Eskom	Standard	Technology

Title: **SECONDARY PLANT LINE TRAP MAINTENANCE**

Unique Identifier: **240-122850198**

Alternative Reference Number. **TPC41-89**

Area of Applicability. **Engineering**

Next Review Date: **STABILISED**

COE Acceptance

Richard McCurrach

PTM&C Senior Manager

Date. 13/1/2017

DBOUS Acceptance

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DBOUS Manager

Date 16/1/17

This document is **STABILISED.** The technical content in this document is not expected to change because the document covers: *(Tick applicable motivation)*

1	A specific plant, project or solution	
2	A mature and stable technical area/technology	✓
3	Established and accepted practices	
Notes:	Par 4.2 & 4.4 "TPL41-75" should read "TST41-75" Par 2 : For maintenance periods, the requirements of 240-54894702 Maintenance Standard for Power Line Carrier (PLC), associated Transmission Line Coupling Equipment and Teleprotection Equipment, shall apply	
	This document is stabilized until such time that a task manual is compiled to supersede it.	

PCM Reference **240-41836800**

SCOT Study Committee Number/Name: **Power Delivery Maintenance**

Eskom Transmission	PROCEDURE	Document Classification : PUBLIC

Title: **SECONDARY PLANT LINE TRAP MAINTENANCE**

Reference: **TPC41-89**
Revision: **1**
Effective date: **April 2008**
Total pages: **1 Of 9**
Revision date: **September 2012**

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DATE: 09.04.08	DATE: 9/4/2008	DATE: 2/4/08

Content **Page**

1 Introduction

This procedure covers the action taken when doing maintenance on existing line traps at Transmission substations. This procedure is part of the Secondary Plant Maintenance Procedures.

2 Procedure

Note:
Line Traps, for most intents and purposes are robust devices. Experience over many years has shown however that the critical tuning units and surge arrestors fitted inside line traps have a relatively short life expectancy, especially on lines with a relatively higher frequency of switching and/or circuit breaker operation. When tuning units fail the damage will rarely be visible and the associated PLC will continue to function without alarms under normal conditions. When the Teleprotection is required to operate to clear line faults however, the added attenuation caused by tuning unit failure may lead to delayed tripping and ultimately to plant damage or system instability. Even Line trap main coils suffer tremendous stresses during line faults and undetected cracks and corrosion may lead to mechanical failure. For these reasons it is strongly recommended that Line Trap maintenance periods not be extended beyond three years.

2.1 Visual Inspection.

2.1.1 Ring crosses (“spider”)

- Ring crosses shall be checked for cracks and mechanical damage. The findings shall be reported to the specialist for advice.
- Check the bottom ring cross for drain holes and if none, report to the Primary Plant manager of the Grid concerned, so that the necessary action can be taken.

2.1.2 Tensile rods

- Should it be necessary to torque the tensile rods, inform the Primary Plant manager of the Grid concerned.
- Where broken rods are found, report immediately to the Primary Plant manager of the Grid concerned.

2.2 Electrical Evaluation

2.2.1 Tuning Unit and Surge Arrester

- Test the blocking characteristics of the tuning unit, with the surge arrester and main coil connected in circuit. Constant Current or Impedance Bridge method, as per ANNEXURE 1.
- Any electrical measurements or the replacement of components required shall be recorded and reported.
- The replacement of the ABB TLJO Line trap tuning unit is shown in ANNEXURE 2

3 Documentation

The following information should be documented for reference purposes, using the test sheet - APPENDIX A.
- Date tested and results of blocking response
- Faults found (if applicable)
- Date repaired (if applicable)

4 Supporting Clauses

4.1 Scope

This document sets out a maintenance procedure that will cover the maintenance on all the line traps and associated components.

The Safety and High Voltage regulations and requirements, applicable to personnel performing maintenance on line traps, are not covered in this document.

4.2 Related/Supporting Documents.

ESKPVAEY6	Operating Regulations for High Voltage Systems
TPL41-125	Secondary Plant Refurbishment Policy
TPL41-425	Maintenance Management Policy and Strategy
TST41-475	Standard for Transmission Maintenance Planning and Control
TPL41-75	Maintenance Intervals of Powerline Carrier, Integrated Teleprotection Equipment and Associated Transmission Line Coupling Equipment
TPC41-84	PLC System Coupling Device Maintenance
TPC41-532	PLC and Integrated Teleprotection System Maintenance Procedure
E8231.1	Haefely technical instruction number E8231.1, operating instructions for Line Traps.

4.3 Definitions

The definitions in ESKPVAEY6 are applicable to this standard.

