standard Data Entry examples

Priority

Priority option is only to be filled in for 'Z' codes for DD and SD notifications.

Inspection Method

Select the appropriate Inspection Code relevant to the type if Inspection/Patrol being conducted.

Voltage

Record applicable voltage(s).

MRV Consequence	LOSS OF SUPPLY
MRV Probability	LIKELY
MRV Cust. Affected	AFFECTED-FEEDER/SUB STN
Defect Severity	HIGH

New Long Text

```
Pole 145
New Pole Location
Line guards corroded with broken strands.adjacent new pole site
Suggest sleeving in new section of conductor.-All Phases.
Photos
```

MRV – Maintenance Risk Value

The Maintenance Risk Value considers the potential level of risk to the Network that the defect poses. By choosing the appropriate responses in the drop down boxes and MRV value is calculated once loaded into SAP. These are mandatory fields that must be filled in; refer to Guidelines Section 9 – Misc 9–8.

The MRV only applied to DD (Distribution Defects) and SD (Substation Defects) not VG (Vegetation) notifications.

New Long Text

The New Long text box is where additional information about the defect and site location etc should be recorded to assist with subsequent Job Planning.

A recommended fix must be recorded in the Notes field of each Notification. Refer to typical text examples to be utilised during creation of notifications at the end of this section.

7. IDENTIFICATION

The following guidelines are provided to assist with the recording of identified maintenance work.
To identify maintenance work recorded from inspections, firstly refer to the direction of the inspection, utilising maintenance reports (the report for outstanding defects for priority 2, 3 and Tree data is feeder based) and examining the sequence in which the jobs are recorded. This may be in ascending or descending order AND will assist further with the on-site identification of maintenance work.

Tower Structure

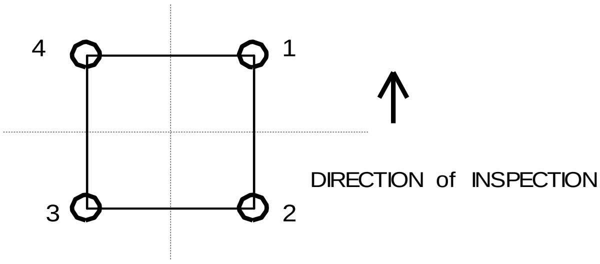
When looking directly down from above the structure could be divided to 4 sections.

Maintenance can be clearly identified throughout the structure or at ground level.

For example:

Ground (G) - G3

Structure (S) - Top(T) = ST1
- Middle (M) = SM3
- Bottom (B) = SB4



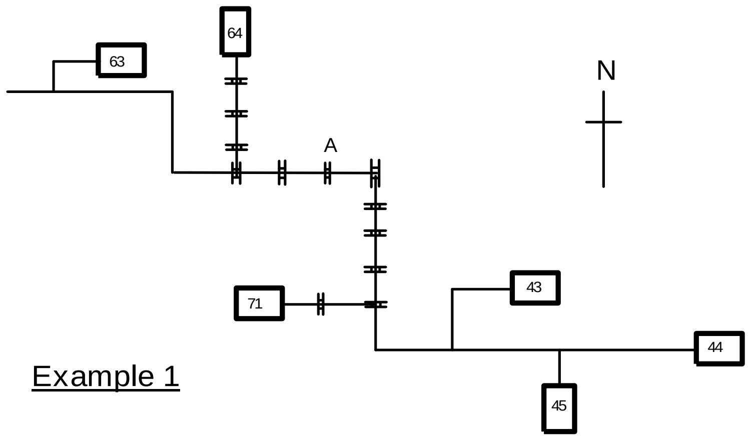
Pole Numbering System

This method relies on:

- Use of Feeder Plan Numbers
- Use of Transformer Numbers on Feeder Plans
- Use of a physical count of HV poles during patrol/inspection
- Allocating pole numbers to LV poles (eg Example 3)

Method - HV Poles
Example 1:

Consider the following example for the 'HYPOTHETICAL 11 kV FEEDER' in the Imaginary District, IM69.



Assume we wish to identify the pole at A. The pole is identified as: *TF71-TF64/7*

TF71- TF64	indicates that it is between transformers 71 and 64
/7	indicates that it is the 7th pole from Transformer 71

The same pole could also be identified as:

TF64-TF71/6

in this instance the pole count starting from Transformer 64.

Mid-Span Identification

If we wish to identify the span West of A, then the span could be identified as either:

TF64-TF71/5-6 or

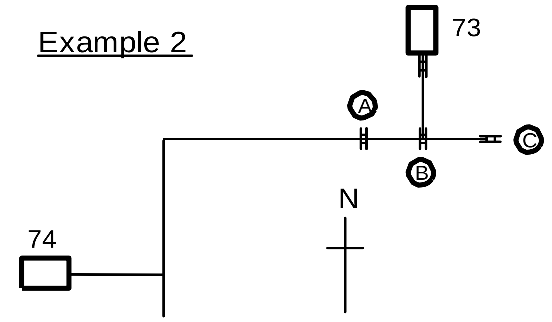
TF71-TF64/7-8

Conventions to be Adopted - HV Poles

- Poles need not be physically numbered - an on-site count can be made during patrol/inspection.
- Counting begins from the nearer transformer, although not essential.
- The transformer pole is identified completely by the transformer number eg TF 64 includes the pole.
- Number 1 of the count is attributed to the first pole out from the transformer.
- At the end of a spur, a HV pole which is only used as the final dead end pole is to be designated by the addition of letters DE after the previous pole number.

Again, considering feeder number IM69

Example 2:



TF73 Identifies T/F Station (including pole)

TF73-TF74/1 Identifies Pole at B

TF73-TF74/2 Identifies Pole at A

***TF73-TF74/1* DE**

OR Identifies Pole at C

***TF73-TF74*/HV East 1DE**

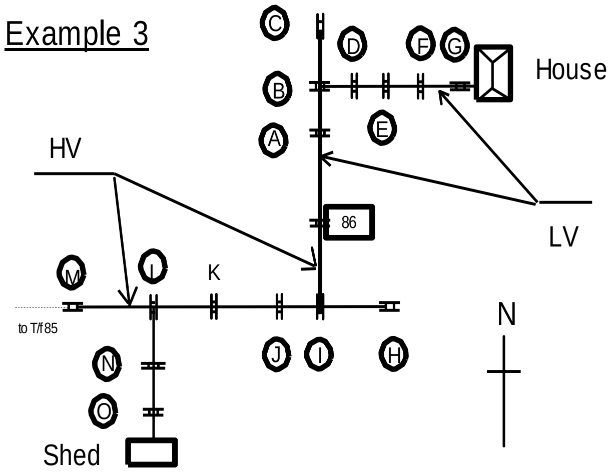
Method LV - Poles

To identify LV poles, numbers must be allocated to each pole. If the LV network associated with a particular transformer is extensive, a LV area plan (pn), to assist with locating each pole may be required. All plans (pn) must be filed away under the appropriate feeder file, or physical numbering of the poles must be considered.

Note: To indicate to ASC personnel from the computer printout that a plan (pn) exists, show the pole location as: **pn TF86/6**.

Example 3:

LV only poles are to be identified as:



Pole A **TF86/LV NTH 1**

Pole B **TF86/LV NTH 2**

Pole C **TF86/LV NTH 3**

Pole D **TF86/LV NTH 2 EAST 1**

Pole E **TF86/LV NTH 2 EAST 2**

Pole F **T 86/LV NTH 2 EAST 3**

Pole G **T 86/LV NTH 2 EAST 4**

Conventions to be Adopted - Combined HV/LV Poles

Combined HV/LV poles and LV only poles erected in line under HV mains retained the HV pole location.

In Example 3 above, the poles at H, I, J, K, L, M, N and O carrying HV and LV mains would be identified as:

***TF86-TF85*/HV EAST 1DE**	Pole H
TF86-TF85/1	Pole I
TF86-TF85/2	Pole J
TF86-TF85/3	Pole K
TF86-TF85/4	Pole L
TF86-TF85/5	Pole M
***TF86-TF85/4*/LV STH 1**	Pole N
***TF86-TF85/4*/LV STH 2**	Pole O

8. STANDARD DEFECT DATA ENTRY EXAMPLES for SAP – DD NOTIFICATIONS

The following are examples of typical text data entry values for specific DD notifications; refer to heading/Quick-code descriptions. Suggest folder be saved electronically for use to cut and paste values into relevant notification fields during on-site notification creation.

3/12 Steel Connections

Descriptions Field:

LLC 3/12 Steel Corroded

LLC 3/12 Steel/Grips Corroded

LLC 3/10 Alum Corroded

TC 3/12 Steel Corroded

TC 3/12 Steel/Grips Corroded

TC 3/10 Alum/Grips Corroded

Corroded LLC/Tee Con or Heat-shrink Missing

Replace entire tap with new tap and connections including heat-shrink sleeving as per E-Drawing standards. Also, ensure all old connections/fittings/tee cons/live line clamps are removed and any damaged conductor repaired.

Heat-shrink Sleeving Missing

Replace entire tap with new tap and connections including heat-shrink sleeving to the current E-Drawings.

Service Box Lid Missing

Replace lid as per E1155, Possible Moisture Ingress.

Hot Joints

Replace lugs and DF base.

Ensure all connections including switch mechanisms are cleaned and greased.

TF Oil Leaks

Fresh oil on ground and/or infrastructure – Environmental Incident Report logged in SA Power Networks CURA Web site.

LV Taps rubbing/touching steel components

L/V service active tap rubbing/touching on brace strap.
Reattach conduit to LV X-arm as per E-Drawings; bend all taps clear of steel components.
Repair/replace any damage on LV tap.
Photo attached.

Pole Plating

Descriptions Field:

Plate Pole 1105 (4”) 25% rust.
Plate Pole 1115 (6”) 38% rust.
Pole Age / Size / previously plated <15% above plates.
Pole Age / Size / <20% rust.
Pole Age / Size / Galv Pole.
Pole Age / Size / H iron Telstra pole.
Pole Age / Size / plated.
Pole Age / Size / <5% rust.
Replace pole 0905 (4”) 80% rust.
DD Noti recorded results of Equipment Failure Investigation.

Pole Plating Only

Between 10 and 12 Sharam St. Pt Augusta.
Plate 4 inch LV Service Pole.
North Channel –40%.
South Channel –35%.
‘P’ painted on pole.
Telstra and O/U service in pole channel.
Photo attached.

Pole Replacement

Example 1 – Previous plated pole.

Pole previously plated, rusted above plates and plates rusted away approximately 30%.
4 x Locations of channel corrosion in S2 section of channel, up channel.
3 x Locations of concrete spalling.
Channels swelling behind pole tie bolts.

Example 2 – LV service pole.

Replace Pole Like for Like – WB0905

4 x photos attached.
No. 1 Telford Avenue Findon.
Replace 4” LV Service Pole, Like for Like.
North Channel -80%.
South Channel -40%.
Concrete Cracked at G/L base.
Telstra and Consumer Service Pipe on pole.

Example 3 – HV line pole.

TF62-TF61/4
Replace 4” HV Line Pole, Like for Like.
7 x Location of channel corrosion in S2 section of channel, up East Channel.
Large holes rusted through channel at approximately 5ft from ground level.
Channels swelling behind pole tie bolts.
No ground level corrosion.
Photos attached.

Example 4 – Concrete spalling

Replace pole like for like, 6 locations of concrete spalling, rust up north side channel, pole previously plated.

Exposed Footing Top Collar Concrete

Footing top collar exposed at ground level.

Approx 200mm exposed, soil erosion.

19kV Line Pole.

Photos attached.

Noti reviewed
Example 1:

DD Noti reviewed via Site Inspection 26/03/2010, G Ising. New photos attached.
Photos show, rust in S2 channel web section and corrosion behind channels.

Example 2:

Pole Vehicle Damage

Cnr Princess & William Street.
Re-inspected 25/06/2009 G Ising. New photos added, date changed, MRV changed.
Remains P2.

Switching Point ID Plates

ID Plate required at DF13143.

Install ID Plate as per E1023 paying attention to securing methods and positioning of sign above ground level.

Low Spans

HV 19kV ground clearance measures 4.6m @ 25deg, the span length is 217m of 3/12 steel.
Paddock traversable by vehicle.
Suggest install Prop. Pole.
NPO input required.
Low span 4.9m 60m span 17 degrees.
Copper Mains.
Suggest install extension pieces on pole 1 and 2 ???
NPO input required.
Traversable ground. Photos attached.

Suspension Component Wear
Example 1:

Single side socket tongue/pin and suspension clamp wear.
Replace socket tongues, pins and conductor clamps, insulators and hooks, all phases.
Photos attached.
S/Side and T/double hook and hole worn. Install hook hole x-arm repair kits and replace hooks – all phases.

If any other suspension wear present at con clamps/pins/socket tongues also replace – all phases.

Example 2:

Wishbone suspension arrangement.
Hook hole wear – all phases, photos attached.
Install hook hole x-arm repair kits and replace hooks – all phases.

Helidrone Inspection Required
Heli Drone Inspection Required to check wear at conductor clamps/pins/socket tongues.

Broken Strands / Corroded Conductor
Example 1:

'H' Phase, 6/1/2.75 ACSR, 4 x broken strands.
Repair using full tension sleeve.
Check other phases for damage, repair as required.

Example 2:

1 x broken strand of 3/12 steel conductor. Repair to E-Drawing standards.

Note for data entry:

1 x DD Noti required per span of conductor that is damaged.
Corroded conductor – include conductor type/size, how many broken strands per phase?
Which phases/all phases? How many spans are corroded?
Provide a DD Noti for each span of corroded conductor.

LV Isolators

Cracked LV isolator, blue phase, requires replacement.
Check other phases and replace as required.
Photo attached.

Broken LV Ties

Replace LV W&B ph broken ties. Ties broken both sides of LV pin 7/14cu.
Check other phases and replace as required.
Cnr Cox & Ameroo Streets.
Photo attached.

Broken HV tie wires
Broken HV steel line tie wire.
Replace with steel seizing clamp.
Small neck HV insulator.
Check other phases and replace as required.
Photo attached.

Damaged Pit Lids
(Public Hazard)

Split in service pit lid.
Replace service pit lid.
Photo attached.

Service Pit Lid Split/Replace

HV Fuse liquid empty.
#3 Contact HV fuse empty – replace.

Outside phase #3 contact HV 50A fuse has no liquid, replace the fuse.

SWER Distribution TF Earthing
Example 1:

Check SWER TF earthing values correct and ensure earthing and signage is to current standards as per E1452 / E1453.
Repair earthing to current E-Drawing standards as required.

'DERRED' Notifications
Example 1:

This defect does not meet Line Inspection Manual, priority guidelines and is no longer required. Notification has had DERR Status applied – 01/04/2010.

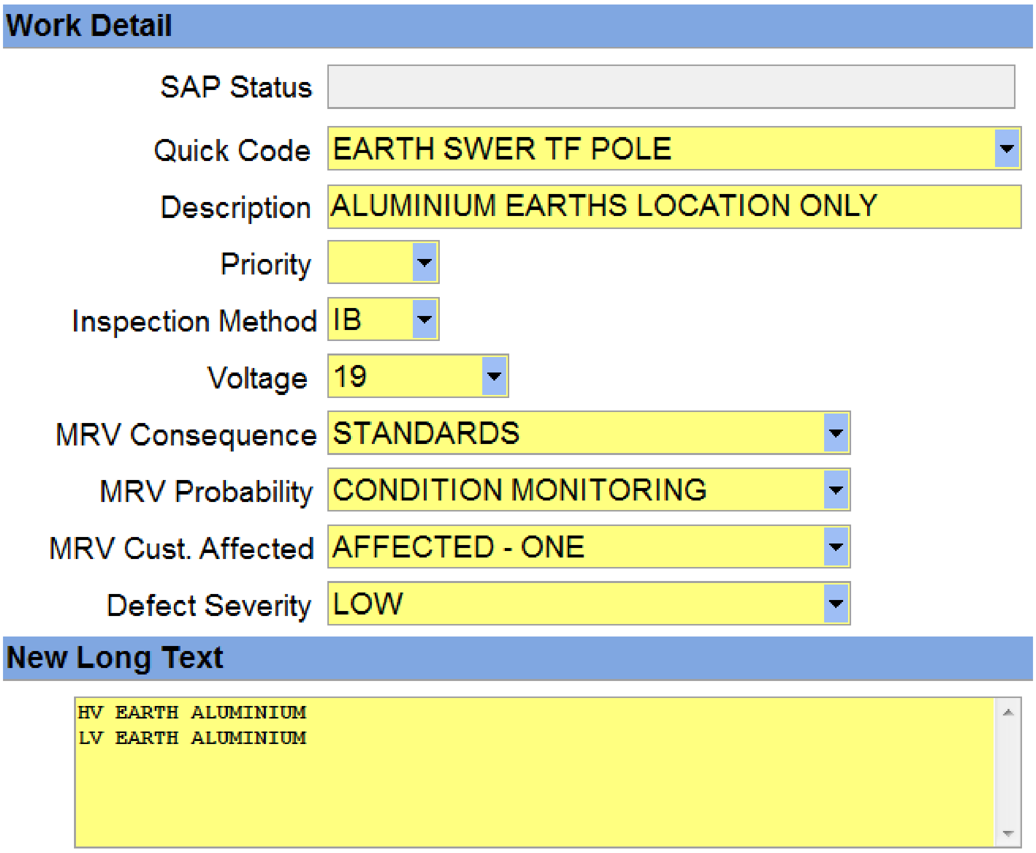
Example 2:

This defect has been completed Notification has had DERR Status applied – 01/04/2010. Re-inspected 25/05/2010, DERR Status applied to this Noti. New DD Noti ………… raised to replace this.

9. RECORDING SPECIFIC EXAMPLES

9.1 Recording SWER Aluminium Earths

On a SWER transformer where an aluminium earth exists on either the LV, HV or both, record type of conductor for both earths. Example below shows aluminium on both earths.


Work Detail
SAP Status
Quick Code EARTH SWER TF POLE
Description ALUMINIUM EARTHS LOCATION ONLY
Priority
Inspection Method IB
Voltage 19
MRV Consequence STANDARDS
MRV Probability CONDITION MONITORING
MRV Cust. Affected AFFECTED - ONE
Defect Severity LOW
New Long Text
HV EARTH ALUMINIUM
LV EARTH ALUMINIUM

9.2 Metered Mains

SAP long text – choose the most appropriate from text below:

- Meets SA Power Networks standards
- Does not meet SA Power Networks standards but well constructed and in good condition
- Does not meet SA Power Networks standards, in poor condition but not currently posing a safety risk or
- Does not meet SA Power Networks standards and in extremely poor condition and posing a safety risk

Work Detail

SAP Status	INIT
Quick Code	SERV O/W DAMAGED
Description	METERED MAINS LOCATION ONLY
Priority	
Inspection Method	IB
Voltage	.24
MRV Consequence	STANDARDS
MRV Probability	CONDITION MONITORING
MRV Cust. Affected	AFFECTED - ONE
Defect Severity	LOW

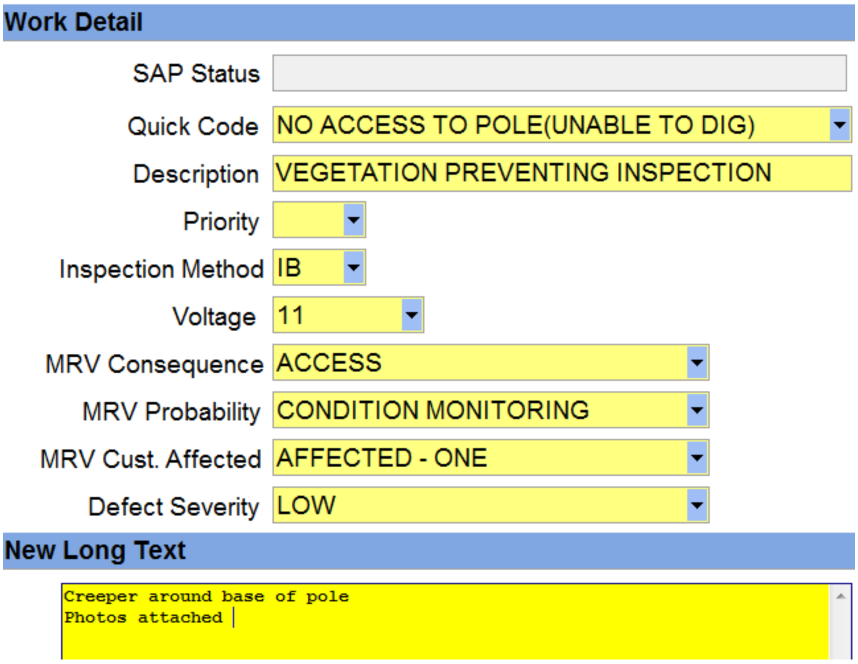
New Long Text

```
Does not meet SA Power Networks standards but well constructed and in
good condition
Two span
```

If the construction does not meet SA Power Networks standards and is in extremely poor condition or poses a safety risk, it must be escalated via a P1 to B defect dependent on the severity, and a separate DD for location only as above.

9.3 Pole Unable to be Inspected

Vegetation – DD notification to be created with MRV <60.



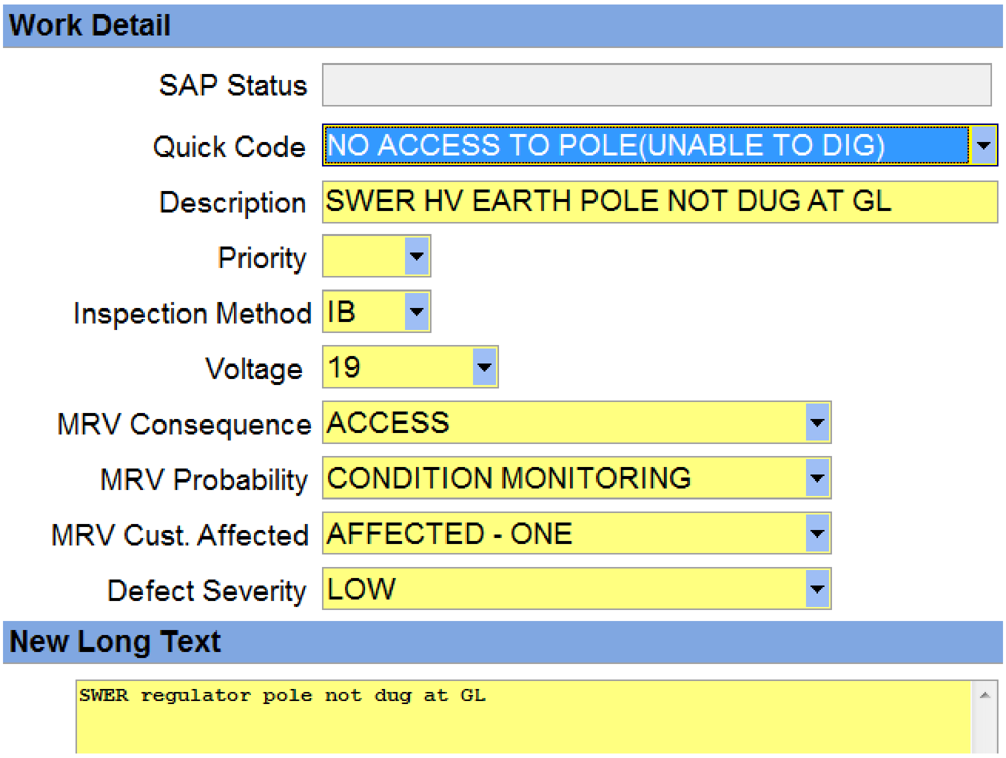
Work Detail

SAP Status	
Quick Code	NO ACCESS TO POLE(UNABLE TO DIG)
Description	VEGETATION PREVENTING INSPECTION
Priority	
Inspection Method	IB
Voltage	11
MRV Consequence	ACCESS
MRV Probability	CONDITION MONITORING
MRV Cust. Affected	AFFECTED - ONE
Defect Severity	LOW

New Long Text

Creeper around base of pole
Photos attached

SWER isolating transformer, SWER distribution transformer, SWER regulator poles and SWER remote earth poles – DD notification to be created with MRV <60.



Work Detail

SAP Status	
Quick Code	NO ACCESS TO POLE(UNABLE TO DIG)
Description	SWER HV EARTH POLE NOT DUG AT GL
Priority	
Inspection Method	IB
Voltage	19
MRV Consequence	ACCESS
MRV Probability	CONDITION MONITORING
MRV Cust. Affected	AFFECTED - ONE
Defect Severity	LOW

New Long Text

SWER regulator pole not dug at GL

Locations where bitumen, pavers, concrete or similar exist around base of pole – DD notification to be created with MRV <60.

Work Detail

SAP Status	
Quick Code	NO ACCESS TO POLE(UNABLE TO DIG)
Description	ULTRASONIC TEST REQUIRED
Priority	
Inspection Method	IB
Voltage	11
MRV Consequence	ACCESS
MRV Probability	CONDITION MONITORING
MRV Cust. Affected	AFFECTED - ONE
Defect Severity	LOW

New Long Text

```
***Examples only of entries below enter as applicable***
Bitumen around base of pole
Pavers around base of pole
Concrete around base of pole
Photos attached
```

9.4 Access tracks

Work Detail

SAP Status	
Quick Code	ACCESS ROADS
Description	TRACK REQUIRES VEGETATION CLEARANCE
Priority	
Inspection Method	IB
Voltage	
MRV Consequence	ACCESS
MRV Probability	LIKELY
MRV Cust. Affected	AFFECTED - ONE
Defect Severity	LOW

New Long Text

```
Hydro axe required
3 Span approx 800m - mallee regrowth approx 1.5m high
```

3.23A RECORDING VEGETATION INFORMATION

1. PURPOSE OF DOCUMENT

This document describes the standards for terminology and formatting of vegetation clearance infringement and data for the creation of SAP Notifications.

2. DEFINITION

CGM	Contract Governance Manager.
Contractor SAP Portal	Web based page to interface into SAP.
MDT	Maintenance Data Terminal.
VSM	Vegetation Services Manager.

3. DATA ENTRY REQUIREMENTS

Note that <u>during non-bushfire season</u>, reporting of vegetation infringements are only required for the following cases.

1. Vegetation is touching conductor;
2. If identified during reliability patrol or major event patrol.

Vegetation scopers are responsible for identifying all other cases prior to the bushfire season.

During bushfire season, infringements may be reported to the VSM (for contractors via the CGM).

<u>Vegetation preventing pole inspection shall be recorded as a DD notification (not VG notification). Refer Section 3.23 (part 9.3).</u>

Vegetation data may be recorded via the MDT, SAP or Contractor SAP Portal.

SAP Data entry deadlines and classifications of VG defects are specified in the following Table:

Classification	Definition	Timing
B Code	Any vegetation needing attention *prior to the immediate* BFDS eg touching conductor or vegetation defect that is not a fire start	Immediate attention – generally within 24 hours
Z Code (Fire Start)	Any Vegetation that is likely to bend or grow into the Clearance Zone (CZ) in *the immediate* BFDS eg prior to 30 April 2014	*During the bushfire season* – immediate (as soon as practical given the prevailing weather conditions – generally within 24 hours if during a FDL2 or FDL3 day *Prior to the BFDS* – before the next BFDS
Priority 2	**In *BFRAs***, any Vegetation that is likely to grow into the CZ prior to the commencement of *the following* BFDS eg prior to 30 April 2015 **In *NBFRAs***, any Vegetation that is likely to bend or grow into the CZ within the next 36 months	**In *BFRAs***, prior to the commencement of the following BFDS **In *NBFRAs***, within 6 months
Priority 3	Customer or stakeholder issues (J jobs) eg emergency cuts received from call centre	Completion date attached to job but within 12 months from date job raised
Priority 4	Inappropriate plantings or cutting postponed	Monitor and reassess next cycle
Priority 1 (Special Purpose)	This code is only used in special circumstances, usually to de-escalate a Z-coded defect prior to an FDL day. It may only be used if the Vegetation Defect is currently outside of the CZ and is not likely to bend or grow into the CZ within 28 days. eg hazardous trees	within 4 weeks (28 days) from date identified

Vegetation related information needs to be retained in archives for at least 7 years.

4. NOTES ON SPECIFIC ITEMS

Creating Notifications

An individual Notification must be created for each span or unit.

SAP Dates

The SAP Notification date format is dd.mm.yyyy (eg 12.05.2002 or 04.12.2001).

Digital Photos

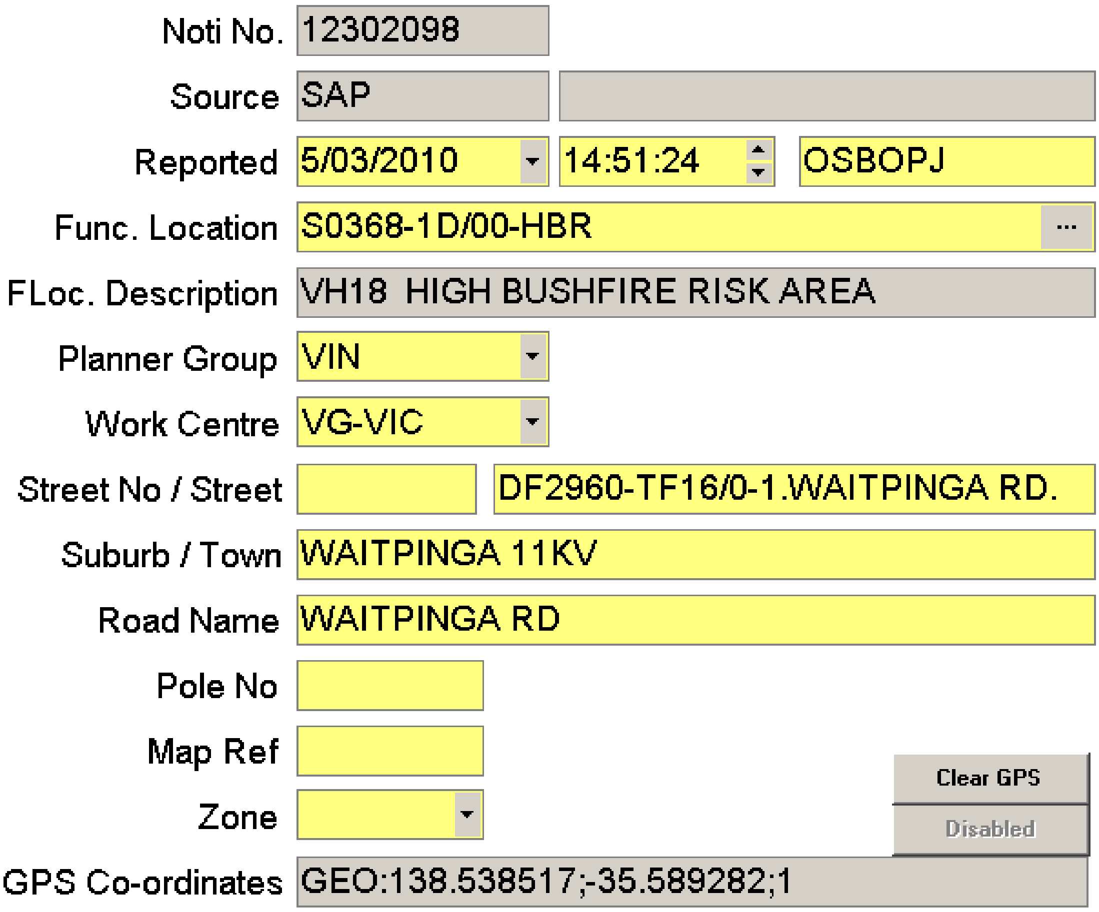
Digital photos are only required for Priority Z vegetation infringements identified during Aerial Patrols and must be 'in focus' and correctly exposed.

Inspection Dates

Where an existing notification has been re-assessed and modified by the Inspector, the original notification date must be amended to ensure that Start / Finish dates are appropriate.

Details of amendments made or new photos attached along with inspector's name and reason for change must be added to the Notes field.

5. DATA ENTRY

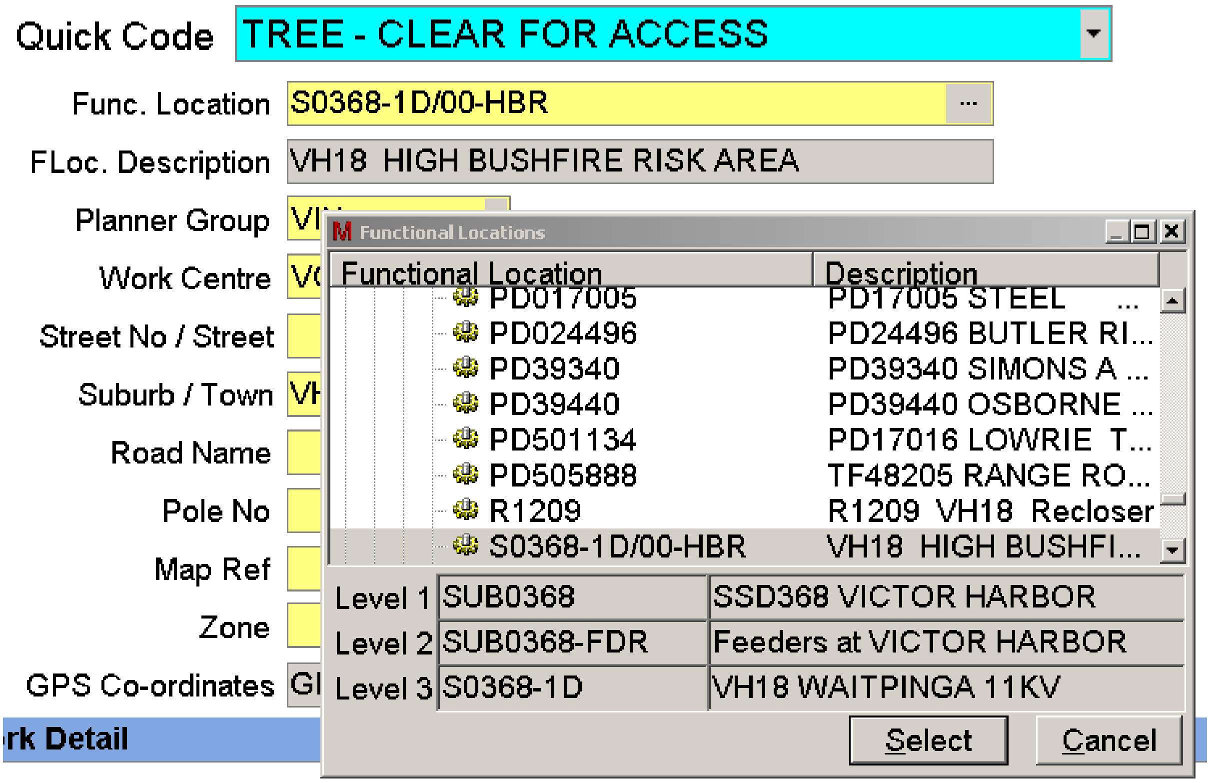


Reported: Inspector name

SAP user identification is recorded automatically.

Func. Location

Entry of the Functional location including appropriate **Risk Area** is **mandatory**.



For Risk Area Boundaries

Refer to the Feeder plan, Section 9 -BFRA Maps, Electricity Act & Regulations.

Planner Group & Work Centre

Overwrite default values with Planner group = VIN. For Work Centre, use drop down menu to select appropriate local area. (eg VH18 = Victor Harbor VG-VIC or if unsure, use Vegetation Program for correct work centre.)

Street No / Street

For urban locations, a street number and street name should be recorded in the appropriate fields.

For rural/other locations, in the Street field, insert number of the transformer pole, disconnect fuse, Fuse, Air Break, Recloser, Sectionaliser, pole or tower as physically numbered on structure. Alternatively, an electrical address as described in *Part 6 – Identification* should be recorded.)

Note the Street field is restricted to 29 characters.

Suburb/Town

Overwrite the default Functional Location Description with the feeder name and voltage.

Road Name

Enter the Road Name.

Pole No

No entry required.

Map Ref

In Prescribed Areas only, enter relevant UBD Map & reference numbers.

Zone

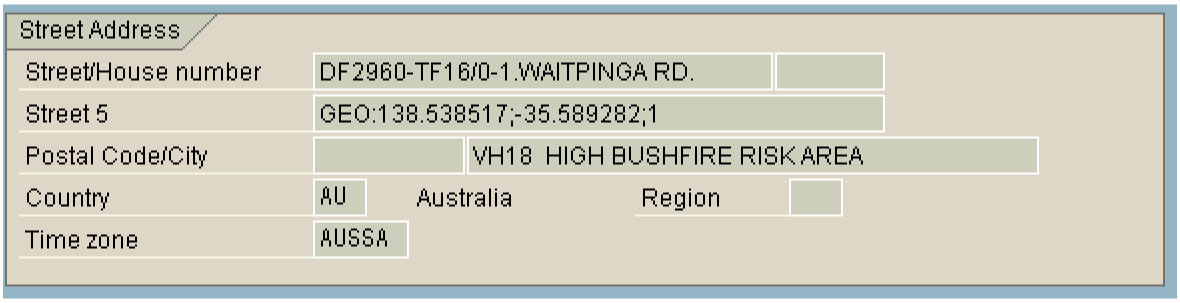
No entry required.

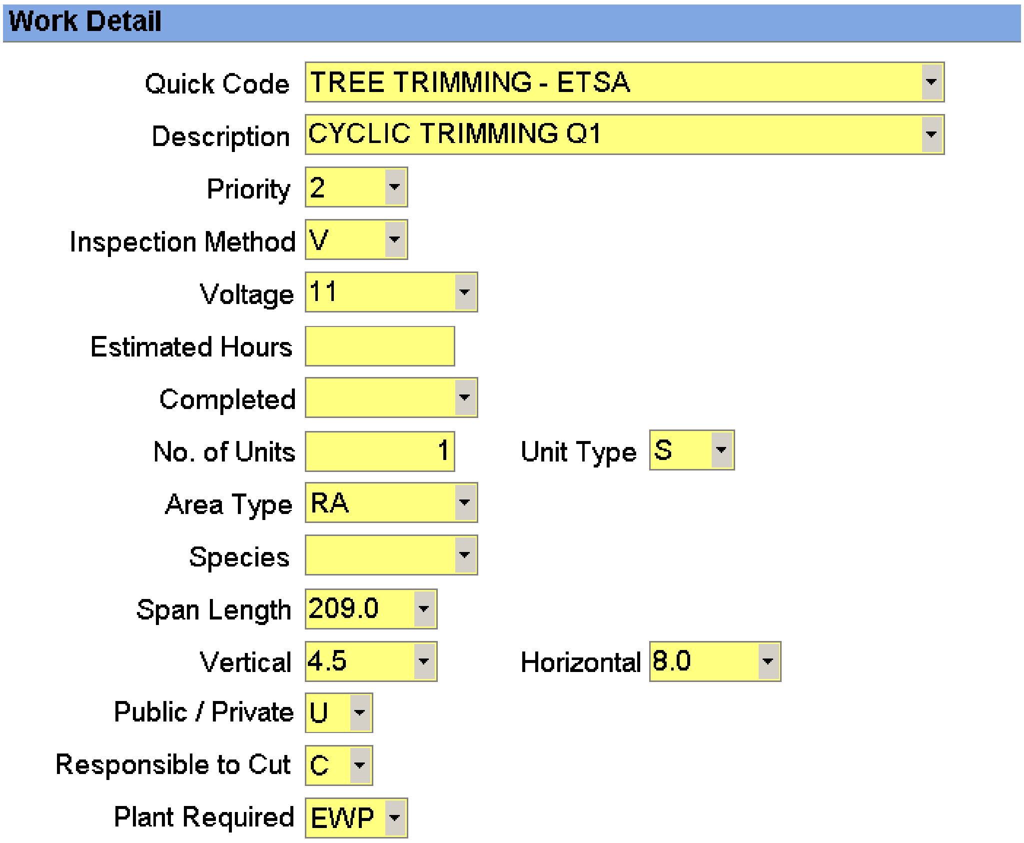
GPS Co-ordinates

Enter a valid GPS Waypoint when prompted in the MDT application.

If using an external GPS device other than the MDT, ensure that the device has been set to the correct format (ie Degrees.degrees hddd.ddddd.)

If recording a Waypoint to an existing Notification in SAP manually type entry as follows GEO:138.582033;-34.942143;1 as per screen dump example below:





Quick Code

Select the most appropriate Quick Code from the drop down list.

Description

Select the most appropriate Description from the drop down list along with the year (yyyy).

Priority

Priority option is to be filled in using drop down menu selections.

Inspection Method

Select the appropriate Inspection Code relevant to the type of Inspection/Patrol being conducted.

Voltage

Record applicable voltage(s).

Estimated Hours

Enter appropriate estimated cutting time.

Completed

Entry only required following completion of work.

No of Units

One Notification represents 1 Span or Unit.

Unit Type

Select appropriate Unit Type from drop down menu.

Area Type

Use drop down menu to select appropriate area type.

Species

Use drop down menu to select appropriate species (optional).

Span Length

Enter span length in metres using numbers only.

Vertical / Horizontal

Enter Vertical and Horizontal clearances required to ensure compliance with the Vegetation Clearance Regulations.

Public / Private

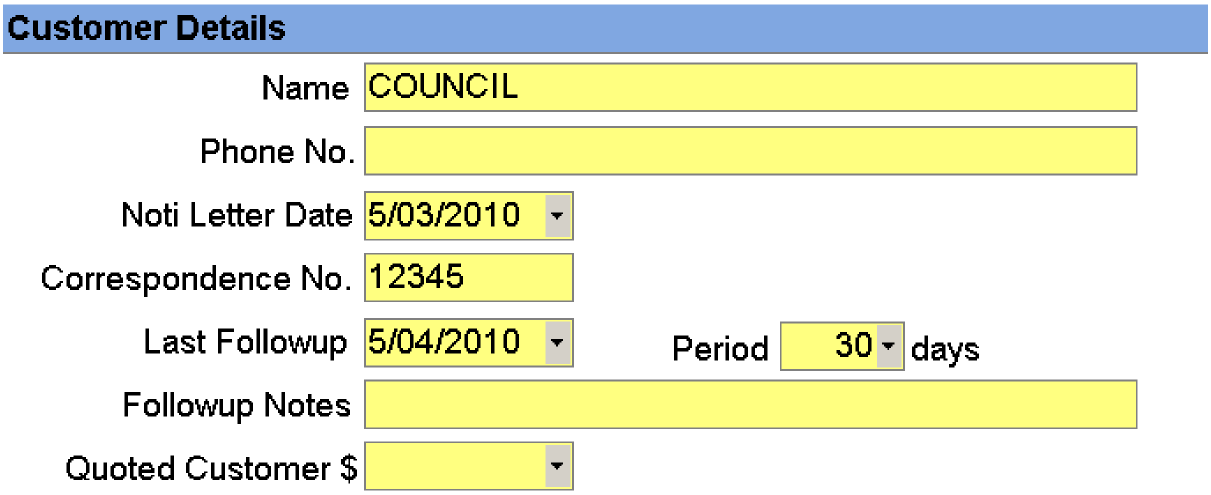
Use drop down menu to select appropriate ownership.

Responsible to Cut

Use drop down menu to select appropriate responsibility.

Plant Required

Use drop down menu to select suggested selection.



Name

Enter customer name.

Phone No.

Enter customer contact number.

Noti Letter Date

Enter date of issue of notice.

Correspondence No.

Enter correspondence reference number.

Last Followup / Period

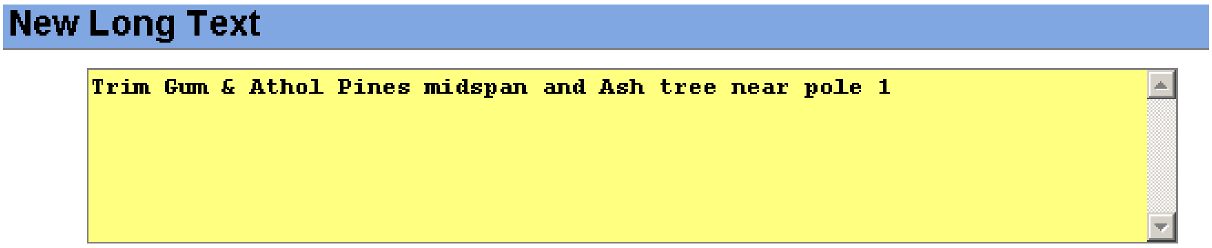
Enter notice expiry date and Period of Notice in days.

Followup Notes

Enter any relevant follow-up notes (optional).

Quoted Customer $

Enter quoted amount (Private Supply Lines or Exemptions only).



New Long Text

Enter cutting instructions and any relevant customer issues and access instructions. Following download of job into SAP, this field is used to add any relevant new notes to the VG Notification.

6. IDENTIFICATION FOR VEGETATION INFRINGEMENTS

The following guidelines are provided to assist with the recording of identified Vegetation Infringement work.

To identify Vegetation Infringement work recorded from inspections, firstly refer to the direction of the inspection, utilising maintenance reports (the report for Tree data is feeder based) and examining the sequence in which the jobs are recorded. This may be in ascending or descending order AND will assist further with the on-site identification of work.

POLE NUMBERING SYSTEM

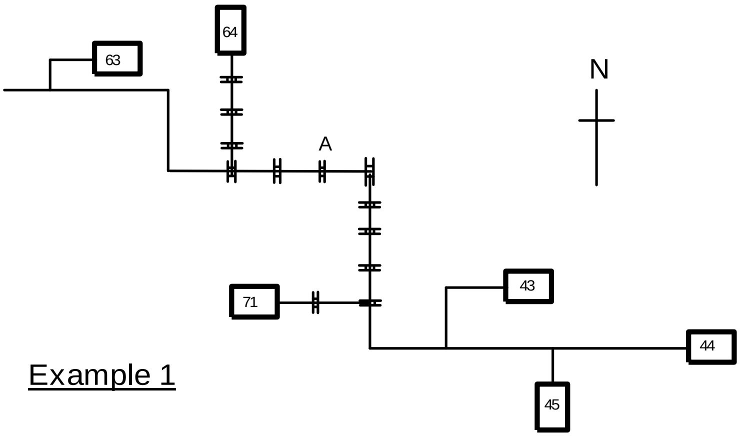
This method relies on:

- Use of Feeder Plan Numbers;
- Use of Transformer Numbers on Feeder Plans;
- Use of a physical count of HV poles during patrol/inspection;
- Allocating pole numbers to LV poles (eg Example 3);
- Use of compass directions where no physical asset identification exists; and
- Use of **spans** as an identifier of vegetation infringement locations.

Method - HV Poles

Example 1

Consider the following example for the "HYPOTHETICAL 11 kV FEEDER" in the Imaginary District, IM69.



Assume we wish to identify the span at A. The pole is identified as TF71-TF64/6-7:

TF71- TF64	indicates that it is between transformers 71 and 64
/6-7	indicates that it is the 6-7th span from Transformer 71

The same span could also be identified as:

TF64-TF71/6-7

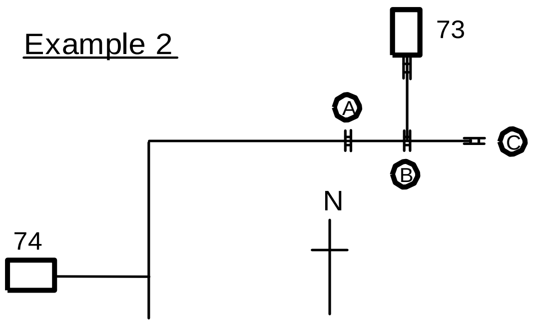
in this instance, the pole count starting from Transformer 64.

Conventions To Be Adopted - HV Poles

- Poles need not be physically numbered - an on-site count can be made during patrol/inspection.
- Counting begins from the nearer transformer, although not essential.
- The transformer pole is identified completely by the transformer number eg TF 64
- includes the pole.
- Number 1 of the count is attributed to the first pole out from the transformer.
- At the end of a spur, a HV pole which is only used as the final dead end pole is to be designated by the addition of letters DE after the previous pole number.

Again, considering feeder number IM69.

Example 2



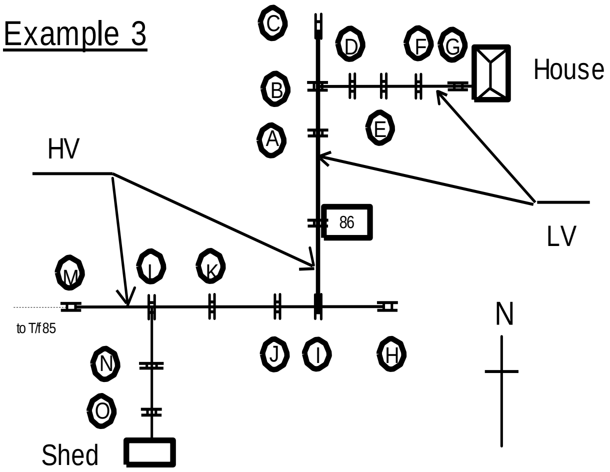
TF73 Identifies T/F Station
(including pole)
TF73-TF74/1 Identifies Pole at B
TF73-TF74/2 Identifies Pole at A
TF73-TF74/1 DE
OR Identifies Pole at C
TF73-TF74/HV East 1DE

Method LV - Poles

To identify LV spans, numbers must be allocated to each pole.

Example 3

LV only spans are to be identified as:



Pole A	TF86/LV NTH 1
Pole B	TF86/LV NTH 2
Pole C	TF86/LV NTH 3
Pole D	TF86/LV NTH 2 EAST 1
Pole E	TF86/LV NTH 2 EAST 2
Pole F	T 86/LV NTH 2 EAST 3
Pole G	T 86/LV NTH 2 EAST 4

Conventions to Be Adopted - Combined HV/LV Poles

Combined HV/LV spans and LV only poles erected in line under HV mains retained the HV pole location.

In Example 3 above, the poles at H, I, J, K, L, M, N and O carrying HV and LV mains would be identified as:

TF86-TF85/HV EAST 1DE Pole H
TF86-TF85/1 Pole I
TF86-TF85/2 Pole J
TF86-TF85/3 Pole K
TF86-TF85/4 Pole L
TF86-TF85/5 Pole M TF86-TF85/4/LV STH 1 Pole N TF86-TF85/4/LV STH 2 Pole O.

3.24 SWER DISTRIBUTION TRANSFORMER POLE EARTH TEST

1. PURPOSE OF DOCUMENT

This document details the procedures to be followed for Pole Earth Testing of SWER Distribution Transformers.

2. PURPOSE OF TESTING

Testing of the pole earth of SWER Distribution Transformers is conducted to ensure that the pole earthing system is operating within specification, to identify hazards and components that have deteriorated to the extent that failure of the earthing system is likely. Emphasis is placed on identification and management of known hazard and component failure modes, which could jeopardise:

- Safety of the Public, Employees and Operators.

3. DEFINITIONS

Testing is usually defined as a detailed electrical assessment of the operating specifications of the equipment and specified components, to detect deterioration likely to lead to failure of the equipment or pose a hazard to employees, operators or members of the general public.

Split Earth System is an earthing system constructed to an obsolete standard, which utilises the pole as an earth conductor for the HV connection.

4. SAFETY

4.1 Visual Inspection of Area

A visual inspection of the area should be carried out before proceeding with testing to identify hazards such as snakes, lizards, and spiders.

5. EQUIPMENT REQUIRED

The following equipment will be required to conduct testing of pole earths of SWER Distribution Transformers:

- Kyoritsu 4105 Digital Earth Tester (temporary earth stakes and red, yellow and green connecting leads included with earth tester).

6. SKILLS / RESOURCES REQUIRED

Earth testing is to be conducted by Asset Inspectors who have completed formal training and demonstrated necessary competencies as determined by the Manager Network Asset Management.

The test procedure has been designed to be conducted safely by one accredited (refer above) Asset Inspector.

7. TEST PROCEDURE

1 Ensure installed earthing is not a **SPLIT EARTH SYSTEM**, if so do not proceed with pole earth testing and a P4 defect notification to be raised.
2 Install two temporary earth stakes, supplied with the Digital Earth Tester, aligned and at an interval of 5 to 10 meters from the pole earth under test, as specified in the Digital Earth Tester instruction manual.
3 Connect the red and yellow leads supplied with the Digital Earth Tester to the temporary earth stakes and the green lead supplied to the pole earth. Ensure that the red, yellow and green leads are connected to the red, yellow and green inputs of the Digital Earth Tester respectively.
4 Measure the resistance of the pole following the instructions given in the Digital Earth Tester instruction manual. Record the measurement.
5 If the pole is greater than 100Ω raise a defect notification.

8. RECORDING OF RESULTS

- Pole earth resistance values to be recorded and issued to Network Standards & Performance group.
- If pole earth resistance value is outside of specification (> 100 ohms), raise a defect notification in SAP.

9. REFERENCE DOCUMENTS

9.1 FSWM 136

9.2 Field Service Job Safe Work Method

High Voltage Earth Testing - 19kV SWER Isolating Transformer.

9.3 E1453

Earthing Arrangement, SWER Distribution Transformer.

3.25 POLE CORROSION ASSESSMENT

1. PURPOSE OF DOCUMENT

This document describes the requirements to report pole corrosion for defects within SA Power Networks Overhead Distribution System.

2. PURPOSE OF INSPECTION

Inspection of pole corrosion is conducted to assess the condition of SA Power Networks Stobie poles and to identify hazards and components that have deteriorated to the extent that failure of the equipment is likely. Emphasis is placed on identification and management of known hazards and component failure modes which could jeopardise the:

- Safety of the Public, Employees and Operators
- Safety of SA Power Networks equipment
- Continuity of supply to customers

3. ASSESSMENT OF GROUND LINE CORROSION

This section details the procedure to calculate the extent of ground line corrosion of Stobie poles.

3.1 Procedure

- The pole joist cross-section is divided into 5 sections as described in Section 7.1.
- Excavate around the top of the footing to expose the corroded section of the pole/structure and clean / *chip* away the scale.
- Take measurements, using a needle profile gauge (with) table or similar approved measuring device and calculate the corrosion index for each joist (or channel) using the guidelines in Section 7.
- If unable to obtain one of the five joist corrosion measurements due to the placement of the earth cables, complete assessment on the other four joist sections and apply the average of the four readings to the joist section which you are unable to read (refer Section 7.2 for example).
- If cable guards or other objects limit the ability to excavate around a pole, remove corrosion from sections wherever possible to allow assessment on whether pole plating is required. If pole plating is required, a defect is to be raised.
- If using ESRI Priority Assets Tool, input results into corrosion calculator to determine amount of corrosion.
- If defect is required (as per sections 5, 6), create notification as per section 8 and take photos of any corroded flange(s) and web and attach to the notification.
- For Pole Plating, paint a small yellow P at eye level on pole for physical confirmation.
- Re-instate ground soil at base of pole on completion of ground line assessment.

4. REPORTING AND ESTIMATING POLE TOP CORROSION ON STOBIE POLES

4.1 Procedure

The pole joist cross-section is divided into 5 sections as described in Section 7.1. Each section is visually assessed and percentage corrosion determined for each section.

- Visually scan the pole from ground level to the top of the pole to assess extent of corrosion or other defects.
- Evidence of web steel bulging around the bolt heads or nuts is evidence of significant corrosion between the steel and the concrete as is the angle of the flange. Rust occupies seven times the volume of the original steel, therefore the distortion of the web or flange indicates the degree of corrosion of the steel.
- Consider how the defects may impact on structural strength of the pole.
- Take photos of any corroded flange(s), web, other damage/deterioration and associated concrete related defects and attach to the SAP notification.
- Be sure to attach one typical defect and one overall pole construction photo to DD notification.

5. DETERMINE REPAIR METHOD

Determine whether the pole can be repaired by plating or whether the pole needs to be replaced.

Repair details are shown in E0600 sheets 1 to 4.

5.1 Repair Criteria

Poles are able to be repaired by plating where:

- Ground line corrosion is less than 150mm along the joist regardless of corrosion index; and
- No other condition under Section 5.2 is applicable.

5.2 Replacement Criteria

Poles shall be replaced if:

- Bulging of the web steel around bolts or the angle of the flange indicates that steel loss over the length of the pole is greater than 50% for either of the joists
- Extent of ground line corrosion is greater than 150mm in length and corrosion index >20
- The pole is manufactured from 'notch sensitive steel' and there is damage or a visible crack in the steel
- If pole is plated and plate is rusted with corrosion index >20
- If pole is plated and the pole is corroded above plate with corrosion index >20
- Any service or strained pole with one joist corrosion index >80
- Any line pole with one joist corrosion index >90.

6. DETERMINE MRV/PRIORITY

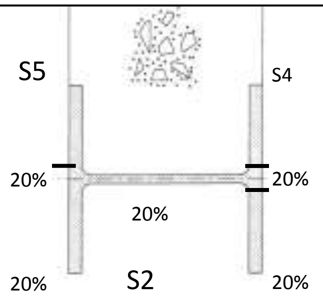
Determine the MRV/Priority Designation for the pole using the following guideline.

- Add up the corrosion index for each joist
- Determine the MRV/Priority from the following table based on the total corrosion loss using the larger corrosion index joist to determine the MRV:

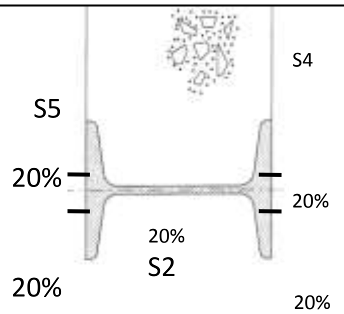
MRV/Priority	Corrosion Index
60 - 89 (P3)	20 - 29
90 – 189 (P2)	30 - 49
>189 (P1)	50 or greater

7. GUIDE TO CALCULATION CORROSION INDEX

7.1 Sections of the Pole Joist



Universal Section (UC or UB)



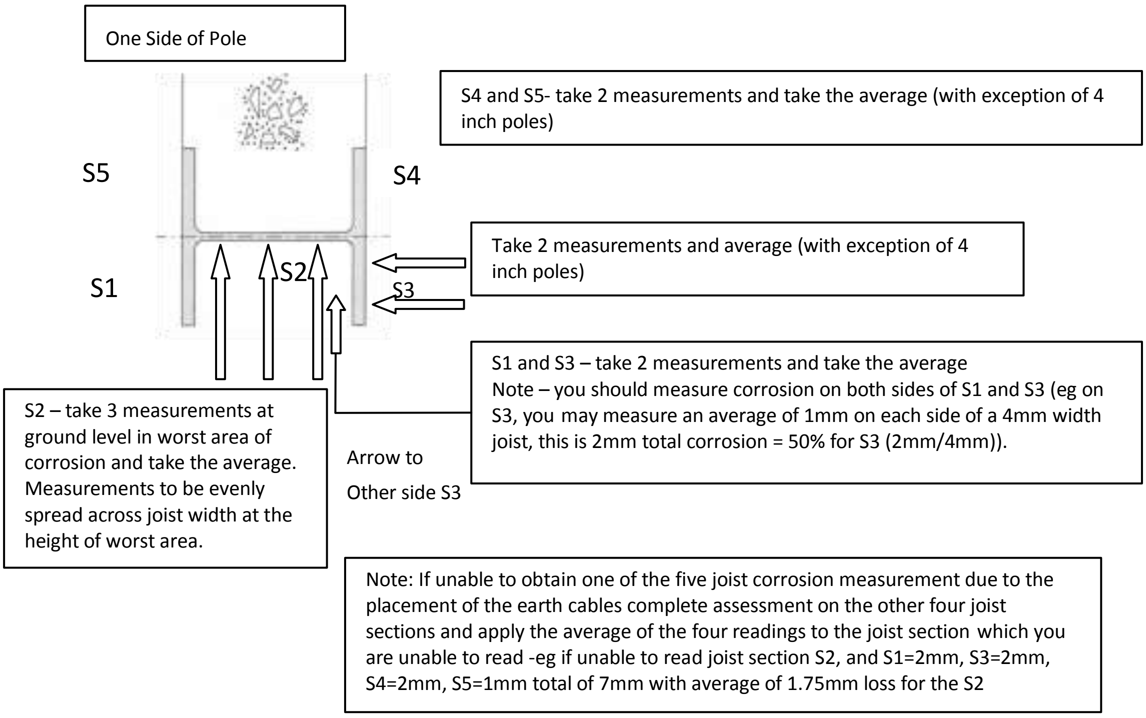
Taper Flange Beam (TFB)

S1 – OUTER FLANGE LEFT
S2 – WEB
S3 – OUTER FLANGE RIGHT
S4 – OUTER FLANGE RIGHT
S5 – OUTER FLANGE LEFT

Each Section represents 20% of the total cross-section.

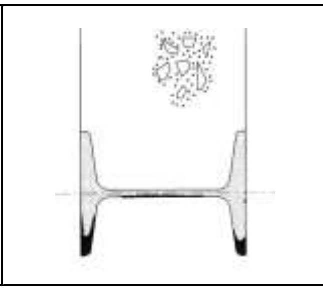
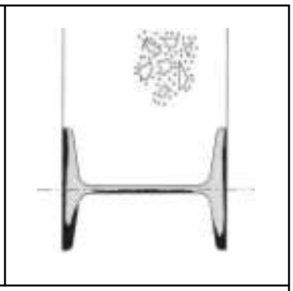
The average web thickness is 7mm.

7.2 Measure Corrosion



7.3 Determine Corrosion Index

* Note: When determining the MRV of plated poles use an S2 value of 0% in the corrosion index calculation for defects (only do this for poles plated as per E0600). However, still record the actual S2 value in the PAT.

<table>
<tr><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2">Measure & % Estimation
S1 - 5%
S2 - 5%*
S3 - 5%
S4 - 0%
S5 - 0%

Corrosion Index = (S1+S2+S3+S4+S5)/5
= (5+5+5+0+0)/5

Corrosion Index = 3</td><td colspan="2">Measure & % Estimation
S1 - 25%
S2 - 50%*
S3 - 5%
S4 - 3%
S5 - 25%

Corrosion Index = (S1+S2+S3+S4+S5)/5
= (25+50+5+5+25)/5

Corrosion Index = 22</td></tr>
<tr><td colspan="2">Maximum Corrosion Index per Joist is 100</td><td colspan="2">Maximum Corrosion Index per Joist is 100</td></tr>
</table>

8. RECORDING POLE INFORMATION IN SAP

The defect/s shall be reported and entered into SAP as a 'Distribution Defect', with the appropriate Quick Code and MRV priority allocation using the Line Inspection Manual Priority allocation.

Pole information is to be recorded via ESRI Priority Assets Tool.

Additional information to record for corroded poles via DD defect Notification:

- For Pole Plating Defects Only: change default Planner Group to PCN and the Work Centre to PC-Weld. **(Note: do not use PC_Weld)**
- Record the *total* corrosion index for *the pole*, and any associated structural damage in the long text of the SAP notification
- The defect MRV/Priority
- Include the required remedial action, ie plate or replace pole according to condition of pole
- Photos of any corroded joist(s) and attach to the notification
- Photos of any other corrosion and/or other associated damage/deterioration or concrete related defects and attach to the notification
- Photo of overall pole construction

A permanent record of the Inspection is to be initiated by 'signing off' the SAP Works Order that initiated the Inspection.

