



11/10007A 37

**Annexure B - Condition assessment and reporting form – (Refer Page 14 and onwards for equipment photos)**

<b>Transmission/zone substation and switching station condition assessment and reporting form</b>		Date of review:	22/02/2017				
		Reviewed by:	Humayoun Khan				
		Date of site visit:	07/12/16 and 15/02/17				
SUBSTATION NAME: MARAYONG ZONE SUBSTATION							
<b>OVERVIEW OF SUBSTATION DETAILS</b>							
Year built or commissioned:	Established 1965						
Location:	Charles Street, Blacktown (Cnr Frederick St)						
<b>POWER TRANSFORMERS</b>							
<b>Power transformer no. 1</b>							
Year of manufacture:	1973	Age:	43	MVA / Vector group:	25/19/15 / Dyn1	Make:	Tyree
Voltage HV/LV/TV:	33kV/11kV		Serial no.:	70686			
Tap changer make:	Reinhausen		Tap changer model:	CIII350D			
<b>Mechanical strength of the paper insulation</b>							
Degree of polymerisation:	360 (DP sample gathered from B phase high voltage bushing lead - DP test date: 20/10/2008) 316 (based on 2FAL – last oil test conducted on 27/06/2016)						
<b>Comments:</b> The transformer paper strength is fair for a transformer of this age. As the DP test is dated, 2FAL levels are used to estimate DP using Chendong's equation. Based on the 2FAL levels (2.529 ppm), DP value of 316 rates the condition of paper insulation as C in line with SMI161 criteria, which suggests that the solid insulation is nearing end of life.							
<b>Electrical properties</b>							
<b>Comments:</b> As per the major overhaul report date 22/02/2014, the winding DLA test results are all $\leq 4.5$ mrad (H-L: 4.1, H-G: 4.25, L-G: 4.3, tested at 22°C). This corresponds to a condition rating of A, which means that the insulation between winding to winding and winding to ground is in 'as new' condition as per SMI161. Insulation resistance (HV: 1695.58M $\Omega$ , LV: 1436.72M $\Omega$ ) is above the minimum IR (HV: 167M $\Omega$ , LV: 55.66M $\Omega$ ) and the reduction is greater than 30% of previous routine IR test result (HV: 3390.41M $\Omega$ , LV: 1436.72M $\Omega$ ). Based on the IR result, the condition rating is D, which suggests that the paper and liquid insulation has deteriorated significantly. The polarization index is also on the lower side (HV: 1.44, LV: 1.65) indicating a relatively high moisture content. Bottom lid gasket limits the ability to dry this unit.							
<b>Oil quality</b>							
<b>Comments:</b> As per the oil test on 27/06/2016, apart from colour classification (4.5), the oil quality parameters are within limits as specified in SMI 103, however there is some negative trending. There is a noticeable reduction in the oil breakdown voltage (44kV from 66kV) and increase in DDF (0.0381 radians from 0.0285 radians) and water content (17.9 from 15 ppm) as compared to the last oil test on 14/01/2016, indicating presence of some moisture and oxidation byproducts. The oil quality condition rating as per SMI161 methodology is D, which suggests that the oil is in poor condition.							
<b>Defect history</b>							
<b>Comments:</b> A total of 25 defects against this transformer have been raised in Ellipse since 1999. The majority of defects have been raised due to oil leaks. Oil gaskets were replaced and leaks issue rectified in 2008 as part of capital refurbishment. There have been only four defects raised in the last 5 years. New transformer oil leak defects have been raised in 2016.  There have been 21 defects reported in Ellipse for tap changer/motor box since 1997 and mainly compromise of mechanical issues involving cam switches and dirty contacts. These have been progressively repaired under maintenance work orders. There have been only four defects raised in the last 5 years. Therefore, a total of eight work orders have been raised for this transformer over the last 5 years. Based on the defects history, the SMI161 condition rating is B, which suggests that the transformer is in satisfactory condition.							
<b>Tap changer</b>							
<b>Comments:</b> The tap changer is a CIII Reinhausen in which the carbonised oil contaminates main tank oil and therefore requires annual inspection and drainage of carbonised oil. The exercise is required once each year with transformers de-energised and complete oil in tap changer is replaced once every three (3) years to address the issue of contamination of TC oil with main tank oil. Tap changer cubicle shows normal signs of wear.							
<b>Overall condition</b>							
<b>Comments:</b> In addition to the above criteria, there is noticeable rust on radiator fins. There are also leaks from the bottom radiator connections with slight bulge in tap changer gasket							

Based on the SMI161 health index condition assessment, the health index for this transformer is calculated as 54 and is assessed to be in a fair condition. There appear to be a number of problems with the transformer's internal components. The IR and oil quality are poor. The paper insulation condition is fair.

