





DS307 – HOLEC MD4 EPOXY HV SWITCHGEAR REPLACEMENT

Project Scope DS307.19 – 2018/19

Prepared by Asset Strategy and Planning

November 2017

REVIEW AND APPROVAL SCHEDULE

Responsibility	Position	Name	Signature	Date
Authored	Renewal Planning Engineer	Mark Alexander		10/11/17
Reviewed	Senior Renewal Project Development Engineer	Jonathan Cook		10/11/17
Endorsed	Network Investment Planning Manager	Manoraj Jayasekara		10/11/17
Approved	Manager Asset Strategy and Planning	Peter Langdon		13.11.17

CONTENTS

1.0	PURPOSE	4
2.0	BACKGROUND	4
3.0	SELECTION CRITERIA.....	4
4.0	SCOPE OF WORKS	5
4.1	PROACTIVE WORKS.....	5
4.2	REACTIVE REPLACEMENT	5
5.0	COST ESTIMATE	5
5.1	CONTINGENCY	6
6.0	DATA RECORDING REQUIREMENTS.....	6
7.0	APPENDICES	6

1.0 PURPOSE

The purpose of this document is to specify the scope of works required under SARP program DS307 during the year 2018/19.

Program DS307 is a condition based program whose purpose is to contribute to the safe and reliable operation of the distribution network by replacing MD4 cast resin HV switchgear which is in poor condition and at risk of failure presenting a safety hazard for workers and the public.

2.0 BACKGROUND

Approximately 10,900 MD4 cast resin switch units are currently installed in 5,300 11kV padmount, indoor and ground substations throughout Endeavour Energy's distribution network.

Over time the switchgear is prone to failure due to discharge over the surface of the resin. The R4M compound terminations commonly used for the 11kV terminations onto the MD4 switchgear can also lose compound resulting in discharge and failure.

The degradation of the switchgear is more pronounced in distribution switching stations where there is no transformer or heater to keep the cubicle warm and reduce condensation.

As a result of a number of failures of MD4 switchgear in 11kV switching stations, this program was established for the replacement of units installed in switching stations across the network. In some switching stations where the MD4 switchgear was in reasonable condition and an LV supply was readily available, heaters have been installed to defer the need to replace the switchgear.

The replacement of switchgear (or the installation of heaters) in switching stations is now complete and the scope of this program was extended to include MD4 switchgear in padmount, ground, and indoor/kiosks substations. A program of testing for partial discharge (PD) was also initiated to give warning of impending failure.

All HV epoxy switchgear in padmount, ground, and indoor/kiosks substations are inspected and tested for partial discharge every three years in accordance with substation maintenance instruction SMI101 *Minimum requirements for maintenance of distribution equipment*.

Units which exceed the PD limits or have other defects which persist after maintenance, are scheduled for replacement under this program in accordance with substation maintenance instruction SMI212 *HV switch and switch fuse units*.

Repair or replacement of defective 11kV cable boxes in accordance with SMI 212 is expensed and not funded in this program.

Defective MD4 units are replaced with metal-clad switchgear from the current supply contract.

The DS307 program is an ongoing program for the replacement of MD4 HV switchgear.

All work in this project scope is capital expenditure and is covered by SARP item DS307.

Gate 2 approval for this program is for a total amount of \$5.3 million in 2018/19.

3.0 SELECTION CRITERIA

A review of the inspection and partial discharge (PD) testing processes carried out under Substation Maintenance SMI 212 was prompted due to the observed increase in the failure rate of 11kV MD4 switchgear in padmount substations and the associated safety and reliability risks.

As a result, Technical bulletin TB-0236 was released in June 2017 and outlines new test limits and defect prioritisation methodology to improve the outcomes of the PD testing process.

These changes are detailed in a statement of asset need provided by Asset Standards and Design and have resulted in an uplift in the proactive replacement of MD4 units assessed as being in poor condition and at risk of failure.

4.0 SCOPE OF WORKS

Program DS307 is a condition based program whose purpose is to contribute to the safe and reliable operation of the distribution network by proactively and reactively replacing MD4 cast resin HV switchgear which is in poor condition and at risk of failure presenting a safety hazard for workers and the public

4.1 PROACTIVE WORKS

In accordance *TB-0236 – MD4 HV Switchgear PD Testing Revision and Introduction of New Inspection App*, the proactive works include the replacement of MD4 switchboards identified as either category 3 or 4 which have been found to show signs of deterioration through recent testing and inspection and considered as priority replacement due to increased risk of failure in the short term.