9. REFERENCE DOCUMENTS

9.1 Network Maintenance Manual

6.2 Overhead Subtransmission Lines.

6.3 Overhead Distribution Assets.

9.2 Line Inspection Manual

3.15 Subtransmission Line Component Inspection.

3.16 Distribution Line Component Inspection.

3.25A GROUND LINE CORROSION ASSESSMENT ON SWER TRANSFORMER POLES, SWER ISOLATING TRANSFORMER POLES, SWER REGULATOR POLES & SWER POLES WITH REMOTE HV EARTHS

1. PURPOSE OF DOCUMENT

This document describes the process for ground line corrosion inspection on SA Power Networks SWER transformer poles, SWER isolating transformer poles, SWER regulator poles and any SWER poles with remote HV earths.

2. PURPOSE OF INSPECTION

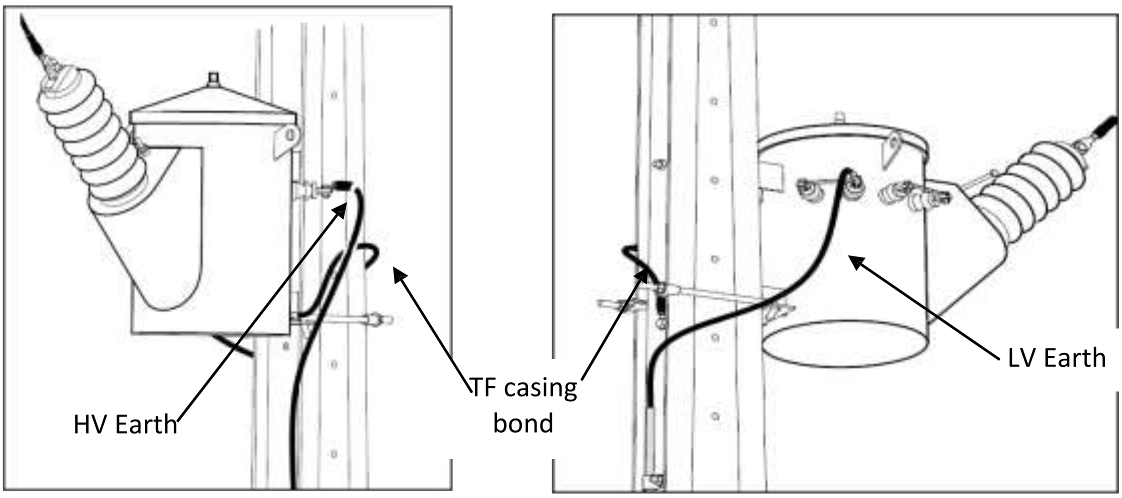
Inspection of Pole Corrosion is conducted to assess the condition of SA Power Networks Stobie Poles and to identify hazards and components that have deteriorated to the extent that failure of the equipment is likely. Emphasis is placed on identification and management of known hazards and component failure modes which could jeopardise the:

- Safety of the Public, Employees and Operators;
- Safety of SA Power Networks equipment; and
- Continuity of supply to customers.

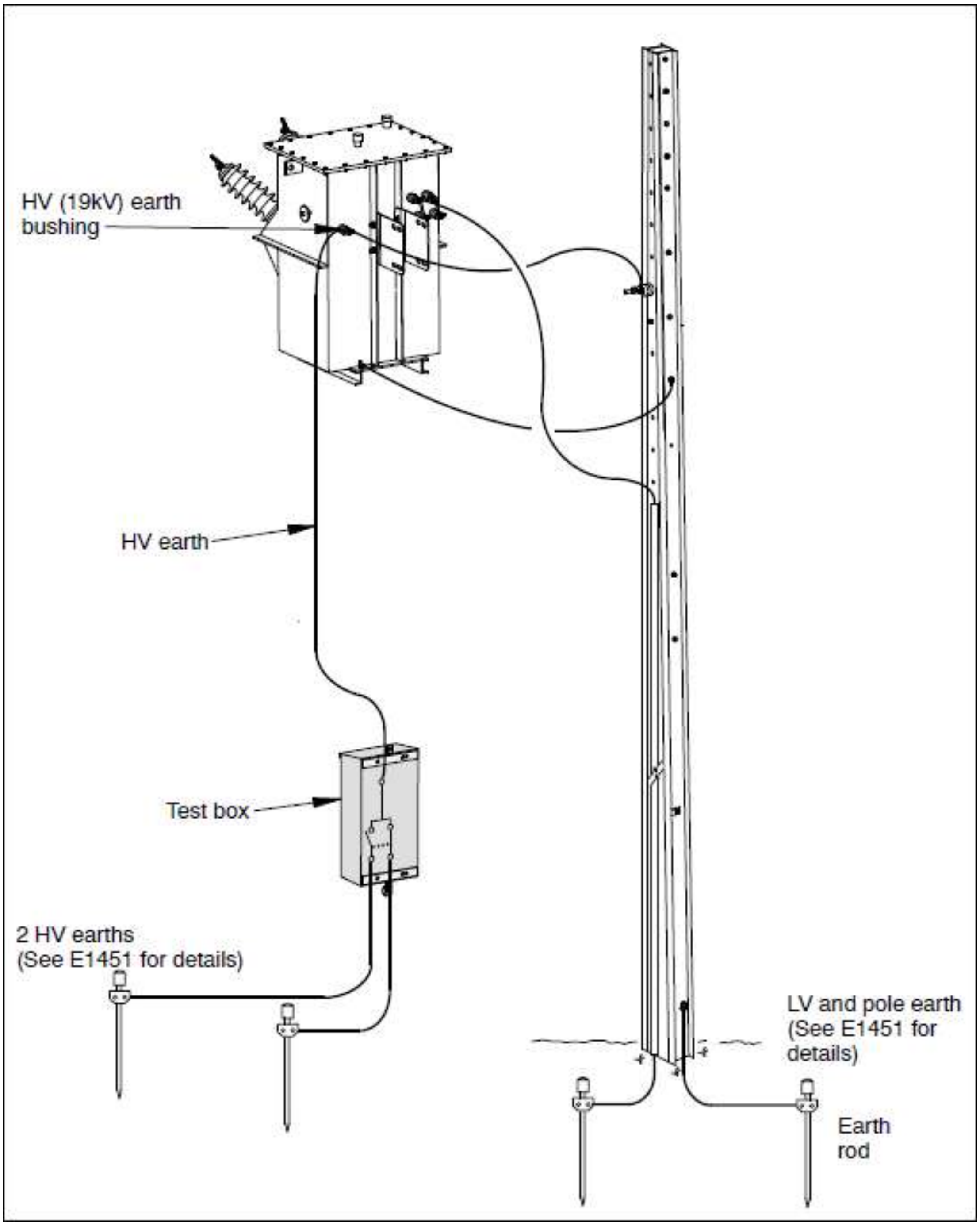
3. HAZARD IDENTIFICATION

Hazard Identification **MUST** be carried out prior to commencing each job.

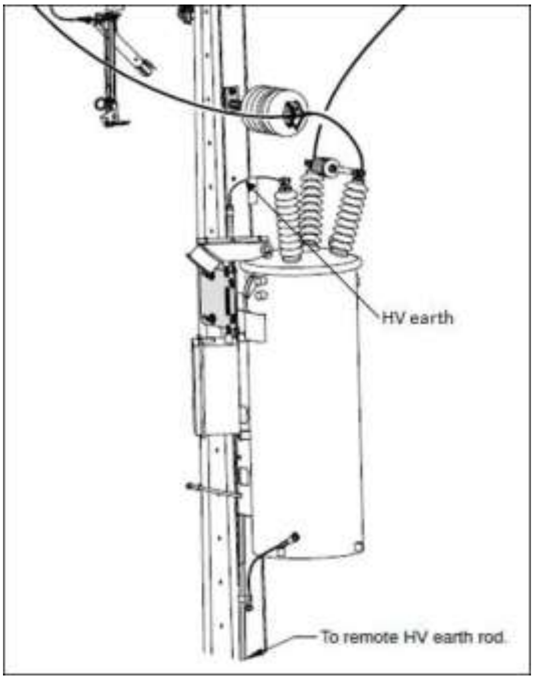
1. Be aware that if the pole earthing system, the high voltage earthing system or the LV insulation system is damaged/faulty, there may be a voltage present on the steel of the pole and associated metal. Voltages present in certain fault conditions have the potential to be fatal.
2. A visual inspection of the area should be carried out before proceeding to identify hazards such as snakes, lizards and spiders.
3. Identify earthing systems and inspect overhead components for any potential hazards or deterioration.



Most common SWER distribution transformer high voltage and low voltage earthing configurations, for more detail view E1450 series of drawings.

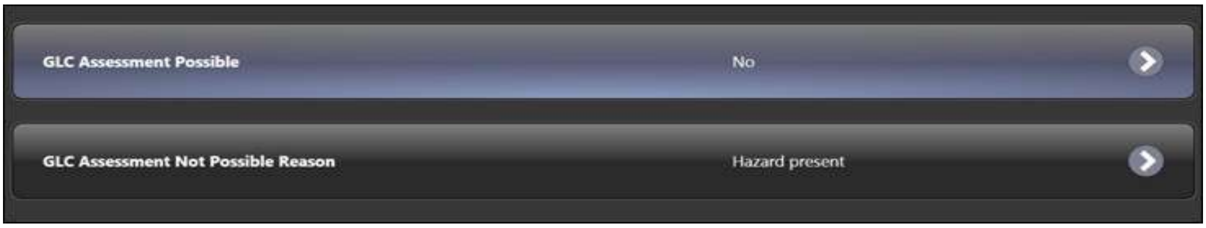


Overview of SWER isolating transformer earthing, for more detail view E1450 series of drawings.



Overview of SWER Regulator HV earthing, for more detail view E1441 series of drawings

4. **If any** visible damage to earthing system **do not** excavate and a distribution defect is to be entered in SAP for the identified defect.
5. If corrosion is evident in the case of item 3.4 above and the inspector is able to make a reasonable visual assessment that the pole requires plating or replacement enter a distribution defect in SAP as per requirements in the line inspection manual.
6. If no corrosion evident or unable to make the assessment as per item 3.5 above make an entry in the priority asset tool under "GLC Assessment Possible" and record reason as Hazard present



7. **If no** visible damage to earthing systems continue with item 4 Safe Approach Procedure.

4. SAFE APPROACH PROCEDURE

Refer to Job Safe Work Procedure JSWP136 for safe approach procedure for working on Live 19kV SWER isolating and SWER distribution transformer poles.

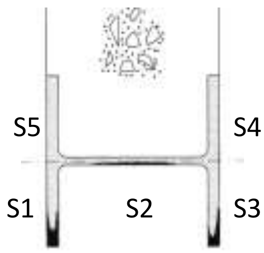
Refer to ND-J6 Appendix A1 and A2 for trenching near underground cables and associated equipment.

5. ASSESSMENT OF GROUND LINE CORROSION

If safe approach criteria compliant as per JSWP136

1. Gently excavate by hand-tool digging only, the base of pole starting from S1/S5 and S3/S4 working way toward S2 avoiding contact with earthing systems.

*Earth cables are generally placed in the S2 channel, if not always excavate working towards the cable and avoiding contact with the earthing system.

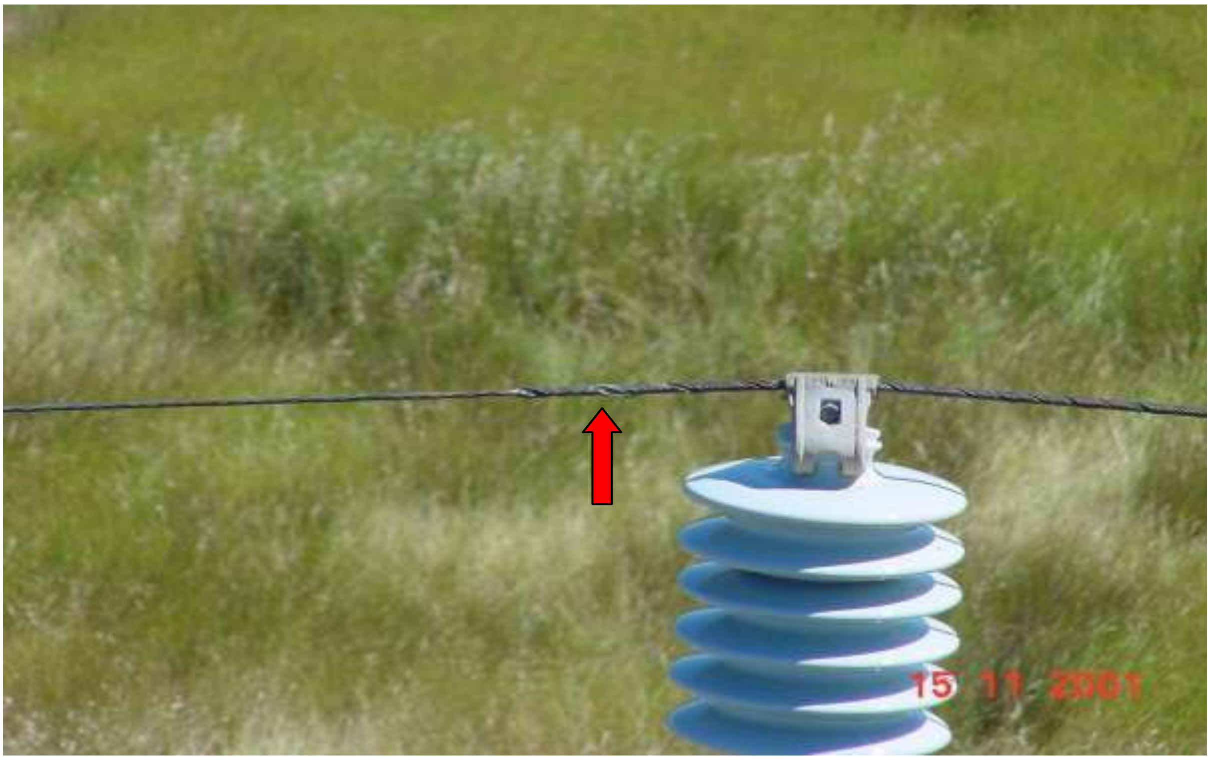


2. Remove any rust and assess ground line corrosion as per guidelines in section 3.25 of the Line Inspection Manual.
3. If unable to obtain one of the five joist corrosion measurement due to the placement of the earth cables complete assessment on the other four joist sections and apply the average of the four readings to the joist section which you are unable to read
   - example if unable to read joist section S2 and S1=2mm, S3=2mm, S4=2mm, S5=1mm total of 7mm with average of 1.75mm loss for the S2 reading.

4. CONDUCTORS

Contents

4.1 CONDUCTOR – ARMOUR ROD



This photo is a typical of PZ-1

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code

CONDUCTOR BROKEN STRAND

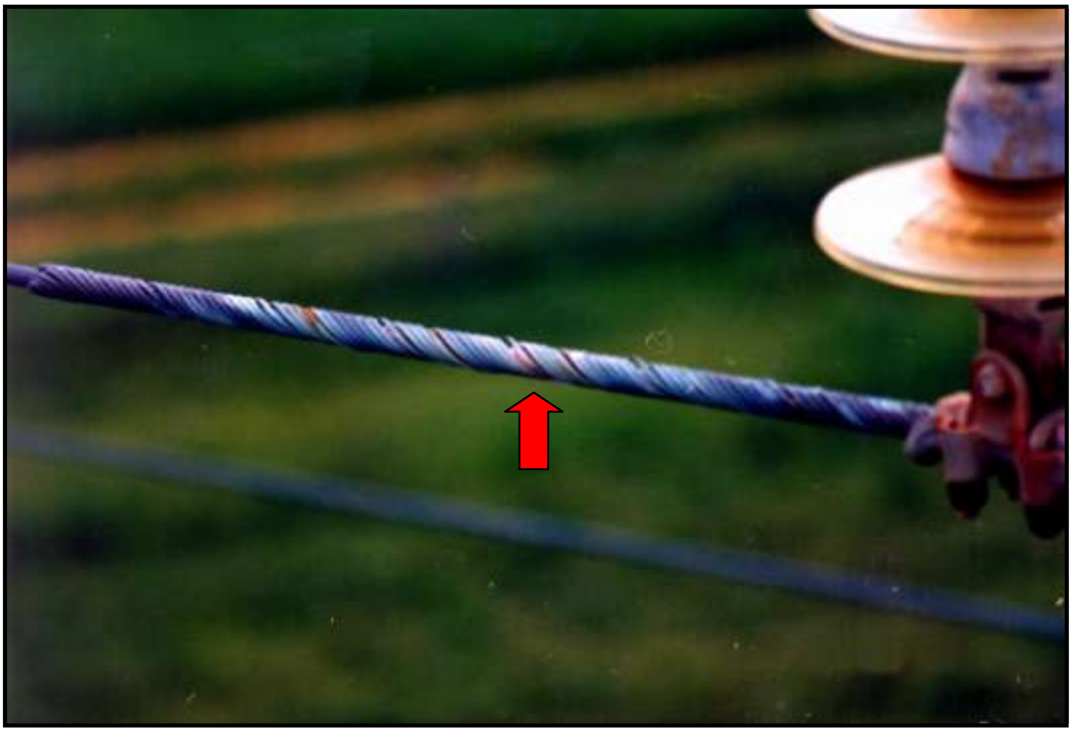
This photo is a typical of P2

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code

CONDUCTOR VIBRATION DAMPERS

Note: green discolouration at conductor / line guards wear points.



This photo is a typical of PZ-1

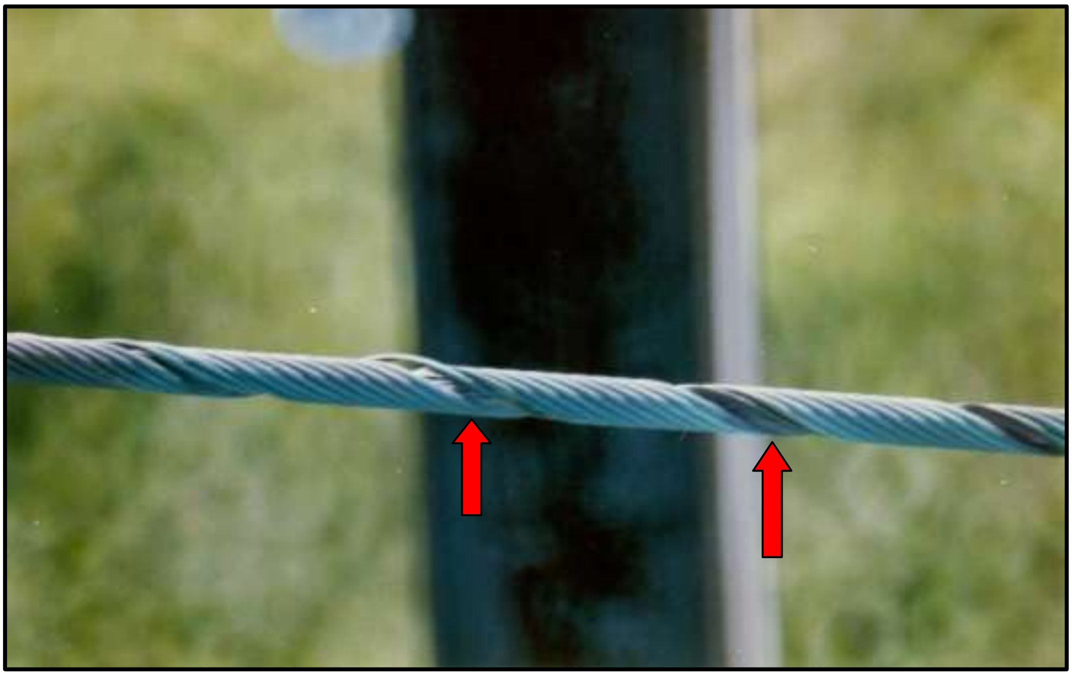
PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code

CONDUCTOR VIBRATION DAMPERS

Worn line guard and damaged conductor.

Note staining.



This photo is a typical of PZ-1

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

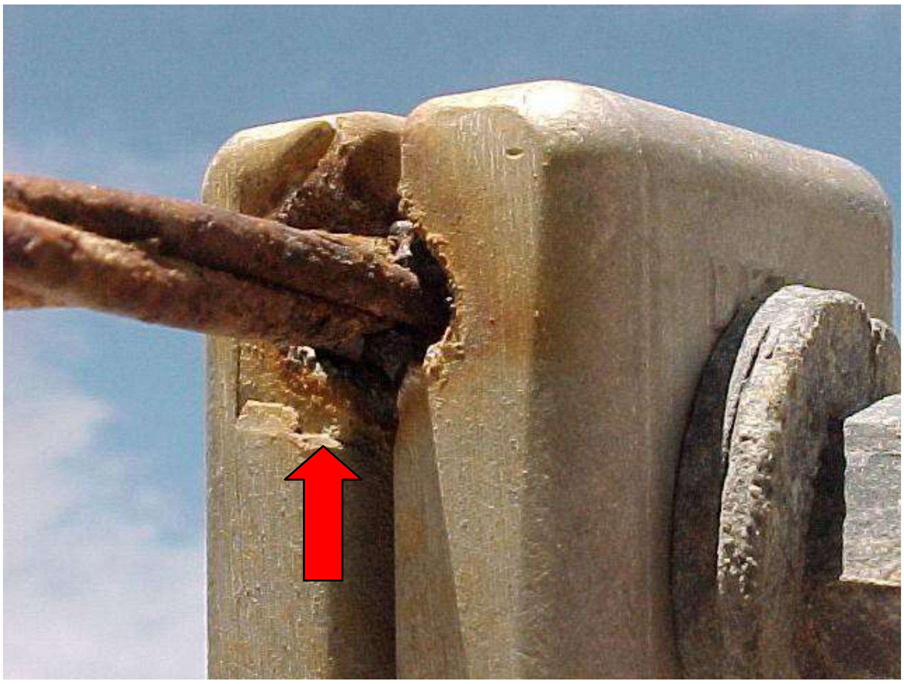
Quick Code

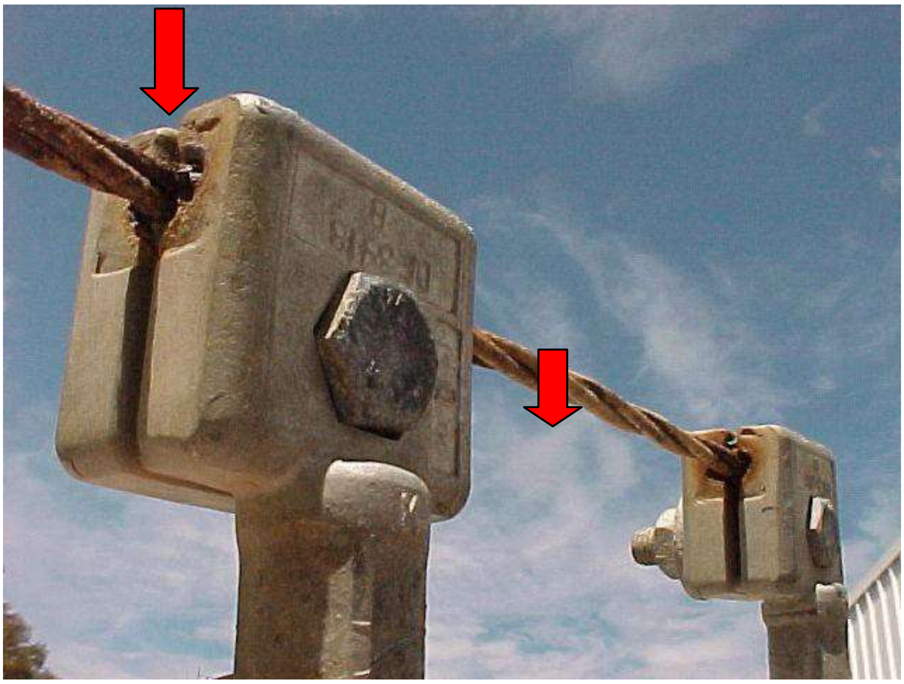
CONDUCTOR VIBRATION DAMPERS

Loose line guard. Vibration has worn away conductor strands internally.

Note staining.

4.2 CONDUCTOR – CONNECTORS

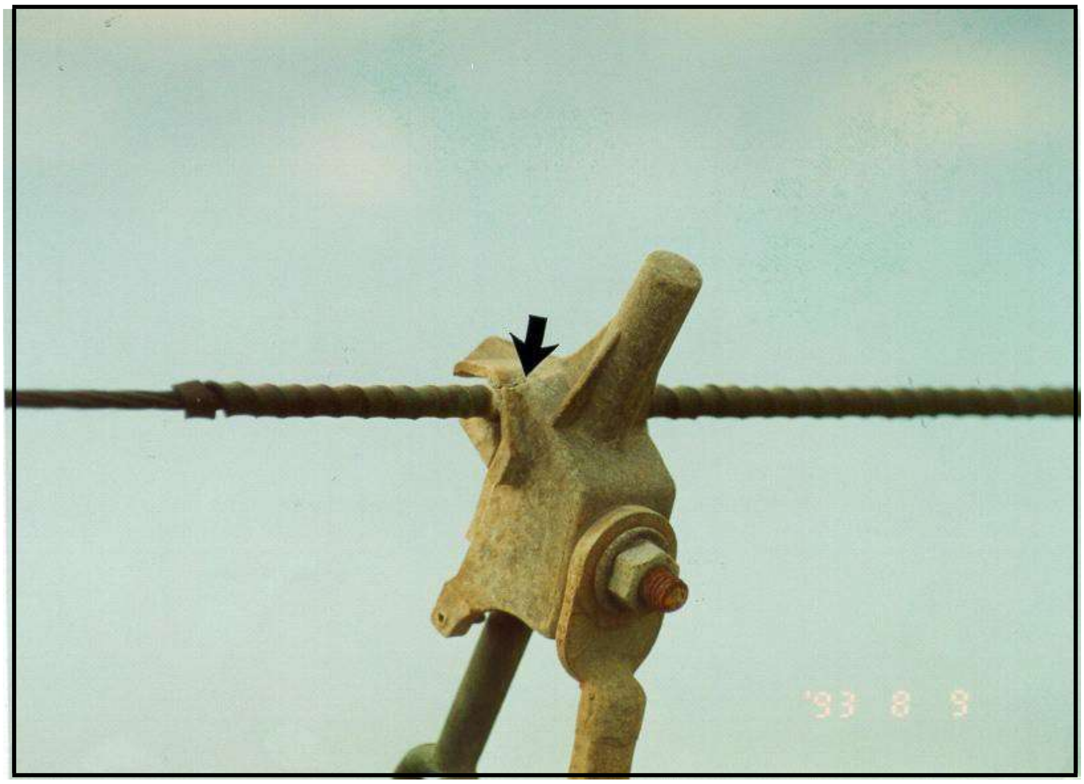




This photo is a typical Priority B

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
ALUM/STEEL JOINTS



This photo is a typical of PZ-1

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
ALUM/STEEL JOINT LLC

Damaged live line clamp.

Note cracking and electrolysis.

Aluminium clamp **should not** be installed on copper conductor.

Standard Data Entry Requirements Example Below

Replace entire tap with new tap and connections including heat shrink sleeving as per E-Drawing Standards. Also ensure all old connections/fittings/tee cons/live line clamps are removed and any damaged conductor repaired.

This photo is a typical of PZ-1

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
ALUM/STEEL JOINT LLC

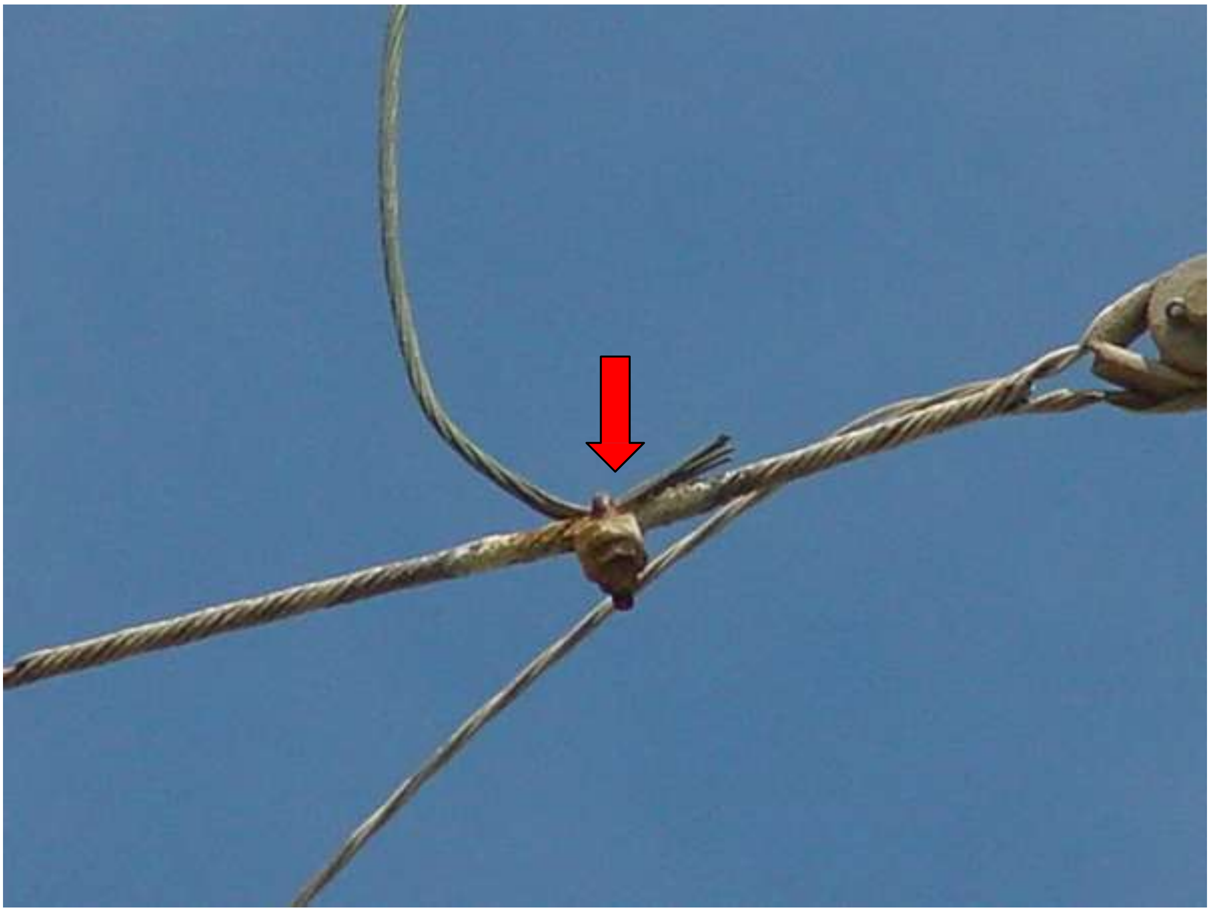
Damaged live line clamp.

Note cracking and electrolysis.

Aluminium clamp **should not** be installed on copper conductor.

Standard Data Entry Requirements Example Below

Replace entire tap with new tap and connections including heat shrink sleeving as per E-Drawing Standards. Also ensure all old connections/fittings/tee cons/live line clamps are removed and any damaged conductor repaired.



This photo is a typical of PZ-1

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
ALUM/STEEL/COPPER JOINTS

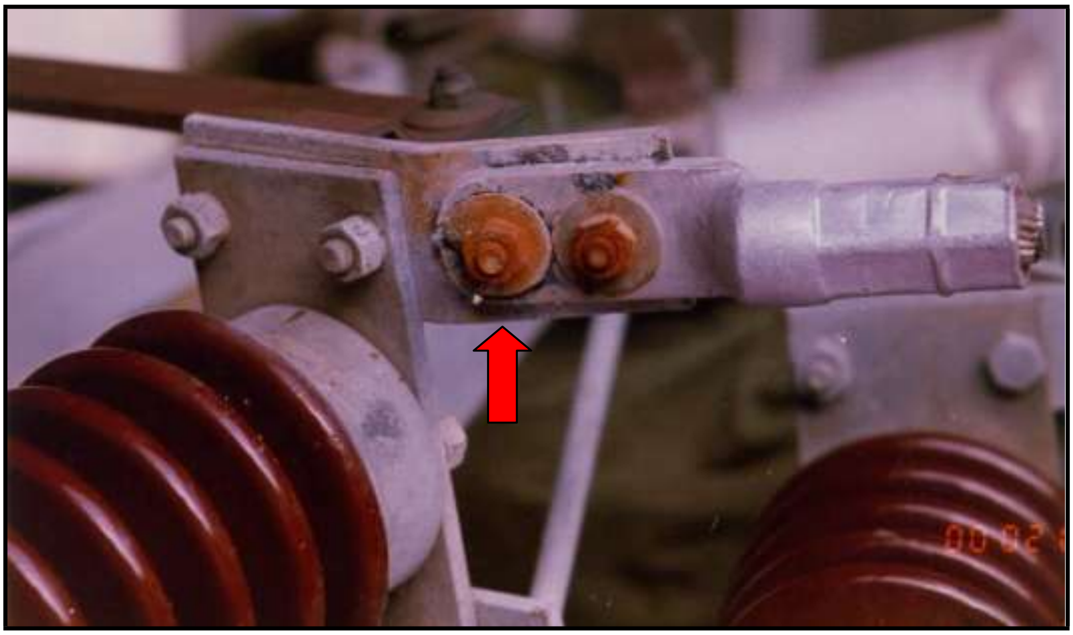
NOTE: REQUIRES 2 BULLDOG GRIPS, AND SHOULD NOT BE ON GRIP.

This photo is a typical of Priority B

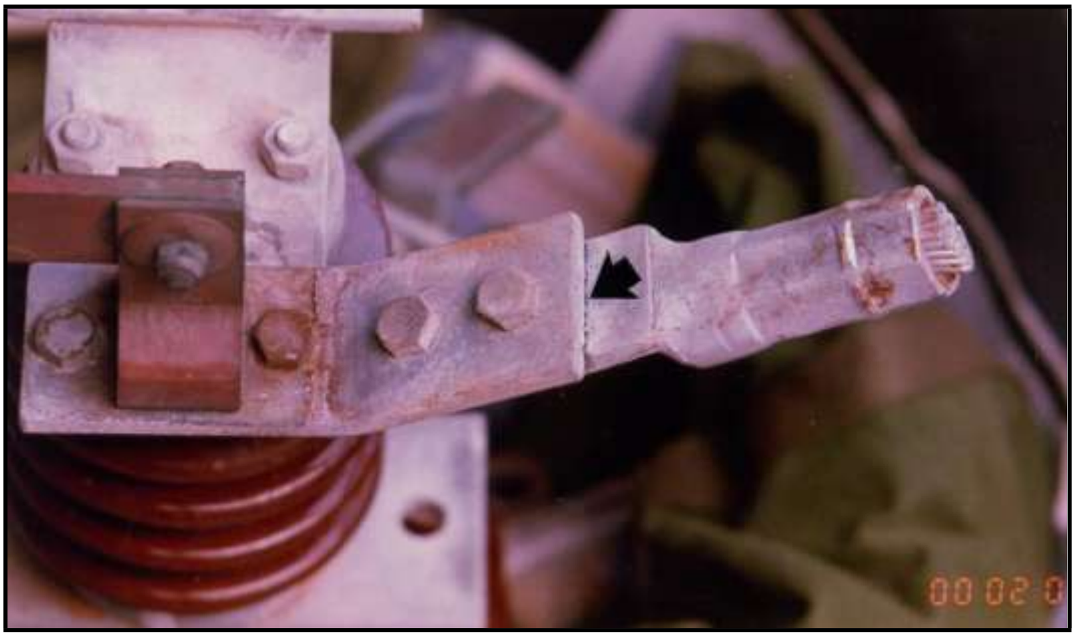
PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
HOT JOINT (LINE INSPS)

Note: Damaged / charred terminal lug and palm.



Top view.



Bottom view.

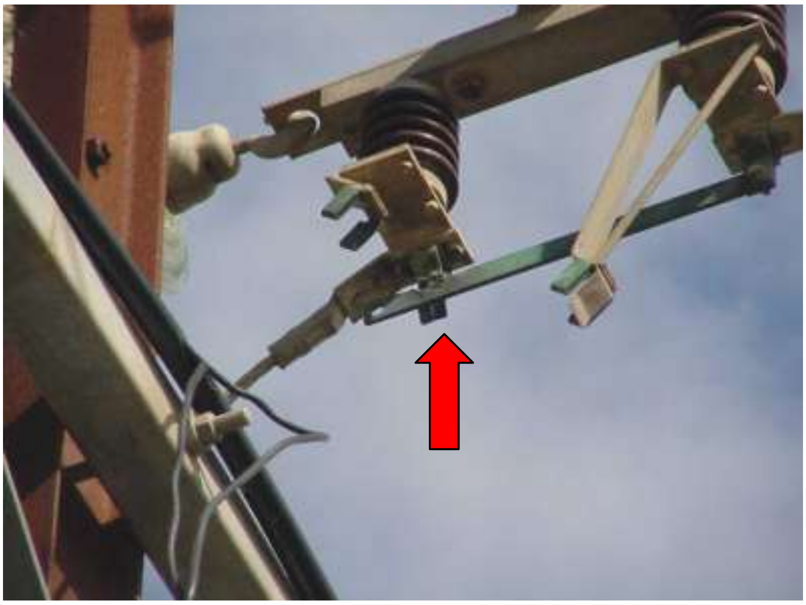
Note arcing.

PRIORITY B – 2 **NBFRA**
PRIORITY BZ – 2 **H/MBFRA**

Quick Code
HOT JOINT (LINE INSPS)

Standard Data Entry Requirements Example Below

Replace lugs & DF Base.
Ensure all connections including switch mechanisms are cleaned & greased.



This photo is typical of PZ-1

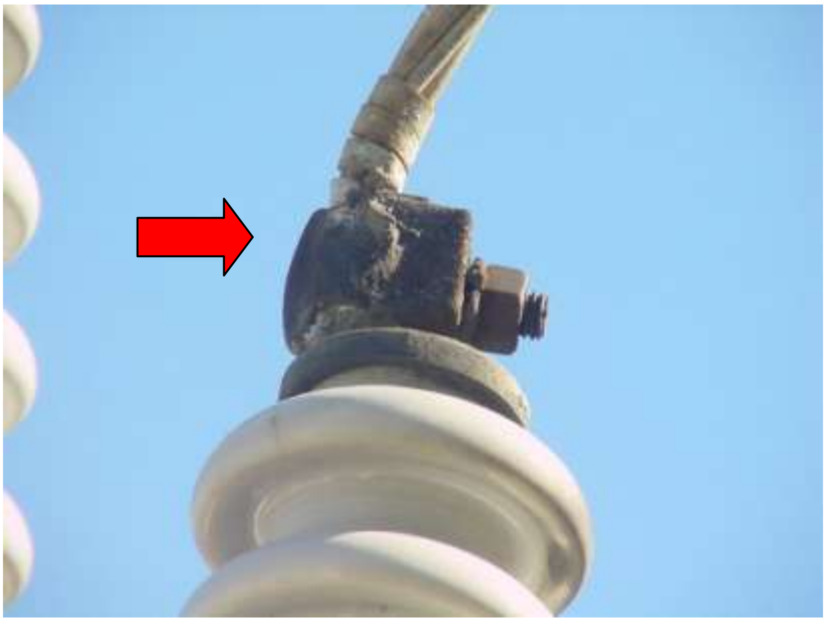
PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
HOT JOINT (LINE INSPS)
HOT JOINT (IR SURVEY)
HOT JOINT (I/SURVEY CRT SECT)

This photo is typical of Priority B

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
HOT JOINT (LINE INSPS)



This photo is typical of PZ-1

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
HOT JOINT (LINE INSPS)
HOT JOINT (I/SURVEY CRT SECT)

This photo is typical of PZ-1

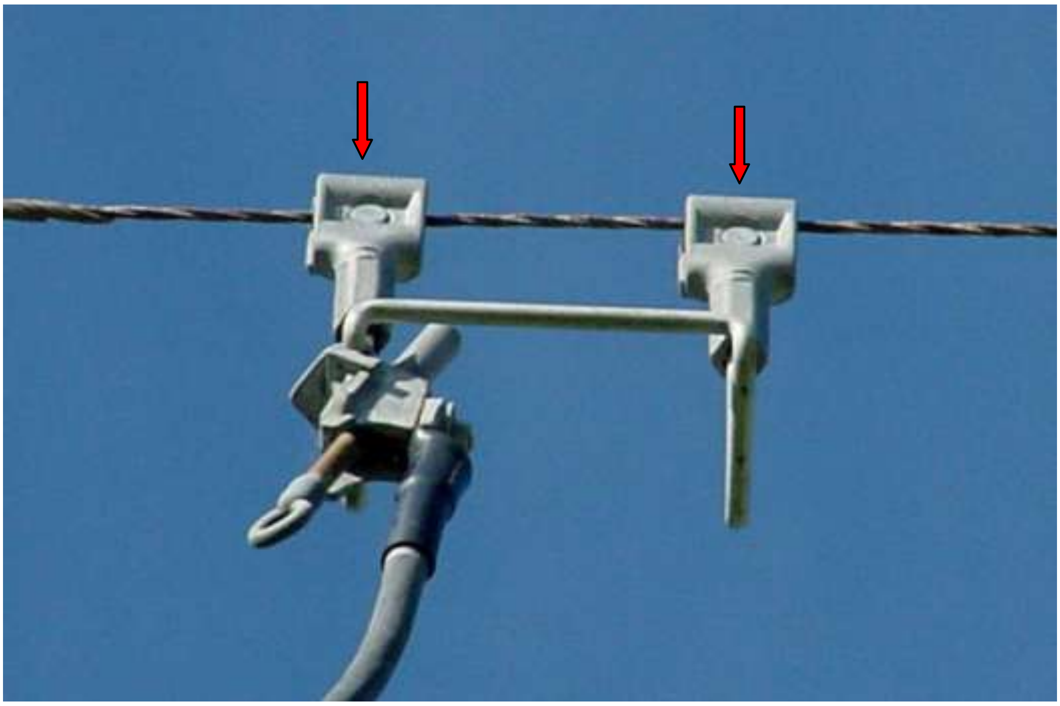
PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
HOT JOINT (LINE INSPS)

This photo is typical of Priority B

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/MBFRA

Quick Code
HOT JOINT (LINE INSPS)



PRIORITY 1 – 3 NBFRA
PRIORITY BZ – 3 H/MBFRA

Quick Code
ALUM/STEEL/COPPER JOINTS

Flexible Taps / Heat Shrink:

No heat shrink (refer E1205 & E1206):

- **H/MBFRA** without any heat shrink sleeving is a **PZ** defect.
- **NBFRA** without any heat shrink sleeving is a **P3** defect.

Inadequate heat shrink (refer E1205 & E1206):

- **H/MBFRA** with inadequate heat shrink (not installed to standard refer to E1205 2.1) is a **P2** defect.
- **NBFRA** with inadequate heat shrink (not installed to standard refer to E1205 2.1) is **NOT** a defect.

Damaged heat shrink:

- **H/MBFRA** with severely split or damaged heat shrink is a **P1** defect.
- **H/MBFRA** with minor damage (eg. bird peck) is a **P2** defect.
- **NBFRA** with any damage is a **P3** defect.

Damaged flexible tap:

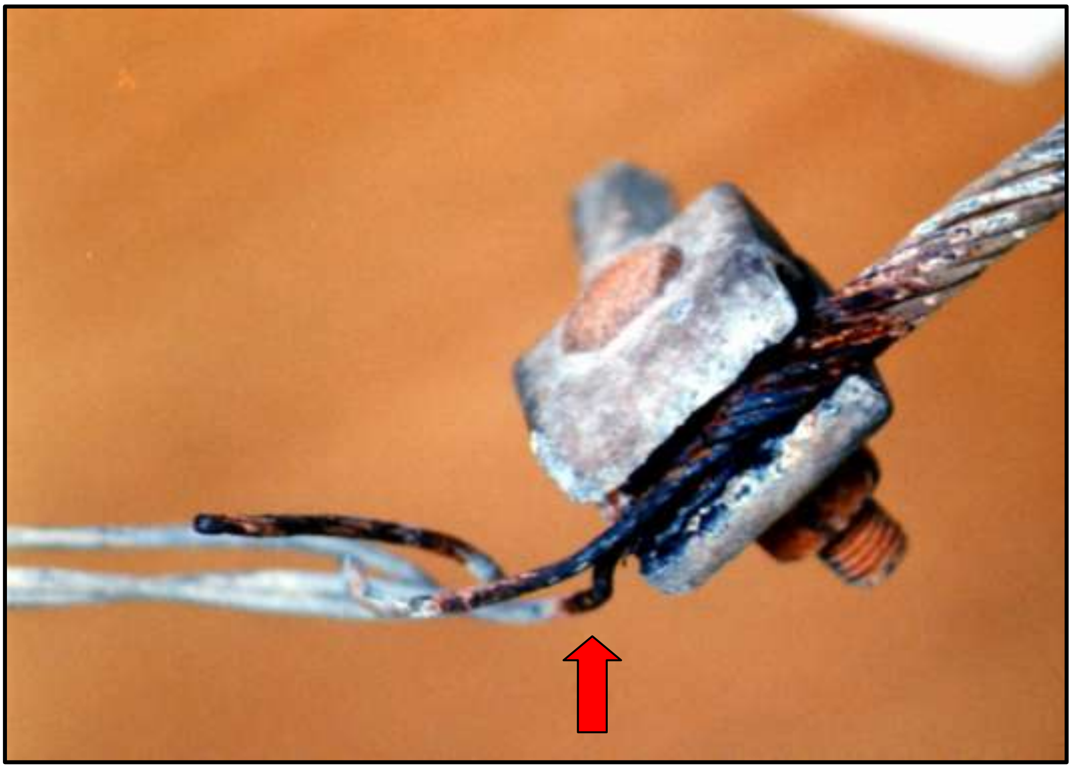
- **H/MBFRA** with damaged covering and visible strands, bulging or oxidisation is a **PZ** defect.
- **NBFRA** with damaged covering and visible strands, bulging or oxidisation is a **P1** defect.
- **All Areas** with minor damage (eg. bird peck) is a **P2** defect.

PRIORITY 3 **NBFRA**
PRIORITY BZ **H/MBFRA**

Heat shrink Sleeving Missing on Live Line Clamp

Standard Data Entry Requirements Example Below

Replace entire tap with new tap and connections including Heat Shrink Sleeving to the current E-Drawings.



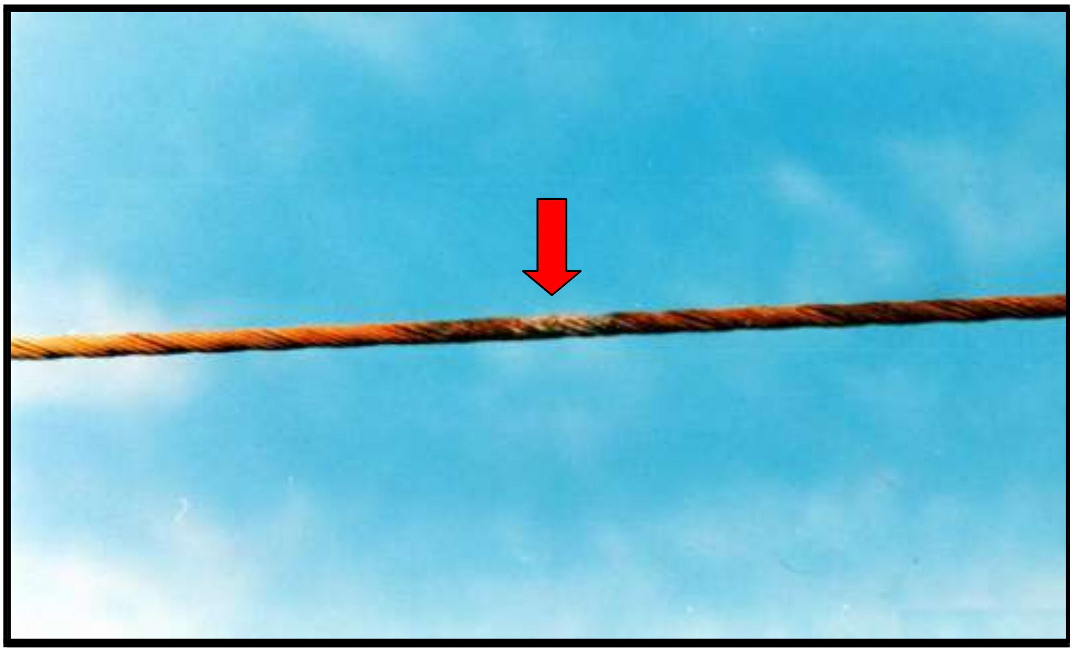
This photo is typical of Priority B

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
ALUM/STEEL/COPPER JOINTS

Damaged conductor, tee clamp.

4.3 CONDUCTOR – LINE JOINT



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code

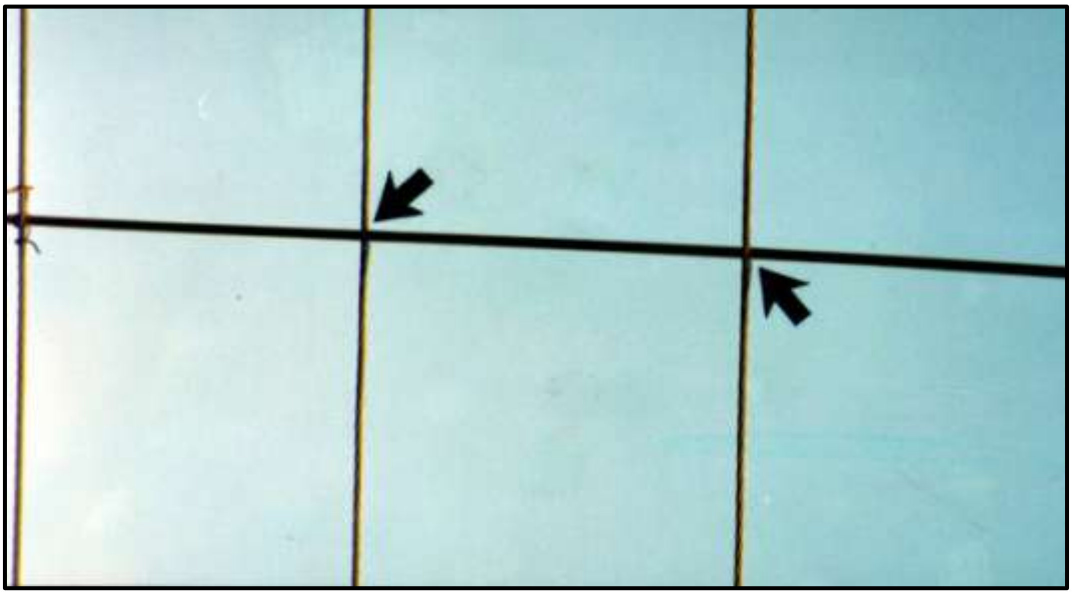
CONDUCTOR GRIPS/SPLICES

NOTE: CHECK FOR DISCOLOURATION AT CENTRE OF SPLICE.
CHECK FOR DISCOLOURATION AT EITHER END OF LINE SPLICE.

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code
CONDUCTOR WRAPLOCK

4.4 CONDUCTOR – SPACERS

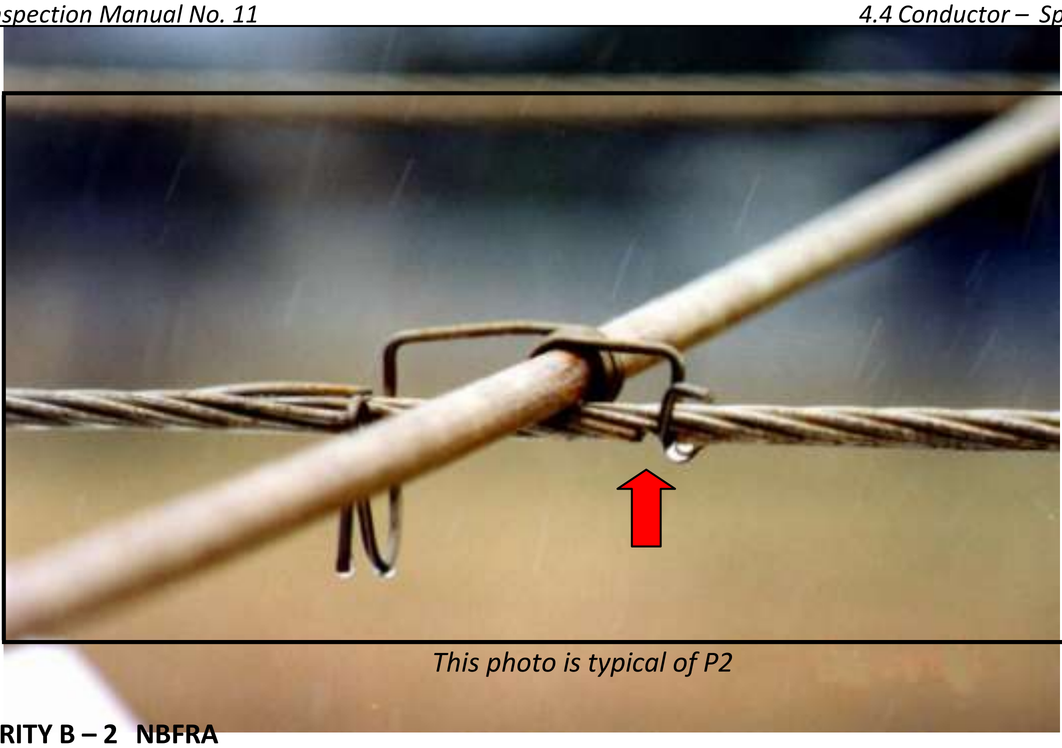


PRIORITY Z in H/BFRA

Quick Code

CONDUCTOR SPACERS

NOTE: Two spacer clips missing.



This photo is typical of P2

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code
CONDUCTOR BROKEN STRAND

Note: conductor damage.

Standard Data Entry Requirements Example Below

- Spacer has worn conductors at spacer clips,6/1/3.75 AL Conductor.
- Blue & Red Phases are worst affected.
- Repair Conductors & remove spacer, spacer not required as this span is in NBRA or after repairs re-install spacer HBRA.
- Photos attached.

4.5 CONDUCTOR – STRAIN CLAMPS

Photo to be issued when available

4.6 CONDUCTOR – SUSPENSION CLAMPS

This photo is typical of P2

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code
CONDUCTOR SUSPENSION CLAMPS

Note: The wear on the socket tongue and suspension clamp.

Standard Data Entry Requirements Example Below

Single Side Socket Tongue/Pin & Suspension Clamp Wear.
Replace Socket Tongues, Pins & Conductor Clamps, Insulators & Hooks, All Phases.

This photo is typical of P2

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code
CONDUCTOR SUSPENSION CLAMPS

Note:

Hole visible beyond clevis pinhead and dark staining.

Standard Data Entry Requirements Example Below

Single Side Socket Tongue/Pin & Suspension Clamp Wear.
Replace Socket Tongues, Pins & Conductor Clamps, Insulators & Hooks, All Phases.

This photo is typical of PZ-1

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code
CONDUCTOR SUSPENSION CLAMPS

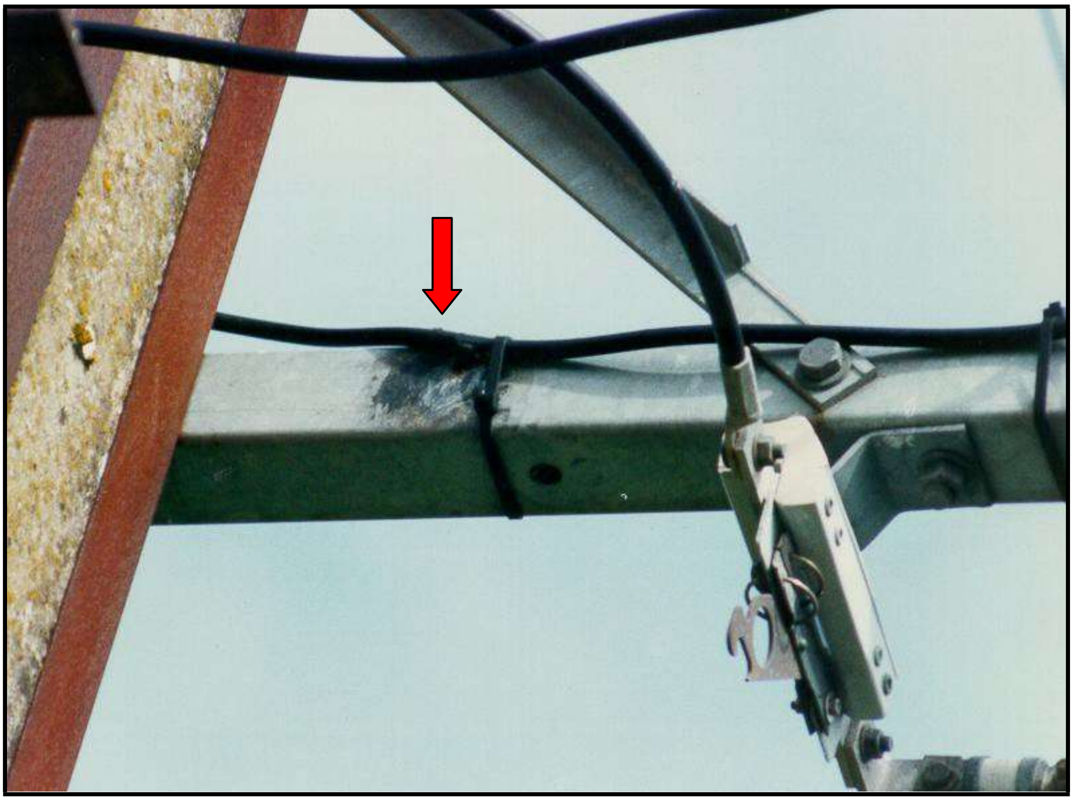
Note:

Hole visible beyond clevis pinhead.

Standard Data Entry Requirements Example Below

Single Side Socket Tongue/Pin & Suspension Clamp Wear.
Replace Socket Tongues, Pins & Conductor Clamps, Insulators & Hooks, All Phases.

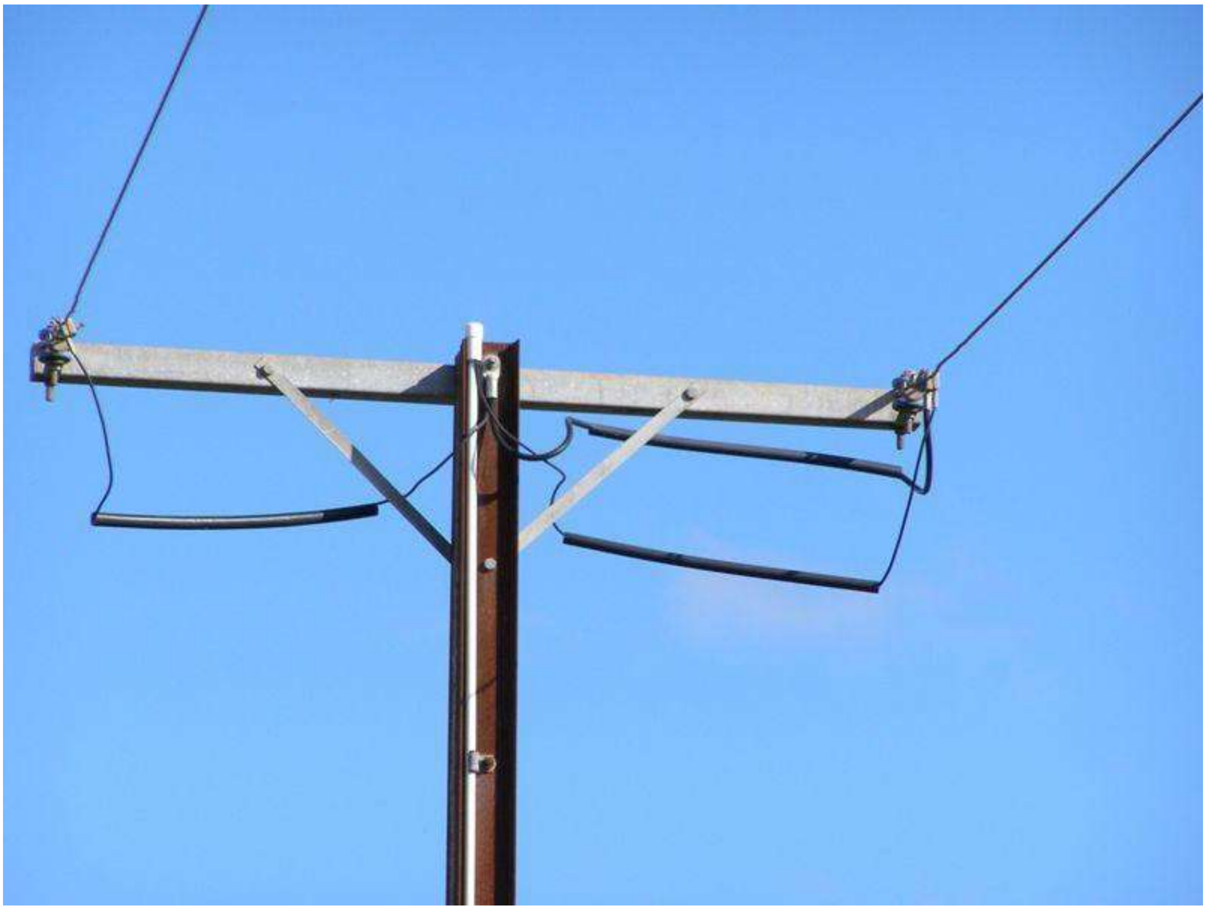
4.7 CONDUCTOR ATTACHMENTS – TAPS



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code
CONDUCTOR ABC/COVERED DAMAGED

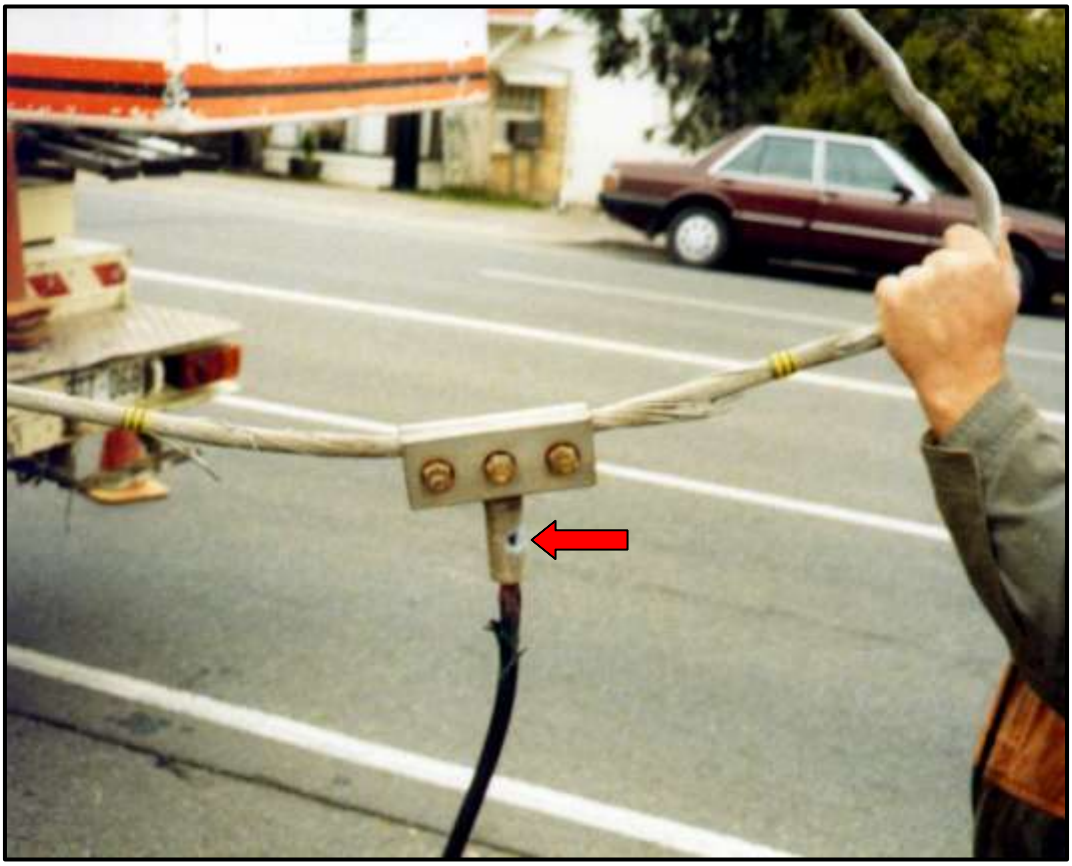
Covered conductor touching steel cross arm with visible signs of damage.