The TX was refurbished in 2008 with a refurbishment follow up in 2011.

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MARAYONG ZONE SUBSTATION

Power Transformer no. 2							
Year of manufacture:	1973	Age:	43	MVA / Vector group:	25/19/15 / Dyn1	Make:	Tyree
Voltage HV/LV/TV:	33kV/11kV		Serial no.:	70594			
Tap changer make:	Reinhausen		Tap changer model:	CIII350D			
Mechanical strength of the paper insulation							
Degree of polymerisation:	446 (DP test date: 29/03/2007); 318 (based on 2FAL – last oil test conducted on 27/06/2016)						
Comments:	<p>The transformer paper strength is fair for a transformer of this age. As the DP test is dated, 2FAL levels are used to estimate DP using Chendong's equation. Based on the 2FAL levels (2.5017 ppm), DP value of 318 rates the condition of paper insulation as C in line with SMI161 criteria, which suggests that the solid insulation is nearing end of life.</p>						
Electrical properties							
Comments:	<p>The winding DLA value between L-G from major overhaul report dated 01/06/2012 is 6.95 mRad (tested at 16°C). This corresponds to a condition rating of C, which means that the insulation between winding to winding and winding to ground has deteriorated. Insulation resistance (HV: 835.66MΩ, LV: 139.68MΩ) is above the minimum IR. Previous IR result is not available however it is assumed that the reduction in IR is greater than 30%. Based on the IR result, the condition rating is D, which suggests that the paper and liquid insulation has deteriorated significantly. The polarization index is also on the lower side (HV: 1.95, LV: 1.24) indicating a relatively high moisture content. Bottom lid gasket limits the ability to dry this unit.</p>						
Oil quality							
Comments:	<p>As per the oil test on 27/06/2016, both colour classification (4.0) and DDF values (0.0982 radians) are outside the quality limits specified in SMI 103. Also, there is some negative trending in all values. There is a noticeable reduction in the oil breakdown voltage (67kV from 80kV) and increase in DDF (0.0982 radians from 0.0488 radians) on 16/12/2015, indicating presence of some moisture and oxidation byproducts. The oil quality condition rating as per SMI161 methodology is D, which suggests that the oil is in poor condition.</p>						
Defect history							
Comments:	<p>A total of 25 defects have been reported since 1998, however low oil and major oil leak defect was reported in June 2016. Oil was topped up and the TX was returned to service. The need for repairs was identified, however Ellipse does not have any records indicating that these repairs have been carried out yet. There have been only seven defects raised in the last 5 years.</p> <p>There have been 20 defects reported in Ellipse for tap changer/motor box since 1997 and mainly compromise of mechanical issues involving gear, cam switches and tap changer and auxiliary contacts. These have been progressively repaired under maintenance work orders. Broken gear was found and replaced in 2010 and no problems with the gear box have occurred since. There have been only seven defects raised in the last 5 years. Therefore, a total of 14 work orders have been raised for this transformer over the last 5 years. Based on the defects history, the SMI161 condition rating is C, which suggests that the transformer is nearing end of life.</p>						
Tap changer (TC)							
Comments:	<p>The tap changer is a CIII Reinhausen in which the carbonised oil contaminates main tank oil and therefore requires annual inspection and drainage of carbonised oil. The exercise is required once each year with transformers de-energised and complete oil in tap changer is replaced once every three (3) years to address the issue of contamination of TC oil with main tank oil. Tap changer cubicle shows normal signs of wear.</p>						
Overall condition							
Comments:	<p>In addition to the above criteria, there are oil leaks visible from the oil pump, sampling point, radiator outlet and neutral gasket. The tap changer gasket also appears slightly bulged. There is also some rust and corrosion on the TX main tank.</p> <p>Based on the SMI161 health index condition assessment, the health index for this transformer is calculated as 58 and is assessed to be in a fair condition. There appear to be a number of problems with the transformer's internal components. The IR and oil quality are poor. The paper insulation condition is fair.</p> <p>The maintenance history of this transformer does not indicate that any major refurbishment has been carried out previously.</p>						
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MARAYONG ZONE SUBSTATION

