

University of Wollongong

Commissioning Standard Electrical Services
Version 3 – 5 June 2015

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4. ELECTRICAL SERVICES

The electrical services provide University of Wollongong (UOW) with the supply and reticulation of electricity. The electrical services include the following elements:

- Reticulation.
- Switchboards.
- Metering.
- General Power.
- Lighting.
- Backup and Emergency Services.

4.1 OVERVIEW

The commissioning standard for the electrical services involves the following stages:

Stages	Description	Parties Involved
Stage 1	Unit Testing - Performed by the manufacturer at a component level.	Manufacturer
Stage 2	Installation Inspections - Performed by the project manager during the installation process. The objective is to identify poorly installed equipment or parts of the installation that do not comply with the provisions of the design specifications. Provided the defect is identified at an early stage, the cost of remedial work and delays to the project program can be minimised.	Project Manager
Stage 3	Final Commissioning - Performed by the installation contractor and witnessed by the project manager.	Contractor, Project Manager

Table 1 - Commissioning Stages

Final commissioning is the most important part of the quality control process. It is at this stage of the project that the project manager will determine whether the system is ready to be approved for Practical Completion.

All commissioning tests are critical and shall be performed to ensure that all electrical services operate correctly. It is UOW's objective to complete the commissioning tests with zero defects remaining in the system.

The electrical services commissioning tests have been designed to test the functionality and performance of each electrical sub-system, equipment and device. It is important that the electrical services be tested under all operational conditions to ensure that the electrical services operate efficiently and safely and comply with the design specification.

4.2 COMMISSIONING PROCESS

The following flow diagram depicts the commissioning process:

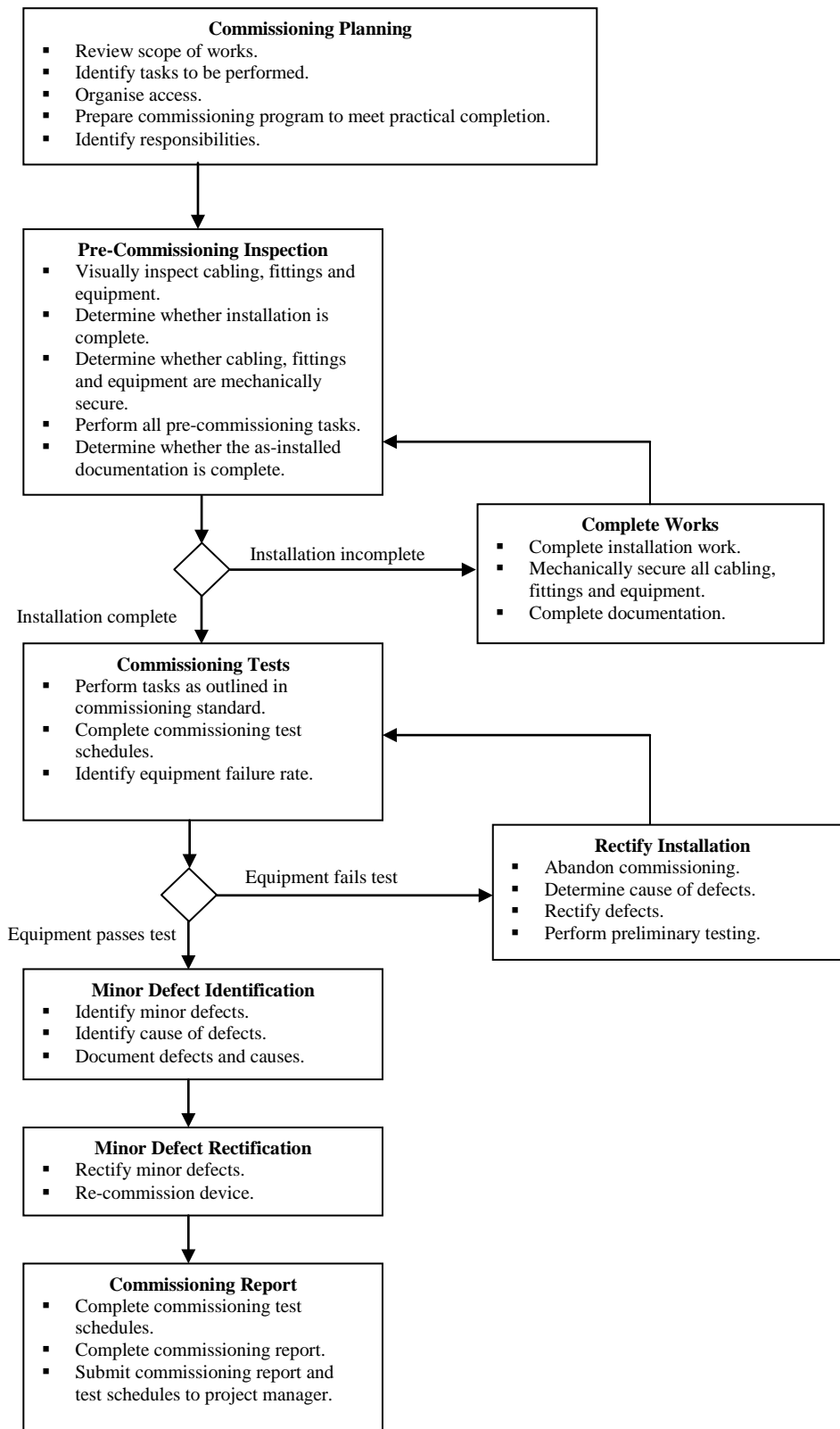


Figure 1 - Commissioning Process Flowchart

4.3 DOCUMENTATION

The contractor shall submit a complete set of documentation to the project manager no later than one (1) week prior to the planned commissioning date. As a minimum the documentation shall comprise:

- a. As-installed drawings.
- b. Equipment technical manuals.
- c. Equipment operation manuals.

The contractor shall obtain written approval of the documentation before commencing the commissioning tests.

4.4 COMMISSIONING TIME AND DATE

The contractor shall submit a program to the project manager containing the proposed time and date for each commissioning test at least two (2) weeks prior to the planned commissioning date. The program must contain allowances for defect rectification and remedial works.

The contractor shall obtain written approval of the program from the project manager before commencing the commissioning tests.

4.5 COMMISSIONING TESTS

Commissioning tests shall be performed to assess the functionality, performance and safety of the electrical services. Each commissioning test is specific to the electrical service being tested.

All commissioning tasks shall be performed by persons having qualifications and experience suitable for the testing and inspection tasks and all associated remedial work.

As each commissioning test is performed, the results shall be recorded on the appropriate commissioning test schedule. Any comments regarding abnormal operation in particular to failed tests shall be recorded in the comments section of the commissioning schedule.

If the sub-system, equipment or device fails a test then the commissioning process shall be abandoned. The contractor shall determine the cause of the defects and retest the equipment. A report shall be provided to the project manager outlining the cause of the failure and the action taken to ensure that the remainder of the installation shall not experience the same failure.

4.5.1 General

All tests shall be performed in accordance with relevant codes, regulations and standards. Due to the inherent danger of working with electrical services, appropriate safety precautions and procedures must be followed at all times.

Following are the general commissioning procedures that apply to all sub-systems, equipment and devices:

- a. Verify that all sub-systems, equipment and devices have been installed at the location and in the configuration specified in the design documentation.
- b. Verify that all equipment and devices have been correctly secured to protect against operational damage and ensure stability for continuous use.
- c. For all electrical commissioning tests, a record of the test results shall be maintained (refer section 4.9 Commissioning Schedules).
- d. For all defects identified, the corrective action must be recorded and the equipment shall be retested.

4.5.2 Reticulation

The following commissioning tasks shall be performed for all reticulation systems:

- a. Verify that cabling has been concealed where possible in ceiling spaces, wall cavities or risers.
- b. Verify that electrical cables have been correctly sized and are protected against fault current and overload.
- c. Verify that all cabling has been correctly terminated.
- d. Verify that all cabling has been correctly insulated.
- e. Verify that mechanical protection has been provided for all cabling to minimise the likelihood of physical damage to cabling.
- f. Verify that ducting, conduit and cable trays have been effectively secured to ensure that they can support currently installed and future cabling.
- g. Verify that all cabling has been clearly labelled to comply with UOW's labelling convention.

