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Protection commissioning & maintenance

PMI 1000

Amendment No 1
21 April 2020

Revision History

This standard supersedes amendment 0.
Changes to this revision include amendments to the protection scheduled maintenance regime given in table 2. Appendix A has been added to provide a decision framework around maintenance period allocation. All changes have been highlighted in grey.

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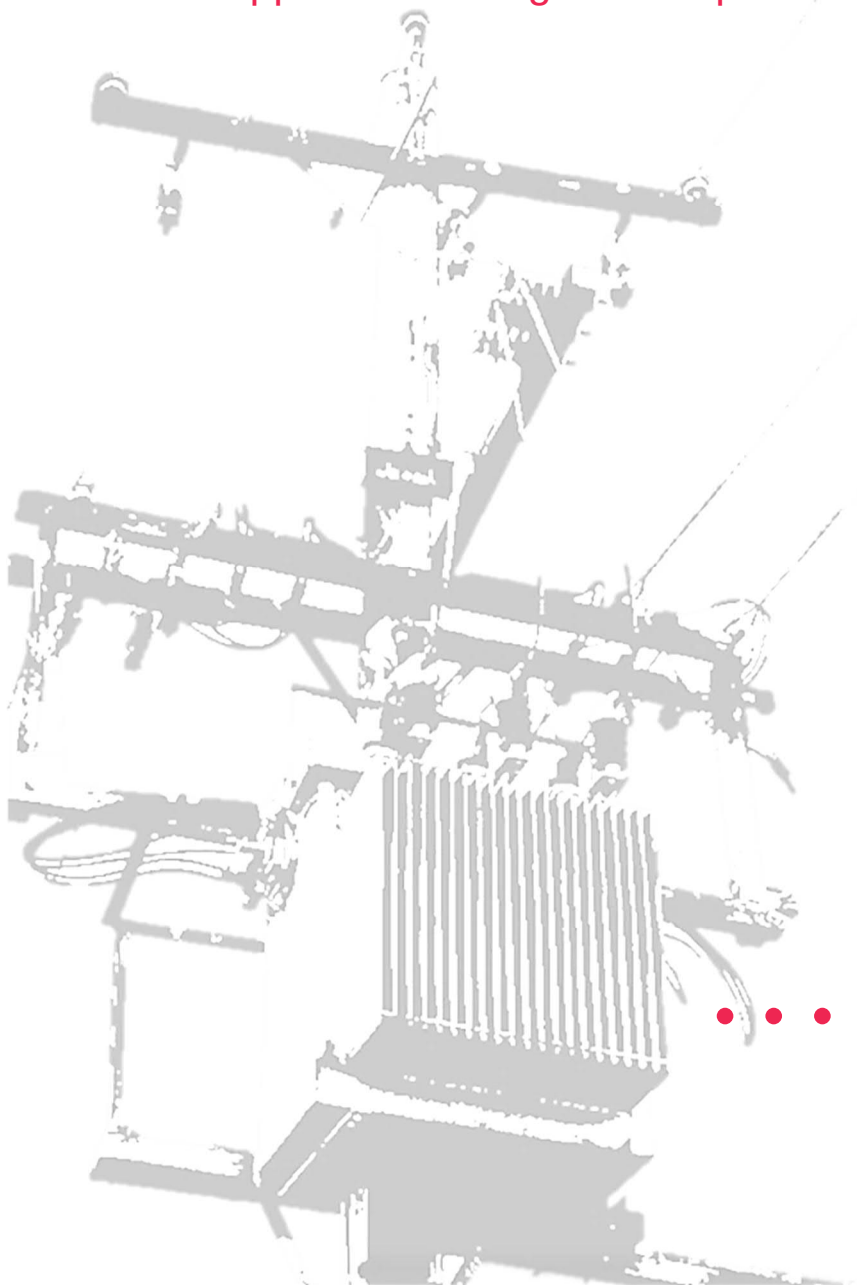
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Content coordinator: Protection Manager

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1 Document scope

This Company Standard details the overall requirements for commissioning and maintenance of the Company's high voltage protection systems. It includes acceptance testing, workshop testing, and commissioning of protection relays and overall schemes, as well as detailing the requirements for routine and non-routine maintenance activities.

The detailed requirements in relation to each type of scheme or activity is outlined in the referenced Procedures and Workplace Instructions.

The Protection Development Specialist is responsible for the development and maintenance of Procedures and Workplace Instructions that achieve the requirements of this Standard.

2 References

External Regulation

Electricity Supply Act 1995 (NSW)

Electricity Supply (Safety and Network Management) Regulation 2014

Work Health and Safety Act 2011 (NSW)

Work Health and Safety Regulation 2017 (NSW)

National Electricity Rules (NER)

External Standards

AS 2067:2016 - Substations and high voltage installations exceeding 1kV a.c.

