EQUINIX

WHERE OPPORTUNITY CONNECTS

Global Commissioning & QA/QC Playbook

Name	Equinix Global Commissioning and M&E QA/QC Playbook

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Input From
Signed Date

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1.0 Contents

2.0 Introduction

1.1 Summary of Document

- This Document will provide the basis of all Commissioning Authority activities across Equinix. This framework will provide a consistent and repeatable template of activities, requirements and expectations to ensure that all projects are commissioned to the highest standards of quality and are operationally sound.
- This Playbook can be used as a catalogue of requirements that can be scaled from a small UPS upgrade or chiller replacement to a full IBX facility.
- Elements from sections 4 and 5 can be used as required based on the equipment being installed by the project.

1.2 Standards and Regulations

- Commissioning should be carried out in accordance with Equinix Global Standards and the appropriate International Standards/Code of Practice as highlighted within the specification & must also comply with all statutory regulations and local bylaws relating to the location of the facility.
- Where the International Standards/Code of Practice and local bylaws are not the same, the most onerous of the standards shall be applied to the installation.
- All authorities should be notified in accordance with their regulations and obtain any required approvals for the installation from local authorities and the engineer.
- All documentation must be written in English and where a specific regional language is required, documentation must be in English and the required Regional Language.

1.3 Documentation Language

- All documentation through Levels 0 to 6 shall be written in English, local language can also supplement the documents based on region specific.

3.0 Acronyms and Abbreviations

The following are acronyms used in this document and comply with the SoR and Equinix global standards for definitions of acronyms.

Acronyms	*Definition*

ECxM	*Equinix Commissioning Manager*
EoR	*Engineer of Records*
Cx	*Testing & Commissioning of Assets & Systems*
CxA	*Commissioning Authority*
FG	*Facility Grid Software Platform*
GC	*General Contractor*
QA/QC	*Quality Assurance / Quality Control*
CYT	*Conditional Yellow Tag*
Site Op's	*Equinix Site Operation Engineers*
TFM	*Equinix Technical Facility Management*
SoR	*Statement of Requirement document. This document outlines the primary goals, requirements, and preferences of the project.* *It is used throughout the project as a benchmark as to whether the project is meeting Equinix expectations.*
Contract Document	*The documents governing the responsibilities and relationships between parties involved in the design and construction of this project including (but not necessarily limited to):* ➢ Agreements/contracts: ➢ Construction plans and drawings: ➢ Specifications: ➢ Change Orders:
FWT or FAT	*Factory Witness Test or Factory Acceptance Test.*
SAT	*Site Acceptance Test also referred to as Commissioning Level 4. The detailed and thorough testing of Assets & building systems and their interactions with the building components and other building systems.*
HLT	*A Heat Load test is to verify the cooling capacity of the mechanical equipment supports the electrical full load in any critical environments.*
Integrated Systems Testing (IST)	*This is site wide testing on completion of all Asset & System testing, incorporating a defined series of failure test to prove the resilience of the design. This can only be undertaken upon all installation, and commissioning being complete and all systems running in Auto.*

4.0 Commissioning Agent / Authority Scope

Summary

- It is key that the Commissioning Agent / Authority (CxA) service provided to projects and TFM maintains its cost effectiveness and maintains a high quality of output to Equinix, to ensure operations are provided with the very best product.

- This means that the CxA must be a focused service that works solely within the scope and does not deviate from this core function. The CxA roles and responsibility are clearly defined in the Equinix PARIS Table and this Playbook.

- Should deviations arise that compromise this, these must be identified and escalated immediately so that they can be dealt with by the appropriate responsible body.

3.1 Commissioning Agent / Authority scope

The CxA scope can be split into 4 phases, Design, Construction, Acceptance and Transition. Each phase is covered by the 0 – 6 levels of commissioning as shown below.

Design Phase	Commissioning/Design Review of Approved RIBA 4c	Level 0
	Factory Acceptance/Witness Testing (FAT/FWT)	Level 1
Construction Phase	Equipment placement QA/QC Checks & sign Off	Level 2A
	Pre-Energisation QA/QC Checks & Static Testing & Sign Off	Level 2B
	Commissioning/Pre-Functional Testing & Sign off	Level 3
Acceptance Phase	Functional /Performance testing & sign off	Level 4
	Integrated Systems Testing & Sign off	Level 5
Transition Phase	Training & Documentation	Level 6

5.0 Commissioning of Equipment/ Systems **Overview**

Table below provides a general overview example of the MEP equipment / systems requiring Test and Commissioning and to which Commissioning level.

Items	*Equipment*	*Level 1*	*Level 2A*	*Level 2B*	*Level 3*	*Level 4*	*Cx L4 (Integration)*	*Level 5*	*Level 6*
1	High Voltage Panels	YES	YES	YES	YES	SAT	Mains Failure	YES	YES
2	Transformers	YES	YES	YES	YES	SAT	Inter tripping	YES	YES
3	Medium Voltage Panels	YES	YES	YES	YES	SAT	Mains Failure	YES	YES
4	Main Input Boards	YES	YES	YES	YES	SAT	Mains Failure	YES	YES
5	Main Output Boards	YES	YES	YES	YES	SAT	Mains Failure	YES	YES
6	PDU Switchboard	NO	YES	YES	YES	SAT	Mains Failure for PDUS with ATS	YES	YES
7	STSSB Panels	YES	YES	YES	YES	SAT + Load Test	Mains Failure for STSSBs with STS	YES	YES
8	Remote Power Panels	NO	YES	YES	YES	SAT	Mains Failure	YES	YES
9	Circuit Breakers	YES	YES	YES	N/A	N/A			

10	Generators	YES	YES	YES	YES	SAT + load test	Mains Failure	YES	YES
11	Generator Fuel System	NO	YES	YES	YES	SAT	Mains Failure	YES	YES
12	Generator Cooling System	NO	YES	YES	YES	SAT	Main Failure	YES	YES
13	Uninterrupted Power Supply (UPS)	YES	YES	YES	YES	SAT + Load Test + Battery Autonomy	Mains Failure & UPS units' sync, load share & system functional test including failure scenarios	YES	YES
14	Automatic Transfer Switches (ATS)	NO	YES	YES	YES	SAT	Mains Failure, Transfer, Functional test including failure scenarios	YES	YES
15	Static Transfer Switches		YES	YES	YES	SAT + Load Test	Mains Failure, Sync & out of sync Transfer, Functional test including failure scenarios	YES	YES
16	Battery Monitoring System	NO	YES	YES	YES	YES	Monitoring interface to electrical systems	YES	YES
17	Power Management System / EMS	NO	YES	YES	YES	SAT	All monitoring interface to electrical systems	YES	YES
18	Branch Circuit Management System (BCM)	NO	YES	YES	YES	SAT	All monitoring interface to electrical systems	YES	YES
19	Bus bar system	NO	YES	YES	YES	Load (SAT)	N/A	N/A	YES
20	Load bank connection system and controls	NO	YES	YES	YES	SAT	System functional test	YES	YES
21	110 VDC Trip units	NO	YES	YES	YES	SAT	Mains Failure & functional + system autonomy	YES	YES
22	Lighting Controls	NO	YES	YES	YES	SAT	N/A	N/A	YES
23	Lighting & Emergency	NO	YES	YES	YES	SAT	N/A	N/A	YES

	Lighting + Lux levels								
24	Small Power Electrical	NO	YES	YES	YES	N/A	N/A	N/A	N/A
25	Lightning Protection	NO	YES	YES	N/A	N/A	N/A	N/A	N/A
22	Earthing and Bonding	NO	YES	YES	N/A	N/A	N/A	N/A	N/A
26	Air handling Units & Ventilation	NO	YES	YES	YES	SAT	Integration with BMS controls	YES	YES
27	Fan Coil Units	NO	YES	YES	YES	SAT	Integration with BMS controls	YES	YES
28	Dehumidifiers	NO	YES	YES	YES	SAT	Integration with BMS controls	YES	YES
29	Hybrid Dry Air Coolers	YES	YES	YES	YES	SAT	Integration with BMS controls	YES	YES
30	Chiller	YES	YES	YES	YES	SAT + Load Test	Integration with BMS controls	YES	YES
31	Cooling Tower	YES	YES	YES	YES	SAT + Load Test	Integration with BMS controls	YES	YES
32	Cooling pumps	NO	YES	YES	YES	SAT	Integration with BMS controls	YES	N/A
33	Frost protection & trace heating systems	NO	YES	YES	YES	N/A	Integration with BMS controls	N/A	N/A
34	Computer Room Air Handlers units (CRAH) Units	NO	YES	YES	YES	SAT + HLT	Integration with BMS controls	YES	YES
35	Treated RO water	NO	YES	YES	YES	SAT	Integration with BMS controls	N/A	YES
36	Above Ground Drainage SVP	NO	YES	YES	YES	N/A	N/A	N/A	N/A
37	Rainwater system	NO	YES	YES	YES	N/A	N/A	N/A	N/A
38	Leak detection	NO	YES	YES	YES	SAT	Integration with BMS controls	N/A	YES
39	Building management system (DCOS)	YES	YES	YES	YES	SAT	Integration with other systems	YES	YES

40	Cooling Management System (CMS)	YES	YES	YES	YES	SAT	Integration with other systems / complete DESOPS testing	YES	YES
41	Access Control System	NO	YES	YES	YES	SAT	Integration with FAS	YES	YES
42	CCTV System	NO	YES	YES	YES	SAT	N/A	N/A	YES
40	PA System	NO	YES	YES	YES	NO	NO	N/A	YES
43	Fire Alarm System (FAS)	NO	YES	YES	YES	Cause & Effect	Integration with other systems	YES	YES
44	Water Mist System	NO	YES	YES	YES	SAT	Integration with FAS	YES	YES
45	Sprinkler (Dry / Wet) System	NO	YES	YES	YES	SAT	Integration with FAS	YES	YES
46	Gas Suppression System	NO	YES	YES	YES	SAT	Integration with FAS	YES	YES
47	Dry Risers	NO	YES	YES	YES	N/A	N/A	N/A	N/A
48	Communicatio n Network (BMS / EMS / DCOS	NO	YES	YES	YES	SAT	Functional resilience testing Core / access switch / fiber failures	N/A	N/A
49	Lifts	NO	YES	YES	YES	SAT	Integration with FA	YES	YES

6.0 Commissioning Levels

6.1 Commissioning Level 0 Design stage.

- The Commissioning process begins during the design of a project. During the design phase the project will define the design intent,
- The CxA shall undertake a commissioning design review from the issued Approved RIBA 4 documentation to determine the commissionability of the design.

- This will include all issued IFC drawings, Sequence of operations for all disciplines and any issues or queries highlighted are logged on the commissioning design template and issued back to the design team for clarification. This should enhance the quality of the construction and functional testing of the project.

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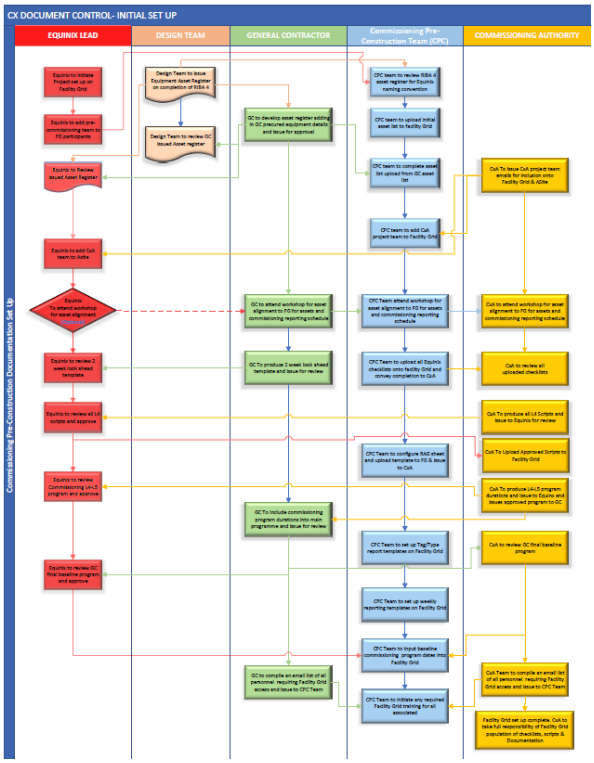
- This completed review should be issued to the Equinix Commissioning Manager for review and once approved should be attached to the relevant Commit Compliance Deliverables Checklist on Facility Grid.

- In this phase the initial commissioning plan shall also be developed and issued for review. Once approved by the Equinix commissioning Manager, this should also be attached to the relevant Commit Compliance Deliverables Checklist on Facility Grid and send to the MCEs & GC for reference. The Commissioning plan is a live document and should be updated to reflect any changes during the contract.

Commissioning Level 0 - Deliverables and Responsibilities



6.2 Commissioning Level 1 - Factory Acceptance, Witness Testing & Inspections

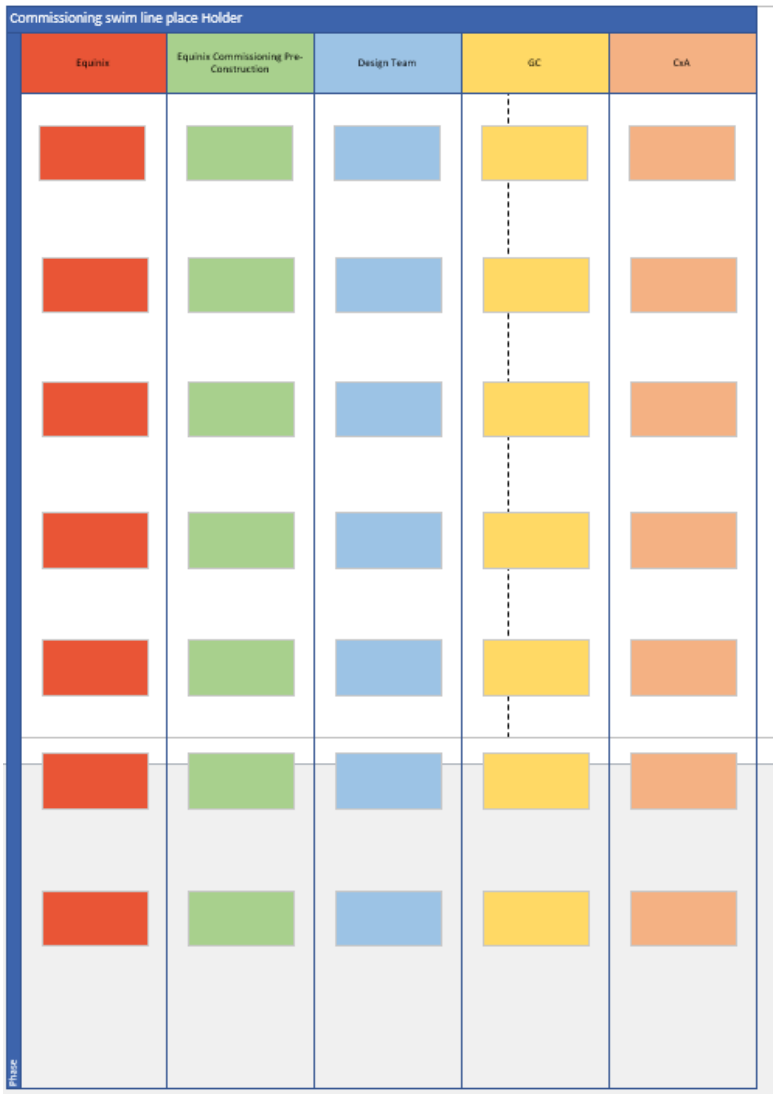
There are three types of factory inspections regarding the commissioning process:

Factory Witness Tests (FWT), Factory Acceptance Tests (FAT) and End of Line Inspections (ELI).

FWT - Factory Witness test	FWT is testing executed in the factory and witnessed by the project professional team to approve that the equipment has met all the performance parameters (capacity, efficiency, fault tolerance) according to the design, & Equinix operational requirements prior to the shipment of the equipment to site.
FAT – Factory Acceptance test	FAT is testing executed in the factory and witnessed and signed off by the factory quality control personnel. Documentation of this testing is provided as part of the required commissioning documentation.

ELI – End of Line Inspection	ELI are inspections of Assets prior to leaving the factory to capture any incomplete work or obvious defects prior to shipment.

Commissioning Level 1 - Deliverables and Responsibilities



6.3 Commissioning Level 2A – QA/QC Installation Verification Red Tag

- The Commissioning Level 2A process is to validate that the Assets have been installed in accordance with the project requirements and approved design before any external connections are undertaken.

- The Initial QA/QC inspection is undertaken by the General Contractor, who completes their test pack and issues on to the project Portal. The GC compiles all the recorded test data into a test pack and uploads this to the project portal.

- The CxA having reviewed the GC documentation validates and witnesses the asset, completes the Facility Grid checklist, attaches all supporting documentation to the checklist and signs off the QA/QC process.

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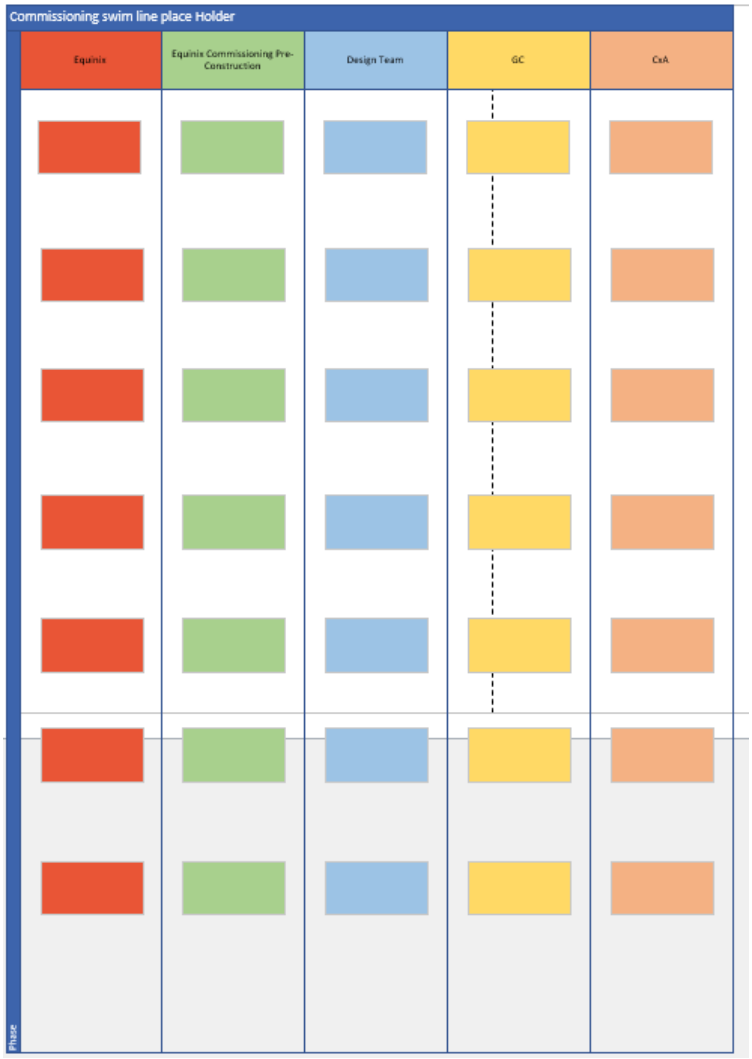
Commissioning Level 2A - Deliverables and Responsibilities



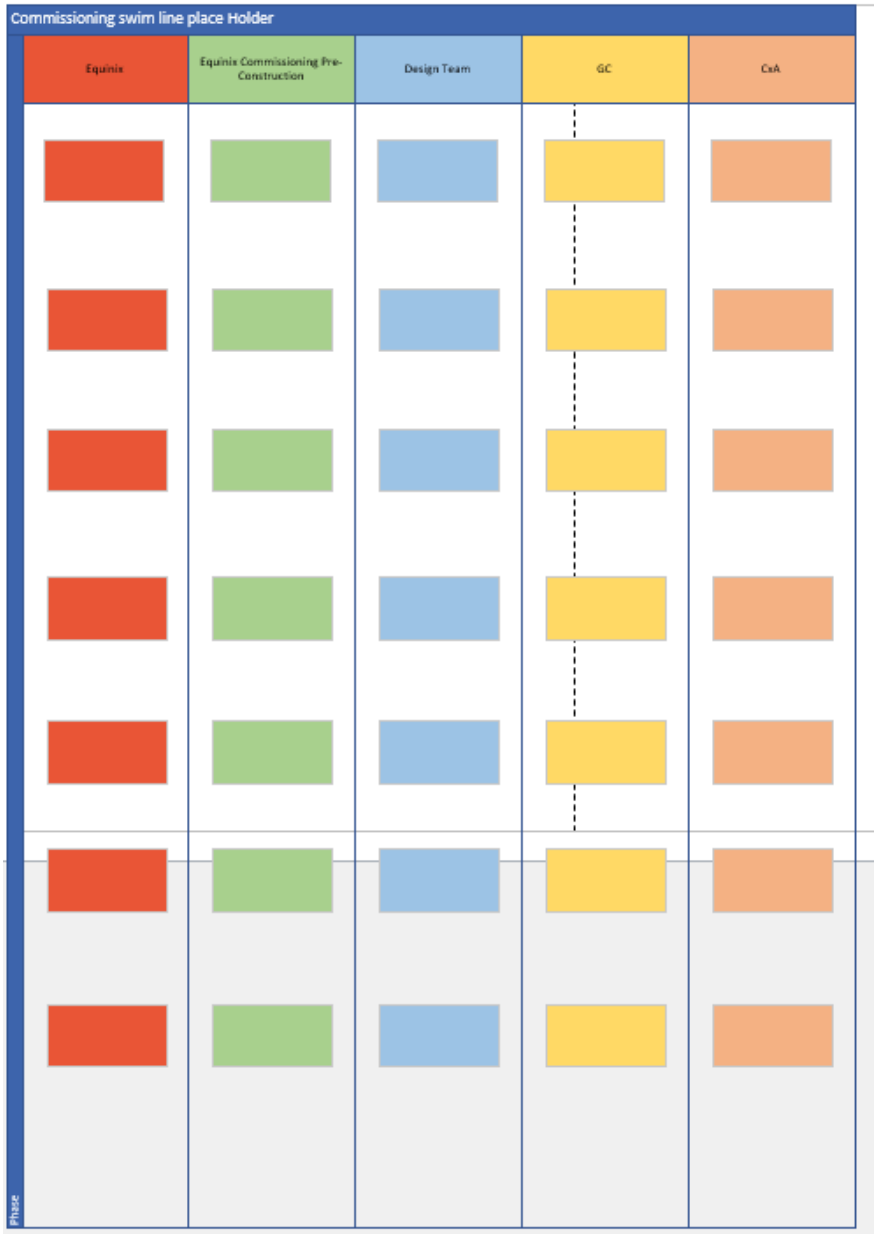
6.4 Commissioning Level 2B – Static testing Yellow Tag

- The process starts with the GC/Specialist Contractor/MCE connecting all services to an asset (Electrical cables, Power/ELV/pipework) and undertaking and recording the required tests in line with the approved MS and Equinix requirements stated within this playbook as a minimum (see asset test requirements)

- The GC compiles all the recorded test data into a test pack and uploads this to the project portal.