The line traps discussed in this document are used for isolating Power line carrier signals, and are usually found in Transmission substation yards, Power Station HV yards and also in and Distributor distribution station yards and are connected in series with the High Voltage power line.

4.4 Roles and Responsibilities.

It will be the responsibility of the various Grid secondary Plant Managers to ensure that regular maintenance is performed, by competent personnel, on all Power Line Carrier coupling devices installed on all Transmissions Power Line Carrier Systems in their area. The maintenance interval is specified in the Power Line Carrier System Maintenance Policy Document TPL41-75.

All maintenance personnel shall comply with this procedure and shall ensure that any defective components found, during the maintenance procedure, are either replaced or repaired, and document results as per clause 4 – “Documents”.

Maintenance or repair work done on the line traps must be supervised by the Primary Plant Manager and the Secondary Plant Manager of each specific Grid

4.5 Implementation Date.

The implementation date is September 2007

4.6 Process for monitoring.

As per Policies and Standards detailed in clause 4.2

4.7 Safety.

There are definite hazards inherent in working in an HV environment and strict observance of regulations, an alert and responsible attitude and common sense is required if staff are to work safely
The requirements of ESKPVAEY6 are to be strictly applied to at all times.

5 Authorization

This document has been seen and accepted by:

Name	**Designation**
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6 Revisions

Revision Information

Rev	Notes	Date
01	Original document was TPR0300	01/10/01
0	New document replaces TRMPVACZ2 – TPC0047	OCT 2005
1	Procedure for the painting of the main coil added.	May 2006
2	Document Title changed to Secondary Plant Line Trap maintenance Procedure and Primary Plant component removed and now part of the Pimary Plant Line Trap maintenance Procedure TPC41-742	Sept. 2007

7 Development Team

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ANNEXURE 1. Measurement of Line Trap Blocking Response.

NOTE:- This procedure can only be performed if the line is OUT OF SERVICE and a earth is placed on the line side of the Line Trap

1 Scope.
This procedure applies to all versions of line trap installed in the Transmission system.

2 Test Equipment.

a. S.L.M.S. And tracking oscillator e.g. W&G SPM3/PS3, SPM31, SPM33, PSM137 etc.
b. Impedance Measuring set / attachment e.g. W&G SFZ1.
c. Test box for constant current method of testing if SFZ-1 not available.
d. Multimeter e.g. “Fluke”.
e. Test cords.

3 Safety.

The apparatus to be worked on must be made safe in accordance with ESKPVAEY6.

4 Actions.

4.1 Line Trap blocking response measurement.

a. Line earths **must** be connected on the line side of the line trap. **Observe all safety regulations. When working in or on the LT always work between two earths.** If the line isolators, on the yard side of the trap, are not mounted in close proximity to the line trap or if a C.T. is connected between the line trap and the isolators, the interconnecting conductors may have to be disconnected, as they will introduce extra capacitance which will severely influence measurements. Any work on the HV conductors must only be done with co-operation of Operating Staff who are responsible for the integrity of connections on the primary plant. It is preferable to test the functioning of the Tuning Unit (TU) by disconnecting one end of the TU and connecting the TU and surge arrester in parallel with a suitable inductor to simulate the line trap inductance. It is very important afterwards to inspect and verify that all connections are correct.

b. Measure the blocking response by either using the constant current technique (refer to figure 1) or by making use of an impedance bridge technique (refer to figure 2). The frequency span over which the tests must be performed, will be determined by the frequency rating of the specific tuning unit. Ensure that the line trap/tuning unit values are co-ordinated and suitable for the proposed PLC frequencies.
Note:
- Haefely tuning units of the later (spark plug - spark gap) type should always be used in combination with the matching zinc oxide surge arrester (type XBE). Earlier type arresters are not suitable.
- BBC TLJO type line traps must always be refurbished with the TU/surge arrester/ bracket kits available for this purpose from ABB. (ANNEX 5)

c. Record the results (on copies of Appendix A) and plot graphs from the results obtained.

d. Repeat steps a., b. and c. for additional traps.

APPENDIX A:

Station …….. Distant Station…….

Feeder No. …… Line Name:……..

Line No. …… Line voltage……kV.

Freq. (kHz)	Line Trap Blocking (Ohms)		
	R - Ø	W - Ø	B-Ø
20			
40			
60			
80			
100			
120			
140			
160			
180			
200			
220			
240			
260			
280			
300			
320			
340			
360			
380			
400			
420			
440			
460			
480			
500			

Date of Test:…….