ENA DOC 001-2008 - National Electricity Safety Code

Company Policies

Company Policy 9.1.7 - Commissioning Network Electrical Assets

Company Policy 9.2.2 - Network Protection

Company Policy 9.2.5 - Network Asset Design

Company Policy 9.7.1 - Network Asset Construction

Company Policy 9.9.1 - Network Asset Maintenance

Company Standards

Substation Maintenance Instruction SMI 113 - Distribution and field transmission data asset structure and nameplate details

Substation Maintenance Instruction SMI 119 - Transmission and zone substation data asset structure and nameplate details

Substation Maintenance Instruction SMI 124 - Maintenance data entry and defect prioritisation

Substation Design Instruction SDI 535 - Site testing and pre-commissioning

Protection Design Instruction PDI 1000 - Protection of high voltage plant

Company Procedures

Divisional Procedure (Network) GNV1044 - Commissioning Network Electrical Assets

Branch Procedure - NCB 0642 Protection Withdrawal Authority

Branch Procedure TBC 0004 - Protection Design Process

Branch Procedure TTB 0053 - Design Process for Asset Standards and Design Branch Projects

Company Workplace Instructions

Branch Workplace Instruction WPC 1207 - Inspection and Testing of New and Serviceable Protection and Control Equipment

Branch Workplace Instruction WPC 1209 - Replacement and Repair of Defective Equipment

Branch Workplace Instruction WPC 1300 - Pre-commissioning and Testing of Protection Schemes

Branch Workplace Instruction WPC 1301 - Preventative Maintenance and Operational Checking of Protection Schemes

Branch Workplace Instruction WPC 1302 - Preventive Maintenance of Busbar Protection

Branch Workplace Instruction WPC 1303 - In Service Checks on Protection Equipment

Branch Workplace Instruction WPC 1306 - Balance Trailer Operating Instruction

Branch Workplace Instruction WPC 1308 - Identification of Protection Equipment on Which Work is to Be Carried Out

Branch Workplace Instruction WPC 1309 - Protection and Control Mandatory Isolations

Branch Workplace Instruction WPC 1310 - Control and Use of Protection Software

Branch Workplace Instruction WPC 1311 - Installation of Temporary Protection and Control Panels

Branch Workplace Instruction WPC 1313 - NULEC Recloser/LBS Commissioning Checks

Branch Workplace Instruction WPC 1314 - Noja Recloser Commissioning Checks

Branch Workplace Instruction WPC 1315 - Transformer Protection - Thermal Relay Calibration

Branch Workplace Instruction WPC 1316 - Frame Leakage Commissioning and Maintenance

Branch Workplace Instruction WPC 1317 - Transformer Protection - Buchholz And Pressure Relay Maintenance

Branch Workplace Instruction WPC 1318 - Protection Relay Maintenance Tolerances

Branch Workplace Instruction WPC 1319 - Protection Tests on Current Transformers

Company Workplace Instructions

Branch Workplace Instruction WPC 1320 - Inspection and Testing of Intertrip Dry Cell Battery Banks

Branch Workplace Instruction WPC 1322 - Recloser And Load Break Switch (LBS) Maintenance

Branch Workplace Instruction WPC 1323 - BBP Blocking Buswire Protection Maintenance

Branch Workplace Instruction WPC 1325 - High Impedance BBP Maintenance

Branch Workplace Instruction WPC 1326 - Protection Withdrawal Authority

Branch Workplace Instruction WPC 1401 - Scada Maintenance - RTU Equipment

Branch Workplace Instruction WPC 1409 - Field Voltage Regulators Commissioning and Maintenance

Branch Workplace Instruction WPC 1412 - SCADA Software Testing

Branch Workplace Instruction WPC 1413 - Testing of Medical Emergency Routine

Branch Workplace Instruction WPC 1501 - GRN/PMR Mobile Radio Installation Standard

Branch Workplace Instruction WPC 1504 - Entering and Working at Radio Communication Installations

Other references

ENA National Electricity Network Safety Code (Doc 01-2008)

3 Definitions and Abbreviations

Term	Definition
AC	Alternating current
Calibration Maintenance	A comprehensive check of components in a protection scheme to check the accuracy and correctness of the applied relay settings to expose any deterioration of equipment, and make repairs as required. The primary purpose of this maintenance is for checking the full functionality of the protection relays and associated systems to expose hidden faults and to recalibrate the relay where necessary.
CBM	Condition based maintenance - unplanned maintenance that is not the result of a breakdown.
CT	Current transformer
CT Charging	This test checks for faults in the CT circuits that cannot be detected with an insulation resistance test. The test requires AC injection to be connected across a CT secondary and the excitation current observed.
FTP	Field test plan
GTP	Generic test plan.
I/O	Input/output
Non-routine Maintenance	Maintenance that is not routine maintenance. Includes condition-based maintenance and fault and emergency maintenance.
Operational Check (op-check)	An action carried out to determine whether an item is functioning correctly. In protection terms this is a test of the main components of a protection scheme. This check must include a trip of all circuit breakers associated with the scheme. This check does not include the measurement of any equipment setting values.
Relay setting file	An electronic file that contains individual relay setting data required to correctly set a protection relay, separate from SPD settings.
Routine Maintenance	Maintenance organised and carried out in accordance with a predetermined policy or plan to prevent breakdown or reduce the likelihood of an item failing to meet an acceptable condition. In protection terms, this is the testing and inspection of protection schemes through a planned maintenance cycle.
SCADA	Supervisory control and data acquisition
SPD	Substation protection data, an electronic document that contains relay and scheme data required to verify the correct set-up of a protection scheme.
VT	Voltage transformer

4 General Requirements

4.1 Approval to work on protection systems

Only Technologists - Protection and certified external contractors are authorised to carry out the work outlined in this Standard, namely the commissioning, maintenance, testing and verification of protection systems, including pre-commissioning checks.

