QA/QC templates for General Electrical Construction Standard

No. TMPL-15

Ver. 2.1

Date: 27 July 2021

Revision	Description	Released By	Date
0.1	First draft	J de Villiers	02/03/2016
1	First release	J de Villiers – Principal Engineer, Standards	17/11/2016
2	Updated format. Amended to include construction requirements across all sites	J de Villiers	25/03/2020
2.1	Updated section to add in main site switchboard testing requirements	J de Villiers	27/07/2021

Reviewers:

Ver. 2.1
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Summary of changes

Version	Section	Description of revision
2.1	1 – General electrical	Added minimal general QA/QC
	3 - Switchboards	Added testing and certification requirements along with link to material supply standard and code of practice for switchboards

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1. General electrical installation

1.13 QA/QC template

Minimum mandatory tests:

Quality / Control		Measurement	Certification		
			Document supplied	Site supervisor witness	Engineer witness
1	Visual inspection	Conducted visual inspection as required by AS/NZS3000		Required	Required
2	Main earth and bonding conductors	Continuity test		Required	Required
3	Protective earth conductors	Loop impedance test, or continuity/ resistance test		Required	Required
4	Insulation resistance			Required	Required
5	Polarity of main supply and sub-circuits			Required	Required
6	Revenue Metering and Correct circuit connectors			Required	Required
7	Protective devices (CBs, RCDs, etc.) verification			Required	Required
		Sign-off			

3. Switchboards, distribution centres and control centres

3.9 QA/QC template

ENSURE THE MAIN SITE SWITHBOARD IS NOT LIVENED UNTIL THE FOLLOWING IS CARRIED OUT AND DOCUMENTED

Quality / Control		Measurement	Certification		
			Document supplied	Site supervisor witness	Engineer witness
1	Factory Testing	Provision of factory acceptance test sheets - both visual inspection and test sheets (by switchboard builder)		Required	Required
2	Factory Testing – ESC/CoC	Provision of ESC (electrical safety certificate) – by switchboard builder		Required	Required
3	Site Testing	Provision of site acceptance test sheets (by switchboard builder) – NOTE: REASSEMBLY & MODIFICATION OF SWITCHBOARDS IS TO BE COMPLETED BY THE MANUFACTURER		Required	Required
4	Site Testing – ESC/CoC	Provision of ESC after site assembly & testing (electrical safety certificate) – by switchboard builder		Required	Required
5	Material Supply Standard Check	Cross-check switchboard supplied on site complies with WSL Material Supply standard checklist (MS-01)		Required	Required
6	Pre-commissioning checks	Cross-check switchboard compliance with Code of Practice (COP-03) for checks and **hold points**		Required	Required
7	Revenue Metering and livening (ESC/CoC & ROI)	Provision of ESC and ROI (record of inspection) of metering and mains connection **PRIOR TO LIVENING**		Required	Required
		Sign-off			

4. Uninterruptable power supplies (UPS)

4.6 QA/QC template

Quality / Control		Measurement	Certification		
			Document supplied	Site supervisor witness	Engineer witness
1	Installation process	Clear access, not located below water or chemical lines	N/A	Required	Required
		Secured and restrained	N/A	Required	Required
2	Cabling	Sufficient length provided for removal and maintenance	N/A	Required	Required
		Confirm size and rating as per design	N/A	Required	Required
		Neutral to earth connection confirmed as one location	N/A	Required	Required
3	Maintenance	Documentation provided	Required	Required	N/A
		Sign-off			

6. Motors

6.7 QA/QC template

Quality / Control		Measurement	Certification		
			Document supplied	Site supervisor witness	Engineer witness
1	Fault indications	All connected; Common fault lamp provided	N/A	Required	Required
2	Circuit breakers	Load rating confirmed as appropriate	N/A	Required	Required
		Rotary pivot arm connected to front panel	N/A	Required	Required
		Breaker provided per motor	N/A	Required	Required
3	Heaters	Connected on load side of motor circuit breaker	N/A	Required	Required
		VSD (if installed) anti-condensation **not** installed in lieu of heater	N/A	Required	Required
4	Vibration and noise	Limitation confirmed per limits set out in AS 1359.114	Required	Required	Required
5	Insulation resistance	Measured at > 1.5 megohm. When lower insulation measured the motor may not be energized	N/A	Required	Required
6	Winding resistance	Document winding resistance measurements	Required	Required	Required

Quality / Control	Measurement	Certification		
		Document supplied	Site supervisor witness	Engineer witness
	Sign-off			

8. Electrical cables

8.16 QA/QC template

Quality / Control		Measurement	Certification		
			Document supplied	Site supervisor witness	Engineer witness
1	Cable length	No joints – single length	N/A	Required	Required
2	Conductors	Multi-core copper for cabling < 70mm^2	N/A	Required	Required
		Unused cores grouped and heat shrink sleeved	N/A	Required	Required
3	Un-armoured cable	Trunked in conduit or cable support.	N/A	Required	Required
4	Instrumentation cable	Lay lines to cross power cables at right angles	N/A	Required	Required
		ELV and LV using separate cables	N/A	Required	Required
		Minimum 300mm spare length at cable ends	N/A	Required	Required
		Cable depth maximum 3 on cable supports	N/A	Required	Required
5	Communication cables	Min 300mm separation from power cables	N/A	Required	Required
		Installation individual in 20mm conduit	N/A	Required	Required
		Dual redundancy installed in separate cable paths	N/A	Required	Required
6	Glands	Installed to manufacturer requirements and appropriate to the operating environment	N/A	Required	Required
		Minimum 50mm straight cable allowance before entering gland	N/A	Required	Required
		Cables are not under tension	N/A	Required	Required
7	Bending and twist	Within maximum allowed for cable type	N/A	Required	Required
8	Cable ends sealed	Heat shrink	N/A	Required	Required
9	Identification	Cables tagged and identified	N/A	Required	Required
		Sign-off			