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Standard data Entry Requirements Example Below

L/V service active tap rubbing/Touching? on brace strap.
Reattach conduit to LV xarm as per E Drawings, bend all taps clear of steel components.
Repair/replace any damage on LV Tap.

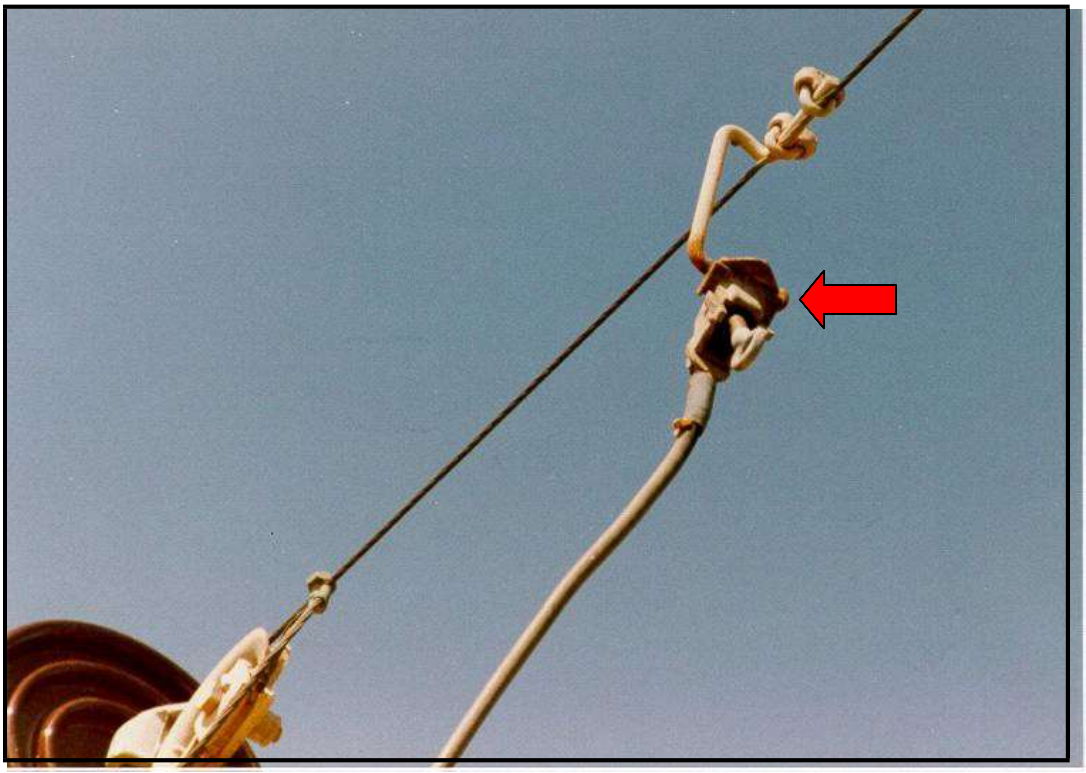


This photo is typical of Priority B

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code
ALUM/STEEL/COPPER JOINTS

NOTE: Damaged conductor, tee clamp.



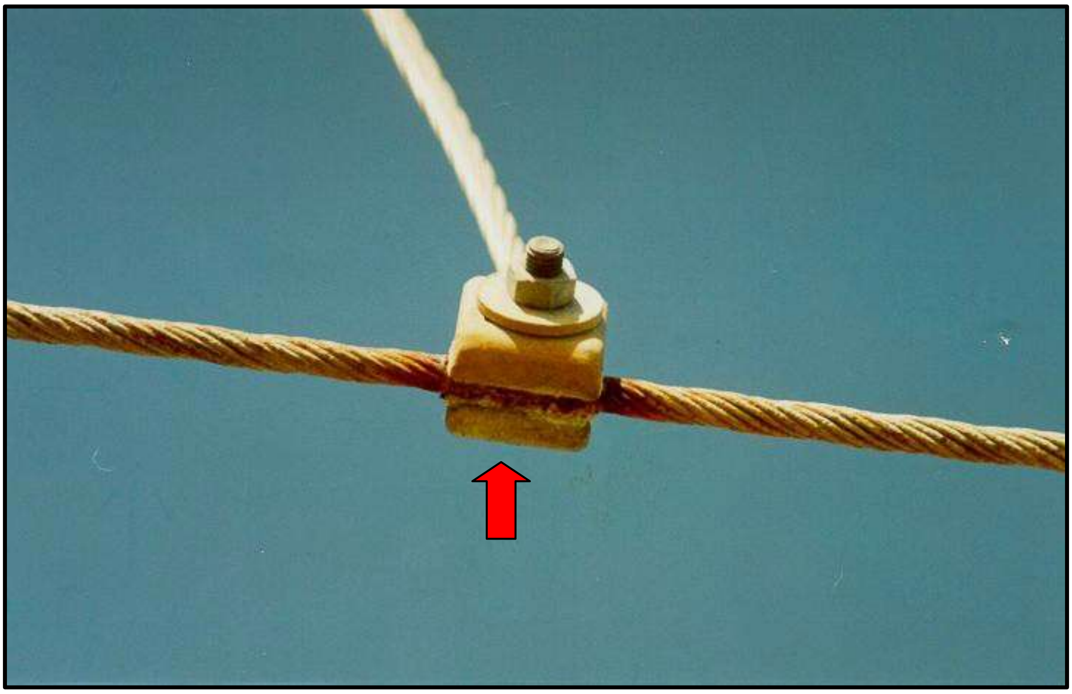
PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code
ALUM/STEEL JOINT LLC

NOTE: Damaged live line clamp connection. (Discolouration)

Standard data Entry Requirements Example Below

Replace entire tap with new tap and connections including heatshrink sleevings as per E-Drawing Standards. All so ensure all old connections/fittings/tee cons/live line clamps are removed and any damaged conductor repaired.


This photo is typical of P2

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

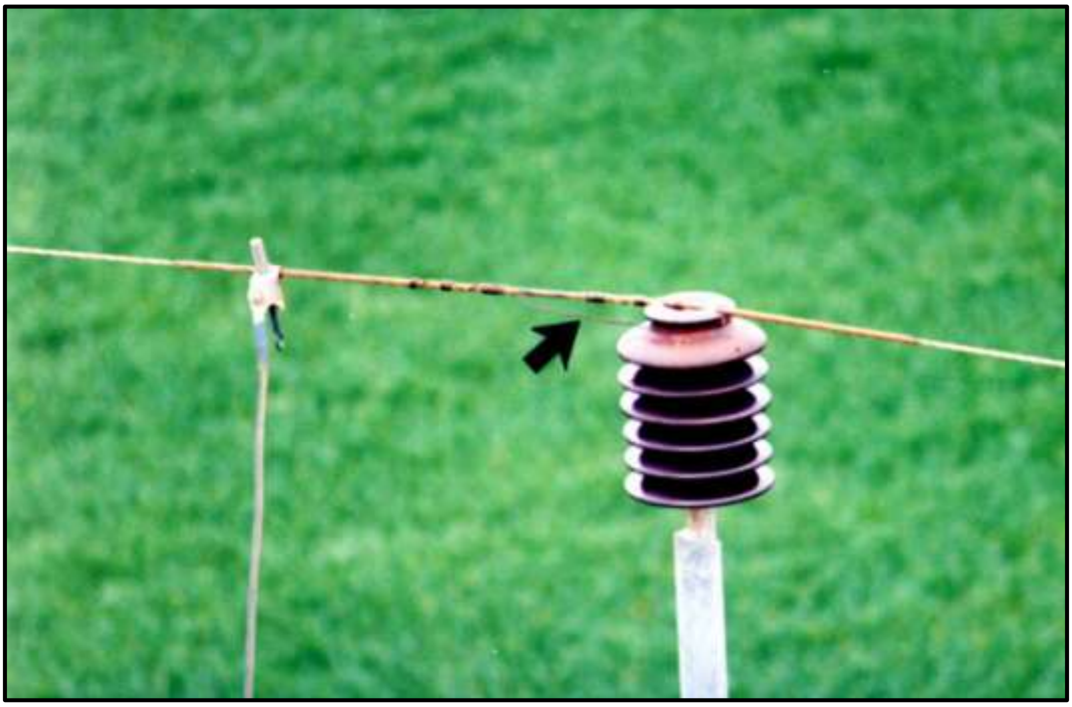
Quick Code
ALUM/STEEL/COPPER JOINTS

NOTE: Tee clamp should not be installed on grip / line guard.

Standard data Entry Requirements Example Below

Replace entire tap with new tap and connections including heatshrink sleevings as per E-Drawing Standards. All so ensure all old connections/fittings/tee cons/live line clamps are removed and any damaged conductor repaired.

4.8 CONDUCTOR ATTACHMENTS – TIE WIRES



This photo is typical of PZ in BFRA/HBFRA

PRIORITY B – 1 NBFRA
PRIORITY B - Z H/BFRA

Quick Code
CONDUCTOR TIE WIRES

NOTE: Broken tie wire.

Standard Data Entry Requirements Example Below

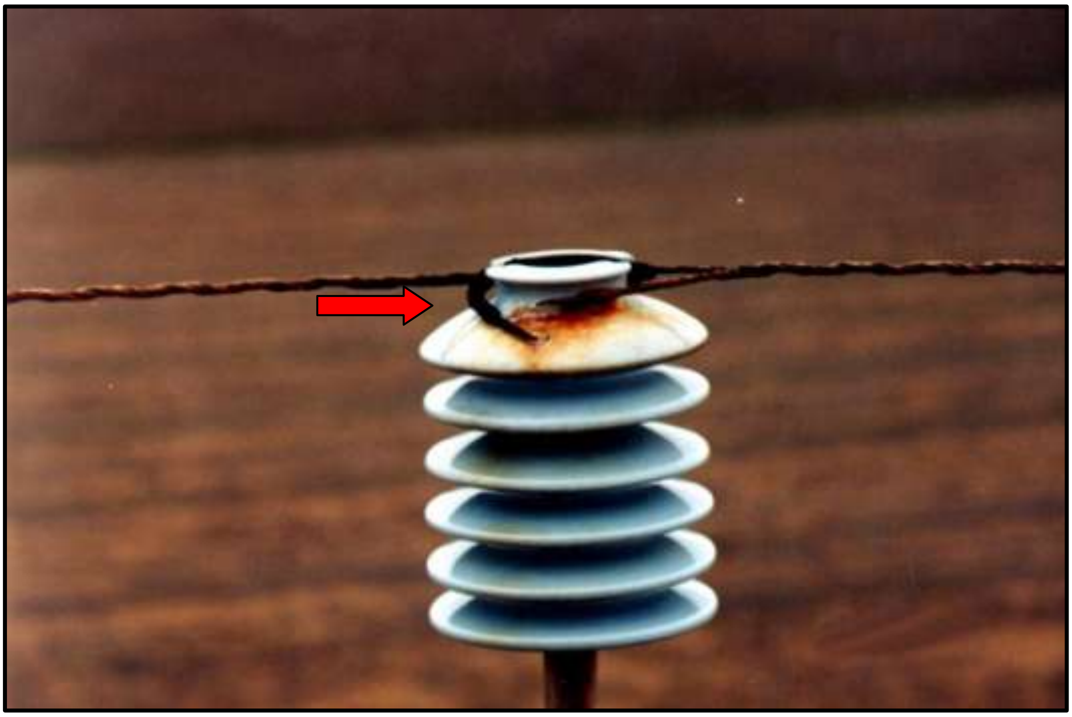
Broken HV Steel Line Tie Wire.
Replace with Steel Seizing Clamp.
Large Neck HV Insulator.
Check Other Phases & Replace As Required
Photo Attached.

This photo is typical of PZ in BFRA/HBFRA

PRIORITY B – 1 NBFRA
PRIORITY B - Z H/BFRA

Quick Code
CONDUCTOR TIE WIRES

NOTE: Broken tie wire.



This photo is typical of PZ in BFRA/HBFRA

PRIORITY B – 1 NBFRA
PRIORITY B - Z H/BFRA

Quick Code
CONDUCTOR WRAPLOCK

NOTE: Corroded / worn wraplock ties.

NOTE: BROKEN / DAMAGED WRAP LOCK TIES

This photo is typical of PZ in BFRA/HBFRA

PRIORITY B – 1 NBFRA
PRIORITY B - Z H/BFRA

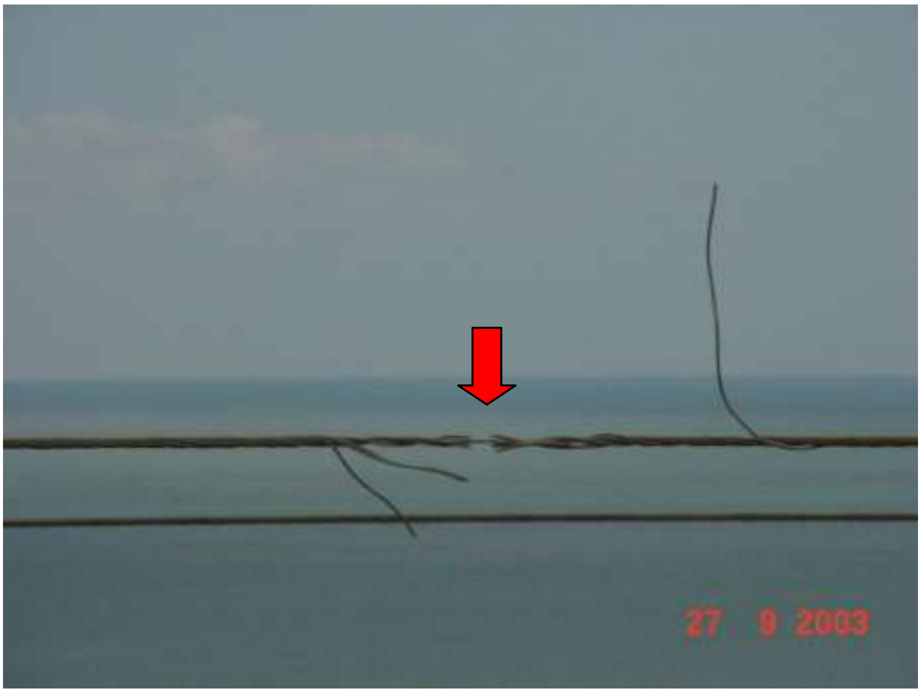
Quick Code
CONDUCTOR TIE WIRES

NOTE: Corroded conductor with Adelect tie.

4.9 CONDUCTOR ATTACHMENTS – VIBRATION DAMPERS

Photo to be issued when available

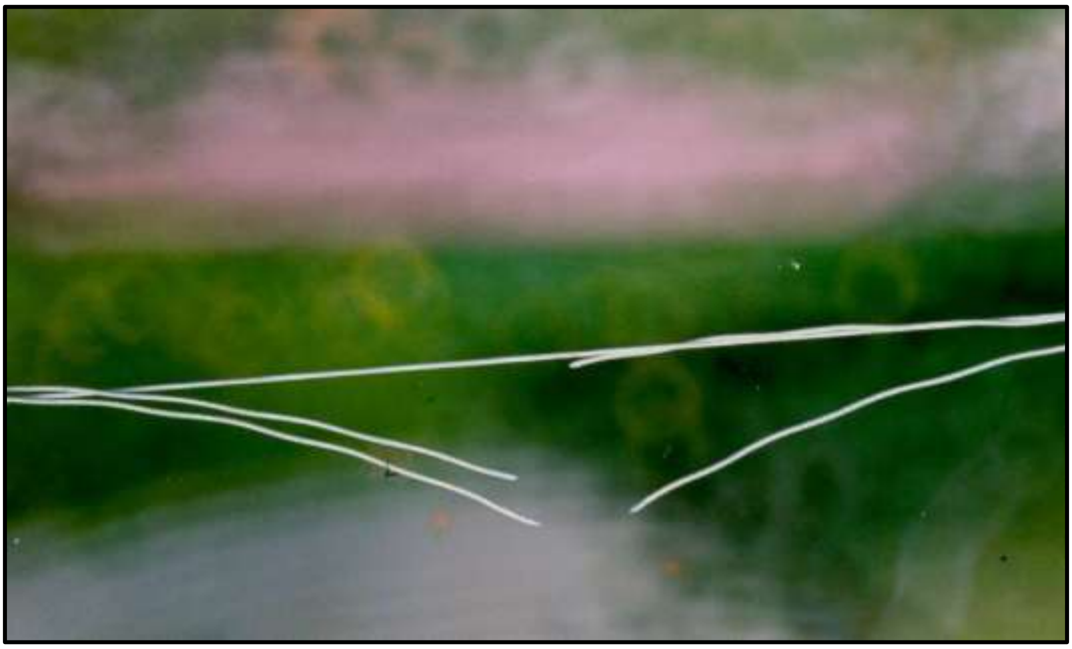
4.10 CONDUCTOR ATTACHMENTS – OVERHEAD, BARE



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
CONDUCTOR BROKEN STRAND

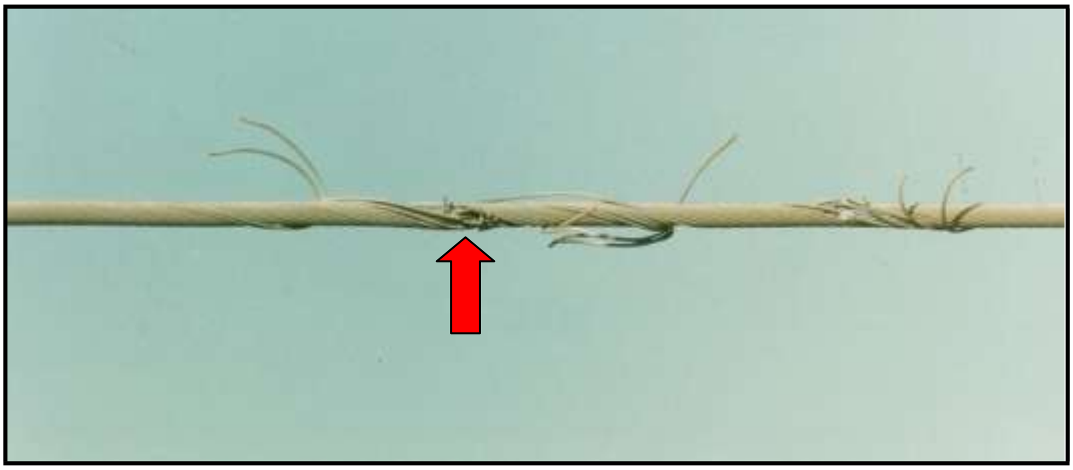
NOTE: Aluminium strands broken. Steel core remaining intact.



PRIORITY B NBFRA
PRIORITY B H/MBFRA

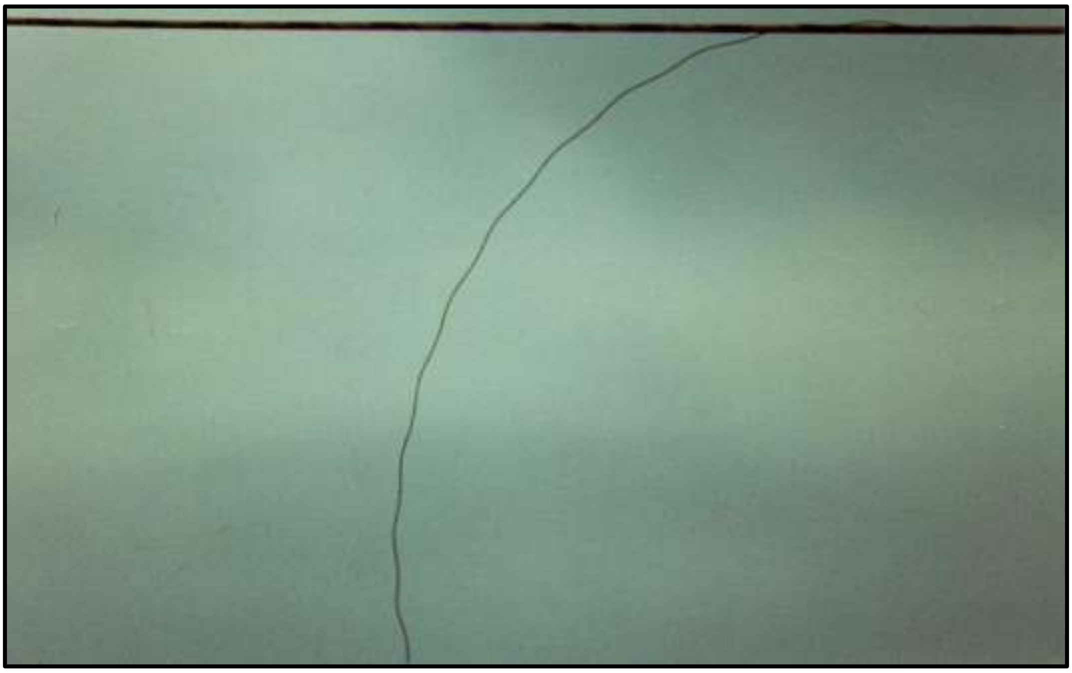
Quick Code
CONDUCTOR BROKEN STRAND

NOTE: 2 broken strands in 3/10 alumoweld or 3/12 steel requires immediate fixing.



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
CONDUCTOR BROKEN STRAND



This photo is typical of PZ-1

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
CONDUCTOR BROKEN STRAND

NOTE: BROKEN STRAND UNRAVELLING. BE AWARE THAT UNRAVELLING STRANDS CAN REDUCE CLEARANCES.

Standard Data Entry Requirements Example Below

1x Broken Strand of 3/12 Steel Conductor. Repair to E-Drawing Standards.

This photo is typical of PZ-1

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
CONDUCTOR BROKEN STRAND

NOTE: BROKEN STRAND UNRAVELLING. BE AWARE THAT UNRAVELLING STRANDS CAN REDUCE CLEARANCES.

Standard Data Entry Requirements Example Below

1x Broken Strand of 3/12 Steel Conductor. Repair to E-Drawing Standards.

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Standard Data Entry Requirements Example Below

- 1 x DD Noti Required Per Span Of Conductor That Is Damaged
- Corroded conductor- How many broken strands per phase?
- Which Phases/All Phases? If multiple phases affected, indicate number of phases
- Quality photos to be provided

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
CORRODED CONDUCTOR REPLACEMENT
CONDUCTOR BROKEN STRAND

Standard Data Entry Requirements Example Below

- 1 x DD Noti Required Per Span Of Conductor That Is Damaged
- Corroded conductor- How many broken strands per phase?
- Which Phases/All Phases? If multiple phases affected indicate number of phases
- Quality photos to be provided

PRIORITY 102 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
PHASE TO PHASE / EARTH CLEARANCES

Note:Typical construction that may reduce clearances.

PRIORITY 1 – 2 NBFRA
PRIORITY Z1 – 2 H/MBFRA

Quick Code
PHASE TO PHASE / EARTH CLEARANCES

NOTE: Poor phase to phase clearance along span with standard crossarms.

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA
Quick Code
CONDUCTOR BROKEN STRAND

Standard Data Entry Requirements Example Below

- 'H' Phase, 4 x Broken Strands.
- Repair Using Full Tension Sleeve
- Check Other Phases For Damage, Repair As Required.

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
PHASE TO PHASE / EARTH CLEARANCES

NOTE: Incorrect installation due to phase roll around vertical angle (ie. reduced phase to phase clearance)

PRIORITY 1 – 2 NBFRA

PRIORITY 1 – 2 H/MBFRA

Quick Code
GROUND CLEARANCE

NOTE: Low ground clearance over embankment.

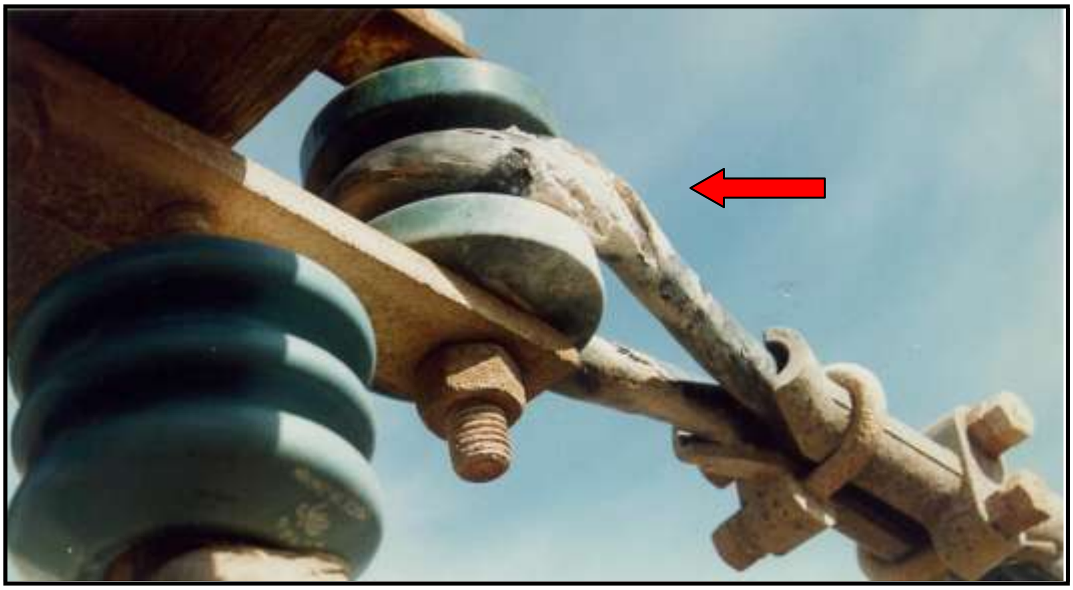
(REFER TO Guide for Assessment of Ground Clearances)

4.11 CONDUCTOR ATTACHMENTS – OVERHEAD, COVERED

H/MBFRA - Signs of damaged insulation **AND** evidence of burn marks **OR** bulging due to oxidisation is a **PZ** defect.

NBFRA - Signs of damaged insulation **AND** evidence of burn marks **OR** bulging due to oxidisation is a **P1** defect.

All Fire Risk Areas – Minor damage, other than mentioned above is a **P2** defect.



This photo is typical of PZ in H/MBFRA or P1 in NBFRA

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
CORRODED CONDUCTOR REPLACEMENT

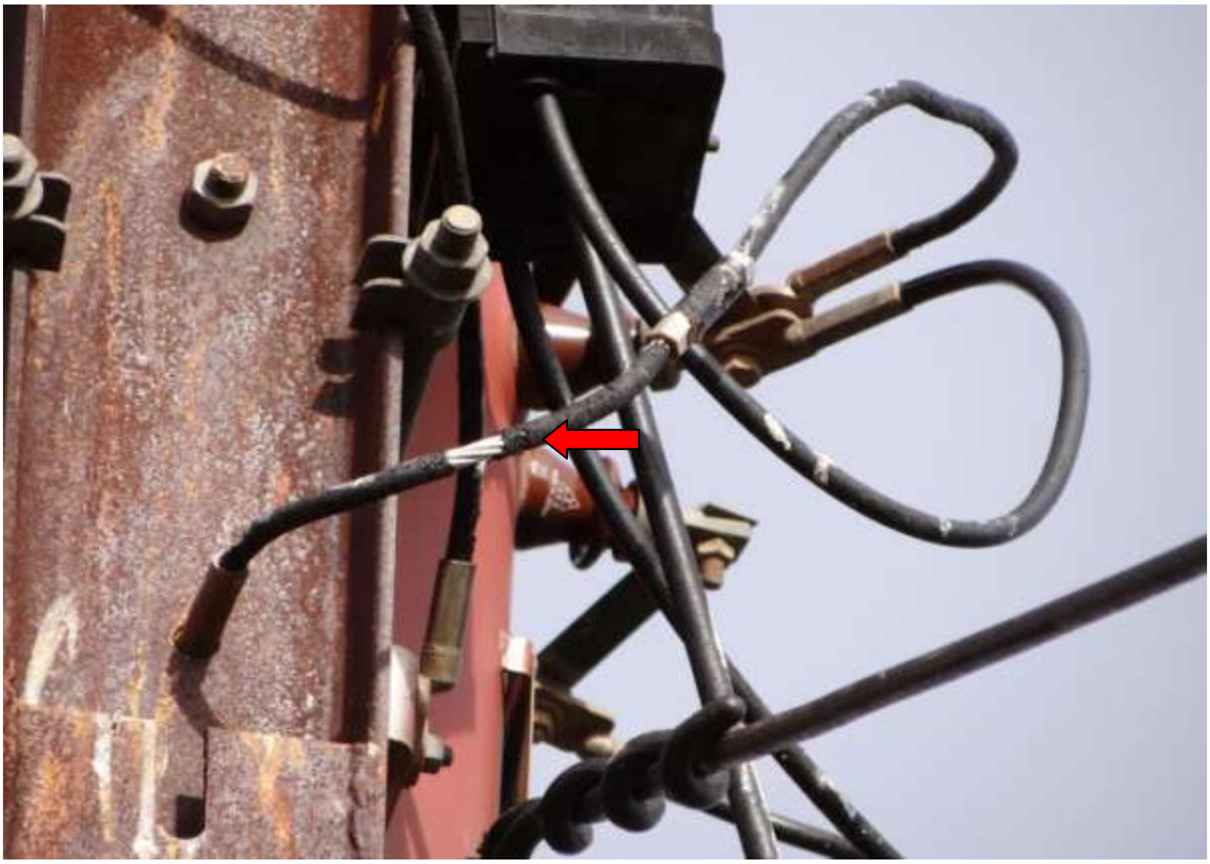
The insulation is damaged and oxidation is occurring in the conductors, therefore PZ for H?MBFRA or P1 for NBFRA.

This photo is typical of PB

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
CORRODED CONDUCTOR REPLACEMENT

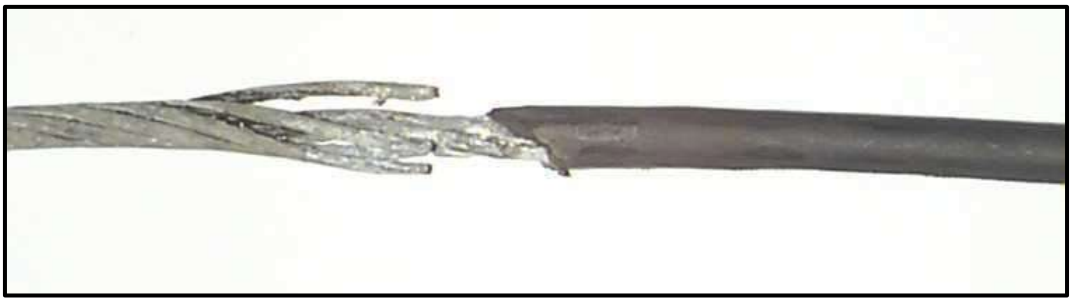
The insulation is damaged and oxidation is occurring in the conductors, due to the severity of the oxidation, this should be called in as a breakdown.


This photo is typical of P2

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
CONDUCTOR O/H COVERED

Minor damage is present therefore it is a P2. There is no evidence of burn marks or bulging due to oxidisation, therefore not a PZ-1.



PRIORITY B - 1 NBFRA
PRIORITY BZ - 1 H/MBFRA

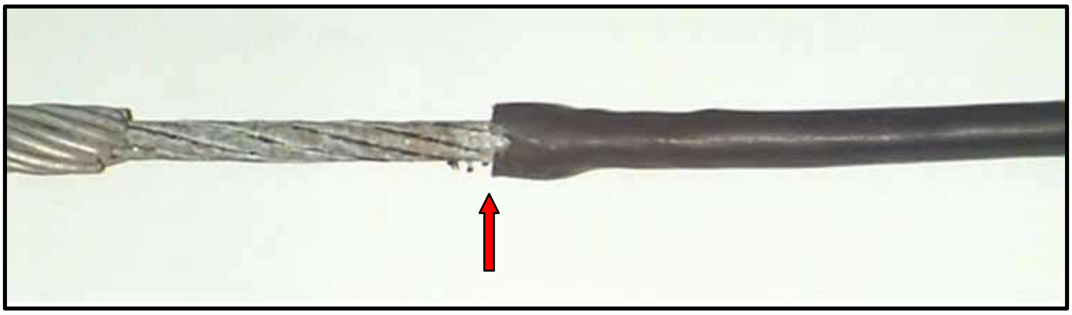
Quick Code
CORRODED CONDUCTOR REPLACEMENT

PRIORITY B - 1 NBFRA
PRIORITY BZ - 1 H/MBFRA

Quick Code
CORRODED CONDUCTOR REPLACEMENT

Standard Data Entry Requirements Example Below

- 1 x DD Noti Required Per Span Of Conductor That Is Damaged
- Corroded conductor- How many broken strands per phase?
- Which Phases/All Phases? If multiple spans affected indicate number of spans
- Quality photos to be provided



PRIORITY 2 NBFRA
PRIORITY 2 H/MBFRA

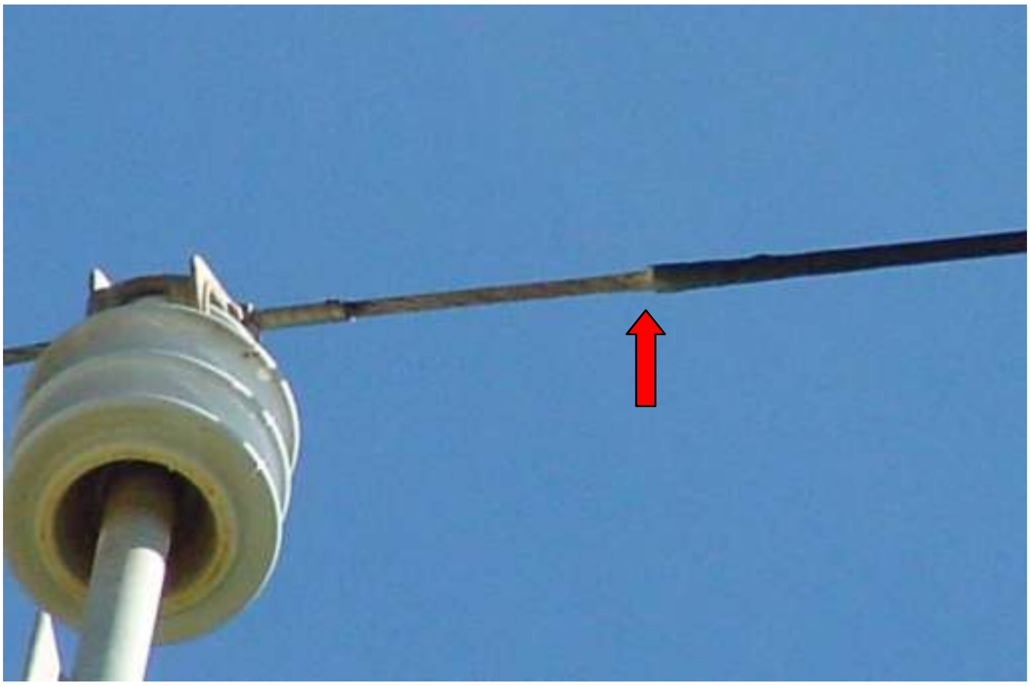
Quick Code
CORRODED CONDUCTOR REPLACEMENT

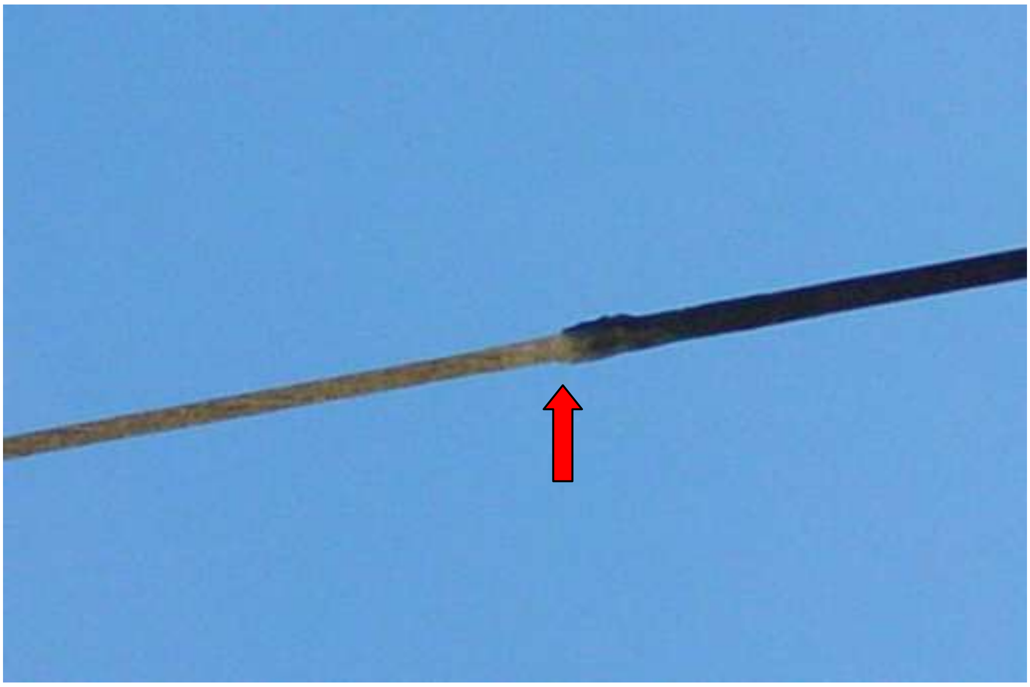
NOTE: BULGING OF CONDUCTOR

NO PRIORITY REQUIRED

Quick Code
CORRODED CONDUCTOR REPLACEMENT

NOTE: JUVENILE CORROSION





PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
CORRODED CONDUCTOR REPLACEMENT

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
CORRODED CONDUCTOR REPLACEMENT

Standard Data Entry Requirements Example Below

- 1 x DD Noti Required Per Span Of Conductor That Is Damaged
- Corroded conductor- How many broken strands per phase?
- Which Phases/All Phases? If multiple spans affected indicate number of spans
- Quality photos to be provided

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
CORRODED CONDUCTOR REPLACEMENT

Standard Data Entry Requirements Example Below

- 1 x DD Noti Required Per Span Of Conductor That Is Damaged
- Corroded conductor- How many broken strands per phase?
- Which Phases/All Phases? If multiple spans affected indicate number of spans
- Quality photos to be provided

4.12 CONDUCTOR– EARTHED, COVERED

Aluminium Earths:

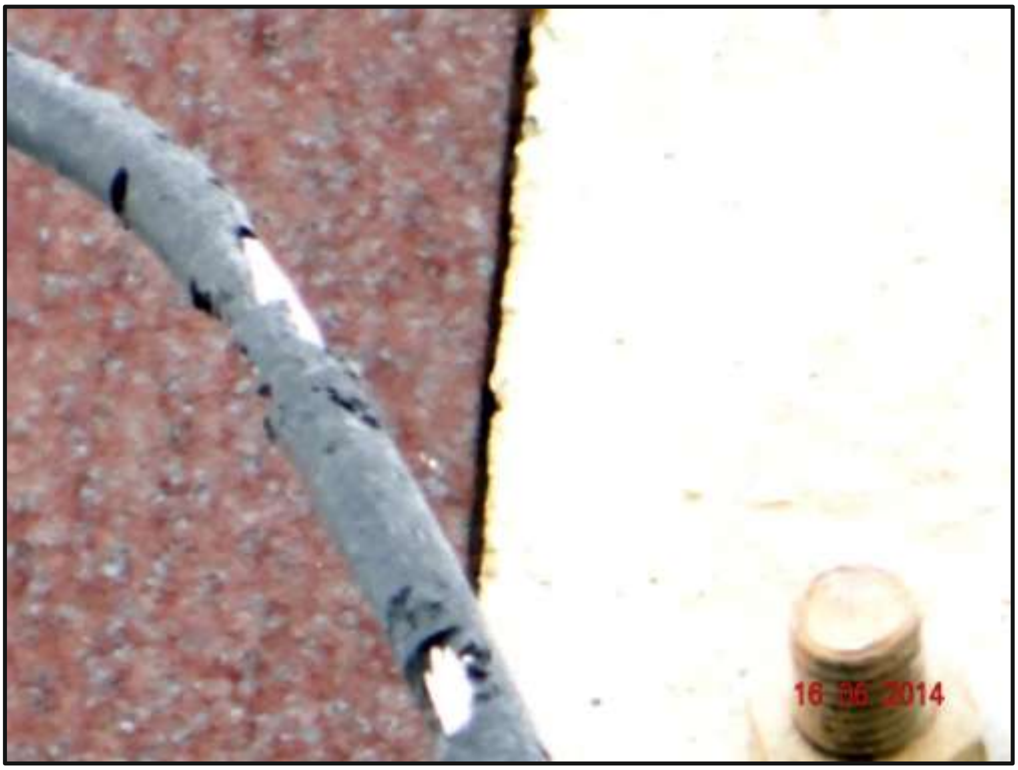
Condition	Priority
Broken	B
Damaged Strands, Corrosion or Swelling	B-P1
Exposed GL Earthing	P1
Damaged Insulation	P2

This photo is typical of PB

The aluminium earth is broken, therefore it is a PB.

This photo is typical of P1

The aluminium earth is damaged, however its severity isn't significant enough to be considered a PB, therefore it is a P1.



This photo is typical of P2

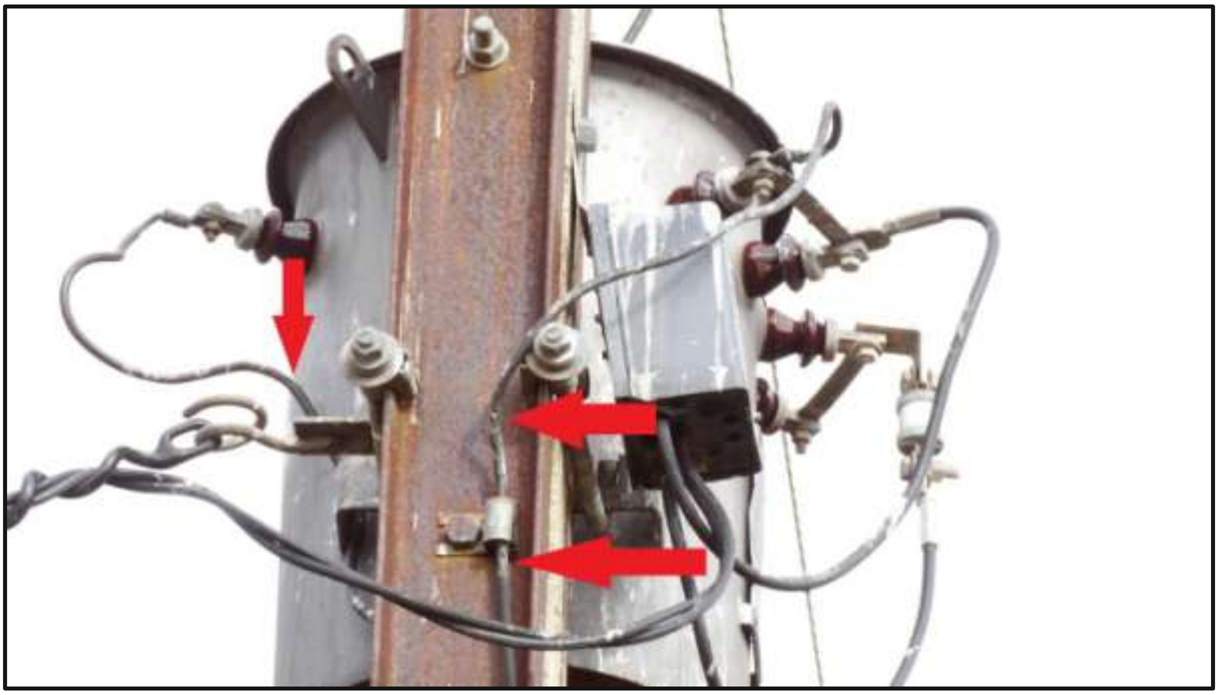
The insulation of the aluminium earth is damaged, therefore it is a P2 defect.

Copper Earths:

Condition	Priority
Broken	B
Damaged Strands, Corrosion or Swelling	B-P1
Exposed GL Earthing	P1
Damaged Insulation	N/A

This photo is typical of P1

The copper ground level earthing is exposed, therefore it is a P1.



Note: This does not require to be recorded as a defect

The insulation of the copper earth is damaged, this should not be recorded as a defect.

Note: This does not require to be recorded as a defect

The insulation of the copper earth has been cut back during an earth test, this should not be recorded as a defect.

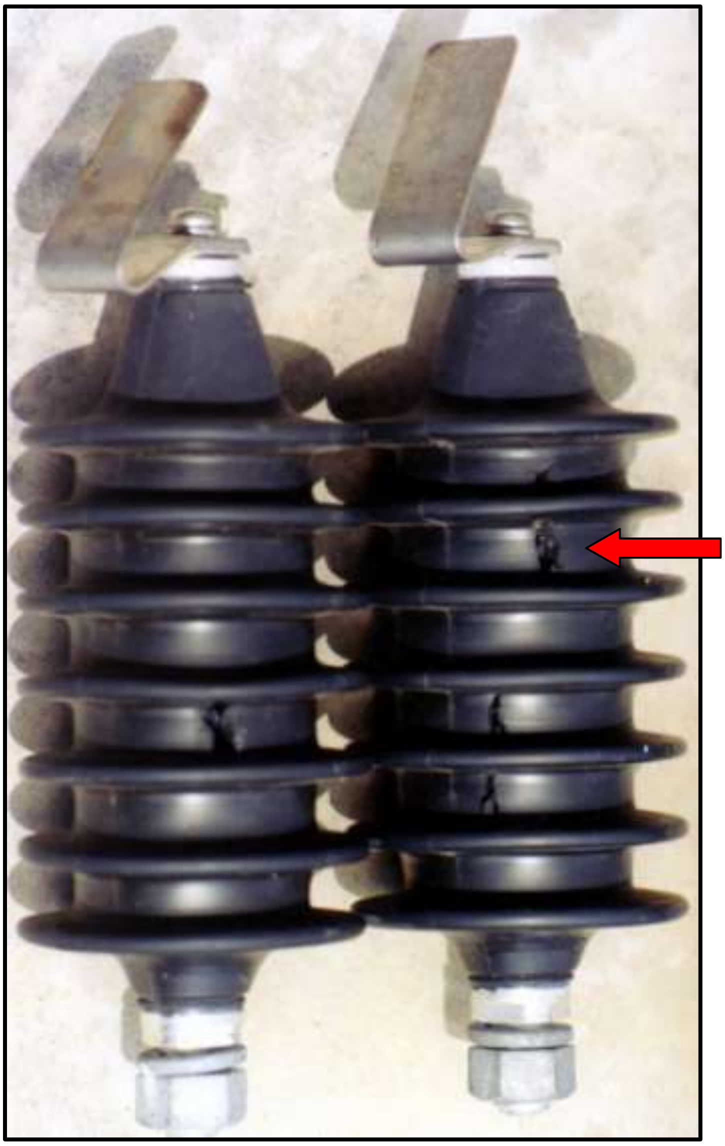
5. INSULATORS

Contents

5.1 INSULATORS – AIR GAP

Photo to be issued when available.

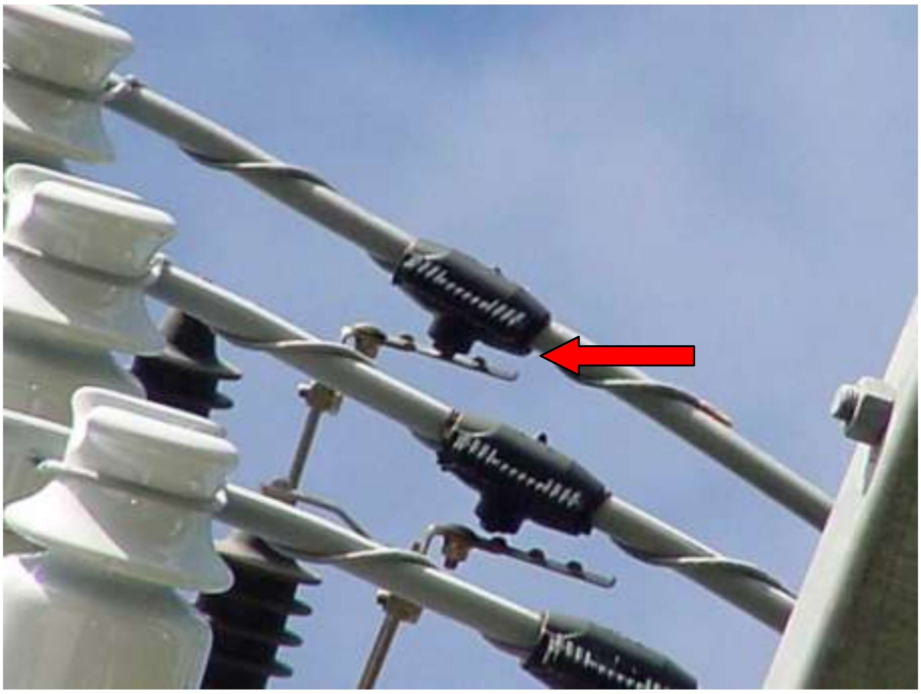
5.2 INSULATORS – CLAH



PRIORITY 1 NBFRA

PRIORITY 1 H/BFRA

Quick Code:
CLAH DAMAGED



This photo is typical of P1

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

QuickCode:
CLAH DAMAGED

NOTE: INADEQUATE CLEARANCE AS PER ARROW
(20mm CLEARANCE REQUIRED)

This photo is an example of P1, damaged surge diverters

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/MBFRA

Quick Code:
CLAH DAMAGED

5.3 INSULATORS – DISC

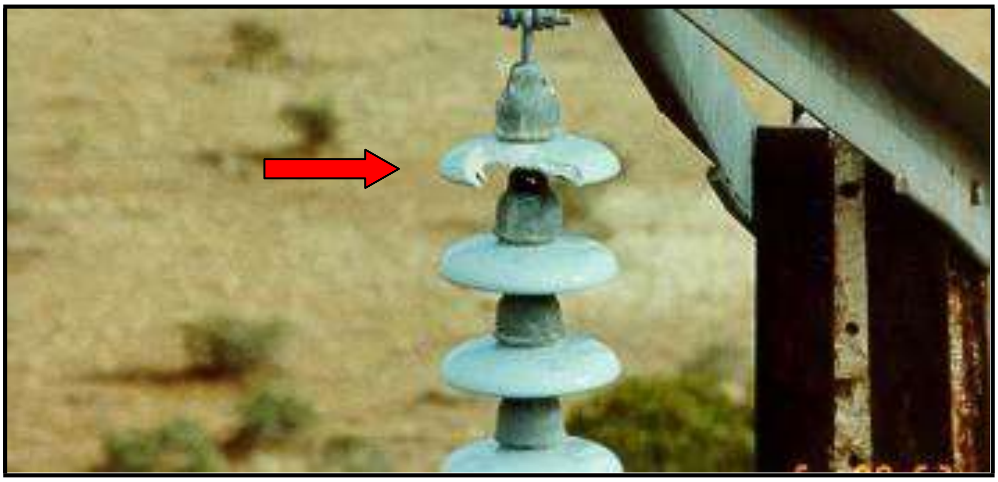
This photo is typical of PZ-1

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
INSULATOR DISC DAMAGED

Minimum number of undamaged disks

- If a single disc is broken or missing from a 66kV line, it is a P1 defect, regardless of whether it originally had 5 or 6 discs.
- The minimum insulators for 33kV/19kV line are 3 discs. If only 2 discs are remaining (either due to a disc being broken or missing) it is a P1 defect, if only 1 disc is remaining it is a PB.
- If a single disc is missing from an over insulated 33kV line, it should be recorded as a P4 defect (assuming it has 3 or more undamaged discs remaining.
- If the defect has the potential to cause a fire on a fire danger risk day and is in a H/MBFRA, it should be recorded as a PZ defect.

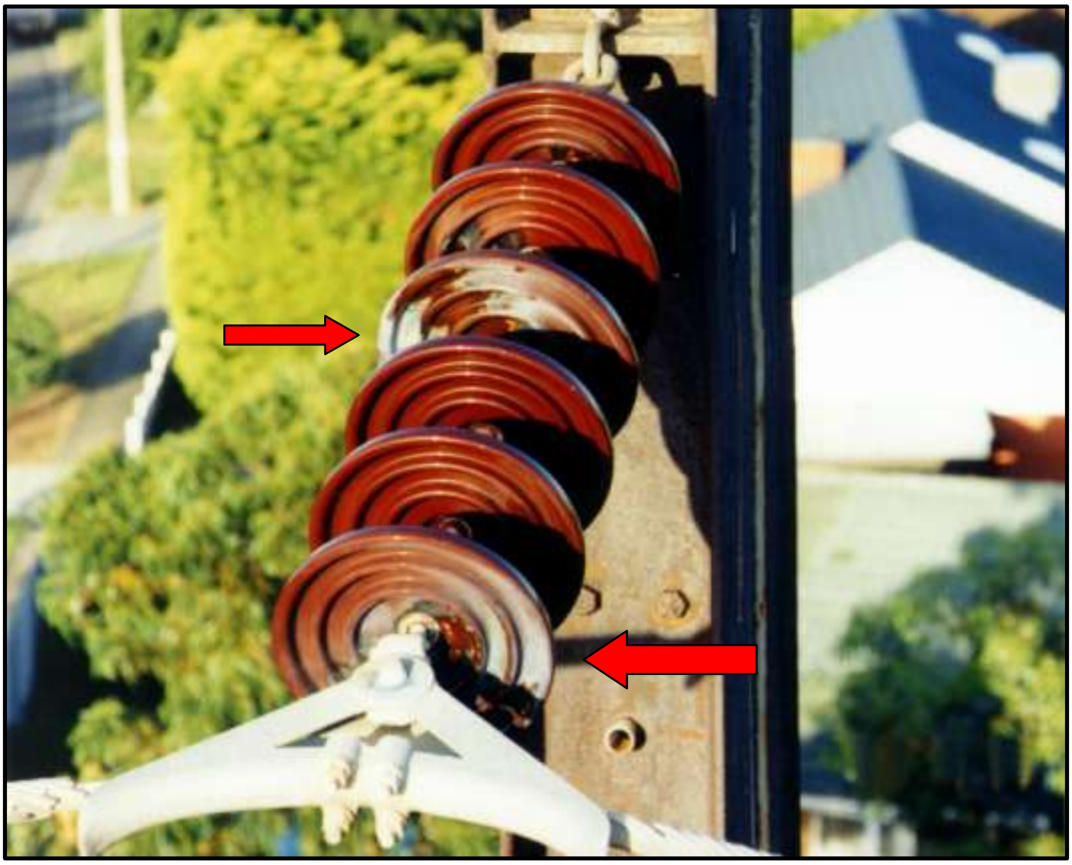


PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
INSULATOR DISC DAMAGED

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
INSULATOR DISC DAMAGED



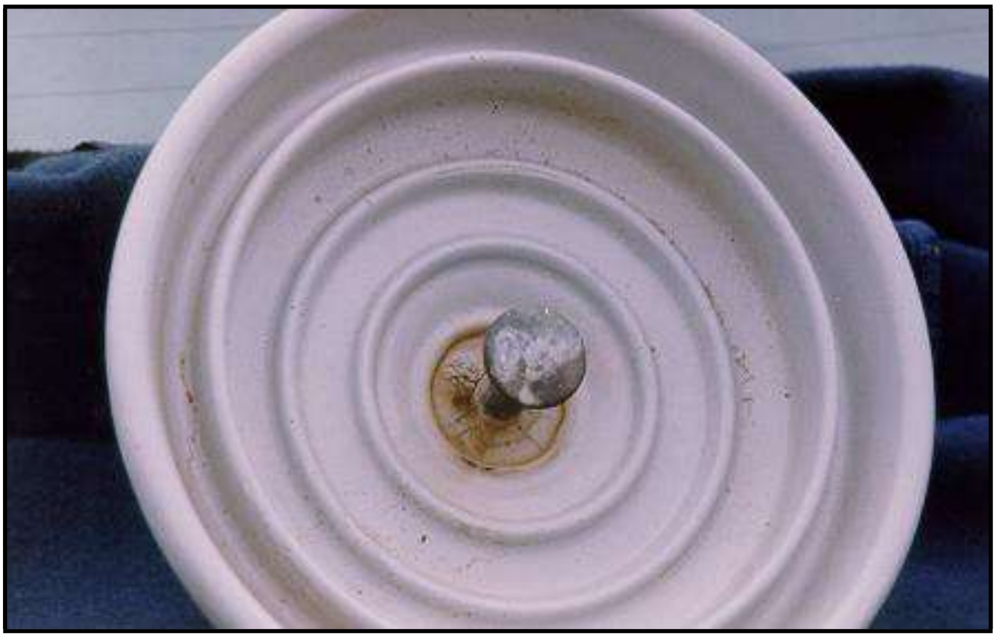
PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
INSULATOR DISC DAMAGED

Minimum number of undamaged discs

- If a single disc is broken or missing from a 66kV line, it is a P1 defect, regardless of whether it originally had 5 or 6 discs.
- The minimum insulators for 33kV/19kV are 3 discs. If only 2 discs are remaining (either due to a disc being broken or missing) it is a P1 defect, if only 1 disc is remaining it is a PB.
- If a single disc is missing from an over insulated 33kV line, it should be recorded as a P4 defect (assuming it has 3 or more undamaged discs remaining).
- If the defect has the potential to cause a fire on a fire danger risk day and is in a H/MBFRA, it should be recorded as a PZ defect.

Upper Surface *This photo is typical of Priority B*



Lower Surface

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
INSULATOR DISC DAMAGED

NOTE: The insulator has been electrically punctured.

PRIORITY 4 NBFRA
PRIORITY 4 H/MBFRA

Quick Code:
INSULATOR DINNER PLATE (BULLER/DIA)

NOTE: 'DIA' dish type standard disc insulator, have a recent history of failure (mechanically and / or electrically).

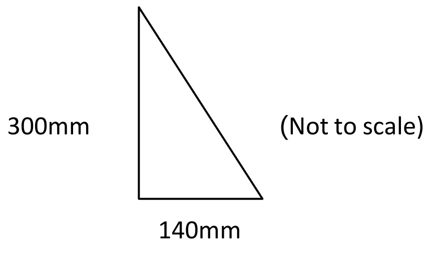
Visually inspect for damage and record location.

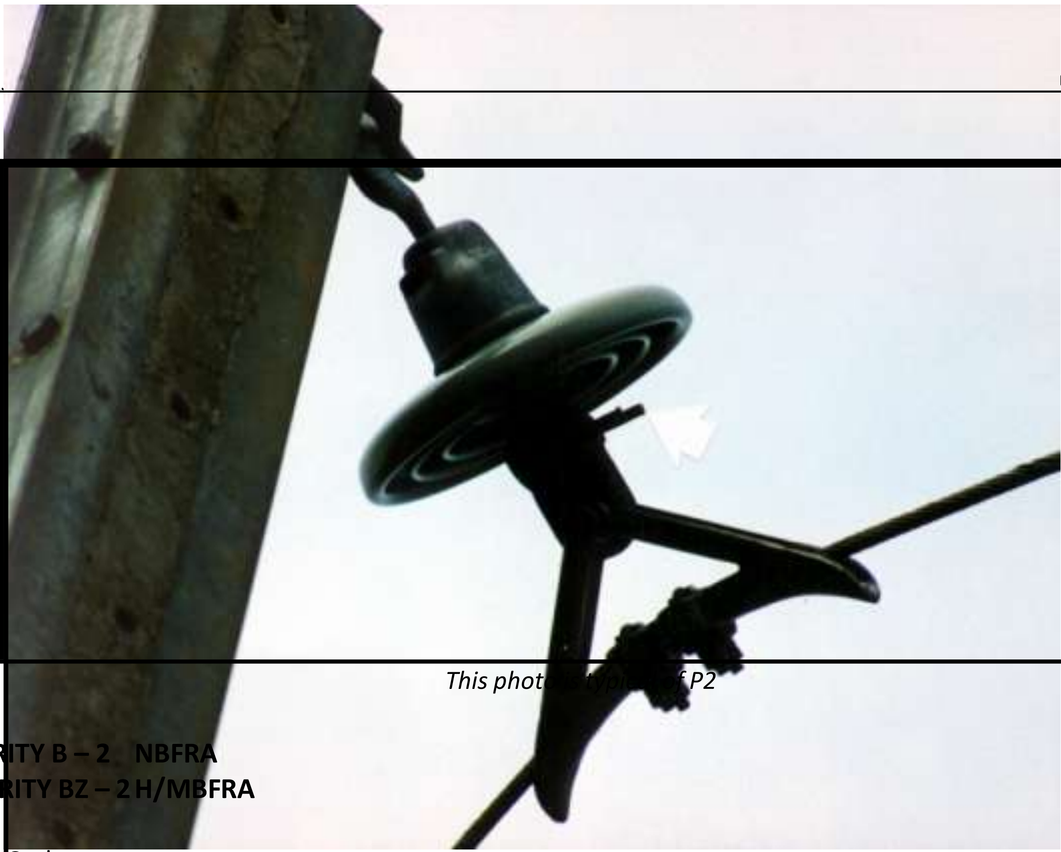
PRIORITY 1 – 2 NBFRA
PRIORITY 1 – 2 H/MBFRA

QuickCode
Insulators Misaligned

Note: greater than 25 degrees should be higher priority as undue strain can be put on the line guard and conductors. Also inspect nearby sections of the line to determine if some cause for the misalignment exists.

25 degrees may be estimated by comparing to a right angle triangle with height of 300 mm and a base of 140 mm.





This photo is typical of P2

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
INSULATOR DISC DAMAGED

NOTE: Dislodged 'W' clip

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

QuickCode:
INSULATOR SOCKET TONGUE

NOTE: Worn split pin.