Any other persons, such as trainees, transmission technologists or apprentices, must only carry out this work if acting under the direct supervision of a Technologist – Protection employee or certified external contractor. In these instances, the supervising person is responsible for all work performed and must sign all paperwork.

Technologists - Protection will normally be required to demonstrate a satisfactory level of technical competency and achieve a satisfactory result in Company approved protection training. They must also have completed training in the type of equipment being commissioned or maintained.

External contractors wishing to be certified must provide at the time of tender, details, qualifications, training and experience of all employees that will be performing protection work.

Certification of individual employees is at the discretion of the Protection Development Specialist. The certification issued to external contractors will list all tasks they are authorised to perform. Certified contractors are not authorised to perform any tasks outside of what is listed.

4.2 Supervision of work

Operations Managers – Protection & Control have the authority to direct employees to undertake the work covered by this Standard. Employees should be restricted to performing work within their competencies, giving regard to their qualifications, training, experience, currency and the nature of and risk of the work being performed.

Operations Managers – Protection & Control must periodically verify that Technologists – Protection are undertaking their work in accordance with this Standard and the Company's Procedures, Workplace Instructions and Safe Work Method Statements.

4.3 Recordkeeping

Test records in relation to all equipment tested must be kept for the life of the equipment and in a recoverable and readable format. Relay test standards specify the test results that must be recorded. All records must be documented within the recordkeeping system within one week of the work being completed.

All asset data must be recorded and maintained in accordance with:

- SMI 113 – Distribution and field transmission data asset structure and nameplate details
- SMI 119 – Transmission and zone substation data asset structure and nameplate details

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All maintenance activities must be recorded in accordance with:

- SMI 124 – Maintenance data entry and defect prioritisation.

5 Commissioning

5.1 General requirements

The purpose of pre-commissioning processes is to:

- Validate that the equipment is fit for service and complies with the relevant design requirements and manufacturer's specifications.
- Validate the designed protection settings and tripping sequences.
- Remove or rectify any defects or design faults before commissioning.
- Validate the documentation, for the effective and efficient maintenance and operation of the scheme over the serviceable life is correct and available.
- Document and record the test records and asset data.

5.2 Relay preliminary testing

New protection relays must have an initial inspection and acceptance, and a workshop test, as set out in section 7, prior to being commissioned.

5.3 Design changes & errors

All design changes must be approved prior to commissioning. The process is outlined in TTB 0053 – Design Process for Asset Standards and Design Branch Projects.

Design documentation must be updated to rectify errors, omissions, and make approved corrections and modifications. All such changes must be documented in an equipment/site defect record for future reference and review. The format, control and documentation of these issues will be developed by the Regional Protection and Control Section. A copy of the documentation of these problems must be provided for the records of the site Project Manager, and to the Protection Development Specialist.

5.4 Design Validation

All validated design documentation must be processed under the requirements of the relevant Workplace Instructions including TBC 0004 – Protection Design Process.

All configurations, functions, and parameters detailed in the design documentation such as Substation Protection Datasheets (SPDs) and the associated relay setting files and logic diagrams, must be checked and confirmed to have been implemented correctly.

5.5 Clearance to energise

Before any protection equipment associated with HV plant (excluding distribution transformers and drop-out-fuses) is put into service, written clearance must be given as described in GNV1044 – Commissioning Network Electrical Assets.

Where further tests or work are required post commissioning, all recommended restrictions on the use of the equipment must be included in the clearance advice.

5.6 Pre-commissioning checks

Before giving clearance to energise the associated HV plant, all new equipment must pass the applicable checks detailed in Table 1. Detailed information on how to carry out these checks are incorporated into the referenced Procedures and Workplace Instructions.

All checks listed below must be carried out with the equipment installed in the final position. No further modifications can be made without re-commencing the pre-commissioning process.

Table 1 – Pre-commissioning checks

Equipment	Tasks
Current transformer (CT)	• CT wiring check • CT polarity check • CT insulation resistance test • CT magnetisation check • CT ratio check
Voltage transformer (VT)	• VT wiring check • VT polarity check • VT secondary insulation resistance test
Relay	• Relay setting and logic validation • Relay secondary injection tests as required
Scheme	• Wiring and connection checks • Insulation test • Primary injection test • LV balance tests • Reduced voltage trip check • Pre-commissioning trip checks • Functional checks of all SCADA routines, analogue indications and alarms • Panel and link labelling • SPD and electrical drawing validation • Asset Database information validation • Protection Mandatory Isolation Sheet creation and validation
In-service	• In-service balance checks • Directional checks where required • VT voltage phase-out where required.

6 Maintenance

6.1 Scheduled maintenance

Calibration maintenance and operational checks of protection equipment must be completed according to the periods defined in Table 2. The maintenance must be completed within the latitude period indicated.

The Protection Manager has the authority to approve exceptions to the specified intervals.

The first maintenance after commissioning must not be undertaken by the Technologist(s) who were involved in the initial commissioning of the scheme whenever practical.