<b>Power Transformer No. 3</b>							
<b>Year of manufacture:</b>	1973	<b>Age:</b>	43	<b>MVA / Vector group:</b>	25/19/15 / Dyn1	<b>Make:</b>	Tyree
<b>Voltage HV/LV/TV:</b>	33kV/11kV		<b>Serial no.:</b>	70595			
<b>Tap changer make:</b>	Reinhausen		<b>Tap changer model:</b>	CIII350D			
<b>Mechanical strength of the paper insulation</b>							
<b>Degree of Polymerisation:</b>	398 (DP test date: 29/03/2007); 243 (based on 2FAL – last oil test conducted on 16/12/2015)						
<b>Comments:</b>							
The transformer paper strength is poor. As the DP test is dated, 2FAL levels are used to estimate DP using Chendong's equation. Based on the 2FAL levels (4.5477 ppm), DP value of 243 rates the condition of paper insulation as D in line with SMI161 criteria, which suggests that the solid insulation is close to failure. This transformer has reached its end of life and shall be replaced <del>immediately</del> <i>in the near term</i> due to the increased risk of failure.							
<b>Electrical properties</b>							
<b>Comments:</b>							
The winding DLA values from major overhaul report dated 23/11/2013 (H-L: 4.95, H-G: 5.85, L-G: 6.15 mRad) indicate an increase since the last signature test on 13/04/2011 (H-L: 4.85, H-G: 4.45, L-G: 5.35 mRad). This corresponds to a condition rating of B, which means that there is evidence of ageing of insulation between winding to winding and winding to ground. The insulation resistance values (HV: 605.93MΩ, LV: 544.9MΩ) are above the minimum criteria, however there is a significant decrease (approximately 50%) since the signature test on 13/04/2011 (IR values – HV: 1257.1MΩ, LV: 1027.71MΩ). Based on the IR result, the condition rating is D, which suggests that the paper and liquid insulation has deteriorated significantly. The polarization index has also decreased and is HV: 1.44, LV: 1.58, indicating a relatively high moisture content. Bottom lid gasket limits the ability to dry this unit.							
<b>Oil quality</b>							
<b>Comments:</b>							
The oil quality test from 16/12/2015 indicates that the oil quality is poor. There is a significant drop in the breakdown voltage (60kV from 91kV), however it is still above the quality limit as specified in SMI 103. The neutralization value (0.16 mN/m), moisture (27 ppm) and DDF (0.1142 radians) all exceed the quality limit criteria. The oil quality condition rating as per SMI161 methodology is E, which suggests that the liquid insulation is close to failure. The maintenance records show that the TX has been topped with new oil on several occasions. The TX was refurbished 2008. Although the main tank oil was earmarked for replacement at the same time, but was not replaced.							
<b>Defect history</b>							
<b>Comments:</b>							
A total of 30 defects have been reported since 1999. Majority of these were reported in the period between 1999 and 2008 and were mainly due to oil leaks. The transformer was refurbished in 2008 to repair these defects. Only four defects have been since raised due to other causes including fan and tap changer failures. There have been only three defects raised in the last 5 years.							
There have been 71 defects reported in Ellipse for tap changer/motor box since 1997 and mainly compromise of mechanical issues involving switches and contacts. These have been progressively repaired under maintenance work orders. There have been 14 defects raised in the last 5 years. Therefore, a total of 17 work orders have been raised for this transformer over the last 5 years. Based on the defects history, the SMI161 condition rating is D, which suggests that the transformer is in poor condition.							
<b>Tap changer</b>							
<b>Comments:</b>							
The tap changer is a CIII Reinhausen in which the carbonised oil contaminates main tank oil and therefore requires annual inspection and drainage of carbonised oil. The exercise is required once each year with transformers de-energised and complete oil in tap changer is replaced once every three (3) years to address the issue of contamination of TC oil with main tank oil. Tap changer cubicle shows normal signs of wear.							
<b>Overall condition</b>							
<b>Comments:</b>							
In addition to the above, there are clear oil leaks visible from the radiator connection, tap changer and cable box. The tap changer gasket is bulged. There is rust and corrosion on the TX main tank, one radiator fin, bolts and connections, and supports.							
Based on the SMI161 health index condition assessment, <b>the health index for this transformer is calculated as 42</b> and is assessed to be in a poor condition. The paper insulation is in poor condition and other indicators of the transformer condition are also poor.							
The transformer was refurbished in 2008.							
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MARAYONG ZONE SUBSTATION

AUXILIARY TRANSFORMERS					
<b>Auxiliary Transformer No. 1</b>					
<b>Year of manufacture:</b>	1981 (Commissioning year)	<b>KVA:</b>	200	<b>Make:</b>	Tyree
<b>Voltage HV/LV:</b>	11kV / 110V	<b>Serial no.:</b>	78396	<b>SPN:</b>	TX9504-01
<b>Electrical properties</b>					
<b>Comments:</b>					
HV and LV terminations cannot be accessed. No comments on the electrical properties.					
<b>Oil quality, DGA results (if available)</b>					
<b>Comments:</b>					
Cannot be confirmed.					
<b>Defect history</b>					
<b>Comments:</b>					
Slight leaks at oil filling points and tap changer.					
<b>Overall condition</b>					
<b>Comments:</b>					
Overall condition is average.					