4.5.3 General Power

The following commissioning tasks shall be performed for general power:

- a. Verify the integrity of all cables and connections.
- b. Verify the integrity and operation of all general power outlets and switching devices.
- c. Verify correct polarity.
- d. Verify earth connectivity.
- e. Verify that all active, neutral and protective earthing conductors are correctly connected.
- f. Verify that appropriate resistance exists between active, neutral and protective earthing conductors.
- g. Verify that isolating switches have been provided adjacent to all fixed equipment.
- h. Where RCDs have been installed, verify that the RCD operates correctly by using the integral test device to trip the RCD.
- i. Verify that all general power outlets have been clearly labelled to comply with UOW's labelling convention.

4.5.4 Automatic Controls

The following commissioning tasks shall be performed for all automatic control equipment:

- a. Verify the integrity of all associated cabling.
- b. Verify all connections have been correctly terminated.
- c. Verify that contacts and relays have been correctly installed and operate on the desired signal.
- d. Verify that all meters have been correctly calibrated.
- e. Verify the automatic control (status changes) of equipment and devices operates correctly.
- f. For automatic protection circuits, verify the circuit fault-loop impedance is correct so that the protective device will operate correctly.
- g. Isolate the coil circuits of all sensing relays and contactors from the a.c. supply and verify the system operates correctly.
- h. Where specified, verify the control software has been fully installed and configured and operates correctly.
- i. Verify the correct operation of all indicator devices.
- j. Verify that all equipment and devices have been clearly labelled to comply with UOW's labelling convention.

4.5.5 Switchboards

The following commissioning tasks shall be performed for all switchboards:

- a. Verify the integrity of all cabling and connections.
- b. Ensure that switchboards have been correctly sealed to prevent intrusion of dust, smoke or liquids.
- c. Verify that appropriate ventilation has been provided and operates efficiently.
- d. Verify that insulation has been correctly applied and is free from defects.
- e. Verify the specified spare capacity has been provided.
- f. Verify that meters have been correctly calibrated.
- g. Verify that the rating of fuses is correct and labelled.
- h. Verify the operation of all circuit breakers by tripping and re-closing.
- i. Verify the operation of all switches and indicating devices.
- j. Verify the operation of all interlocks and linkages.
- k. Verify the connection of the main earth neutral and labelled.
- l. Verify the connectivity of the earth electrode and labelled.
- m. Verify the size of the earthing conductors.
- n. Verify that earthing equipment is of an adequate current carrying capacity to suit the fault level of the switchboard.
- o. Verify that earth mats have been correctly installed where required.
- p. Ensure that insulating mats, stands and screens have been provided where necessary and are of an appropriate standard.
- q. Simulate the activation of an alternate power supply and verify the operation of PLC control of changeover switches.
- r. Verify that all surge filters operate correctly.
- s. Where RCDs have been installed, verify that the RCD operates correctly by using the integral test device to trip the RCD.
- t. Verify that all switchboards have been clearly labelled to comply with UOW's labelling convention.

4.5.6 Metering

All electrical metering shall be tested to verify correct operation and measurements. The commissioning tester shall perform the following tasks for each meter:

- a. Verify that meters have been installed in designated service areas with adequate access and ventilation.
- b. Verify that the meters have been correctly connected and are mechanically secure.

- c. Verify the integrity of all cabling and connections.
- d. Verify that meters have been correctly calibrated.
- e. Using a portable meter, verify the meter records under varying operational conditions.
- f. Simulate operational fluctuations and verify that meter returns to steady state conditions.
- g. Where specified, verify that meters provide the BMCS with real time monitoring.
- h. Verify that all meters have been clearly labelled to comply with UOW's labelling convention.

4.5.7 Motors

Motors shall be inspected and tested in accordance with the following procedures:

- a. Verify that motors have been securely mounted and that vibration provisions have been installed where necessary.
- b. Verify the integrity of all associated cabling.
- c. Verify the operation of all switches and indicating devices.
- d. Verify the integrity and polarity of the electrical connections.
- e. Verify the stop/start operation.
- f. Where specified, verify variable speed control and motor performance.
- g. Where specified, verify motors have been fitted with PTC thermistors to provide Class 1 protection matched to the motor's insulation class.
- h. Where specified, verify the performance of emergency stop devices.
- i. Verify that all motors have been clearly labelled to comply with UOW's labelling convention.