- The CxA having reviewed the GC documentation validates and witnesses the asset, completes the Facility Grid checklist, attaches all supporting documentation to the checklist and Signs off the Static testing process.

Commissioning Level 2B - Deliverables and Responsibilities

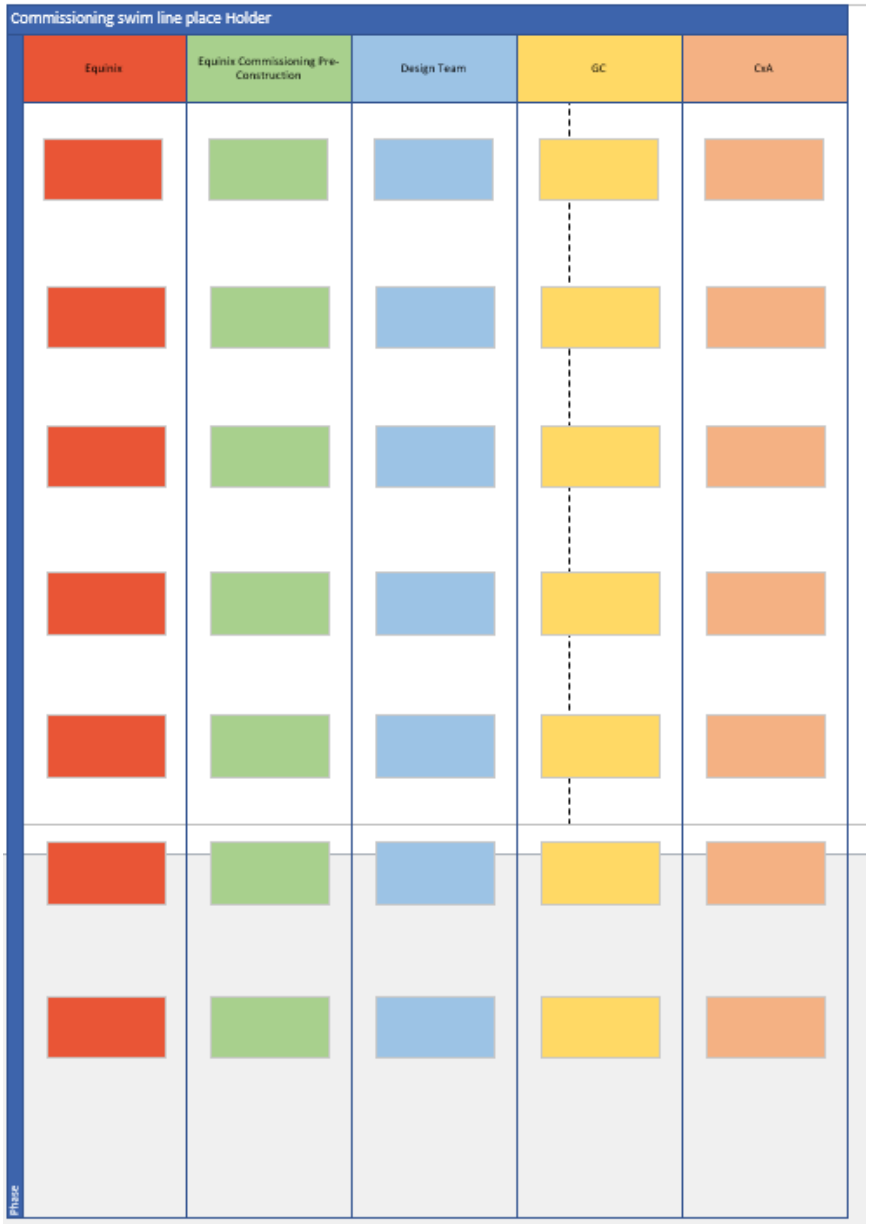


6.5 Commissioning Level 3 – Start-up & Pre-functional Testing Green Tag

- This process starts with the energisation of the Asset. Energisation can only be undertaken by an authorised person and in the presence of the CxA.
- Asset commissioning will be undertaken by the specialist contractor/MCE in accordance with the approved Level 3 method statement. This will also include Air & Water Balancing.
- All systems and equipment shall be verified complete by the GC who will compile the test results and upload the test pack to the project portal.
- The CxA having reviewed the GC documentation validates and witnesses the asset, completes the Facility Grid checklist, attaches all supporting documentation to the checklist and signs off the pre-functional testing process.

Commissioning Level 3 - Deliverables and Responsibilities

Note: Cx Level 3 is 100% for all critical system



6.6 Commissioning Level 4 – Functional & Performance Testing Blue Tag

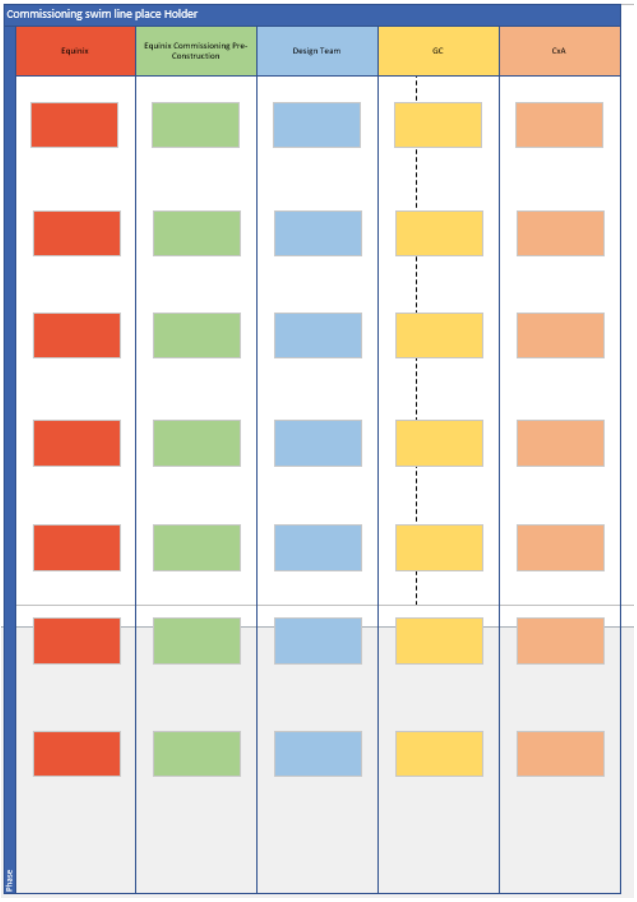
- Functional Tests are intended to validate the asset/system performances / capacity, sequences of operations and prove the interface with other connected systems such as DCOS.
- These tests shall be rigorous enough to ensure that the systems and equipment will perform at its rated design function with required redundancy and respond to failure conditions per the design intent.
- Electrical asset/systems load, and transfer testing will be Undertaken, Mechanical system load testing, redundancy and Heat Load Testing will all be carried out during Commissioning of Level 4.
- These tests will require the participation of several parties and shall be coordinated / managed by the CxA with the assistance of the GC and MCE.

- Although the CxA is responsible for delivery of the Commissioning level 4 test scripts from a contractual view point the GC and MCE will be responsible for the execution and completion of Commissioning level 4 testing overall as per the contract.

- The GC/MCE is responsible for monitoring & recording all required test data and issuing the data to the project Portal. This must include all Raw data & configured data in the form of graphs/ photos as per approved method statement requirements.

- The CxA will complete the approved Facility Grid scripts during the testing, and upon reviewing the uploaded supporting documentation, attach these and sign off the functional & performance testing.

Commissioning Level 4 - Deliverables and Responsibilities



6.7 Commissioning Level 5 – Integrated systems Testing White Tag

- This phase of testing will subject all equipment directly associated with the plant, sub-system, system, and components to a robust sequence of tests and simulated conditions at full system design load.

- All levels of commissioning must be complete and signed off by the CxA before integrated testing can start.

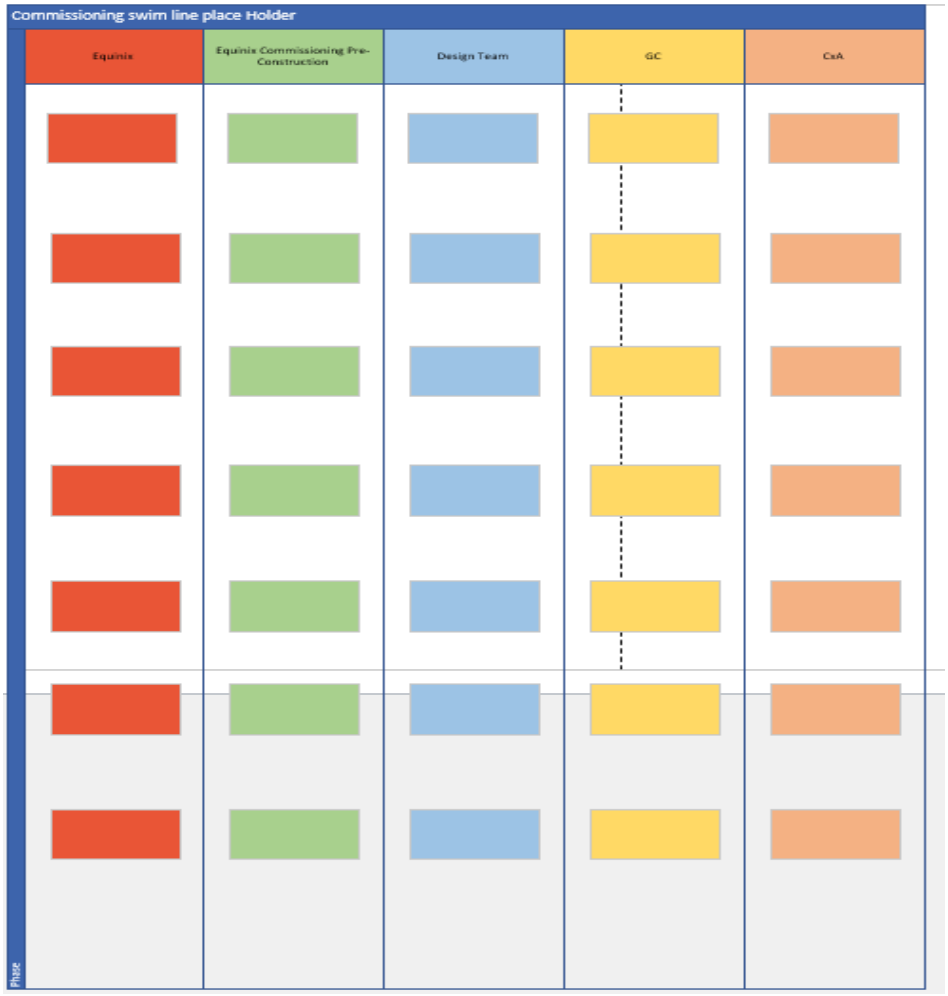
- The CxA is responsible for producing and issuing the complete IST test script for approval which should include, locations of any supplementary monitoring, heat load and trending requirements.

- Although the CxA is responsible for delivery of the Commissioning level 5 test script from a contractual viewpoint, the GC & MCE will be responsible for the execution and completion of Commissioning level 5 testing overall as per the contract.

- The GC/MCE is responsible for monitoring & recording all required test data and issuing the data to the project Portal. This must include all Raw data & configured data in the form of graphs/ photos as per approved method statement requirements.

- The CxA will complete the approved Facility Grid scripts during the testing, and upon reviewing the uploaded supporting documentation, attach these and sign off the Integrated System testing process.

Commissioning Level 5 - Deliverables and Responsibilities



6.8 Level 6 Transition Phase

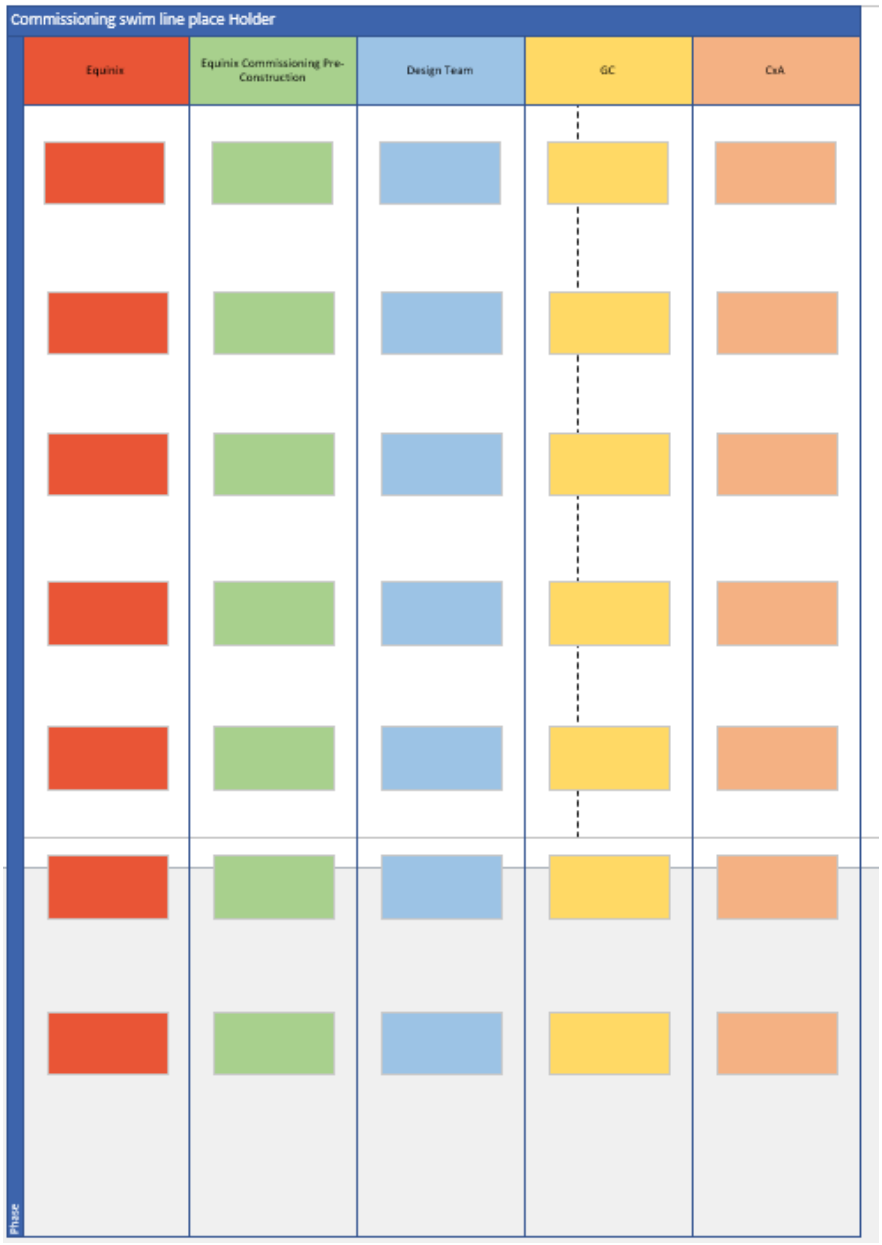
- Part of the handover process is to ensure that asset & systems level training of vendor equipment has been provided to the local Equinix site manager.

- It is the responsibility of the GC with support from the CxA to organise training delivered by the Vendors to provide the Facility Operations /Maintenance Team with a general and holistic understanding of the MEP assets and Building Automation System delivered to include fault and failure scenarios, and detailed operation of the MEP infrastructure.

- A training Matrix should be developed by the CxA from which training manual must be developed and approved before training is undertaken.

- A lessons Learned workshop must be conducted by the CxA and a Lessons learnt document must be issued to Equinix.

Commissioning Level 6 - Deliverables and Responsibilities

- 

7.0 Commissioning Documentation

7.1 Commissioning Schedule

- It is the responsibility of the GC to produce a baseline construction program. This should detail all L1-L3 commissioning and an overview of L4-L5 testing.
- This must be issued to the CxA who will develop a detailed sequenced schedule of all L4 & L5 testing requirement durations.
- Once developed this must be issued for approval by Equinix Commissioning Manager, issued to the GC and then incorporated into the overall program by the GC.
- The L4-L5 detailed sequenced commissioning schedule should be built working backwards from the RFS date with key milestones included.

- If any of the key milestones highlight a problem or do not align with the construction program this should be raised to Equinix immediately.

7.2 Test Method Statements / Checklists / Scripts Production

- The Commissioning Method Statements will consist of the following for all Assets/Systems. Each CMS will contain all necessary information like design info, drawings mark ups, checklists, calibration certs for any instruments used and empty forms etc.
- All L1- 5 method statements, Checklists and Scripts MUST meet the required levels of Testing and Commissioning for the equipment and systems and MUST be in conformance with the Equinix global standards and approved design documents.
- All method statements, Checklists and Scripts MUST be site specific.

The contents of the method statements shall include but not be limited to the following:

Front sheet that incorporates: • Project title • Identification of the Asset/System • Test description. • Author of the document
The body of the method statement must incorporate: • Index identifying the contents of the document. • Introduction – Brief Summary of the plant and location. • Plant schematics. • Installation drawings • Performance criteria/conformity statement, where applicable • Pass / Fail Criteria • Reference documents and procedures • The magnitude and duration of tests
The Method Statement Must Contain: • Full description of how the pre-commissioning, commissioning and demonstration are to be carried out. • List of constraints or other interfacing elements that must be in place before pre-commissioning & commissioning can commence. • Duration and program for carrying out the pre-commissioning, commissioning and demonstration works.
Risk assessment that incorporates: • Potential Risks • Control Measures • Access Requirements • Lighting • Tools & Equipment • Training Requirements • Hazardous Materials & substances (COSH) • Special Control Measures and emergency arrangements

- The method statements will be required to be issued at least 1 month prior to the commencement of any testing and commissioning activity, to allow sufficient time for review and comment by the required parties.
- The method statements and associated documents must achieve “Approved” status 14 days prior to the commencement of any testing and commissioning activities.
- It should be noted that a CMR is required for any integration into an existing “Live” system. The CMR requires a detailed Method Statement which is prepared by the GC or MCE (Depending of type of equipment / system) and is to be issued no later than 37 days in advance.

7.3 Commissioning Test Packs

The contents of the commissioning Test pack shall include but not be limited to the following:

Project, test & Asset title
A record of visual observations of performance
A statement that the tests were carried out in accordance with the method statement
A statement describing any temporary works and whether in the judgment of the Specialist Contractors, or manufacturer, they influenced the results of the test.
Ambient conditions including temperature, before and after testing, where applicable
Control logic flow chart, where applicable
System commissioning sheets showing recorded values at time of test and inclusive of design data
Schedule of test equipment, including calibration certificates
Identify who will witness the system installation, pre-commissioning, commissioning and demonstrations.
Identify how, and at what stages in the commissioning process, the system is to be demonstrated.
Record any variation to the agreed Method Statement
Manufacturer's standard test certificates for ALL equipment

- Every step in the checklists and procedures must be clearly checked by the CxA, with any deviations from the test plan clearly noted and subjected to the acceptance of Equinix Commissioning Manager. The forms should be the original records used by the GC/Vendor on site during the commissioning. Accurate reflection of the testing is the primary concern.