**FAE 3123**  
*MARAYONG ZONE SUBSTATION*

<b>33kV CBs</b>				
<b>Common name/SPN</b>	<b>Make</b>	<b>Year of manufacture</b>	<b>Serial no.</b>	<b>Comments based on recent test results, defect history and availability of spares</b>
9504SA02CB00S041	ALSTOM/OX36	2003	49R3244/1K	IR and contact resistance values are good. Trip and close times results are within acceptable limits. Minor damage on the incoming blue phase bushing weather shroud and dent on bushing turret.
9504SA03CB00S042	ALSTOM/OX36	2003	49R2883/1C	IR and contact resistance values are good. Trip and close times results are within acceptable limits.
9504SA01CB00S040	ALSTOM/OX36	2003	49R3244/1C	IR and contact resistance values are good. Trip and close times results are within acceptable limits. Minor damage on the incoming blue phase bushing weather shroud and dent on bushing turret.
9504SC02CB00S052	ALSTOM/OX36	2003	49R2883/1D	IR and contact resistance values are good. Trip and close times results are within acceptable limits. Dent on one bushing turret. Also, minor damage on the incoming red phase bushing weather shroud.
9504SC03CB00S053	ALSTOM/OX36	2002	49R2883/1B	IR and contact resistance values are good. Trip and close times results are within acceptable limits.
9504SC01CB00S051	HAWKER SIDDELEY/ Horizon	2011	915090-05	Breaker was commissioned in 2011 and has not yet been tested.

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MARAYONG ZONE SUBSTATION

11kV Indoor CBs				
Common name/SPN	Make	Year of manufacture	Serial no.	Comments based on recent test results, defect history and availability of spares
9504SE02CB001950	WESTINGHOUSE/ B18	1960	20376	Contact resistance and IR values (>90% of previous IR values) are acceptable. Trip times have increased and are on the high side, although still within limit. Fault maintenance in 1999 and 2003.  <u>SMI161 Health index assessment</u> Health index score: 62 Condition: Fair
9504SE05CB001953	WESTINGHOUSE/ B18	1960	20077	IR values less than 70% as compared to last test. Contact resistance above manufacturer's specification. All contacts dressed and oil replaced in 1997 due to number of fault operations.  <u>SMI161 Health index assessment</u> Health index score: 44 Condition: Poor
9504SE07CB001956	WESTINGHOUSE/ B18	1960	20075	IR well above acceptable limit. Contact resistance and trip times with acceptable limit. Racking issues in 2012 (fixed by reshaping the shutter and lever arm). Limit switch and close coil burnt out and repaired in 2014. Racking issue again in 2014 due to CB tank not fully bolted onto CB truck (fixed by tightening the CB tank). Oil leak from tank due to high oil level in 2015 (fixed by correcting the oil level).  <u>SMI161 Health index assessment</u> Health index score: 60 Condition: Fair
9504SE03CB001951	WESTINGHOUSE/ B18	1960	20375	Previous IR test not available. Rating D is assumed as IR are within acceptable limits but at the lower side (5.88G). Contact resistance is within acceptable limits. Trip times not available.  <u>SMI161 Health index assessment</u> Health index score: 40 Condition: Poor
9504SE12CB001962	WESTINGHOUSE/ B18	1960	20076	IR values are acceptable but between 80 – 70% of previous IR test values. Contact resistance and trip times are within acceptable limits, with trip times approaching the limit.  <u>SMI161 Health index assessment</u> Health index score: 51 Condition: Fair
9504SE04CB001952	WESTINGHOUSE/ B18	1960	20074	IR values greater than 90% as compared to the previous result and within acceptable limits. Contact resistance is within acceptable limit however it has increased noticeably since the last result. Trip times are outside the acceptable limits. Number of defects identified in 1997 and fixed in 1998.  <u>SMI161 Health index assessment</u> Health index score: 53 Condition: Fair
9504SD01CB001955	WESTINGHOUSE/ B18	1960	20069	IR values, contact resistance and trip times are all within acceptable values, however, trip times are approaching the acceptable limit.  <u>SMI161 Health index assessment</u> Health index score: 62 Condition: Fair
9504SD02CB001961	WESTINGHOUSE/ B18	1960	20070	IR results not available but previous results within acceptable limits. It is assumed that the IR result is within 80-90% of previous result. Contact resistance and trip times are within