Table 2 - Scheduled maintenance intervals

Network element	Type	Activity	Interval (years)	Latitude (years)
11/22kV feeders (including 12.7kV SWER)	Schemes containing multiple microprocessor main relays (*Note 1)	Calibration	6	0.5
	Other	Alternating Op-check/Calibration	3	0.5
33/66kV feeders	Schemes containing multiple microprocessor main relays (*Note 1)	Calibration	6	0.5
	Other	Alternating Op-check/Calibration	3	0.5
	All	Post commissioning calibration (high consequence sites only) (*Note 2)	1.5	0.5
132kV feeders	All	Alternating Op-check/Calibration	3	0.5
		Post commissioning calibration (high consequence sites only) (*Note 2)	1.5	0.5
Transformers	Schemes containing multiple microprocessor main relays (*Note 1)	Calibration	6 (*Note 3)	0.5

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	Other	Alternating Op-check/Calibration	3	0.5
	All	Post commissioning calibration (high consequence sites only) (*Note 2)	1.5	0.5
Capacitor banks	All	Alternating Op-check/Calibration	3	0.5
Busbar protection (including frame leakage)	All	Calibration	3	0.5
		Post commissioning calibration (high consequence sites only) (*Note 2)	1.5	0.5
Underfrequency load shedding	All	Calibration	3	0.5
Batteries – Intertripping	All	Check	0.5	0.5
		Replace	1.5	0.5
Pilots (un-supervised)	All	Op-check	1	0.25
Reclosers	All	Calibration & battery replacement	4	0.5
	Non-SCADA connected (*Note 4)	Inspection and data interrogation	1	0.25
Recloser batteries	All	Replace	4	0.5
Spare and auxiliary bays	Schemes containing multiple microprocessor main relays (*Note 1)	Calibration	6	0.5
	Other	Alternating Op-check/Calibration	3	0.5
Other schemes	All	Alternating Op-check/Calibration	3	0.5

Note 1: Definition of schemes containing duplicate or multiple non-duplicate microprocessor main relays are specified in Appendix A.

Note 2: Post commissioning calibration maintenance tasks are only required for high consequence sites, listed in Appendix B.

Note 3: Transformer scheme intervals of seven years are permitted if aligning with transformer plant maintenance.

Note 4: Unmonitored non-SCADA connected reclosers do not provide feedback to indicate functional failures have occurred. These may be due to internal faults, hardware failures or other. Inspections and interrogation of event records shall be carried out by Technologists to ensure that scheme functional and operational integrity is upheld. Documented maintenance forms and event records shall be processed appropriately for recordkeeping.

6.2 Condition based maintenance (CBM)

Condition based maintenance is required when a condition exists that requires the performance of calibration maintenance, operational checks, protection setting changes, special investigation, installation of temporary protection or defect repairs that cannot be deferred until the next routine maintenance.

When CBM maintenance is required, Operations Managers – Protection & Control must coincidentally undertake routine maintenance if it is economical and practicable to do so.

6.3 Fault and Emergency maintenance (F&E)

Fault and emergency maintenance is required to restore failed equipment to an operational state. Defects or design errors which seriously compromise the performance of a protection scheme may require immediate attention and be classed as F&E.

6.4 Outage planning

Protection maintenance work must not be carried out without approval from System Operations.

Before protection maintenance work begins, appropriate measures must be put in place to prevent unintentional tripping of any in-service equipment.

Any protection scheme that needs to be made non-auto must comply with the requirements of Branch Procedure - NCB 0642 Protection Withdrawal Authority, and any specific requirements detailed in the applicable Workplace Instructions.

6.5 Defects

Reported defects, or defects found during routine maintenance or non-routine maintenance must be evaluated by the Technologist - Protection and prioritised to determine the appropriate action to be taken. The prioritisation of defects will be in accordance with Substation Maintenance Instruction SMI 124 – Maintenance data entry and defect prioritisation.

If installation of temporary protection is necessary, an approved design in the form of an SPD and setting file is required and the design approval process outlined in TBC 0004 – Protection Design Process must be followed.

Any protection scheme that needs to be made non-auto must comply with the requirements of NCB 0642 - Protection Withdrawal Authority

6.6 Routine maintenance checks

The table below details the checks required for routine maintenance. Detailed information on how to carry out these checks will be incorporated into Procedures and Workplace Instructions.

All relay testing must be performed only after modifications or calibration has been completed.

Table 3 - Routine maintenance checks

Equipment	Tasks
Current transformer	• CT insulation resistance test • CT charge
Voltage transformer	• VT secondary insulation resistance test
Relay	• Comparison of in service settings with reference files on network • Relay secondary injection tests as required
Scheme	• Any next maintenance defects corrected • Wiring and connection checks • Insulation test • Trip checks (including reduced voltage checks on electro-mechanical equipment) • SPD and electrical drawing validation • Functional checks of all SCADA routines analogue indications and alarms • Asset Database information validation • Protection Mandatory Isolation Sheet validation

6.7 Restoration

Actions must be taken to confirm that the relay settings are correct, all temporary wiring and test shorts are removed, and all the required alarms, links, switches and flags have been restored.

6.8 In-service checks

The correct performance and measurement of CT, VT and pilot circuits must be proven post commissioning where necessary and practicable. Special care is required during these checks to avoid open circuiting CT circuits, and for ensuring network security.

6.9 Relay setting change

When a relay requires a setting change, arrangements must be made to take the protection scheme out of service. If a relay plug, dial or software setting is changed, the calibration of the protection relay must be checked after the setting change. If a CT ratio change is made, an in-service check is required when the equipment is returned to service.

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6.10 Installation of temporary protection

Protection settings will be provided by the Protection Engineer or Protection Specialist. A check of protection relay calibration and tripping performance is required before the temporary protection is put into service.