Tested by:…… ……..
Print Name Signature

Comments on the physical condition of traps:

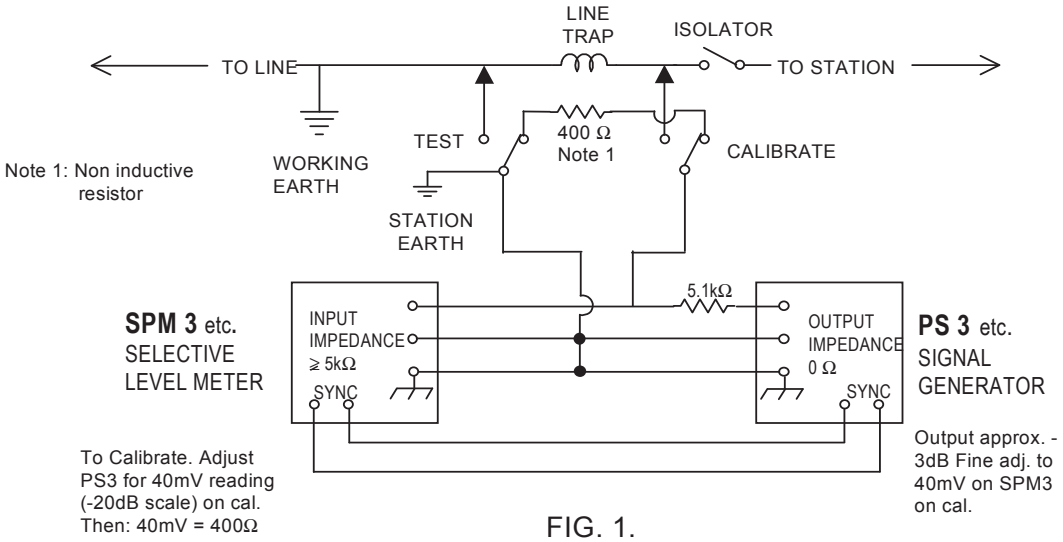

FIG. 1.

MEASURMENT OF LINE TRAP BLOCKING IMPEDANCE
(CONSTANT CURRENT SOURCE TECHNIQUE)

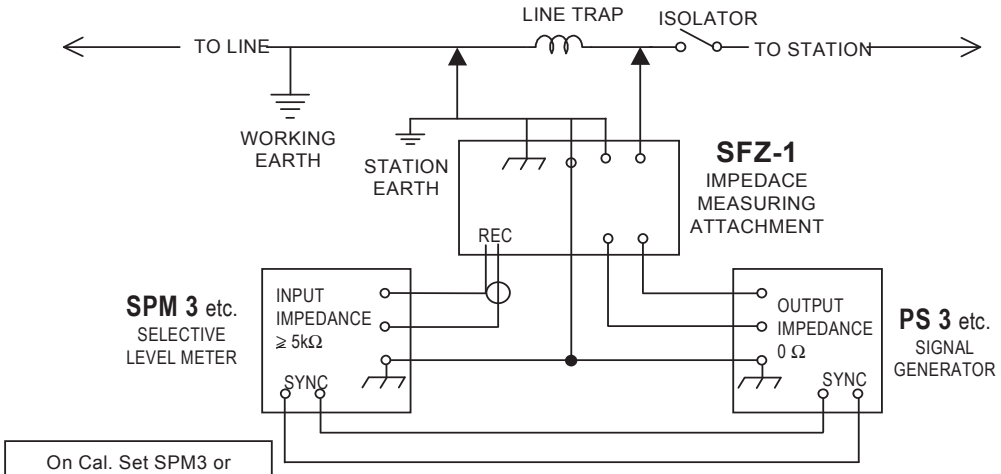

FIG. 2.

MEASURMENT OF LINE TRAP BLOCKING IMPEDANCE
(IMPEDANCE BRIDGE TECHNIQUE)

ANNEXURE 2. Replacement of Tuning Units on BBC TLJO Line Traps.

NOTE:- This modification MUST only be performed when the line is OUT OF SERVICE and a portable earth is applied on both sides of the line trap.

1 **Scope.**

This procedure applies to all versions of BBC TLJO line traps.

2 **Introduction.**

The BBC TLJO line trap is a well constructed unit and it would not be wise to scrap them due to unavailability of the tuning unit spares. To extend the life of the of these line traps, tuning unit and surge arrester refurbishment kits are available from ABB South Africa (PTY) LTD, Utilities Power Systems, Private Bag Z37 Sunninghill 2157.