11kV Indoor CBs				
Common name/SPN	Make	Year of manufacture	Serial no.	Comments based on recent test results, defect history and availability of spares
				limits. CB failed to close due to interlock link issue which was adjusted (2011).  <u>SMI161 Health index assessment</u> Health index score: 57 Condition: Fair
9504SE13CB001963	WESTINGHOUSE/ B18	1960	20072	IR values are greater than previous test results. Contact resistance is within acceptable limits. Trip times are outside the limit.  <u>SMI161 Health index assessment</u> Health index score: 54 Condition: Fair
9504SE06CB001954	WESTINGHOUSE/ B18	1960	20071	IR greater than 90% of previous IR values and within acceptable limits. Contact resistance within acceptable limit. Trip times not available.  <u>SMI161 Health index assessment</u> Health index score: 58 Condition: Fair
9504SE10CB001959	WESTINGHOUSE/ B18	1960	20073	IR values less than 70% of previous IR values. Trip times are acceptable but on the higher end. Contact resistance is within limits. All six (6) contacts were replaced in 1997 due to arcing damage. In 1997, issue was identified where CB was not closing due sticky shutter gear.  <u>SMI161 Health index assessment</u> Health index score: 47 Condition: Poor
9504SE01CB001949	WESTINGHOUSE/ B18	1960	20377	IR values greater than 90% as compared to last test. Contact resistance is within acceptable limits. Trip times not available.  <u>SMI161 Health index assessment</u> Health index score: 58 Condition: Fair
9504SE08CB001957	WESTINGHOUSE/ B18	1960	20078	Previous IR values are available but no temperature was recorded. It is assumed that the latest IR values are less than 70% of previous result. IR values within acceptable limits. Contact resistance are high compared with other CBs. Trip times are acceptable. All six (6) contacts were badly burnt and replaced in 1997.  <u>SMI161 Health index assessment</u> Health index score: 44 Condition: Poor
9504SE11CB001960	WESTINGHOUSE/ B18	1960	20068	Contact resistance and IR values are acceptable, with IR values being greater than 90% of previous result. Trip times are not available. Compound leaks rectified and defective contact assembly replaced in 1997.  <u>SMI161 Health index assessment</u> Health index score: 58 Condition: Fair
9504SE09CB001958	WESTINGHOUSE/ B18	1960	20079	IR values are acceptable however between 80 – 70% of previous IR results. Contact resistance are too high compared with other CBs. Trip times are acceptable, but on the high side. Fixed contacts replaced in 2001. CB failed to operate in 2002 during fault on the overhead feeder - Truck raised boom on 11kV feeder.  <u>SMI161 Health index assessment</u> Health index score: 49 Condition: Poor