This photo is typical of Priority B

PRIORITY B – 1 **NBFRA**

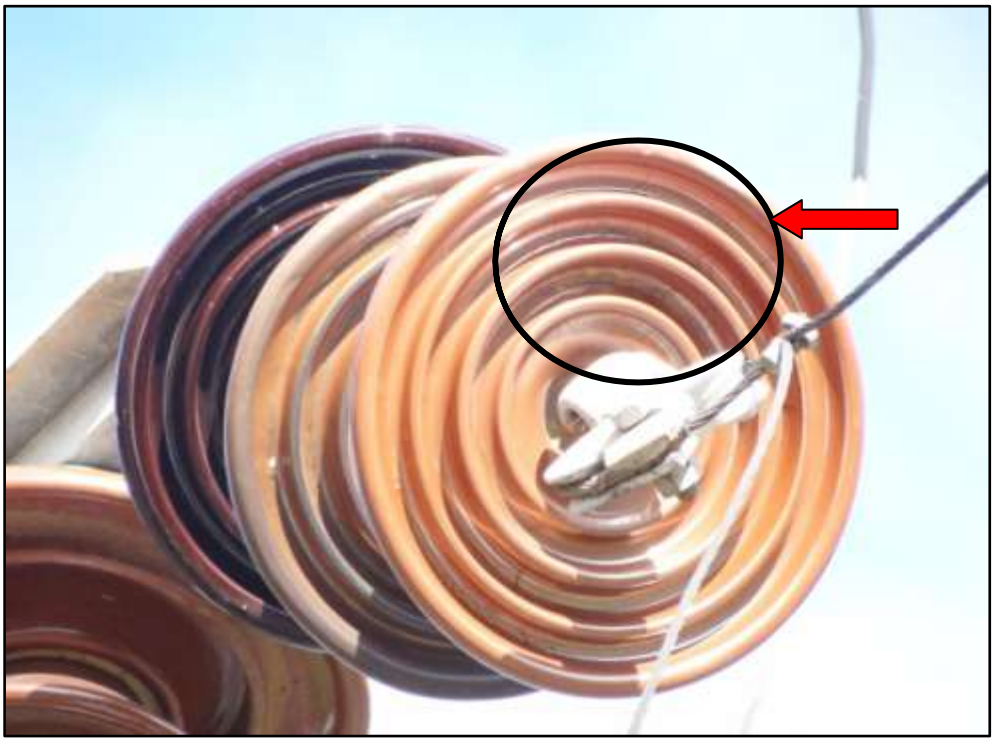
PRIORITY BZ – 1 **H/MBFRA**

Quick Code:
INSULATOR DISC DAMAGED

PRIORITY B – 1 NBFRA
PRIORITY BZ – 1 H/MBFRA

Quick Code:
INSULATOR DISC DAMAGED

The minimum insulators for 33kV/19kV are 3 discs. If only 2 discs are remaining it is a P1 defect, if 1 disc is remaining it's a breakdown.



Note: This does not require to be recorded as defect

An example of 'crazing' of the glaze. This should not be recorded as a defect.

Crazing can be identified by looking for multiple thin lines travelling in random directions in the glazing of the insulator.

5.4 INSULATORS – HOOK

PRIORITY B – 3 NBFRA
PRIORITY BZ – 3 H/BFRA

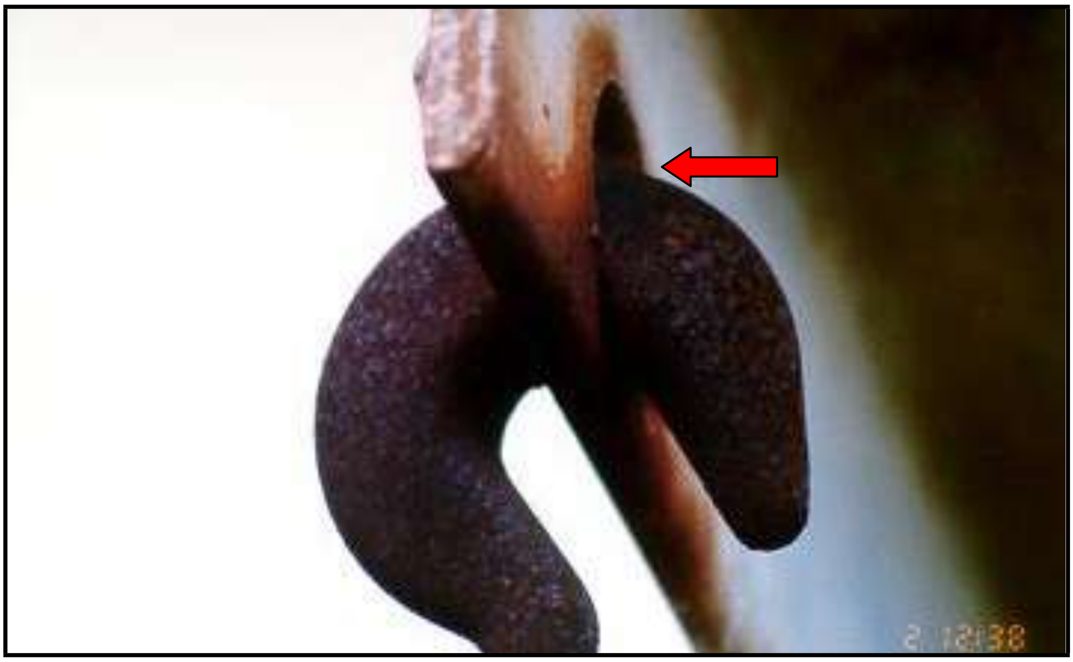
Quick Code:
INSULATOR HOOK

Note:
Estimated amount of steel crossarm remaining:

less than 5 mm	**Priority 1**	**MRV selection (Likely/Extreme)**
5 - 7 mm	**Priority 2**	**MRV selection (Possible/High)**
7 - 10 mm	**Priority 3**	**MRV selection (Unlikely/Medium)**

Standard Data Entry Requirements Example Below

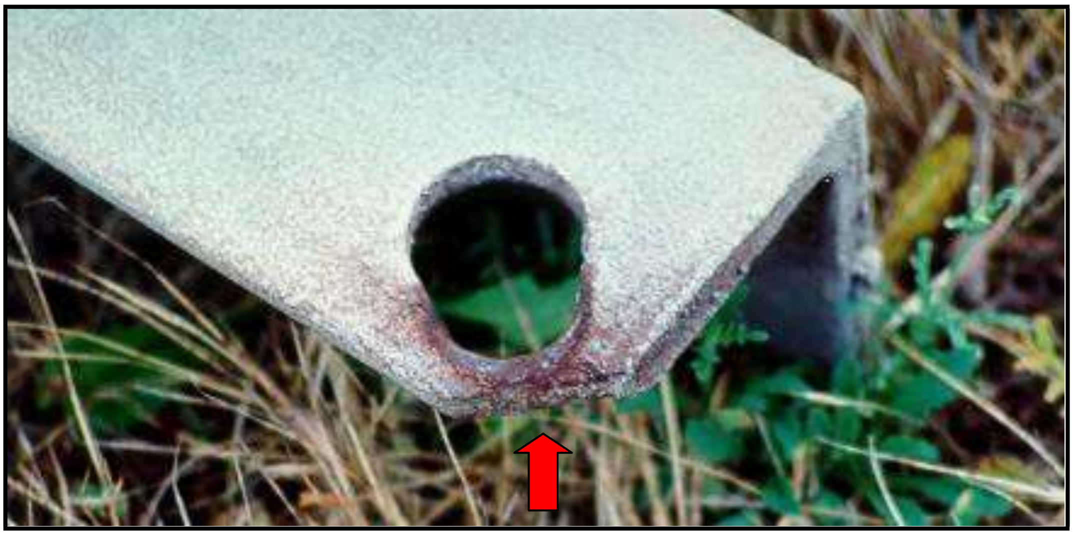
S/side and T/double hook and hole worn.
Install hook hole x-arm repair kits & Replace Hooks - All Phases.
Photos Attached



PRIORITY B – 3 NBFRA
PRIORITY BZ – 3 H/BFRA

Quick Code:
INSULATOR HOOK

Elongated cross arm hole.



PRIORITY B – 3 NBFRA
PRIORITY BZ – 3 H/BFRA

Quick Code:
INSULATOR HOOK

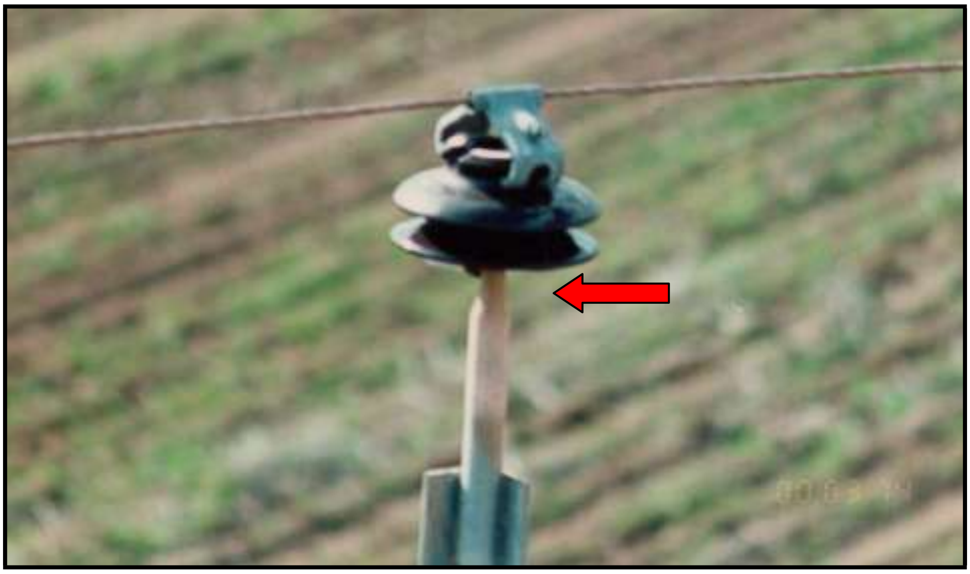
This photo is typical of P2

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:
INSULATOR HOOK

Note: Hook not in cross arm properly

5.5 INSULATORS – PIN



This photo is typical of Priority B

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
INSULATOR PIN DAMAGED

This photo is typical of Priority B


This photo is typical of P2

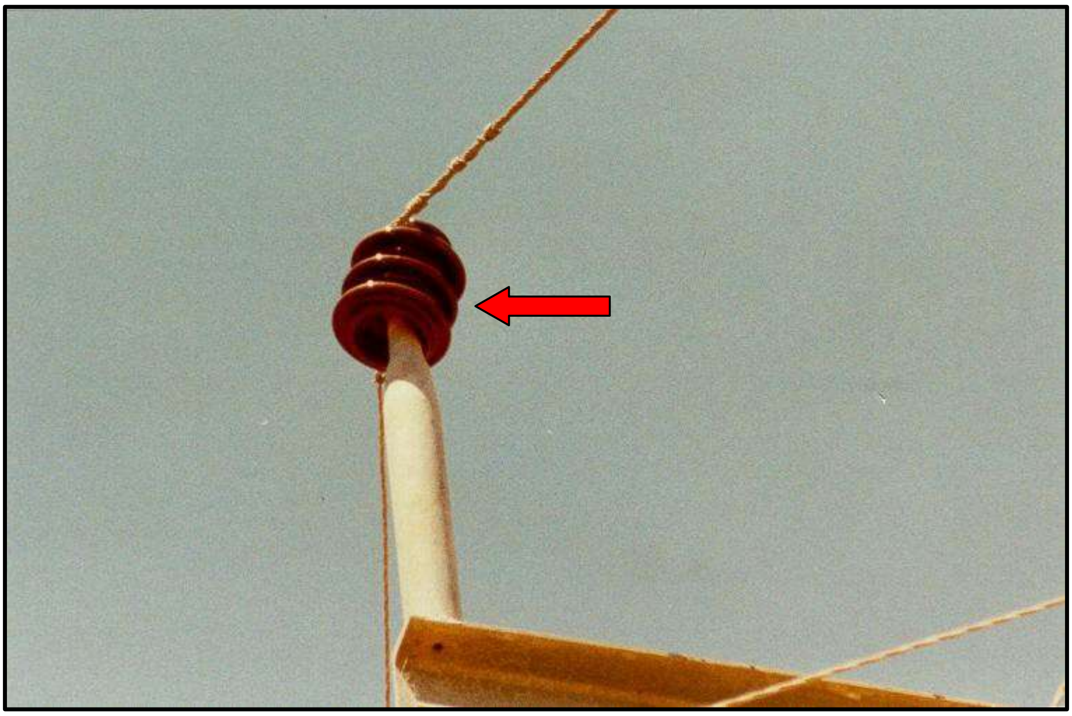
PRIORITY B – 2 **NBFRA**
PRIORITY BZ – 2 **H/MBFRA**

Quick Code:
INSULATOR PIN DAMAGED

This photo is typical of P2

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
INSULATOR PIN DAMAGED



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
INSULATOR PIN DAMAGED

Tilted line angle insulator.

Note: This does not require to be recorded as defect

This photo is typical of Priority B

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
INSULATOR PIN DAMAGED

This photo is typical of Priority B

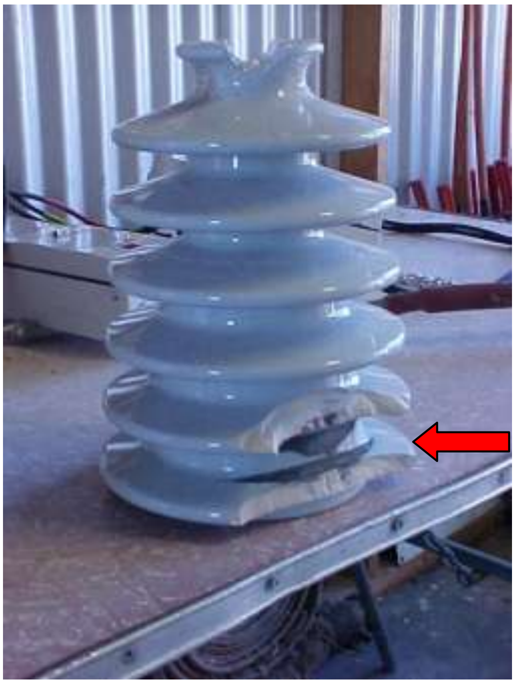
PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
INSULATOR PIN DAMAGED

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
BUSHING DAMAGED REPLACE TF

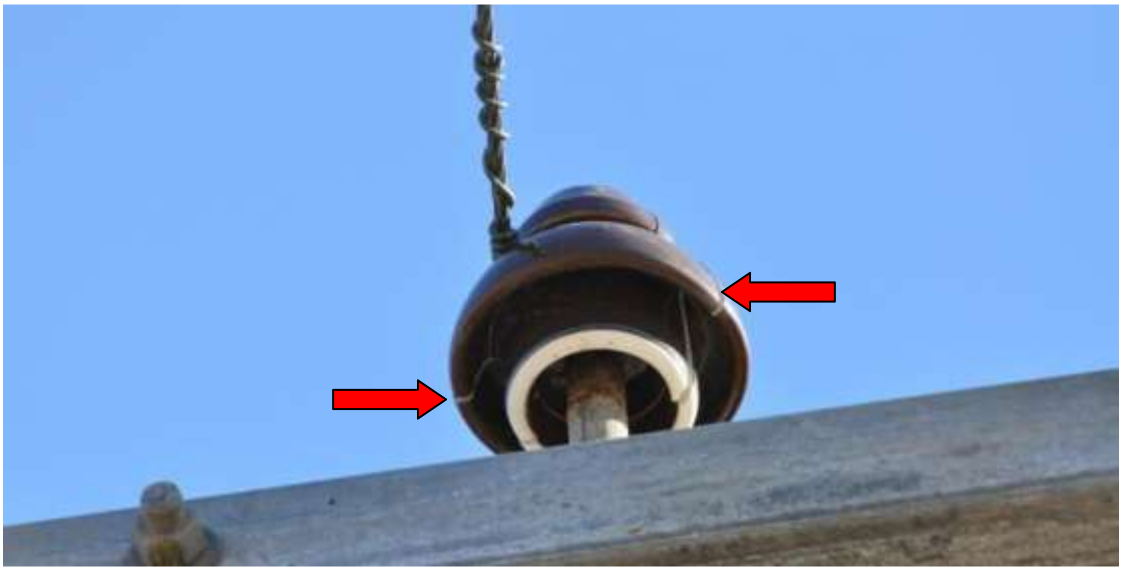
Only raise defect if feeder has a poor performance history and TF has evidence of arcing or flashover



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
INSULATOR PIN DAMAGED

This photo is typical of Priority Z



This photo is typical of PZ in H/MBFRA or P1 in NBFRA

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
INSULATOR PIN DAMAGED

Severe damage is present and the significant cracks have the potential to cause a fire on a high fire danger risk day, therefore a Z code is required.

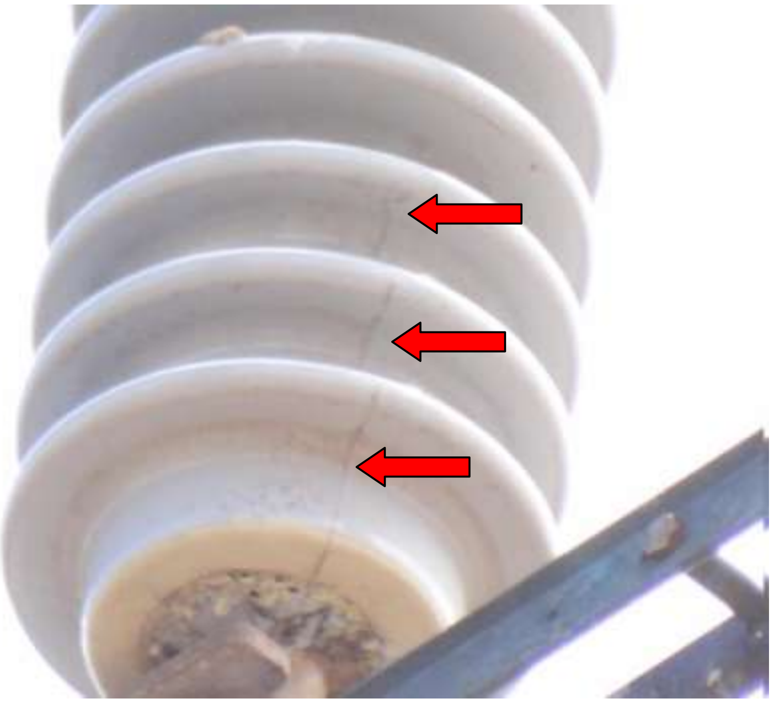
This photo is typical of PZ in H/MBFRA or P1 in NBFRA

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
INSULATOR PIN DAMAGED

SWER PIN INSULATOR CRACKED completely around between 2nd and 3rd skirt.

This Insulator is a one piece insulator, however has a significant crack all the way around with the potential to cause a fire in a H/MBFRA on a high fire danger risk day, therefore PZ.



This photo is typical of PZ in H/MBFRA or P1 in NBFRA

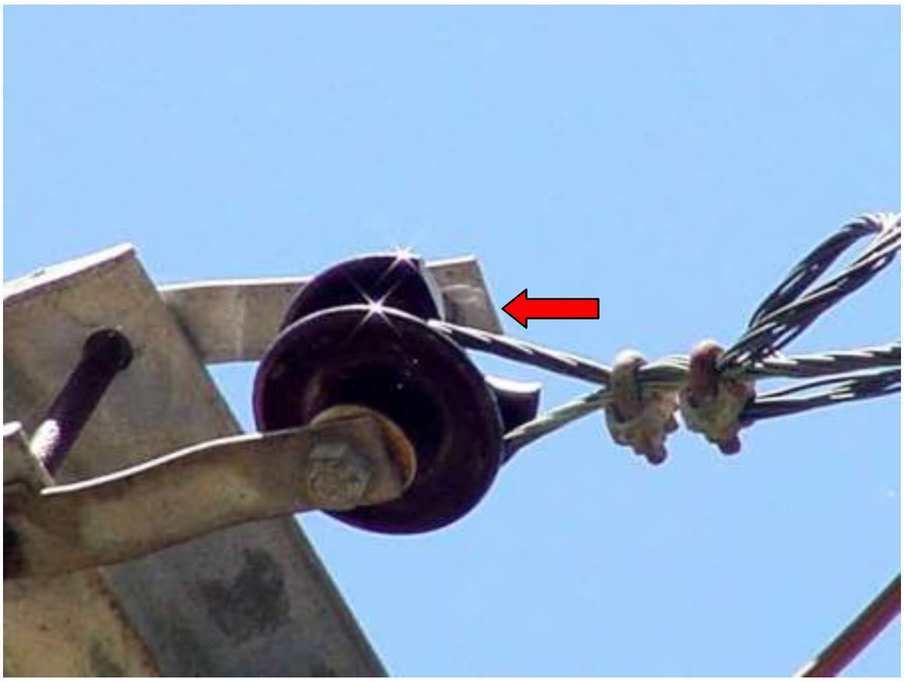
PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
INSULATOR PIN DAMAGED

5.6 INSULATORS – SHACKLE

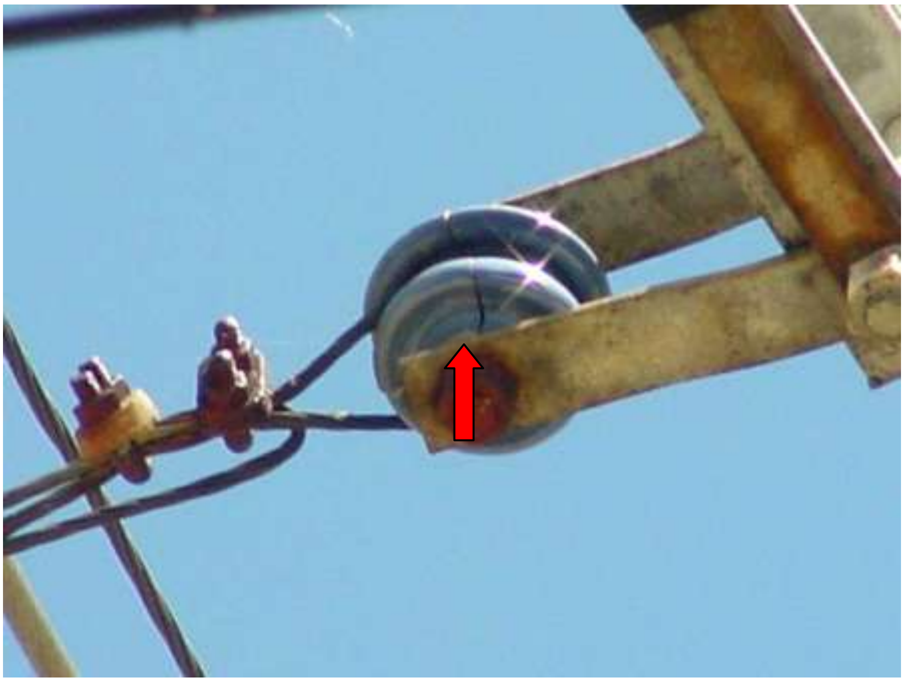
PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:
INSULATOR LV BROKEN



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:
INSULATOR LV BROKEN

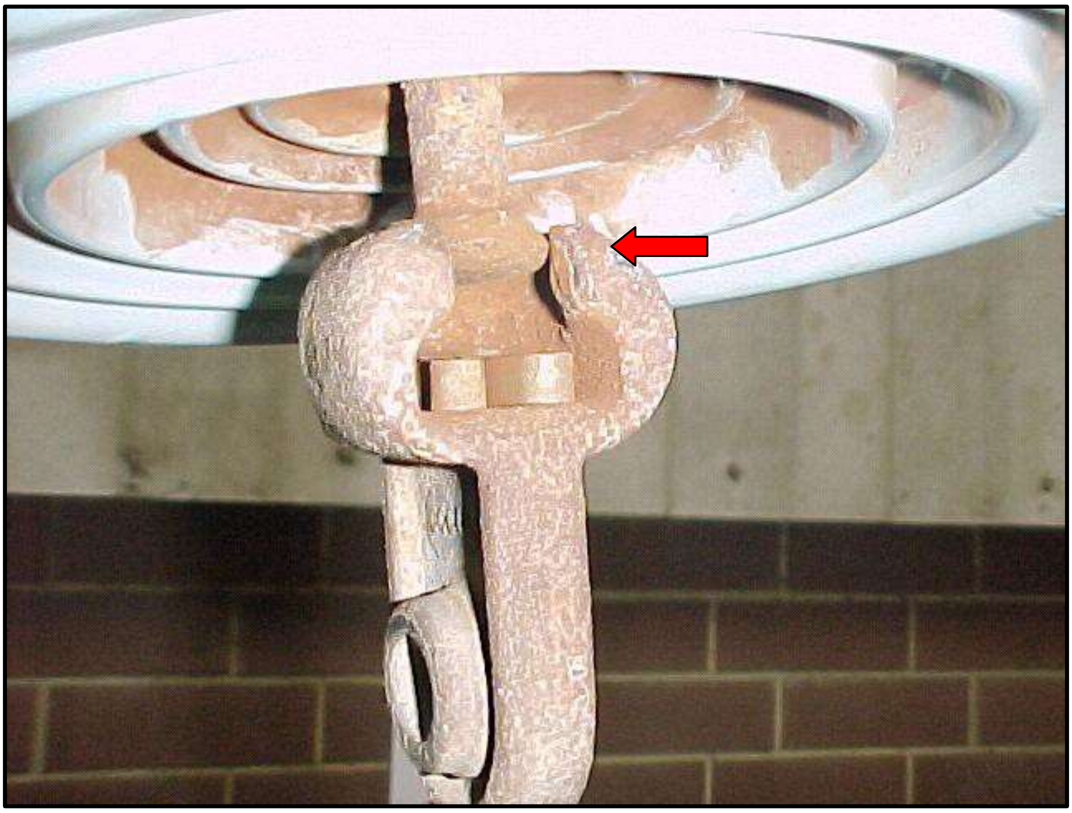


This photo is typical of P2

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:
INSULATOR LV BROKEN

5.7 INSULATORS – SOCKET TONGUE



This photo is typical of Priority B

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

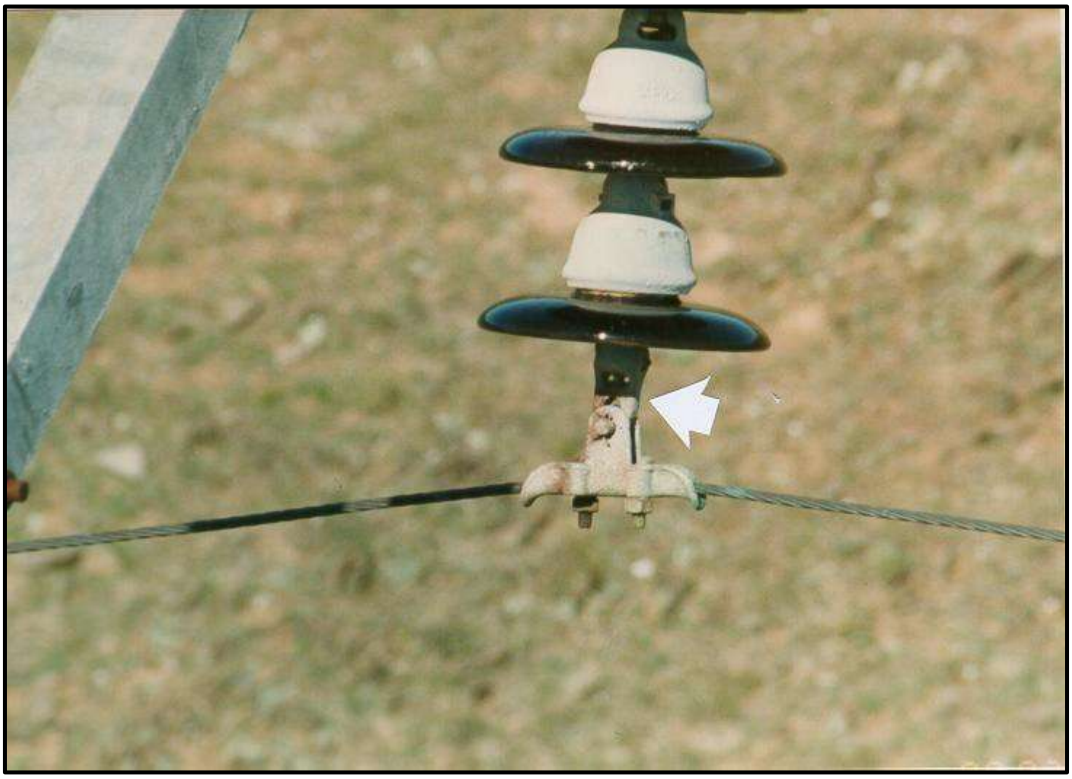
Quick Code:
INSULATOR SOCKET TONGUE

Worn socket clevis & insulator ball. Look for rust as a sign of wear.

Standard Data Entry Requirements Example Below

Single Side Socket Tongue/Pin & Suspension Clamp Wear.
Replace Socket Tongues, Pins & Conductor Clamps, Insulators & Hooks, All Phases.
Photos Attached

Mandatory Photo requirement
Min 2x Photos
1 of Overall View Of Construction
1 of Close up of Wear Location

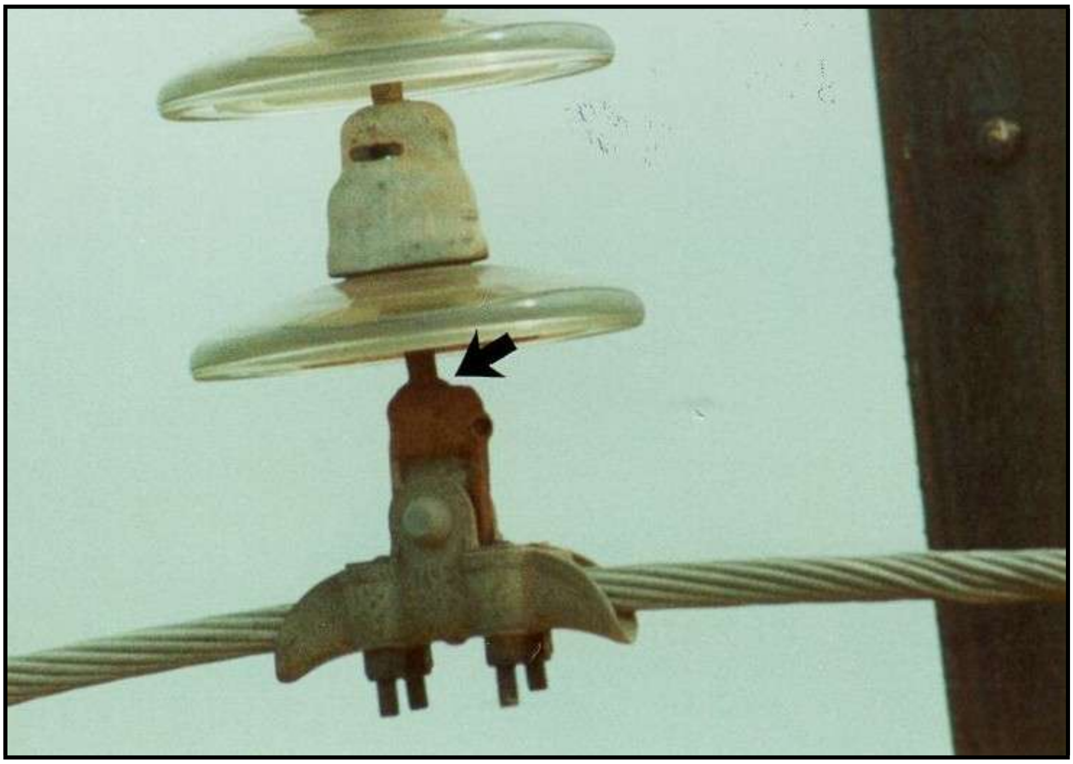


This photo is typical of PZ-1

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:
INSULATOR SOCKET TONGUE

Worn socket tongue & pin.



This photo is typical of Priority B

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:
INSULATOR SOCKET TONGUE

Worn socket clevis.

Note:
Top of insulator pin protruding from above clevis.

This photo is typical of Priority B

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:
INSULATOR SOCKET TONGUE

Worn socket clevis.

Note:
Top of insulator pin protruding from above clevis

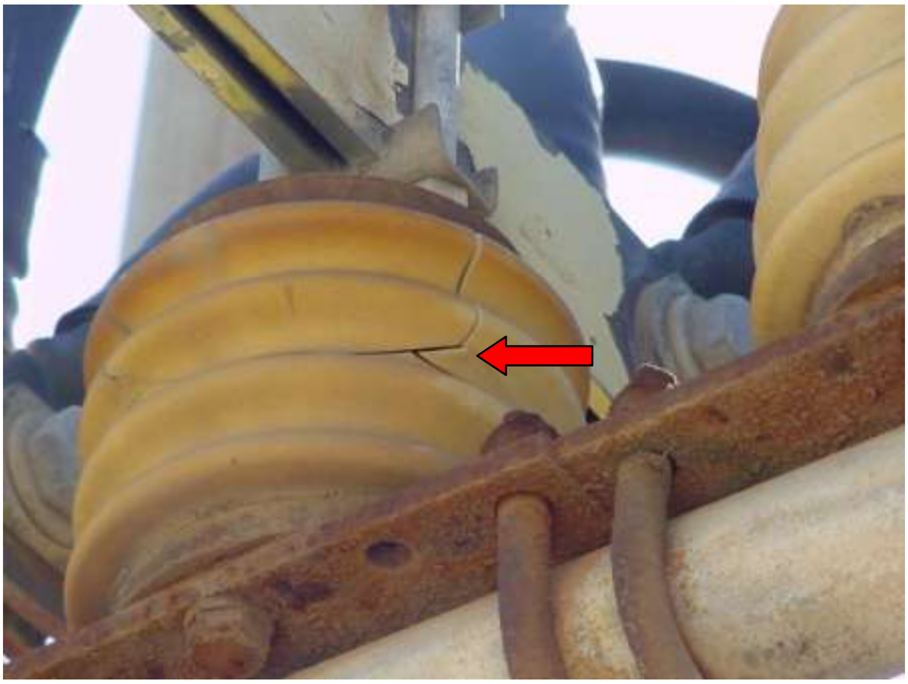

This photo is typical of Priority B

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:
INSULATOR SOCKET TONGUE

Clamp pin almost worn through.

5.8 INSULATORS – LOW VOLTAGE



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:
INSULATOR POST BROKEN

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:
ISOL DAMAGED

Standard Data Entry Requirements Example Below

Cracked LV isolator, Blue phase, requires replacement.
Check other phases and replace as required
Photo attached.

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:
ISOL DAMAGED

Standard Data Entry Requirements Example Below

Damaged LV isolator, Blue phase, requires replacement.
Check other phases and replace as required
Photo attached.

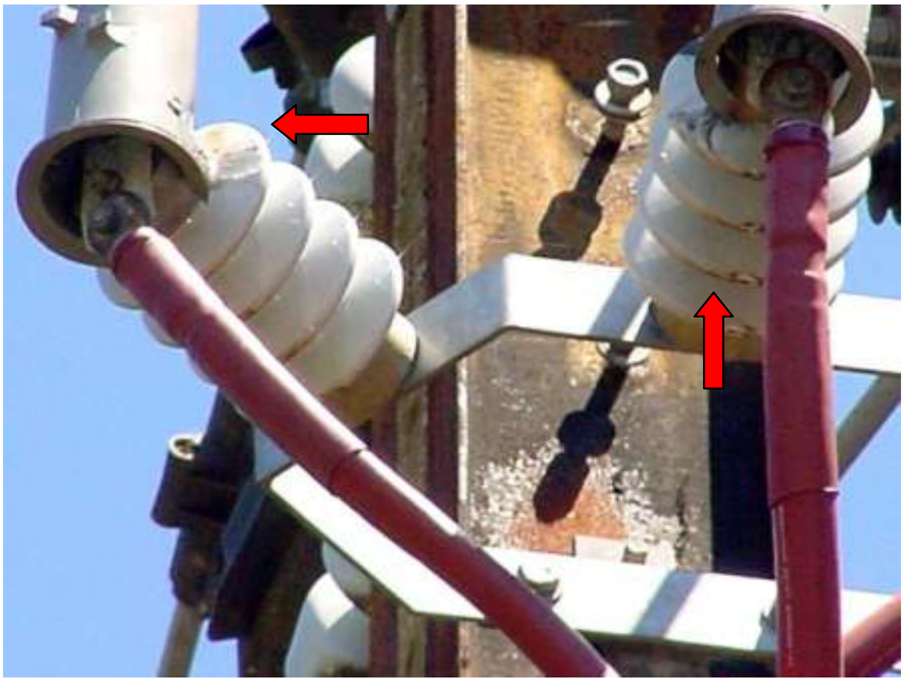
PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:
ISOL DAMAGED

Standard Data Entry Requirements Example Below

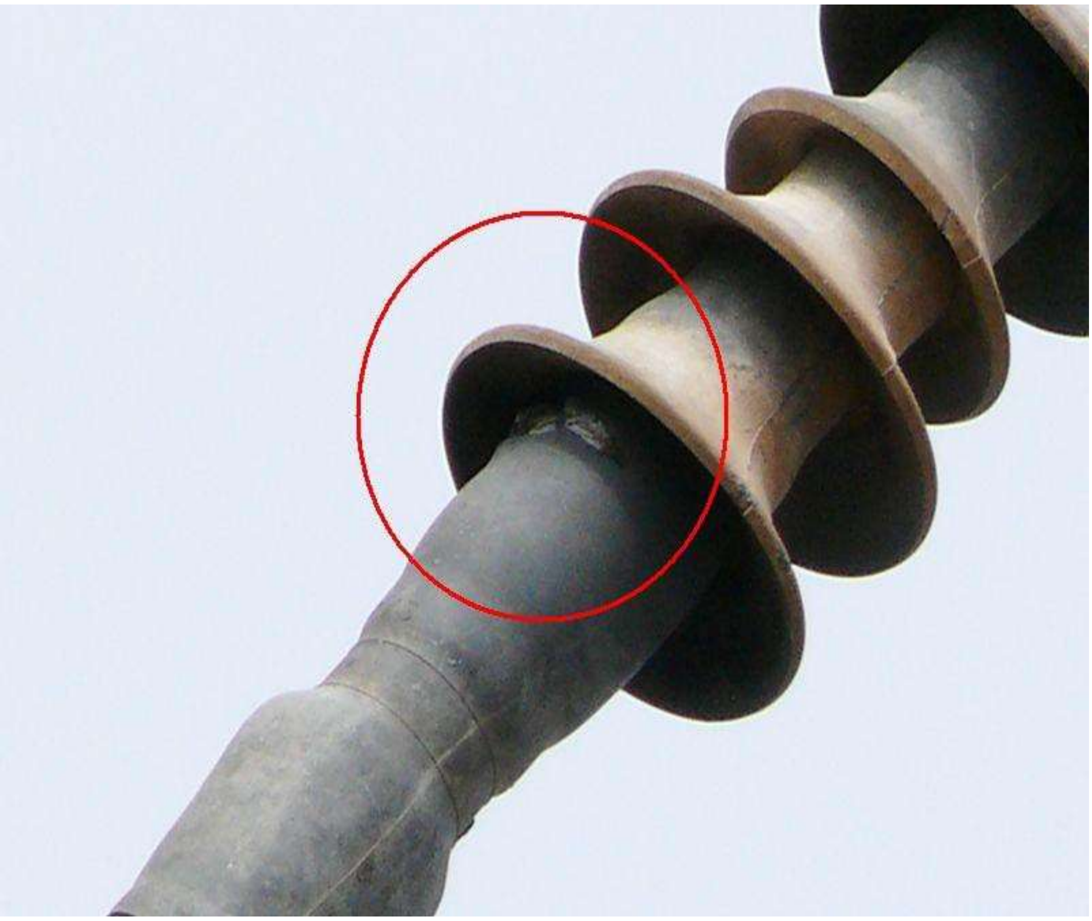
Cracked LV isolator, Blue phase, requires replacement.
Check other phases and replace as required
Photo attached.

5.9 INSULATORS – UD TERMINATIONS



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

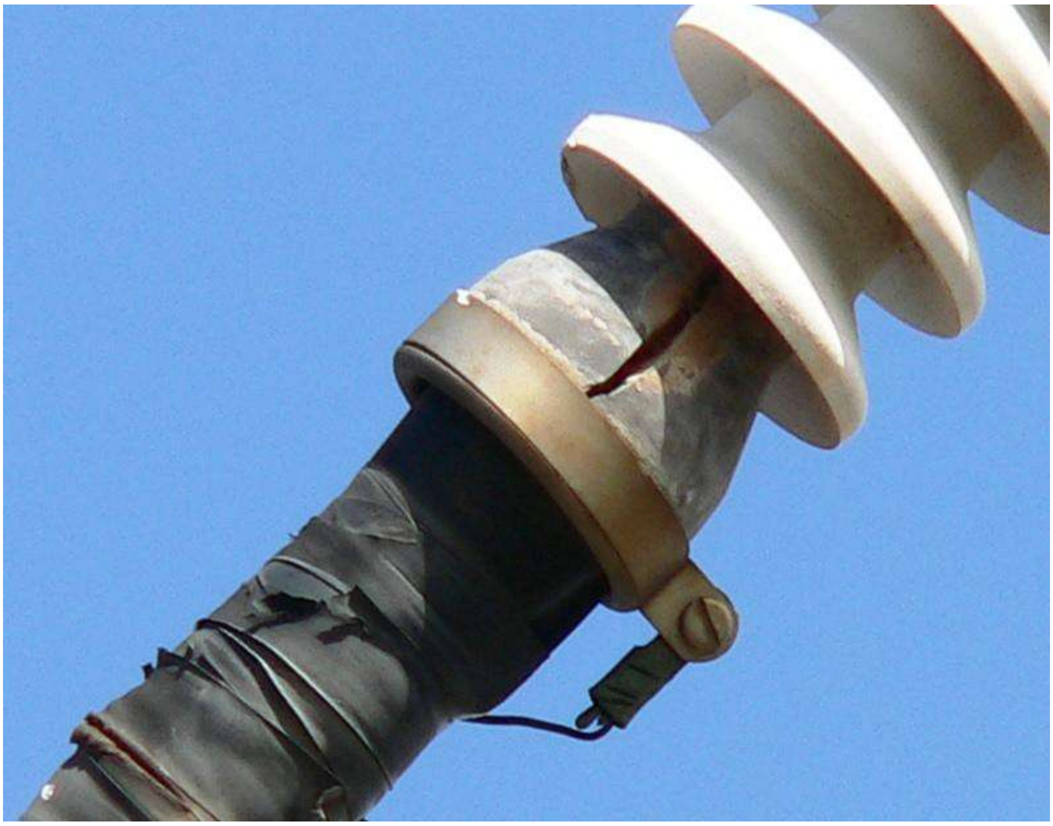
Quick Code:
URD CABLE DEFECT



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:
URD CABLE DEFECT


Damaged/Corroded at
Top of Termination.



5.10 INSULATORS - 33kV TERMINATIONS

There has been a number of 33 kV Raychem/TYCO outdoor cable termination failures causing large outages and subsequently a significant SPS impact.

Example of Sheds starting to split / creases developing, white powder appears on termination – photos shows P3.

Action: Create a DD if termination is starting to deteriorate.

PRIORITY B – 3 NBFRA
PRIORITY B – 3 H/BFRA

Quick Code:
URD CABLE DEFECT

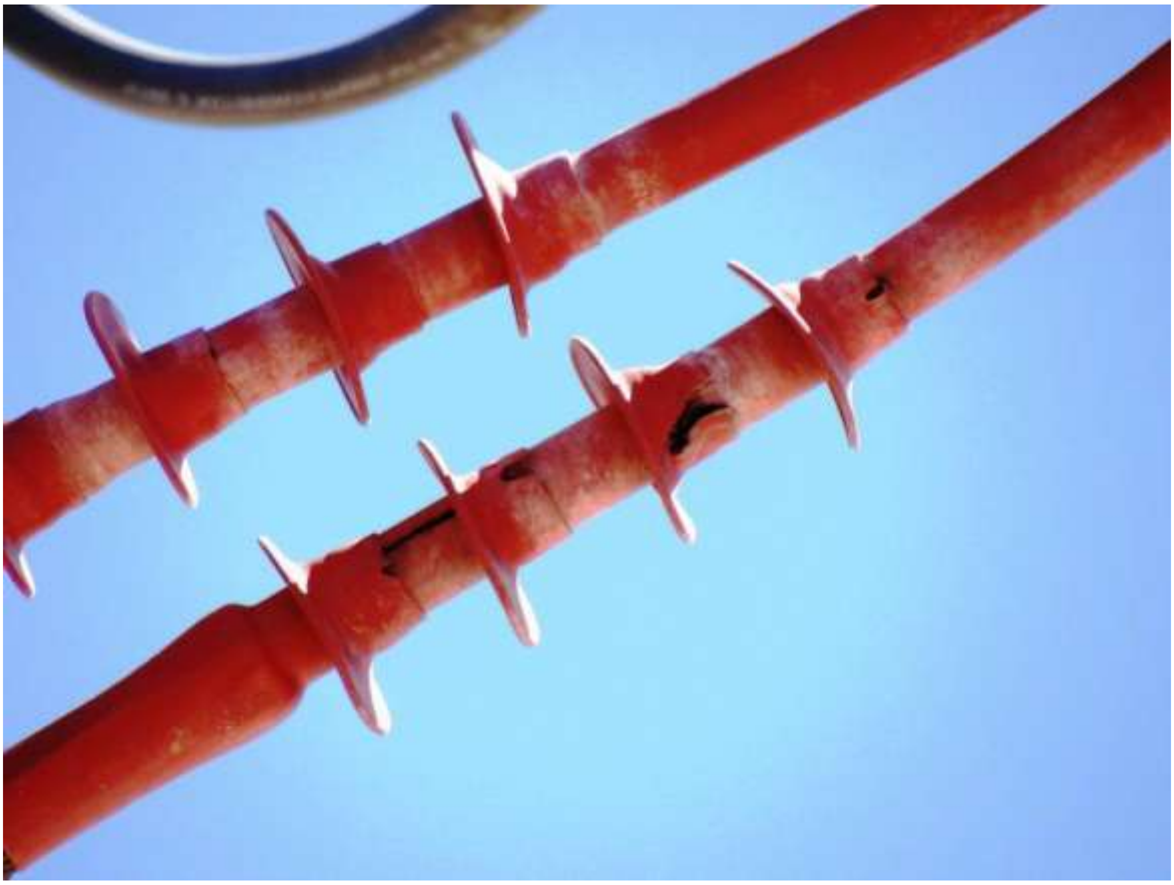
Example of Sheds with splits / creases, white powder appears on termination – photos shows P1.

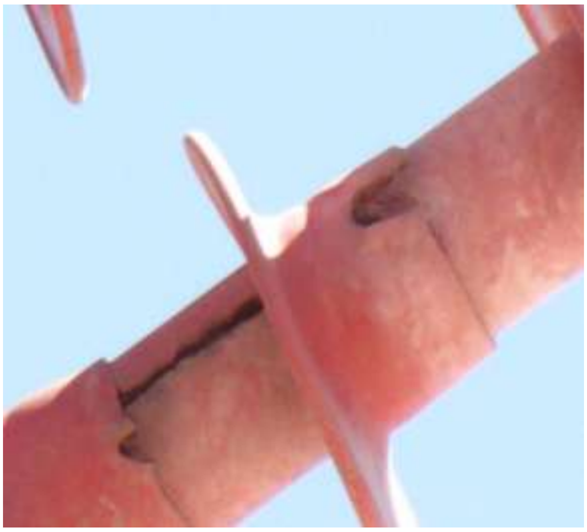
Action: Create a DD if termination is starting to deteriorate.

PRIORITY B – 3 NBFRA
PRIORITY B – 3 H/BFRA

Quick Code:
URD CABLE DEFECT

33kv Termination P1 Damage





Example of where tracking has eaten into the termination Sheath - photos shows P1.
Failure is imminent - terminations in this condition need to be replaced ASAP.

PRIORITY B – 3 NBFRA
PRIORITY B – 3 H/BFRA
Quick Code:
URD CABLE DEFECT

6. SUPPORTS

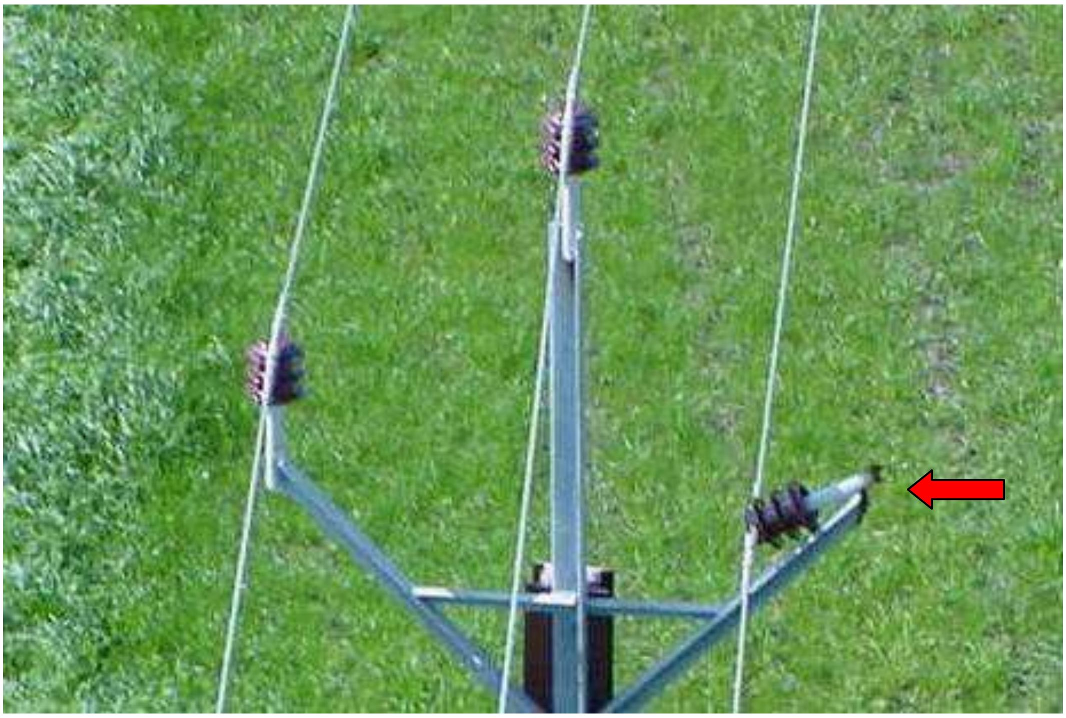
Contents

6.1 SUPPORTS – CABLE GUARDS

PRIORITY 1 – 2 NBFRA
PRIORITY 1 – 2 H/BFRA

Quick Code:
BLACK STRAPS / SUPPORTS

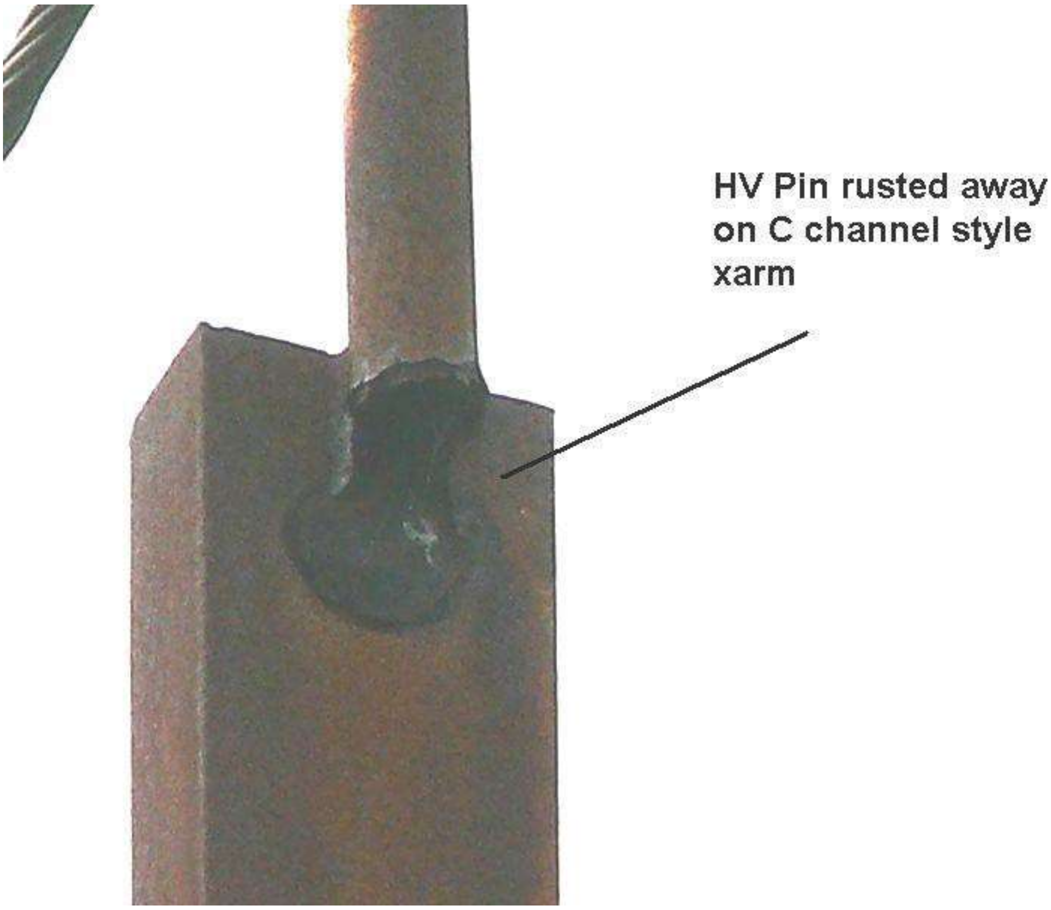
6.2 SUPPORTS – CROSSARM, LINE



This photo is typical of Priority B

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

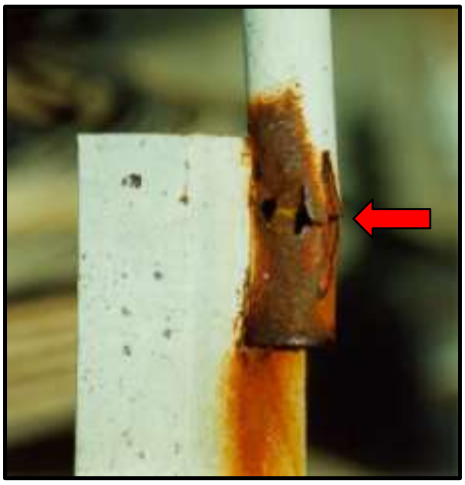
Quick Code:
HV X ARM LINE



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
HV X ARM LINE

This photo is typical of PZ-1



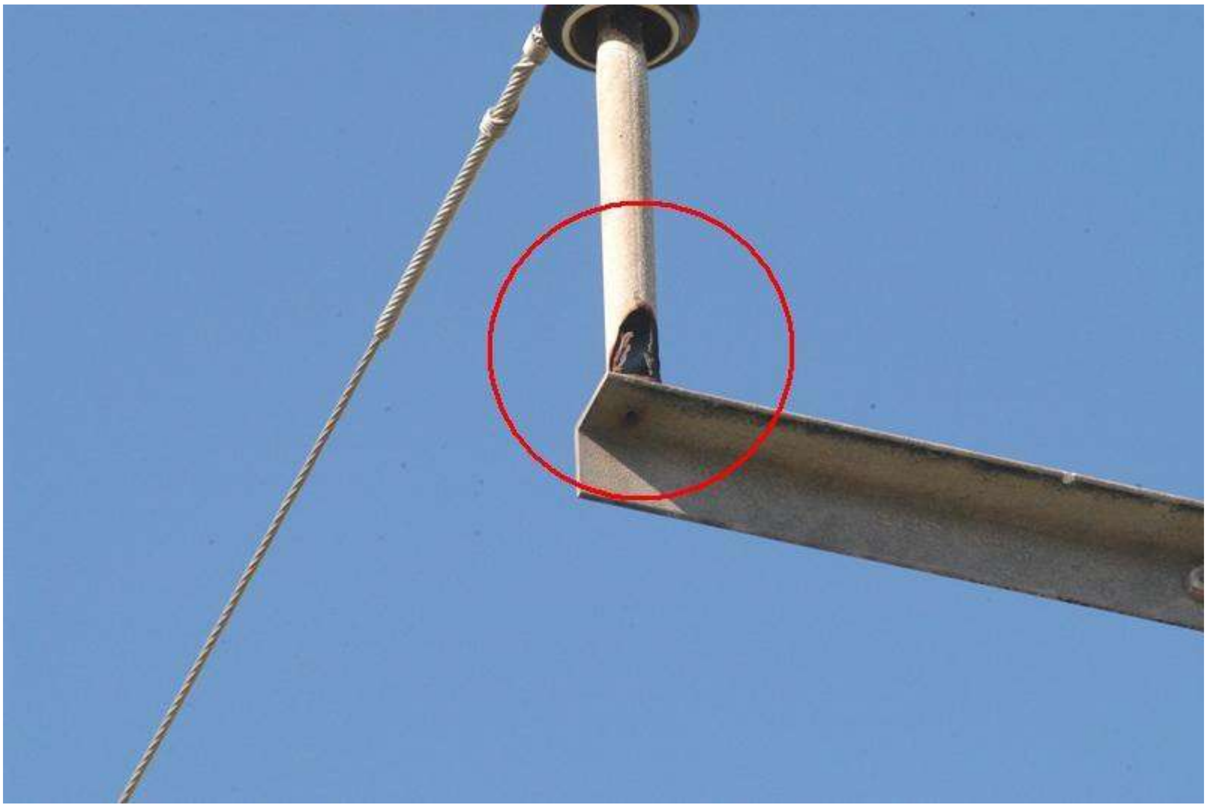
PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
HV X ARM LINE

This photo shows insufficient corrosion to warrant a notification.

Assign a priority with MRV >190 if a hole in the pin is identified. Take particular note when carrying out inspections in corrosive areas.

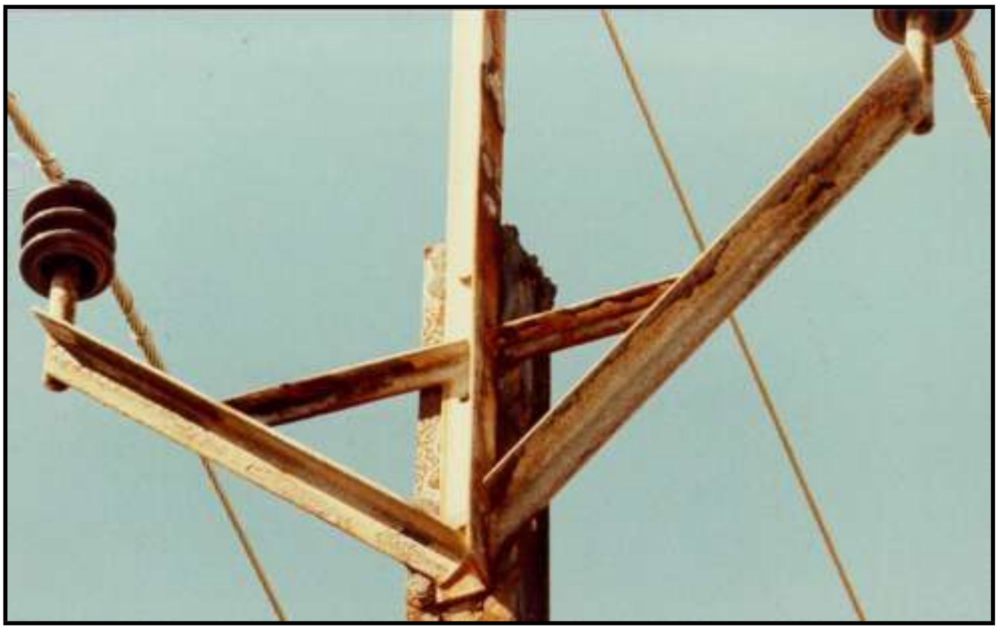
Assign a priority with MRV >190 where the pin is bent/distorted due to extensive corrosion on the pin (**Not Tilted Insulators).**



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
HV X ARM LINE

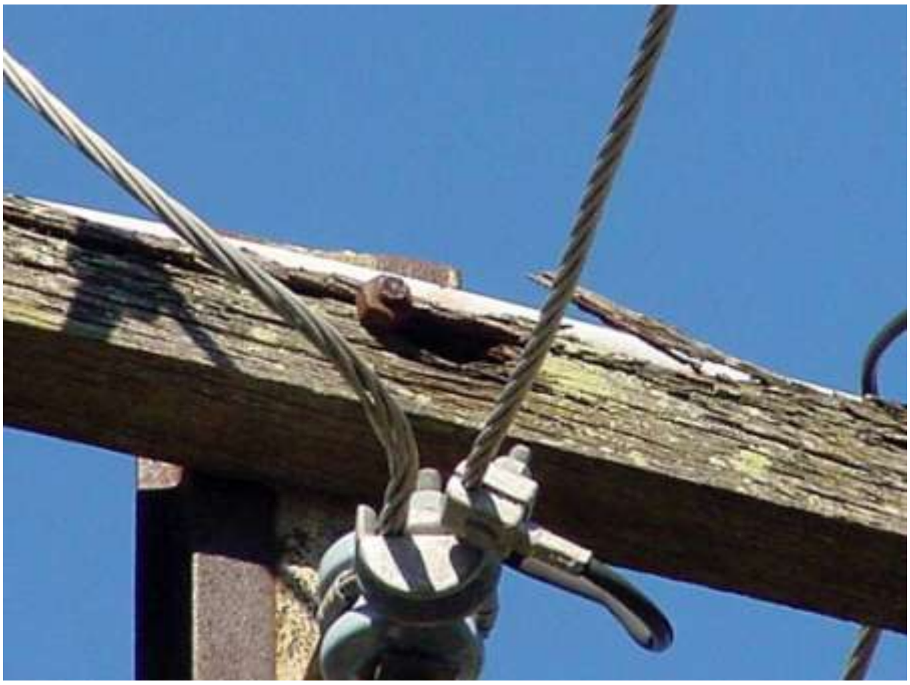
Assign a higher priority if a hole in the pin is identified. Take particular note when carrying out inspections in corrosive areas.



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code
HV X ARM LINE

The illustrated crossarm will last for some years. If rust is more extensive, and failure is imminent, assign a higher priority.