A detailed list of switches identified for replacement within 2018/19 can be found in Appendix A.

4.2 REACTIVE REPLACEMENT

MD4 switchboards which have failed or after they have been maintained remain in a poor condition indicating imminent failure (Category 1 or 2 as per TB-0236) are to be defected in Ellipse and scheduled for replacement.

The defects outlined in *SMI 212 – HV Switch and Switch Fuse Units* should be considered when assessing MD4 switchboards for replacement. Including:

- Significant carbon tracking or discharge emanating between terminations;
- Significant presence of white residue;
- High partial discharge activity identified through high ultrasonic and TEV levels; and
- Noticeable cracks in the epoxy allowing moisture ingress.

The DS307 program provides a funding allocation for the capitalisation of MD4 switchboards which have been assigned defects in the corporate database and that require full switch replacement as means of the rectification. However, minor repairs do not on their own trigger the replacement of the whole switch.

Each defected switch is to be included into the program as they are found based on their condition and level of risk they present.

5.0 COST ESTIMATE

As part of the annual program development, PMG have determined an average nominal replacement cost of \$35,000. This has been based on actual costs of previously delivered works and includes:

- Project Management;
- Design;
- Materials;
- Labour and plant; and
- Traffic management.

An allowance of \$4.9 million should provide funding for the replacement of 140 MD4 switches as specified in Appendix A.

A funding allowance of \$350,000 is included to cover reactive works and should provide funding for approximately 10 switches identified for priority replacement during the year.

A summary of approved funding is shown in Table 1 below.

TABLE 1 – SUMMARY OF ESTIMATED FUNDING

Region	Quantity	Cost (\$)
Northern	38	1,330,000
Central	99	3,465,000

Southern	3	105,000
Sub-total	140	4,900,000
Unspecified (Reactive)	10	350,000
TOTAL	150	5,250,000

It is expected that the scope of work outlined in Table 1 will be completed within 2018/19 financial year.

5.1 CONTINGENCY

It is considered that there is sufficient diversity of sites within the overall program to allow for cost “overs and unders” to cancel out and therefore a contingency amount has not been included.

6.0 DATA RECORDING REQUIREMENTS

To demonstrate the effectiveness of this program and to ensure continued funding it is essential to record the details of the works carried out and the costs of those works for each switchgear unit. To this end, the following information shall be recorded along with other data as required, in the corporate data base:

1. The location and detail of each of the replaced units including the reason for replacement (PD results tests, other specific defects);
2. The actual cost of each project as they are completed;
3. The work order number(s).

Note: - The brief description of each job shall be clearly stated amongst other information in the appropriate column e.g. in the Work Order Desc. column.

This information is to be recorded within three months of the completion of each project within the program.

7.0 APPENDICES

APPENDIX A – Nominated refurbishment works in 2018/19

APPENDIX A – NOMINATED REFURBISHMENT WORKS IN 2017/18

NORTHERN REGION (38)