<b>11kV Indoor CBs</b>				
<b>Common name/SPN</b>	<b>Make</b>	<b>Year of manufacture</b>	<b>Serial no.</b>	<b>Comments based on recent test results, defect history and availability of spares</b>
9504SC01CB00D837	REYROLLE/ LMT2/X32/MO	Estimated 1972	3LSLMT2- 2089	IR values greater than 90% as compared to last test. Contact resistance and trip times are within acceptable limits. Problem with racking mechanism in 2000 rectified. Racking mechanism issues resurfaced in 2015 due to bent bracket that was bent due to hardened grease on worn drive. It was repaired and put back into service.  <u>SMI161 Health index assessment</u> Health index score: 65 Condition: Fair
9504SC02CB00D838	REYROLLE/ LMT2/X32/MO	Estimated 1972	3LSLMT2- 788	IR values greater than 90% as compared to last test. Contact resistance and trip times are within acceptable limits although contact resistance on phase A approaching acceptable limit. CB racking problem identified and repaired in 2015.  <u>SMI161 Health index assessment</u> Health index score: 63 Condition: Fair
9504SC01CB00D839	REYROLLE/ LMT2/X32/MO	Estimated 1972	3LSLMT2- 2088	IR values greater than 90% as compared to last test. Contact resistance is outside manufacturer's limits. Trip times are within acceptable limits. Problem with racking mechanism in 2009 rectified. CB failed to open in 2012 due to sticky roller on latching part of CB mechanism. Repaired and returned to service.  <u>SMI161 Health index assessment</u> Health index score: 60 Condition: Fair
<b>11 CBs and switchboard</b>				
<b>Overall comments for the 11kV bulk oil switchgear</b>				
<p>There are a total of thirteen (13) 11kV feeder circuit breakers, eight (8) of which are double cabled. This arrangement is undesirable from operational and reliability perspectives. There are no spare 11kV CBs available.</p> <p>The three (3) transformer CBs are installed in separate rooms and are direct connected. A separate building was constructed circa-1972 to accommodate the three breakers.</p> <p>The Westinghouse B18 CBs are generally in a fair condition with five (5) out of fifteen (15) CBs being in poor condition based on SMI161 health index methodology. The CBs have good insulation and contact resistances apart from a few cases. Four (4) out of fifteen (15) CBs have a high contact resistance value mainly due to high number of faults leading to contact wear. It has been advised by the Northern Region field staff that the contacts for these CBs cannot be improved further. The original OEM spare parts and contacts for these bulk oil switchgear/CBs are not available anymore; therefore the regional staff are relying on parts supplied by local manufacturers.</p> <p>The Reyrolle LMT CBs at Marayong ZS are in fair condition. All electrical test results are within acceptable limits but trending is poor.</p> <p>There is an inherent fire risk associated with bulk oil switchgear.</p> <p>TEV acoustic tests were carried out on the complete switchboard on 24/07/2012. The TEV analysis indicates that there are no partial discharge issues.</p>				

**CONDITION ASSESSMENT OF TRANSMISSION/ZONE SUBSTATION  
AND SWITCHING STATION ASSETS**

**Amendment No: 1**

**FAE 3123**  
MARAYONG ZONE SUBSTATION

<b>33kV VTs</b>				<i>Insert row/s for more data</i>
<b>Common name/SPN</b>	<b>Make</b>	<b>Year of manufacture</b>	<b>Serial no.</b>	<b>Comments based on recent test results, defect history</b>
9504SA02VT00S032; Feeder 445	Hanson	1965	8953	Test values are within limits
9504SA03VT00S033; Feeder 470	Hanson	1964	7851	Test values are within limits. Neutral bushing was found cracked.
9504SA01VT00S031; Feeder 473	ABB/ MWK3	2008	-	Test values are within limits; Hanson unit were replaced in 2008 with ABB manufactured VT.

<b>11kV VTs</b>				<i>Insert row/s for more data</i>
<b>Common name/SPN</b>	<b>Make</b>	<b>Year of manufacture</b>	<b>Serial no.</b>	<b>Comments based on recent test results, defect history</b>
9504SC01VT00S314	Reyrolle	1972	1992 P078	Test values are within limits
9504SC02VT00S315	Reyrolle	1972	R10840	Test values are within limits
9504SC03VT00S316	Reyrolle	1972	R10841	Test values are not available

**FAE 3123**  
*MARAYONG ZONE SUBSTATION*

SUBSTATION BATTERY
<i>Assessment of equipment based on test reports</i>
No issues. Battery and battery charger system is generally in good condition.

AFIC EQUIPMENT
<i>Assessment of equipment based on test reports current defects and issues</i>
Old motor-generator set - The condition is generally ok however minor lubricant leak was found coming from the motor side during the site visit on 6/12/2016.

<i>11 &amp; 22 kV capacitor banks</i>				<i>Insert row/s for more data</i>
Common name/SPN	Make	Year of manufacture	Serial no.	Comments based on recent test results and defect history
000000973192	ABB	2002	1960-063 ***X7013986	No major issues recorded for 11kV cap bank no.1