This photo is typical of P2

PRIORITY B – 3 NBFRA
PRIORITY BZ – 3 H/MBFRA

Quick Code:
LV X ARM LINE WOOD

PRIORITY B – 3 NBFRA
PRIORITY BZ – 3 H/MBFRA

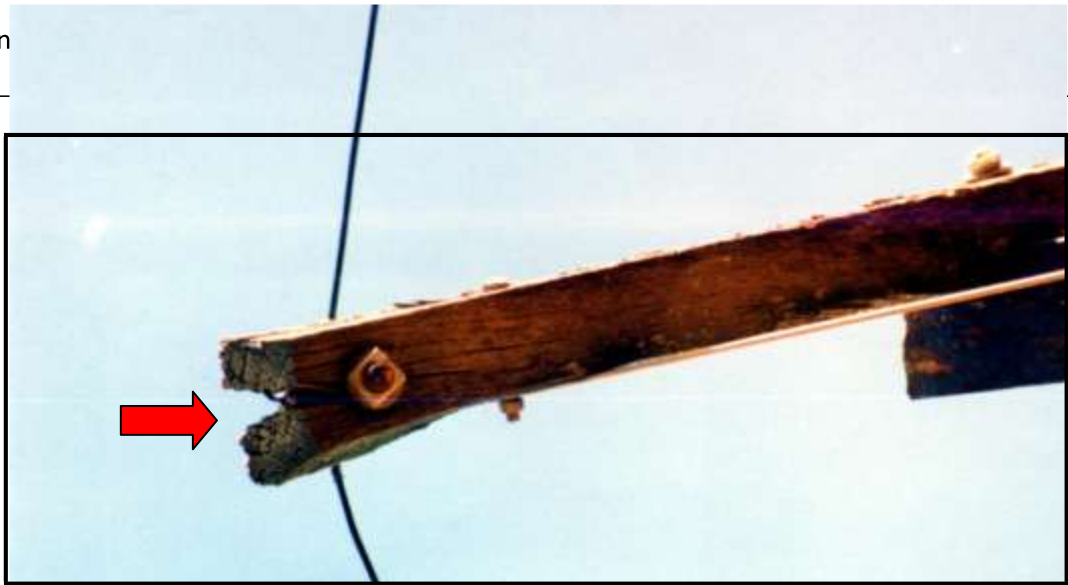
Quick Code:
LV XARM LINE WOOD

This photo is typical of PZ-1

PRIORITY B – 3 NBFRA
PRIORITY BZ – 3 H/MBFRA

Quick Code
LV X ARM LINE WOOD

Missin



This photo is typical of P2

PRIORITY B – 3 NBFRA
PRIORITY BZ – 3 H/MBFRA

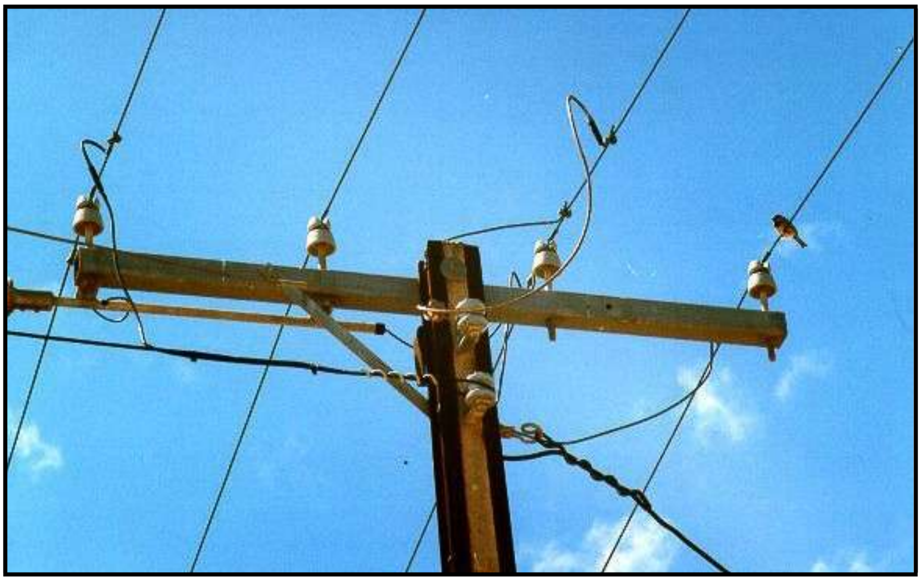
Quick Code:
LV X ARM ANGLE WOOD

This photo is typical of P3

PRIORITY B – 3 NBFRA
PRIORITY BZ – 3 H/MBFRA

Quick Code:
LV X ARM LINE WOOD

Twisted crossarm.



PRIORITY 1

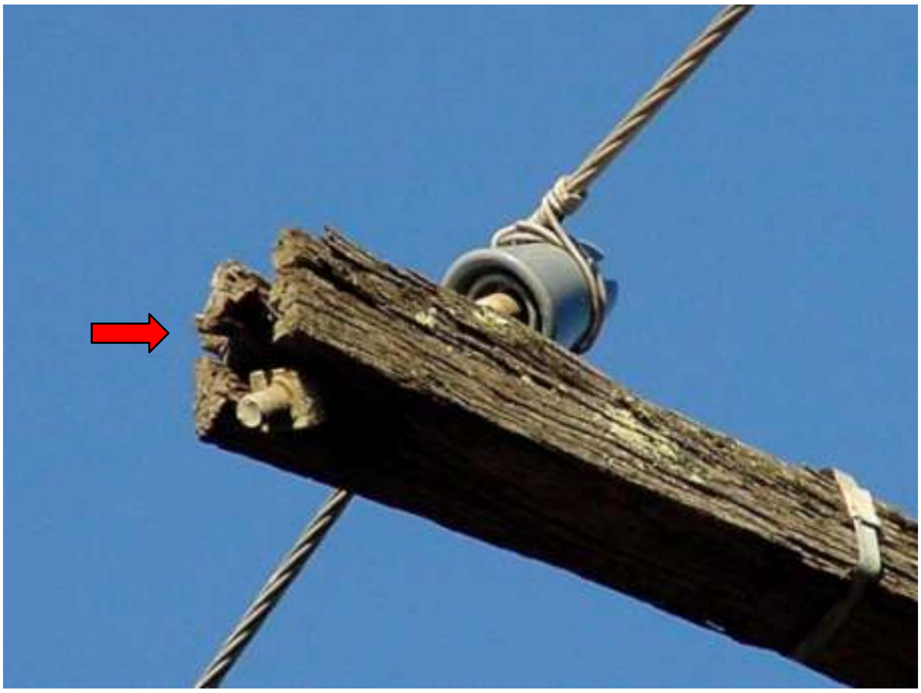
Quick Code:
WARNING SIGNAGE

LV non-standard phasing where the neutral is in the incorrect position.

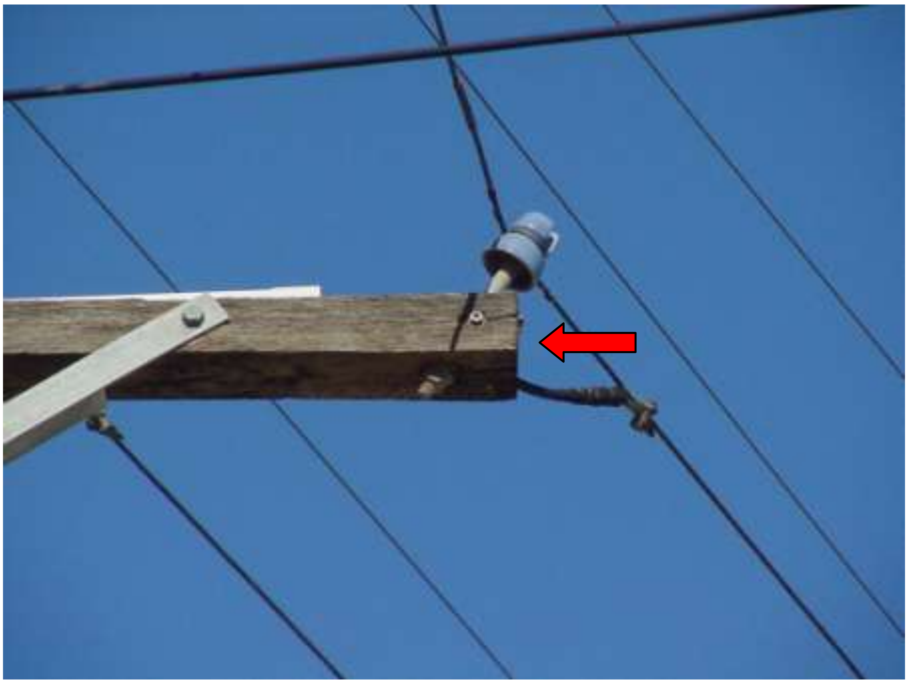
PRIORITY 1

Quick Code:
WARNING SIGNAGE

LV non-standard phasing where the neutral is in the incorrect position.



This photo is typical of PZ-2



Note: This xarm does not require recording of defect.

PRIORITY B – 3 NBFRA
PRIORITY BZ – 3 H/MBFRA

Quick Code:
LV X ARM LINE WOOD

This photo is typical of Priority B

PRIORITY B – 3 NBFRA
PRIORITY BZ – 3 H/MBFRA

Quick Code:
LV X ARM LINE WOOD

This photo is typical of PZ-1

PRIORITY B – 3 NBFRA
PRIORITY BZ – 3 H/MBFRA

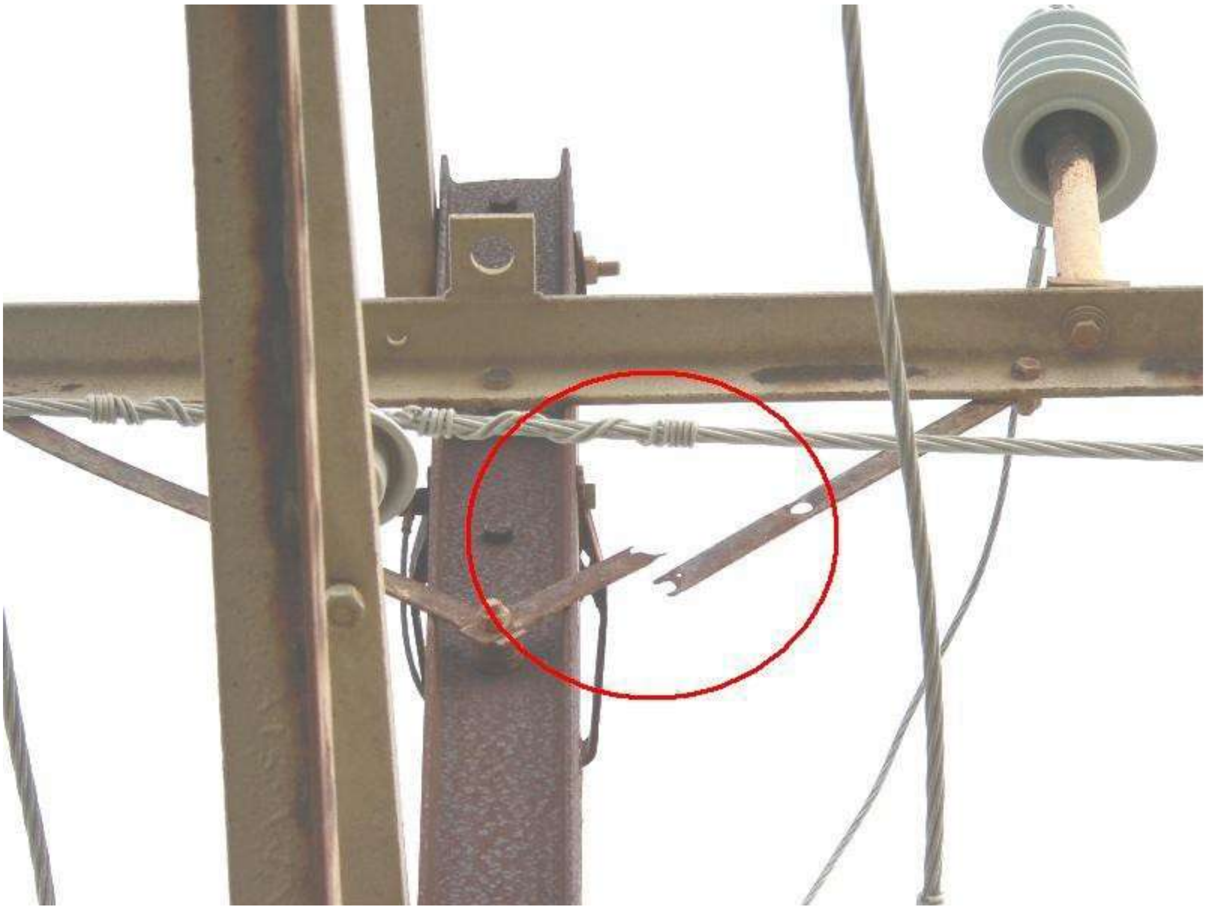
Quick Code:
LV X ARM LINE WOOD

This photo is typical of PZ in H/MBFRA or P1 in NBFRA

PRIORITY B – 3 NBFRA
PRIORITY BZ-3 H/MBFRA

Quick Code:
LV X ARM LINE WOOD

6.3 SUPPORTS – CROSSARM, BRACE



PRIORITY B – 2 **NBFRA**
PRIORITY BZ – 2 **H/BFRA**

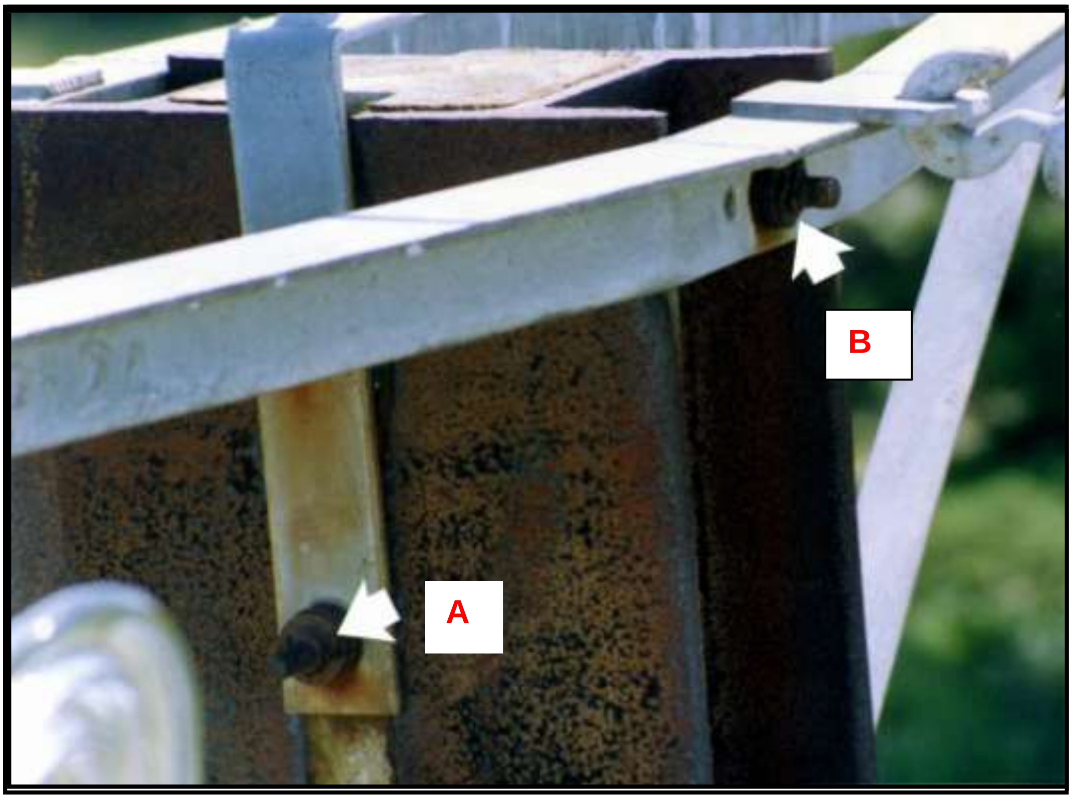
Quick Code:
HV Line Hardware - Other

HV Brace rusted away.

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:
HV Line Hardware - Other

HV MS straps rusted away.



This photo is typical of P2 on fig A

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

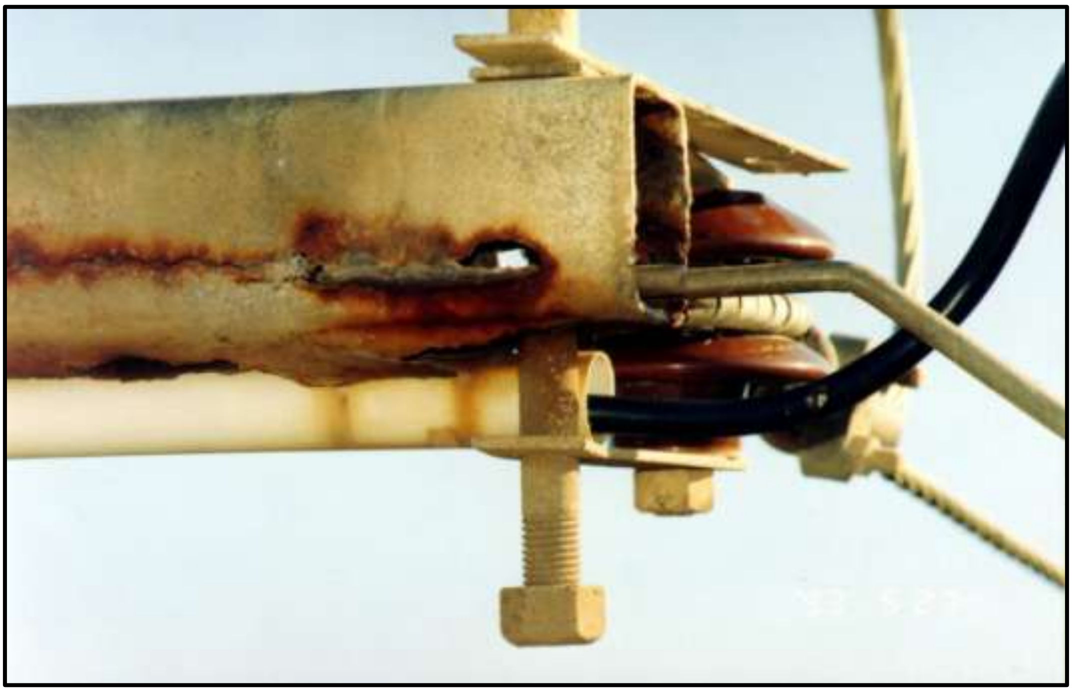
Quick Code:
HV X-ARM TERM/BRACE

Nuts rusted away.

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

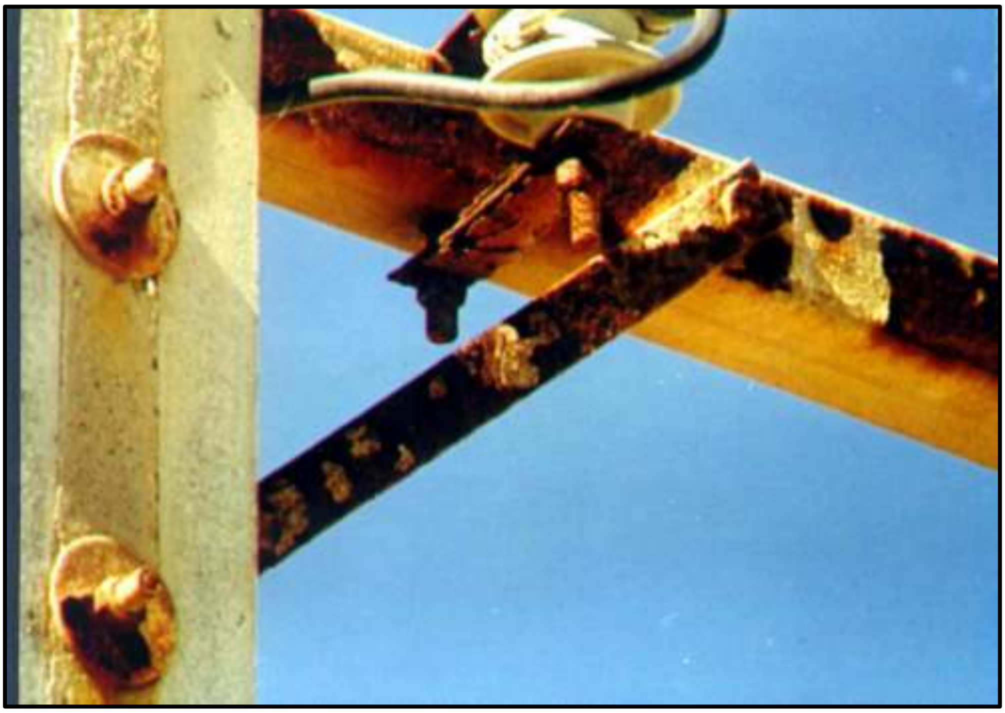
Quick Code:
HV Line Hardware - Other

HV Brace rusted away.



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:
LV X-ARM TERM/BRACE WOOD



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:
LV Line Hardware – Other LV Shackle rusted away.

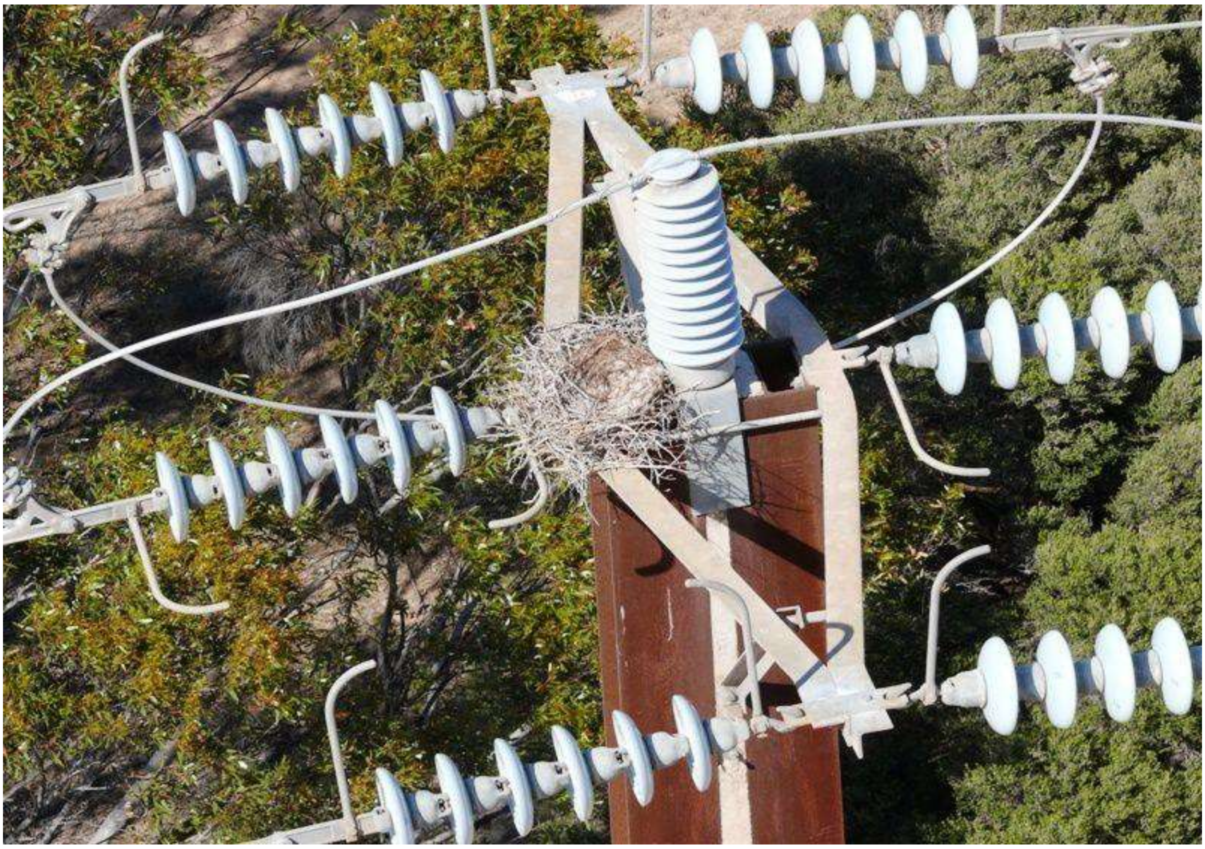
Note: example of early deterioration for comparison only.

This photo is typical of PZ-1

PRIORITY B – 2 NBFRA
PRIORITY BZ H/BFRA

Quick Code:
BIRDNEST

Hazardous birds nest.



This photo is typical of PZ-1

PRIORITY B – 2 NBFRA
PRIORITY BZ H/BFRA

Quick Code:
BIRDNEST

Hazardous birds nest.

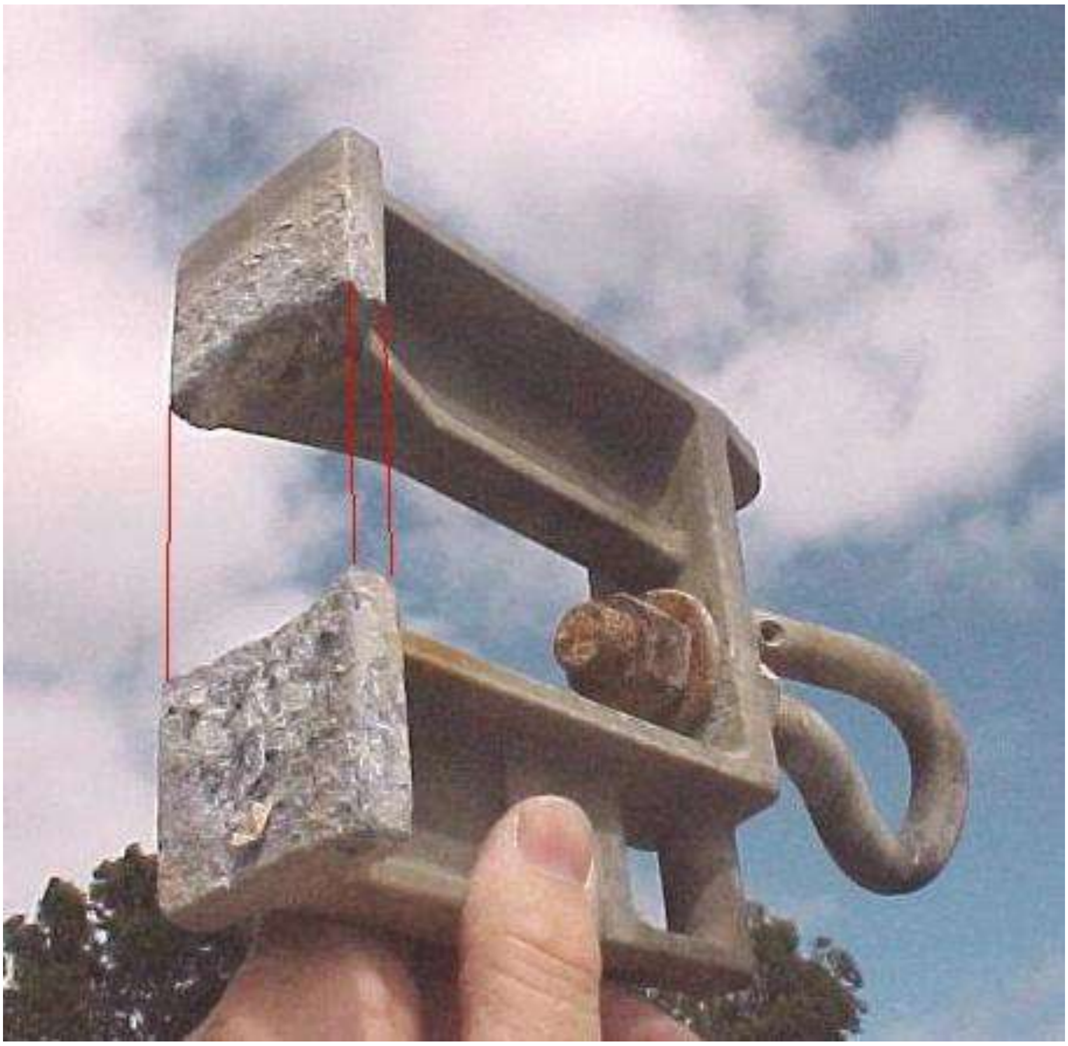
This photo is typical of PZ-1

PRIORITY B – 2 NBFRA
PRIORITY BZ H/BFRA

Quick Code:
BIRDNEST

Hazardous birds nest.

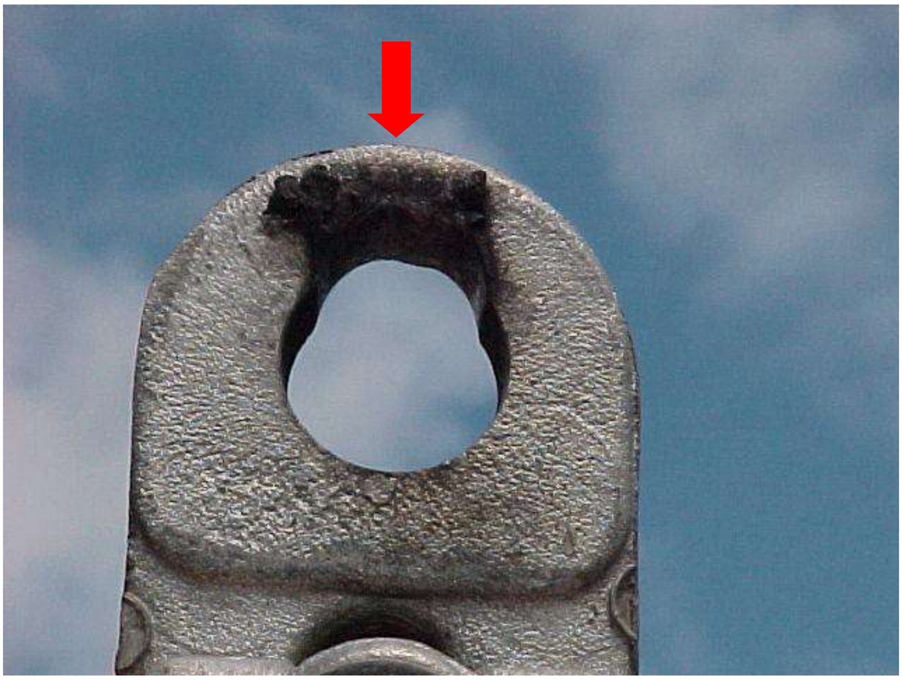
6.4 SUPPORTS – ABC


This photo is typical of Priority B

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:

Bracket corroded entirely away at the mounting hole.



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:

6.5 SUPPORTS – FOOTING

PRIORITY 1 – 2 NBFRA

PRIORITY 1 – 2 H/MBFRA

Quick Code:
FOOTING

If any of the bottom of the top collar of the footing is exposed, it is a P1 defect (MRV >190).

Otherwise, if any of the top collar of the footing is exposed more than 250mm in height at any point, it is a P2 defect (MRV between 90 and 189).

No defect is required if the top collar of the footing is exposed less than 250mm. However, for safety issues in high pedestrian traffic areas, refer to 'Dangerous Protrusions' in section 9.8.

This photo is typical of P1 defect

PRIORITY 1 – 2 NBFRA

PRIORITY 1 – 2 H/MBFRA

Quick Code:
FOOTING

Standard Data Entry Requirements Example Below

Pole Top Footing Collar Exposed At Ground Level
REPLACE POLE LIKE FOR LIKE
OR Network Project Officer where a new design folder is appropriate.
Photos Attached.

This photo is typical of P1 defect

PRIORITY 1 – 2 NBFRA

PRIORITY 1 – 2 H/MBFRA

Quick Code:
FOOTING

A 'toe and collar' footing with the bottom of the top collar exposed, therefore P1 defect.

This photo is typical of P2 defect

PRIORITY 1 – 2 NBFRA

PRIORITY 1 – 2 H/MBFRA

Quick Code:
FOOTING

Assess pole location (eg strain or brace position).

More than 250mm of the top collar of the footing is exposed but the bottom of the top collar isn't exposed, therefore it is a P2 defect.

PRIORITY 1 – 2 NBFRA
PRIORITY 1 – 2 H/MBFRA

Quick Code:
FOOTING

Note:
Only 0.5m of pole in ground.

6.6 SUPPORTS – POLE, ANGLE / TERMINAL / TEE

This photo is typical of Priority B

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:
POLE ANGLE TERM-T/OFF DAMAGED

Nut missing from MS strap bolt.

6.7 SUPPORTS – POLE LINE

PRIORITY 1 – 3 NBFRA
PRIORITY Z1 – 3 H/MBFRA

Quick Code:
POLE LINE >50% RUSTED

Note:
Pole replacement required.

If there is no steel under the rust, this would be Priority B.

PRIORITY 1 – 3 NBFRA
PRIORITY 1Z – 3 H/MBFRA

Quick Code:
POLE LINE >50% RUSTED

Pole replacement required due to level of corrosion along length of channel.

Standard Data Entry Requirements Typical Examples Below

Pole Replacement Only

Pole previously plated, rusted above plates & plates rusted away approx 30%.
4 X locations of channel corrosion in S2 section of channel, up channel.
3 x Locations of Concrete Spalling.
Channels swelling behind pole tie bolts.
REPLACE POLE LIKE FOR LIKE – WB0905
4 X Photos Attached.

Or extra notes in Noti

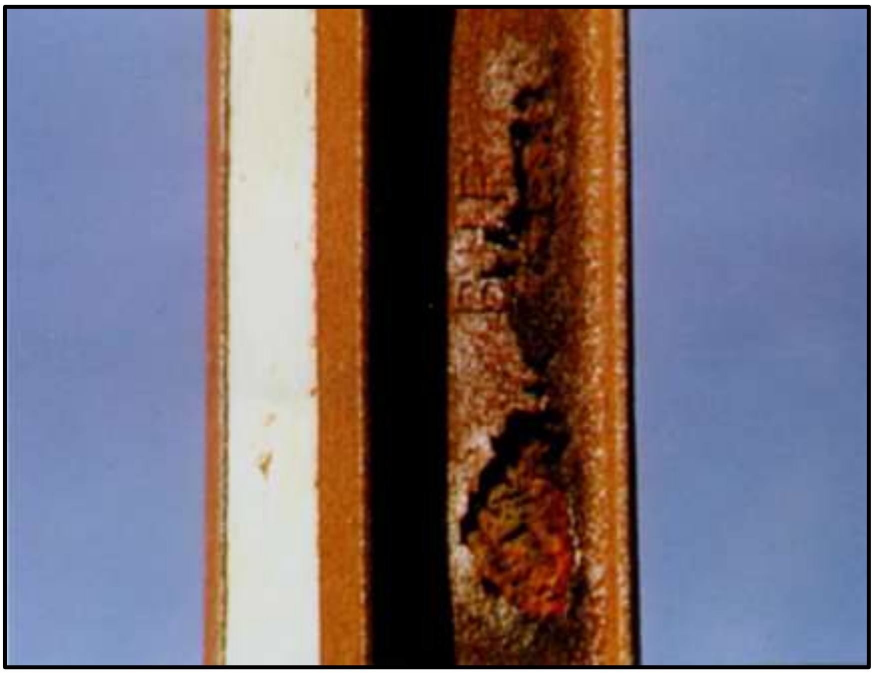
Replace pole like for like, pole previously plated, Holes Rusted through Plates.

No ground line corrosion, No channel corrosion, 1 x location of spalling. Tie bolt rusted thru & concrete has fallen out.

Replace pole like for like, 6 locations of concrete spalling, rust up north side channel, pole previously plated.

Photos Required of:

- **G/L corrosion**
- **Channel Corrosion – S2 Section**
- **Concrete Spalling**
- **Corrosion Behind Tie Bolts**
- **Overview photo of construction**



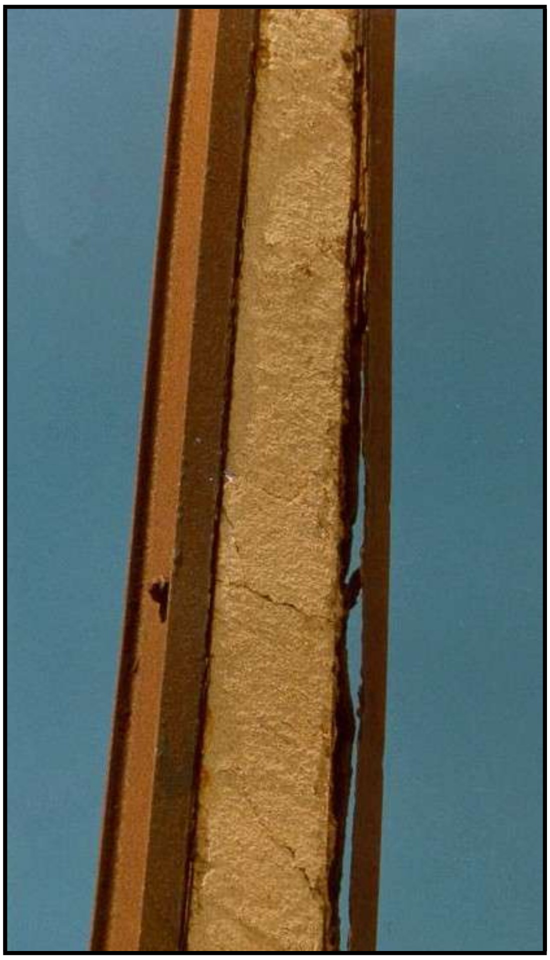
PRIORITY 1 – 3 NBFRA
PRIORITY 1Z – 3 H/MBFRA

Quick Code:
POLE LINE >50% RUSTED

Standard Data Entry Requirements Typical Example Below

Replace Pole Like For Like

4 X location of channel corrosion in S2 section of channel, up channel.
Photos Attached



PRIORITY 1 – 3 NBFRA
PRIORITY 1Z – 3 H/MBFRA

Quick Code:
POLE LINE >50% RUSTED

Note:
Priority and replacement may depend on a combination of both corrosion and the strategic purpose of the structure. If in a built up area, consideration should be given to safety due to sharp edges etc. – Public Hazard High MRV Score Required

PRIORITY 1 – 3 NBFRA
PRIORITY 1Z – 3 H/MBFRA

Quick Code:
POLE LINE >50% RUSTED

Before cleaning

After cleaning

PRIORITY 1 – 3 NBFRA
PRIORITY Z – 3 H/MBFRA

Quick Code:
POLE LINE PLATE <50 %

Note:
Use needle profile gauge and pole rust percentage chart to determine steel loss.

PRIORITY 1 – 3 NBFRA
PRIORITY 1Z – 3 H/MBFRA

Quick Code:
POLE LINE >50% RUSTED

Poles with plates rusted through require replacement.

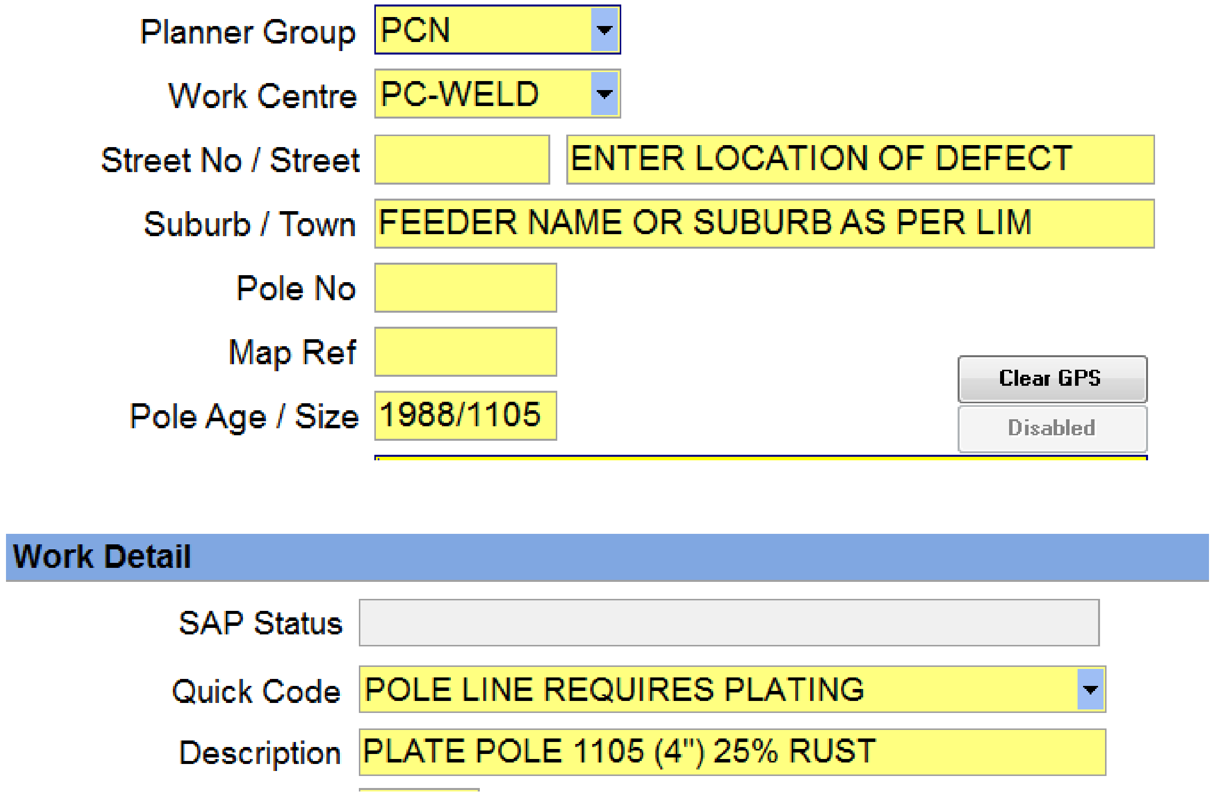
PRIORITY 1 – 3 NBFRA
PRIORITY 1Z – 3 H/MBFRA

Quick Code:
POLE LINE >50% RUSTED

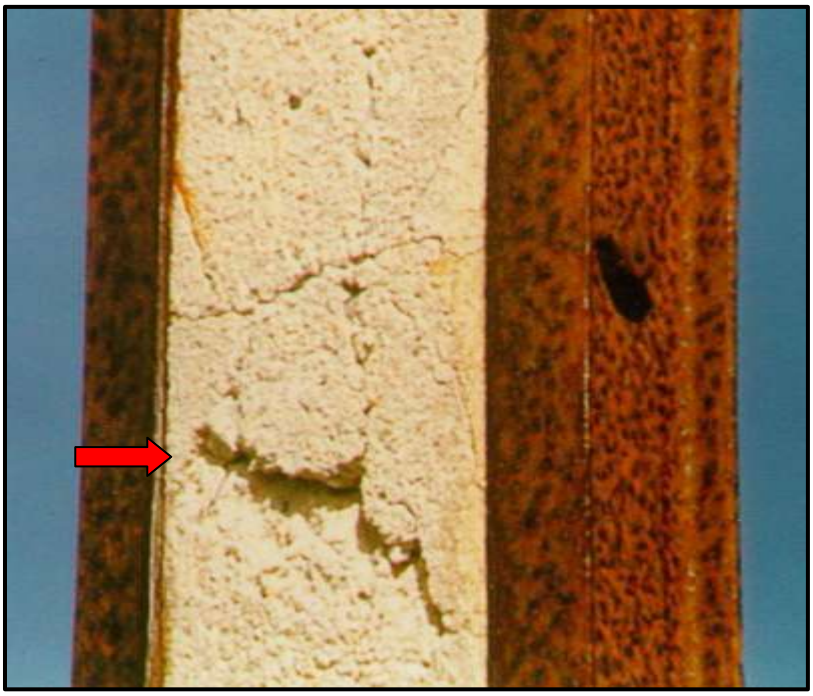
Use needle profile gauge & pole rust percentage chart to determine steel loss

Standard Data Entry Requirements Typical Example Below

Between 10 & 12 Sharam St Pt Augusta
Plate 4 inch LV Service Pole.
North Channel -40%
South Channel -35%
'P' Painted On Pole.
Telstra & O/U Service in Pole Channel.
Photos Attached



When entering a Functional Location it will always populate default values, however for pole plating defects, Property Services & some Sub Maintenance require manual Planner Group & Work Centre changes within the drop down tables. Eg Pole plating defects = Planner Group **PCN** & Work Centre **PC- Weld**



PRIORITY B – 3 NBFRA
PRIORITY BZ – 3 H/MBFRA

Quick Code:
POLE LINE DAMAGED

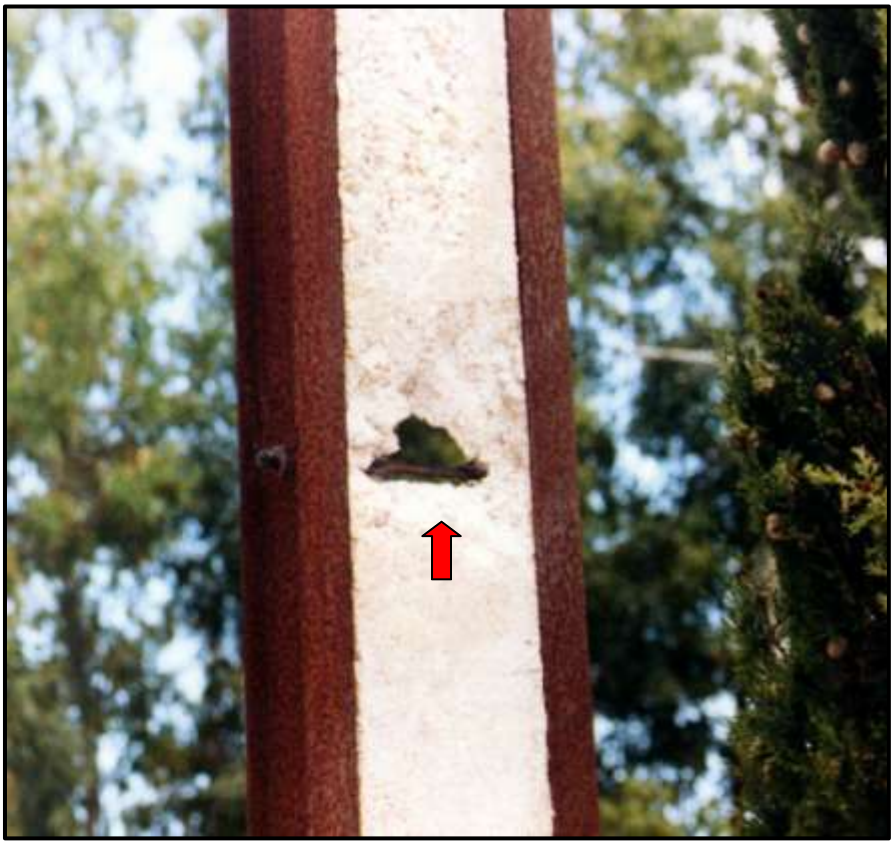
Note that spalling has occurred where the tie bolt connects the two channels on the pole. As the tie bolt corrodes, the expanding rust pushes out and cracks the concrete. As shown, with damage restricted to one location, no defect should be issued. Report this defect only if the spalling occurs at multiple tie bolt locations on the pole.

PRIORITY B – 3 NBFRA
PRIORITY BZ – 3 H/MBFRA

Quick Code:
POLE LINE DAMAGED

Example of pole deterioration when considering poles for replacement.

Corrosion and damage around pole bolts. Report only if damage occurs at multiple locations on the pole.



PRIORITY B – 3 NBFRA
PRIORITY BZ – 3 H/MBFRA

Quick Code:
POLE LINE DAMAGED

Example of pole deterioration when considering poles for replacement.

Corrosion and damage around pole bolts. Report only if damage occurs at multiple locations on the pole.

PRIORITY B – 3 NBFRA
PRIORITY BZ – 3 H/MBFRA

Quick Code:
POLE LINE DAMAGED

Pole replacement required

PRIORITY B – 3 NBFRA
PRIORITY BZ – 3 H/MBFRA

Quick Code:
POLE LINE DAMAGED

Pole replacement required

PRIORITY B – 3 NBFRA
PRIORITY BZ – 3 H/MBFRA

Quick Code:
POLE LINE DAMAGED

Pole replacement required.

Standard Data Entry Requirements Example Below

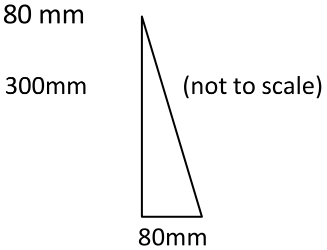
Cnr Princess & William St
Replace pole like for like
Or Network Project Officer to provide design folder if changes required.
HV/LV Alley Arm with LV Tee Off. Pole Has Vehicle Damage.
Photos Attached

PRIORITY B – 2 NBFRA
PRIORITY Z – 2 H/MBFRA

Quick Code
FOOTING

The example pole pictured has tilted approximately 7 degrees.
Only report poles with tilt of **15 degrees** or more under normal line conditions.
Higher priority may be appropriate if the pole is likely to tilt further, for instance, if the surrounding soil was an unstable slope. (Refer to section 6-5)

15 degrees may be estimated by comparing a right angled triangle with a height of 300 mm and a base of 80 mm



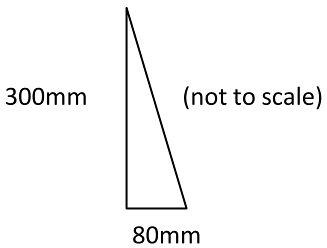
PRIORITY B – 2 NBFRA
PRIORITY Z – 2 H/MBFRA

Quick Code

FOOTING

The example pole pictured has tilted approximately 7 degrees.
Only report poles with tilt of **15 degrees** or more under normal line conditions.
Higher priority may be appropriate if the pole is likely to tilt further, for instance, if the surrounding soil was an unstable slope. (Refer to section 6-5)

15 degrees may be estimated by comparing a right angled triangle with a height of 300 mm and a base of 80 mm



Notch Sensitive Steel (NSS) Poles

NSS is a type of steel that has numerous impurities, which affect the microstructure of the steel, causing it to become brittle and sensitive to cracking around its notches.

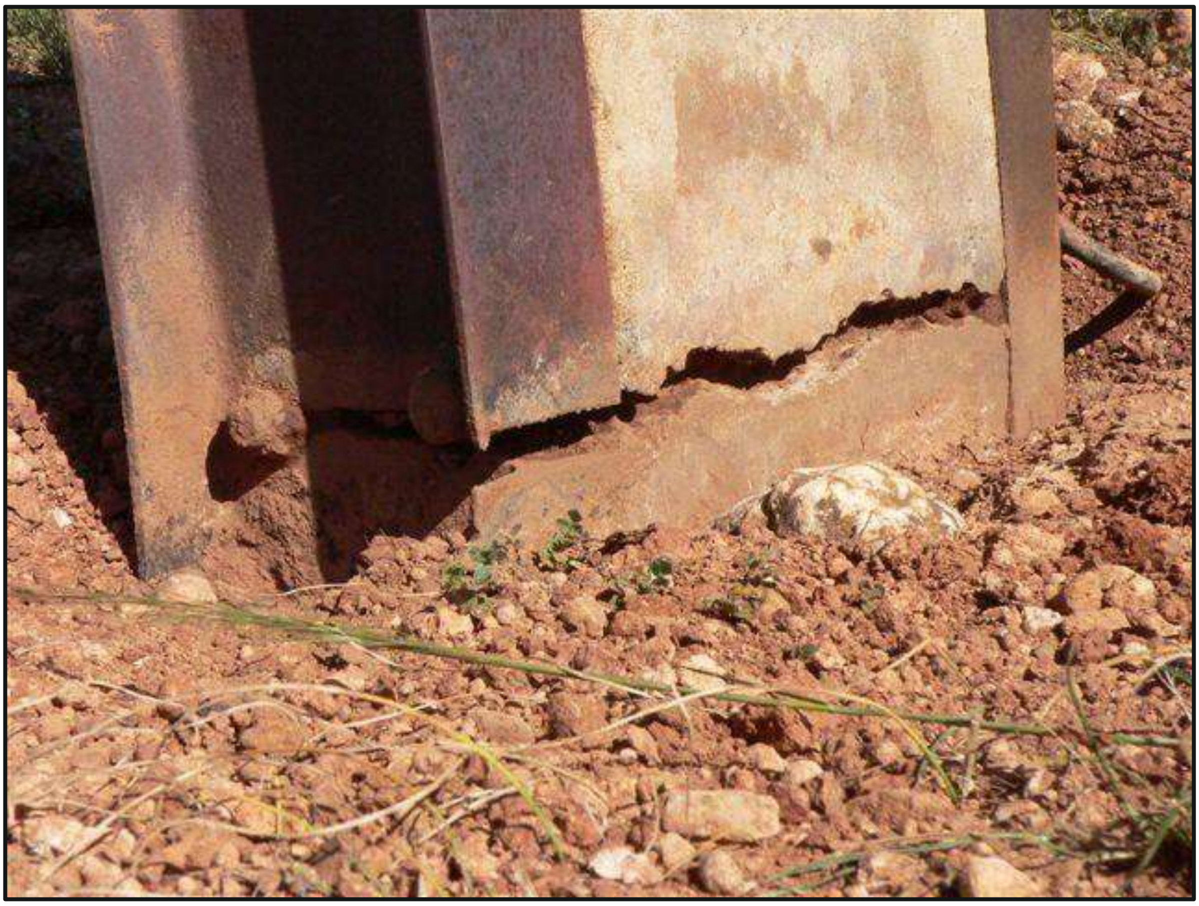
How to identify it?
There is no absolute way to determine this, the following is recommended:
- Poles marked +8x4+ or NTKNP20N **are** notch sensitive steel
- Poles marked BHP or KEMBLA **are not** notch sensitive steel
- Look for cracks developing around bolt holes

PRIORITY B – 4 NBFRA
PRIORITY BZ – 4 H/MBFRA

Quick Code:
POLE OTHER

All Notch Sensitive Steel poles must be recorded.

MRV < 59 when there is no obvious damage and deterioration.
MRV > 90 when damage and deterioration is present.



PRIORITY B – 4 NBFRA
PRIORITY BZ – 4 H/MBFRA

Quick Code:
POLE OTHER

All Notch Sensitive Steel poles must be recorded.

MRV < 59 when there is no obvious damage and deterioration.
MRV > 90 when damage and deterioration is present.

6.8 SUPPORTS – NON STANDARD POLES

PRIORITY 1 – 3 NBFRA
PRIORITY Z H/BFRA

Quick Code:
POLE OTHER

Note: Replacement of MTT poles, consideration needs to be given to Heritage listing if applicable.

PRIORITY 1 – 3 NBFRA
PRIORITY Z H/BFRA

Quick Code:
POLE OTHER

Note: Replacement of MTT poles, consideration needs to be given to Heritage listing if applicable.

7. SERVICE EQUIPMENT

Contents

7.1 SERVICE EQUIPMENT – ATTACHMENTS

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/MBFRA

Quick Code:
SERV FUSE BOX LID MISSING

Explanation of Priorities:
Priority B – Severely damaged fuse box, eg vandalism.
Priority 1 – Box open **and** cables bare or insulation missing.
Priority 2 – Box open or lid missing, moisture ingress possible.

Example of P2 (**Standard Data Entry Requirements** Replace Lid as per E1155, Possible Moisture Ingress)

Example of P2 (**Standard Data Entry Requirements** Replace Lid as per E1155, Possible Moisture Ingress).

Example of **P1 for NBFRA or PZ for H/MBFRA.**

Example of **P2**

Example of **P2**

7.2 SERVICE EQUIPMENT – CONDUCTOR, NEUTRAL SCREENED

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/MBFRA

Quick Code:
SERV GRIPS BROKEN

7.3 SERVICE EQUIPMENT – PIT / PILLAR

PRIORITY B – 1 NBFRA
PRIORITY B – 1 H/BFRA

Quick Code:
SERV PIT PILLAR DAMAGED

Note: Priority should be selected based on public safety.

Bees in pit

PRIORITY B – 1 NBFRA
PRIORITY B – 1 H/BFRA

Quick Code:
SERV PIT PILLAR DAMAGED

Note: For vermin in pits (eg bees, termites etc use above quick code)

Termites in pit

PRIORITY B – 1 NBFRA
PRIORITY B – 1 H/BFRA

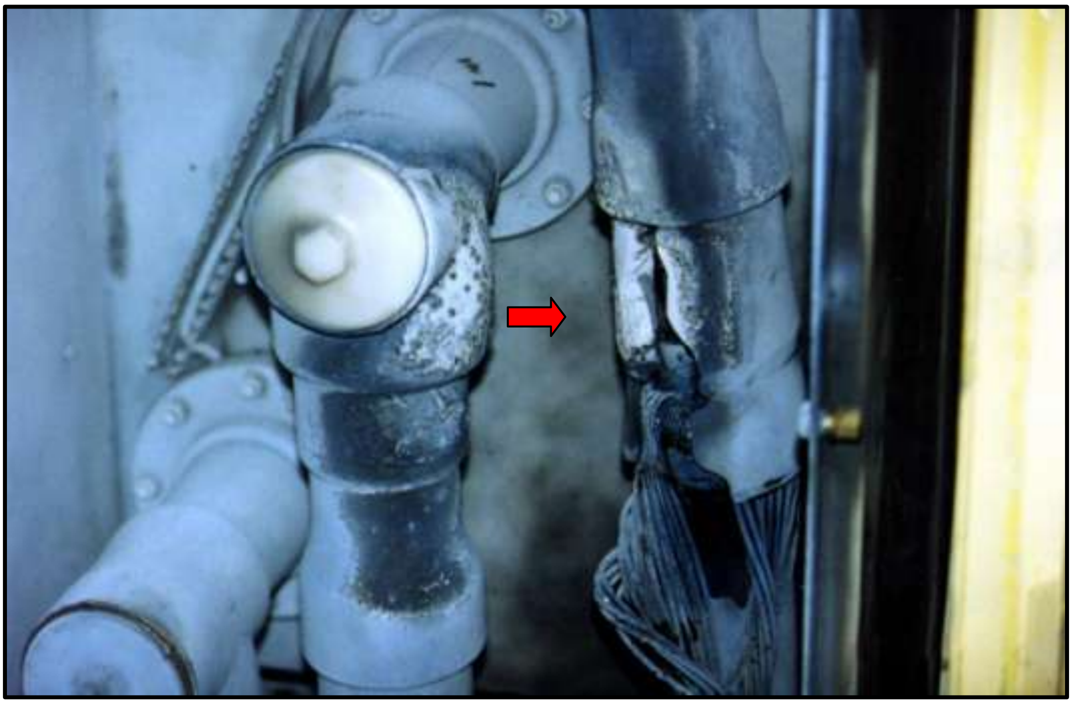
Quick Code:
SERV PIT PILLAR DAMAGED

Note: For vermin in pits (eg bees, termites etc use above quick code).

8. OTHER

Contents

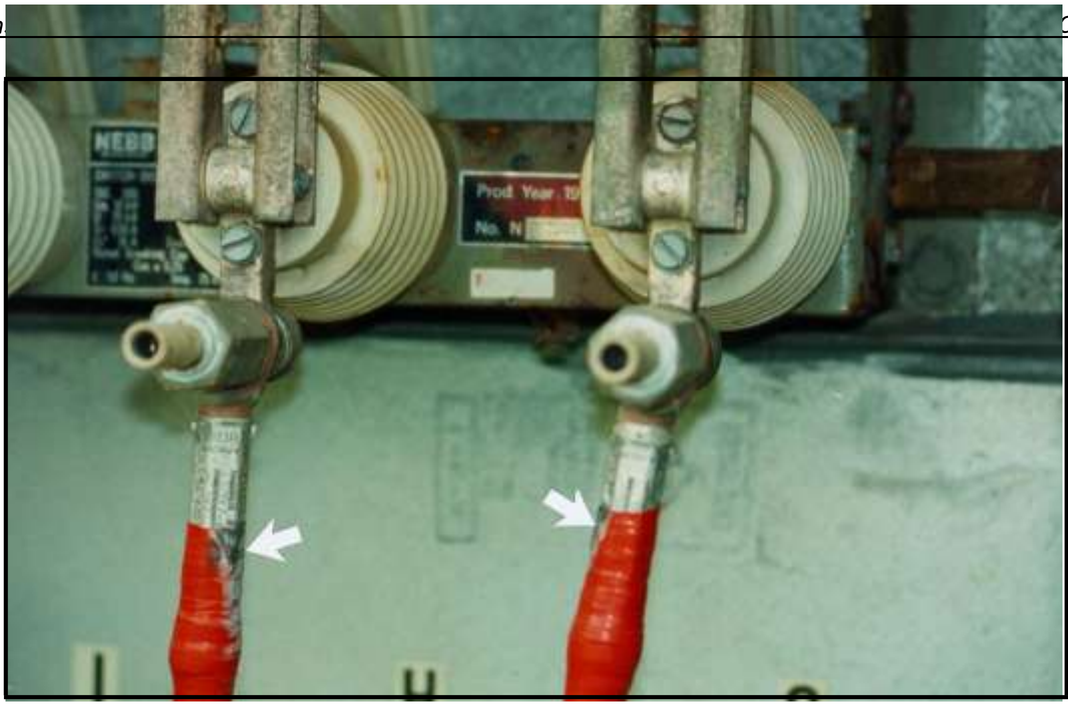
8.1 OTHER – CUBICLE



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
CUBICLE SF6 REPLACEMENT

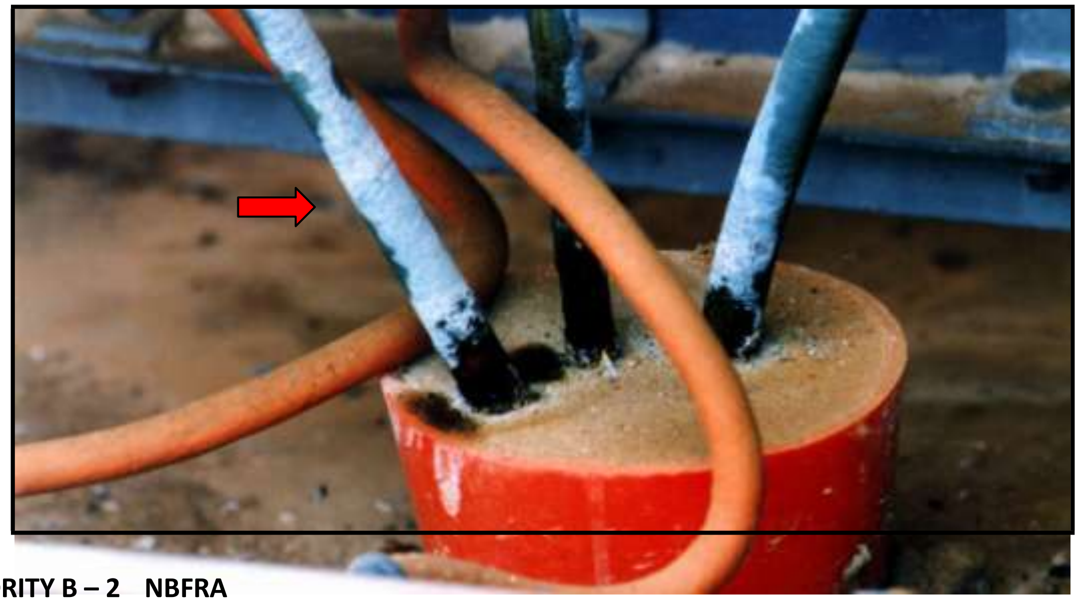
This is an unscreened F&G termination. In this example, the stress cone design was too tight when used on 630 mm^2 cable. Stress cone splitting inside the termination can occur. These terminals are normally behind the barrier board and can not be accessed while the cubicle is live.



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
CUBICLE (MINOR REPAIRS)

Priority level to be determined by the extent of tracking.



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
URD CABLE DEFECT

Severe tracking on lead cable terminations.

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
URD CABLE DEFECT

Severe tracking on lead cable terminations. Possibly as a result of dampness.