2.2 **MODIFICATION (Figure 1 refers)**

2.2.1 Insert and tighten four Hex bolts, nuts and washers to the top “spider” (ring crosses) of the line trap.

2.2.2 Bolt tuning unit and arrester to the mounting bracket.

2.2.3 Bolt the mounting bracket with the tuning unit and surge arrester to the top “spider”, where the four bolts in paragraph 2.2.1 were installed.

2.2.4 Connect the leads of the tuning unit and the surge arrester to the top and bottom “spiders” of the line trap respectively.

2.2.5 Tighten the mounting blots nuts to a torque of 30nm.

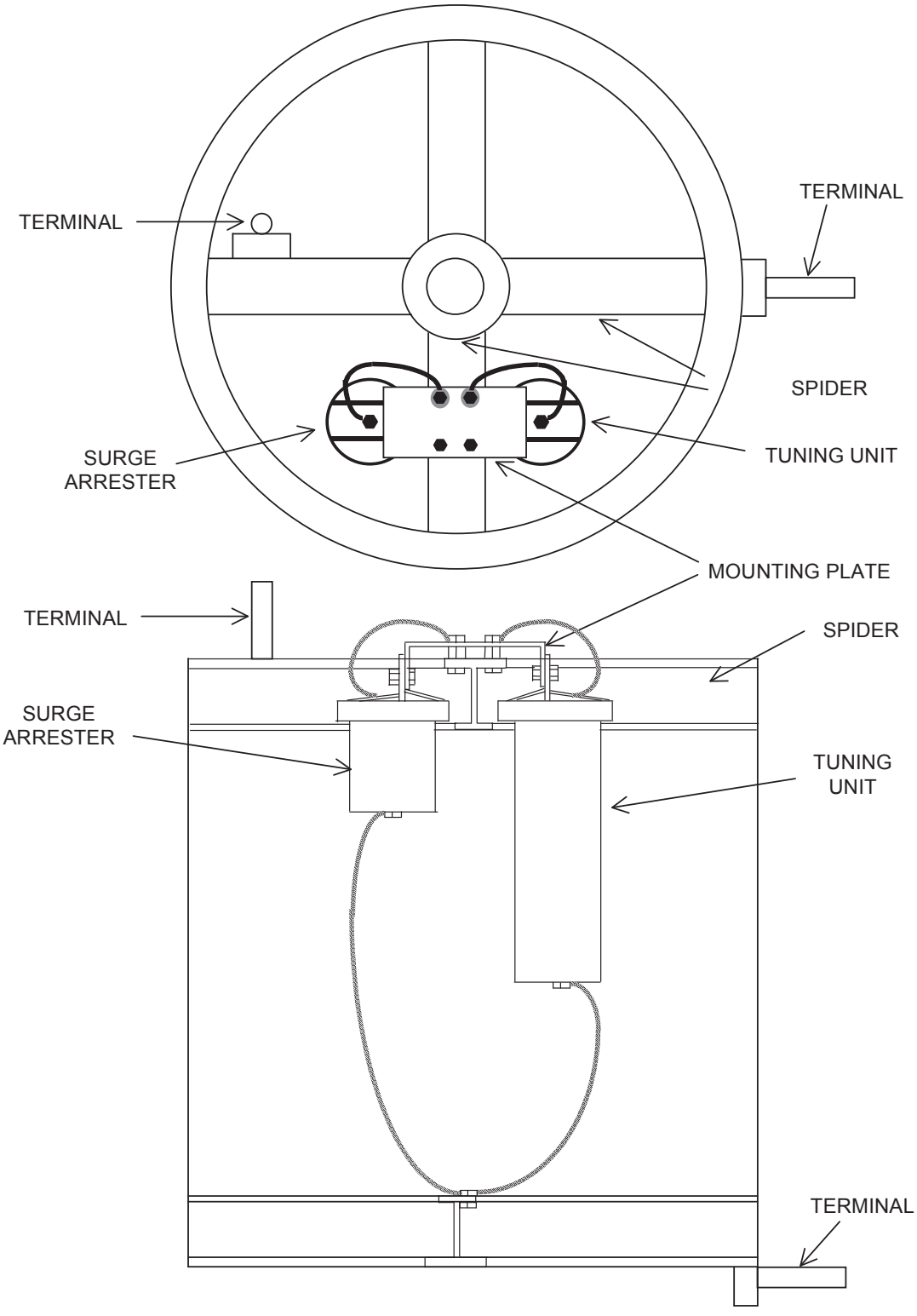

Figure showing the installation of the Tuning unit and Surge arrester in a BBC TLJO line trap

FIG. 1