- Completion of all tests must be signed off via the Facility Grid Checklists & Scripts by the CxA at the completion of all Commissioning Verifications.

7.4 M&E QA/QC Installation Reports

- The GC is responsible in providing a QA/QC (Red Tag) report for the installation of each asset & uploaded to the project portal for review by the CxA.
- The GC report should include any deficiencies found which have not been addressed during the installation process.
- Once complete the CxA will conduct a witness in line with the approved Facility Grid Checklist (L2A Red Tag)
- The CxA will raise any issues found on the Facility Grid IRL log and dependent on the seriousness of the issue either sign off the Red Tag Checklist or request the raised issues has been addressed before moving on to the next stage

7.5 TMS & Completed Commissioning Records

TMS / Commissioning test pack Structure	Responsibility
QA/QC Installation checklist Red Tag	GC to issue test pack after each asset installation. CxA to complete Facility Grid Checklist
Commissioning level 2B TMS	GC/Vendor to develop an issue. CxA to review & approve
Level 2B test & commissioning documentation & results	GC/Vendor to compile and test pack & issue. CxA to review data, complete Facility Grid Script, attach GC/Vendor test pack & sign off
Commissioning level 3 TMS	GC/Vendor to develop an issue. CxA to review & approve
Level 3 test & commissioning documentation & results	GC/Vendor to compile and test pack & issue. CxA to review data, complete Facility Grid Script, attach GC/Vendor test pack & sign off
Commissioning level 4 TMS (Test Script)	CxA to develop script on Facility Grid Equinix to review & approve
Level 4 test & commissioning documentation & results	GC/Vendor to issue recorded data. CxA to review data, complete Facility Grid Script, attach issued data & sign off
Commissioning level 4 TMS (Test Script)	CxA to develop IST script on Facility Grid Equinix to review & approve
Level 4 test & commissioning documentation & results	GC/Vendor to issue recorded data. CxA to review data, complete IST Script, attach issued data & sign off

Any equipment test reports produced or overseen by GC & Specialist contractors must be provided in the final report. Examples may include power quality or oscilloscope measurements of UPS, generators, or static transfer switches, thermography reports of critical electrical and mechanical systems, analysis reports, data loggers trending etc.

7.6 Commit Compliance Deliverables

Commit Compliance documentation will be started at Commissioning Level 0 through to Level 6. This will be utilised and managed by the CxA throughout the life cycle of the project to ensure that Key Commissioning deliverables, for key commissioning deliverables are tracked accordingly and have been completed as per the approved schedule.

Documents are tracked on Facility Grid and all approved documentation is attached to the relevant task. This allows direct access to all approved key documentation when required.

Commit Compliance Deliverables Level 0	
CCD-L0-1	RIBA 4 Design Complete & Issued
CCD-L0-2	Cx Design Commissionability Review Issued
CCD-L0-3	Ongoing Commissioning Plan Issued
CCD-L0-4	Discrimination & Arch Flash Studies Issued
CCD-L0-5	GC Baseline Construction Program Issued
CCD-L0-6	CX L4-L5 Durations Program Issued
CCD-L0-7	L4-L5 durations integrated into GC Program & Issued
CCD-L0-8	QA/QC Review of GC Document Test pack Templates
CCD-L0-9	Busduct and support brackets QA/QC Plan
CCD-L0-10	LOTO issued & reviewed
CCD-L0-11	Review regional QA/QC compliance requirements
CCD-L0-12	CxA Cost Report trackers set-up and LIVE

Commit Compliance Deliverables Level 1	
CCD-L1-1	FAT/FWT Schedule Matrix Issued
CCD-L1-2	Review of Vendor Test packs/Method Statements (Pre-Test)
CCD-L1-3	Level 1 FWT/FAT/EOL Test packs uploaded to Procore
CCD-L1-4	Generator Load Bank Plan Issued & Approved
CCD-L1-5	UPS Load Bank Plan Issued & Approved
CCD-L1-6	HLT Load Bank Plan Issued & Approved
CCD-L1-7	Flushing Strategy Review & Approval
CCD-L1-8	Thermal Image Plan Issued & Approved

Commit Compliance Deliverables Level 2A	
CCD-L2A-1	QA/QC Benchmark / First of Kind schedule produced - Installation Methods
CCD-L2A-2	QA/QC Benchmark / First of Kind Witness - Electrical
CCD-L2A-3	QA/QC Benchmark / First of Kind Witness - Mechanical
CCD-L2A-4	QA/QC Benchmark / First of Kind Witness - Ancillary Equipment
CCD-L2A-5	Busduct testing and inspection plan issued (to be in line with vendor testing values)
CCD-L2A-6	MV ELEC L2A Tags Completed with Documentation
CCD-L2A-7	LV ELEC L2A Tags Completed with Documentation
CCD-L2A-8	DCOS L2A Tags Completed with Documentation
CCD-L2A-9	Mechanical L2A Tags Completed with Documentation
CCD-L2A-10	Fire Detection L2A Tags Completed with Documentation
CCD-L2A-11	Fire Suppression L2A Tags Completed with Documentation
CCD-L2A-12	Security L2A Tags Completed with Documentation

Commit Compliance Deliverables Level 2B	
CCD-L2A-1	MV ELEC L2A Tags Completed with Documentation
CCD-L2A-2	LV ELEC L2B Tags Completed with Documentation
CCD-L2A-3	DCOS L2B Tags Completed with Documentation
CCD-L2A-4	Mechanical L2B Tags Completed with Documentation
CCD-L2A-5	Fire Detection L2B Tags Completed with Documentation
CCD-L2A-6	Fire Suppression L2B Tags Completed with Documentation
CCD-L2A-7	Security L2B Tags Completed with Documentation

Commit Compliance Deliverables Level 3	
CCD-L3-1	MV ELEC L3 Tags Completed with Documentation
CCD-L3-2	LV ELEC L3 Tags Completed with Documentation
CCD-L3-3	DCOS L3 Tags Completed with Documentation
CCD-L3-4	Mechanical L3 Tags Completed with Documentation
CCD-L3-5	Fire Detection L3 Tags Completed with Documentation
CCD-L3-6	Fire Suppression 3 Tags Completed with Documentation
CCD-L3-7	Security L3 Tags Completed with Documentation

Commit Compliance Deliverables Level 4	
CCD-L4-1	MV ELEC L4 Tags Completed with Documentation
CCD-L4-2	LV ELEC L4 Tags Completed with Documentation
CCD-L4-3	DCOS L4 Tags Completed with Documentation
CCD-L4-4	Mechanical L4 Tags Completed with Documentation
CCD-L4-5	Fire Detection L4 Tags Completed with Documentation
CCD-L4-6	Fire Suppression L4 Tags Completed with Documentation
CCD-L4-7	Security L4 Tags Completed with Documentation
CCD-L4-8	Busduct thermal imaging plan complete with marked up isometric

Commit Compliance Deliverables Level 5	
CCD-L5-1	IST Plan & Scripts issued
CCD-L5-2	IST Scripts Reviewed & Approved
CCD-L5-3	L5 Raw Data & Test Reports Received
CCD-L5-4	IST Report Issued
CCD-L5-5	Customer Conformity Letter issued (If required)
CCD-L5-6	Issue Resolution Log (IRL) closed
CCD-L5-7	L5 Scripts & Documentation uploaded

Commit Compliance Deliverables Level 6	
CCD-L6-1	'Go Live' issued CX Documents complete
CCD-L6-2	Local Operations Training program completed / signed
CCD-L6-3	Final Cx Close Out Report Issued
CCD-L6-4	Root Cause Analysis (RCA) to be uploaded with RCA Register
CCD-L6-5	Final customer SharePoint upload including all require Cx documentation.
CCD-L6-6	Facility Grid project marked as complete
CCD-L6-7	Lessons Learnt Documentation and Workshops Completed

Commit Compliance Deliverables LEED	
CCD-LEED-1	LEED Requirements Complete Requested by AMER to be developed further

7.7 Commissioning Issues Resolution Log

- The CxA shall manage the commissioning Issues Resolution Log (IRL) via Facility Grid which must be reviewed weekly with the commissioning team.

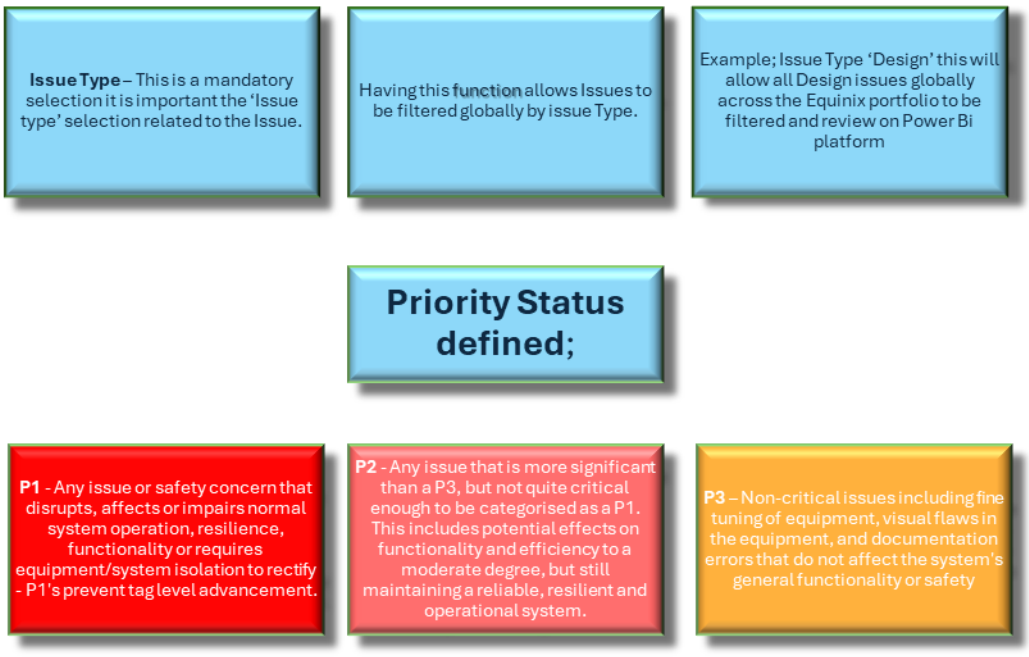
- All P1(High) & P2 (Medium) must be reviewed at the weekly commissioning meeting and actions logged against each issue.

- Even if problems are found and fixed on the same day, they must be recorded on the IRL log to provide lessons learnt information

- The descriptions of each issue recorded in the IRL must be detailed and clearly referenced to the appropriate Commissioning Level, Document & asset. The IRL must highlight the Issue Type

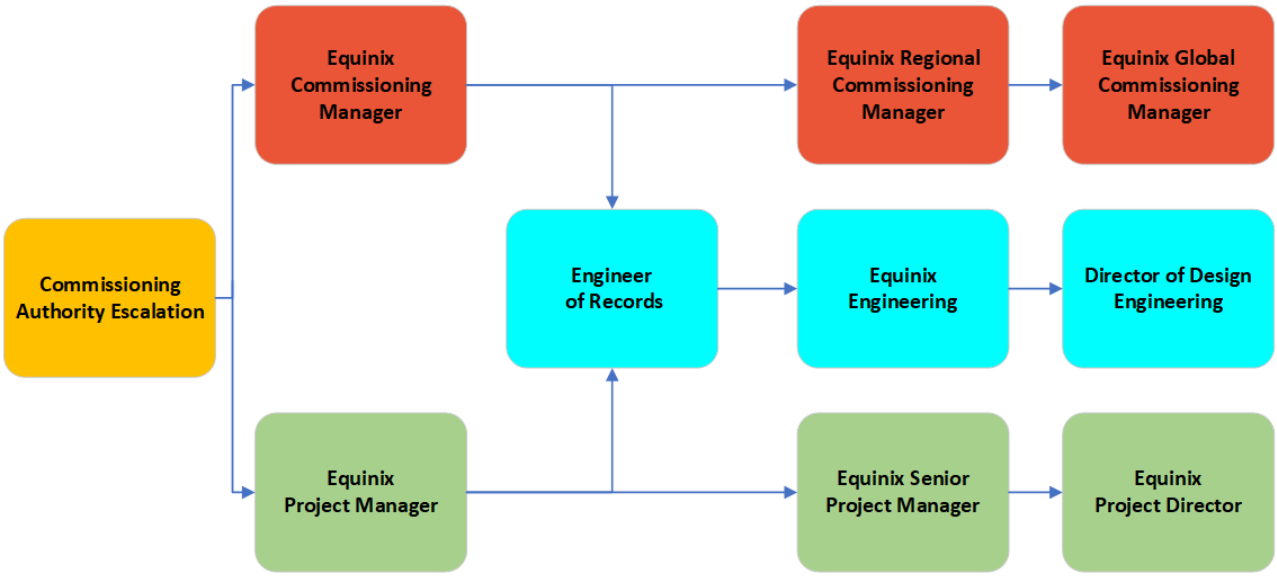
P1 (High)	Any issue or safety concern that disrupts, affects, or impairs normal system operation, resilience, functionality or requires equipment/system isolation to rectify - P1's prevent tag level advancement.
P2 Medium	Any issue that is more significant than a P3, but not critical enough to be categorised as a P1. This includes potential effects on functionality and efficiency to a moderate degree, but still maintaining a reliable, resilient, and operational system.
P3 Low	Non-critical issues including fine tuning of equipment, visual flaws in the equipment, and documentation errors that do not affect the system's general functionality or safety

Possible inclusion



7.8 Escalation of issues

- There are many triggers that can instigate escalation of issues, but for the avoidance of doubt, if it is not clear whether escalation is required – Escalate it. Escalation points Quality/Time/Design
- Concerns around Quality, Delay (Time) or Design can appear on site during any phase, but specifically during the L0-L3 testing/construction phase.
- Any concerns that need to be escalated shall be escalated as per the diagram below.
  updated as at present CxA does not report to EoR



7.9 Progress Meetings

- QAQC/ Commissioning meetings will be held on an agreed basis depending on the Commissioning level and progress of the commissioning is at and will require the attendance of the GC, MC, Commissioning Agent / Authority and MCE (when required) as described below:
- CxA QA/QC Monthly Commissioning focus meetings will be held during the early stages of construction and installation. The intent is to look closely at detailed and specific commissioning issues. Attendance is anticipated to include GC, MCE, EoR, and CxA. The frequency of the meeting will be agreed by the Commissioning Team.

Weekly Commissioning Meetings:

- To be held during level 2 design stage to Commissioning Level 5. This is to define the scope for Commissioning, FWT, TMS, development of Commissioning documentation, and program/schedule progress.

Weekly QA / QC Meetings and Site walks:

- For Construction Quality Control (CQC), the CxA will provide, as defined, an onsite visual inspection and/or observation. This will ensure the following scope of work maintains quality control focused on MEP and Fire Protection disciplines over suppliers, manufacturers, products, services, site conditions, and workmanship.
- To be held during Level 2 to Level 5 Commissioning stages to discuss short term progress and immediate issues to be resolved. Attendance anticipated to include the GC, MCE, and Commissioning Team. Any issues arising during the Commissioning process which have been recorded in IRL will be discussed and resolved where possible.

Daily Commissioning Workshops

- CxA Daily Workshop Held as required, typically during Commissioning Level 4 and Level 5 stages to be certain of a coordinated immediate approach and to identify and address any impediment to the Commissioning Process. Attendance to include the GC, MCE, and Commissioning Team

7.10 Commissioning Agent / Authority Reporting

To Review and align with Bi Dashboard reporting requirements

7.11 Preliminary IST Report

- Upon the completion of integrated systems testing, the CxA will provide a preliminary report stating whether the infrastructure meets the goals and is recommended for acceptance. The most recent copy of the commissioning issues log will be provided in this report, showing the outstanding Issues, along with a list of the equipment tested, and whether each system passed.

- The final IST report is expected within 4 weeks upon completion of IST with all recorded data and required trending.

7.12 General Contractor / Specialist Contractors Notification Lead Times

- The General Contractor shall notify the Commissioning team members from Level 1 through Level 5 activities. Notification protocols will involve both emails, project calendar events and 2 week look ahead, based on the need for coordination with the team members. Any issues raised shall be recorded on the IRL in Facility Grid.

7.13 Health & Safety

- Health and Safety plays an important part in the project and all rules / regulations must be uphold and enforced throughout. The General Contractors site health and safety plan will be adhered to and maintained by the entire project team. Energised electrical switch rooms will be secured and managed by the GC (Access will be restricted to approved personnel). The CxA can pick up, record any health & safety issues, and escalate it to the Equinix Project Manager or Commissioning Manager.

- The CxA shall document any safety issues observed during the site walk or commissioning process and escalate it to Equinix Project Manager, Equinix Commissioning Manager and the GC.

7.14 Instruments

- The Equipment vendors/GC are responsible for providing their own required instruments for carrying out the Level 1 to Level 3 Commissioning activities.

- The General Contractors shall provide the required instrumentation which includes Temperature / Humidity Data Loggers and Thermo-hydro graphs required for Level 4 and Level 5 Commissioning activities. The PQMs required for Level 4 and Level 5 Commissioning shall be provided by the MCE (UPS, ASTS and Generator supplier). The required quantity will be determined by the CxA and agreed upon by Equinix Commissioning Manager.

- Where thermal scanning is concerned, the GC or the electrical contractor shall be responsible for carrying out the thermal scans on their installation. E.g. Electrical Cables and terminations. The Switchgear, UPS, ASTS and Generator supplier or MCE will be responsible for conducting the thermal scans within their provided equipment which shall include internal bus bar connections and breakers.

8.0 Commissioning Agent / Authority Tagging Process

- The product of Tagging provides a reliable and accurate record of the status of the various systems, plant and equipment as the works progress from initial static completion through to final systems commissioning.

- The Specialist Contractors responsible for the works are required to provide comprehensive documentation that demonstrates that the installations along with other relevant factors such as environment and construction are complete and tested as necessary before they can be tagged. It is imperative that a high standard of quality control, and compliance with the design information is maintained.

8.1 Equipment Tagging

- A colour coded equipment tagging system shall be implemented that correlates to each of the Commissioning Levels. The tagging process will be implemented to provide progressive visual indication that each piece of equipment has been verified & has successfully completed each stage of the commissioning process.

- This process shall be followed for all sites except where special permissions have been granted for upgrades and updates to live sites. Permissions for all deviations must be approved by the Equinix Commissioning Manager.

- The CxA shall be responsible for managing and implementing the tagging process including providing the tags and ensuring the equipment is properly signed off.

- The coloured tags will be weatherproof stickers no larger than a credit card in size and professionally formatted with signature block for the person installing the tag.

  Visual of the new Tag Sticker?

- The actual placement of the tags shall be reviewed and approved by the owner prior to placement and the tags shall be placed in a professional and level manner.

- The tags will be attached to each piece of critical MEP equipment in the field per the master equipment list. If there is not a suitable place to fix the tags on the equipment, then the tags will be attached to a placard and the placard shall be attached to the equipment. This placard will be kept in a protective plastic document holder. The tags will be attached to the placard as appropriate.

- Equipment shall not proceed to the next level of commissioning without having the preceding Quality Assurance/Quality Control (QA/QC) or Commissioning Tag installed.

8.2 Summary of the Tagging Process

L2A Red Tag	Installation complete (Not Ready for Start-up)
L2B Yellow Tag	Ready for start-up
TPC	Temporary Power Certificate
L3 Green Tag	Pre-Functional testing (PFT).
L4 Blue Tag	Functional testing Complete
L5 White Tag	Integrated Systems Testing

Responsibility

The CxA shall be responsible for managing and implementing the tagging process including providing the tags, installing all physical tags and ensuring the asset tag is properly signed off.

9.0 Overview of Tagging Process

9.1 Red Tag Process

Red Tag – Commissioning Level 2A Installation Complete (Not Ready for Start-up):

Definition:

- The equipment has been set into place and anchored and the necessary inspections have been performed to ensure that it is ready to have Level 2 QA/QC inspections and tests performed.
- Any major deficiencies have been corrected; any outstanding items are documented on the Issue Resolution Log.

Overview of Inspection requirements for Red Tag L2A
The equipment matches the required contract documents.
Initial inspection has been performed by the Vendor/subcontractor. (where applicable)
Inspection has been performed by the GC and documented
CxA inspection in line with the Red Tag checklists and sign off
All required documentation to include GC/Vendor inspection documentation has been received, uploaded to project portal, reviewed by the CxA & attached to the relevant checklist on the Commissioning Portal.