**CONDITION ASSESSMENT OF TRANSMISSION/ZONE SUBSTATION  
AND SWITCHING STATION ASSETS**

**Amendment No: 1**

**FAE 3123**

MARAYONG ZONE SUBSTATION

**DISCONNECTORS/AIR BREAK SWITCHES (Identify by voltage)**

**Issues identified with potential hazards from test reports**

SPN	Feeder No.	Make	Serial no.	Comments based on recent test results and defect history
9504SB02SW00S044	MARAYONG ZS, 33kV, 445	Taplin	504C06	Serviceable condition.
9504SA02SW00S038	MARAYONG ZS, 33kV, 445	Taplin	504C02	Serviceable condition.
9504SB03SW00S045	MARAYONG ZS, 33kV, 470	Taplin	504C07	Serviceable condition.
9504SA03SW00S039	MARAYONG ZS, 33kV, 470	Taplin	504C03	Serviceable condition.
9504SA01SW00S037	MARAYONG ZS, 33kV, 473	Taplin	504C01	Serviceable condition.
9504SB01SW00S043	MARAYONG ZS, 33kV, 473	Taplin	504C05	Serviceable condition.
9504SB01SW00S048	MARAYONG ZS, 33kV, No 1 Transformer	Taplin	504C09	Serviceable condition. Hot joint in 1998 rectified.
9504SB02SW00S049	MARAYONG ZS, 33kV, No 2 Transformer	Taplin	504C10	Serviceable condition.
9504SB03SW00S050	MARAYONG ZS, 33kV, No 3 Transformer	Taplin	504C11	Serviceable condition.
9504SB01SW00S046	MARAYONG ZS, 33kV, No A/B Section	Taplin	504C13	Serviceable condition.
9504SB02SW00S047	MARAYONG ZS, 33kV, No B/C Section	Taplin	504C15	Serviceable condition.

**Comments:**

All 33kV disconnectors are in good and serviceable condition.

**AUXILIARY SWITCHBOARD**

**Issues identified with potential hazards from test reports**

SPN	Feeder No.	Make/ Part No.	Serial no.	Comments based on recent test results and defect history
9504SL01SW006211	MARAYONG ZS, 11kV, Aux Busbar, Magnefix	Holec/MD4	A3830	Serviceable condition. PD and thermovision tests on 10/08/2015. PD activity categorised as category 5 defect requiring a re-test within 12-18 months (Max TEV: 18 dB, Ultrasonic: 0 dB). A follow-up/re-test has not yet occurred.
9504SL01SW006210	MARAYONG ZS, 11kV, Aux Busbar, Magnefix	Holec/MD4	A3830	Serviceable condition. PD and thermovision tests on 10/08/2015. PD activity categorised as category 5 defect requiring a re-test within 12-18 months (Max TEV: 18 dB, Ultrasonic: 0 dB). A follow-up/re-test has not yet occurred.
9504SL01SW000A88	MARAYONG ZS, 11kV, Aux Busbar, Magnefix	Holec/MD4	A3830	Serviceable condition. PD and thermovision tests on 10/08/2015. PD activity categorised as category 5 defect requiring a re-test within 12-18 months (Max TEV: 18 dB, Ultrasonic: 0 dB). A follow-up/re-test has not yet occurred.
9504SL01SW006637	MARAYONG ZS, 11kV, Aux Busbar, Magnefix	Holec/MD4	A3830	Serviceable condition. PD and thermovision tests on 10/08/2015. PD activity categorised as category 5 defect requiring a re-test within 12-18 months (Max TEV: 18 dB, Ultrasonic: 0 dB). A follow-up/re-test has not yet occurred. No overheating of joints or connection defects detected from thermovision.

FAE 3123  
MARAYONG ZONE SUBSTATION

**EARTH GRID**

**Issues identified with potential hazards from test reports**

**Comments:**

A number of issues were identified in the Marayong ZS Earthing Remediation Design Endorsement & Implementation Plan (dated August 2015) based on the Marayong ZS Earthing remediation design report (SC12-195-06-R2) prepared by Safearth Consulting dated 26/08/15.

The issues mainly comprised of non-compliant touch voltages and poor bonding at several points. The identified issues are being rectified under the TS036 Substation earthing program. The program for Marayong ZS earthing includes distribution earthing remediation and earthing installation defects rectification works.

**SWITCHYARD**

**Comments**

The substation site was found to be vandalised as stones and glass were found in the switchyard. It is suspected that the damage to the 33kV CB's and some insulators was from stones and other projectiles being thrown from the outside.

Part of the retaining wall in the switchyard is slanted with respect to adjacent retaining walls.

**SWITCHYARD SUPPORT STRUCTURES**

**Comments**

Rust and surface corrosion was evident on the following structures:

- No. 1-2 bus section isolator S046
- feeders 445 and 470 gantries

Half of the first skirt of the support insulator on Feeder 470 Bus Isolator S045 was broken, possibly from stones thrown into the substation.