Region	Priority category rating	Ellipse reference	Sub. No.	Address	Nominal unit rate (\$)
Northern	3	DS00198HFSU-01	DS00198	Crane Rd, CASTLE HILL	35,000
Northern	3	DS01481HFSU-01	DS01481	Windsor St, RICHMOND	35,000
Northern	3	DS01497HFSU-01	DS01497	Myrtle Rd, CLAREMONT MEADOWS	35,000
Northern	3	DS01504HFSU-01	DS01504	Bayley Rd, SOUTH PENRITH	35,000
Northern	3	DS01617HFSU-01	DS01617	Hyatts Rd, PLUMPTON	35,000
Northern	3	DS01627HFSU-01	DS01627	Cascade Rd CRANE BROOK	35,000
Northern	3	DS03097HFSU-01	DS03097	Weaver St, ERSKINE PARK	35,000
Northern	3	DS03111HFSU-01	DS03111	Weaver St, ERSKINE PARK	35,000
Northern	3	DS03114HFSU-01	DS03114	Old Northern Rd, BAULKHAM HILLS	35,000
Northern	3	DS06674HFSU-01	DS06674	Whitby Rd, KINGS LANGLEY	35,000
Northern	3	DS07034HFSU-01	DS07034	Prescott Crct, QUAKERS HILL	35,000
Northern	3	DS08211HFSU-01	DS08211	Lindridge Pl, COLYTON	35,000
Northern	3	DS08544HFSU-01	DS08544	Forge St, BLACKTOWN	35,000
Northern	3	DS15597HFSU-01	DS15597	Morrel Pl, KINGSWOOD	35,000
Northern	3	DS15762HFSU-01	DS15762	Stoddart Rd, PROSPECT	35,000
Northern	3	DS16068HFSU-01	DS16068	Alexander St, BLIGH PARK	35,000
Northern	3	DS16083HFSU-01	DS16083	Windsor St, RICHMOND	35,000
Northern	3	DS16151HFSU-01	DS16151	Cowper Cir, QUAKERS HILL	35,000
Northern	3	DS16169HFSU-01	DS16169	Standish Ave, OAKHURST	35,000
Northern	3	DS16407HFSU-01	DS16407	Peace Ave, ST CLAIR	35,000
Northern	3	DS16436HFSU-01	DS16436	Eucumbene Pl, ST CLAIR	35,000
Northern	3	DS17065HSWU-01	DS17065	Glenbrook St, JAMISONTOWN	35,000
Northern	3	DS17107HSWU-01	DS17107	Hyatts Rd, OAKHURST	35,000
Northern	3	DS17273HFSU-01	DS17273	Rawson St, EPPING	35,000
Northern	3	DS17364HFSU-01	DS17364	Parke St KATOOMBA	35,000
Northern	3	DS17394HFSU-01	DS17394	Great Western Hwy, KATOOMBA	35,000
Northern	3	DS17550HFSU-01	DS17550	Union La PENRITH	35,000
Northern	3	DS18056HFSU-01	DS18056	Werona Ave, CLAREMONT MEADOWS	35,000
Northern	3	DS18084HFSU-01	DS18084	Mulgoa Rd, REGENTVILLE	35,000
Northern	3	DS19918HFSU-01	DS19918	Holbeche Rd, ARNDELL PARK	35,000
Northern	3	DS20113HFSU-01	DS20113	Norwest Blvd BAULKHAM HILLS	35,000
Northern	3	DS20410HFSU-01	DS20410	North Pde MOUNT DRUITT	35,000
Northern	3	DS20594HFSU-01	DS20594		35,000
Northern	3	DS21381HFSU-01	DS21381	,	35,000
Northern	3	DS21544HFSU-01	DS21544	Katoomba St, KATOOMBA	35,000

Region	Priority category rating	Ellipse reference	Sub. No.	Address	Nominal unit rate (\$)
Northern	3	DS21698HFSU-01	DS21698	Bowen Pl, SEVEN HILLS	35,000
Northern	3	DS22315HFSU-01	DS22315	.	35,000
Northern	3	DS22752HFSU-01	DS22752	Old Telegraph Rd, MAROOTA	35,000
Northern region sub-total					1,330,000

CENTRAL REGION (99)