Acceptance:

- The Red Tag checklist shall be completed and be signed off by the CxA when all inspections have been completed. Once the Red Tag verification has been undertaken the Facility Grid checklists status should be moved to *'Awaiting Documentation'* where the CxA is awaiting the GC/Vendor completed test pack provided the Verification was acceptable.
- Once the supporting documentation has been received, reviewed and attached to the relevant checklist the checklist status should be moved to *'Signed Off'*
- Checklists with a status of *'Awaiting Documentation'* should not restrict fixing a Red Tag to the asset or restrict the asset from starting the Yellow Tagging process.
- Any exceptions to the process or outstanding issues shall be documented and submitted to the Equinix Commissioning Manager for agreement and the approval signed in writing by the Equinix Commissioning Manager before proceeding. Once approved the issues will be added to the Issue Resolution Log (IRL).

9.2 Yellow Tag Process

Yellow Tag – Commissioning Level 2B Static Testing (Ready for Start Up)

Definition:

- All Electrical and Mechanical inspections and static tests have been completed and the system is ready to be energized.
- Field inspections are completed by the manufacturer's representative and/or the installation contractor.
- All inspections and test forms have been submitted and reviewed.
- Any major deficiencies have been corrected; any outstanding items are documented on the Issue Resolution Log.

Overview of Inspection requirements for Yellow Tag L2B
All Level 2B inspections are completed, and the results uploaded
All P1 and P2 Issues from L2A have been corrected and verified
Equipment is clean and free of debris.
All electrical and mechanical connections are correctly installed.
All control cables are correctly installed.
All accessories are correctly installed.
All protective covers are installed
All protection devices are correct – Fuse sizes, circuit breaker and relay settings.
All proper signage and tagging installed
The equipment is safe to energise and ready to proceed to Level 3 start-up
Pre-start-up inspections had been performed by the vendor/Installer and documented
Inspection has been undertaken by the GC & documented
Inspection by the CxA & Documented on Facility Grid
Level 2B documents have been submitted, uploaded and have been reviewed by CxA

- Multiple pictures shall be taken of the electrical cubicle prior to closing the covers and uploaded. These pictures shall show the overall electrical connections as well as detailed photos that capture connections, torque marks, terminal crimps, grounding, bonding, conduit or wire entrances and cable supports etc.

Acceptance:

- The Yellow Tag Checklist shall be completed and be signed off by the CxA when all inspections have been undertaken. Once Yellow Tag verification has been undertaken the Facility Grid checklists status should be moved to ***'Awaiting Documentation'*** where the CxA is awaiting the GC/Vendor issued Test pack (provided the Verification was acceptable)

- Once the supporting documentation has been received, reviewed and attached to the relevant checklist, the checklist status should be moved to ***'Signed Off'***

- Checklists with a status of ***'Awaiting Documentation'*** should not restrict fixing a Yellow Tag to the asset or restrict the asset to start the Green Tagging process.

- Any exceptions to the process or outstanding issues shall be documented and submitted to the Equinix Commissioning Manager for agreement and the approval signed in writing by both the Equinix Commissioning Manager before proceeding. Once approved the issues will be added to the Issue Resolution Log (IRL).

9.3 Green Tag Process

Green Tag – Level 3 Pre-Functional testing (PFT)

Definition:

- All Level 3 start-up inspections have been completed and the system is ready for functional testing.
- Start-up documentation has been submitted, uploaded and has been reviewed.
- All inspections and test forms have been submitted, uploaded and have been reviewed.
- Any major deficiencies have been corrected; any outstanding items are documented on the Issue Resolution Log.

Overview of Inspection requirements for Level 3 Green Tag
All Level 3 inspections are completed, and the results uploaded
All P1 and P2 Issues from L2B have been corrected and verified
Verify AC supply has been Live tested, and documentation is available
Verify protection settings are as Latest Protection Study
Verify all DCOs points, ie Breaker Statuses, Alarms/notices are correct
Verify all monitoring DCOS points are correct
Verify all DCOS points are visible on DCOS graphics
Verify that all controls, circuit breakers and values are in normal conditions after witnessing
Verify all Alarm logs have been cleared after testing
Inspection has been undertaken by the GC & documented
Inspection by the CxA & Documented on Facility Grid
Level 3 documents have been submitted, uploaded and have been reviewed by CxA

Acceptance:

- The Green Tag Checklist shall be completed and be signed off by the CxA when all inspections have been undertaken. Once Yellow Tag verification has been undertaken the Facility Grid checklists status should be moved to ***'Awaiting Documentation'*** where the CxA is awaiting the GC/Vendor issued Test pack (provided the Verification was acceptable.)

- Once the supporting documentation has been received, reviewed and attached to the relevant checklist, the checklist status should be moved to ***'Signed Off'***

- Checklists with a status of ***'Awaiting Documentation'*** should not restrict fixing a Green Tag to the asset or restrict the asset to start the Blue Tagging process.

- Any exceptions to the process or outstanding issues shall be documented and submitted to the Equinix Commissioning Manager for agreement and the approval signed in writing by both the Equinix Commissioning Manager before proceeding. Once approved the issues will be added to the Issue Resolution Log (IRL).

9.4 Blue Tag Process

Blue Tag – Level 4 functional testing

Definition:

- All Leve
- l 4 Functional Testing inspections have been completed and the system is ready for Integrated System Testing.
- All Level 4 Functional Testing documentation has been uploaded and has been reviewed.
- All inspections, test results, raw data and test forms have been submitted, uploaded and have been reviewed by the CxA
- Any deficiencies and issues have been corrected; There Must be no P1or P2 issues on the completion of the Blue Tag

Overview of Inspection requirements for Level 4 Blue Tag
All Level 3 inspections are completed, and the results uploaded
All P1 and P2 Issues from 3 have been corrected and verified
Equipment is clean and free of debris.
All electrical and mechanical connections are correctly installed.
All control cables are correctly installed.
All accessories are correctly installed.
All protective covers are installed
All protection devices are correct – Fuse sizes, circuit breaker and relay settings.
All proper signage and tagging installed
The equipment is safe to energise and ready to proceed to Level 3 start-up
Pre-start-up inspections had been performed by the vendor/Installer and documented
Inspection has been undertaken by the GC & documented
Inspection by the CxA & Documented on Facility Grid
Level 2B documents have been submitted, uploaded and have been reviewed by CxA

Acceptance:

- The Blue Tag script shall be completed and be signed off by the CxA when all inspections have been completed. Once Blue Tag verification has been undertaken the Facility Grid checklists status should be moved to ***'Awaiting Documentation'*** where the CxA is awaiting the GC/Vendor completed Test pack provided the Verification was acceptable.
- Once the supporting documentation has been received, reviewed and attached to the relevant checklist, the checklist status should be moved to ***'Signed Off'***

- **All documentation should have been issued reviewed and attached to the Blue Tag Scripts before Level 5 testing is started. The Blue Tag should only be attached to the asset once the Script has been moved to *'Signed Off'***

- There should be no outstanding issues on the completion of the Blue Tag Testing. Any issues must be documented and submitted to the Equinix Commissioning Manager for agreement and the approval signed in writing by the Equinix Commissioning Manager before signing off. Once approved the issues will be added to the Issue Resolution Log (IRL).

9.5 White Tag Process

White Tag – Level 5 Integrated Systems Test (IST)

Definition

- Meeting the requirements of the drawings and specifications with testing.
- All Level 5 Integrated Systems Tests have been completed
- All Level 5 Integrated Systems Test documentation and Test Data has been submitted, uploaded and reviewed.
- All issues that were identified for the complete system have been corrected.

IST Pre-Requisites to be achieved before final Test
All Level 4 testing of Assets that form part of the Integrated System test completed with all issues closed
All Level 4 supporting documentation uploaded and reviewed
Workshop undertaken with all parties to run through the IST Script and signed off by all participants
Pre-IST test, running through each test on the script to highlight any discrepancies and issues
All alarms closed. Where recurring alarms are shown Full alarms list to be recorded. To be attached to the IST script.
Pre-IST de-brief meeting to review pre-IST tests and agreement that recurring alarms do not have any effect on the IST testing

IST Close Out Requirements
Level 5 Integrated Systems Testing is successfully completed.
Level 5 Integrated Systems Test report, raw data and results have been submitted, reviewed, approved and uploaded.
Level 5 Integrated Systems Test Data has been collected, verified & uploaded.
Documentation has been received and uploaded. This should include Completed Level 5 Integrated Systems Test script Additional Inspection Forms & Reports as required Integrated Systems Test Data from: PQM's, Power Meters DCOS Screen Captures DCOS Trend Logs Data Loggers.

IST Low Load Strategy Post RFS

9.6 Temporary Power Certificate

Temporary Power Certificate

Discussion Needed

- In construction when working on fast-track builds, we sometimes come into a which comes first scenario, i.e. Chicken and Egg. Thus, we have what is referred to as a Temporary Power Certificate. ***These are not granted every day and must be authorised and signed off by a member of the Equinix Commissioning team.***

- The CxA can apply to the Equinix Commissioning managers, for a Temporary Power Certificate. This is only granted when a piece of equipment requires a temporary supply to allow for the initial start-up of units to be completed prior to Full Energisation. Examples would be, 110/24v for controls checks or pumps & Valves for flushing.
- The GC & CxA must prove that there are no outstanding deficiency's that can affect safety, and that all warning notices are in place, a safe system of working is agreed, and the system is safe to energise.

- The GC Vendor/Manufacturer are not authorised to energise any Assets without formal written authority by either the CxA or the Equinix Commissioning Manager. And the temporary connection should undergo Yellow Tag checks and documented in the same manner as if it was the designed connection.

- This is NOT a reason to part finish an installation to get it energised. Another example is for temporary power to energise valves that are required for flushing. Level 3 testing cannot be completed under a TPC. A TPC shall only be signed off by Equinix Commissioning or Equinix Engineering personnel, this is to ensure the safety of everyone involved in the project.

10.0 Tagging Pre-Requisite Requirements

Electrical Tagging Pre-requisites

- All Electrical Assets require the following pre-requisites before moving into the next tagging process
- Some Assets would not need the complete pre-requisite requirements listed below
  i.e. Lightning Protection would not require FWT/FAT pre-requisite
- Where certain assets require additional pre-requisites to the list below, they will be highlighted on each specific asset

10.1 Red Tag ELEC

Electrical Red Tags Pre-Requisites
Verify the technical submittals and as built drawings have been uploaded to Equinix document control platform by the vendor and approved by the EOR
Verify the shop drawings have been uploaded to Equinix document control platform by the vendor and approved by the EOR.
Verify the cable/busbar schedules/cable interface schedules have been uploaded to Equinix document control platform by the vendor and approved by the EOR
Verify the DCOS points list have been uploaded to Equinix document control platform by the vendor and approved by the EOR.
Verify the FWT/FAT documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA. Any issues raised in FAT/FWT have been addressed (Routine FAT/EOL documentation acceptable where FWT testing has not been procured)
Verify the Cx level 2B static testing method statement and risk assessment (RAMS) have been uploaded to Equinix document control platform by the GC/vendor and approved by the CxA
Verify the material delivery receipt has been uploaded to Equinix document control platform by the GC, GC to identify upon kerbside delivery any defects/damages during transit
Verify the electrical protection study is approved and have been uploaded to Equinix document control platform by the vendor and approved by the EOR
GC has compiled a test pack template in line with Equinix document matrix.

10.2 Yellow tag ELEC

Electrical Yellow Tags Pre-Requisites
Verify red tag checklist has been signed off by CxA and Yellow Tag applied to the Asset.
Verify all Red Tag QA/QC documents has been completed and documentation uploaded to project portal and approved by CxA
Verify the Cx level 3 start-up/pre functional testing method statement and risk assessment (RAMS) have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Verify the ARC flash study is approved and uploaded to Equinix document control platform by the EOR and approved by the Equinix Design Manager
Verify all related Red Tag test reports are complete, signed and have been uploaded to Equinix document control platform by the GC/vendor and approved by the CxA
Confirm As-Built documentation (if applicable) have been uploaded to Equinix document control platform by the vendor and approved by the EOR
Confirm As-Built documentation (if applicable) have been uploaded to Equinix document control platform by the vendor and approved by the EOR
Confirm Load Bank plans (Where applicable) have been approved and uploaded to the Commit Compliance section of the commissioning online Portal
GC has compiled a test pack template in line with Equinix document matrix.

10.3 Green Tag ELEC

Electrical Green Tags Pre-Requisites
Verify Yellow Tag Checklist has been signed off and Yellow Tag has been applied to the Asset
Verify all Yellow Tag testing has been completed and documentation uploaded to project portal and approved by CxA
Verify DCOS is operational, and all Point-to-Point tests have been completed and test document uploaded to project Portal and reviewed by CxA
Confirm all secondary injection testing (Where Applicable) has been completed
Verify protection study has been uploaded and approved
Verify protection study has been uploaded to the Commit Compliance section of the commissioning online Portal
Verify the Cx level 4 functional & performance test script have been uploaded to Equinix commissioning platform by CxA and approved by Equinix Commissioning Manager
Confirm CxA load bank & thermal imaging strategy is approved by Equinix Commissioning Manager and uploaded to the Commit Compliance section of the commissioning online Portal
Confirm LOTO has been approved and uploaded to the Commit Compliance section of the commissioning online Portal
Confirm LOTO has been applied to the asset before energisation
Verify switching schedule and energisation plan is implemented by the GC's approved SAP/AP.
GC has compiled a test pack template in line with Equinix document matrix.
Verify approved SOO have been uploaded to the project portal by the vendor and approved by the EOR.
Verify approved SOO have been uploaded to the Commit Compliance section of the commissioning online Portal

10.4 Blue Tag ELEC

Electrical Blue Tags Pre-Requisites

Mechanical Tagging Pre-Requisites

Mechanical Tagging Pre-requisites

- All Mechanical Assets require the following pre-requisites before moving into the next tagging process
- Some Assets would not need the complete pre-requisite requirements listed below
- i.e. Leak detection would not require FWT/FAT pre-requisite
- Where certain assets require additional pre-requisites to the list below, they will be highlighted on each specific asset
-

10.5 Red Tag MECH

Mechanical Red Tags Pre-Requisites
Verify the technical submittals and as built drawings have been uploaded to Equinix document control platform by the vendor and approved by the EOR
Verify the shop drawings have been uploaded to Equinix document control platform by the vendor and approved by the EOR.
Verify the DCOS points list have been uploaded to Equinix document control platform by the vendor and approved by the EOR.
Verify the FWT/FAT documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA. Any issues raised in FAT/FWT have been addressed (Routine FAT/EOL documentation acceptable where FWT testing has not been procured)
Verify the Cx level 2B static testing method statement and risk assessment (RAMS) have been uploaded to Equinix document control platform by the GC/vendor and approved by the CxA
Verify the material delivery receipt has been uploaded to Equinix document control platform by the GC, GC to identify upon kerbside delivery and after installation any defects/damages during transit
GC has compiled and issued a test pack template in line with Equinix document matrix.

10.6 Yellow Tag MECH

Mechanical Yellow Tags Pre-Requisites
Verify red tag checklist has been signed off by CxA and Yellow Tag applied to the Asset.
Verify all Red Tag QA/QC documents has been completed and documentation uploaded to project portal and approved by CxA
Verify the Cx level 3 start-up/pre functional testing method statement and risk assessment (RAMS) have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Verify all related Red Tag test reports are complete, signed and have been uploaded to Equinix document control platform by the GC/vendor and approved by the CxA
Confirm As-Built documentation (if applicable) have been uploaded to Equinix document control platform by the vendor and approved by the EOR
Confirm Load Bank plans (Where applicable) have been approved and uploaded to the Commit Compliance section of the commissioning online Portal
GC has compiled a test pack template in line with Equinix document matrix.

10.7 Green Tag MECH

Mechanical Green Tags Pre-Requisites
Verify Yellow Tag Checklist has been signed off and Yellow Tag has been applied to the Asset
Verify all Yellow Tag testing has been completed and documentation uploaded to project portal and approved by CxA
Verify DCOS is operational, and all Point-to-Point tests have been completed and test document uploaded to project Portal and reviewed by CxA
Verify the Cx level 4 functional & performance test script have been uploaded to Equinix commissioning platform by CxA and approved by Equinix Commissioning Manager
Confirm CxA load bank strategy is approved by Equinix Commissioning Manager and uploaded to the Commit Compliance section of the commissioning online Portal
Verify switching schedule and energisation plan is implemented by the GC's approved SAP/AP.
GC has compiled a test pack template in line with Equinix document matrix.
Verify approved SOO have been uploaded to the project portal by the vendor and approved by the EOR.
Verify approved SOO have been uploaded to the Commit Compliance section of the commissioning online Portal

10.8 Blue Tag MECH

Electrical Blue Tags Pre-Requisites

11.0 Tagging Requirements Electrical

12.0 HV/MV Electrical Systems

12.1 HV Cabling Testing Requirement

HV Cabling Level 2 Commissioning –Yellow Tag
Perform a visual inspection of the full length of cable to check for damages and adequate fixing arrangement.
Verify cable grouping arrangement is as per design specification.
Verify all cables are installed with appropriate glands as per design, manufacturers guidance and approved technical submittals.
Verify all cables bending radiuses are as per manufacturers guidance.
Verify all cables are installed with appropriate termination kits as per design, manufacturers guidance and approved technical submittals.
Verify all cables are torqued to the correct value as per manufacturers guidance.
Verify cable braid is routed correctly for the core balance CT (CBCT).
Verify all cables are labelled as per design specification.
Testing Required *(below tests are the minimum requirement)***:**
Perform sheath integrity test
Perform phase polarity identification
Perform 5kV insulation resistance test before and after dielectric test.
Perform dielectric withstand tests, test voltage and time to be determined by cable manufacturer guidance.
VLF dielectrics withstand test
Note: if VLF dielectric withstand test equipment is not available a DC Hi-pot dielectric withstand test is acceptable
HV Cable Sign Off:
All required documentation is uploaded to the Equinix document control platform by GC or Vendor and reviewed by CxA.
All required documentation is uploaded to commissioning management platform by CxA

12.2 HV / MV Main Panels

HV/MV Panels Level 2A Commissioning – Red Tag
Confirm all deficiencies/comments from FWT/FAT have been closed.
Confirm room/area condition is acceptable as per the Equinix room readiness checklist
Confirm equipment has been installed/positioned as per approved design drawings, manufactures specifications and approved technical submittals
Confirm the unit is correct dimensionally, handed correctly and accessible for operation and maintenance as per local code
Confirm the equipment has the correct ratings, components, protective devices, interlocks (if applicable) as per approved design drawings, manufactures specifications and approved technical submittals
Confirm all gland plates are correct as per the approved technical submittal
Confirm appropriate warning/safety labels are in place.
Confirm all device labelling is correct as per approved Equinix naming convention
Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
Carry out all external and internal quality checks of the equipment
Confirm equipment IPXX ratings are correct as per the approved technical submittals
Confirm network interface card has been supplied as per the approved technical submittals
Confirm system and equipment grounding installation is as per the approved design drawings and the approved technical submittals
Record all equipment details as per the Equinix provided template on the equipment parameter list within commissioning management platform.
Verify Cx level 2A Installation and QAQC inspection checklist has been carried out as per the Equinix approved checklist.

HV/MV Panels Red Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Red tag applied to the equipment and signed by CxA

HV/MV Panels Level 2B Commissioning – Yellow Tag
Confirm earthing systems comply with Equinix Global Design Standards and/or design drawings.
Confirm power cables have been dead tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA
Confirm control/monitoring cables have been dead tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA
Confirm control/monitoring cables have been point to point tested, signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA
Confirm all cables are identified with permanent labels, soundly fixed (glands/cable ties/cleats) identifying source, load, size & type as per the project specification provided by the EOR
Verify all cable connections pull test & tightness test is found satisfactory
Verify all connections are torqued correctly (if applicable) and double marked.
Confirm all trunking covers and equipment terminal/protection covers are in place and secured.
Confirm supply breaker/fuse has an equal or greater current capacity than the incoming breaker/fuse of the distribution board.
Confirm all protection settings are set for the equipment as per approved protection study.
Confirm cable entry box (if applicable) is installed as per approved design drawings, manufactures specifications, and approved technical submittals

Confirm PTW/LOTO procedures are implemented correctly by the GC's approved SAP/AP
Confirm all equipment labelling and circuit identification is present and correct
Confirm Construction clean of room and of equipment
Cx level 2B equipment static testing MUST consist of as a minimum: • Continuity & polarity test • Low OHM resistance testing of all connections (contact resistance test) • Insulation resistance measurement (before and after HV pressure test). • High voltage pressure/dielectric test. • CT magnetisation curves certification to be included in FWT/FAT/QAQC reports (if not, this needs to be done on site). • CT and VT Insulation resistance tests • CT and VT ratio and polarity tests by primary injection
Verification of mechanical operation.
Prove safety interlocks (mechanical and electrical)
Verify Insulation resistance tests of AC & DC control and protection internal control cables (if applicable).
Confirm primary & secondary injection protection scheme testing of all breakers/relays (if applicable) and security seal along with protection settings label applied by CxA
Verify HMI mimic and operation
Verify firmware/software revisions meet Equinix global design standards Confirm interface with DNO is complete (if applicable)
Conduct a White Glove Inspection to ensure equipment is clean and free of debris or foreign materials and the appropriate protection is in place prior to energisation.
Verify vendor Cx level 2B static testing has been carried out as per the vendors Cx level 2B static testing method statement approved by the CxA.
Verify Cx level 2B static testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 2B checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA.