7 Relay Test Standards

7.1 Generic Test Plan (GTP) development

A Generic Test Plan (GTP) must be developed for all protection relays. This plan must be developed by either a Technologist – Protection or a Protection Development Specialist and reviewed and approved by a Protection Development Specialist.

The GTP must be developed for use with computer-controlled test equipment whenever practical.

This GTP must include full testing of the power supply modules, all digital I/O, analogue I/O, and correct operation of all features and settings within the relay that are typically used.

Instructions for the testing of protection relays must be documented in the GTP file if practical, or otherwise in a Workplace instruction.

The following points are a guide for developing a test plan. The term Electronic relays in this guide mean non-numerical relays.

Table 4 - Test plan requirements guide

Type	Checks
Plug, switches and dials on electronic and electro-mechanical relays	Either a setting, calibration or functional test must be used to prove that each switch, dial or plug position operates correctly. If the dial is of a variable type, the three marked positions must be tested (unless specified otherwise, one test in the low range end, one at middle range and one at the high end of the dial).
Pick-up/drop-out values on electronic and electro-mechanical relays	The pick-up/drop-out values of devices must be verified to the manufacturer's tolerances, for each dial setting in the relay. For equipment with software switches, the pickup/drop-out must be tested for three settings, one in the low, one in the middle and one at the high end of the range.
Relay characteristics on non-numerical relays	A calibration test is required for each operating characteristic that is normally used in the relay. The tolerances must be in accordance with the manufacturer's specifications. Enough points must be tested to verify the protection characteristic is operating as expected.
Relay characteristics on numerical relays	- A calibration test is required for each setting that will be used at the specific relay location. The tolerances must be in accordance with the manufacturer's specifications. - Tests will be kept to the minimum amount necessary to verify the settings are correct. Testing to verify characteristics created in algorithms are not required.
Inputs, outputs and indicators	Correction operation of all inputs, output contacts, indicators, target, flags, and event recording features must be verified. All analogue

inputs and outputs must be tested for accuracy to the manufacturer's tolerances.

7.2 Test equipment

Equipment used for testing protection equipment must meet the following specification. All equipment must have a current calibration sticker attached by an approved testing laboratory that has certified traceable calibration.

Table 5 - Test equipment specification

Equipment	Aspect	Accuracy	Calibration frequency
Relay Test Set	Electrostatic discharge immunity	To meet IEC 801A or equivalent	18 months
	Amplitude accuracy	$\leq 0.5\%$ of reading maximum (0°C to 50°C) {for amplitudes $>10\%$ of any range}	
	Total harmonic distortion	2% maximum at 50/60 Hz	
	Phase angle accuracy	0.5° at 50 and 60 Hz	
	Frequency accuracy	$\leq 0.01\%$ at 50 Hz	
	Timer	$\leq 0.01\%$ of reading and $\leq$ least significant digit	
Portable ammeter *	Accuracy Movement	Class 0.5 True RMS	2 years
Portable voltmeter	Accuracy Movement	Class 0.5 True RMS	2 years
Tong meter	Accuracy	$\leq 2\%$ of range	2 years
Portable timer	Accuracy	$\leq 0.1\%$ of range	2 years
Phase angle meter	Accuracy	≤ 1 degree	2 years
Multimeter *	Accuracy Movement	$\leq 1\%$ DC, $\leq 1\%$ AC True RMS	2 years
G-Ohm	Accuracy	$\leq 2\%$ of range	2 years
DC resistance bridge	Accuracy	$\leq 2\%$ of range (including CT secondary resistance measurement)	2 years
Insulation Resistance Tester	Accuracy	$\leq 5\%$ on 1000 V range	2 years

* Not to be used on in-service CT circuits if fused or have auto cut-out (due to the danger of open circuiting CT).

7.3 Relay test processes

Table 6, Table 7, and Table 8 outline the three acceptance/test processes for protection relays; initial inspection and acceptance; workshop testing; and final commissioning field testing. The Protection Development Specialist may approve the omission or modification of test/acceptance requirements if satisfied that the functional performance requirements of any commissioned protection scheme will still be met.

Table 6 - Initial inspection and acceptance of protection relays

Element	Particulars
Purpose	To verify that the protection equipment delivered from a supplier or from stores is what was ordered and has not been damaged in transit.
Equipment	Before protection equipment is accepted for any testing or application on the network, it must be physically inspected to verify that it complies with the organisation's physical specifications and configuration requirements. The devices must also be inspected to confirm there is no evidence of any physical damage prior to its arrival.
Process	On receipt of any protection device, it must be unpacked, completely removed from its packaging and inspected for physical damage or other obvious defects. The device will be inspected and verified in relation to its ordering information. This inspection will include, but not be limited to, checks of: • Model number. • Basic style and configuration. • Software/firmware version number. • Contact output numbers and types. • Input types and numbers, (including CT and VT inputs). • Termination equipment (for example, screws, studs, washers). This inspection is the responsibility of the section receiving the device.
Results	If the device has any evidence of a physical defect, or it does not comply with the ordering requirements, it must be returned to the supplier by the appropriate process. If there is any issue with the validity of the configuration, model number or version of the device, this must be raised with the Project Manager for rectification. This issue must be resolved to the satisfaction of all concerned parties. The completion of this process will be the responsibility of the section that is receiving the device. Note: As part of this process, all numerical/digital protection devices must be allocated to the specific protection scheme/location for which it was purchased, and this information must be detailed on the device.