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

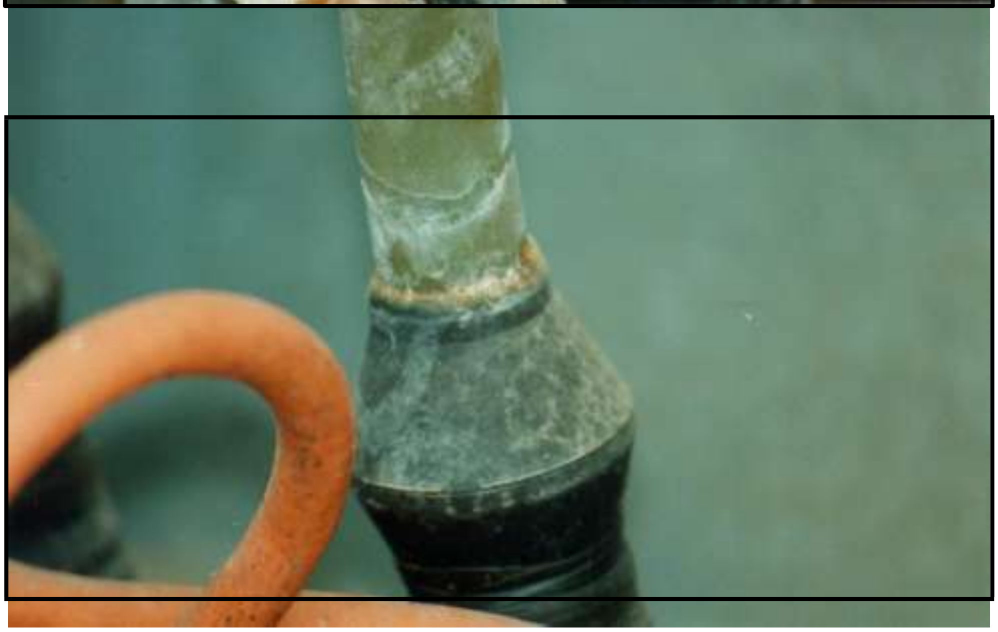
Quick Code:
URD CABLE DEFECT

Tracking and mild damage on top of termination.

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
URD CABLE DEFECT

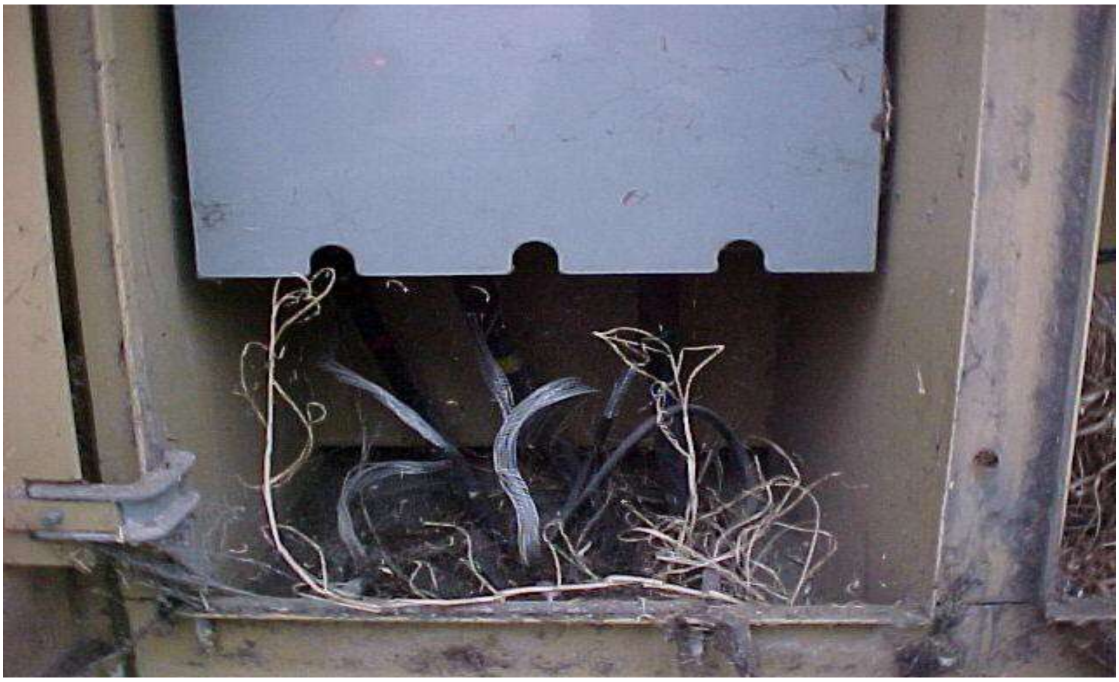
Tracking on terminations.
Note that the coloured PVC tape applied to the stress relieving part of the termination is the likely cause. Coloured tape should only be applied well down the cable, away from the termination. Tracking across coloured PVC tape may also lead to TV interference.



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/MBFRA

Quick Code:
URD CABLE DEFECT

Reposition earth terminals away from termination to reduce tracking. Note that the insulation has become grooved.



PRIORITY B – 1 NBFRA
PRIORITY BZ – 1 H/MBFRA

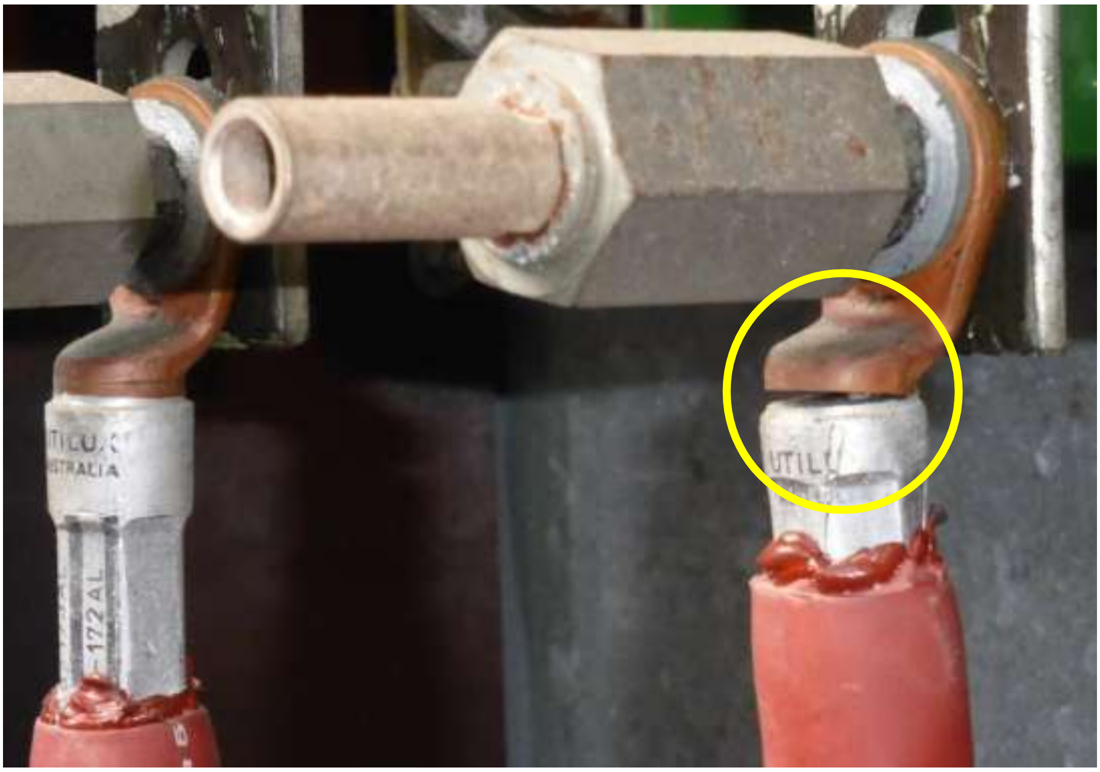
Quick Code:
CUBICLE (MINOR REPAIRS)

Remove vegetation.

PRIORITY B – 1 NBFRA
PRIORITY BZ – 1 H/MBFRA

Quick Code:
CUBICLE (MINOR REPAIRS)

Remove Termites.

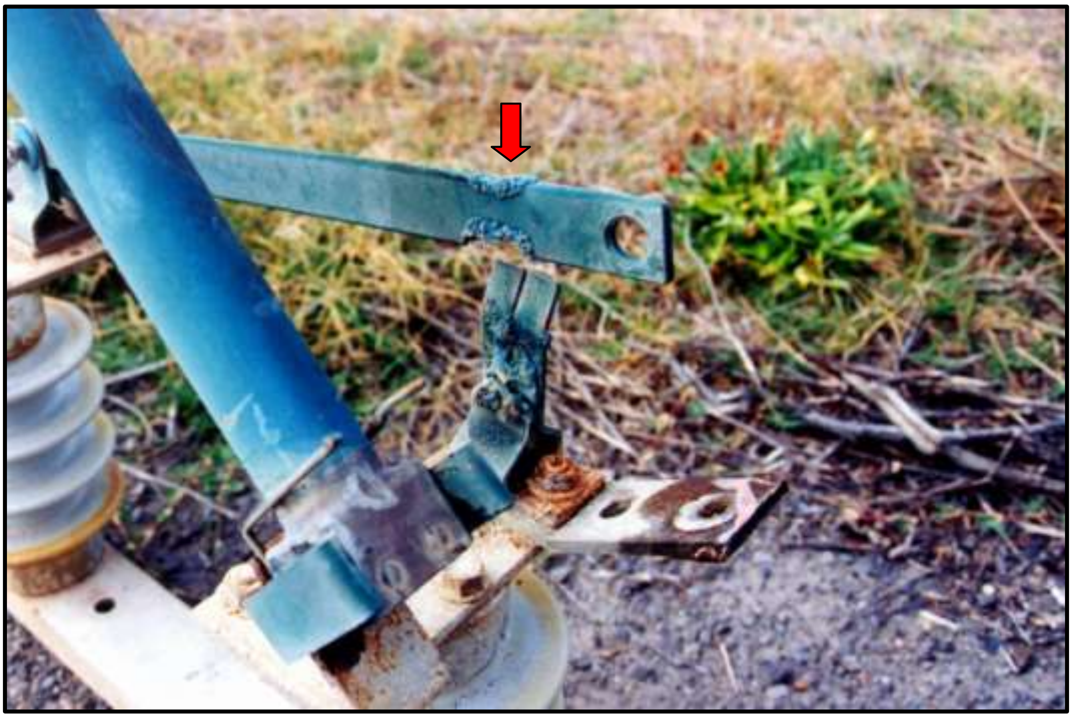


PRIORITY B **NBFRA**

PRIORITY B **H/MBFRA**

Separating Bi-metal lugs on cable terminations.
Identified during Brown Boveri switch gear inspection.
Called in as a breakdown.

8.2 OTHER – DF



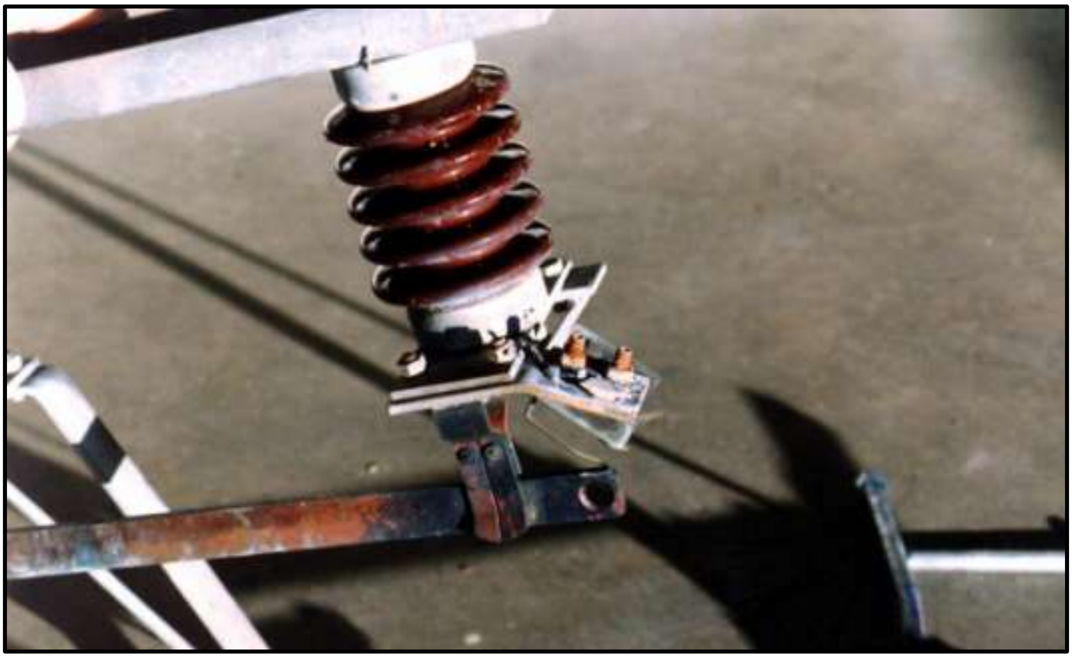
This photo is typical of Priority B

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:
DF/ FUSE BASE DAMAGED

Blade contact burnt.

Check for visible damage to prioritise correctly.



Top view *Terminal lug and DF base severely melted and blade contact has annealed.*

Bottom view *This photo is typical of PZ-1*

PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:
DF/ FUSE BASE DAMAGED

Check for visible damage to prioritise correctly.

8.3 OTHER – FUSE

PRIORITY 3 **NBFRA**
PRIORITY 2 **H/MBFRA**

Quick Code:
FUSE LIQUID LOW

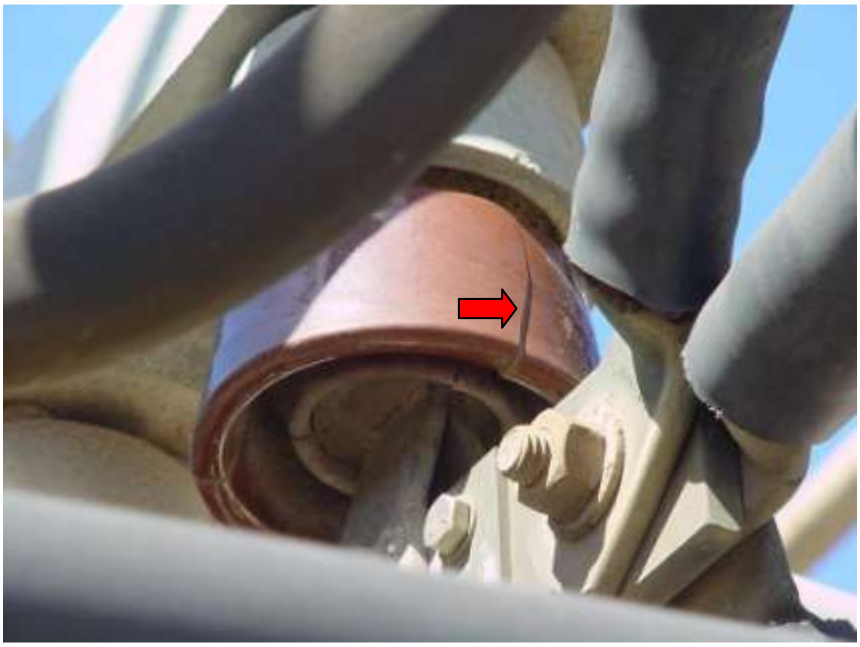
The liquid level must not be more than 20mm below the top ferrule as per E2816 Sheet 2. If it is, then a defect should be recorded.

8.4 OTHER – ISOLATOR

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
ISOL DAMAGED

Note:Depending on severity of crack/damage a higher priority may be required.



PRIORITY B – 2 NBFRA

PRIORITY B – 2 H/BFRA

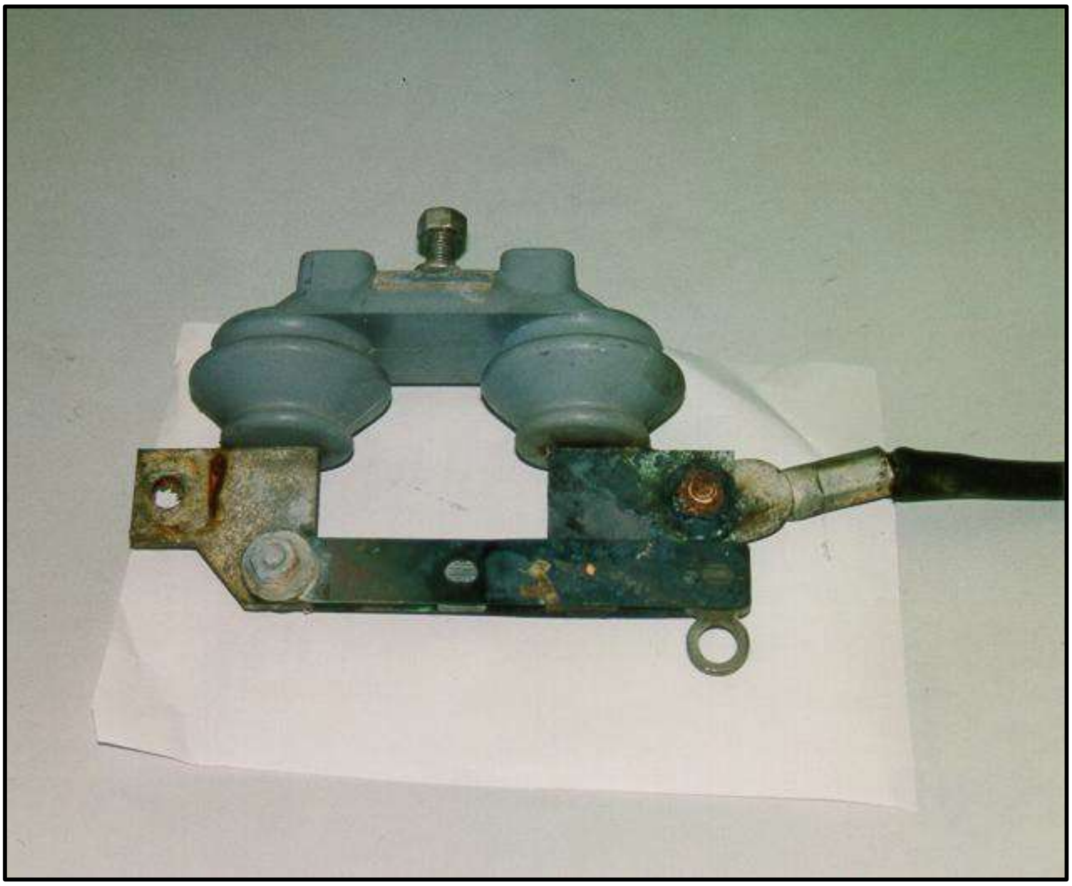
Quick Code:
ISOL DAMAGED

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
ISOL DAMAGED

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

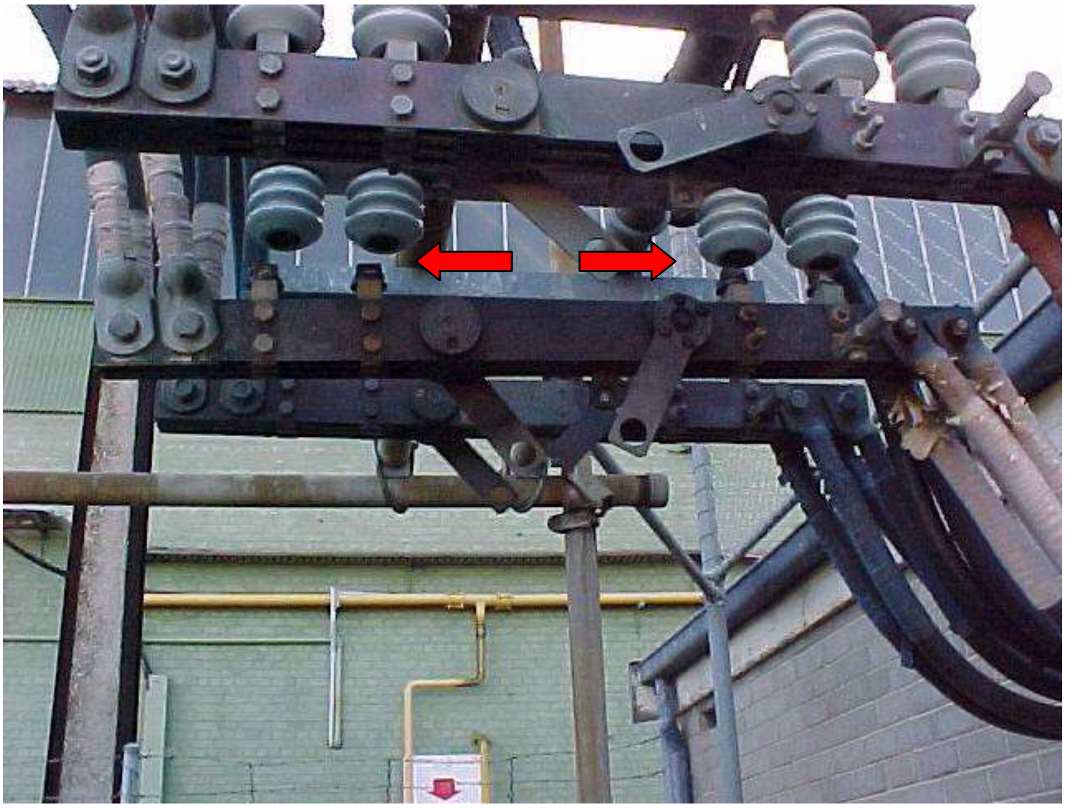
Quick Code:
ISOL DAMAGED



PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:
HOT JOINT (LINE INSPS)

Damaged terminal lug, LV isolator palm & blade contact.

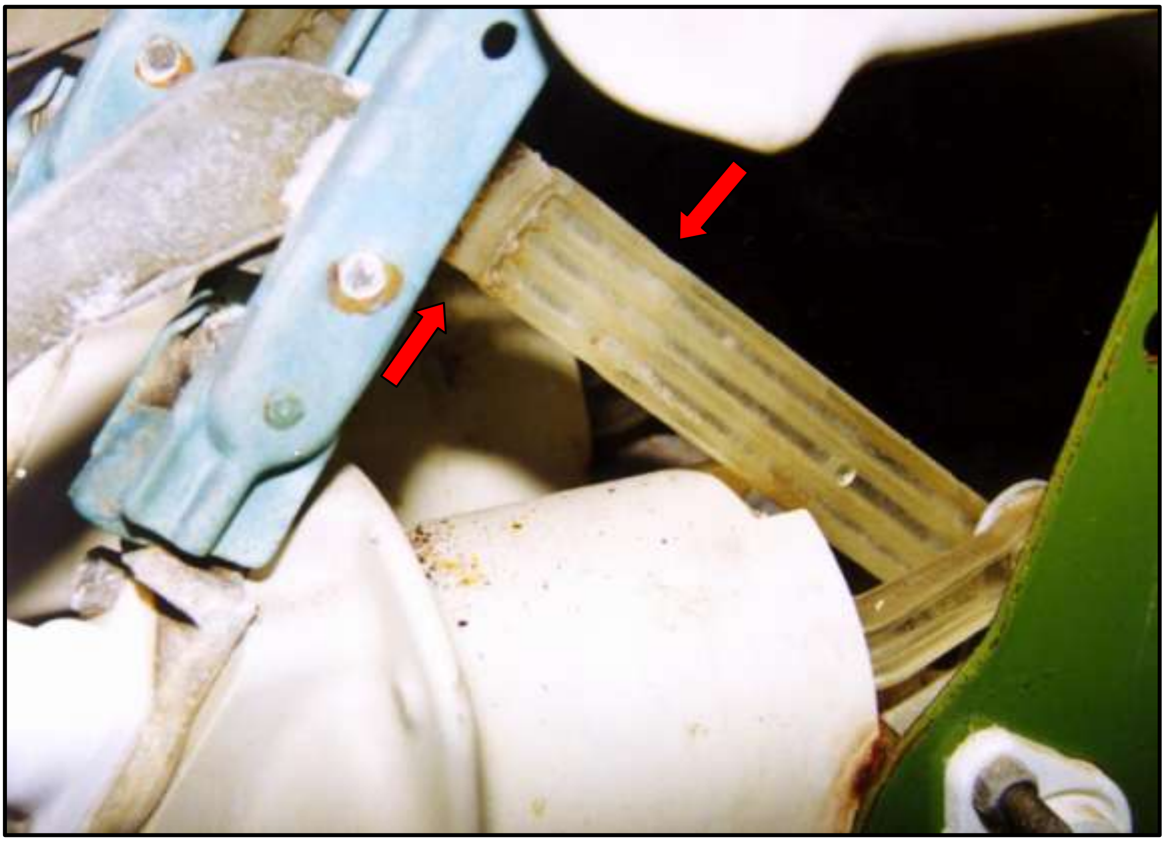


PRIORITY B – 2 NBFRA
PRIORITY BZ – 2 H/BFRA

Quick Code:
HOT JOINT (LINE INSPS)

Damaged, heat affected stand off insulators, centre phase.

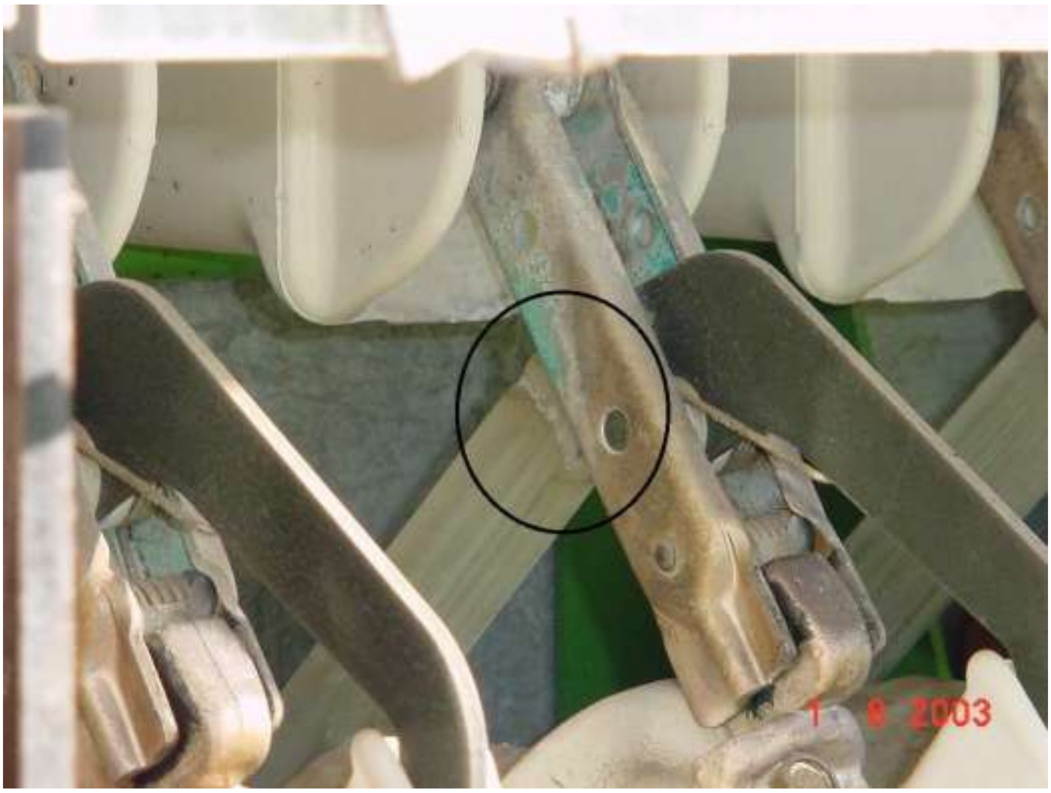
8.5B OTHER – SWITCH, BROWN BOVERI



PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
CUBICLE BB REPLACEMENT

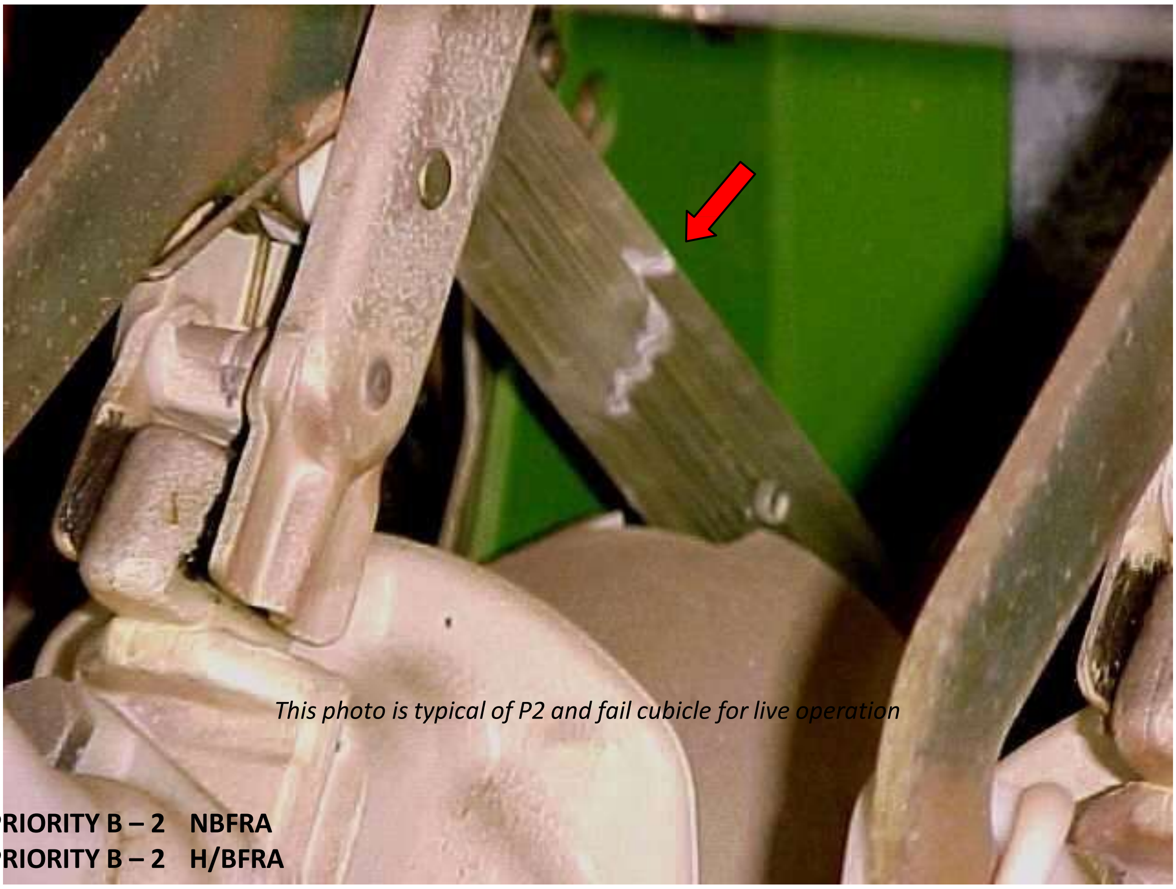
INSPECTION ITEMS
Tracking and etching of plastic push rods.
Note the green corrosion deposit on the blades.
Note also the smaller plastic push rod that operates the piston in the bottom insulator of the NAL 12 switch.
Check that both rods are in good order.



This photo is typical of P2 and fail cubicle for live operation

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
CUBICLE BB REPLACEMENT

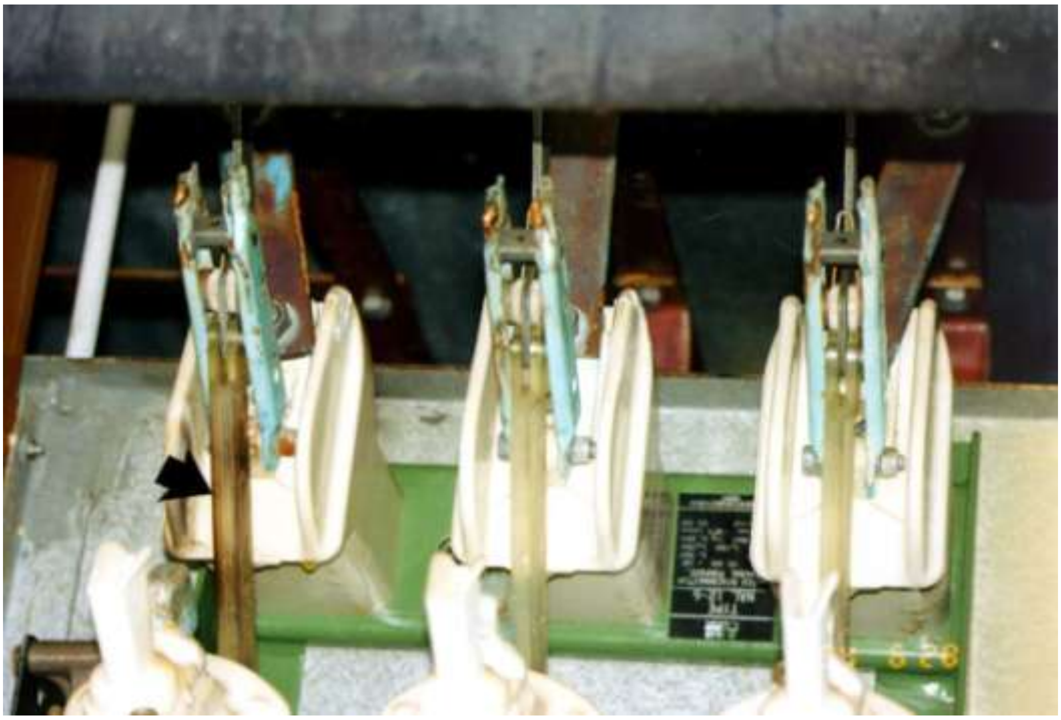


This photo is typical of P2 and fail cubicle for live operation

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
CUBICLE BB REPLACEMENT

Note damage to push rods.



This photo is typical of P1 and fail cubicle for live operation

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:

CUBICLE BB REPLACEMENT

Damaged push rods.

Note: If green deposits on blades, high ozone present and arcing, raise job to replace switchgear.

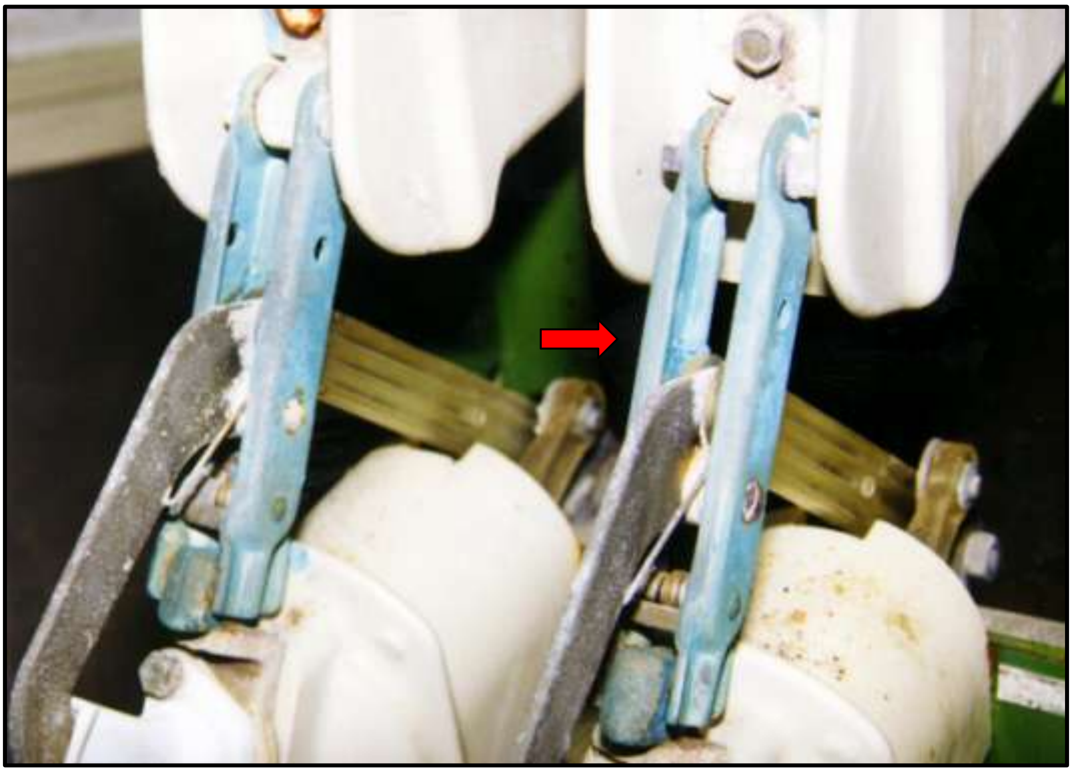
Green tags to be removed.

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
CUBICLE BB REPLACEMENT

This amount of O-ring exposed is acceptable and switch is operational.
If O-ring is fully exposed and outside of shroud then switchgear fails inspection.

Remove green tags and switch is inoperable.



PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
CUBICLE BB REPLACEMENT

INDICATORS TO LOOK FOR INSIDE CUBICLE:
Green deposit on metal (silver coated) blades and contacts indicating significant condensation and discharge has occurred. Check for evidence of Ozone gas and audible arcing prior to opening cubicle as per inspection sheet.

Front View

Rear view This photo is typical of P1 and fail cubicle for operation

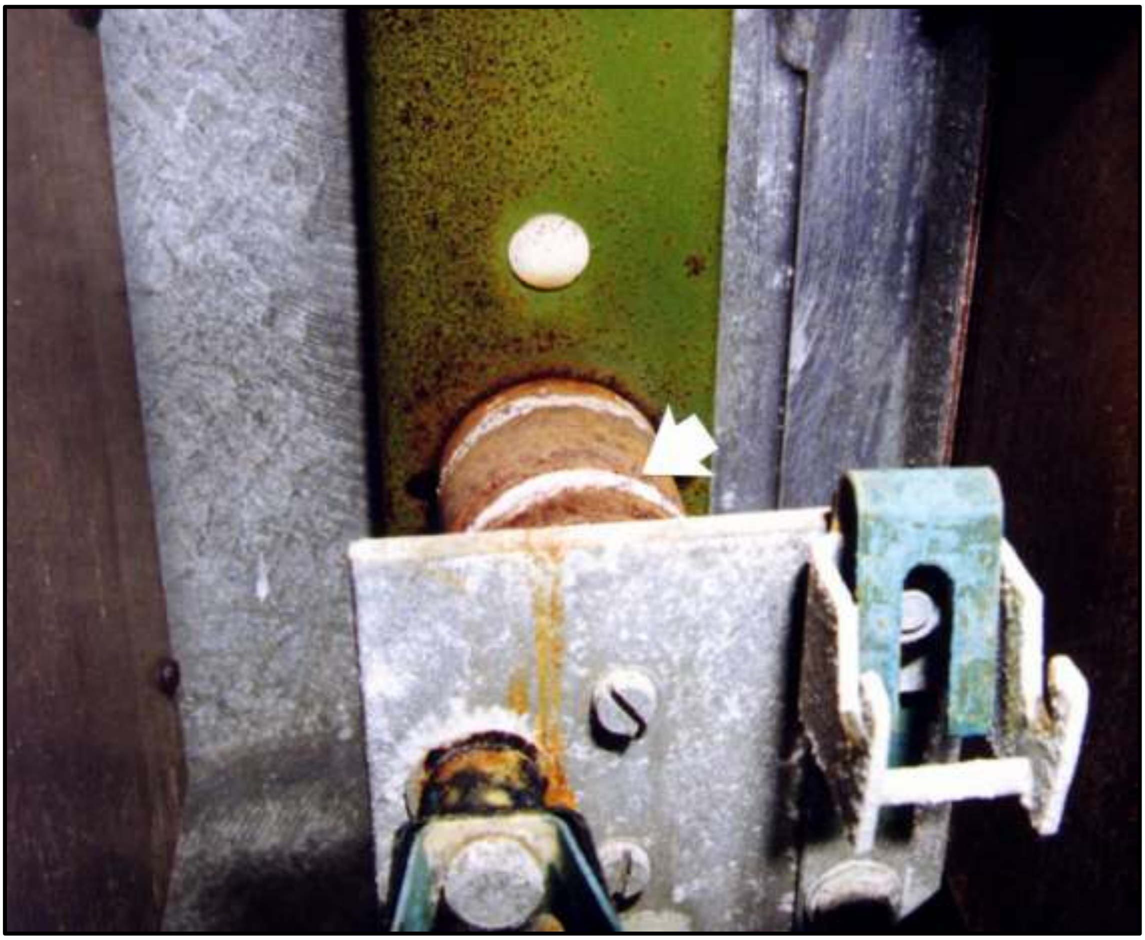
PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
CUBICLE BB REPLACEMENT

INSPECTION ITEMS

Tracking on plastic push rod. Looking from the front all that is visible is some etching and a little burning. In this case there was more damage as indicated in the bottom photograph.
Note damage to push rods.

The bottom of the piston assembly of the phase has been blown out as a result of water in the piston. This would be almost impossible to detect from a visual inspection, but evidence of burning around the bottom of the push rod could be used as **a key indicator of a flashover in the piston area.**

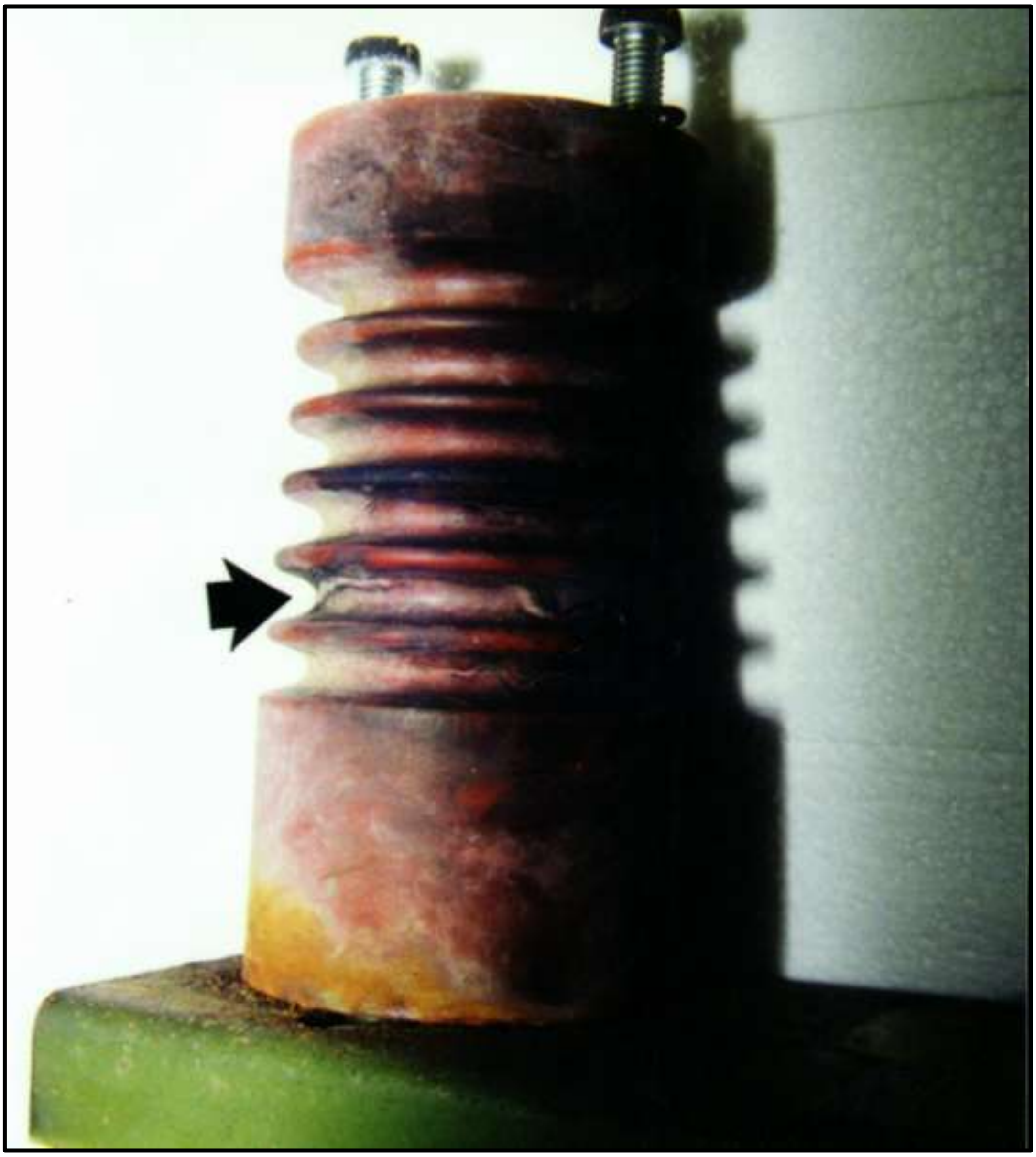


This photo is typical of P1 and fail cubicle for live operation

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
CUBICLE BB REPLACEMENT

Note the white bands indicating electrical stress and probable erosion of the epoxy insulator.
Note corrosion around base of insulator on metal mounting plate.



PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
CUBICLE BB REPLACEMENT

Photo shows dirty insulator that has flashed over.
Note tracking in the skirt area, second from bottom.

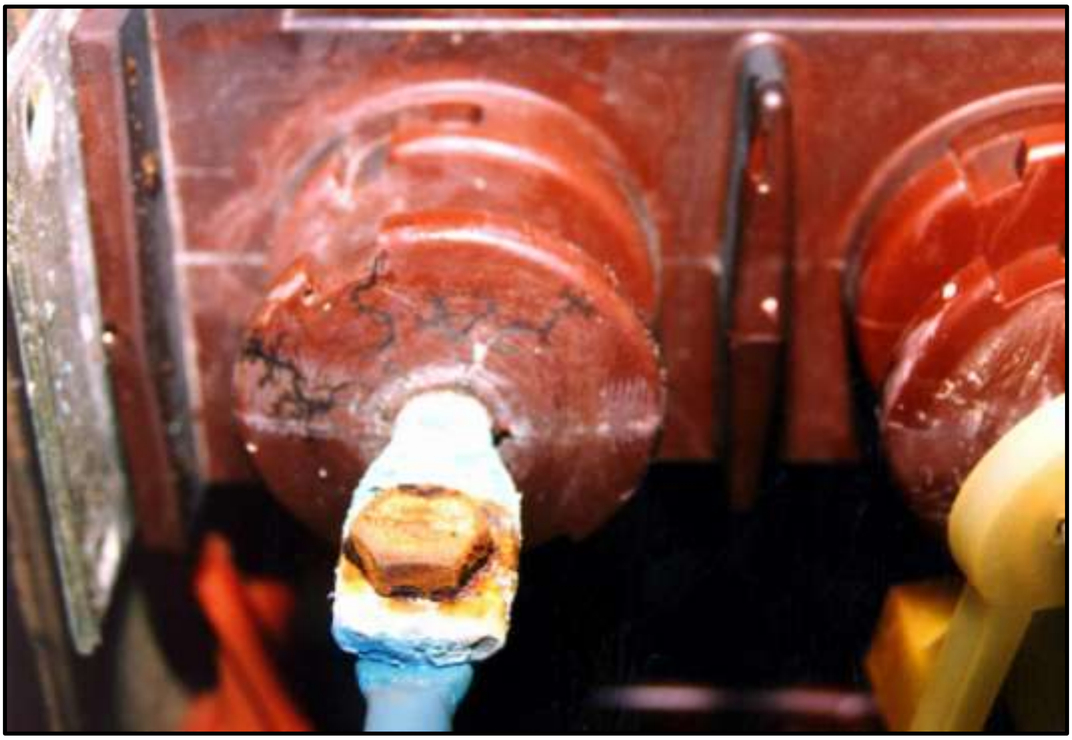
PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
URD CABLE DEFECT

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
URD CABLE DEFECT

8.5K OTHER – SWITCH, KRONE



PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

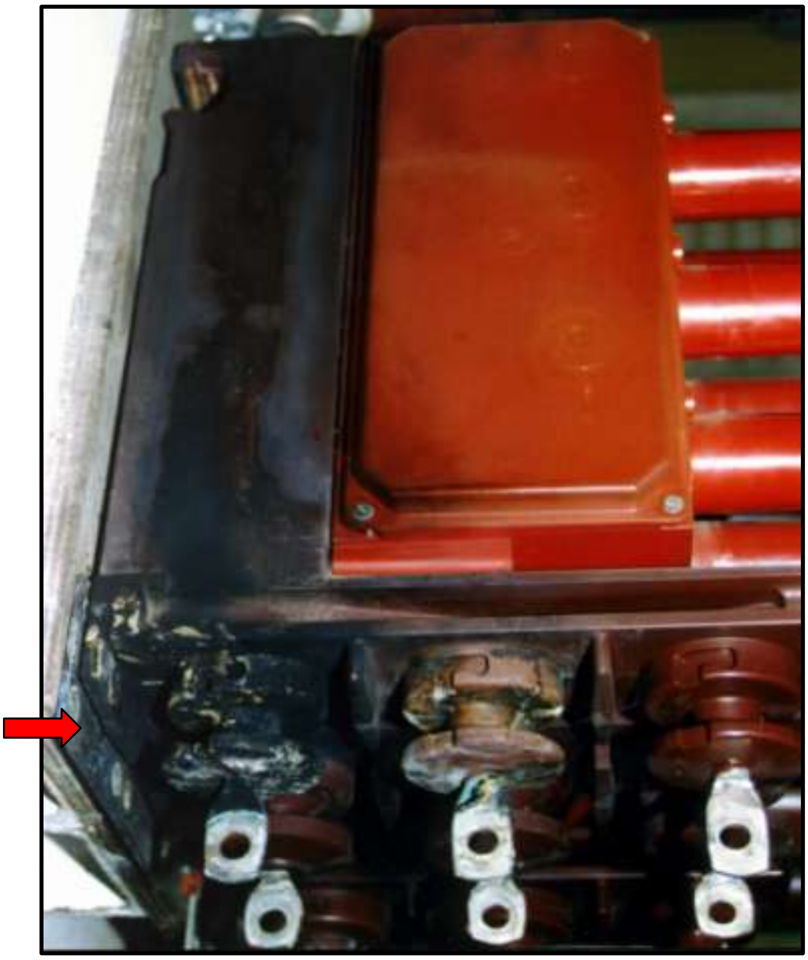
Quick Code:
CUBICLE KRONE REPLACEMENT

Tracking of the epoxy bushings.

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
CUBICLE KRONE REPLACEMENT

Bus bars connecting switch to fuse unit.
Note the upper bus has corrosion on the bolt and nut and the seal has changed to a rusty brown colour.
Lower bus bar and seal in good condition.



PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
CUBICLE KRONE REPLACEMENT

Damage caused by water running down epoxy body and into the bushings and cable terminations.

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

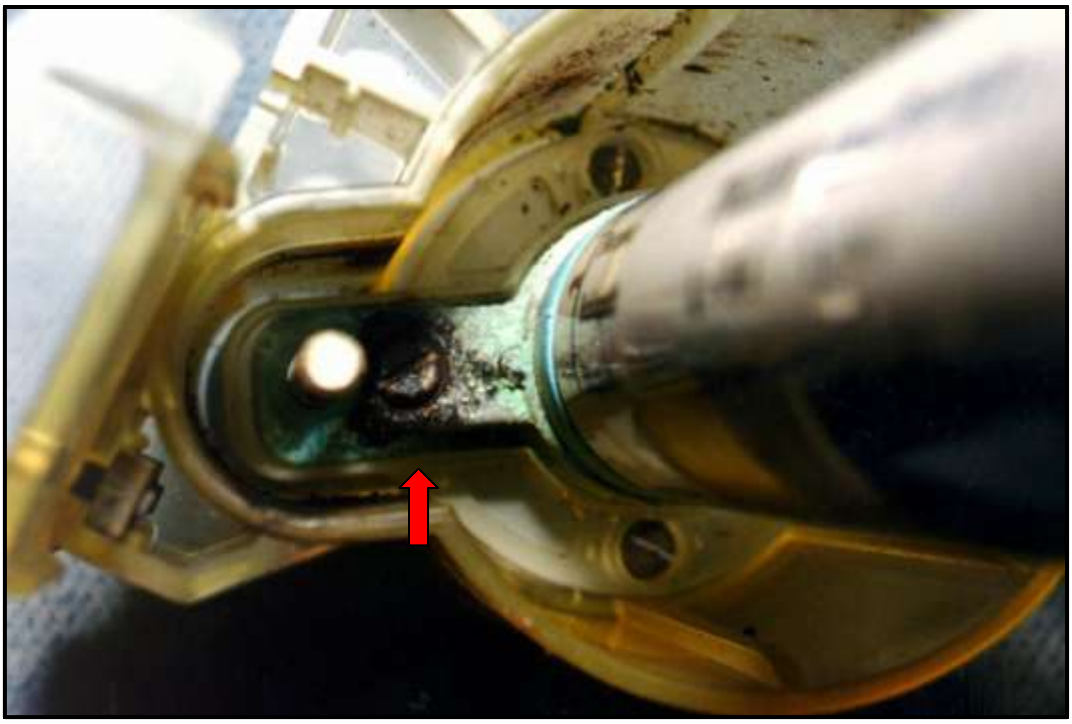
Quick Code:
CUBICLE KRONE REPLACEMENT

Tracking of the epoxy bushings.

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
CUBICLE KRONE REPLACEMENT

Evidence of 'armpit' tracking and corrosion inside fuse cap.
Fuse cap becoming discoloured.



PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
CUBICLE KRONE REPLACEMENT

Fuse Unit - the effect of 'armpit' tracking and condensation inside fuse cap.

8.6 OTHER – VAULT

PRIORITY B – 1 NBFRA
PRIORITY B – 1 H/BFRA

Quick Code:
VAULT REPLACEMENT

On Brown Boveri cubicles remove green tags from cubicle.

PRIORITY B – 1 NBFRA
PRIORITY B – 1 H/BFRA

Quick Code:
VAULT REPLACEMENT
VAULT REPAIR

Determine level of damage to choose appropriate Quick Code.

On Brown Boveri cubicles remove green tags from cubicle.

PRIORITY B – 1 NBFRA
PRIORITY B – 1 H/BFRA

Quick Code:
VAULT REPLACEMENT

PRIORITY B – 1 NBFRA
PRIORITY B – 1 H/BFRA

Quick Code:
VAULT REPAIR

PRIORITY B – 1 NBFRA
PRIORITY B – 1 H/BFRA

Quick Code:
VAULT REPAIR

PRIORITY B – 1 NBFRA
PRIORITY B – 1 H/BFRA

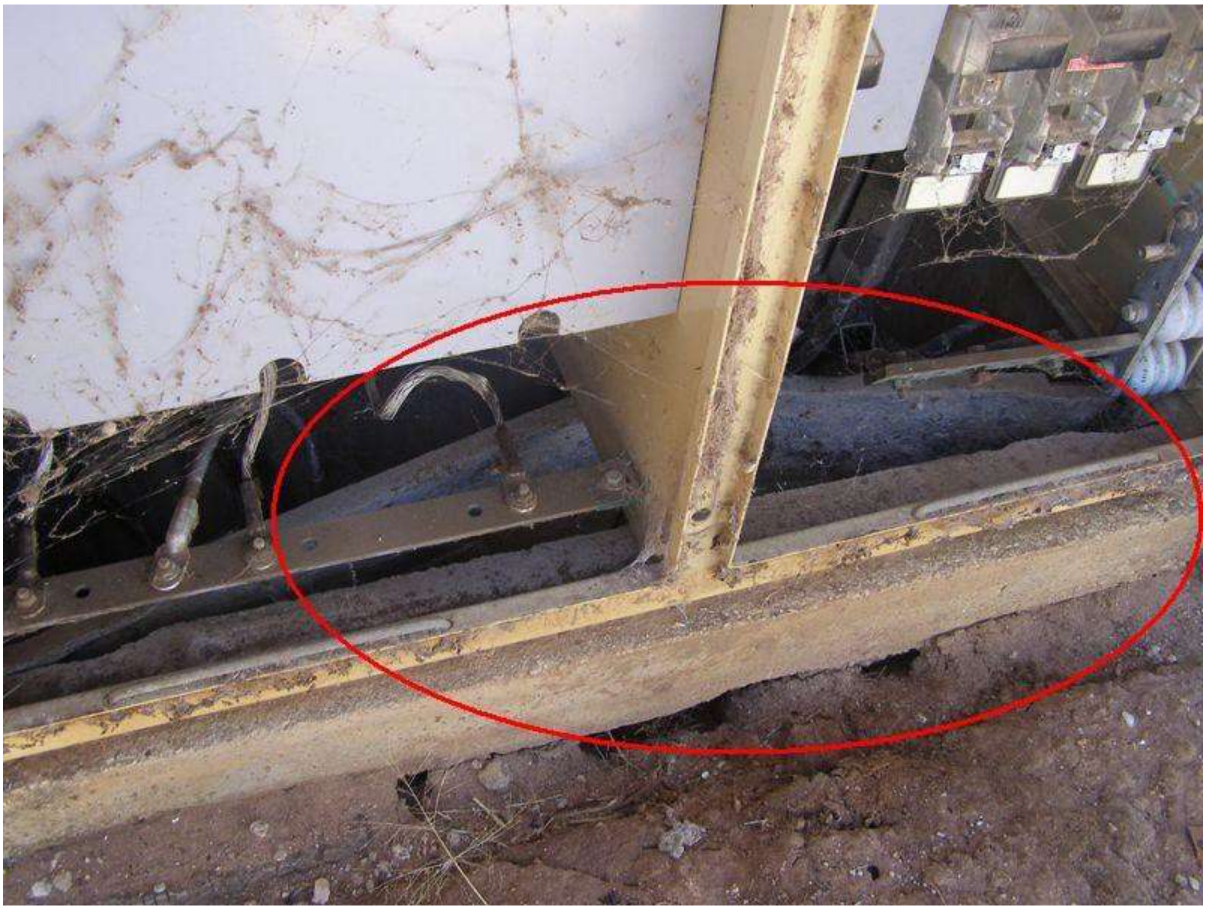
Quick Code:
VAULT REPLACEMENT

Example Padmount TF - View

PRIORITY B – 1 NBFRA
PRIORITY B – 1 H/BFRA

Quick Code:
VAULT REPLACEMENT

Example Padmount TF – Close Up In LV Compartment



PRIORITY B – 1 NBFRA
PRIORITY B – 1 H/BFRA

Quick Code:
VAULT REPLACEMENT

Example Padmount TF – Close Up Both Padmount Doors Open.

Vandalised equipment.

Report Graffiti direct to Risk & Insurance Branch (Greg Darling via email with address details & photos).

Vandalised equipment.

Report Graffiti direct to Risk & Insurance Branch (Greg Darling via email with address details & photos).

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
GL STATION BUILDING DEFECTS

When entering a Functional Location it will always populate default values, however for Property Services defects these require manual Planner Group & Work Centre changes within the drop down tables.
eg. = Planner Group **PSP** & Work Centre **WP-SUB-P**

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
GL STATION BUILDING DEFECTS

When entering a Functional Location it will always populate default values, however for Property Services defects these require manual Planner Group & Work Centre changes within the drop down tables.
eg. = Planner Group **PSP** & Work Centre **WP-SUB-P**

8.7 OTHER – TRANSFORMER

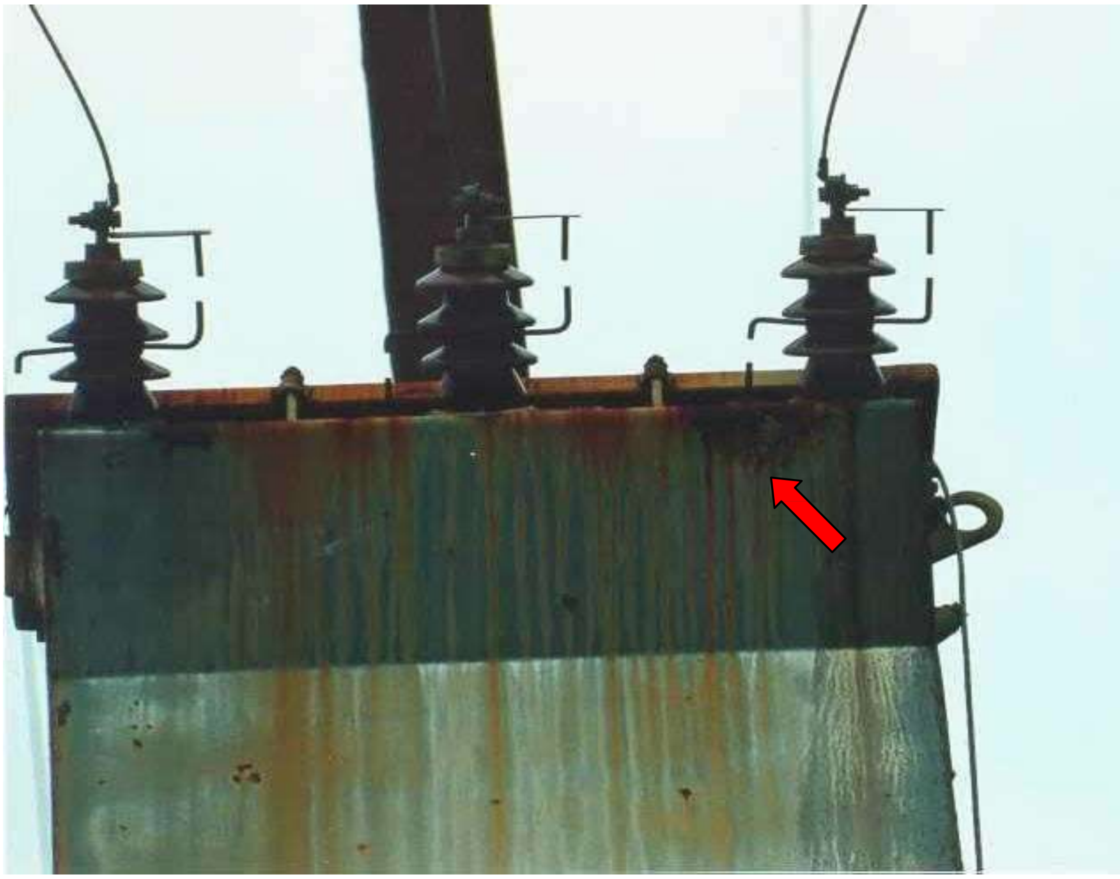
Example of Transformer Corrosion – Priority 1

Corroded Transformers – Severe – Priority B-2 (Identify severely corroded transformers for replacement due to potential for ingress of water).

Corroded Transformers – Minor/Moderate – Priority 3 (Identify transformers where rust has progressed beyond surface rust)

PRIORITY B – 3 NBFRA
PRIORITY B – 3 H/MBFRA

Quick Code:
TF REPLACEMENT



Example of Transformer Corrosion – Priority 1 (as rust has gone through and formed a hole). If no hole, then would be Priority 2.

PRIORITY B – 3 NBFRA
PRIORITY B – 3 H/MBFRA

Quick Code:
TF REPLACEMENT

Possible ingress of water.

Examples of Transformer Oil Leaks

PRIORITY B – 3 NBFRA
PRIORITY B – 3 H/MBFRA

As per LIM section 9.8 any TF with Fresh Oil Leaks where oil has leaked onto the ground or surrounding infrastructure need to be a P1 defect via MRV Selection. Rate of oil leak will increase the priority.

Priority 3 or higher = Transformers/Devices, leaking/weeping oil but not on the ground.

Quick Code:
TF REPLACEMENT

Standard Data Entry Requirement example Below

Replace TF, Clean Up Oil leak as per Environmental Policies & Procedures. Incident report lodged in SA Power Networks Cura Web Site – Environmental.