HV/MV Panels Yellow Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform

HV/MV Panels Level 3 Commissioning – Green Tag
Confirm LOTO procedures are implemented correctly by the GC's approved SAP/AP
Verify metering accuracy
Verify protection relays readings
Verify HMI mimic readings
Verify 100% of automation graphics
Verify vendor Cx level 3 start-up/pre-functional testing has been carried out as per the vendors Cx level 3 start-up/pre functional method statement approved by the CxA
Verify Cx level 3 start-up/pre-functional testing has been carried out as per the approved checklist
Confirm all vendor Cx level 3 checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA.

HV/MV Panels Green Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Green tag applied to the equipment and signed by CxA

HV/MV Panels Level 4 Commissioning – Blue Tag
Verify green tag has been applied to the BTU and signed off by the CxA
Verify green tag has been applied to the automation system and signed off by the CxA.
Verify green tag has been applied to the generator and signed off by the CxA.
Verify all related P1 & P2 Cx issues are closed on the IRL
Confirm DCOS/BMS verifications are complete and alarm free
Verify 100% functional testing of automation/system controls as per SOO including all maintenance scenarios, load bank scenarios, failure scenarios and interlocking.
Verify full power block shutdowns and isolation scenarios including circuits earths
Verify all automation/system controls redundancy by means of testing
Verify all automation/system controls redundancy by means of testing

HV/MV Panels Blue Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Blue tag applied to the equipment and signed by CxA

12.3 HV/MV/LV/Earthing Transformers (Oil Filled)

HV/MV/LV Earthing Transformers (Oil Filled) Level 2A Commissioning – Red Tag
Confirm all deficiencies/comments from FWT/FAT have been closed
Confirm room/area condition is acceptable as per the Equinix room readiness checklist.
Confirm equipment has been installed/positioned as per approved design drawings, manufactures specifications and approved technical submittals
Confirm the unit is correct dimensionally, handed correctly and accessible for operation and maintenance as per local code
Confirm the equipment has the correct ratings, components, protective devices, interlocks (if applicable) as per approved design drawings, manufactures specifications and approved technical submittals
Confirm antivibration pads are correct as per the approved technical submittals) if applicable)
Confirm all gland plates are correct as per the approved technical submittals
Confirm appropriate warning/safety labels are in place.
Confirm all device labelling is correct as per approved Equinix naming convention
Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed.
Carry out all external and internal quality checks of the equipment.
Confirm equipment IPXX ratings are correct as per the approved technical submittals
Confirm network interface card has been supplied as per the approved technical submittals
Confirm interlocking is present (if applicable)
Confirm transformer enclosure/cage clearances meet local code
Confirm system and equipment grounding installation is as per the approved design drawings and the approved technical submittals
Record all equipment details as per the Equinix provided template on the equipment parameter list within commissioning management platform
Verify Cx level 2A Installation and QAQC inspection checklist has been carried out as per the Equinix approved checklist.

HV/MV/LV Earthing Transformers (Oil Filled) Red Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Red tag applied to the equipment and signed by CxA

HV/MV/LV Earthing Transformers (Oil Filled) Level 2A Commissioning – Yellow Tag
Confirm earthing systems comply with Equinix Global Design Standards and/or design drawings.
Confirm power cables have been dead tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA
Confirm busduct have been dead tested (refer to busduct section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA
Confirm control/monitoring cables have been dead tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm control/monitoring cables have been point to point tested, signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA
Confirm all power cables and control/monitoring cabling identification are present as per approved cable schedule and cable interfacing schedule.
Confirm all cables are identified with permanent labels, soundly fixed (glands/cable ties/cleats) identifying source, load, size & type as per the project specification provided by the EOR
Verify all cable connections pull test & tightness test is found satisfactory
Verify all connections are torqued correctly (if applicable) and double marked.

Confirm all trunking covers and equipment terminal/protection covers are in place and secured.
Confirm all protection settings are set for the equipment as per the approved protection study.
Confirm PTW/LOTO procedures are implemented correctly by the GC's approved SAP/AP.
Confirm all equipment labelling and circuit identification is present and correct
Construction clean of room and of equipment is complete
Cx level 2B equipment static testing MUST consist of as a minimum: • High voltage pressure/dielectric tests (Insulation resistance test HV-MV, MV-LV & LV-Ground) • Transformer ratio/vector group test • CT Ratio and magnetisation curves (if applicable). • Tangent delta test (if applicable). • Sweep Frequency Response Analysis (SFRA) for comparison to factory results
Record tap selection
Check oil levels and gauges
Verify over pressure relief/Bucholtz alarm simulation (if applicable)
Check oil containment measures and sump operation (if applicable)
Prove transformer winding and oil temperature monitoring operation including inter tripping (if applicable)
Prove restrictive earth fault (REF) operation (if applicable)
Prove safety interlocks operation (if applicable)
Confirm transformer room cooling/ventilation is ready for service (if applicable)
Conduct a White Glove Inspection to ensure equipment is clean and free of debris or foreign materials and the appropriate protection is in place prior to energisation.
Verify vendor Cx level 2B static testing has been carried out as per the vendors Cx level 2B static testing method statement approved by the CxA.
Verify Cx level 2B static testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 2B checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA

HV/MV/LV Earthing Transformers (Oil Filled) Yellow Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform

HV/MV/LV Earthing Transformers (Oil Filled) Level 3 Commissioning – Green Tag
Confirm LOTO procedures are implemented correctly by the GC's approved SAP/AP.
Verify transformer temperature alarms and trips points including transformer fan operation (if applicable)
Verify and record transformer secondary off load voltages as per Equinix global design standards
Check oil levels and samples, verify results as per manufacturers specifications
Verify safety interlocks operation (if applicable)
Verify transformer room cooling/ventilation is operational
Confirm DCOS/BMS point to graphic testing is complete, signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA
Verify vendor Cx level 3 start-up/pre-functional testing has been carried out as per the vendors Cx level 3 start-up/pre functional method statement approved by the CxA.
Verify Cx level 3 start-up/pre-functional testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 3 checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA.

HV/MV/LV Earthing Transformers (Oil Filled) Green Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA

All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Green tag applied to the equipment and signed by CxA

HV/MV/LV Earthing Transformers (Oil Filled) Level 3 Commissioning – Blue Tag
Verify 12hr soak test before loading transformer
100% load test of transformer for a duration of 4 hours
Check oil and winding temperatures at 100% load
Verify and record transformer secondary on load voltages as per Equinix global design standards
Verify transformer room cooling/ventilation systems are maintaining room temperatures as per Equinix global design standards (if applicable).

HV/MV/LV Earthing Transformers (Oil Filled) Blue Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Blue tag applied to the equipment and signed by CxA

12.4 HV/MV/LV Cast Resin Transformers

Cast Resin Transformers Level 2A Commissioning – Red Tag
Confirm all deficiencies/comments from FWT/FAT have been closed.
Confirm room/area condition is acceptable as per the Equinix room readiness checklist.
Confirm equipment has been installed/positioned as per approved design drawings, manufactures specifications and approved technical submittals
Confirm the unit is correct dimensionally, handed correctly and accessible for operation and maintenance as per local code.
Confirm the equipment has the correct ratings, components, protective devices, interlocks (if applicable) as per approved design drawings, manufactures specifications and approved technical submittals
Confirm all gland plates are correct as per the approved technical submittals
Confirm appropriate warning/safety labels are in place.
Confirm all device labelling is correct as per approved Equinix naming convention.
Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed.
Carry out all external and internal quality checks of the equipment.
Confirm equipment IPXX ratings are correct as per the approved technical submittals
Confirm network interface card for TMU has been supplied as per the approved technical submittals
Confirm interlocking is present (if applicable)
Confirm transformer enclosure/cage clearances meet local code
Confirm system and equipment grounding installation is as per the approved design drawings and the approved technical submittals
Record all equipment details as per the Equinix provided template on the equipment parameter list within commissioning management platform.
Verify Cx level 2A Installation and QAQC inspection checklist has been carried out as per the Equinix approved checklist.

Cast Resin Transformers Red Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Red tag applied to the equipment and signed by CxA

Cast Resin Transformers Level 2A Commissioning – Yellow Tag
Confirm earthing systems comply with Equinix Global Design Standards and/or design drawings.
Confirm power cables have been dead tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm busduct have been dead tested (refer to busduct section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm control/monitoring cables have been dead tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm control/monitoring cables have been point to point tested, signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA
Confirm all power cables and control/monitoring cabling identification are present as per approved cable schedule and cable interfacing schedule.
Confirm all cables are identified with permanent labels, soundly fixed (glands/cable ties/cleats) identifying source, load, size & type as per the project specification provided by the EOR.
Verify all cable connections pull test & tightness test is found satisfactory
Verify all connections are torqued correctly (if applicable) and double marked.
Confirm all trunking covers and equipment terminal/protection covers are in place and secured.

Confirm all protection settings are set for the equipment as per the approved protection study.
Confirm PTW/LOTO procedures are implemented correctly by the GC's approved SAP/AP.
Confirm all equipment labelling and circuit identification is present and correct
***Cx level 2B equipment static testing <u>MUST</u> consist of as a minimum**:* • *High voltage pressure/dielectric tests* *(Insulation resistance test HV-MV, MV-LV & LV-Ground)*
Record tap selection
Prove transformer temperature monitoring unit (TMU) settings and operation including inter tripping
Prove restrictive earth fault (REF) operation (if applicable)
Prove safety interlocks operation (if applicable)
Confirm transformer room cooling/ventilation is ready for service
Conduct a White Glove Inspection to ensure equipment is clean and free of debris or foreign materials and the appropriate protection is in place prior to energisation.
Verify vendor Cx level 2B static testing has been carried out as per the vendors Cx level 2B static testing method statement approved by the CxA.
Verify Cx level 2B static testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 2B checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA.

Cast Resin Transformers Yellow Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Yellow tag applied to the equipment and signed by CxA

Cast Resin Transformers Level 2A Commissioning – Green Tag
Confirm LOTO procedures are implemented correctly by the GC's approved SAP/AP.
Verify transformer temperature alarms and trip points including transformer fan operation (if applicable)
Verify and record transformer secondary off load voltages as per Equinix global design standards
Verify safety interlocks operation (if applicable)
Verify transformer room cooling/ventilation is operational
Confirm DCOS/BMS point to graphic testing is complete, signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA
Verify vendor Cx level 3 start-up/pre-functional testing has been carried out as per the vendors Cx level 3 start-up/pre functional method statement approved by the CxA.
Verify Cx level 3 start-up/pre-functional testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 3 checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Physical Checks (If Applicable
Bucholtz alarm simulation
PTemperature and/or pressure devices alarms and trips to HV/MV protection and to SCADA, DCOS
PCheck oil containment measures

Cast Resin Transformers Green Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Green tag applied to the equipment and signed by CxA

Cast Resin Transformers Level 2A Commissioning – Blue Tag
100% load test of transformer for a duration of 4 hours
Verify and record transformer secondary on load voltages as per Equinix global design standards
Verify transformer temperature monitoring unit (TMU) operation on load
Verify transformer room cooling/ventilation systems are maintaining room temperatures as per Equinix global design standards

Cast Resin Transformers Blue Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Blue tag applied to the equipment and signed by CxA

12.5 MV/LV Generators

Generator Level 2A Commissioning – Red Tag
Confirm room/area condition is acceptable as per the Equinix room readiness checklist.
Confirm equipment has been installed/positioned as per approved design drawings, manufactures specifications and approved technical submittals
Confirm the unit is correct dimensionally, handed correctly and accessible for operation and maintenance as per local code.
Confirm the equipment has the correct ratings, components, protective devices, interlocks (if applicable) as per approved design drawings, manufactures specifications and approved technical submittals
Confirm all gland plates are correct as per the approved technical submittals
Confirm appropriate warning/safety labels are in place.
Confirm all device labelling is correct as per approved Equinix naming convention.
Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed.
Carry out all external and internal quality checks of the equipment.
Confirm equipment IPXX ratings are correct as per the approved technical submittals
Confirm network interface card has been supplied as per the approved technical submittals
Confirm system and equipment grounding installation is as per the approved design drawings and the approved technical submittals
Record all equipment details as per the Equinix provided template on the equipment parameter list within commissioning management platform.
Verify Cx level 2A Installation and QAQC inspection has been carried out as per the Equinix approved checklist.

Generator Red Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Red Tag applied to the equipment and signed by CxA

Generator Level 2B Commissioning – Yellow Tag
Confirm earthing systems comply with Equinix Global Design Standards and/or design drawings.
Confirm power cables have been dead tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm control/monitoring cables have been dead tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm control/monitoring cables have been point to point tested, signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA
Confirm all power cables and control/monitoring cabling identification are present as per approved cable schedule and cable interfacing schedule.
Confirm ALL cables are identified with permanent labels, soundly fixed (glands/cable ties/cleats) identifying source, load, size & type as per the project specification provided by the EOR.
Verify all cable connections pull test is found satisfactory
Verify all connections are torqued correctly (if applicable) and double marked.
Confirm all trunking covers and equipment terminal/protection covers are in place and secured.
Confirm supply breaker/fuse has an equal or greater current capacity than the incoming breaker/fuse of the distribution board.
Confirm all protection settings are set for the equipment as per approved protection study.
Confirm secondary injection protection testing of all breakers/relays (if applicable) and security seal along with protection settings label applied by CxA.

Confirm fusible link rating of fuel system drop valve
Confirm battery charger supply breaker rating and type
Verify generator day tank (if applicable) fuel level sensors are set as per Equinix approved global design standards.
Confirm generator AUX distribution board Cx level 2B is complete and ready for service.
Confirm generator cooling system (if applicable) is filled and ready for service
Confirm generator emissions system (if applicable) is ready for service
Confirm generator air ventilation system (if applicable) is ready for service
Confirm all cable entry points are sealed and watertight as per approved design drawings, manufactures specifications and approved technical submittals
Confirm cable entry box (if applicable) is installed as per approved design drawings, manufactures specifications and approved technical submittals
Confirm PTW/LOTO procedures are implemented correctly by the GC's approved SAP/AP.
Conduct a White Glove Inspection to ensure equipment is clean and free of debris or foreign materials and the appropriate protection is in place prior to energisation.
Verify vendor Cx level 2B static testing has been carried out as per the vendors Cx level 2B static testing method statement approved by the CxA.
Verify Cx level 2B static testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 2B checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA.

Generator Yellow Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform

Generator Level 2B Commissioning – Green Tag
Confirm LOTO procedures are implemented correctly by the GC's approved SAP/AP.
Confirm supply cables have been live tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm DCOS/BMS and automation point to graphic testing is complete, signed off and documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Verify Generator settings comply with latest approved Equinix global design standards
Verify firmware versions for all generator controllers comply with approved Equinix global design standards (if applicable).
Record firmware versions for all generator controllers on checklist within commissioning management platform.
Verify fuel system operation and alarms in accordance with approved SOO and approved Equinix global design standards.
Verify fire alarm system is operational
Take oil and coolant samples before and following completion of commissioning and perform laboratory evaluation to determine the presence of unwanted metals and liquids.
Verify alternator insulation resistance by polarisation index test
Verify fuel water separator operation
Verify battery and charger system operation, record voltages and confirm all chargers are monitored/generate an alarm

Verify fail to crank test is completed with 3 cranks (10 second cycles), ensure generator starts correctly after resetting fault.
Verify all auxiliary alarms and generator shutdowns
Perform generator load steps as per approved Equinix global design standards recorded via Power Quality Analyser (refer to power quality analyser section XX)
Perform generator load steps as per approved Equinix global design standards recorded via Power Quality Analyser (refer to power quality analyser section XX) • 0%-25%-0% :0%-50%-0% :0%-75%-0% :0%-100%-0%
Perform generator ISO steps as detailed in the ISO 8528-5 ensuring that the generator meets the G performance class as per project specification, recorded via Power Quality Analyser
Perform 4-hour 100% load test the following values should be recorded every 15 minutes, along with Power Quality Analyser capturing power data every minute (refer to power quality analyser section XX) ❖ Voltage line to line and line to neutral ❖ Current on L1, L2, L3 ❖ Power kW and KVA. ❖ Frequency. ❖ Power Factor. ❖ Oil pressure. ❖ Engine hours run. ❖ Temperatures – ambient, coolant, oil, alternator windings and bearings. ❖ Fuel rate. ❖
Note: 1. 100% generator capacity @ unity PF for standalone generators. 2. 100% generator capacity @ 0.8 PF for synchronised
Perform thermal imaging every 30 minutes during 100% load test (refer to thermal imaging section XX)
Verify vibration during 100% load test.
Verify generator noise levels comply with local code (if applicable)
Verify that backpressure at full-rated load is within the manufacturer's written allowable limits for the diesel engine.
Verify generator emissions system correct operation and emissions levels comply with local code (if applicable)
Hot Swapping of fuel filter while the generator is running at full load if the functionality is provided.
Verify vendor Cx level 3 start-up/pre-functional testing has been carried out as per the vendors Cx level 3 start-up/pre functional method statement approved by the CxA.
Verify Cx level 3 start-up/pre-functional testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 3 checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA.

Generator Yellow Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Green Tag applied to the equipment and signed by CxA

Generator Level 2B Commissioning – Blue Tag
Verify 100% functional testing of automation/system controls as per SOO including all maintenance scenarios, load bank scenarios, failure scenarios and interlocking.

Verify full power block shutdowns and isolation scenarios including circuits earths.
Verify all automation/system controls redundancy by means of testing
Verify communication network redundancy failures
Verify fuel system is operational
Verify generator performance during UPS transient load steps
Verify generator load sharing, phasing and load steps (if applicable

Generator Blue Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Blue Tag applied to the equipment and signed by CxA

12.6 NER switchboard

NER Switchboard Level 2A Commissioning – Red Tag
Visual inspection of switchboard and ancillary – ensure no transit damage on arrival
As built drawings from factory
Verify equipment has been installed / positioned as per approved shop drawings
Visual inspection of generator, including alternator (Confirming alternator class rating)
Factory Testing documentation is available, Issues raised have been addressed (QA documentation acceptable where FAT testing has not been procured)
Prove earth connections meet global standard details (reference EES-5)
Pre-Commission Check sheet
Vendor Dead testing method statement is submitted and approved
Interface Schedule has been submitted & approved
Cable Schedule has been submitted and approved
Calibration certificates used to carry out the tests are uploaded to Equinix document control
Confirm all device labelling is correct as per site labelling schedule
Confirm the correct equipment as per design specification has been delivered and record nameplate information. Check serial numbers and other identification and appropriate warning labels are in place.
Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
Confirm the unit is correct dimensionally
Confirm the unit is handed correctly
Confirm equipment has been Installed/ positioned as per approved design drawings
Check no debris or foreign materials have entered the equipment
Confirm all necessary cabling is correctly glanded to ensure the characteristics of the enclosure (e.g. IP56) which the cable enters can be maintained adequately.
Confirm all cabling has appropriate strain relief in place.
Confirm the correct BMS interface card has been supplied
Confirm system and equipment grounding installation is per approved Equinix grounding installation drawing
Check no debris or foreign materials have entered the equipment

NER Switchboard Red Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Red Tag applied to the equipment and signed by CxA

NER Switchboard Level 2B Commissioning – Yellow Tag
Verify protection settings meet latest discrimination study
Low OHM resistance tests of joints
Verify cable connections are torqued correctly and marked
Prove earth connections meet global standard details (reference EES-5, Ref Section 4.8 Earthing Systems)
Earth connection for Star point, good bare metal contact between lug and chassis bond point
Insulation resistance
OHM measurement of resistor

Factory QA/QC documentation
Continuity checks and contact resistance
Secondary wiring tightness checks
Continuity checks and contact resistance
Yellow tag applied to the equipment and signed, recorded accordingly

NER Switchboard Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform

NER Switchboard Level 2B Commissioning – Green Tag
CT Ratio and magnetisation curve
Protection relay secondary injection
Mechanical checks
Interlocking proven (electrical and mechanical)
Functional testing (manual and automatic)
SCADA / EMS Monitoring Points & Metering Verification
Green tag applied to the equipment and signed, recorded accordingly

NER Switchboard Yellow Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Green Tag applied to the equipment and signed by CxA