Prepared by:



Humayoun Khan  
Electrical Engineer - Substations

Date: 17/03/2017

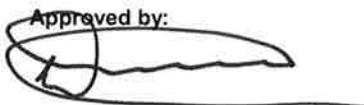
Reviewed by:



Colin Crisafulli  
Network Substations Manager

Date: 17/3/2017

Approved by:



Danny Asvestas  
Manager Asset Standards & Design

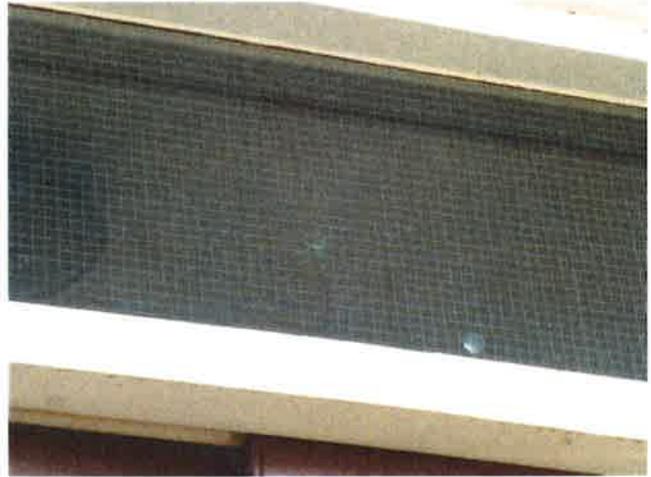
Date: 20.3.17

**FAE 3123**  
*MARAYONG ZONE SUBSTATION*

**EQUIPMENT PHOTOGRAPHS – Taken during site visits on 07/12/2016 and 15/02/2017:**



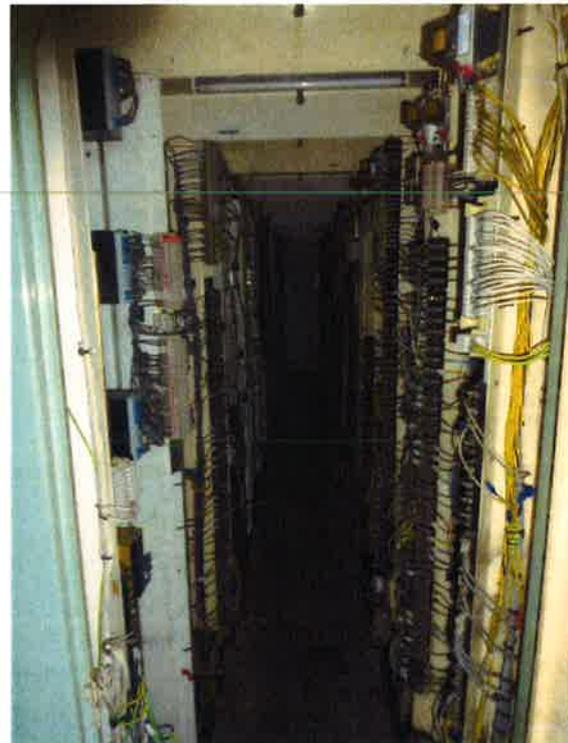
**Substation building**



**Substation building door glass panel damaged**



**Control room**



**Tunnel boards (old design - all exposed terminations)**



AFIC – Motor generator set



Motor generator set oil leak from motor side



120 VDC battery bank



Holec MD4 auxiliary switchboard



11kV Westinghouse B18 breakers



11kV Westinghouse B18 breakers arc chute and closing coil contactor covers contain asbestos



11kV Westinghouse B18 breakers (rear view)



11kV Bulk oil Reyrolle LMTs Power TX secondary side circuit breakers



Tyree 33kV/11kV 25 MVA TX no. 1 oil leak from radiator and tap changer



TX no. 1 oil leak from top bushing gaskets



TX no. 1 33kV CB – Hawker Siddeley Horizon (installed 2011)



**Tyree 33kV/11kV 25 MVA TX no. 2 – oil leak from gaskets**



**Tyree 33kV/11kV 25 MVA TX no. 2 – oil leak from RTD box**



**Tyree 33kV/11kV 25 MVA TX no. 2 – rust and surface corrosion on structures**



Feeder 473 33kV CB – Alstom OX36 (installed 2004)



Bushing weather shield and denting on bushing turrets on Alstom 33kV OX36 CBs



Stones (white) and other foreign material was found scattered in the switchyard near power transformers and 33kV outdoor circuit breakers



**33kV Taplin isolator**



**Feeder 470 Bus Isolator S045 support insulator**



**33kV 3-phase Voltage Transformer – Hanson**



**Neutral bushing found damaged on Feeder 470 Voltage Transformer**



**Rust and surface corrosion on feeder gantries**



**Auxiliary transformer – slight oil leak from tap changer**



**Retaining wall is slanted**