Region	Priority category rating	Ellipse reference	Sub. No.	Address	Nominal unit rate (\$)
Central	3	DS00594HFSU-01	DS00594	Neil St, MERRYLANDS	35,000
Central	3	DS01037HFSU-01	DS01037	Kelvin Park Dr, BRINGELLY	35,000
Central	3	DS01180HFSU-01	DS01180	Dunmore St, PENDLE HILL	35,000
Central	3	DS01371HFSU-01	DS01371	Nagle St, LIVERPOOL	35,000
Central	3	DS01762HFSU-01	DS01762	Railway Pde, FAIRFIELD	35,000
Central	3	DS02076HFSU-01	DS02076	Heysen St, ABBOTSBURY	35,000
Central	3	DS02131HFSU-01	DS02131	Epping Forest Dr, KEARNS	35,000
Central	3	DS02258HFSU-01	DS02258	Kerr Rd, INGLEBURN	35,000
Central	3	DS02914HFSU-01	DS02914	Airds Rd, MINTO	35,000
Central	3	DS02970HFSU-01	DS02970	Flinders Cres, HINCHINBROOK	35,000
Central	3	DS03036HFSU-02	DS03036	Percival Rd, SMITHFIELD	35,000
Central	3	DS03332HFSU-01	DS03332	Norfolk Sbw, LIVERPOOL	35,000
Central	3	DS03688HFSU-01	DS03688	Kerr Rd, INGLEBURN	35,000
Central	3	DS03689HFSU-01	DS03689	Airds Rd, MINTO	35,000
Central	3	DS03787HFSU-01	DS03787	Sirius Crct, NARELLAN	35,000
Central	3	DS03795HFSU-01	DS03795	Heathcote Rd, MOOREBANK	35,000
Central	3	DS03897HFSU-01	DS03897	Queen St, NARELLAN	35,000
Central	3	DS04424HFSU-01	DS04424	Heysen St, ABBOTSBURY	35,000
Central	3	DS04653HFSU-01	DS04653	The Horsley Dr, WETHERILL PARK	35,000
Central	3	DS05150HFSU-01	DS05150	Northumberland St, LIVERPOOL	35,000
Central	3	DS05246HFSU-01	DS05246	Hill St CABRAMATTA	35,000
Central	3	DS05269HFSU-01	DS05269	Seton Rd, MOOREBANK	35,000
Central	3	DS05295HFSU-01	DS05295	Blackfriar Pl, WETHERILL PARK	35,000
Central	3	DS05334HFSU-01	DS05334	Castlereagh St, LIVERPOOL	35,000
Central	3	DS05338HFSU-01	DS05338	Warren Sbw, LIVERPOOL	35,000
Central	3	DS05560HFSU-01	DS05560	Fairfield St, VILLAWOOD	35,000
Central	3	DS05566HFSU-01	DS05566	Nelson St, FAIRFIELD	35,000
Central	3	DS05578HFSU-01	DS05578	John St, CABRAMATTA	35,000
Central	3	DS05641HFSU-01	DS05641	Woodville Rd, OLD GUILDFORD	35,000
Central	3	DS05710HFSU-01	DS05710	Lisbon St, VILLAWOOD	35,000

Region	Priority category rating	Ellipse reference	Sub. No.	Address	Nominal unit rate (\$)
Central	3	DS05735HFSU-01	DS05735	Long St, SMITHFIELD	35,000
Central	3	DS05867HFSU-01	DS05867	Lisbon St, FAIRFIELD	35,000
Central	3	DS05968HFSU-01	DS05968	Dunmore St, WENTWORTHVILLE	35,000
Central	3	DS06217HFSU-01	DS06217	Alfred St MERRYLANDS	35,000
Central	3	DS07127HFSU-01	DS07127	Cumberland Rd GREYSTANES	35,000
Central	3	DS07302HFSU-01	DS07302	Nelson St FAIRFIELD	35,000
Central	3	DS07361HFSU-01	DS07361	Bathurst St LIVERPOOL	35,000
Central	3	DS07371HFSU-01	DS07371	Longfield St CABRAMATTA	35,000
Central	3	DS07471HFSU-01	DS07471	Flemington St ST JOHNS PARK	35,000
Central	3	DS07501HFSU-01	DS07501	Castlereagh St, LIVERPOOL	35,000
Central	3	DS07655HFSU-01	DS07655	Du Maurier Pl WETHERILL PARK	35,000
Central	3	DS08312HFSU-01	DS08312	Hall Pl, FAIRFIELD WEST	35,000
Central	3	DS08320HFSU-01	DS08320	Sheffield St MERRYLANDS	35,000
Central	3	DS08503HFSU-03	DS08503	Alfred Rd, CHIPPING NORTON	35,000
Central	3	DS08935HFSU-01	DS08935	The Appian Wy, MOUNT VERNON	35,000
Central	3	DS08971HFSU-01	DS08971	The Appian Wy, MOUNT VERNON	35,000
Central	3	DS09535HFSU-01	DS09535	Sappho Rd WARWICK FARM	35,000
Central	3	DS09597HFSU-01	DS09597	Frank Oliveri Dr CHIPPING NORTON	35,000
Central	3	DS09654HFSU-01	DS09654	Henrietta Dr, NARELLAN VALE	35,000
Central	3	DS09700HFSU-01	DS09700	Percival Rd, SMITHFIELD	35,000
Central	3	DS09791HFSU-01	DS09791	Currawong St GREEN VALLEY	35,000
Central	3	DS09807HFSU-01	DS09807	Loftus St YENNORA	35,000
Central	3	DS11243HFSU-01	DS11243	Dumaresq St CAMPBELLTOWN	35,000
Central	3	DS11532HFSU-01	DS11532	Hartley Rd, SMEATON GRANGE	35,000
Central	3	DS12390HFSU-01	DS12390	Wilson Rd GREEN VALLEY	35,000
Central	3	DS12675HFSU-01	DS12675	Day St, LANSVALE	35,000
Central	3	DS13013HFSU-02	DS13013	Airds Rd, MINTO	35,000
Central	3	DS13237HFSU-01	DS13237	Pembury Rd, MINTO	35,000
Central	3	DS13306HFSU-01	DS13306	Longhurst Rd, MINTO	35,000
Central	3	DS13444HFSU-01	DS13444	Frank Oliveri Dr, CHIPPING NORTON	35,000
Central	3	DS13452HFSU-01	DS13452	Mcdonnell St, RABY	35,000
Central	3	DS13470HFSU-01	DS13470	Saywell Rd, MACQUARIE FIELDS	35,000
Central	3	DS13523HFSU-01	DS13523	Short St CAMPBELLTOWN	35,000
Central	3	DS13524HFSU-01	DS13524	Jiniwin Pl AMBARVALE	35,000
Central	3	DS13545HFSU-01	DS13545	Chester Rd, INGLEBURN	35,000
Central	3	DS13602HFSU-01	DS13602	Goldsmith Ave CAMPBELLTOWN	35,000
Central	3	DS15272HFSU-01	DS15272	Judd Ave, HAMMONDVILLE	35,000
Central	3	DS15306HFSU-01	DS15306	Park Rd, CABRAMATTA	35,000