4.5.8 Lighting

The lighting systems shall be inspected and tested in accordance with the following procedures:

- a. Verify the integrity of cabling and connections.
- b. Verify that diffusers have been correctly fitted where appropriate.
- c. For security lighting, verify that security light fittings are connected to a security designated circuit.
- d. Verify that switching is logical and complies with the design specification.
- e. Verify the operation of all lighting and associated switching.
- f. Verify that lighting in all designated areas produce the lux levels as specified in the design specifications.
- g. Where specified, verify that all lighting equipment and associated switching has been clearly labelled to comply with UOW's labelling convention.

4.5.9 Emergency and Exit Lighting

The emergency and exit lighting systems shall be inspected and tested in accordance with the following procedures:

- a. Verify the integrity of all cabling and connections.
- b. Ensure that all lamps are operational.
- c. Verify the operation of all switching and indicator devices.
- d. Simulate a power failure and verify that all emergency and exit lighting operates correctly.
- e. For indirect lighting, ensure that the finish of major reflecting surfaces does not cause inappropriate reflectance.
- f. For indirect lighting, ensure that directional beam type emergency luminaires, when operating, will not interfere with the vision of persons moving through the area.
- g. Where specified, verify that all lighting equipment and associated switching has been clearly labelled to comply with UOW's labelling convention.

4.5.10 Batteries

Batteries shall be inspected and tested in accordance with the following procedures:

- a. Verify the integrity of all cabling.
- b. Verify the integrity of all battery connections.
- c. Verify the operation of all switching and indicator devices.
- d. Verify the meters have been correctly calibrated.
- e. Inspect all cell containers to ensure that they are mechanically secure and ensure that electrolyte leakage has not occurred.
- f. For lead-acid batteries, measure the electrolyte density and ensure that it complies with manufacturer's recommendations.
- g. Check that the electrolyte level complies with the manufacturer's recommendation.
- h. Boost charge each battery.
- i. Measure the float charge battery voltage and individual cell voltages and verify that they comply with the manufacturer's recommendations.
- j. Perform manual and automatic discharge tests where the corresponding facilities exist.
- k. Ensure that all exposed metal surfaces are protected with a coating of petroleum jelly or other suitable battery terminal preservative.
- l. Where specified, verify that all battery equipment has been clearly labelled to comply with UOW's labelling convention.

4.5.11 Battery Chargers

Battery chargers shall be inspected and tested in accordance with the following procedures:

- a. Verify the integrity of all cabling and connections.
- b. Verify the operation of all switching and indicator devices.
- c. Verify the meters have been correctly calibrated.
- d. Ensure that the battery voltage complies with the normal float voltage range recommended by the manufacturer.
- e. Where earth-fault detection systems exist, verify that the system operates correctly.
- f. Simulate a low voltage condition and verify that the battery low-voltage alarm operates correctly.
- g. Where specified, verify that all battery charger equipment has been clearly labelled to comply with UOW's labelling convention.

4.5.12 Inverters

Inverters shall be inspected and tested in accordance with the following procedures:

- a. Verify the integrity of all cabling and connections.
- b. Verify the operation of all switching and indicator devices.
- c. Verify the meters have been correctly calibrated.
- d. Ensure that the d.c. input voltage and current are within the tolerance limits of recommended by the manufacturer.
- e. Ensure that the a.c. output voltage and current are within the output tolerance limits recommended by the manufacturer.
- f. Verify that all inverters have been clearly labelled to comply with UOW's labelling convention.

4.5.13 Uninterrupted Power Supplies

Uninterrupted power supplies (UPS) shall be inspected and tested in accordance with the following procedures:

- a. Verify the integrity of all cabling and connections.
- b. Verify the meters have been correctly calibrated.
- c. Verify the operation of all switching and indicator devices.
- d. Verify that the batteries have been correctly configured and comply with manufacturer's recommendations.
- e. Simulate a power failure and verify that the UPS operates correctly, ensuring that equipment does not experience a loss of power.

- f. Simulate UPS bypass switches for maintenance mode.
- g. Verify that the UPS batteries charge and discharge correctly (refer to sections 4.5.8 Batteries and 4.5.9 Battery Chargers).
- h. Verify that the UPS capacity is sufficient to supply power for the time specified in the design specifications.
- i. Verify that all UPS equipment has been clearly labelled to comply with UOW's labelling convention.