NER Switchboard Level 2B Commissioning – Blue Tag
Refer to Generator blue Tag

12.7 SCADA Control System

SCADA Control Level 2A Commissioning – Red Tag
As built drawings from factory.
Installation check sheets.
Correct labelling of the panels and devices.
Factory Testing documentation is available, Issues raised have been addressed (QA documentation acceptable where FAT testing has not been procured)
Prove earth connections meet global standard details (reference EES-5)
Pre-Commission Check sheet
Vendor Dead testing method statement is submitted and approved
Interface Schedule has been submitted & approved
Cable Schedule has been submitted and approved
Calibration certificates used to carry out the tests are uploaded to Equinix document control
Confirm all device labelling is correct as per site labelling schedule
Confirm the correct equipment as per design specification has been delivered and record nameplate information. Check serial numbers and other identification and appropriate warning labels are in place.
Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
Confirm the unit is correct dimensionally
Confirm the unit is handed correctly
Confirm installation location is available and correctly prepared – Level floor, no ongoing works, etc
Confirm equipment has been installed / positioned as per approved shop drawings
Check no debris or foreign materials have entered the equipment
Confirm all necessary cabling is correctly glanded to ensure the characteristics of the enclosure (e.g. IP56) which the cable enters can be maintained adequately.
Confirm all cabling has appropriate strain relief in place.
Confirm the correct BMS interface card has been supplied
Confirm system and equipment grounding installation is per approved Equinix grounding installation drawing

SCADA Control Red Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform

SCADA Control Level 2A Commissioning – Yellow Tag
Installation and testing of fibre / network connections (if applicable).
Point to point testing.
Prove alarms to HMI.
Verify interfaces and interlocks with EMS / Generator control / HV & LV switches pre- power on.
Synchronise HMI screens.
Prove auto/manual switches.
Yellow tag applied to the equipment and signed, recorded accordingly

SCADA Control Yellow Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform

SCADA Control Level 3 Commissioning – Green Tag
Full scope of tests performed at FAT to be performed on site with all devices/equipment connected (including scenarios that were decided after FAT).
Point to graphic testing.
Display accuracy.
Green tag applied to the equipment and signed, recorded accordingly

SCADA Control Green Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Green Tag applied to the equipment and signed by CxA

SCADA Control Level 4 Commissioning – Blue Tag
Verify Commissioning level 3 is complete and signed off
Loss of Utility A only, Utility B only and then both
Maintenance scenarios (automated via SCADA and manual monitored by SCADA)
Utility failures during maintenance scenarios
Equipment failures during utility failures (Utility/generator/bus coupler Breaker fail to open / close)
Electrical fault scenarios during utility failures (Breaker trip)
SCADA power supply and Communication faults (prove PLC redundancy)
Verify load monitoring and load step sequence (fail generators during load steps)
Generator cascade failure and re-instatement. (fail genset one by one until black building)
Verify Automatic and manual utility return facility.
Communication and PLC failures. (Prove redundancy & standalone operation)
Blue tag applied to the equipment and signed, recorded accordingly

13.0 LV Electrical System

13.1 LV Cabling systems Testing Requirement

LV Cable Testing Requirements Level 2A Commissioning – Red Tag
As Built/installed drawings issued.
Provision of certification / specification to confirm fire performance conformity according to EU CPR regulations
Grouping – TriFoil Cable arrangement to be maintained, please see below appendix reference for more detail
Carry out wiring inspections, terminal/lug tightness, cable routing, grommets at panel entries, etc
Verify outgoing feeder cable supports are provided either with neoprene gasket or glastic insulator
Visual inspection of install is undertaken, no defects present
Verify cabling has been installed/positioned as per approved design drawings
Vendor Dead testing method statement is submitted and approved
Calibration certificates used to carry out the tests are uploaded to Equinix document control
Verify glanding / lugs of cables correct
Verify connections are torqued to correct value and double marked or pre-set snap off bolts have been sheared. Torque marking using torque marker pens are visible
Ensure minimum bend radius is observed and upheld – (Appendix 07)
Labelling installed.
Red tag applied to the equipment and signed, recorded accordingly

LV Cable Testing Requirements Level 2B Commissioning – Yellow Tag
All LV cable inspection & testing is to comply with local code and documented in agreed format
Dead Testing
Perform continuity test by means of measuring the circuit resistance and record the Ohm value (R1+R2).
Perform polarity test, can be verified in above test.
Perform insulation resistance test.

Circuit Nominal Voltage (V)	Test Voltage DC (V)	Minimum Insulation Resistance (MΩ)
SELV and PELV	250	0.5
Up to and including 500V with the exception of the above systems	500	1.0
Above 500V	1000	1.0

LV Cable Testing Requirements Level 3 Commissioning – Green Tag
Phase rotation check
All test results to show actual measured results
Voltage checks – provide actual test reading results
Earth loop impedance test – provide actual test reading results
Prospective short circuit current (PSCC) test
Full load test of cable Power Ways 4hr with Thermal image of all joints throughout

13.2 Circuit Breakers

Circuit Breaker Protection Testing
If Primary injection testing is not carried out in the factory then it **must** be performed on site for each circuit breakers feeding critical equipment (e.g. UPS, ATS, ASTS, PDU, etc.) greater than (225A US) (250A EMEA) setting shall be tested on site utilizing primary current injection method)
Secondary injection test shall be carried out for all circuit breakers both in the factory and on site.
Primary injection testing is performed on each breaker during manufacturer QA testing in factory prior to shipping. - This will be validated with documentation presented by manufacturer, date and time stamped.
Ensure no transit damage on arrival. - This will be validated by thorough inspection of switchboard on arrival at site.
Prove operation of tripping circuit by Secondary injection testing during onsite Commissioning process.
Circuit breakers shall be tested and labelled per the approved local authority having jurisdiction for testing and certification standard requirements by a certified contractor.
Verify that each circuit breaker tested is labelled, dated and signed-off by the testing agency.

13.3 Uninterruptible Power Supply (UPS) & (STS) Modules (Built-In)

UPS Level 2A Commissioning – Red Tag
Confirm all deficiencies/comments from FWT/FAT have been closed.
Confirm room/area condition is acceptable as per the Equinix room readiness checklist (refer to section XXX).
Confirm equipment has been installed/positioned as per approved design drawings, manufactures specifications and approved technical submittals
Confirm the unit is correct dimensionally, handed correctly and accessible for operation and maintenance as per local code.
Confirm the equipment has the correct ratings, components, protective devices, interlocks (if applicable) as per approved design drawings, manufactures specifications and approved technical submittals
Confirm all gland plates are correct as per the approved technical submittals
Confirm all busbar flanges are correct as per the approved technical submittals and approved shop drawings
Confirm appropriate warning/safety labels are in place.
Confirm all device labelling is correct as per approved Equinix naming convention.
Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed.
Carry out all external and internal quality checks of the equipment.
Confirm equipment IPXX ratings are correct as per the approved technical submittals drawings and the approved technical submittals
Record all equipment details as per the Equinix provided template on the equipment parameter list within commissioning management platform.
Confirm suitable protection is in position after L2A visual inspection.
Verify Cx level 2A Installation and QAQC inspection has been carried out as per the Equinix approved checklist.

UPS Red Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Red Tag applied to the equipment and signed by CxA

UPS Level 2B Commissioning – Yellow Tag
Confirm earthing systems comply with Equinix Global Design Standards and/or design drawings.
Confirm busbar have been dead tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm AC/DC power cables have been dead tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm control/monitoring cables have been dead tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm control/monitoring cables have been point to point tested, signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA
Confirm all power cables and control/monitoring cabling identification are present as per approved cable schedule and cable interfacing schedule.
Confirm ALL cables are identified with permanent labels, soundly fixed (glands/cable ties/cleats) identifying source, load, size & type as per the project specification provided by the EOR.
Verify all cable connections pull test is found satisfactory
Verify all connections are torqued correctly (if applicable) and double marked.
Confirm all trunking covers and equipment terminal/protection covers are in place and secured.
Confirm supply breaker/fuse has an equal or greater current capacity than the incoming breaker/fuse of the distribution board.
Confirm all protection settings are set for the equipment as per approved protection study.
Confirm secondary injection protection testing of all breakers/relays (if applicable) and security seal along with protection settings label applied by CxA.
Confirm UPS and UPS batteries interfaces and safety interlocking.
Confirm UPS batteries is Cx Level 2B is complete.
Confirm the cooling system is Cx level 2B complete and operational for both UPS switchroom and battery room.
Confirm PTW/LOTO procedures are implemented correctly by the GC's approved SAP/AP.
UPS vendor to conduct a deep clean of UPS and provide report
Conduct a White Glove Inspection to ensure equipment is clean and free of debris or foreign materials and the appropriate protection is in place prior to energisation.
Verify vendor Cx level 2B static testing has been carried out as per the vendors Cx level 2B static testing method statement approved by the CxA.
Verify Cx level 2B static testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 2B checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA

UPS Yellow Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Red Tag applied to the equipment and signed by CxA

UPS Level 3 Commissioning – Green Tag
Confirm LOTO procedures are implemented correctly by the GC's approved SAP/AP.
Confirm AC/DC supply cables have been live tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm busbars have been live tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm DCOS/BMS point to graphic testing is complete, signed off and documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Verify UPS settings comply with latest approved Equinix global design standards
Verify firmware versions for UPS comply with approved Equinix global design standards (if applicable).
Record firmware versions for UPS on checklist within commissioning management platform.
Verify castell key / interlocking functionality and battery inter-trips.
Verify batteries are charging.
Verify load transfers between UPS Inverter/Static Bypass & return.
Verify load sharing across UPS modules
Confirm UPS output voltage is as per approved GDS and recorded.
Verify vendor Cx level 3 start-up/pre-functional testing has been carried out as per the vendors Cx level 3 start-up/pre functional method statement approved by the CxA.
Verify Cx level 3 start-up/pre-functional testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 3 checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA

UPS Green Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Red Tag applied to the equipment and signed by CxA

UPS Level 4 Commissioning – Blue Tag
Confirm a calibrated PQM is installed on both the UPS input and the UPS output.
If UPS's are in parallel, both UPS require a PQM to be installed on both the UPS input and the UPS output.
PQM's are to be provided by the UPS vendor and set up correctly (refer to PQM section XXXX).
Confirm a calibrated PQM is installed on both the UPS input and the UPS output.
Perform transient load steps as per global standards on both Utility and Generator sources. • 0%-25%-0% • 0%-50%-0% • 0%-75%-0% • 0%-100%-0%
Perform UPS steady states at 25%, 50%, 75% & 100% load on both utility and generator source and record UPS parameters
Perform 100% full design load test of the UPS through each power path with thermal imaging of UPS to be conducted. (refer to thermal imaging section). • 4 hours inverter • 4 hours static bypass • 4 hours maintenance bypass Note: refer to CRAH Cx level 4 section XXXX for room cooling redundancy testing
Perform 100% full load transfers while monitoring input / output voltages and frequency.

• Transfer from inverter to static bypass on utility • Transfer from static bypass to maintenance bypass on utility • Transfer from maintenance bypass to inverter on utility • Transfer from inverter to static bypass on generator • Transfer from static bypass to maintenance bypass on generator • Transfer from maintenance bypass to inverter on generator
Verify system overload transfer to static bypass. Perform full load battery discharge test per module/string to meet battery end of life design. • Battery vendor to remove covers to allow for thermal imaging and reinstate. • Battery vendor to take screenshot of battery monitoring system before & after discharge test and provide report. • Verify battery monitoring system during battery discharge test. • Perform thermal imaging of batteries directly after discharge test and provide report.
Perform UPS system full load battery discharge test to prove automatic recovery on system restoration.
Record battery charging current and recharge time
Verify Automatic transfers under mains failure and mains return (where applicable)
Verify load sharing between modules.
Verify UPS module operation in parallel mode (if applicable)
Verify module communication failure (if applicable)
Verify transfer between normal to ECO modes occurs without power disruption (If applicable)
Verify Castell key signals – Inverter inhibit and Castell release when on STS
Verify rectifier walk-in test
Perform core redundancy test
Verify communication network redundancy failures
Confirm DCOS/BMS point to graphic testing is complete and screenshots captured for all of the above tests.

UPS Blue Tag Sign Off
Verify all related test reports including raw data files are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform

13.4 Low Voltage Switchboards

Low Voltage Switchboards Level 2A Commissioning – Red Tag
Confirm all deficiencies/comments from FWT/FAT have been closed.
Confirm room/area condition is acceptable as per the Equinix room readiness checklist.
Confirm equipment has been installed/positioned as per approved design drawings, manufactures specifications and approved technical submittals
Confirm the unit is correct dimensionally, handed correctly and accessible for operation and maintenance as per local code.
Confirm the equipment has the correct ratings, components, protective devices, interlocks (if applicable) as per approved design drawings, manufactures specifications and approved technical submittals
Confirm all gland plates are correct as per the approved technical submittals
Confirm switchboard mimic lines as per GA drawings
Confirm appropriate warning/safety labels are in place.
Confirm all device labelling is correct as per approved Equinix naming convention.
Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed.
Carry out all external and internal quality checks of the equipment.
Confirm equipment IPXX ratings are correct as per the approved technical submittals
Confirm network interface card has been supplied as per the approved technical submittals
Confirm system and equipment grounding installation is as per the approved design drawings and the approved technical submittals
Record all equipment details as per the Equinix provided template on the equipment parameter list within commissioning management platform.
Verify Cx level 2A Installation and QAQC inspection checklist has been carried out as per the Equinix approved checklist.

Low Voltage Switchboard Red Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Red Tag applied to the equipment and signed by CxA

Low Voltage Switchboards Level 2B Commissioning – Yellow Tag
Confirm earthing systems comply with Equinix Global Design Standards and/or design drawings.
Confirm power cables have been dead tested (refer to cable section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm busduct have been dead tested signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm control/monitoring cables have been dead tested (refer to cable section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm control/monitoring cables have been point to point tested, signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA
Confirm DC supply control circuits are as per Equinix Global Design Standards
Confirm all power cables and control/monitoring cabling identification are present as per approved cable schedule and cable interfacing schedule
Confirm all cables are identified with permanent labels, soundly fixed (glands/cable ties/cleats) identifying source, load, size & type as per the project specification provided by the EOR.
Verify all cable connections pull test & tightness test is found satisfactory

Verify all connections are torqued correctly (if applicable) and double marked.
Confirm all trunking covers and equipment terminal/protection covers are in place and secured.
Confirm supply breaker/fuse has an equal or greater current capacity than the incoming breaker/fuse of the distribution board.
Confirm all protection settings are set for the equipment as per approved protection study.
Confirm cable entry box (if applicable) is installed as per approved design drawings, manufactures specifications and approved technical submittals
Confirm PTW/LOTO procedures are implemented correctly by the GC's approved SAP/AP.
Confirm all equipment labelling and circuit identification is present and correct
Construction clean of room and of equipment
Cx level 2B equipment static testing MUST consist of as a minimum: • Continuity & polarity test • Low OHM resistance testing of all connections (contact resistance test). • Pressure/dielectric tests (Insulation resistance test) • Verification of mechanical operation.
Prove safety interlocks (mechanical and electrical).
Confirm primary & secondary injection protection scheme testing of all breakers/relays (if applicable) and security seal along with protection settings label applied by CxA.
Verify firmware/software revisions meet Equinix global design standards
Conduct a White Glove Inspection to ensure equipment is clean and free of debris or foreign materials and the appropriate protection is in place prior to energisation.

Low Voltage Switchboards Yellow Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Red Tag applied to the equipment and signed by CxA

Low Voltage Switchboards Level 3 Commissioning – Green Tag
Confirm LOTO procedures are implemented correctly by the GC's approved SAP/AP.
Confirm power cables have been live tested (refer to cable section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm busduct have been live tested (refer to busduct section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Verify metering
Verify HMI mimic and PLC operation as per Equinix global design standards
Verify safety interlocks (mechanical and electrical).
Confirm DCOS/BMS point to graphic testing is complete, signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA
Verify vendor Cx level 3 start-up/pre-functional testing has been carried out as per the vendors Cx level 3 start-up/pre functional method statement approved by the CxA.
Verify Cx level 3 start-up/pre-functional testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 3 checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA

Low Voltage Switchboards Green Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA

CxA to sign off checklist as Approved on commissioning management platform
Red Tag applied to the equipment and signed by CxA

Low Voltage Switchboards Level 4 Commissioning – Blue Tag
100% load test of LV switchgear for a duration of 4 hours
Perform thermal imaging of LV switchgear (refer to thermal imaging section XX)
Verify 100% functional testing of automation/system controls as per SOO including all maintenance scenarios, load bank scenarios, failure scenarios and interlocking.
Verify all automation/system controls redundancy by means of testing
Verify communication network redundancy failures
Monitor and record power quality data at the load-side of each MSB when transferring to/from Utility and generator

Low Voltage Switchboards Blue Tag Sign Off
Verify all related test reports including raw data files are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform

13.5 PDUs & RPP

PDU & RPP Level 2A Commissioning – Red Tag
Confirm all deficiencies/comments from FWT/FAT have been closed.
Confirm room/area condition is acceptable as per the Equinix room readiness checklist.
Confirm equipment has been installed/positioned as per approved design drawings, manufactures specifications and approved technical submittals
Confirm the unit is correct dimensionally, handed correctly and accessible for operation and maintenance as per local code.
Confirm the equipment has the correct ratings, components, protective devices, interlocks (if applicable) as per approved design drawings, manufactures specifications and approved technical submittals
Confirm all gland plates are correct as per the approved technical submittals
Confirm appropriate warning/safety labels are in place.
Confirm all device labelling is correct as per approved Equinix naming convention.
Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed.
Carry out all external and internal quality checks of the equipment.
Confirm equipment IPXX ratings are correct as per the approved technical submittals
Confirm network interface card has been supplied as per the approved technical submittals
Confirm system and equipment grounding installation is as per the approved design drawings and the approved technical submittals
Record all equipment details as per the Equinix provided template on the equipment parameter list within commissioning management platform.
Verify Cx level 2A Installation and QAQC inspection checklist has been carried out as per the Equinix approved checklist

PDU & RPP Red Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Red Tag applied to the equipment and signed by CxA

PDU & RPP Level 2B Commissioning – Yellow Tag
Confirm earthing systems comply with Equinix Global Design Standards and/or design drawings.
Confirm power cables have been dead tested (refer to cable section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm control/monitoring cables have been dead tested (refer to cable section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm control/monitoring cables have been point to point tested, signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA
Confirm all power cables and control/monitoring cabling identification are present as per approved cable schedule and cable interfacing schedule.
Confirm all cables are identified with permanent labels, soundly fixed (glands/cable ties/cleats) identifying source, load, size & type as per the project specification provided by the EOR.
Verify all cable connections pull test & tightness test is found satisfactory
Verify all connections are torqued correctly (if applicable) and double marked.
Confirm all trunking covers and equipment terminal/protection covers are in place and secured.
Confirm supply breaker/fuse has an equal or greater current capacity than the incoming breaker/fuse of the distribution board.
Confirm all protection settings are set for the equipment as per approved protection study.

Confirm cable entry box (if applicable) is installed as per approved design drawings, manufactures specifications and approved technical submittals
Confirm PTW/LOTO procedures are implemented correctly by the GC's approved SAP/AP.
Confirm all equipment labelling and circuit identification is present and correct
Construction clean, of room and of equipment
Verification of mechanical operation.
Conduct a White Glove Inspection to ensure equipment is clean and free of debris or foreign materials and the appropriate protection is in place prior to energisation.
Verify vendor Cx level 2B static testing has been carried out as per the vendors Cx level 2B static testing method statement approved by the CxA.
Verify Cx level 2B static testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 2B checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA.

PDU & RPP Yellow Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Red Tag applied to the equipment and signed by CxA

PDU & RPP Level 3 Commissioning – Green Tag
Confirm LOTO procedures are implemented correctly by the GC's approved SAP/AP.
Confirm power cables have been live tested (refer to cable section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Verify metering (if applicable)
Confirm DCOS/BMS point to graphic testing is complete, signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA
Verify vendor Cx level 3 start-up/pre-functional testing has been carried out as per the vendors Cx level 3 start-up/pre functional method statement approved by the CxA.
Verify Cx level 3 start-up/pre-functional testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 3 checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA

PDU & RPP Green Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Red Tag applied to the equipment and signed by CxA

PDU & RPP Level 4 Commissioning – Blue Tag
Operation of all breakers (open, closed, tripped). Verify on EMS
Verify meter readings using a calibrated clamp meter where load is available.
Four-hour test at 100% rating through all possible power paths with IR Scan after 30 minutes
Blue tag applied to the equipment and signed, recorded accordingly
From REV 5.1 as no review available

13.6 Standalone Automatic Transfer Switch (ATS)

Standalone Automatic Transfer Switch (ATS) Level 2A Commissioning – Red Tag
Confirm all deficiencies/comments from FWT/FAT have been closed.
Confirm room/area condition is acceptable as per the Equinix room readiness checklist (refer to section XX).
Confirm equipment has been installed/positioned as per approved design drawings, manufactures specifications and approved technical submittals
Confirm the unit is correct dimensionally, handed correctly and accessible for operation and maintenance as per local code.
Confirm the equipment has the correct ratings, components, protective devices, interlocks (if applicable) as per approved design drawings, manufactures specifications and approved technical submittals
Confirm all gland plates are correct as per the approved technical submittals
Confirm all busbar flanges are correct as per the approved technical submittals and approved shop drawings
Confirm appropriate warning/safety labels are in place.
Confirm all device labelling is correct as per approved Equinix naming convention.
Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed.
Carry out all external and internal quality checks of the equipment.
Confirm equipment IPXX ratings are correct as per the approved technical submittals
Confirm network interface card has been supplied as per the approved technical submittals
Confirm system and equipment grounding installation is as per the approved design drawings and the approved technical submittals
Record all equipment details as per the Equinix provided template on the equipment parameter list within commissioning management platform.
Confirm suitable protection is in position after L2A visual inspection.
Verify Cx level 2A Installation and QAQC inspection has been carried out as per the Equinix approved checklist.