PRIORITY B – 1 NBFRA
PRIORITY B – 1 H/MBFRA

Quick Code:
TF OIL LEAK (repair on site)

When entering a Functional Location it will always populate default values, however for Sub Maintenance defects in GL stations require manual Planner Group & Work Centre changes within the drop down tables. eg = Planner Group SUB & Work Centre **WP- SUB-M**

Standard Data Entry Requirement example Below

Replace TF, Clean-Up Oil leak as per Environmental Policies & Procedures. Incident report lodged in SA Power Networks Cura Web Site Environmental.

Example of P1 – Oil on ground

PRIORITY B – 1 NBFRA
PRIORITY B – 1 H/MBFRA

As per LIM section 9.8 page 8 any TF with Fresh Oil Leaks where oil has leaked onto the ground or surrounding infrastructure need to be a P1 defect via MRV Selection.

Quick Code:
TF REPLACEMENT

Transformer leaking oil onto pad.

Note, cabinet doors also rusted.

Standard Data Entry Requirement example Below

Replace TF, Clean-Up Oil leak as per Environmental Policies & Procedures. Incident report lodged in SA Power Networks Cura Web Site – Environmental.

PRIORITY B – 1 NBFRA
PRIORITY B – 1 H/MBFRA

As per LIM section 9.8 any TF with Fresh Oil Leaks where oil has leaked onto the ground or surrounding infrastructure need to be a P1 defect via MRV Selection.

Quick Code:
TF REPLACEMENT
Transformer leaking oil onto pad.
Note: cabinet doors also rusted.

Standard Data Entry Requirements Example Below.

Minimum 3 x Photos Required

1x PhotoView of Leaking Pad Mount
1 x PhotoLV/HV Configuration
1 x Photo I.D. Plate Inside Cabinet/Cubicle

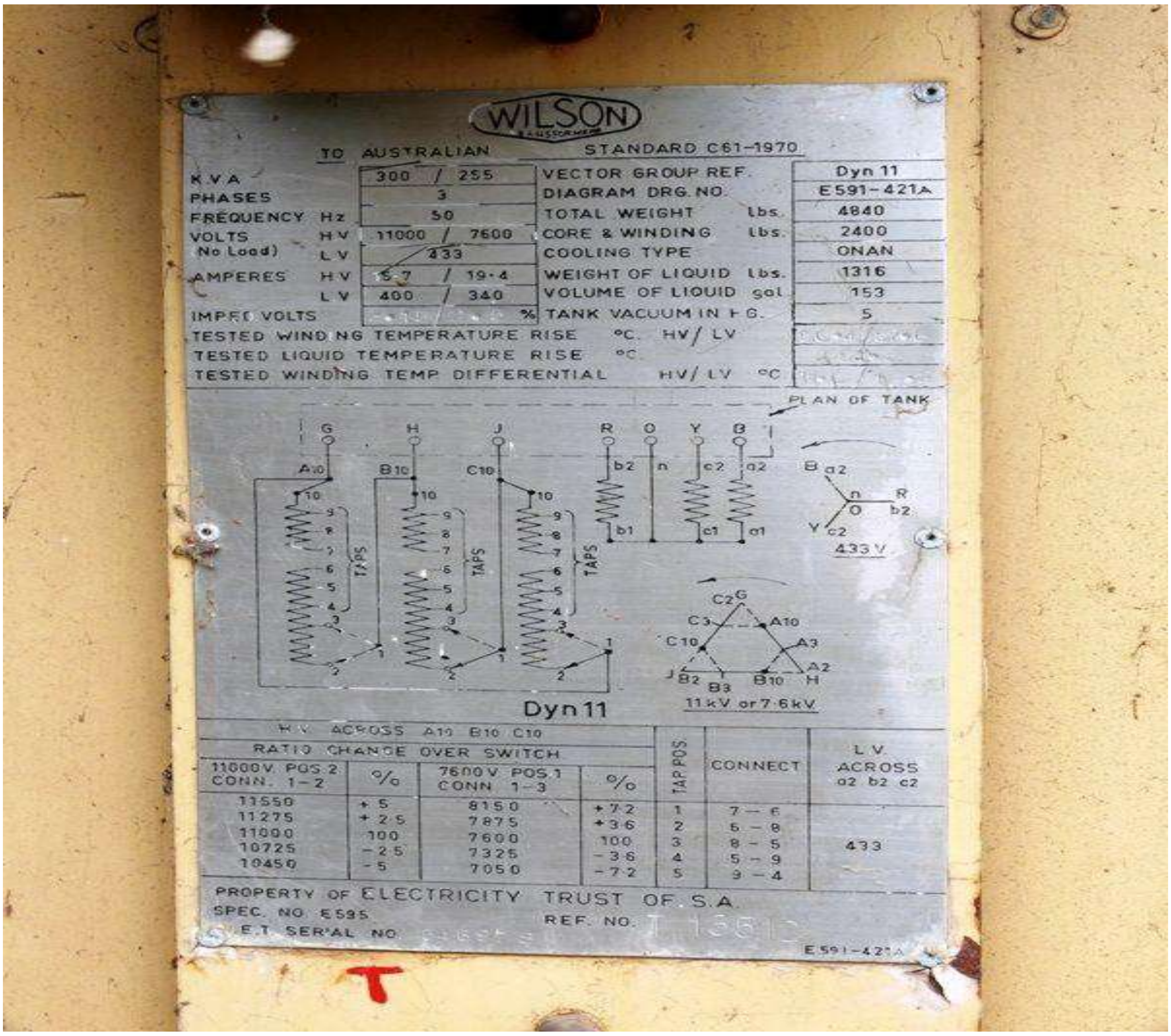
Replace TF, Clean-Up Oil leak as per Environmental Policies & Procedures. Incident report lodged in SA Power Networks Cura Web Site – Environmental.

Standard Data Entry Requirements Example Below.

Minimum 3 x Photos Required

1x PhotoView of Leaking Pad Mount
1 x PhotoLV/HV Configuration
1 x Photo I.D. Plate Inside Cabinet/Cubicle

Replace TF, Clean-Up Oil leak as per Environmental Policies & Procedures. Incident report lodged in SA Power Networks Cura Web Site – Environmental.



Standard Data Entry Requirements Example Below.

Minimum 3 x Photos Required

1x PhotoView of Leaking Pad Mount
1 x PhotoLV/HV Configuration
1 x Photo I.D. Plate Inside Cabinet/Cubicle

Replace TF, Clean-Up Oil leak as per Environmental Policies & Procedures. Incident report lodged in SA Power Networks Cura Web Site – Environmental.

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/MBFRA

Quick Code:
TF URD REPLACEMENT

Higher priority to be given where conductive material could be inserted into cabinet onto Energised equipment. If in a built up area, consideration should also be given to safety due to shape edges etc.

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/MBFRA

Quick Code:
TF URD REPLACEMENT

Higher priority to be given where conductive material could be inserted into cabinet onto Energised equipment.
If in a built up area, consideration should also be given to safety due to shape edges etc.

Standard Data Entry Requirements Example Below.

Minimum 3 x Photos Required

1x PhotoView of Rusty/Damaged Pad Mount
1 x PhotoLV/HV Configuration
1 x Photo I.D. Plate Inside Cabinet/Cubicle

Examples of 11kV/7.6kV/33kV TFs warning signs.

PRIORITY 2 – 3 NBFRA

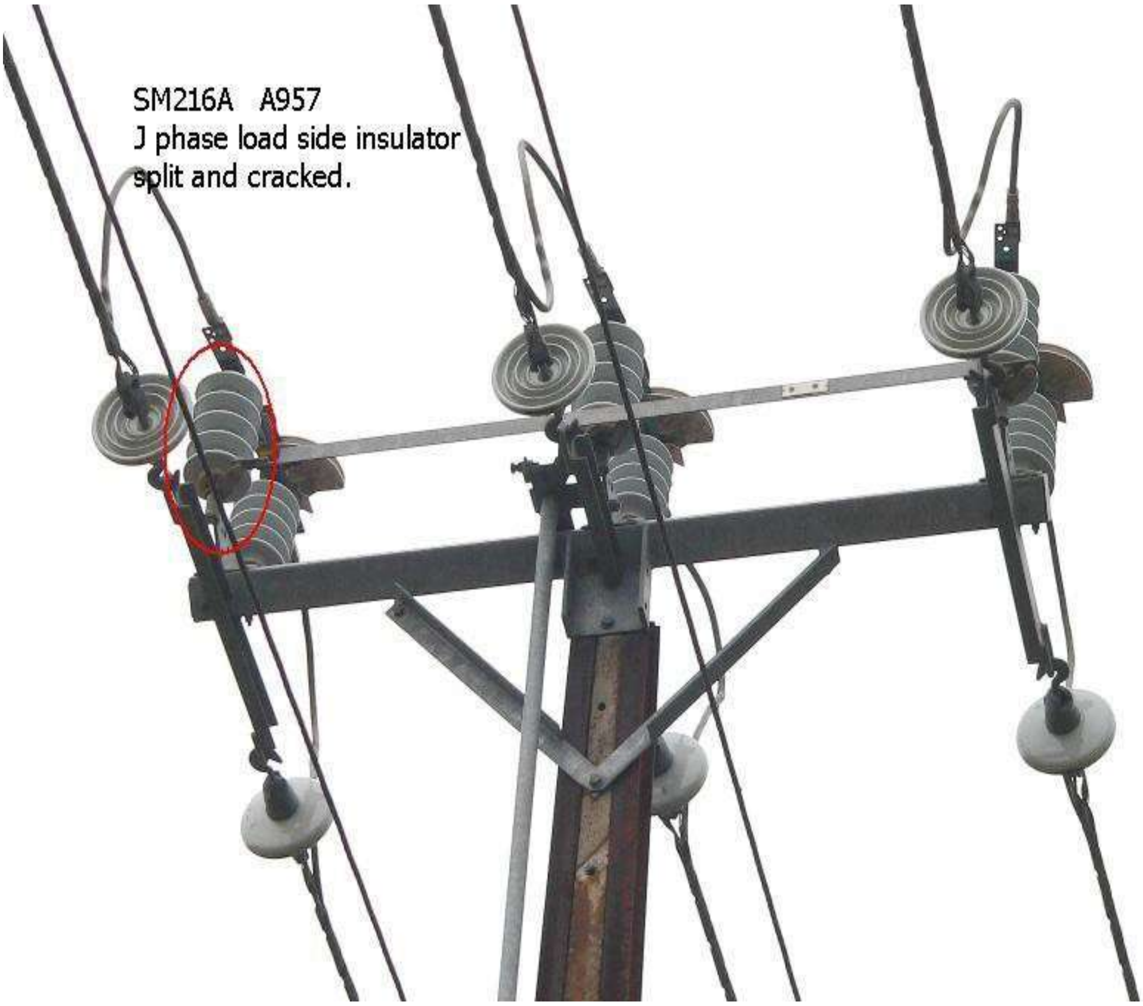
PRIORITY 2 – 3 H/MBFRA

If missing or illegible in MEN Area, raise defect 'Earthing Warning Sign Required', refer E1453.

8.8 OTHER – LSDF / AIRBREAKS

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

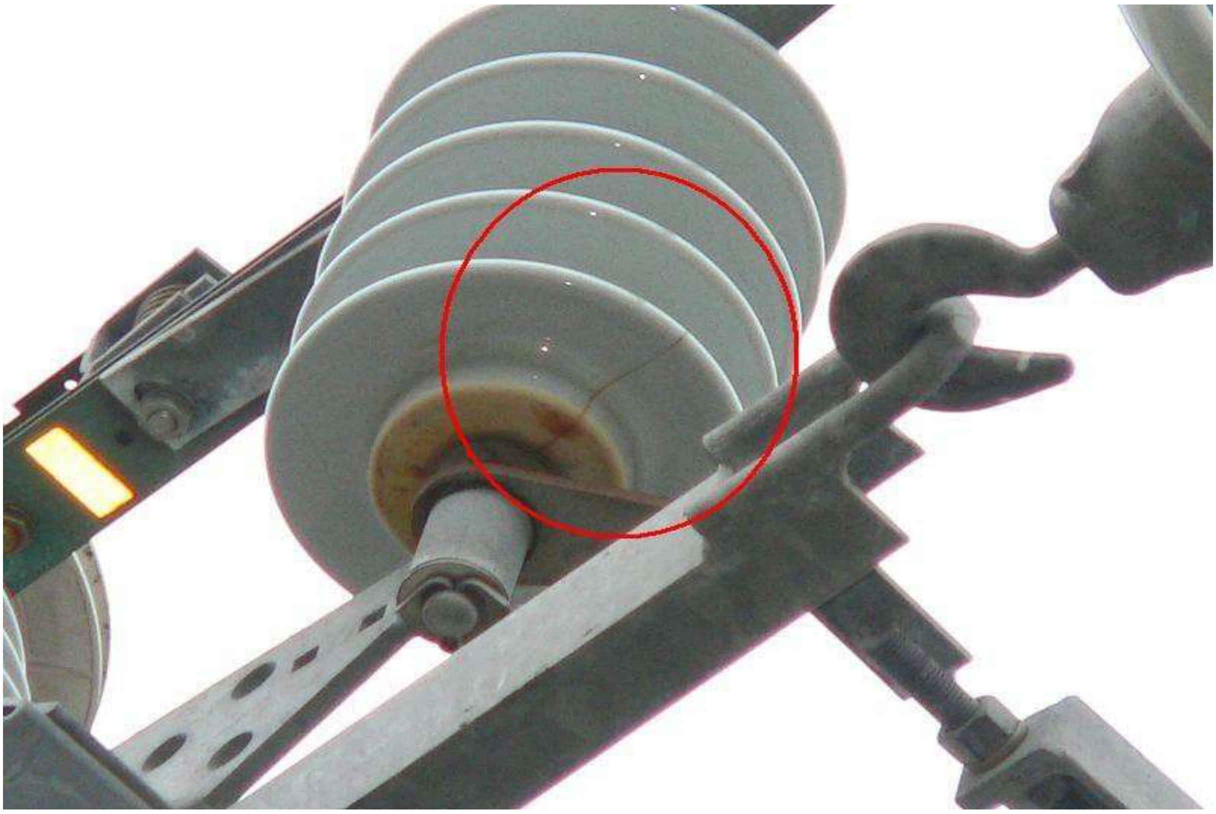
Quick Code:
LSDF DAMAGED



PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
A/BREAK OR L/SWITCH DAMAGED

Overall View of defect **construction.**



PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

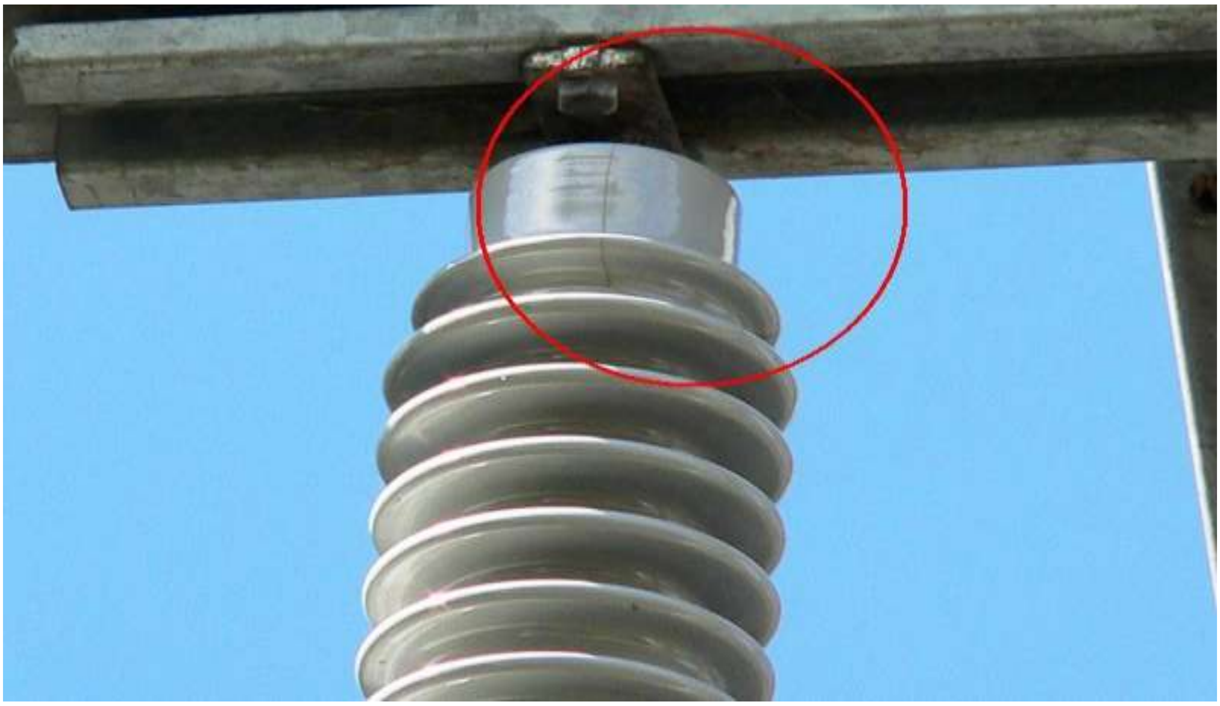
Quick Code:
A/BREAK OR L/SWITCH DAMAGED

Close-up view of defect / Cracked Insulator.

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
A/BREAK OR L/SWITCH DAMAGED

View of Cracked Insulator On Switch.



PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
A/BREAK OR L/SWITCH DAMAGED

Close Up view of Cracked Insulator On Switch.

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
A/BREAK OR L/SWITCH DAMAGED

Close-Up view of Cracked Insulator On Switch.

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
DF/ FUSE BASE DAMAGED

Close-Up view of DF Base Not Fully Closed At Blade Contact.

Consider Calling into NOC Switch To Be Closed By Linesman.
Consider Thermography Request.
Check for Signs of Visual Damage.

PRIORITY B – 2 NBFRA
PRIORITY B – 2 H/BFRA

Quick Code:
DF/ FUSE BASE DAMAGED

Close-Up view of DF Base Not Fully Closed At Blade Contact.

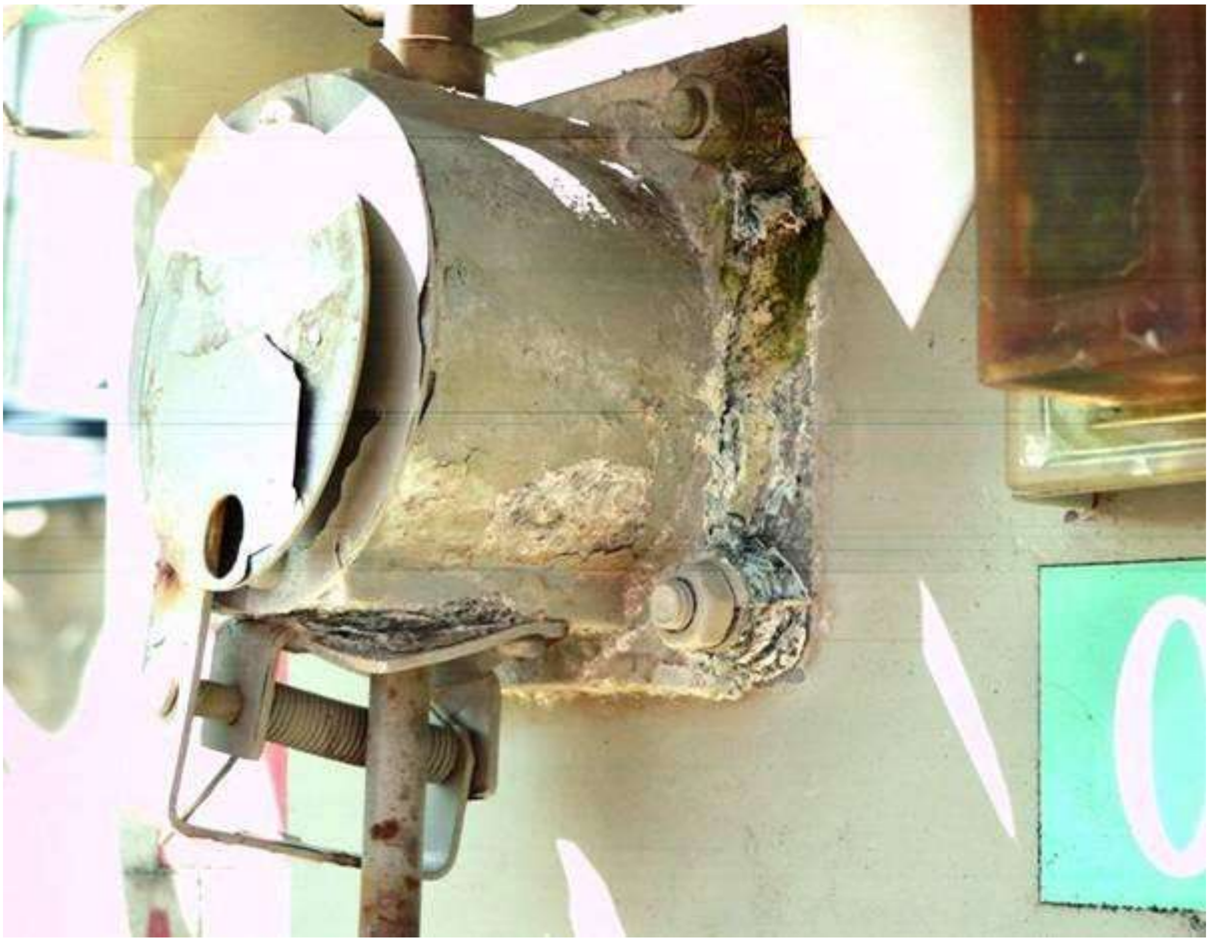
Consider Calling into NOC Switch To Be Closed By Linesman.
Consider Thermography Request.
Check for Signs of Visual Damage.

AK Power Iljin enclosed 33kv Switches have been found to have corrosion surrounding the metal gas plug which is made of a different metal to the switch body.

Example of P3 – condition monitoring required.

PRIORITY B – 3 NBFRA
PRIORITY 1 – 3 H/BFRA
Quick Code:

A/BREAK OR L/SWITCH DAMAGED



Example of Priority Breakdown as the gas will have dispersed (failed unit).

PRIORITY B – 3 NBFRA
PRIORITY B – 3 H/BFRA

Quick Code:

A/BREAK OR L/SWITCH DAMAGED

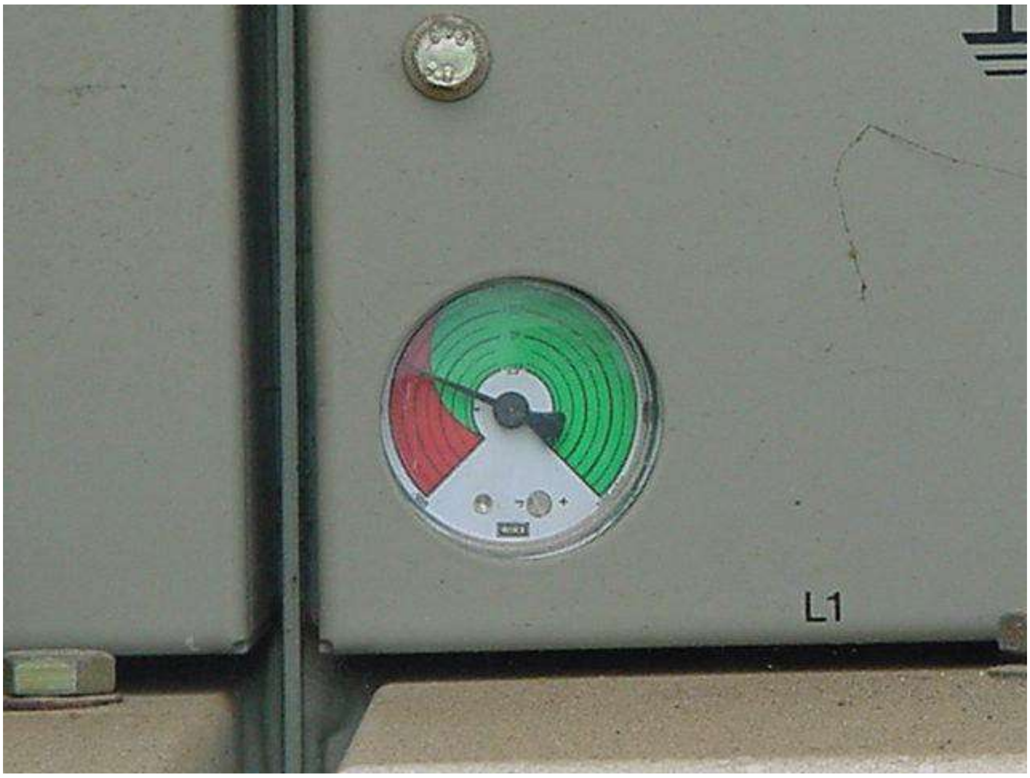
Example of P1 due to significant cracked housing.

PRIORITY B – 3 NBFRA
PRIORITY B – 3 H/BFRA

Quick Code:

A/BREAK OR L/SWITCH DAMAGED

8.9 OTHER – SF_6 GAS



PRIORITY 1 NBFRA
PRIORITY 1 H/MBFRA

Quick Code:
CUBICLE (MINOR REPAIRS)

The attached digital photo is of an SF_6 gas gauge showing the current gas level. If the gas indicator needle is in the red range for the current ambient temperature, it should be considered as low gas pressure and defect raised.

Standard Data Entry Requirements Example Below.

Minimum 4 x Photos Required

1 x PhotoView Cubicle.
1 x Photo Close Up Of Gas Guage.
1 x Photo HV Configuration.
1 x Photo I.D. Plate Inside Cabinet/Cubicle

Standard Data Entry Requirements Example Below.

Minimum 4 x Photos Required

1 x PhotoView Cubicle.
1 x Photo Close Up Of Gas Guage.
1 x Photo HV Configuration.
1 x Photo I.D. Plate Inside Cabinet/Cubicle

9. MISCELLANEOUS

Contents

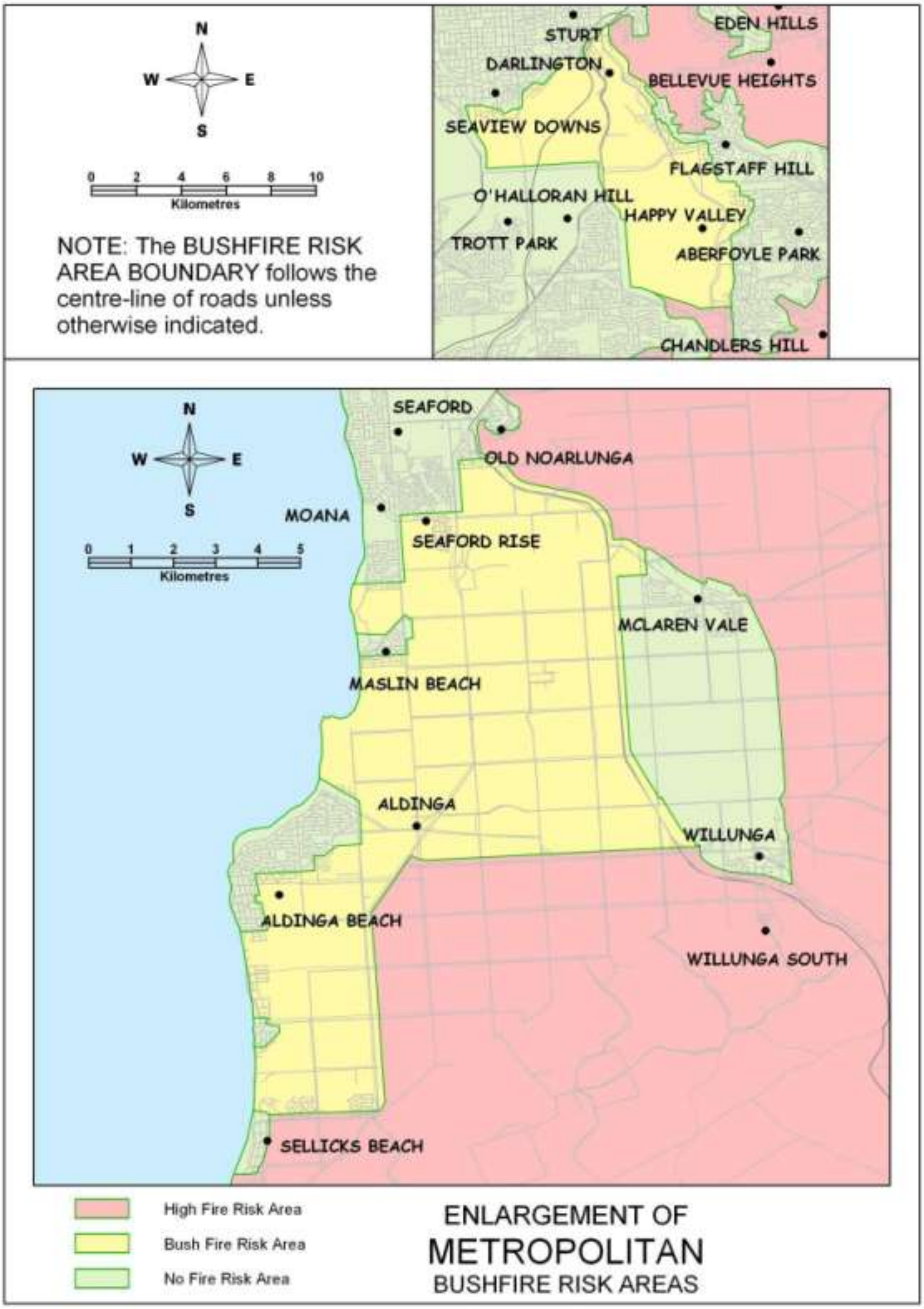
9.1 MISCELLANEOUS – BUSHFIRE RISK AREA MAPS

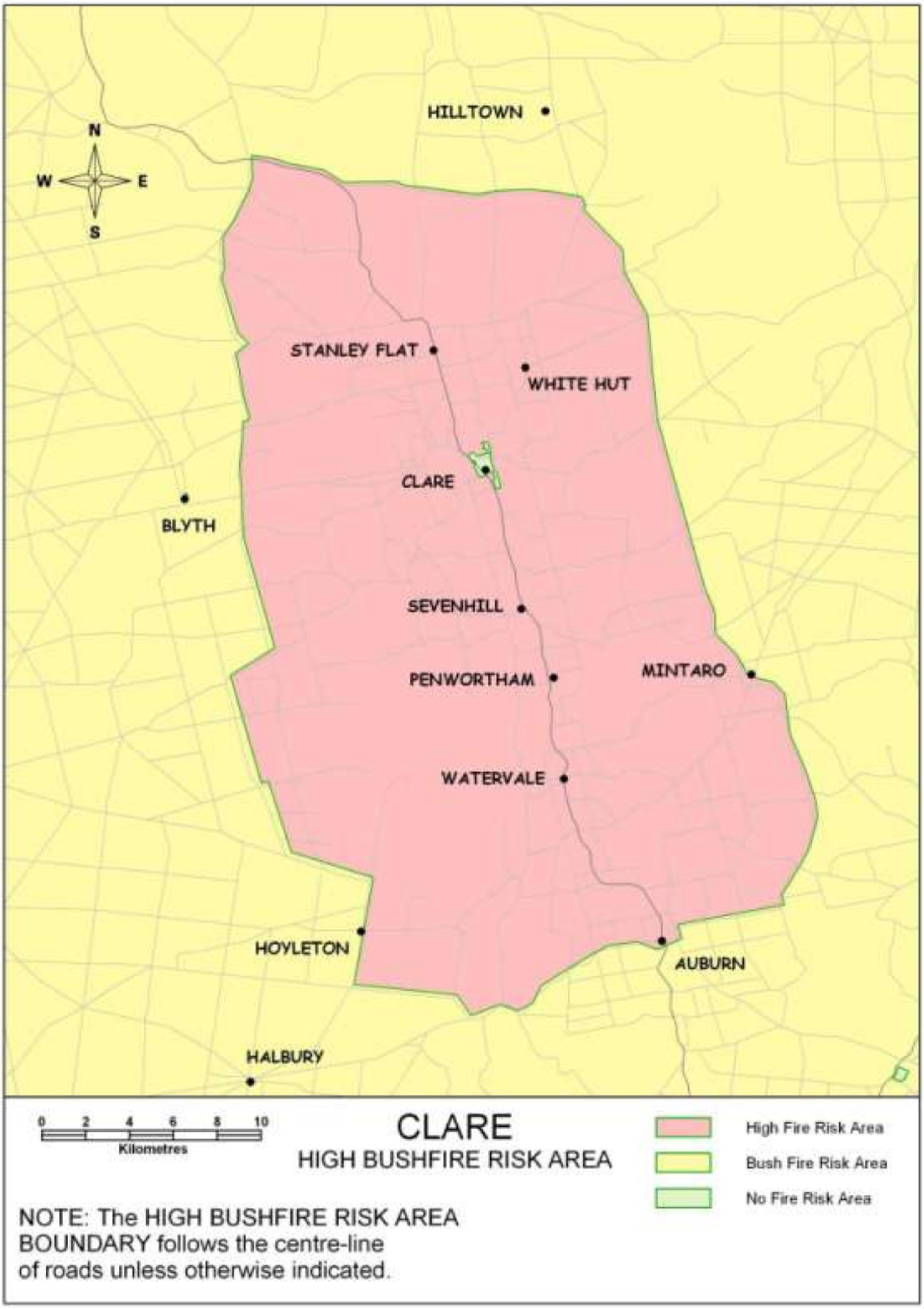
Maps for the following regions are included to define the areas covered by the definition of High Bush Fire Risk Area and Bush Fire Risk Area.

Page

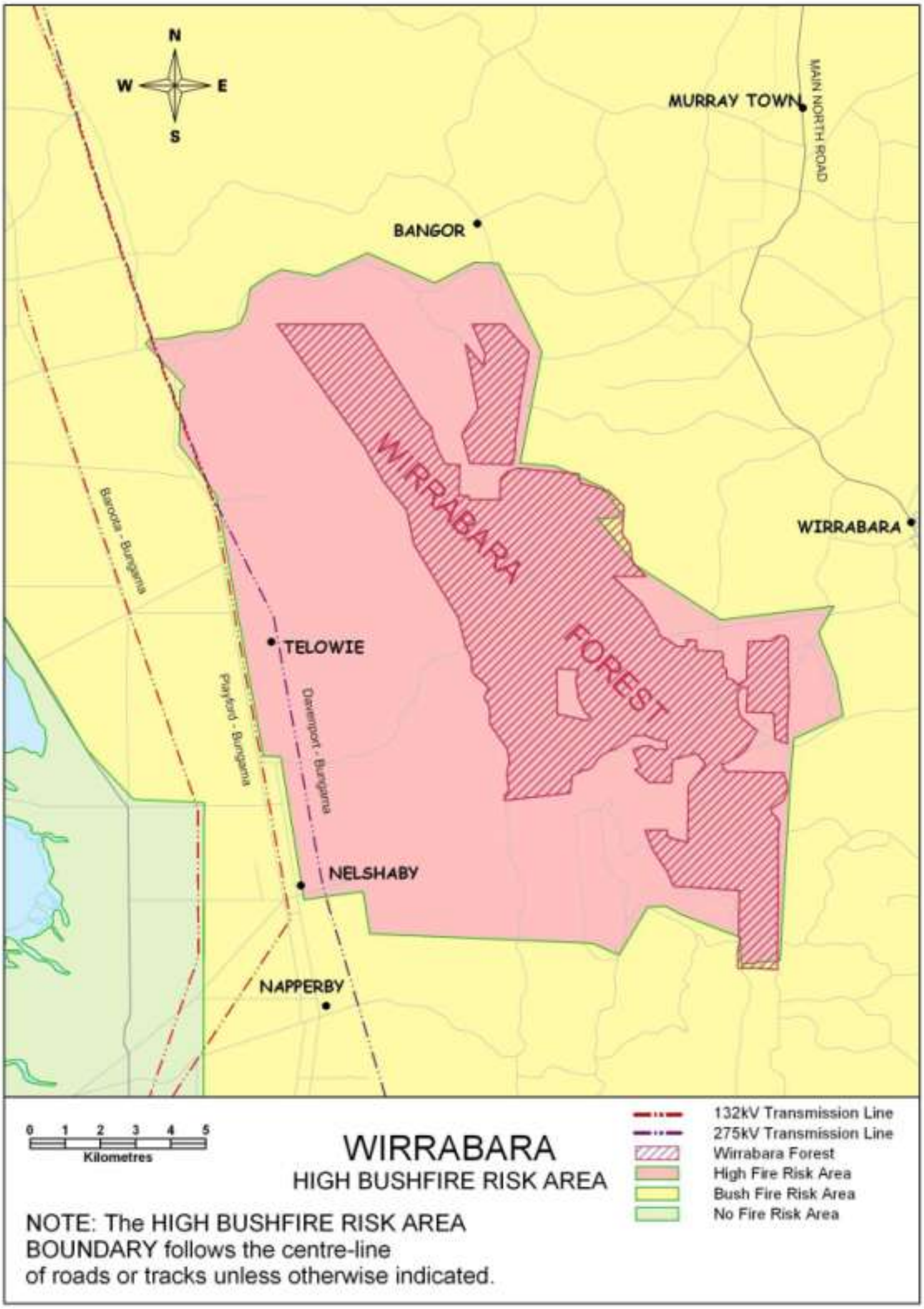

N
W
E
S
NORTH WEST PASTORAL
NORTH EAST PASTORAL
FLINDERS
WEST COAST
EASTERN EYRE
MID NORTH
LOWER EYRE
RIVERLAND
MURRAYLANDS
YORKE PENINSULA
KANGAROO ISLAND
UPPER SOUTH EAST
LOWER SOUTH EAST
0 50 100 150 200 250
Kilometres
SA Power Networks Depot Locations
Bureau of Meteorology Wind Monitoring Sites
Field Services Contract Supervisor Boundaries
CFS Fire Ban Districts
High Fire Risk Area
Bush Fire Risk Area
No Fire Risk Area
PORTION OF
SOUTH AUSTRALIA
SHOWING BUSHFIRE RISK AREAS,
FIRE BAN DISTRICTS & SA Power
Networks DEPOTS


TARLEE
HAMLEY BRIDGE
KAPUNDA
N
W
E
S
DUBLIN
MALLALA
FREELING
NURIOOTPA
TRURO
WASLEYS
GREENOCK
ANGASTON
ROSEWORTHY
TANUNDA
TWO WELLS
GAWLER
LYNDOCH
VIRGINIA
WILLIAMSTOWN
ELIZABETH
BIRDWOOD
PALMER
ADELAIDE
LOBETHAL
WOODSIDE
HAHNDORF
LITTLEHAMPTON
See ENLARGEMENT MAP
for finer detail
ECHUNGA
CALLINGTON
MEADOWS
STRATHALBYN
MYPONGA
FINNISS
MILANG
CURRENCY CREEK
YANKALILLA
NARRUNG
RAPID BAY
VICTOR HARBOR
GOOLWA
CAPE JERVIS
0 5 10 15 20 25
Kilometres
ADELAIDE HILLS
HIGH BUSHFIRE RISK AREA
High Fire Risk Area
Bush Fire Risk Area
No Fire Risk Area
Field Services Contract Supervisor Boundaries
NOTE: The HIGH BUSHFIRE RISK AREA BOUNDARY follows the centre-line of roads unless otherwise indicated.


N
W
E
S
0 2 4 6 8 10
Kilometres
NOTE: The BUSHFIRE RISK AREA BOUNDARY follows the centre-line of roads unless otherwise indicated.
STURT
EDEN HILLS
DARLINGTON
BELLEVUE HEIGHTS
SEAVIEW DOWNS
FLAGSTAFF HILL
O'HALLORAN HILL
HAPPY VALLEY
TROTT PARK
ABERFOYLE PARK
CHANDLERS HILL
N
W
E
S
0 1 2 3 4 5
Kilometres
SEAFORD
OLD NOARLUNGA
MOANA
SEAFORD RISE
MCLAREN VALE
MASLIN BEACH
ALDINGA
WILLUNGA
ALDINGA BEACH
WILLUNGA SOUTH
SELLICKS BEACH
High Fire Risk Area
Bush Fire Risk Area
No Fire Risk Area
ENLARGEMENT OF
METROPOLITAN
BUSHFIRE RISK AREAS


HILLTOWN
N
W
E
S
STANLEY FLAT
WHITE HUT
CLARE
BLYTH
SEVENHILL
PENWORTHAM
MINTARO
WATERVALE
HOYLETON
AUBURN
HALBURY
0 2 4 6 8 10
Kilometres
CLARE
HIGH BUSHFIRE RISK AREA
High Fire Risk Area
Bush Fire Risk Area
No Fire Risk Area
NOTE: The HIGH BUSHFIRE RISK AREA BOUNDARY follows the centre-line of roads unless otherwise indicated.


N
W
E
S
KEITH
BORDERTOWN
NARACOORTE ROAD
PADTHAWAY
WIMMERA HIGHWAY
NARACOORTE
HYNAM
LUCINDALE
RIDDOCH HIGHWAY
PRINCES HIGHWAY
ROBE
COONAWARRA
PENOLA
BEACHPORT
MOUNT BURR
NANGWARRY
MILLICENT
DONOVANS
0 10 20 30 40 50
Kilometres
SOUTH EAST
HIGH BUSHFIRE RISK AREA
High Fire Risk Area
Bush Fire Risk Area
No Fire Risk Area
NOTE: The HIGH BUSHFIRE RISK AREA BOUNDARY follows the centre-line of roads unless otherwise indicated.


N
S
W
E
MURRAY TOWN
MAIN NORTH ROAD
BANGOR
WIRRABARA FOREST
WIRRABARA
TELOWIE
NELSHABY
NAPPERBY
Baroota - Bungama
Playford - Bungama
Davenport - Bungama
0 1 2 3 4 5
Kilometres
WIRRABARA
HIGH BUSHFIRE RISK AREA
NOTE: The HIGH BUSHFIRE RISK AREA BOUNDARY follows the centre-line of roads or tracks unless otherwise indicated.
132kV Transmission Line
275kV Transmission Line
Wirrabara Forest
High Fire Risk Area
Bush Fire Risk Area
No Fire Risk Area

9.2 MISCELLANEOUS – CORROSION AREA MAPS

9.3 MISCELLANEOUS – OBJECT, PROBLEM AND CAUSE CODES

9.3.1 Object Codes

Code Group	Description	Code	Description
OBACCESS	**Access**		
		O200	Access, Fences
		O201	Access, Gates
		O202	Access, Locks
		O203	Access, Roads
OBCOND	**Conductor**		
		O210	Conductor, Underground, XPLE
		O211	Conductor, Underground, PLY
		O212	Conductor Attachments, Spacers
		O213	Conductor Attachments, Taps
		O214	Conductor Attachments, Seizing clamps
		O215	Conductor Attachments, Tie wires
		O216	Conductor Attachments, Connectors
		O217	Conductor Attachments, Vibration dampers
		O218	Conductor Attachments, Bird diverter
		O219	Conductor Attachments, Armour rod
		O220	Conductor Attachments, Line Joint
		O221	Conductor Attachments, Grips
		O222	Conductor Attachments, Strain clamps
		O223	Conductor Attachments, Suspension Clamps
		O224	Conductor, Overhead, ABC
		O225	Conductor, Overhead, IUC
		O226	Conductor, Overhead, Covered
		O227	Conductor, Overhead, Bare
		O228	Cable Oil insulated
		O229	Cable Connection
OBCUST	**Customer**		
		0370	Customer service fuse (operated)
		0371	Customer installation
		0372	Customer installation upgrade / repair
		0373	Customer reconnection upgrade / repairer
OBEARTH	**Earth**		
		O240	Earthing System, , CMEN
		O241	Earthing System, , Earth Stake
		O242	Earthing System, , MEN
		O243	Earthing System, , O/H Earth Wire
		O244	Earthing System, , SWER earth
		O245	Earthing System, , Bond
OBINSUL	**Insulator**		
		O250	Bushings
		O251	Bushing covers

		O252	Insulator, Socket tongue
		O253	Insulator, Hook
		O254	Insulator, Bow shackle
		O255	Insulator, CLAH
		O256	Insulator, Air Gap
		O257	Insulator, Extension link
		O258	Insulator, Clevice pin
		O259	Insulator, Disc
		O260	Insulator, Pin
		O261	Insulator, Polymer
		O262	Insulator, Post
		O263	Insulator Shackle
OBOTHER	**Other**		
		O270	Ducts
		O271	Vegetation
		O272	Transformer Oil
		O273	LSDF
		O274	Air break switch (Isolator)
		O275	DF
		O276	HV Fuse
		O277	LV Isolator
		O278	LV Fuse (Transformer)
		O279	Vault
		O280	Cubicle
		O281	Transformer SMALL
		O282	TRANSFORMER LARGE
		O283	Operation Counter
		O284	Manholes
		O285	SA Power Networks pilot Cables
		O286	***DO NOT USE**** Ref O371
		O287	Dist Capacitor Bank
		O288	Barrier Safety
		O289	Boards
		O290	Switchgear
		O291	Fire Extinguisher
OBPL	**Public Lighting**		
		O300	Public Lighting, Control
		O301	Public Lighting, Column,
		O302	Public Lighting, Luminaire
		O303	Public Lighting, Lamp, Fluorescent
		O304	Public Lighting, Lamp, Incandescent
		O305	Public Lighting, Lamp, Mercury
		O306	Public Lighting, Lamp, Sodium - HP
		O307	Public Lighting, Lamp, Sodium - LP
		O308	Public Lighting, Mounting Bracket,
OBSERV	**Service**		
		O320	Serv Equip, Attachment,

		O321	Serv Equip, Conductor, Neutral screened
		O322	Serv Equip, Conductor, Open Wire
		O323	Serv Equip, Conductor, ABC
		O324	Serv Equip, Fuse Box
		O325	Serv Equip, Junction Pit,
		O326	Serv Equip, Metering Equipment,
		O327	Serv Equip, Over / Under
		O328	Serv Equip, P.T.J.B,
		O329	Serv Equip, Pit / Pillar,
		O330	Serv Equip, Pit Cover,
OBSIGN	**Signage**		
		O340	Aircraft Warning, Light
		O341	Aircraft Warning, Marker
		O342	Numbering / Signage, Device
		O343	Numbering / Signage, Feeder Plan
		O344	Numbering / Signage, Structure
		O345	Numbering / Signage, Warning
OBSUPPT	**Supports**		
		O350	BLACK STRAPS
		O351	Footing
		O352	Pole, Angle / Terminal / Tee-off
		O353	Pole, Line,
		O354	Pole, Stub
		O355	Pole, Service,
		O356	Supports
		O357	Tower
		O358	Cable guard
		O359	Trident
		O360	Stay
		O361	Extension piece
		O362	Tank
		O363	Crossarm, Line,
		O364	Crossarm, Terminal/Brace,
		O365	Crossarm, Angle
		O366	Pole Attachment

9.3.2 Problem Codes

Code Group	Descrip.	Code	Description
DACONDTN	**Condition**		
		P001	CONTAMINATED OIL
		P002	DARK LIQUID
		P003	GASING
		P004	LEAKING
		P005	LOW FLUID LEVEL
		P006	LOW GAS PRESSURE
		P007	LOW OIL LEVEL
		P008	CORRODED <50%
		P009	CORRODED >50%
		P010	SEIZED
		P011	SPRING DISCHARGED
		P012	SPRING NOT CHARGED
		P013	WORN / ABRADED
		P014	FLASHED OVER
		P015	ERODED
		P016	POLLUTION
DACUSDAM	**Customer Related Damage**		
		P020	HOT WATER COLD
		P021	HOT WATER RUNNING OUT
		P022	J COLD
		P023	J MISCELLANEOUS
		P024	J TS STOPPED
		P025	Miscellaneous for MAXPCI Transfer
DACUSTNS	**Customer No Supply**		
		P030	N/S COMMERCIAL
		P031	N/S COMMERCIAL PART
		P032	N/S CROTCH JOINT Failed
		P033	N/S DOMESTIC
		P034	N/S DOMESTIC PART
DADESIGN	**Design**		
		P040	MISSING
		P041	NON STANDARD OR UNSUITABLE ARRANGEMENT
		P042	NON STANDARD PHASING
DAELECT	**Electrical**		
		P050	DISCHARGE GAP NOT PROPERLY SET
		P051	EARTH LEAKAGE
		P052	HIGH THERMAL IMAGE
		P053	INADEQUATE CLEARANCE
		P054	LEAKAGE CURRENT
		P055	LOW VOLTS
		P056	NO AC SUPPLY
		P057	NO DC SUPPLY
		P058	OPEN CIRCUIT
		P059	OVERHEATING

		P060	PHASE TO PHASE
		P061	PITTED CONTACTS
		P062	RESISTANCE HIGH
		P063	RESISTANCE LOW
		P064	TEST SIGNAL FAIL
		P065	TRACKING
		P066	OUT OF STEP
DAGENERL	**General**		
		P070	BROKEN
		P071	FAILED CHECK LIST INSPECTION
		P072	FAILED EARTH RESISTANCE TEST
		P073	FAILURE
		P074	GRAFFITI
		P075	ILLEGIBLE
		P076	INADEQUATE
		P077	INCORRECT / NO ALARM
		P078	INCORRECT / NO INDICATION
		P079	INCORRECT OPERATION
		P080	MAL OPERATION
		P081	OPERATION AT SUBSTATION
		P082	REDUNDANT
DAINTER	**Interruption**		
		P090	CABLE FAULT
		P091	CONDUCTOR BIRD CAGING
		P092	CONDUCTOR CLASHING
		P093	CONDUCTOR CONTACT WITH TREE
		P094	CONDUCTOR CONTACT WITH GROUND
		P095	CONDUCTOR CONTACT WITH CROSSARM
		P096	CONDUCTOR CONTACT WITH STRUCTURE
DAMECH	**Mechanical**		
		P100	BURNT
		P101	CHIPPED
		P102	CRACKED
		P103	DAMAGE
		P104	DOWN
		P105	TRIP FREE
		P106	EXCESSIVE NOISE
		P107	EXCESSIVE VIBRATION
		P108	MARLIN HANGING LOOSE
		P109	MISALIGNMENT
		P110	OVER RUN
		P111	TILTED
		P112	UN EVEN TENSION
DAOPERAL	**Operational**		
		P120	DOCUMENTATION / PLAN INADEQUATE
		P121	ISOLATION - BUSHFIRE RISK REDUCTION
		P122	ISOLATION - FIRE (Customer Property)
		P123	ISOLATION - LOAD SHEDDING
		P124	ISOLATION - NEW CONSTRUCTION / CONN

		P125	ISOLATION - PLANNED MAINTENANCE
		P126	ISOLATION - SYSTEM ALTERATION
		P127	ISOLATION - THIRD PARTY - ADDRESS
		P128	ISOLATION - THIRD PARTY - SAFETY
		P129	ISOLATION - TREE TRIMMING / REMOVAL
		P130	LOCK BROKEN, DAMAGED, UNSUITABLE
		P131	LOCKED OUT
		P132	NIL FOUND - BLOWN FUSE
		P133	NIL FOUND - FEEDER LOCKOUT
		P134	NIL FOUND - SUCCESSFUL RECLOSE
		P135	RECLOSED
		P136	SUPPLY INTERRUPTION - 1 - SINGLE
		P137	SUPPLY INTERRUPTION - 2 - MINOR
		P138	SUPPLY INTERRUPTION - 3 - SIGNIFICANT
		P139	SUPPLY INTERRUPTION - 4 - MAJOR
		P140	SUPPLY INTERRUPTION - 5 - WIDESPREAD
		P141	LARCENY INVESTIGATION
DAPLIGHT	**Public Lighting**		
		P150	ALL LIGHTS OFF
		P151	ALL LIGHTS ON
		P152	SINGLE LIGHT ON
		P153	SINGLE LIGHT OUT
DASAFETY	**Safety**		
		P180	FIRE
		P181	FIRE START ACTUAL
		P182	FIRE START POTENTIAL
		P183	HAZARD EMPLOYEE
		P184	HAZARD PUBLIC
		P185	SHOCK
DASERV	**Service**		
		P190	LID DAMAGED/MISSING
		P191	PIT DAMAGED
DA3RDPTY	**Third Party**		
		P200	DEFECTIVE ELECTRICAL INSTALLATION
		P201	THIRD Party equipment damaged
DAVEGTN	**Vegetation**		
		P210	INAPPROPRIATE SPECIES
		P211	INFESTATION
		P212	VEGETATION
		P213	VERMIN
		P214	BIRD NEST
DAVTREE	**Tree**		
		P250	TREE TRIMMING – SA POWER NETWORKS
		P251	CREEPER UP POLE
		P252	TREE TRIMMING - PRIVATE
		P254	RECOMMEND FOR RECONSTRUCTION
		P255	INAPPROPRIATE SPECIES
		P256	TREE GROWTH RETARDANT
		P257	TREE - CLEAR FOR ACCESS

		P258	TREE - STUMP REMOVAL
		P259	REPLACEMENT TREES TO BE SUPPLIED
		P260	SEEDLINGS / REGROWTH - POISON
		P261	TREE - STUMP POISON
		P262	TREE - REMOVAL – SA POWER NETWORKS
		P263	TREE - REMOVAL - PRIVATE

9.3.3 Cause Codes

Code Group	Descrip.	Code	Description
CADESIGN	**Design**		
		C001	DESIGN FAULT
		C002	MANUFACTURE
		C003	INCORRECT MAINTENANCE
		C004	INSTALLATION / WORKMANSHIP
		C005	INSTALLATION FAULT
		C006	NOT CURRENT STANDARD
CAELECT	**Electrical**		
		C013	ELECTRICAL OVERLOAD
		C082	ANNEALING
		C091	FAIL TO OPERATE
		C099	OPERATED
		C116	INSULATION Material Breakdown
CAENVIRO	**Environment**		
		C050	ANIMAL
		C051	BIRDS
		C052	SUBSIDENCE / EROSION
		C053	FLOODING
		C054	INSECT - ANTS
		C055	INSECT - OTHER
		C056	INSECT - TERMITE
		C057	LIGHTNING
		C058	POLLUTION
		C060	UV DEGRADATION
		C061	VEGETATION - INSIDE DZ
		C062	VEGETATION - NBFRA
		C063	VEGETATION - OUTSIDE DZ
		C064	VERMIN
		C066	WEATHER - RAIN
		C067	WEATHER - WIND
		C068	DEBRIS
		C070	DUST
CAGENRL	**General**		
		C087	EXPLOSION
		C100	OPERATION ERROR
		C104	FIRE (EXTERNAL)
		C105	NOTHING FOUND
		C106	PRE ARRANGED WORK
CAMECH	**Mechanical**		
		C080	ABRASION / WEAR
		C081	AGE
		C083	BENT / BOWED / CRACKED
		C084	CORROSION / RUST
		C088	FAIL - NON TENSION
		C089	FAIL - TENSION

		C090	FAIL - THERMAL
		C092	FATIGUE
		C094	GROUNDLINE CORROSION
		C098	MOISTURE / INGRESS
		C110	BRAKE ADJUSTMENT
		C111	GASKET FAILURE
		C117	MECHANICAL OVERLOAD
		C118	PUNCTURED/ PENETRATED
		C122	VIBRATION
		C123	WOOD ROT
CAQUAL	**Quality of Supply**		
		C120	Lights Exploding (HV)
		C121	Lights Shattering/damaged
		C122	Lights dimming - Cust A/Con
		C123	Lights Dimming - Neighb A/Con
		C124	Lights Dimming - Other
		C125	Appliances not working - Computer
		C126	Appliances not working - Small
		C127	Appliances not working - Large
		C128	A/C not running
		C129	A/C stalling-not running as expected
		C130	Pumps not starting
		C131	Fuses continuing blowing
		C132	Appliances damaged - Computer
		C133	Appliance damaged - large
		C134	Appliances damaged - small
		C135	Other - text required
		C136	Numerous momentary losses of power
		C137	Numerous prolonged losses of power
		C140	RFI Television
		C141	RFI AM Radio
		C142	RFI FM Radio
		C143	RFI Amateur Radio
		C144	RFI Other
		C150	Customer not Compliant
		C151	System not Compliant
		C152	Service Point Compliant
CA3RDPRT	**Third Party**		
		C130	AEROPLANE
		C131	BOAT MAST
		C132	CONTACT PERSON
		C133	CRANE
		C134	DIG IN
		C135	FAULT IN CUSTOMERS INSTALLATION
		C136	FARM IMPLEMENT
		C137	TREE FELLING
		C138	VANDALISM
		C139	VEHICLE
		C140	GROUND LEVEL

		C141	STRUCTURE
		C142	LARCENY OF SUPPLY
		C143	THIRD PARTY UNKNOWN
		C144	RESTRICTED / NO ACCESS

9.4 MISCELLANEOUS – ASSIGNMENT OF DEFECT PRIORITIES

Guidelines FOR ALLOCATION OF MAINTENANCE Risk Value (MRV) and PRIORITY.

General

Assets must be inspected and any identified defects recorded using codes as specified in section 9.3 of Line Inspection Manual and an allocated MRV / Priority for attention according to condition.

It is essential that the MRV / Priority be allocated in a consistent and uniform manner throughout the State. The Inspection Operations Manager must ensure that MRV/ Priority be allocated in accordance with Line Inspection Manual section 9.4 and section 9.8.

A defect may deteriorate into a failure resulting in a single or several adverse outcomes depending upon the locality and environment at the point of the defect, hence there is an associated risk to the Network. The MRV is a score that takes into account the identifiable factors for each identified defect, its location, condition and other localised contributing factors.

The MRV and associated Priority range is determined after consideration is given to the current state of the componentry, the rate of deterioration, and potential consequences should a failure occur.

The MRV value corresponds to a Priority range which is allocated to enable the defect to be rectified before failure. Accordingly defects are ranked by the MRV risk value with the highest value defects being issued to Field Services for completion in the corresponding ranking order. SAP defect notifications are passed through to Field Services for appropriate work scheduling.

Determining an MRV / Priority range the Following Occurs

IDENTIFY

The inspector identifies a defect by visually examining each component at the location and assessing its condition.

ASSESS THE CONSEQUENCE OF FAILURE

The potential consequences of a failure are considered as part of the process to determine an appropriate MRV. These outcomes are as follows:

- Safety -Personal Injury / Safety
- Supply Interruption
- Quality of Supply
- Environmental
- Essential Equipment out of Service
- Access
- Standards

ASSESS THE CONSEQUENCE OF FIRE START (Z Code)

The consequences of a failure with resultant Fire start potential in a Bushfire Risk area during days of Extreme Fire Danger level eg FDL conditions, Z code Priority must be selected.

- Z Code Defect – Must be flagged within the **Priority** field for FDL fire start potential.

DETERMINE THE PROBABILITY OF FAILURE

The potential probability of a failure is considered as part of the process to determine an appropriate MRV. These outcomes are as follows:

- Imminent – Failure has occurred or will occur in the immediate term. Phone thru to NOC.
- Likely - Failure is likely to occur in the short term potentially up to 4 weeks.
- Possible - Failure is likely to occur potentially up to 6 months.
- Unlikely - Failure is likely to occur in the longer term potentially 6mths- 2yrs.
- Condition Monitoring - Record for location only due to asset or equipment type.

DETERMINE THE DEFECT SEVERITY

The inspector needs to assess the current condition of the asset, and ask:

- Extreme – extreme level of deterioration/damage/condition.
- High – high level of deterioration/damage/condition.
- Medium – medium/average level of deterioration/damage/condition.
- Low – Record for location only due to asset or equipment type.

DETERMINE THE NUMBER OF AFFECTED CUSTOMERS

The inspector needs to assess the APPROXIMATE NUMBER OF Customers that may potentially be affected. These outcomes are as follows:

- AFFECTED – CBD FEEDER – where feeder is a CBD feeder.
- AFFECTED – CRITICAL SUB - Critical Customer where known.
- AFFECTED – LARGE SUB – Significant (large) Sub Station.
- AFFECTED – METRO FEEDER – Where feeder is a Metropolitan feeder.
- AFFECTED – ONE – One customer affected.
- AFFECTED – PART FEEDER - where portion of a Feeder or Sub Station is likely affected.
- AFFECTED – PART SUB – Part Sub Station affected.
- AFFECTED – SMALL SUB – Small Sub Station.
- AFFECTED – T/F AREA – Where a TF LV area is affected.
- AFFECTED – FEEDER/SUB where entire Feeder or Sub Station is likely affected.

Priority descriptions and MRV range.

Priority	MRV Range		
Z **Fire Start**	N/A	Failure Condition	Poses a **FIRE HAZARD**. A defect that has the potential to cause a fire in a HBFRA or BFRA on high fire danger risk days (FDL)
		Rectification	During the fire season – IMMEDIATE At all other times – BEFORE NEXT FIRE SEASON
B **Breakdown**	N/A	Failure Condition	Poses an **IMMINENT** risk or actual instance related to safety, fire or major interruption to supply.
		Rectification	Requires IMMEDIATE attention. Telephone Network Operations Centre (NOC) to arrange immediate issue.
1 **Urgent**	190+	Failure Condition	Poses a SIGNIFICANT/LIKELY risk to safety or interruption to supply – ***Failure within 4 weeks.***
		Rectification	Requires URGENT attention and repair (4 weeks)
2 **Non Urgent**	90-189	Failure Condition	No plant failure has occurred but there is POSSIBLE potential to deteriorate/fail. Poses a Possible risk to safety or interruption to supply **Failure between 4 weeks to 6 months**
		Rectification	Requires EARLY attention (6 months)
3 **Pre-emptive**	60-89	Failure Condition	Unlikely to fail but degradation may slowly continue. Poses a medium risk to safety or interruption to supply ***Failure between 6 months and 2 years.***
		Rectification	Requires TIMELY attention (2 Years)
4 **Location**	1-59	Failure Condition	- Condition Monitoring.
		Rectification	Generally used to record the location of equipment where the asset performance is being monitored.

Line Inspection Guidelines for Determining Priorities in section 9.8 have suggested typical MRV – Priority ranges.