4.5.14 Power Factor Correction

Where power factor correction equipment has been installed, the commissioning tester shall perform the following tasks:

- a. Verify the integrity of all cabling and connections.
- b. Verify the meters have been correctly calibrated.
- c. Verify the operation of all switching and indicator devices.
- d. Verify that the design power factor is achieved.
- e. Verify that capacitance/induction devices have been correctly configured and comply with manufacturer's recommendations.
- f. Verify that all power factor correction equipment has been clearly labelled to comply with UOW's labelling convention.

4.6 MINOR DEFECTS

As minor defects are identified during the commissioning tests, each defect shall be rectified before proceeding to the next test. The cabling, equipment or device that was found to be defective will be recorded in the commissioning report.

Once rectification is complete, the equipment shall be retested and the results recorded in the commissioning schedules.

4.7 COMMISSIONING SCHEDULES

The commissioning schedules shall be completed in accordance with this standard. Where sub-systems, equipment or devices need to be retested, the retest results shall be recorded. At the completion of the commissioning tests, UOW shall have one complete set of commissioning schedules containing all sub-systems, equipment and devices that are free of defects.

4.7.1 Electrical Services Commissioning Schedule - Reticulation

Building Number: _____ Building Name: _____

Test	Commissioning Results		Test Reference Notes	Defect Details
	Pass	Fail		
Cable Size & Type	<input type="checkbox"/>	<input type="checkbox"/>		
Duct/Conduit Size & Type	<input type="checkbox"/>	<input type="checkbox"/>		
Mechanical Protection	<input type="checkbox"/>	<input type="checkbox"/>		
Cabling Installation	<input type="checkbox"/>	<input type="checkbox"/>		
Duct/Conduit Installation	<input type="checkbox"/>	<input type="checkbox"/>		
Insulation	<input type="checkbox"/>	<input type="checkbox"/>		
Connections & Terminations	<input type="checkbox"/>	<input type="checkbox"/>		
Labelling	<input type="checkbox"/>	<input type="checkbox"/>		

Commissioning Date: ___/___/___

Commissioning Contractor Name: _____

Commissioning Contractor Representative: _____

Project Manager Name: _____

Project Manager Reference: _____

4.7.2 Electrical Services Commissioning Schedule - General Power

Building Number: _____ Building Name: _____

Commissioning Date: __/__/__

Test	Commissioning Results		Test Reference Notes	Defect Details
	Pass	Fail		
Cabling	<input type="checkbox"/>	<input type="checkbox"/>		
Connections & Terminations	<input type="checkbox"/>	<input type="checkbox"/>		
Polarity	<input type="checkbox"/>	<input type="checkbox"/>		
Earthing	<input type="checkbox"/>	<input type="checkbox"/>		
Isolating Switches	<input type="checkbox"/>	<input type="checkbox"/>		
RCDs	<input type="checkbox"/>	<input type="checkbox"/>		
General Power Outlets	<input type="checkbox"/>	<input type="checkbox"/>		
Contacts	<input type="checkbox"/>	<input type="checkbox"/>		
Labelling	<input type="checkbox"/>	<input type="checkbox"/>		

Commissioning Contractor Name: _____

Commissioning Contractor Representative: _____

Project Manager Name: _____

Project Manager Reference: _____

4.7.3 Electrical Services Commissioning Schedule - Automatic Controls

Building Number: _____ Building Name: _____
 Equipment Number: _____ Equipment Location: _____ Equipment Type: _____
 Commissioning Date: __/__/__

Test	Commissioning Results		Test Reference Notes	Defect Details
	Pass	Fail		
Cabling	<input type="checkbox"/>	<input type="checkbox"/>		
Connections & Terminations	<input type="checkbox"/>	<input type="checkbox"/>		
Indicator Devices	<input type="checkbox"/>	<input type="checkbox"/>		
Automatic Control Operation	<input type="checkbox"/>	<input type="checkbox"/>		
Fault Loop Impedance	<input type="checkbox"/>	<input type="checkbox"/>		
Relays	<input type="checkbox"/>	<input type="checkbox"/>		
Contacts	<input type="checkbox"/>	<input type="checkbox"/>		
Software Installation	<input type="checkbox"/>	<input type="checkbox"/>		
Software Operation	<input type="checkbox"/>	<input type="checkbox"/>		
Meters	<input type="checkbox"/>	<input type="checkbox"/>		
Labelling	<input type="checkbox"/>	<input type="checkbox"/>		