Region	Priority category rating	Ellipse reference	Sub. No.	Address	Nominal unit rate (\$)
Central	3	DS15338HFSU-01	DS15338	Homepride Ave, WARWICK FARM	35,000
Central	3	DS15367HFSU-01	DS15367	Cabramatta West Rd CABRAMATTA WEST	35,000
Central	3	DS15384HFSU-01	DS15384	Nottingham Cres, CHIPPING NORTON	35,000
Central	3	DS15786HFSU-01	DS15786	Bumbera Rd, PRESTONS	35,000
Central	3	DS16206HFSU-01	DS16206	Cunninghame St, FAIRFIELD	35,000
Central	3	DS16238HFSU-01	DS16238	Wenban Pl, WETHERILL PARK	35,000
Central	3	DS16312HFSU-01	DS16312	Kalang Rd, EDENSOR PARK	35,000
Central	3	DS16363HFSU-01	DS16363	Arrowhead Rd GREENFIELD PARK	35,000
Central	3	DS16365HFSU-01	DS16365	Cheyenne St GREENFIELD PARK	35,000
Central	3	DS17626HFSU-01	DS17626	Glen Elgin Cres, EDENSOR PARK	35,000
Central	3	DS17636HFSU-01	DS17636	Kurrara St, LANSVALE	35,000
Central	3	DS17669HFSU-02	DS17669	Kurrajong Rd, CASULA	35,000
Central	3	DS17671HFSU-01	DS17671	Barry Rd CHIPPING NORTON	35,000
Central	3	DS18109HFSU-01	DS18109	Belair Pl PRAIRIEWOOD	35,000
Central	3	DS18125HFSU-01	DS18125	Province St, ABBOTSBURY	35,000
Central	3	DS18126HFSU-01	DS18126	Province St, ABBOTSBURY	35,000
Central	3	DS18137HFSU-02	DS18137	Hargraves Pl, WETHERILL PARK	35,000
Central	3	DS18196HFSU-02	DS18196	Nelson Rd YENNORA	35,000
Central	3	DS18203HFSU-01	DS18203	Heathcote Rd, MOOREBANK	35,000
Central	3	DS18265HFSU-01	DS18265	Hinchinbrook Dr, HINCHINBROOK	35,000
Central	3	DS18709HFSU-01	DS18709	Chetwynd Rd MERRYLANDS	35,000
Central region sub-total					3,465,000

SOUTHERN REGION (3)

Region	Priority category rating	Ellipse reference	Sub. No.	Address	Nominal unit rate (\$)
Southern	3	DS41511HFSU-01	DS41511	Marshall St, DAPTO	35,000
Southern	3	DS42225HFSU-01	DS42225	The Avenue, CORRIMAL	35,000
Southern	3	DS72434HFSU-01	DS72434	South St, ULLADULLA	35,000
Southern region sub-total					105,000