Table 7 - Workshop testing and setup of protection relays

Element	Particulars
Purpose	To verify that installed protection equipment operates correctly for all the specified functionality. Note: For multi-function numerical/digital devices, it is only required to check the operation of the specific functions that are used at the installed location. The relevant Project Manager must nominate the specific location for each device.
Equipment	A GTP must be used to test protection relays in the workshop. As part of the testing process, the GTP will be modified to create a location/equipment specific Field Test Plan (FTP). This FTP will then be utilised to test the relay in its final location. To minimise the amount of time and testing the FTP must include all tests relevant to complying with the first three points above, however for the final point, test only those features that will be used in the device at the installed location. The list of features to test will be listed on the SPD for the specific location.
Process	If the protection equipment fails any test, the Protection Development Specialist must be notified to determine if device needs be returned to the supplier/manufacture for corrective action.
Results	All test results must include a record of the equipment name, location, model, serial number, firmware version (if applicable), test date, technologist's name and test equipment used. A copy of all test results must be stored on the approved Company's Protection Relay Results database.

Table 8 - Field testing of protection relays

Element	Particulars
Purpose	To verify that non-numerical protection relays installed as part of a protection scheme on the network are set and operate correctly and within tolerances in accordance with the SPD and design documentation.
Equipment	A location specific test plan (FTP) must be developed for all protection relays installed as part of a protection scheme on the network. This requirement is optional for any auxiliary relays that form part of a protection scheme, and which have a single, non-adjustable operating value (such as multi-trip relays). All FTPs developed as a software file must be stored on the Company's approved network folder, described in the relevant Workplace Instruction. FTP's must be designed to test those features of the relay that are used at the specific location. The test plan will contain a series of tests that verify all settings that have been used within the relay and verify the operating characteristic and functionality of the relay. The FTP must be based on an approved GTP.
Process	All protection devices must be tested according to relevant Workplace Instructions and test plans. If the protection equipment fails any test, the Protection Development Specialist must be notified to determine if device needs be returned to the supplier/manufacturer for corrective action.
Results	All test results must include a record of the equipment name, location, model, serial number, firmware version (where applicable), test date, testing technologist's name and test equipment used. A copy of all test results must be stored on the approved Company's Protection Relay Results database.

8 Authorities and Responsibilities

Position	Authority/Responsibility
Manager System Operations	Approving amendments to this Standard in accordance with Company Procedure GAM 0001 – Network Standards Framework: Preparation and Amendment of Network Standards.
Protection Manager	- Keeping this Standard up to date and assigning a suitable Project Officer to periodically review this Standard. - Overseeing the implementation of this Standard within the Protection section. - Approving exceptions to the specified routine maintenance intervals.
Protection Development Specialist	- Approving the omission or modification of a test requirement if satisfied that the functional performance requirements of the protection scheme will still be met. - Overseeing the development and maintenance of Procedures and Workplace Instructions that achieve the requirements of this Standard. - Certifying employees to work on the Company's protection systems.
Operations Managers – Protection & Control	- Directing employees to undertake the work covered by this Standard. - Restricting employees to undertake work only which they are competent to perform, giving regard to their qualifications, training, experience, currency and the nature of the work being performed. - Verifying periodically that Technologists – Protection are undertaking their work in accordance with this Standard and the Company's Procedures, Workplace Instructions and Safe Work Method Statements.
Technologists – Protection	Working in accordance with this Standard and the Company's Procedures, Workplace Instructions and Safe Work Method Statements.
Network Operations & Control Room Manager	Maintaining a procedure outlining the requirements in relation to continued operation of HV plant with protection schemes out of service or degraded.

9 Appendix A – Microprocessor scheme classifications

9.1 General

This section specifies the requirements for each protection scheme incorporating either duplicate microprocessor main relays or multiple non-duplicate microprocessor main relays to be identified solely for calibration maintenance (excluding operational checks) based on scheme inclusions and design.

The following must be met for schemes to be classified solely into calibration maintenance intervals (excluding operational checks):