Commissioning Contractor Name: _____
 Commissioning Contractor Representative: _____

Project Manager Name: _____
 Project Manager Reference: _____

4.7.4 Electrical Services Commissioning Schedule - Switchboards

Building Number: _____ Building Name: _____
 Switchboard Number: _____ Switchboard Location: _____ Switchboard Type: _____ Switchboard Rating: _____
 Commissioning Date: __/__/__

Test	Commissioning Results		Test Reference Notes	Defect Details
	Pass	Fail		
Construction	<input type="checkbox"/>	<input type="checkbox"/>		
Earthing	<input type="checkbox"/>	<input type="checkbox"/>		
Cabling	<input type="checkbox"/>	<input type="checkbox"/>		
Insulation	<input type="checkbox"/>	<input type="checkbox"/>		
Ventilation	<input type="checkbox"/>	<input type="checkbox"/>		
Fuses	<input type="checkbox"/>	<input type="checkbox"/>		
Relays	<input type="checkbox"/>	<input type="checkbox"/>		
Contacts	<input type="checkbox"/>	<input type="checkbox"/>		
Circuit Breakers	<input type="checkbox"/>	<input type="checkbox"/>		
Interlocks	<input type="checkbox"/>	<input type="checkbox"/>		
Linkages	<input type="checkbox"/>	<input type="checkbox"/>		
Fuses	<input type="checkbox"/>	<input type="checkbox"/>		
Meters	<input type="checkbox"/>	<input type="checkbox"/>		
PLC Control	<input type="checkbox"/>	<input type="checkbox"/>		
Surge Filters	<input type="checkbox"/>	<input type="checkbox"/>		
RCDs	<input type="checkbox"/>	<input type="checkbox"/>		
Labelling	<input type="checkbox"/>	<input type="checkbox"/>		

Commissioning Contractor Name: _____
 Commissioning Contractor Representative: _____

Project Manager Name: _____
 Project Manager Reference: _____

4.7.5 Electrical Services Commissioning Schedule - Metering

Building Number: _____ Building Name: _____
 Meter Number: _____ Meter Location: _____ Meter Type: _____

Test	Commissioning Results		Test Reference Notes	Defect Details
	Pass	Fail		
Meter Installation	<input type="checkbox"/>	<input type="checkbox"/>		
Cabling	<input type="checkbox"/>	<input type="checkbox"/>		
Connections & Terminations	<input type="checkbox"/>	<input type="checkbox"/>		
Calibration	<input type="checkbox"/>	<input type="checkbox"/>		
Operation	<input type="checkbox"/>	<input type="checkbox"/>		
Interface With BMCS	<input type="checkbox"/>	<input type="checkbox"/>		
Labelling	<input type="checkbox"/>	<input type="checkbox"/>		

Commissioning Date: ___/___/___

Commissioning Contractor Name: _____

Commissioning Contractor Representative: _____

Project Manager Name: _____

Project Manager Reference: _____

4.7.6 Electrical Services Commissioning Schedule - Motors

Building Number: _____ Building Name: _____
 Motor Number: _____ Motor Location: _____ Motor Type: _____ Motor Rating: _____
 Commissioning Date: __/__/__

Test	Commissioning Results		Test Reference Notes	Defect Details
	Pass	Fail		
Motor Installation	<input type="checkbox"/>	<input type="checkbox"/>		
Cabling	<input type="checkbox"/>	<input type="checkbox"/>		
Connections & Terminations	<input type="checkbox"/>	<input type="checkbox"/>		
Indicator Devices	<input type="checkbox"/>	<input type="checkbox"/>		
Polarity	<input type="checkbox"/>	<input type="checkbox"/>		
Emergency Stop	<input type="checkbox"/>	<input type="checkbox"/>		
Stop/Start Operation	<input type="checkbox"/>	<input type="checkbox"/>		
VSD Control	<input type="checkbox"/>	<input type="checkbox"/>		
Labelling	<input type="checkbox"/>	<input type="checkbox"/>		