Standalone Automatic Transfer Switch (ATS) Red Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Red Tag applied to the equipment and signed by CxA

Standalone Automatic Transfer Switch (ATS) Level 2B Commissioning – Yellow Tag
Confirm earthing systems comply with Equinix Global Design Standards and/or design drawings.
Confirm busbar have been dead tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm AC power cables have been dead tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm control/monitoring cables have been dead tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm control/monitoring cables have been point to point tested, signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA
Confirm all power cables and control/monitoring cabling identification are present as per approved cable schedule and cable interfacing schedule.
Confirm ALL cables are identified with permanent labels, soundly fixed (glands/cable ties/cleats) identifying source, load, size & type as per the project specification provided by the EOR.
Verify all cable connections pull test is found satisfactory
Verify all connections are torqued correctly (if applicable) and double marked.
Confirm all trunking covers and equipment terminal/protection covers are in place and secured.

Confirm supply breaker/fuse has an equal or greater current capacity than the incoming breaker/fuse of the distribution board.
Confirm all protection settings are set for the equipment as per approved protection study.
Confirm secondary injection protection testing of all breakers/relays (if applicable) and security seal along with protection settings label applied by CxA.
Confirm PTW/LOTO procedures are implemented correctly by the GC's approved SAP/AP.
ATS vendor to conduct a deep clean of ATS and provide report.
Conduct a White Glove Inspection to ensure equipment is clean and free of debris or foreign materials and the appropriate protection is in place prior to energisation.
Verify vendor Cx level 2B static testing has been carried out as per the vendors Cx level 2B static testing method statement approved by the CxA.
Verify Cx level 2B static testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 2B checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA

Standalone Automatic Transfer Switch (ATS) Yellow Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Red Tag applied to the equipment and signed by CxA

Standalone Automatic Transfer Switch (ATS) Level 3 Commissioning – Green Tag
Confirm LOTO procedures are implemented correctly by the GC's approved SAP/AP.
Confirm AC supply cables have been live tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm busbars have been live tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm DCOS/BMS point to graphic testing is complete, signed off and documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Verify ATS settings/timers comply with latest approved Equinix global design standards
Verify firmware versions for ATS comply with approved Equinix global design standards (if applicable).
Record firmware versions for ATS on checklist within commissioning management platform.
Verify source transfers in automatic and manual.
Verify HMI and power meters are operational and reading correctly.
Confirm ATS output voltage is as per approved GDS and recorded.
Verify vendor Cx level 3 start-up/pre-functional testing has been carried out as per the vendors Cx level 3 start-up/pre functional method statement approved by the CxA.
Verify Cx level 3 start-up/pre-functional testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 3 checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA.

Standalone Automatic Transfer Switch (ATS) Green Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Green Tag applied to the equipment and signed by CxA

Standalone Automatic Transfer Switch (ATS) Level 4 Commissioning – Blue Tag
Perform a one hour 100% full design load test of the ATS through each power path with thermal imaging of ATS to be conducted. (refer to thermal imaging section XX). • 1-hour S1 Main • 1-hour S2 Main • 1-hour External Bypass (if applicable)
Confirm trending is captured throughout the above load tests.
Verify source transfers via manual operation
Verify source transfers via automatic operation • S1 mains failure and return • S2 mains failure and return
Verify source seeking functionality between S1 and S2
Perform blip test on S1 and S2.
Verify change over with single phase failure
Confirm DCOS/BMS point to graphic testing is complete and screenshots captured for all the above tests.

13.7 Standalone Static transfer switches (STS)

Standalone Static transfer switches (STS) Level 2A Commissioning – Red Tag
Confirm all deficiencies/comments from FWT/FAT have been closed.
Confirm room/area condition is acceptable as per the Equinix room readiness checklist (refer to section XXX).
Confirm equipment has been installed/positioned as per approved design drawings, manufactures specifications and approved technical submittals
Confirm the unit is correct dimensionally, handed correctly and accessible for operation and maintenance as per local code.
Confirm the equipment has the correct ratings, components, protective devices, interlocks (if applicable) as per approved design drawings, manufactures specifications and approved technical submittals
Confirm all gland plates are correct as per the approved technical submittals
Confirm all busbar flanges are correct as per the approved technical submittals and approved shop drawings
Confirm appropriate warning/safety labels are in place.
Confirm all device labelling is correct as per approved Equinix naming convention.
Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed.
Carry out all external and internal quality checks of the equipment.
Confirm equipment IPXX ratings are correct as per the approved technical submittals
Confirm network interface card has been supplied as per the approved technical submittals
Confirm system and equipment grounding installation is as per the approved design drawings and the approved technical submittals
Record all equipment details as per the Equinix provided template on the equipment parameter list within commissioning management platform.
Confirm suitable protection is in position after L2A visual inspection.
Verify Cx level 2A Installation and QAQC inspection has been carried out as per the Equinix approved checklist

Standalone Static Transfer Switch (STS) Red Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Red Tag applied to the equipment and signed by CxA

Standalone Static transfer switches (STS) Level 2B Commissioning – Yellow Tag
Confirm earthing systems comply with Equinix Global Design Standards and/or design drawings.
Confirm busbar have been dead tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm AC power cables have been dead tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm control/monitoring cables have been dead tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm control/monitoring cables have been point to point tested, signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA
Confirm all power cables and control/monitoring cabling identification are present as per approved cable schedule and cable interfacing schedule.
Confirm ALL cables are identified with permanent labels, soundly fixed (glands/cable ties/cleats) identifying source, load, size & type as per the project specification provided by the EOR.
Verify all cable connections pull test is found satisfactory
Verify all connections are torqued correctly (if applicable) and double marked.
Confirm all trunking covers and equipment terminal/protection covers are in place and secured.

Confirm supply breaker/fuse has an equal or greater current capacity than the incoming breaker/fuse of the distribution board.
Confirm all protection settings are set for the equipment as per approved protection study.
Confirm secondary injection protection testing of all breakers/relays (if applicable) and security seal along with protection settings label applied by CxA.
Confirm PTW/LOTO procedures are implemented correctly by the GC's approved SAP/AP.
STS vendor to conduct a deep clean of STS and provide report.
Conduct a White Glove Inspection to ensure equipment is clean and free of debris or foreign materials and the appropriate protection is in place prior to energisation.
Verify vendor Cx level 2B static testing has been carried out as per the vendors Cx level 2B static testing method statement approved by the CxA.
Verify Cx level 2B static testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 2B checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA.

Standalone Static transfer switches (STS) Yellow Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Red Tag applied to the equipment and signed by CxA

Standalone Static transfer switches (STS) Level 3 Commissioning – Green Tag
Confirm LOTO procedures are implemented correctly by the GC's approved SAP/AP.
Confirm AC supply cables have been live tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm busbars have been live tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm DCOS/BMS point to graphic testing is complete, signed off and documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Verify STS settings comply with latest approved Equinix global design standards
Verify firmware versions for STS comply with approved Equinix global design standards (if applicable).
Record firmware versions for STS on checklist within commissioning management platform.
Verify castell key / interlocking functionality
Verify source transfers in automatic and manual.
Verify HMI and power meters are operational and reading correctly.
Confirm STS output voltage is as per approved GDS and recorded.
Verify vendor Cx level 3 start-up/pre-functional testing has been carried out as per the vendors Cx level 3 start-up/pre functional method statement approved by the CxA.
Verify Cx level 3 start-up/pre-functional testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 3 checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA.

Standalone Static Transfer Switch (STS) Green Tag Sign Off
Verify all related test reports are complete, signed and have been uploaded to Equinix document control platform by the vendor and approved by the CxA
All required documentation is uploaded to commissioning management platform by CxA
CxA to sign off checklist as Approved on commissioning management platform
Green Tag applied to the equipment and signed by CxA

Standalone Static transfer switches (STS) Level 4 Commissioning – Blue Tag
Confirm a calibrated PQM is installed on the STS output throughout all L4 Cx.
Confirm an additional calibrated PQM is installed between STS input sources for out of phase test.
PQM's are to be provided by the STS vendor and set up correctly (refer to PQM section XX).
Perform a one hour 100% full design load test of the STS through each power path with thermal imaging of STS to be conducted. (refer to thermal imaging section XX). • 1-hour S1 Main • 1-hour S1 Bypass • 1-hour S2 Main • 1-hour S2 Bypass • 1-hour External Bypass (if applicable)
Verify source transfers via manual operation
Verify source transfers via automatic operation • S1 mains failure and return • S2 mains failure and return
Verify out of phase transfers (one source on utility and one source on generator).
Confirm DCOS/BMS point to graphic testing is complete and screenshots captured for all of the above tests.
Note: For Cooling during STS Level 4 testing, refer to Room cooling Redundancy testing

13.8 BTUs (MV/LV)

BTUs (MV/LV) Level 2A Commissioning – Red Tag
Confirm all deficiencies/comments from FWT/FAT have been closed.
Confirm room/area condition is acceptable as per the Equinix room readiness checklist (refer to section XX).
Confirm equipment has been installed/positioned as per approved design drawings, manufactures specifications and approved technical submittals
Confirm the unit is correct dimensionally, handed correctly and accessible for operation and maintenance as per local code.
Confirm the equipment has the correct ratings, components, protective devices, interlocks (if applicable) as per approved design drawings, manufactures specifications and approved technical submittals
Confirm all gland plates are correct as per the approved technical submittals
Confirm appropriate warning/safety labels are in place.
Confirm all device labelling is correct as per approved Equinix naming convention.
Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed.
Carry out all external and internal quality checks of the equipment.
Confirm equipment IPXX ratings are correct as per the approved technical submittals
Confirm network interface card (if applicable) has been supplied as per the approved technical submittals
Confirm system and equipment grounding installation is as per the approved design drawings and the approved technical submittals
Record all equipment details as per the Equinix provided template on the equipment parameter list within commissioning management platform.
Confirm suitable protection is in position after L2A visual inspection.
Verify Cx level 2A Installation and QAQC inspection has been carried out as per the Equinix approved checklist.

BTUs (MV/LV) Level 2B Commissioning – Yellow Tag
Confirm earthing systems comply with Equinix Global Design Standards and/or design drawings.
Confirm AC/DC power cables have been dead tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm control/monitoring cables have been dead tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm control/monitoring cables have been point to point tested, signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA
Confirm all power cables and control/monitoring cabling identification are present as per approved cable schedule and cable interfacing schedule.
Confirm ALL cables are identified with permanent labels, soundly fixed (glands/cable ties/cleats) identifying source, load, size & type as per the project specification provided by the EOR.
Verify all cable connections pull test is found satisfactory
Verify all connections are torqued correctly (if applicable) and double marked.
Confirm all trunking covers and equipment terminal/protection covers are in place and secured.
Confirm supply breaker/fuse has an equal or greater current capacity than the incoming breaker/fuse of the distribution board.
Confirm all protection settings are set for the equipment as per approved protection study.
Confirm PTW/LOTO procedures are implemented correctly by the GC's approved SAP/AP.
Conduct a White Glove Inspection to ensure equipment is clean and free of debris or foreign materials and the appropriate protection is in place prior to energisation.
Verify vendor Cx level 2B static testing has been carried out as per the vendors Cx level 2B static testing method statement approved by the CxA.
Verify Cx level 2B static testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 2B checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA.

BTUs (MV/LV) Level 3 Commissioning – Green Tag
Confirm LOTO procedures are implemented correctly by the GC's approved SAP/AP.
Confirm AC supply cables have been live tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm DCOS/BMS point to graphic testing is complete, signed off and documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Verify BTU settings comply with latest approved Equinix global design standards
Verify firmware versions for BTU comply with approved Equinix global design standards (if applicable).
Record firmware versions for BTU on checklist within commissioning management platform.
Confirm DC voltages and float voltages are as per approved design drawings, manufactures specifications and approved technical submittals
Verify metering, alarms and indicators are operational.
Verify vendor Cx level 3 start-up/pre-functional testing has been carried out as per the vendors Cx level 3 start-up/pre functional method statement approved by the CxA.
Verify Cx level 3 start-up/pre-functional testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 3 checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA.

BTUs (MV/LV) Level 4 Commissioning – Blue Tag
Perform a 2 hour battery discharge test using standing load and record battery voltages every 15 minutes.
Perform one open-close operation for each automatically operated breaker
Record current and voltage drop throughout the above testing procedure
Record room ambient temperatures.
Confirm DCOS/BMS point to graphic testing is complete and screenshots captured for all of the above tests.

13.10 Busduct systems

For the full complete requirements for Busduct please refer to The appendix in the Quality Control

Busduct Systems Level 2A Commissioning – Red Tag
Confirm room/area condition is acceptable as per the Equinix room readiness checklist.
Perform a visual inspection of the full length of busbar to check for alignment, damages and adequate fixing arrangement.
Verify all busbar has been installed/positioned as per approved design drawings, manufactures specifications and approved technical submittals
Verify all busbar and flanges are correct dimensionally, handed correctly and accessible for operation and maintenance as per local code.
Verify the busbar has the correct ratings, components, protective devices, interlocks (if applicable) as per approved design drawings, manufactures specifications and approved technical submittals
Confirm appropriate warning/safety labels are in place.
Confirm all busbar labelling is correct as per approved Equinix naming convention.
Confirm busbar IPXX ratings are correct as per the approved technical submittals
Confirm busbar system and equipment grounding installation is as per the approved design drawings and the approved technical submittals.
Verify all busbar joints are torqued to the correct value as per manufacturers guidance.
Verify busbar expansion joints are installed as per design (if applicable).
Verify cast resin busbar joints are installed as per design, manufacturers guidance and approved technical submittals. (if applicable)
Verify galvanic separation of dissimilar metals (if applicable).
Record all busbar details as per the Equinix provided template on the equipment parameter list within commissioning management platform

Busduct Systems Level 2B Commissioning – Yellow Tag
Verify all busbar flange connections are torqued correctly and double marked as per manufacturers guidance.
Verification of mechanical operation of tap off boxes.
Confirm all protection settings are set for the tap off boxes as per approved protection study.
Perform secondary injection testing of all tap off breakers (if applicable) and security seal along with protection settings label applied by CxA.
Confirm PTW/LOTO procedures are implemented correctly by the GC's approved SAP/AP.
On completion of static testing ensure all busbar joint covers and end caps are replaced.
Verify vendor Cx level 2B static testing has been carried out as per the vendors Cx level 2B static testing method statement approved by the CxA.
Verify Cx level 2B static testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 2B checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Testing Required: *(below tests are the minimum requirement)*
Low OHM resistance test on each joint
Contact resistance test
Torque test. Ensure all bolts and nuts are properly marked using Torque marker pen in RED
Continuity and polarity test
Insulation resistance test
Earth Fault loop impedance (Zs)

Busduct Systems Level L3 Commissioning – Green Tag
Confirm LOTO procedures are implemented correctly by the GC's approved SAP/AP.
Confirm DCOS/BMS point to graphic testing is complete, signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA for tap off boxes (if applicable).
Verify vendor Cx level 3 start-up/pre-functional testing has been carried out as per the vendors Cx level 3 start-up/pre functional method statement approved by the CxA.
Verify Cx level 3 start-up/pre-functional testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 3 checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA
Testing Required
Verify voltage.
Perform phase rotation test.
Perform earth loop impedance test (Ze/Zs). For main distribution boards use a high current earth loop impedance test instrument with resolution of 0.1m Ohm and up to 50kA required for this test.
Perform prospective short circuit current test (PSCC)
Perform prospective earth fault current test (PFC)

Busduct Systems Level L4 Commissioning – Blue Tag
Main Busbar on Electrical strings
MVTX-MSB, MSB-UPS, UPS-Output Board, UPS Bypass
Load testing busbar located within the electrical strings is undertaken in conjunction with the 4 hour load testing of the UPS/MSB
A full thermal image scan must be undertaken of all joints every 60 minutes and a report issued
Data Hall Busbars
Including: UPS output board- STS/STSSB/PDU, Cable End Box, Data Hall Busbar
Load testing of Data Hall busbar is undertaken with full load in conjunction with the STS/STSSB 4 hour load test via load banks attached to the data hall busbar
A full thermal image scan must be undertaken of all joints every 60 minutes and a report issued

13.11 Busbar Temperature Monitoring System

Busbar Temperature Monitoring System Level 2A Commissioning – Red Tag
Confirm room/area condition is acceptable as per the Equinix room readiness checklist.
Confirm equipment has been installed/positioned as per approved design drawings, manufactures specifications and approved technical submittals
Confirm the unit is correct dimensionally, handed correctly and accessible for operation and maintenance as per local code.
Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed.
Confirm all glands and cables entries are correct as per the approved technical submittals
Confirm appropriate warning/safety labels are in place.
Confirm all device labelling is correct as per approved Equinix naming convention.
Confirm equipment IPXX ratings are correct as per the approved technical submittals
Confirm network interface card has been supplied as per the approved technical submittals
Record all equipment details as per the Equinix provided template on the equipment parameter list within commissioning management platform

Busbar Temperature Monitoring Level 2B Commissioning – Yellow Tag
Perform a visual inspection of the full length of busbar temperature monitoring cable:
Verify busbar is clean from any foreign debris such as metal swarf that could damage the temperature monitoring cable.
Perform visual check of the cable for cuts, abrasions and any other damages.
Verify fibre optic cables have the correct bend radius as per manufacture guidance.
Perform a visual inspection of the busbar temperature monitoring panel:
Confirm earthing systems comply with Equinix Global Design Standards and/or design drawings.
Confirm power cables have been dead tested (refer to cable section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm control/monitoring cables have been dead tested (refer to cable section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm control/monitoring cables have been point to point tested, signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA
Confirm all power cables and control/monitoring cabling identification are present as per approved cable schedule and cable interfacing schedule.
Confirm all cables are identified with permanent labels, soundly fixed (glands/cable ties/cleats) identifying source, load, size & type as per the project specification provided by the EOR.
Verify all cable connections pull test & tightness test is found satisfactory
Verify all connections are torqued correctly (if applicable) and double marked.
Confirm all trunking covers and equipment terminal/protection covers are in place and secured.
Confirm supply breaker/fuse has an equal or greater current capacity than the incoming breaker/fuse of the distribution board.
Confirm all equipment labelling and circuit identification is present and correct
Confirm PTW/LOTO procedures are implemented correctly by the GC's approved SAP/AP.
Conduct a White Glove Inspection to ensure equipment is clean and free of debris or foreign materials and the appropriate protection is in place prior to energisation

Busbar Temperature Monitoring Level L3 Commissioning – Green Tag
Verify busbar temperature monitoring system functionality, configuration, zoning and alarming is as per manufacturers guidance.
Confirm DCOS point to graphic testing is complete, signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm DCOS / equipment permanent Software License is active before RFS. (DCOS TEAM).
Verify vendor Cx level 3 start-up/pre-functional testing has been carried out as per the vendors Cx level 3 start-up/pre functional method statement approved by the CxA.
Verify Cx level 3 start-up/pre-functional testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 3 checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA

Busbar Temperature Monitoring Level L4 Commissioning – Blue Tag
Not Applicable

13.12 Battery Monitoring System

Battery Monitoring System Level 2A Commissioning – Red Tag
Confirm all deficiencies/comments from FWT/FAT have been closed.
Confirm room/area condition is acceptable as per the Equinix room readiness checklist (refer to section XXX).
Confirm equipment has been installed/positioned as per approved design drawings, manufactures specifications and approved technical submittals
Confirm the unit is correct dimensionally, handed correctly and accessible for operation and maintenance as per local code.
Confirm the equipment has the correct ratings, components, protective devices, interlocks (if applicable) as per approved design drawings, manufactures specifications and approved technical submittals
Confirm all gland plates are correct as per the approved technical submittals
Confirm appropriate warning/safety labels are in place.
Confirm all device labelling is correct as per approved Equinix naming convention.
Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed.
Carry out all external and internal quality checks of the equipment.
Confirm equipment IPXX ratings are correct as per the approved technical submittals
Confirm network interface card has been supplied as per the approved technical submittals
Confirm system and equipment grounding installation is as per the approved design drawings and the approved technical submittals
Confirm battery installation complies to approved manufacturers guidance.
Record all equipment details as per the Equinix provided template on the equipment parameter list within commissioning management platform.
Confirm suitable protection is in position after L2A visual inspection.