9.5 MISCELLANEOUS – ASSIGNMENT OF QUICK CODES

Quick Code	Notif.type	Budget Grp	Budget Cod	Object grp	Object cod	Cause code	Cause code	Damage cde	Damage cod	Activity	Activity	Est Hrs
A/BREAK OR L/SWITCH DAMAGED	DD	LMC-008	L628	OBOTHER	O274	CAMECH	C081	DAMECH	P103	ANWK	REFB	4.000
ACCESS FENCES	DD	LMD-001	L001	OBACCESS	O200	CAMECH	C084	DAMECH	P103	ANWK	REFB	1.000
ACCESS GATES DAMAGED	DD	LMD-001	L002	OBACCESS	O201	CAMECH	C084	DAMECH	P103	ANWK	REFB	2.000
ACCESS LOCKS DAMAGED	DD	LMD-001	L003	OBACCESS	O202	CAMECH	C081	DAMECH	P103	ANWK	REFB	1.000
ACCESS LOCKS MISSING	DD	LMD-001	L004	OBACCESS	O202	CA3RDPRT	C143	DAGENERL	P076	ANWK	REFB	0.500
ACCESS ROADS	DD	LMD-002	L006	OBACCESS	O203	CAENVIRO	C052	DAGENERL	P076	ANWK	REIN	5.000
AIR GAP	DD	LMD-009	L036	OBINSUL	O256	CAELECT	C099	DAGENERL	P076	ANWK	REPL	1.000
AIRCRAFT MARKER MISSING	DD	LMD-009	L037	OBSIGN	O341	CADESIGN	C006	DADESIGN	P040	ANWK	REIN	1.500
ALUM/STEEL FLEXIBLE TAPS	DD	LMC-013	L009	OBCOND	O213	CADESIGN	C004	DADESIGN	P041	ANWK	REPL	1.000
ALUM/STEEL JOINT LLC	DD	LMC-013	L010	OBCOND	O216	CADESIGN	C006	DAELECT	P062	ANWK	REPL	1.000
ALUM/STEEL JOINTS	DD	LMC-013	L011	OBCOND	O216	CAMECH	C084	DAELECT	P062	ANWK	REPL	1.000
ARMOUR RODS/LINE GUARDS	DD	LMD-005	L012	OBCOND	O219	CAMECH	C080	DAMECH	P103	ANWK	REIN	1.000
BARRIERS	DD	LMD-001	L005	OBOTHER	O288	CADESIGN	C006	DADESIGN	P040	ANWK	REPL	1.000
BIRDNEST	DD	LMD-010	L041	OBSUPPT	O356	CAENVIRO	C051	DAVEGTN	P214	ANWK	REMV	0.500
BLACK STRAPS	DD	LMD-009	L038	OBSUPPT	O350	CAENVIRO	C060	DAGENERL	P070	ANWK	REPL	0.500
BUSHING DAMAGED	DD	LMD-003	L007	OBINSUL	O250	CAELECT	C116	DAMECH	P103	ANWK	REFB	3.000
BUSHING SHIELDS DAMAGED	DD	LMD-004	L008	OBINSUL	O250	CAELECT	C116	DAMECH	P103	ANWK	REFB	3.000
CABLES DISTRIBUTION (WHITE ANT)	DD	LMC-011	L633	OBCOND	O210	CAENVIRO	C056	DAMECH	P103	ANWK	REPR	4.000
CAPACITOR REPLACEMENT-REPAIR	DD	LMC-009	L664	OBOTHER	O287	CADESIGN	C006	DAMECH	P103	ANWK	REPL	5.000
CLAH DAMAGED	DD	LMD-009	L039	OBINSUL	O255	CAELECT	C099	DAMECH	P103	ANWK	REPL	1.000
CLEVICE PIN	DD	LMC-013	L013	OBINSUL	O258	CAMECH	C092	DACONDTN	P013	ANWK	REPL	1.000
CONDUCTOR ABC DAMAGED	DD	LMD-005	L014	OBSERV	O224	CAMECH	C092	DAMECH	P103	ANWK	REPL	2.000
CONDUCTOR BROKEN STRAND	DD	LMD-005	L015	OBCOND	O227	CAMECH	C080	DAGENERL	P070	ANWK	REPR	1.000
CONDUCTOR GRIPS	DD	LMC-013	L016	OBCOND	O221	CAMECH	C084	DAGENERL	P070	ANWK	REPL	1.000
CONDUCTOR JOINT INADEQUATE	DD	LMC-013	L666	OBCOND	O220	CAMECH	C081	DAGENERL	P076	ANWK	REPR	1.000
CONDUCTOR O/H COVERED	DD	LMC-013	L017	OBCOND	O226	CAMECH	C084	DAMECH	P103	ANWK	REPR	2.000
CONDUCTOR SEIZING CLAMPS	DD	LMD-017	L051	OBCOND	O214	CAMECH	C089	DAGENERL	P070	ANWK	REPL	1.000
CONDUCTOR SPACERS	DD	LMC-013	L018	OBCOND	O212	CADESIGN	C006	DADESIGN	P040	ANWK	REFB	0.500
CONDUCTOR SUSPENSION CLAMPS	DD	LMC-013	L019	OBCOND	O223	CAMECH	C080	DACONDTN	P013	ANWK	REPL	1.000
CONDUCTOR TIE WIRES	DD	LMD-017	L052	OBCOND	O215	CAMECH	C080	DAGENERL	P070	ANWK	REFB	0.500
CONDUCTOR VIBRATION DAMPERS	DD	LMC-013	L020	OBCOND	O217	CAMECH	C092	DAMECH	P103	ANWK	REIN	1.000

CONDUCTOR WRAPLOCK	DD	LMD-017	L053	OBCOND	O215	CAMECH	C080	DAMECH	P103	ANWK	REFB	0.500
CONTROLLER BATTERY REPLACEMENT	DD	LMC-009	L665	OBOTHER	O290	CADESIGN	C006	DAGENERL	P076	ANWK	REPL	1.000
CORRODED CONDUCTOR REPLACEMENT	DD	LMC-012	L634	OBCOND	O227	CAMECH	C080	DAGENERL	P070	ANWK	REPR	1.000
COUNTER	DD	LMC-006	L626	OBOTHER	O283	CAMECH	C081	DAGENERL	P073	ANWK	REPL	4.000
CREEPER UP POLE	VG	VG-001	V002	OBOTHER	O271	CAENVIRO	C061	DAVTREE	P251			0.000
CUBICLE (MINOR REPAIRS)	DD	LMD-011	L042	OBOTHER	O280	CAELECT	C116	DAMECH	P103	ANWK	REFB	6.000
CUBICLE AD SWITCH REPLACEMENT	DD	LMC-007	L658	OBOTHER	O280	CAELECT	C116	DAMECH	P103	ANWK	REPL	6.000
CUBICLE BB REPLACEMENT	DD	LMC-007	L627	OBOTHER	O280	CAELECT	C116	DAMECH	P103	ANWK	REPL	6.000
CUBICLE SA Power Networks D REPLACEMENT	DD	LMC-007	L654	OBOTHER	O280	CAELECT	C116	DAMECH	P103	ANWK	REPL	6.000
CUBICLE KRONE REPLACEMENT	DD	LMC-007	L653	OBOTHER	O280	CAELECT	C116	DAMECH	P103	ANWK	REPL	6.000
CUBICLE OD SWITCH REPLACEMENT	DD	LMC-007	L656	OBOTHER	O280	CAELECT	C116	DAMECH	P103	ANWK	REPL	6.000
CUBICLE SF6 REPLACEMENT	DD	LMC-007	L655	OBOTHER	O280	CAELECT	C116	DAMECH	P103	ANWK	REPL	6.000
DF/ FUSE BASE DAMAGED	DD	LMC-008	L630	OBOTHER	O275	CAMECH	C090	DAMECH	P103	ANWK	REPL	1.000
EARTH CMEN MISSING	DD	LMD-007	L026	OBEARTH	O240	CADESIGN	C006	DADESIGN	P040	ANWK	REIN	0.500
EARTH MEN MISSING	DD	LMD-007	L027	OBEARTH	O242	CADESIGN	C006	DADESIGN	P040	ANWK	REIN	0.500
EARTH POLE HIGH READING	DD	LMD-012	L060	OBEARTH	O241	CAMECH	C081	DAGENERL	P072	ANWK	REPL	2.000
EARTH STAKE DAMAGED	DD	LMD-012	L043	OBEARTH	O241	CAMECH	C084	DAMECH	P103	ANWK	REFB	2.000
EARTH SWER TF POLE	DD	LMD-012	L044	OBEARTH	O244	CAMECH	C084	DAELECT	P062	ANWK	REPL	2.000
EXTENSION PIECE DAMAGED	DD	LMC-003	L610	OBSUPPT	O361	CAMECH	C083	DAMECH	P103	ANWK	REFB	2.000
EXTENSION PIECE REQUIRED	DD	LMC-003	L611	OBSUPPT	O361	CADESIGN	C006	DADESIGN	P040	ANWK	REIN	2.000
FOOTING	DD	LMC-004	L615	OBSUPPT	O351	CAMECH	C089	DAMECH	P103	ANWK	REPL	6.000
FOREIGN OBJECTS	DD	LMD-010	L059	OBSUPPT	O356	CAENVIRO	C068	DASAFETY	P184	ANWK	REMV	0.500
FUSE LIQUID LOW	DD	LMC-014	L040	OBOTHER	O276	CAENVIRO	C060	DACONDTN	P005	ANWK	REPL	0.300
GL STATION BUILDING DEFECTS	DD	LMC-007	L636	OBOTHER	O281	CAMECH	C081	DAMECH	P103	ANWK	REFB	2.000
GL STATION ENVIROMENTAL & CLEANUP	DD	LMD-020	L058	OBOTHER	O281	CAENVIRO	C058	DACONDTN	P016	ANWK	REFB	5.000
GL STATION WEEDS	DD	LMD-020	L057	OBOTHER	O281	CAENVIRO	C063	DAVEGTN	P212	ANWK	REMV	2.000
GROUND CLEARANCE	DD	LMC-001	L600	OBCOND	O227	CADESIGN	C006	DAGENERL	P076	ANWK	REIN	5.000
HOT JOINT (I/SURVEY CRT SECT)	DD	LMC-008	L659	OBCOND	O216	CAMECH	C090	DAELECT	P052	ANWK	REPL	2.000
HOT JOINT (IR SURVEY)	DD	LMC-013	L021	OBCOND	O216	CAMECH	C090	DAELECT	P052	ANWK	REPL	2.000
HOT JOINT (LINE INSPS)	DD	LMC-013	L022	OBCOND	O216	CAMECH	C090	DAELECT	P052	ANWK	REPL	2.000
HOT JOINT >> 100 DEGREES	DD	LMC-008	L670	OBCOND	O213	CAMECH	C090	DAELECT	P052	ANWK	REPL	2.000
HV X ARM ANGLE	DD	LMC-003	L640	OBSUPPT	O365	CAMECH	C083	DAMECH	P103	ANWK	REFB	2.000
HV X ARM LINE	DD	LMC-003	L641	OBSUPPT	O363	CAMECH	C083	DAMECH	P103	ANWK	REFB	2.000
HV X ARM OTHER	DD	LMC-003	L643	OBSUPPT	O356	CAMECH	C083	DAMECH	P103	ANWK	REFB	2.000

HV X ARM TERM/BRACE	DD	LMC-003	L642	OBSUPPT	O364	CAMECH	C083	DAMECH	P103	ANWK	REFB	2.000
INAPPROPIATE SPECIES	VG	VG-001	V002	OBOTHER	O271	CAENVIRO	C061	DAVTREE	P255			0.000
INSULATOR DINNER PLATE (BULLER/DIA)	DD	LMC-003	L649	OBINSUL	O259	CADESIGN	C002	DADESIGN	P041	ANWK	REPL	1.000
INSULATOR DISC DAMAGED	DD	LMC-003	L645	OBINSUL	O259	CAMECH	C118	DAGENERL	P070	ANWK	REPL	0.500
INSULATOR HOOK	DD	LMC-003	L650	OBINSUL	O253	CAMECH	C080	DACONDTN	P013	ANWK	REPL	0.500
INSULATOR LV BROKEN	DD	LMC-003	L644	OBINSUL	O259	CAELECT	C116	DAGENERL	P070	ANWK	REPL	0.500
INSULATOR PIN DAMAGED	DD	LMC-003	L652	OBINSUL	O260	CAMECH	C080	DACONDTN	P014	ANWK	REPL	1.000
INSULATOR POLYMER DAMAGED	DD	LMC-003	L646	OBINSUL	O261	CAELECT	C116	DAMECH	P103	ANWK	REPL	1.000
INSULATOR POST BROKEN	DD	LMC-003	L647	OBINSUL	O262	CAELECT	C116	DAGENERL	P070	ANWK	REPL	1.500
INSULATOR POST DAMAGED	DD	LMC-003	L648	OBINSUL	O262	CAELECT	C116	DACONDTN	P014	ANWK	REPL	1.500
INSULATOR SOCKET TONGUE	DD	LMC-003	L651	OBINSUL	O252	CAMECH	C080	DACONDTN	P013	ANWK	REPL	1.000
ISOL DAMAGED	DD	LMC-008	L657	OBOTHER	O277	CAMECH	C090	DAMECH	P103	ANWK	REPL	0.500
LSDF DAMAGED	DD	LMC-008	L629	OBOTHER	O273	CAMECH	C090	DAMECH	P103	ANWK	REPL	3.000
LV FUSING (INSTAL/REFURB)	DD	LMC-008	L660	OBOTHER	O278	CADESIGN	C006	DADESIGN	P041	ANWK	REFB	1.000
LV X ARM ANGLE WOOD	DD	LMC-003	L612	OBSUPPT	O365	CAMECH	C083	DAMECH	P103	ANWK	REFB	1.500
LV X ARM LINE WOOD	DD	LMC-003	L613	OBSUPPT	O363	CAMECH	C083	DAMECH	P103	ANWK	REFB	1.000
LV X ARM TERM/BRACE WOOD	DD	LMC-003	L614	OBSUPPT	O364	CAMECH	C083	DAMECH	P103	ANWK	REFB	2.000
MANHOLE/COVER (INSTAL/REFURB)	DD	LMC-007	L661	OBOTHER	O284	CAMECH	C083	DAMECH	P103	ANWK	REPL	6.000
NUMBER DEVICE MISSING	DD	LMD-006	L023	OBSIGN	O342	CAMECH	C081	DAGENERL	P075	ANWK	REFB	0.300
NUMBER STRUCTURE	DD	LMD-006	L024	OBSIGN	O344	CAMECH	C081	DAGENERL	P075	ANWK	REFB	0.300
NUMBER WARNING	DD	LMD-006	L025	OBSIGN	O345	CADESIGN	C006	DAGENERL	P075	ANWK	REIN	0.300
P/LIGHT BRACKET DAMAGED	DD	LMC-010	L668	OBPL	O308	CAMECH	C092	DAGENERL	P076	ANWK	REPL	1.000
P/LIGHT COLUMN DAMAGED	DD	LMC-010	L669	OBPL	O301	CAMECH	C081	DAGENERL	P076	ANWK	REPL	2.000
P/LIGHT FITTING DAMAGED	DD	LMC-010	L667	OBPL	O303	CAMECH	C308	DAGENERL	P076	ANWK	REPR	1.000
PHASE TO PHASE / EARTH CLEARANCES	DD	LMC-003	L635	OBSUPPT	O365	CADESIGN	C006	DAELECT	P053	ANWK	REPL	2.000
POLE AGE PRTY4	DD	LMC-005	L663	OBSUPPT	O353	CAMECH	C094	DACONDTN	P008	ANWK	REFB	1.000
POLE ANGLE TERM-T/OFF DAMAGED	DD	LMC-004	L616	OBSUPPT	O352	CAMECH	C117	DAMECH	P103	ANWK	REPL	12.000
POLE ANGLE-TERM-T/OFF <50%	DD	LMC-005	L623	OBSUPPT	O352	CAMECH	C094	DACONDTN	P008	ANWK	REFB	1.000
POLE ANGLE-TERM-T/OFF >50%	DD	LMC-004	L617	OBSUPPT	O352	CAMECH	C094	DACONDTN	P009	ANWK	REPL	12.000
POLE LINE >50% RUSTED	DD	LMC-004	L619	OBSUPPT	O353	CAMECH	C094	DACONDTN	P009	ANWK	REPL	12.000
POLE LINE DAMAGED	DD	LMC-004	L620	OBSUPPT	O353	CAMECH	C117	DAMECH	P103	ANWK	REPL	12.000
POLE LINE PLATE <50 %	DD	LMC-005	L624	OBSUPPT	O353	CAMECH	C094	DACONDTN	P008	ANWK	REFB	1.000
POLE OTHER	DD	LMC-004	L618	OBSUPPT	O356	CADESIGN	C006	DAGENERL	P076	ANWK	REPL	5.000
POLE SERVICE <50%	DD	LMC-005	L625	OBSUPPT	O355	CAMECH	C094	DACONDTN	P008	ANWK	REFB	1.000

POLE SERVICE >50%	DD	LMC-004	L621	OBSUPPT	O355	CAMECH	C094	DACONDTN	P009	ANWK	REPL	1.000
POLE SERVICE DAMAGED	DD	LMC-004	L622	OBSUPPT	O355	CAMECH	C117	DAMECH	P103	ANWK	REPL	12.000
PUBLIC LIGHT COLUMN EARTHING	DD	LMC-010	L632	OBPL	O301	CAMECH	C081	DAGENERL	P072	ANWK	REPL	1.500
RECLOSER PROGRAM MAINTENANCE	DD	LMC-006	L638	OBOTHER	O283	CAGENRL	C106	DAGENERL	P078	ANWK	REFB	5.000
RECOMMEND FOR RECONSTRUCTION	VG	VG-001	V002	OBOTHER	O271	CAENVIRO	C061	DAVTREE	P254			0.000
REDUNDANT EQUIP REMOVAL	DD	LMD-018	L054	OBSUPPT	O366	CADESIGN	C006	DAGENERL	P082	ANWK	REMV	1.000
REPLACEMENT TREES TO BE SUPPLIED	VG	VG-001	V002	OBOTHER	O271	CAENVIRO	C061	DAVTREE	P259			0.000
SECURITY PATROL, LINE-DIST	DD	LMD-020	L064	OBOTHER	O272	CAGENRL	C106	DAGENERL	P071	ANWK	INSP	1.000
SEEDLINGS / REGROWTH - POISON	VG	VG-001	V002	OBOTHER	O271	CAENVIRO	C061	DAVTREE	P260			0.000
SERV ABC	DD	LMC-002	L601	OBSERV	O323	CAMECH	C080	DAMECH	P103	ANWK	REPL	2.000
SERV DAMAGED	DD	LMC-002	L602	OBSERV	O320	CAMECH	C081	DAMECH	P103	ANWK	REPL	2.000
SERV DEI REPLACE O/W SVC	DD	LMC-002	L609	OBSERV	O322	CADESIGN	C006	DASAFETY	P184	ANWK	REPL	2.000
SERV FUSE BOX DAMAGED	DD	LMC-002	L603	OBSERV	O324	CAMECH	C081	DAMECH	P103	ANWK	REPL	1.000
SERV FUSE BOX LID MISSING	DD	LMC-002	L604	OBSERV	O324	CAMECH	C081	DASERV	P190	ANWK	REPL	0.300
SERV GRIPS BROKEN	DD	LMC-002	L605	OBSERV	O320	CAENVIRO	C060	DAGENERL	P070	ANWK	REPL	0.300
SERV N/S DAMAGED	DD	LMC-002	L606	OBSERV	O321	CAMECH	C080	DAMECH	P103	ANWK	REPL	2.000
SERV O/W DAMAGED	DD	LMC-002	L607	OBSERV	O322	CAMECH	C081	DAMECH	P103	ANWK	REPL	2.000
SERV PIT COVERS DAMAGED	DD	LMD-014	L046	OBSERV	O330	CA3RDPRT	C143	DASERV	P191	ANWK	REPL	0.500
SERV PIT PILLAR DAMAGED	DD	LMC-002	L639	OBSERV	O329	CA3RDPRT	C143	DAMECH	P103	ANWK	REPL	1.000
SERV PTJB LID MISSING	DD	LMC-002	L608	OBSERV	O328	CAMECH	C081	DASERV	P190	ANWK	REPL	0.300
STAY SHIELD	DD	LMD-015	L048	OBSUPPT	O360	CAMECH	C083	DADESIGN	P040	ANWK	REPL	0.300
SUBS CAP - REPLACE CAPACITOR CAN	SD	SMD-008	S025	OSDPLNT	O075	CAMECH	C081	DAMECH	P103	ANWK	REPL	3.000
SUBS CB - CUBICLE HEATER U/S	SD	SMD-001	S004	OSDPLNT	O086	CAELECT	C091	DAGENERL	P071	ANWK	REPR	2.000
SUBS CB - LOW GAS PRESSURE	SD	SMD-001	S004	OSDPLNT	O091	CAMECH	C111	DAGENERL	P076	ANWK	REFB	1.000
SUBS CB - OIL LEVEL	SD	SMD-001	S001	OSDPLNT	O088	CAGENRL	C105	DACONDTN	P007	ANWK	REPR	3.000
SUBS CB - PCB OIL REPLACEMENT	SD	SMD-001	S003	OSDPLNT	O088	CADESIGN	C006	DACONDTN	P001	ANWK	REPL	3.000
SUBS CB - REPAIR MECHANISM	SD	SMD-001	S002	OSDPLNT	O091	CAMECH	C081	DAMECH	P103	ANWK	REPR	5.000
SUBS CONTROL/RELAY ROOM REPAIRS	SD	SMD-013	S035	OSDCIVIL	O003	CAMECH	C081	DAMECH	P103	ANWK	REPR	2.000
SUBS CVL - BUILDING	SD	SMD-015	S037	OSDCIVIL	O003	CAMECH	C081	DAMECH	P103	ANWK	REPR	2.000
SUBS CVL - CRACKED FOOTINGS	SD	SMD-015	S039	OSDPLNT	O082	CAMECH	C084	DAMECH	P102	ANWK	REPR	3.000
SUBS CVL - FENCES/BARRIERS	SD	SMD-015	S038	OSDCIVIL	O003	CAMECH	C081	DAMECH	P103	ANWK	REPR	2.000
SUBS CVL - FLOODLIGHTS U/S	SD	SMD-015	S040	OSDCIVIL	O008	CAMECH	C092	DAGENERL	P073	ANWK	REPR	3.000
SUBS CVL - NUMBERING INCORRECT ETC	SD	SMD-015	S040	OSDOTH	O061	CADESIGN	C004	DAGENERL	P076	ANWK	REPR	0.500
SUBS CVL - VEGETATION ON FENCE	SD	SMD-015	S040	OSDCIVIL	O015	CAENVIRO	C063	DAVEGTN	P212	ANWK	REMV	2.000

SUBS CVL - WEED SPRAYING	SD	SMD-015	S040	OSDCIVIL	O015	CAENVIRO	C063	DAVEGTN	P212	ANWK	REMV	1.000
SUBS CVL- OTHER DEFECTS	SD	SMD-015	S045	OSDCIVIL	O003	CAMECH	C081	DAMECH	P103	ANWK	REPR	2.000
SUBS CVL-SAFETY EQUIPMENT	SD	SMD-015	S044	OSDOTH	O060	CAMECH	C081	DAMECH	P103	ANWK	REPR	1.000
SUBS DCS - BATTERY BANKS	SD	SMD-003	S010	OSDELEC	O042	CAMECH	C081	DAMECH	P103	ANWK	REPR	2.000
SUBS DCS - BATTERY CHARGER	SD	SMD-003	S009	OSDELEC	O041	CAMECH	C081	DAELECT	P055	ANWK	REPR	3.000
SUBS DISC - CRACKED INSULATORS	SD	SMD-005	S021	OSDPLNT	O089	CAMECH	C081	DAMECH	P102	ANWK	REPR	4.000
SUBS DISC - LOW FUSE LIQUID	SD	SMD-005	S022	OSDELEC	O052	CAENVIRO	C060	DACONDTN	P005	ANWK	REPR	0.500
SUBS HOT JOINT	SD	SMD-006	S023	OSDCOND	O032	CADESIGN	C004	DAELECT	P052	ANWK	REPR	3.000
SUBS HOT JOINT >>100 DEGRESS	SD	SMD-006	S023	OSDCOND	O032	CAELECT	C082	DAELECT	P052	ANWK	REPR	3.000
SUBS HV & EARTH GRID INVESTIGATIONS	SD	SMD-014	S036	OSDPLNT	O090	CAMECH	C081	DAMECH	P103	ANWK	INSP	2.000
SUBS OIL CLEAN UP	SD	SMD-007	S024	OSDPLNT	O088	CAMECH	C081	DACONDTN	P016	ANWK	REIN	6.000
SUBS PHONE / TDU REPAIRS	SD	SMD-012	S031	OSDCIVIL	O014	CAELECT	C09	DAGENERL	P073	ANWK	REPR	2.000
SUBS POLE REPLATING	SD	SMD-013	S033	OSDPLNT	O100	CAMECH	C084	DAMECH	P103	ANWK	REPR	2.000
SUBS PROT - ADJUST SETTINGS	SD	SMD-009	S026	OSDPROT	O113	CADESIGN	C006	DAGENERL	P076	ANWK	REPR	1.000
SUBS PROT - REPAIR RELAYS	SD	SMD-009	S027	OSDPROT	O113	CADESIGN	C006	DAGENERL	P076	ANWK	REPR	1.000
SUBS PROT - REPAIR VOLTAGE FAULTS	SD	SMD-009	S028	OSDPROT	O113	CADESIGN	C006	DAGENERL	P076	ANWK	REPR	1.000
SUBS REPAIR BUSWORK STRUCTURES	SD	SMD-013	S032	OSDCOND	O030	CAMECH	C092	DAMECH	P103	ANWK	REPR	1.000
SUBS REPAIR SURGE ARRESTORS	SD	SMD-010	S029	OSDPROT	O111	CAMECH	C092	DAMECH	P103	ANWK	REPR	1.000
SUBS RMU - OIL TOP UP	SD	SMD-002	S006	OSDPLNT	O091	CAMECH	C111	DAGENERL	P076	ANWK	REPR	1.000
SUBS RMU - REPAIR MECHANISM	SD	SMD-002	S008	OSDPLNT	O091	CAMECH	C111	DAGENERL	P073	ANWK	REPR	1.000
SUBS RMU - REPAIR OIL LEAKS	SD	SMD-002	S007	OSDPLNT	O091	CAMECH	C081	DAMECH	P103	ANWK	REPR	1.000
SUBS SCADA REPAIRS	SD	SMD-011	S030	OSDPROT	O113	CAMECH	C117	DAGENERL	P080	ANWK	REPR	1.000
SUBS SWITCHYARD REPAIRS	SD	SMD-013	S034	OSDCOND	O030	CAMECH	C117	DAGENERL	P073	ANWK	REPR	2.000
SUBS TF - CUBICLE HEATER U/S	SD	SMD-004	S020	OSDPLNT	O086	CAELECT	C091	DAGENERL	P071	ANWK	REPR	2.000
SUBS TF - MAJOR OIL LEAKS	SD	SMD-004	S013	OSDPLNT	O088	CAMECH	C111	DACONDTN	P007	ANWK	REPR	5.000
SUBS TF - MINOR OIL LEAKS	SD	SMD-004	S012	OSDPLNT	O088	CAMECH	C111	DACONDTN	P007	ANWK	REPR	2.000
SUBS TF - OTHER DEFECTS	SD	SMD-004	S020	OSDPLNT	O091	CAMECH	C081	DAGENERL	P076	ANWK	REPR	5.000
SUBS TF - PCB OIL REPLACEMENT	SD	SMD-004	S014	OSDPLNT	O088	CAMECH	C111	DACONDTN	P007	ANWK	REPL	2.000
SUBS TF - REPAIR / TOP-UP OIL LEVELS	SD	SMD-004	S011	OSDPLNT	O088	CAGENRL	C105	DACONDTN	P007	ANWK	REPR	3.000
SUBS TF - REPAIR CABLE BOX/TERMINATI	SD	SMD-004	S020	OSDPLNT	O074	CAMECH	C090	DAGENERL	P073	ANWK	REPR	3.000

9.6 MISCELLANEOUS – INSPECTION CODES

9.6.1 Current Inspection Codes

Inspection Code	Inspection Description	
C	RECLOSER & CB READINGS	
CR	INSPECT ALL RECLOSERS	
CS	INSPECT ALL SECTIONALISERS	
DB	BROWN BOVERI SWITCHGEAR INSP	
DC	CAST RESIN RMU INSP	
DD	SA POWER NETWORKS 'D' TYPE SWITCHGEAR INSP	
DG	GAS RMU INSP	
DK	KRONE SWITCHGEAR INSPECTION	
DO	OIL RMU INSP	
EU	SA POWER NETWORKS UTILITIES CONTACT	
G	PRE B/F PATROL H/BFRA (GRND)	
H	PRE B/F PATROL H/BFRA (HELI)	
IB	INSPECTION BFRA	
IH	INSPECTION HBFRA	
IN	INSPECTION NBFRA	
IP	**IPWG INSP / EFI**	**NEW**
J	INFRA RED 11K FDR BACKBONES	
JS	INFRA RED SUBSTATIONS	
K	GL TF & REGLTR STN INSPECTIONS	
P	PUBLIC CONTACT	
V	VEG INSP ADJ LINES(INCL NOTIF)	
VC	VEG CTRCTR MGT(CLEARANCE)	
VE	VEG CNTNGNCY CUTTNG(INC NOTIF)	
VT	VEG MGE TGR (INCL CONTRACTOR)	
W	SUB TRANS INSPECT CLIMB/EWP	
X	SUB TRANS LINE INSP (HELI)	

9.7 GROUND CLEARANCE

Inspection Criteria for Ground Clearance of Overhead Lines

This section is to be used to determine if the ground clearance of existing overhead power lines is satisfactory. It is not applicable for the design of new lines.

Under the Electricity (General) Regulations 2012, Part 10, Division 1, Safety and technical requirements: Aerial Lines, there are specific clearance requirements that must be met. Schedule 1 of the 2012 Regulations applies to aerial lines (including Service Lines) installed after 1 July 1997. This legislation is not intended to be applied retrospectively; therefore lines built to a previous standard are not defective.

To aid in the interpretation of the Regulations the following checklist has been developed.

Checklist to Determine Ground Clearance Defects (Bare or covered conductor):

	Question	Yes	No
1	Do clearances meet Electricity (General) Regulations 2012, Schedule 1. **(See Table i)**	OK	Go To Q2
2	Do the clearances meet the design standard that existed at time of construction. **(See Table ii)**	OK	Assign appropriate priority

Table i: Clearance Standard* for Overhead Lines (Bare or Covered Conductor) – Post 1997

	Location	LV	7.6kV, 11kV, 33kV	66kV
(a)	Over carriageway of road	5.5m	6.7m	6.7m
(b)	In a settled area other than over carriageway of road. (ie in towns or cities)	5.5m	6.0m	6.7m
(c)	Land (other than (a) or (b) above) capable of being traversed by vehicle	5.5m	6.0m	6.7m
(d)	Land not capable of being traversed by vehicle	4.5m	4.5m	5.5m

* Standards are from the 2012 Electricity (General) Regulations (as of 27/08/14)

- Schedule 1: Requirements for aerial lines
- Table 2: Clearance distance for aerial lines (excluding service lines, other cable systems and aerial lines within substations)

Table ii: Minimum Clearance Standard (Bare or Covered Conductor) – Pre 1997

Applicable before the introduction of the Technical Regulations.

	Location	LV	7.6kV, 11kV, 33kV
(a)	Over carriageway of road	5.5m	6.7m
(b)	In a settled area other than over carriageway of road. (ie in towns or cities)	5.5m	5.5m
(c)	Land (other than (a) or (b) above) capable of being traversed by vehicle	4.9m	4.9m
(d)	Land not capable of being traversed by vehicle	4.6m	4.6m

9.8 MISCELLANEOUS – LINE INSPECTION GUIDELINES FOR DETERMINING MRV SCORE

** **Reminder: Inspectors Must Review and Update al l exi sti n g SAP DD not i 's as p art of In sp ecti on - Photos are Mandatory for all defects**

Priority – MRV Range

DD	B	Ring NOC	-
DD	Z	200+	During declared fire season
DD	1	190	
DD	2	90	189
DD	3	60	89
DD	4	1	59

Typical MRV inputs for Defect Probability and Defect Severity for MRV Score also refer to Sect 9 -4 and 3-23

Approx MRV input combo's for Defect Probability and Severity, also to a lesser degree impacted by number of Customers, Consequence and Failure mode selections! ** Note often a high Probability input corresponds with a high Severity input and vice versa!

Noti	MRV	Probability	Severity
DD	**190+**	**Likely**	**Extreme**
	Within 4 Weeks	Likely	High
	Priority 1	Possible	Extreme
DD	**90 -189**	**Likely**	**High**
	Up to 6 Months	Possible	High
	Priority 2	Possible	Med
DD	**60 - 89**	**Possible**	**Med**
		Possible	Low
	Up to 2 years	Unlikely	High
	Priority 3	Unlikely	Med
DD	**1 -59**	**Unlikely**	**Low**
	Location only	Condition Monitoring	Med
DD	***Priority 4***	Condition Monitoring	Low

LIM SECTION	DESCRIPTION	MRV NBFRA	MRV HBFRA MBFRA	COMMENTS – Note: Photos Mandatory for All Defects
3.25, 6	**POLES / STRUCTURES**			
	Repair or Replacement			
	SA Power Networks pole/structures damaged. Replacement required.	> 60	> 60	Record year of manufacture and size of pole
	Public light column repair/replace	> 60	> 60	Identify corrosion or other damage.
3.25	Channels or steel with corrosion. Plate or repair in situ poles with less than 50% steel remaining	> 60	> 60	Record total percentage of steel affected. Record year of manufacture and size of pole – Refer to section 6.7 page 10 “Standard Data Entry Requirements Example”
6.5	Footing erosion	> 90	> 90	If any of the bottom of the top collar of the footing is exposed, it is a P1 defect (MRV >190). Otherwise, if any of the top collar of the footing is exposed more than 250mm in height at any point, it is a P2 defect (MRV between 90 and 189). No defect is required if the top collar of the footing is exposed less than 250mm. However, for safety issues in high pedestrian traffic areas, refer to ‘Dangerous Protrusions’.
6.7	Cracked concrete footings / pole and structures	> 60	> 90	Considered integrity and or structural degradation that will impact pole strength
6.7	Excessive pole footing movement.	> 60	> 90	Greater than 15 degrees lean
6.7	Notch Sensitive Steel pole	< 59	< 59	Record Location only where no obvious damage and deterioration. All Notch Sensitive Steel poles must be recorded.
6.7	Notch Sensitive Steel pole	> 90	> 90	Assess damage and deterioration to determine MRV.
3.25	Pole – unable to be inspected	< 60	< 60	For SWER poles with HV earth (distribution transformer, regulator, remote earth, isolating transformer). For poles with concrete, bitumen or significant vegetation preventing inspection.

LIM SECTION	DESCRIPTION	MRV NBFRA	MRV HBFRA MBFRA	COMMENTS – Note: Photos Mandatory for All Defects
6	**Non standard SA Power Networks poles / fittings, or poles/fittings of other authorities (Communications etc).**			
	Communication poles with SA Power Networks service lines attached. Note Visually check condition of pole eg ground line assessment.	**> 90**	**> 90**	Assess damage and deterioration to determine MRV value
	SA Power Networks wooden poles	**> 60**	**> 90**	Check directive for Z requirement and apply priority (assess damage and deterioration to determine MRV value)
	Other non standard SA Power Networks pole	**> 60**	**> 90**	Check directive for Z requirement and apply priority (assess damage and deterioration to determine MRV value)
	Corrosion - Ensure helical grip above ground level.	**> 90**	**> 90**	
	Broken Damaged Stay wire	**> 190**	**> 190**	
	Marker shield damaged or missing.	**> 190**	**> 190**	

LIM SECTION	DESCRIPTION	MRV NBFRA	MRV HBFRA MBFRA	COMMENTS – Note: Photos Mandatory for All Defects
	Cable Guards			
	Damaged or loose	**> 90**	**> 90**	
	High Density Conduit - H/MBFRA's	**> 90**	**> 90**	Record locations where High Impact High Density conduit does not have a Cable Guard fitted for protection from adjacent grassland fire potential. **Note High risk sites only!!**
	Not Bonded to pole	**< 59**	**< 59**	Record with MRV <59
	Signs / Numbering			
	Warning signs missing or illegible	**60 to 189**	**60 to 189**	Risk analysis required eg. SWER TF, GL & Sub Stn signage to confirm typical MRV (Record as quick code Number Warning). 11kv/7.6kv/33kv TF's "Earthing Warning Sign Required" if missing or illegible in MEN Area, refer E1453
	Illegible Switching Device numbering	**60 to 89**	**60 to 89**	**Standard Data Entry Requirements Example –**" Install I.D Plate as Per E1023 Paying Attention To Securing Methods and Positioning Of Sign Above Ground Level" (Record as quick code Number Device Missing).
	Structure numbering missing or illegible	**< 59**	**< 59**	Consider methods for number installation whilst on site eg stencils / paint. (EG Feeder/TF number and Pole number record as quick code Number Structure).
	Incorrect feeder plan			(Feeder plan revisions instigated (via T Wright for contractors), **not** to be entered in SAP as a DD defect).
	Dangerous Protrusions			
	Any item that protrudes from the pole (including footing), and is a danger to the public or line personnel	**>190**	**> 190**	
	Identify foreign objects for removal eg kites, birds, animals etc.	**>190**	**> 190**	Identify only if fire start, outage or safety consequence.
	Access			
	Roads, gates, fences and locks	**> 60**	**> 60**	Gates not normally provided by SA Power Networks except for Sub Tx line easement access.

LIM SECTION	DESCRIPTION	MRV NBFRA	MRV HBFRA MBFRA	COMMENTS – Note: Photos Mandatory for All Defects
	CROSSARMS			
	Wood Cross Arm			
	Deteriorated, bent, bowed, or split wood cross arms	**> 60**	**60 to Z**	
	Steel Cross Arm / Extension Piece			
	Wear at suspension positions.	**> 60**	**60 to Z**	**Standard Data Entry Requirements Example –** "S/side and T/double hook and hole worn. Install hook hole x arm repair kits and Replace Hooks" - All Phases.
	Significantly rusted or corroded.	**> 60**	**60 to Z**	
	Rust under high voltage pins	**> 90**	**190 to Z**	Record locations with holes in round steel pins/cracks in welds and visual loss of steel at point where round pin attaches to x arm. Refer section 6.2. Identify where the pin is bent/distorted due to extensive corrosion on the pin (Not tilted insulators).
	Twisted cross arms/extension piece	**> 90**	**> 90**	Record locations where visibly bent/distorted.
	Nuts / Bolts rusted away and missing, loose	**> 90**	**90 to Z**	
5	**INSULATORS**			
	Insulators Requiring Replacement			
5.3	Damaged, insulators.	**> 90**	**90 to Z**	Generally report as damaged where 1/3 or more of the insulation material is compromised or missing. If a single disc is broken from a 66kV line, it is a **P1** defect, regardless of whether it originally had 5 or 6 discs. The minimum undamaged insulators for a 33kV/19kV line is 3 discs. If only 2 discs are remaining (either due to a disc being broken or missing) it is a **P1** defect, if only 1 disc is remaining it is a **PB**. If a single disc is missing from an over insulated 33kV line, it should be recorded as a **P4** defect (assuming it has 3 or more undamaged discs remaining). If the defect has the potential to cause a fire on a fire danger risk day and is in a H/MBFRA, it should be recorded as a **PZ** defect.
	Flashed-over, cracked or punctured	**> 90**	**90 to Z**	Only record where severe damage is evident and or suspect other associated material damage eg pin hole/cracking etc.

LIM SECTION	DESCRIPTION	MRV NBFRA	MRV HBFRA MBFRA	COMMENTS – Note: Photos Mandatory for All Defects
5.3	Missing insulators.	**> 190**	**190 to Z**	If a single disc is broken from a 66kV line, it is a **P1** defect, regardless of whether it originally had 5 or 6 discs. The minimum undamaged insulators for a 33kV/19kV line is 3 discs. If only 2 discs are remaining it is a **P1** defect, if 1 disc is remaining it is a **PB**. If a single disc is missing from an over insulated 33kV line, it should be recorded as a P4 defect (assuming it has 3 or more undamaged discs remaining). If the defect has the potential to cause a fire on a fire danger risk day and is in a H/MBFRA, it should be recorded as a **PZ** defect.
	Polluted / Stained	**> 190**	**> 190**	Consider evidence of tracking, if so replace @ MRV 190+.
	Insulators Tilted			
	Tilted pin/post insulators.	**> 90**	**190 to Z**	When considered moderate to severe eg line angles etc.
	Re-align insulator string >25 DEGREES	**> 190**	**> 190**	
	Disc Insulators and Corroded Equipment			
5.7	Wear or corrosion on socket tongues.	**> 90**	**90 to Z**	**Standard Data Entry Requirements Example** – 'Single Side Socket Tongue/Pin and Suspension Clamp Wear. Replace Socket Tongues, Pins and Conductor Clamps, Insulators and Hooks, All Phases'.
5.5	Corroded or worn insulator caps or pins.	**> 90**	**90 to Z**	Where 50% of pin is lost P1/Z for replacement.
5.6	Worn hooks and shackles.	**> 90**	**90 to Z**	
	Worn or corroded suspension/strain clamp.	**> 90**	**90 to Z**	
	Missing W/clips or split pins.	**> 90**	**90 to Z**	
	Identified for replacement.(ie DIA, Buller, dinner plates)	**< 59**	**< 59**	Location only **when not <u>damaged</u>**

LIM SECTION	DESCRIPTION	MRV NBFRA	MRV HBFRA MBFRA	COMMENTS – Note: Photos Mandatory for All Defects
	CONDUCTOR / TAPS / JOINTS / CABLES			
	Unsatisfactory Clearances to Phase, Taps, Arms			
	Any arrangements **that reduce clearances** (phase to phase and phase to earth) Of mains or taps from other conductors and earthed metal parts.	**> 90**	**90 to Z**	
	Low voltage taps touching steel cross arms. (Refer E1156).	**> 90**	**190 to Z**	Only record locations where LV tap has visible damage or will likely be damaged due to rubbing against sharp objects (eg cross arm brace). **Don't record locations where LV tap is touching but no damage present or imminent.** Subject to severity of defect consider **Z** code if applicable in H/MBFRA. **Standard Data Entry Requirements Example** - L/V tap damaged or potential for damage requires repair/replacement as per E Drawings; Bend all taps clear of steel components.
	Fuse or DF crossarm requiring triangulation. (E1227)		**90 to Z**	Past history, evidence of or high Risk of mains clashing
	Uneven tensions and sags. (Aeroplaned).	**> 60**	**> 190**	Past history, evidence of or high Risk of mains clashing. Where no spacers installed **Z** code applies.
	Unsatisfactory Clearances, to Ground or Buildings / Structures			
9.7	Low ground clearance.	**> 90**	**> 90**	Provide all relevant details. Eg span height and length, temp. etc **Standard Data Entry Requirements Example** – HV 19kv ground clearance measures 1 to 59.6m @ 25deg, the span length is 217m of 3/12 steel. Paddock Traversable by Vehicle. Suggest Install Prop Pole. NPO input required Photos of span and poles either side of clearance issue are also requested.
	Insufficient clearance to buildings/structures.	**> 90**	**> 90**	Refer to SA Power Networks Act and Regs

LIM SECTION	DESCRIPTION	MRV NBFRA	MRV HBFRA MBFRA	COMMENTS – Note: Photos Mandatory for All Defects
	Vertical Construction			
	Vertical to horizontal or flat Constructions H/MBFRA **(higher priority where warranted evidence of damage or risk**).		**90 to Z**	MRV: 1 to 59 - Location only, but where high likelihood of classing, higher MRV for remediation.
	Broken or Damaged Conductors / Cables / Joints (Unsatisfactory Connections)			
	Unsatisfactory connections	**> 90**	**90 to Z**	Where tension sleeves are installed within 10m of Cross arms only record as MRV<59 unless considered high risk of failure.- E1018 Sheet 2.1.
	Broken conductor strands.	**> 90**	**90 to Z**	
	Clouting of conductor's burn marks evident.	**> 90**	**90 to Z**	
	McIntyre sleeves in aluminium conductors,	**> 90**	**90 to Z**	High priority on deteriorated condition, < 59 for location only.
	Conductor corroded/rusted, bulging, black or white oxide	**> 90**	**90 to Z**	
	Damaged pilot cable.	**B**	**B**	
	Damaged, rusty, corroded 3/12 splices and fittings	**> 90**	**90 to Z**	Vigilant assessment of condition required. Discolourisation can be an indicator to deterioration.
	Snail Strain clamp 3/12 conductor	**> 90**	**190 to Z**	Strain constructions with Snail clamps and Stangers installed where conductor is damaged,
	Aluminium Tee clamps and Live Line clamps installed on 3/12 steel conductor.	**> 60**	**90 to Z**	Deteriorated condition only and provide **Standard Data Entry Requirements Example** - Replace entire tap with new tap and connections including heat shrink sleeving as per E-Drawing Standards. All so ensure all old connections/fittings/tee cons/live line clamps are removed and any damaged conductor repaired.
	Live Line clamps installed on **3/10-alumoweld and 3/12 Steel conductor.**	**> 60**	**90 to Z**	Deteriorated condition only
	Live Line clamps and tee clamps installed on **3/10 Alumoweld and 3/12 steel grips**.	**> 60**	**90 to Z**	Deteriorated condition only and provide **Standard Data Entry Requirements** Example As above.

LIM SECTION	DESCRIPTION	MRV NBFRA	MRV HBFRA MBFRA	COMMENTS – Note: Photos Mandatory for All Defects
4.2	**Flexible Taps**			
4.2	No heat shrink (refer E1205 & E1206)	**60 to 89**	**Z**	**H/MBFRA** without any heat shrink sleeving is a **PZ** defect. **NBFRA** without any heat shrink sleeving is a **P3** defect. **Standard Data Entry Requirements Example** – "Replace entire tap with new tap & connections including Heat Shrink Sleeving to the current E-Drawings".
4.2	Inadequate heat shrink (refer E1205 & E1206)	**N/A**	**90 to 189**	**H/MBFRA** with inadequate heat shrink (not installed to standard refer to E1205 2.1) is a **P2** defect. **NBFRA** with inadequate heat shrink (not installed to standard refer to E1205 2.1) is **NOT** a defect.
4.2	Damaged heat shrink	**60 to 89**	**> 90**	**H/MBFRA** with severely split or damaged heat shrink is a **P1** defect. **H/MBFRA** with minor damage (eg. bird peck) is a **P2** defect. **NBFRA** with any damage is a **P3** defect.
4.2	Damaged flexible tap	**> 90**	**90 to Z**	**H/MBFRA** with damaged covering and visible strands, bulging or oxidisation is a **PZ** defect. **NBFRA** with damaged covering and visible strands, bulging or oxidisation is a **P1** defect. **All Areas** with minor damage (eg. bird peck) is a **P2** defect.

LIM SECTION	DESCRIPTION	MRV NBFRA	MRV HBFRA MBFRA	COMMENTS – Note: Photos Mandatory for All Defects
3.18	**Evidence of Overheating and Annealing (Dist Lines)**			
3.18	Any connection showing a temperature rise (reported by a Thermographic survey). Use appropriate Quick Code, options include; **Hot joint IR survey critical section** **Hot joint IR survey** **Hot Joint > 100 degrees**	**> 60**	**60 to Z**	Ring NOC (PB) if there is over 200°C rise above reference with visible damage. MRV 190+ (P1) or PZ if there is over 60°C rise above reference temperature **with no visible damage**. MRV 190+ (P1) or PZ if there is over 40°C rise above reference temperature **with visible damage or signs of heat damage**. MRV 190+ (P1) if there is a 40°C - 60°C rise above reference temperature with **no visible damage**, on the backbone of the feeder, including any spur that has an open point that can be used as a feeder tie. MRV 90 – 189 (P2) if there is 40°C - 60°C rise above reference temperature with **no visible damage**, **not** on the backbone of the feeder. Any visible sign of heat related damage to any connection. Higher priority required depending on location and possible loading on equipment. **Assign Minimum MRV of 90 (P2). If visual damage is significant consider reporting to NOC** **For LV hot joints, only report defects above 60°C above reference temperature, unless visual damage is evident. Assign MRV of 190+ (P1).** **Standard Data Entry Requirements Example -** Replace lugs and DF Base. Ensure all connections including switch mechanisms are cleaned and greased
3.18	**Evidence of Overheating and Annealing (Sub Stations and Sub Transmission Lines)**			
3.18	Any connection showing a temperature rise (reported by a Thermographic survey). Use appropriate Quick Code, options include; **Subs Hot joint IR survey** **Subs Hot Joint > 100 degrees**	**> 60**	**60 to Z**	Ring NOC (PB) if there is over 100°C rise above reference temperature. MRV 190+ (P1) if there is 10°C-100°C showing any **visible signs** of heat damage MRV 190+ (P1) if there is over 60°C rise above reference temperature with **no visible damage**. MRV 90 - 189 (P2) if there is 40°C - 60°C rise above reference temperature with **no visible damage** MRV 60 - 89 (P3) if there is 10°C - 40°C rise above temperature with **no visible damage**

LIM SECTION	DESCRIPTION	MRV NBFRA	MRV HBFRA MBFRA	COMMENTS – Note: Photos Mandatory for All Defects
	Tie Wires / Seizing Clamps			
	Wrap lock ties corroded or broken adjacent to the insulators.	**> 190**	**Z**	High priority where broken condition. Note check for worn/broken conductor where there are no Line guards installed on top of Insulators
	3/12 steel with steel tie wire: Broken adjacent to the insulator.	**> 190**	**Z**	**Standard Data Entry Requirements Example** - Broken HV Steel Line Tie Wire. Replace with Steel Seizing Clamp. Small Neck HV Insulator. Check Other Phases and Replace As Required.
	Adelect ties check clamps and conductor.	**> 190**	**Z**	Broken clamp or conductor.
	Seizing clamps / Adelect ties -- damaged, loose, incorrect size.	**> 90**	**90 to Z**	Check for corrosion adjacent bolt in coastal environments.
	Broken or damaged tie wires. Record tie and conductor material.	**> 190**	**Z**	
	LV Spacers			
	Bare LV mains in H/MBFRA with spans over 45m with no spacers fitted. (excluding arrangements of less than 100 m spans, using Red/White positions only and Covered Conductor	**N/A**	**Z**	Note excludes covered conductor as spacer installations would damage covering allowing ingress of moisture.
	Extra spacers required ie to reduce mains clouting adjacent trees.	**> 90**	**Z**	
	Detached spacer clips.	**> 90**	**Z**	Check for damaged/worn conductor adjacent Spacer clips and especially in high corrosion zones.
	Damaged Conductor	**> 60**	**90 to Z**	Damaged conductor caused by spacer clips.

LIM SECTION	DESCRIPTION	MRV NBFRA	MRV HBFRA MBFRA	COMMENTS – Note: Photos Mandatory for All Defects
	FITTINGS AND HARDWARE			
	Damaged/deteriorated hardware.	**> 90**	**90 to Z**	
	Aircraft markers, navigation lights or line markers damaged or missing.	**> 90**	**> 90**	
	Armour rods or line guards damaged.	**> 90**	**90 to Z**	(Black stains on Aluminium or green on Copper may be evident). Where Line Guards are not installed check critically for any conductor Damage.
	Vibration Dampers damaged /worn	**> 60**	**> 60**	Critically assess for conductor damage and the need to install vibration dampers adjacent conductor fittings.
	Insulated / Covered Conductor (Overhead Conductors) Excluding Flexible Taps			
4.11	Covered conductor rubbed, damaged (HV, LV, ABC, IUC)	**> 90**	**90 to Z**	**H/MBFRA** - Signs of damaged insulation **AND** evidence of burn marks **OR** bulging due to oxidisation is a **PZ** defect. **NBFRA** - Signs of damaged insulation **AND** evidence of burn marks **OR** bulging due to oxidisation is a **P1** defect. **All Fire Risk Areas** – Minor damage, other than mentioned above is a **P2** defect.
	ABC suspension Clamp rubber damaged, not in clamp.	**> 60**	**Z**	
	Bushing covers for ABC/IUC damaged or missing.	**N/A**	**90 to Z**	
	Locations for fitting breakaway disconnect couplings.	**N/A**	**> 190**	Consider corrosion in Coastal Areas. Check for wear in suspension clamp attachment point

LIM SECTION	DESCRIPTION	MRV NBFRA	MRV HBFRA MBFRA	COMMENTS – Note: Photos Mandatory for All Defects
	SERVICES (Refer to NDS6)			
	DEI – defective/damaged customer installations	**< 59 or B**	**< 59 or B**	Refer to Network QA procedure 117. Leave / inform customers of issues via form – Annex A, create a DD noti where replacement of Open Wire Service with Neutral Screen negates the issue. Where a notice has been issued for other service issues create a DD noti for location only. Phone NOC for imminent safety issue.
3.23	Record location of Metered Mains.	**< 59**	**< 59**	Record location of all Metered Mains as per requirements section 3.23.
3.23	Metered Mains extremely poor condition or posing a safety risk	**> 190**	**> 190**	Raise defect for the poor condition / safety risk and if failure imminent, ring through to dispatch as a breakdown. A DD notification for location only also required.
	Damaged Worn Neutral Screen	**> 90**	**> 90**	Should be P1 if exposed aluminium.
	Damaged Worn Over to Under or open Wire Service	**> 90**	**> 90**	
	Fuse Boxes and Pole Top Junction Boxes damaged or missing lids	**> 90**	**> 90**	**Standard Data Entry Requirements Example** – Replace Lid as per E1155, Possible Moisture Ingress.
	Helical Grips broken	**> 90**	**> 90**	

LIM SECTION	DESCRIPTION	MRV NBFRA	MRV HBFRA MBFRA	COMMENTS – Note: Photos Mandatory for All Defects
	TFs / SECTIONALISERS / RECLOSERS / CBs AND SWITCHGEAR			
8.7	Transformers/Devices, freshly leaking oil, where oil has leaked onto the ground or surrounding infrastructure.	**> 190**	**> 190**	Raise incident report via CURA for Leaking TF **only** when Fresh oil on ground. **Standard Data Entry Requirements Example** - Replace TF, Clean Up Oil leak as per Environmental Policies and Procedures. Incident report lodged in SA Power Networks Cura Web Site – Environmental.
	Transformers/Devices, leaking oil but **not** on the ground	**> 60**	**> 60**	Report leaking TF and describe location of leak on device.
	Corroded Transformers - Severe	**> 90**	**> 90**	Identify severely corroded TF's for replacement due to potential for ingress of water
	Corroded Transformers – Minor/Moderate	**> 60**	**> 60**	Identify transformers where rust has progressed beyond surface rust.
	Record locations of Rural G/L transformers with fibreglass TF lids	**> 60**	**> 60**	Fibreglass lids to be recorded, The integrity of lid and securing bolts need to be confirmed.
	Low oil level in T/F indicated.	**> 90**	**> 90**	Typically on a Ground Level TF.
	Rod Air Gaps, CLAH's			
	Rod air gaps and CLAHS with **reduced clearance.**	**> 90**	**> 90**	Only report where reduced clearance will impact reliability implications, *note Point to Point Rod Air Gaps are a non standard but acceptable construction.*
	CLAH/ Surge Diverters Damaged.	**> 190**	**> 190**	Check for damage

LIM SECTION	DESCRIPTION	MRV NBFRA	MRV HBFRA MBFRA	COMMENTS – Note: Photos Mandatory for All Defects
	FUSE / DF SWITCH / AIRBREAK / ISOLATOR			
	Enclosed Load Switches	**> 190**	**> 190**	Corroded tank / Gauge fittings, bottom side of tank
	Blade contacts, HV liquid fuse, and Solid links are incorrectly seated.	**> 90**	**> 90**	
	Ganged air break blades are not fully engaged	**> 90**	**> 90**	
	Flicker blades not intact.	**> 90**	**> 90**	
	Flashed over DF base.	**> 90**	**> 90**	
	Enclosed Iljin Load Switches	**> 60**	**> 60**	Corrosion surrounding the metal gas plug, condition monitoring (P3) to breakdown depending on severity.
8.3	**HV Liquid Fuses**			
	HV liquid fuses with Inadequate Liquid Level	**60 to 89**	**90 to 189**	Liquid fuses only recorded if level more than 20mm below the top ferrule as per E2816 Sheet 2.
	Locations with no HV or LV fusing installed.	**> 190**	**> 190**	Location where no fusing exists.
	LV Isolators			**Standard Data Entry Requirements Example** - Cracked LV isolator, Blue phase, requires replacement. Check other phases and replace as required
	Cracked or broken isolators.	**> 90**	**> 90**	
	Bird / Animal Activity			
	Bird / Animal proofing.	**> 90**	**> 90**	Bushing shields to be installed on Flat Top 3 phase TF's in areas where there is a high evidence of bird activity.
	Positions where significant bird or animal activity occurs.(to be used ONLY where a bird related defect also exists)	**> 90**	**> 90**	
6.3	Bird nests to be removed where considered a fire risk.	**> 90**	**B Z**	Consider potential for Fire Start or supply outage especially with conductive or windborne debris.
	Bird nests in pole top junction box or service box	**> 60**	**> 60**	No visible damage.

LIM SECTION	DESCRIPTION	MRV NBFRA	MRV HBFRA MBFRA	COMMENTS – Note: Photos Mandatory for All Defects
	EARTHING			
	CMEN Conductor Damaged or Missing			
	Spans where the CMEN conductor is a dissimilar size and may result in conductor clouting.		**Z**	
	Cross Arm Bonds	**< 59**	**< 59**	E1009 states that only Cross Arms not directly touching the steel pole joist require Earth bonding to the Channel Joist,
	Earthing Bond Under Size, Damaged, Missing or not to Standard			
	Transformer earth stake not installed in MEN area (refer E1003)	**> 190**	**> 190**	
	Ground level Earth Bond damaged or missing.	**90 to 189**	**90 to 189**	
	Earthing system not installed to Standard	**90 to 189**	**90 to 189**	Where earths are missing/damaged or non-standard
	Co-located MEN/CMEN systems	**< 59**	**< 59**	MEN / CMEN systems that are co-located adjacent each other are only considered Non Standard, record MRV <59.

LIM SECTION	DESCRIPTION	MRV NBFRA	MRV HBFRA MBFRA	COMMENTS – Note: Photos Mandatory for All Defects
	Earth Resistance			
	HV earthing failure, inadequate.	**90 to 189**	**90 to 189**	
	LV earthing of the neutral - failure, inadequate.	**90 to 189**	**90 to 189**	
	Neutral integrity in HV single phase-earth systems - failure, inadequate.	**> 190**	**> 190**	
	SWER earth for replacement	**> 190**	**> 190**	
	SWER Distribution TF Pole earth >100ohms earth for replacement	**< 59**	**< 59**	
	Record location of SWER Split Earth Systems	**< 59**	**< 59**	Situations where the pole joist is utilised as part of the HV earth arrangement.
3.23	Record location of SWER Aluminium Earth Systems	**< 59**	**< 59**	Record aluminium earths for location only. Refer LIM section 3.23 for MDT data entry details.
4.12	**Insulated / Covered Earth**			
4.12	Broken earth conductor	**B**	**B**	
4.12	Damaged strands, corrosion or swelling on earth conductor	**> 190 to B**	**> 190 to B**	
4.12	Exposed ground level earthing	**> 190**	**> 190**	
4.12	Damaged Insulation – Aluminium	**90 to 189**	**90 to 189**	
4.12	Damaged Insulation – Copper	**N/A**	**N/A**	Damage may be due to natural causes or insulation cut back during earth testing, regardless, if it is copper it is not a defect.

LIM SECTION	DESCRIPTION	MRV NBFRA	MRV HBFRA MBFRA	COMMENTS – Note: Photos Mandatory for All Defects
	URD. Underground Defects			
	Service pit lids damaged or cracked	**> 190**	**> 190**	
	URD pad / vault damaged or cracked	**> 90**	**> 90**	
	Vermin in pits/ Padmounts (Bees, Termites, Wasps etc)	**> 190**	**> 190**	
	HV Terminations – Tracking etc	**> 90**	**> 90**	
3.3	B/Boveri switchgear defects (as per inspection checklist)	**> 90**	**> 90**	
	Damaged Padmount TF's / cubicles (Rust etc)	**> 90**	**> 90**	
	Vandalised pole or equipment.	**B**		REPORT GRAFFITI DIRECT TO Risk and Insurance Branch via email. **Customer Service:** 13 12 61 (9am - 5pm Monday to Friday)
	PUBLIC LIGHTING			
	Lights, not working, burning continuously, broken fittings / taps, etc	**N/A**	**N/A**	Report all faulty light defects directly to SAPN Do Not Raise DD notification. For defects other than rusty / damaged light columns and poles. Eg: Lights not working, Burning cotinuously, damaged fittings and broken taps etc. Call: 1800 676 043 or report via www.sapowernetworks.com
	OTHER			
	Record Redundant Equipment	**< 60**	**< 60**	Record location of redundant poles and equipment. Quick Code: Redundant equip removal

9.9 MISCELLANEOUS – COMMON CONDUCTOR TYPES AND SIZES

9.9.1 Common Conductor Types & Sizes

Aluminium Conductor

	ALUMINIUM CONDUCTOR STEEL REINFORCED			
Conductor Stranding				
Metric Conductor Code Name	6/1/2.75 Apricot	6/1/3.75 Banana	6/4.75 & 7/1.60 Cherry	
Imperial Conductor Code Name	6/1/.1052 Sparrow	6/1/.144 Mink	6/.186 & 7/.062 Dog	30/7/.093 Tiger
Conductor range group (E1002 sht 2) Non tension compression fittings	C	D	E	G

	ALUMINIUM CONDUCTOR STEEL REINFORCED			
Conductor Stranding				
Metric Conductor Code Name	30/7/2.50 Grape	30/7/3.25 Lychee	54/7/3.0 Mango	54/7/3.5 Olive
Imperial Conductor Code Name	30/7/.102 Wolf	30/7/.1261 Hen	54/7/.118 Bison	54/7/.139 Moose
Conductor range group (E1002 sht 2) Non tension compression fittings	G	H	J	K

	ALL ALUMINIUM CONDUCTORS					
Conductor Stranding						
Metric Conductor Code Name	7/2.25 Jupiter	7/2.75 Leonids	7/3.75 Mars	7/4.75 Moon	19/3.50 Orion	37/3.25 Sirius
Imperial Conductor Code Name	7/.087 Gnat	7/.1052	7/.144	7/.186	19/.138	37/.126
Conductor range group (E1002 sht 2), Non-tension compression fittings	B	C	D	E	G	H

	ALL ALUMINIUM ALLOY AAAC / 1120					
Conductor Stranding						
Metric Conductor Code Name	7/2.75 Chromium	7/3.75 Helium	7/4.75 Iodine	61/3.50 Silicon	61/3.75 Sulphur	
Imperial						

	ALL ALUMINIUM ALLOY AAAC / 6201			
Conductor Stranding				
Metric Conductor Code Name	7/2.75 Dolomite	7/3.75 Garnet	7/4.75 Jasper	
Imperial	7/.1052	7/.144	7/.186	

Copper Conductor

	COPPER CONDUCTOR – HARD DRAWN				
Conductor Stranding					
–Metric	7/1.25	7/1.75	7/2.0	7/2.75	7/3.50
–Imperial	7/.048	7/.064	7/.080	7/.104	7/.136
–Strand & Gauge	7/18	7/16	7/14	7/12	7/10

	COPPER CONDUCTOR – HARD DRAWN				
Conductor Stranding					
–Metric					
–Imperial	19/.101	19/.116	37/.083	37/.093	37/.103
–Strand & Gauge					

Steel Conductor

	GALVANISED STEEL CONDUCTOR (SC/GZ)			
Conductor Stranding –Metric	3/2.75	7/1.60	19/1.60	19/2.00
–Imperial	3/.104	7/.064	19/.064	19/.080

	3/2.75 SC/GZ TO 3/2.75 SC/AC JOINT	STEEL CONDUCTOR ALUMINUM CLAD (SC/AC) 'Alumoweld'	
Conductor Stranding –Metric		3/2.75	7/2.59
–Imperial		3/.1019	7/.1019

Identification of Conductors:

3/2.75 Galv. steel (SC/GZ) has right hand lay stranding.

Conductor with right hand lay.

3/2.75 SC/AC has left hand lay stranding.

Conductor with left hand lay.