Commissioning Contractor Name: _____
 Commissioning Contractor Representative: _____

Project Manager Name: _____
 Project Manager Reference: _____

4.7.7 Electrical Services Commissioning Schedule - Lighting

Building Number: _____ Building Name: _____
 Lighting Location: _____ Lighting Type: _____ Lighting Rating: _____
 Commissioning Date: __/__/__

Test	Commissioning Results		Test Reference Notes	Defect Details
	Pass	Fail		
Lighting Installation	<input type="checkbox"/>	<input type="checkbox"/>		
Cabling	<input type="checkbox"/>	<input type="checkbox"/>		
Connections & Terminations	<input type="checkbox"/>	<input type="checkbox"/>		
Diffusers	<input type="checkbox"/>	<input type="checkbox"/>		
Operation	<input type="checkbox"/>	<input type="checkbox"/>		
Switching	<input type="checkbox"/>	<input type="checkbox"/>		
Lux Levels	<input type="checkbox"/>	<input type="checkbox"/>		
Security Lighting	<input type="checkbox"/>	<input type="checkbox"/>		
Labelling	<input type="checkbox"/>	<input type="checkbox"/>		

Commissioning Contractor Name: _____
 Commissioning Contractor Representative: _____

Project Manager Name: _____
 Project Manager Reference: _____

4.7.8 Electrical Services Commissioning Schedule - Emergency & Exit Lighting

Building Number: _____ Building Name: _____
 Lighting Location: _____ Lighting Type: _____ Lighting Rating: _____
 Commissioning Date: __/__/__

Test	Commissioning Results		Test Reference Notes	Defect Details
	Pass	Fail		
Lighting Installation	<input type="checkbox"/>	<input type="checkbox"/>		
Cabling	<input type="checkbox"/>	<input type="checkbox"/>		
Connections & Terminations	<input type="checkbox"/>	<input type="checkbox"/>		
Indicator Devices	<input type="checkbox"/>	<input type="checkbox"/>		
Switching Units	<input type="checkbox"/>	<input type="checkbox"/>		
General Operation	<input type="checkbox"/>	<input type="checkbox"/>		
Emergency Operation	<input type="checkbox"/>	<input type="checkbox"/>		
Labelling	<input type="checkbox"/>	<input type="checkbox"/>		

Commissioning Contractor Name: _____
 Commissioning Contractor Representative: _____

Project Manager Name: _____
 Project Manager Reference: _____

4.7.9 Electrical Services Commissioning Schedule - Batteries

Building Number: _____ Building Name: _____
 Equipment Number: _____ Equipment Location: _____ Equipment Type: _____ Equipment Rating: _____
 Commissioning Date: __/__/__

Test	Commissioning Results		Test Reference Notes	Defect Details
	Pass	Fail		
Equipment Installation	<input type="checkbox"/>	<input type="checkbox"/>		
Cabling	<input type="checkbox"/>	<input type="checkbox"/>		
Connections & Terminations	<input type="checkbox"/>	<input type="checkbox"/>		
Meters	<input type="checkbox"/>	<input type="checkbox"/>		
Indicator Devices	<input type="checkbox"/>	<input type="checkbox"/>		
Switching Units	<input type="checkbox"/>	<input type="checkbox"/>		
Electrolyte Levels	<input type="checkbox"/>	<input type="checkbox"/>		
Electrolyte Density	<input type="checkbox"/>	<input type="checkbox"/>		
Battery Operation	<input type="checkbox"/>	<input type="checkbox"/>		
Labelling	<input type="checkbox"/>	<input type="checkbox"/>		

Commissioning Contractor Name: _____
 Commissioning Contractor Representative: _____

Project Manager Name: _____
 Project Manager Reference: _____

4.7.10 Electrical Services Commissioning Schedule - Battery Chargers

Building Number: _____ Building Name: _____
 Equipment Number: _____ Equipment Location: _____ Equipment Type: _____ Equipment Rating: _____
 Commissioning Date: __/__/__