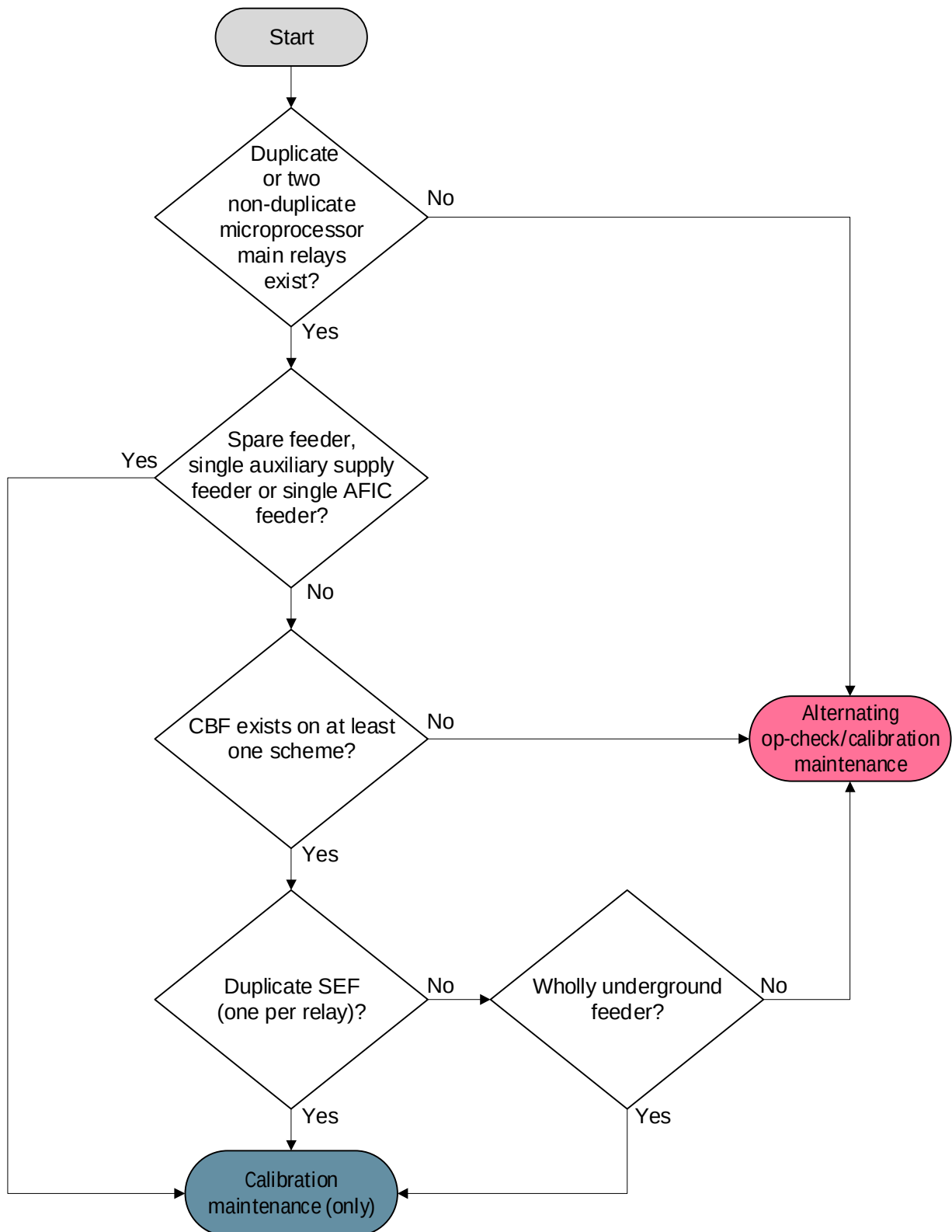
- Duplicate or multiple microprocessor main relays are operational.
- Main relays are not static or electro-mechanical type relays.
- At least one relay is supervised with relay fail.
- Each main relay must have its own dedicated CT.
- Communications fail alarm is enabled on at least one relay.

The following considerations can be omitted in the assessment for calibration maintenance intervals only (excluding operational checks):

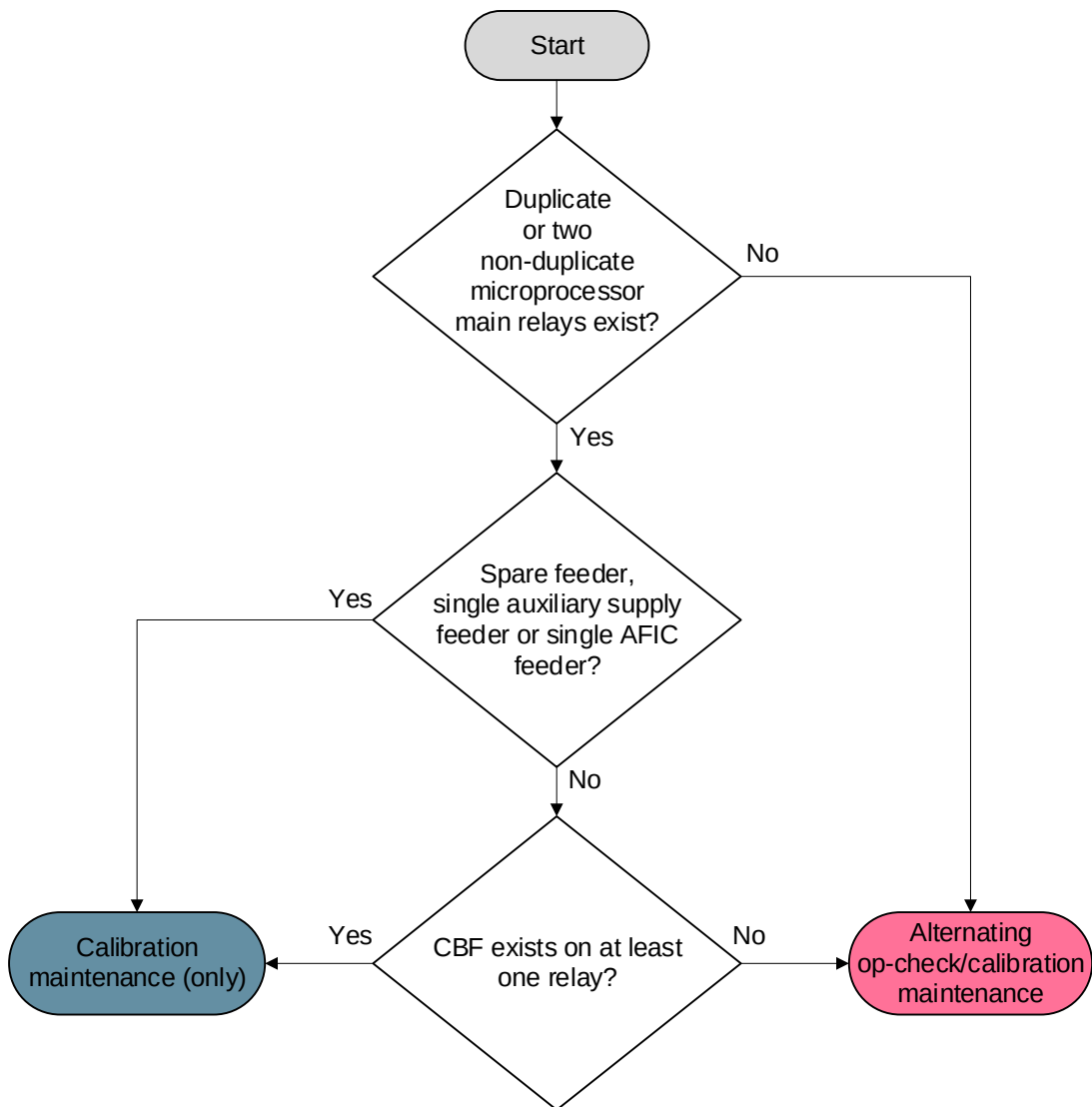
- Auxiliary type electro-mechanical relays and mechanical operating devices are excluded (e.g. multi-trip relays, timers, winding temperature indicators, pressure relief devices).
- Battery supplies and trip circuits must exist but need not to be duplicated.
- Trip circuit supervision and/or fuse supervision is preferential for individual schemes, although is not mandatory.