9. Cable support and protection

9.4 QA/QC template

Quality / Control		Measurement	Certification		
			Document supplied	Site supervisor witness	Engineer witness
1	Cable support	Support brackets space at minimum 300mm	N/A	Required	Required
		Deflection limited to 25mm per 6m	N/A	Required	Required
		Cable support bonding to correct size	N/A	Required	Required
		Heavy duty aluminium	N/A	Required	Required
2	Cable conduit	Support saddles space at minimum 1000mm	N/A	Required	Required
		Expansion joints provided at minimum 25m intervals and conduit boxing provided at minimum 40m intervals	N/A	Required	Required
		Appropriate anchor size used. – Wood or fibre plugs are not allowed	N/A	Required	Required
3	Buried cable	Min 75mm bedding and 300mm width	N/A	Required	Required
		Cable marker tape installed	N/A	Required	Required
		Sign-off			

10. Fibre optic

10.9 QA/QC template

Quality / Control		Measurement	Certification		
			Document supplied	Site supervisor witness	Engineer witness
1	Qualification	Certified to complete fibre installation	Required	Required	Required
2	Duct installation	Bending radius not exceeded	N/A	Required	Selected
		Connection details through pits adhered to; no sharp edges or sharp turns	N/A	Required	Required
		Bedding surround 100mm of the fibre duct.	N/A	Required	Required
		Warning tape installed over top of bedding	N/A	Required	Selected
		Duct integrity tested in accordance with Section 13	Required	Required	Required
3	Cable installation	15m additional length left at each draw end for cable termination	N/A	Required	Required

Quality / Control		Measurement	Certification		
			Document supplied	Site supervisor witness	Engineer witness
		Un-used fibre placed in cassette dark storage area, not in duct.		Required	Required
		Cable and equipment labels installed	N/A	Required	Selected
		Only Velcro ties used	N/A	Required	Selected
4	Record keeping	Records provided	Required	Required	Required
		Sign-off			

11. Cathodic protection

11.11 QA/QC template

Quality / Control		Measurement	Certification		
			Document supplied	Site supervisor witness	Engineer witness
1	Surge protection	Lightening arrestor installed. Not connected to valve or isolated fitting bodies.	N/A	Required	Required
2	Cabling	QA completed as per section 9	Required	Required	Required
		Correct cable size and colour used	N/A	Required	Required
3	Anodes	Position confirmed exactly as per the specific drawings – captured co-ordinates	Required	Required	Required
4	Reference cell	Installed in bentonite fill, ground wetted when placing	N/A	Required	Required
5	Isolation and bonding	Joints and fitting/component isolation inspected for bonding. Flange isolation confirmed as per the mechanical construction standard	N/A	Required	Required
6	Coupons and resistance probes	Drop tube provided. Backfill same material as pipe bedding	N/A	Required	Required
7	Electrical hazard analysis	Analysis completed. Any issues rectified	Required	Required	Required
8	Labelling	Equipment and cables labelled	N/A	Required	Required
		Sign-off			

14. Appendix A: Example of cathodic protection commissioning reporting sheet

CP Site ID	TP #	TP Name/Location	Mounting	Type	Structure	Facility Code	Terminal	Cable	Commissioning surveys							
									IF and influence checks from other systems*		Natives*	Post Energisation		After 3 months	
									Dates:						
									On	Off		On	Off	On	Off
181	1	Cosseys tunnel outlet portal	Bolt	IF	Portal side of IF	WMCOS	Bolt	-							
					Pipe side of IF	WMCOS	Bolt	-							
182	2	Wairoa River, off Cossey Access Rd	Bolt	Potential	Cosseys 1	WMCOS	Bolt	-							
183	3	Hirst propert AV at top of hill	Pillar	Potential	Cosseys 1	WMCOS	4	Black							
184	4	White / John Hill Rd Corner, left TP	Pillar	IF	Cosseys 1	WMCOS	2	Black							
185	5	White / John Hill Rd Corner, right TP	Pillar		Cosseys 1	WMCOS	2	Black							
					Hunua 4	WMHN4	3	White							
186	6	John Hill Rd, right TP	Pillar	IF	Cosseys 1	WMCOS	2	Black							
					Hunua 2	WMHN2	3	White							
187	7	John Hill Rd, middle TP	Pillar	IF	Cosseys 1	WMCOS	2	Black							
					Hunua 3	WMHN3	3	White							
					Bond current	WMCOS									
188		*John Hill Rd, left TP*	*Pillar*	*IF*	*Hunua 2 upstream*	*WMHN2*	*2*	*Black*							
					Hunua 2 downstream	*WMHN2*	*1*	*White*							
					Hunua 3 upstream	*WMHN3*	*4*	*Black*							
					Hunua 3 downstream	*WMHN3*	*3*	*White*							
								Test Point 7 bond current(amps):							
												Panel Meter	Portable	Panel Meter	Portable
								John Hill Rd TR output volts:							
								Amps:							
								Trail Rd TR output volts:							
								Amps:							