Test	Commissioning Results		Test Reference Notes	Defect Details
	Pass	Fail		
Cabling	<input type="checkbox"/>	<input type="checkbox"/>		
Connections & Terminations	<input type="checkbox"/>	<input type="checkbox"/>		
Calibration	<input type="checkbox"/>	<input type="checkbox"/>		
Indicator Devices	<input type="checkbox"/>	<input type="checkbox"/>		
Switching Units	<input type="checkbox"/>	<input type="checkbox"/>		
Earth-fault Operation	<input type="checkbox"/>	<input type="checkbox"/>		
Low Voltage Alarm Operation	<input type="checkbox"/>	<input type="checkbox"/>		
Labelling	<input type="checkbox"/>	<input type="checkbox"/>		

Commissioning Contractor Name: _____
 Commissioning Contractor Representative: _____

Project Manager Name: _____
 Project Manager Reference: _____

4.7.11 Electrical Services Commissioning Schedule - Inverters

Building Number: _____ Building Name: _____
 Equipment Number: _____ Equipment Location: _____ Equipment Type: _____ Equipment Rating: _____
 Commissioning Date: __/__/__

Test	Commissioning Results		Test Reference Notes	Defect Details
	Pass	Fail		
Cabling	<input type="checkbox"/>	<input type="checkbox"/>		
Connections & Terminations	<input type="checkbox"/>	<input type="checkbox"/>		
Calibration	<input type="checkbox"/>	<input type="checkbox"/>		
Indicator Devices	<input type="checkbox"/>	<input type="checkbox"/>		
Switching Units	<input type="checkbox"/>	<input type="checkbox"/>		
D.c. Input Voltage & Current	<input type="checkbox"/>	<input type="checkbox"/>		
A.c. Output Voltage & Current	<input type="checkbox"/>	<input type="checkbox"/>		
Labelling	<input type="checkbox"/>	<input type="checkbox"/>		

Commissioning Contractor Name: _____
 Commissioning Contractor Representative: _____

Project Manager Name: _____
 Project Manager Reference: _____

4.7.12 Electrical Services Commissioning Schedule - Uninterrupted Power Supplies

Building Number: _____ Building Name: _____
 Equipment Number: _____ Equipment Location: _____ Equipment Type: _____ Equipment Rating: _____
 Commissioning Date: __/__/__

Test	Commissioning Results		Test Reference Notes	Defect Details
	Pass	Fail		
UPS Installation	<input type="checkbox"/>	<input type="checkbox"/>		
Cabling	<input type="checkbox"/>	<input type="checkbox"/>		
Connections & Terminations	<input type="checkbox"/>	<input type="checkbox"/>		
Calibration				
Indicator Devices	<input type="checkbox"/>	<input type="checkbox"/>		
Switching Units	<input type="checkbox"/>	<input type="checkbox"/>		
Power Failure Operation	<input type="checkbox"/>	<input type="checkbox"/>		
Bypass Mode	<input type="checkbox"/>	<input type="checkbox"/>		
Charge/Discharge Operation	<input type="checkbox"/>	<input type="checkbox"/>		
Sufficient Capacity	<input type="checkbox"/>	<input type="checkbox"/>		
Labelling	<input type="checkbox"/>	<input type="checkbox"/>		

Commissioning Contractor Name: _____
 Commissioning Contractor Representative: _____

Project Manager Name: _____
 Project Manager Reference: _____

4.7.13 Electrical Services Commissioning Schedule - Power Factor Correction

Building Number: _____ Building Name: _____
 Equipment Number: _____ Equipment Location: _____ Equipment Type: _____
 Commissioning Date: __/__/__

Test	Commissioning Results		Test Reference Notes	Defect Details
	Pass	Fail		
Equipment Installation	<input type="checkbox"/>	<input type="checkbox"/>		
Cabling	<input type="checkbox"/>	<input type="checkbox"/>		
Connections & Terminations	<input type="checkbox"/>	<input type="checkbox"/>		
Calibration	<input type="checkbox"/>	<input type="checkbox"/>		
Indicator Devices	<input type="checkbox"/>	<input type="checkbox"/>		
Switching Units	<input type="checkbox"/>	<input type="checkbox"/>		
Equipment Operation	<input type="checkbox"/>	<input type="checkbox"/>		
Labelling	<input type="checkbox"/>	<input type="checkbox"/>		

Commissioning Contractor Name: _____
 Commissioning Contractor Representative: _____

Project Manager Name: _____
 Project Manager Reference: _____