Decision trees associated with the correct categorisation of microprocessor schemes are outlined in sections 9.2, 9.3 and 9.4 for each respective scheme types. Where a bay is connected to multiple items of plant, the most onerous maintenance intervals shall apply (e.g. double cabled feeder with auxiliary supply feeder).

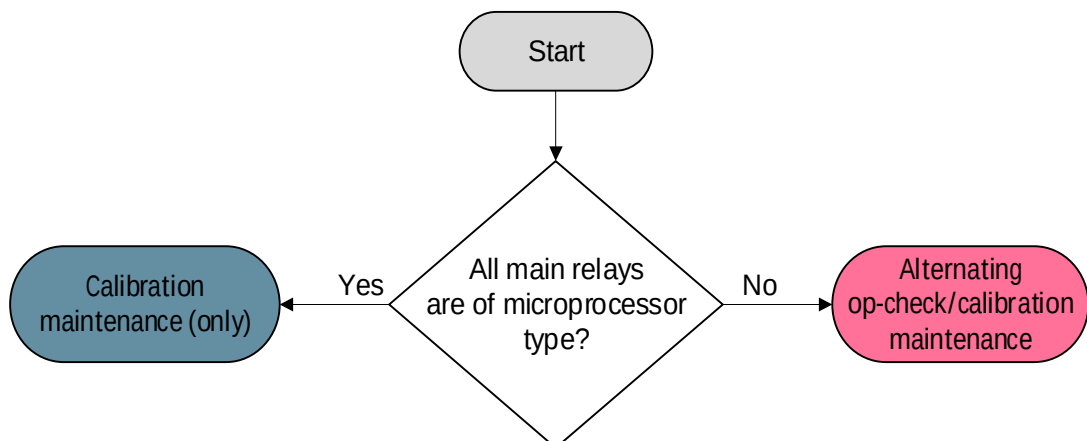
9.2 Distribution feeder (11/22/12.7kV SWER) maintenance interval decision tree



9.3 Sub-transmission feeder (33/66kV) maintenance interval decision tree



9.4 Transformer maintenance interval decision tree



10 Appendix B – High consequence sites

Table 9 – High consequence sites identified for post commissioning maintenance

Substations	
ALBION PARK ZS	MUNGERIE PARK ZS
BAULKHAM HILLS TS	NARELLAN ZS
BELLAMBI TS	NEPEAN 11KV ZS
BLACKTOWN TS	NEPEAN TS
BONNYRIGG ZS	NORTH PARRAMATTA ZS
CAMELLIA TS	PARKLEA ZS
CANLEY VALE ZS	PENRITH TS
CARLINGFORD TS	PLUMPTON ZS
DAPTO ZS	QUAKERS HILL ZS
DOONSIDE ZS	SCHOFIELDS ZS
DUNDAS ZS	SHELLHARBOUR ZS
FAIRFAX LANE TS	SHERWOOD ZS
GUILDFORD TS	SHOALHAVEN TS
HAWKESBURY TS	SMITHFIELD ZS
HINCHINBROOK ZS	SPRINGHILL TS
HOLROYD ZS	ST MARYS ZS
JASPER RD ZS	ULLADULLA ZS
KATOOMBA NORTH TS	WARILLA ZS
KENTLYN ZS	WARRIMOO TS
KINGSWOOD ZS	WEST LIVERPOOL TS
LENNOX ZS	WEST TOMERONG TS
LIVERPOOL 11KV ZS	
LIVERPOOL TS	
MACQUARIE FIELDS ZS	
MINTO ZS	
MOUNT DRUITT TS	
MOUNT TERRY TS	

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