Battery Monitoring System Level 2B Commissioning – Yellow Tag
Confirm earthing systems comply with Equinix Global Design Standards and/or design drawings.
Confirm DC power cables have been dead tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm control/monitoring cables have been dead tested (refer to section XX) signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Confirm control/monitoring cables have been point to point tested, signed off and documentation have been uploaded to Equinix document control platform by the vendor and approved by the CxA
Confirm all power cables and control/monitoring cabling identification are present as per approved cable schedule and cable interfacing schedule.
Confirm ALL cables are identified with permanent labels, soundly fixed (glands/cable ties/cleats) identifying source, load, size & type as per the project specification provided by the EOR.
Verify all cable connections pull test is found satisfactory
Verify all connections are torqued correctly (if applicable) and double marked.
Confirm all trunking covers and equipment terminal/protection covers are in place and secured.
Confirm supply breaker/fuse has an equal or greater current capacity than the incoming breaker/fuse of the distribution board.
Confirm all BCB protection settings are set for the equipment as per approved protection study (if applicable).
Perform mechanical operational tests on BCB's
Confirm UPS and UPS batteries interfaces and safety interlocking.
Confirm UPS is Cx Level 2B is complete.
Confirm the cooling system is Cx level 2B complete and operational for both UPS switchroom and battery room.
Confirm hydrogen monitoring system and extraction is operational (if applicable)

Confirm PTW/LOTO procedures are implemented correctly by the GC's approved SAP/AP.
Battery vendor to conduct a deep clean of batteries/cabinets and provide report
Conduct a White Glove Inspection to ensure equipment is clean and free of debris or foreign materials and the appropriate protection is in place prior to energisation.
Verify vendor Cx level 2B static testing has been carried out as per the vendors Cx level 2B static testing method statement approved by the CxA.
Verify Cx level 2B static testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 2B checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA

Battery Monitoring System Level 3 Commissioning – Green Tag
Confirm LOTO procedures are implemented correctly by the GC's approved SAP/AP.
Confirm DCOS/BMS point to graphic testing is complete, signed off and documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA.
Verify firmware versions for batteries comply with approved Equinix global design standards (if applicable).
Record firmware versions for batteries on checklist within commissioning management platform.
Verify BCB inter-trips.
Confirm battery monitoring system is operational
Verify batteries are charging.
Verify vendor Cx level 3 start-up/pre-functional testing has been carried out as per the vendors Cx level 3 start-up/pre functional method statement approved by the CxA.

Battery Monitoring System Level 4 Commissioning – Blue Tag
Not Applicable

13.13 Branch Circuit Monitoring System (BCM)

Branch Circuit Monitoring System Level 2A Commissioning – Red Tag
As Built drawings issued from the Vendor
Visual inspection of Equipment is undertaken, no defects present
Verify equipment has been Installed/ positioned as per approved design drawings
Vendor Dead testing method statement is submitted and approved
Cable Schedule has been submitted and approved

Branch Circuit Monitoring System Level 2B Commissioning – Yellow Tag
Equipment is clean and free of debris (white glove test)
Vendor checks/dead tests are completed, documents are uploaded to Equinix document control.
Verify inputs and outputs to terminals.
All Equipment Identification (labels/ warning signs etc) are present
Earth connections comply with global standards (Ref EES-5) and/ or design.
AC Supply cables have been initially verified, signed off and preliminary documentation is submitted
Signal cables have been point to point & IR tested, signed off and documentation is uploaded to Equinix document control.
As-Built documentation is submitted and approved
All cables (as above) are identified with permanent labels, soundly fixed (cable ties). identifying source, load, size & type.
Torque test. Ensure all bolts and nuts are properly marked using Torque marker pen.
Verify system configurations and settings are as per Equinix approved settings.
Vendor start-up/ live testing method statements are submitted and approved
All trunking covers and terminal covers are in place and secured
Calibration certificates used to carry out the tests are uploaded to Equinix document control

Branch Circuit Monitoring System Level L3 Commissioning – Green Tag
AC Supply & Load cables have been verified, signed off and final documentation is submitted
Verify monitoring system function, configuration, communications and alarms
Verify amperage values are mapped correctly and accurate by applying a known load on circuit and confirming value on BCM graphic
Vendor Live tests have been carried out as per method statement
BCM point to graphic testing is complete, documented and uploaded to Equinix document control
Calibration certificates used to carry out the tests are uploaded to Equinix document control
BCM mapping complete prior to heat load runs

Branch Circuit Monitoring System Level L4 Commissioning – Blue Tag
Verify functionality and trending of system during heat load test. Trends to be obtain via Branch Circuit Monitoring System and uploaded to Equinix document control
Testing document is signed off by all interested parties
System is left fault/ snag free

13.14 Earthing systems

Earthing Systems Level 2A Commissioning – Red Tag
Confirm room/area condition is acceptable as per the Equinix room readiness checklist.
Confirm earth bars has been installed/positioned as per approved design drawings, manufactures specifications and approved technical submittals
Confirm earth bars is correct dimensionally, handed correctly and accessible for operation and maintenance as per local code.
Confirm appropriate warning/safety labels are in place.
Confirm earth bar fixed correctly and no damage is visible.
Confirm earthing system and equipment grounding installation is as per the approved design drawings and the approved technical submittals
Confirm all earth cables have been installed for all earthing systems MV/LV, main and supplementary bonding and raised access floor (if applicable) as per approved design drawings.
Confirm all earth cables have been installed with adequate fixing arrangement.
Verify all cables bending radiuses are as per manufacturers guidance.
Verify all cables are installed with appropriate terminations and accessories as per design, manufacturers guidance and approved technical submittals.
Verify earth matts/electrodes and earth pits (if applicable) are installed as per as per approved design drawings, manufactures specifications and approved technical submittals.
Record all earthing system details
Verify Cx level 2A Installation and QAQC inspection checklist has been carried out as per the Equinix approved checklist

Earthing Systems Level 2B Commissioning – Yellow Tag
Confirm earthing systems comply with Equinix Global Design Standards and approved design drawings.
Verify all cable connections pull test & tightness test is found satisfactory
Verify all connections are torqued to the correct value as per manufacturers guidance and double marked.
Verify vendor Cx level 2B static testing has been carried out as per the vendors Cx level 2B static testing method statement approved by the CxA.
Verify Cx level 2B static testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 2B checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA
Testing Required *(below tests are the minimum requirement)***:**
Perform continuity test by means of measuring the earthing cable resistance for MV/LV earthing, main and supplementary bonding and raised access floor (if applicable).
Perform earth electrode resistance testing (if applicable) and record the Ohm value.
For HV/MV substations verify touch and step potential test values do not exceed safety limits

Earthing Systems Level 3 Commissioning – Green Tag
Not Applicable

Earthing Systems Level 4 Commissioning – Blue Tag
Not Applicable

13.15 Lightning Protection Systems

Lightning Protection Level 2A Commissioning – Red Tag
Confirm lightning protection system has been installed/positioned as per approved design drawings, manufactures specifications and approved technical submittals
Confirm lightning protection system is correct dimensionally, handed correctly and accessible for operation and maintenance as per local code.
Confirm appropriate warning/safety labels are in place.
Confirm lightning protection system fixed correctly and no damage is visible.
Confirm lightning protection system and equipment grounding installation is as per the approved design drawings and the approved technical submittals
Confirm all earth cables/tape have been installed as per approved design drawings.
Confirm all earth cables/tape have been installed with adequate fixing arrangement.
Verify all earth cables bending radiuses are as per manufacturers guidance.
Verify all earth cables/tape are installed with appropriate terminations and accessories as per design, manufacturers guidance and approved technical submittals.
Verify earth matts/electrodes and earth pits (if applicable) are installed as per as per approved design drawings, manufactures specifications and approved technical submittals.
Record all earthing system details
Verify Cx level 2A Installation and QAQC inspection checklist has been carried out as per the Equinix approved checklist.

Lightning Protection Level 2B Commissioning – Yellow Tag
Confirm earthing systems comply with Equinix Global Design Standards and approved design drawings.
Verify all earth cable/tape connections pull test & tightness test is found satisfactory
Verify all connections are torqued to the correct value as per manufacturers guidance and double marked.
Verify vendor Cx level 2B static testing has been carried out as per the vendors Cx level 2B static testing method statement approved by the CxA.
Verify Cx level 2B static testing has been carried out as per the Equinix approved checklist
Confirm all vendor Cx level 2B checks/tests are complete and all documentation has been uploaded to Equinix document control platform by the vendor and approved by the CxA
Testing Required *(below tests are the minimum requirement)***:**
Perform continuity test by means of measuring the earthing cable/tape resistance.
Perform earth electrode resistance testing (if applicable) and record the Ohm value

Lightning Protection Level 3 Commissioning – Green Tag
Not Applicable

Lightning Protection Level 4 Commissioning – Blue Tag
Not Applicable

14.0 Tagging Requirements Mechanical

15.0 Mechanical Systems

15.1 Chemical Cleaning & Flushing of Pipework (Chilled Water & Condenser Water)

Chemical Cleaning & Flushing Level 2 Pre-requisites before asset energisation
Assets isolated before static Flush
Static flushing to be Undertaken
Passivation to be undertaken and checked before Dynamic Flush
Dynamic flushing could be used on low volume systems, but preferred method on closed loop systems is Side Stream Filtration filled with pre-treated water.
Verify all flushing velocity are met on all pipework
Verify water Quality onsite before chemical dosing
Water Quality report Reviewed
Chemical dosing to be undertaken in line with Manufacturer's Safety Data Sheets (MSDS)
Backflushing of Asset to be undertaken with Dosed Water

Conditions for samples to be collected for Laboratory Analysis
Adequate sampling points to be determined by the CxA
Each sample must be collected in a sterile container.
Samples must be stored at a temperature between 6-8˚C and must be tested within 24 hours of being removed from the system.
Tests must be performed by an accredited laboratory.
Any variation in results from samples taken at different points around the system should be investigated and, if necessary, further samples taken.
Where connection to existing "Live" system is concerned, samples are to be collected from both live & system to be integrated for laboratory analysis
Test results are to be submitted to the CxA and Equinix Operation team for review before the tie-in can be carried out.
Items for analysis: • Hardness • Total alkalinity (ppm CaCO3) • Molybdate (ppm MoO4) • Nitrite (ppm NaNO2) • Conductivity (µS/cm) • Total dissolved solids (TDS) (ppm or mg/l) • Suspended solids (mg/l) • pH • Soluble Iron (mg/l) & Total Iron (mg/l) • Soluble Copper (mg/l) & Total Copper (mg/l) • Silica, Sulphate and Chloride (ppm or mg/l) • Glycol (%) – Where Applicable • Bacteriological Analysis (to include test for pseudomonas) • Biological growth (algae and bacteria, visual & counts per ml) • Treatment chemical residual (ppm or mg/l) • Sediment

15.2 CHW Pipework Pressure Testing

CHW Pipework Pressure testing (Pre-Requisites required before balancing)
Verify that all sectional testing of pipework has been completed
Verify that all section test reports are reviewed, Approved and uploaded to Commissioning Portal
Undertake a pressure test of complete system
Enter minimum requirements

15.3 Water Balancing

Water Balancing Pre-Requisites Level 2B Yellow Tag
Verify the water balancing method statement and risk assessment (RAMS) has been approved and uploaded to Commit Compliance Task on Commissioning Portal
Verify that pressure testing has been completed as per section in Pressure testing
Verify that system flushing has been completed as per section in Chemical Cleaning
Verify that all equipment has been back flushed
Verify that all flushing loops are closed

Water Balancing Level 3 Commissioning Green Tag
Ensure pre-commissioning is carried out on the system
Verify that equipment valves positions are as per factory pre-set values
Verify that the mains flow is equal to 100% of design
Verify that system equipment is on full flow to match 100% of design at N equipment operating
Check all of metering stations to prove design flow (Where Applicable)
Check & record all PICVs are receiving required minimum design pressure
Carry out riser failover test to ensure that respective equipment maintains 100% design flow
Check and record system differential pressure for pump speed control. *This is to be carried out in conjunction with the Chiller Plant controls with N equipment in service and at design flow rates*
Carry out mains / riser failover test to ensure that respective equipment receive 100% design flow
Carry out redundancy failover test to ensure that respective operating equipment receive 100% design flow
Review Balancing report results
Check & record all equipment is receiving minimum design pressure
Check and record system differential pressure for pump control

15.3 Trace Heating systems

Trace Heating Level 2A Commissioning – Red Tag
Ensure that the pressure test of the pipework has been completed prior to any trace heating being installed.
Ensure all Pipework has been connected to equipment before trace heating is installed
Confirm all device labelling is correct as per site labelling schedule
Confirm all necessary cabling is correctly glanded to ensure the characteristics of the enclosure (e.g. IP56) which the cable enters can be maintained adequately
Confirm equipment has been installed / positioned as per approved shop drawings
Confirm all pipework grounding installation is per approved Equinix grounding installation drawing

Trace Heating Level 2B Commissioning – Yellow Tag
Confirm all insulation resistance testing of power cable is as per specification and requirements.
Confirm all electrical torque terminal records have been completed. (Where Applicable)
Confirm that the heating tape shows no signs of kinks or damage during install.
Confirm the heating tape is mounted on the lower part of the pipe at 4 o'clock or 8 o'clock position (depending on either one or two heating cables are used)
Confirm that fibre glass or aluminium tape is used to secure correctly on to the pipework
Confirm heating tape is installed to manufacturer guidelines.
Confirm that the ground-faulting equipment is used on each heating cable branch circuit.
Confirm 100% DCOS point to point has been completed (Where Applicable)

Trace Heating Level 3 Commissioning – Green Tag
Visual inspection (check control and monitoring system for moisture, corrosion, setpoints, switch operations and capillary damage)
Confirm vendor commissioning documentation indicated insulation resistance and continuity check on all heating cables to verify the integrity
Confirm 100% DCOS point to point to graphic has been completed.
Verify Each heater control system changes in temperature set points i.e. On/Off control with adjustment of temperature set point

Trace Heating Level 4 Commissioning – Blue Tag
Status and alarm points with DCOS (point to graphic) on ALL control modules
Verification the setpoints on ALL control modules are as design requirements

15.4 Air Handling Units (AHU)

AHU Level 2A Commissioning – Red Tag
Confirm the correct equipment as per design specification has been delivered
Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
Confirm the unit is correct dimensionally
Confirm installation location is available and correctly prepared – Level floor, no ongoing work
Confirm sufficient maintenance access
Confirm heating and cooling coils are undamaged
Confirm equipment has been installed / positioned as per approved shop drawings
Check equipment is properly mounted as per manufacturer's recommendations
Check adequate maintenance access has been provided for equipment
Confirm all control dampers are properly installed
Confirm all external accessories supplied, such as remote sensors, valves, actuators, differential pressure switch, are securely mounted in appropriate containment as per design drawings or securely stored for DH items.
Check no debris or foreign materials have entered the equipment
Confirm any internal cabling has appropriate strain relief in place.
Confirm all cabling has appropriate strain relief in place
Confirm system and equipment grounding installation is per approved Equinix Standards
Confirm room/area condition is acceptable as per the Equinix room readiness checklist

AHU Level 2B Commissioning – Yellow Tag
Confirm all earthing is completed and recorded
Confirm no damage to the electrical components
Electrical terminations are securely tightened
Confirm that the electrical bonding joints are completed according to the project pipe specification
Bag & paper filters are installed and clean
Drains and piping connections are complete
Drain trap has enough depth for fan suction with dirty filters when running at full hertz, and that it is filled with water
Duct connected, clean and (leakage tested where applicable)
Pipework connected, system cleaned and hydrostatically tested
Cabling connected and tested & DCOS point to point tested
Confirm that the necessary binder points, temperature pockets, filters (if applicable), flush bypass leg, drain points have been installed as per design specification. If Applicable)
Confirm that the in-line piping components are mounted in the correct orientation and with regard to flow direction.
Confirm ALL pipework flange bolts, are in place, show three (3) threads beyond the nut, and have been torqued correctly and documented-accordingly
Confirm control valve and damper actuators can operated freely under hand control.
Confirm any associated ductwork and components (such as dampers, actuators, pressure sensors) match design drawings and specifications

Duct connected, clean and leakage tested (Leakage test applicable to medium and high-pressure ducts only)
Confirm humidifier location and installation. (Where Applicable)
Confirm ALL pipework has been flushed and results are to BISRIA standards and recorded accordingly. Back flushing of coils has been performed and the strainers have been removed and cleaned.

AHU Level 3 Commissioning – Green Tag
Fan rotation correct
Verify AHU settings comply with approved design
Frost protection heater operating correctly
Main pre-heater operating correctly
Inlet / outlet damper operating correctly
Check VFD is as per Equinix approved settings
Check VFD is as per Equinix approved settings
Cooling coil is not damage and has been vented of all air
Confirm the equipment air flow design measurement is carried out and is as per design
VFD Hz setting at 100% design volume is recorded
Measurement of CHW at 100% design flowrate
Confirm & record Pressure profile across: Paper/Bag filters, Cooling/Heating Coils, Fan Inlet/Outlet
Verify point to point graphics and all alarms to the DCOS
Confirm AHU vendor commissioning records include a full parameter list, including but not limited to: • Alarm thresholds • Setpoints • Control Loop Parameters

AHU Level 4 Commissioning – Blue Tag
Check unit runs via the correct DCOS start command
Verify & record Firmware version and ensure Equinix Approval Global settings
Check & record inlet and outlet air temperatures
Check proper response to senor failures and all alarms operate to SOO
Verify AHU operates in accordance with the approved sequence of operations including:
Fan modulation control based on their respective sensors (E.g. Supply / Return air sensor or pressure sensors)
Supply air temperature control (valve modulation) from relevant sensor(s)
Component failure scenarios (fans / flow / valves switch etc.)
Unit response to alarms (high/low temperature / water leak detection, etc.)
CHW valve position during power failure and upon power restored. Record valve opening timing
Unit response to smoke/fire detection interface
Verify dehumidification, humification and heater function
Raise set point and verify that heater energises and maintain air temperature

Lower setpoint and verify that cooling coil (DX or CHW) operates and maintains setpoint
Raise the humidity setpoint and verify that the humidifier operates and maintains setpoint
Lower the humidity setpoint and verify that both the cooling coil and reheat operates correctly and maintains setpoint
Fail one fan (or one unit) and verify that redundant unit starts and maintains air flow
Short and long cycle power failure testing to confirm auto restart of VFD
Verify IBX network comms failure has no impact on operation of unit

15.5 Computer Room Air Handler (CRAH)

Computer Room Air Handler (CRAH) Level 2A Commissioning – Red Tag
Confirm the correct equipment as per design specification has been delivered
Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
Confirm the unit is correct dimensionally
Confirm installation location is correctly prepared – Level floor, no ongoing work
Confirm equipment has been installed / positioned as per approved shop drawings
Check equipment is properly mounted as per manufacturer's recommendations
Check adequate maintenance access has been provided for equipment
Confirm the face of each coil is clean and free from damage
Check no debris or foreign materials have entered the equipment
Confirm any internal cabling has appropriate strain relief in place.
Confirm all cabling has appropriate strain relief in place
Confirm system and equipment grounding installation is per approved Equinix Standards

Computer Room Air Handler (CRAH) Level 2B Commissioning – Yellow Tag
Confirm all earthing is completed and recorded
Confirm no damage to the electrical components
Electrical terminations are securely tightened
Confirm all insulation resistance testing of cable is as per specification and requirements
Confirm all electrical torque terminal records have been completed.
Confirm piping support are in accordance with the piping specification
Confirm that butterfly valves are provided with sufficient pipe lengths either side of the valve to enable operation.
Confirm ALL pipework flange bolts, are in place, show three (3) threads beyond the nut, and have been torqued correctly and documented accordingly.
Confirm external pipework and appropriate CRAH has appropriate leak pressure test documentation
Confirm that the electrical bonding joints are completed according to the project pipe specification
Confirm that all uninsulated pipework is painted in accordance with the piping specification
Confirm Local CRAH isolators are labelled accordingly
Confirm all CRAH air filters are clean and fitted.

Computer Room Air Handler (CRAH) Level 3 Commissioning – Green Tag
Confirm back flushing of coils has been performed and the strainers have been removed and cleaned
Confirm the CRAH has Equinix standard software and settings
Confirm PICV has the minimum pressure to operate and is set to the right flow rate
Verify and record ATS switch, if available, under-voltage and phase monitor relay settings per Equinix approved settings and operation with both supplies
Confirm all sensors have been calibrated in their final position with the relevant calibration certificates
Confirm 100% DCOS point to point & Point to graphics has been completed.
Verify the operation of the filter clog switch and verify setting is correct
Verify all alarms are operating correctly on HMI and DCOS graphics

Computer Room Air Handler (CRAH) Level 4 Commissioning – Blue Tag
Verify & record Firmware version and ensure Equinix Approval Global settings
Verify Fan modulation control based on their respective sensors
Verify redundancy of CRAH units as per approved Sequence of Operations
Prove operation of air fail switch
Remove power and re-instate to verify that unit re-starts correctly and record unit restart / controller reboot time
Verify CHW valve position during power failure and upon power restored. Valves should hold last state during startup
Confirm no water flow through cooling coil when control valve is positioned at 0%
Verify network failure alarm.

15.6 Computer Room Air Conditioner (CRAC) (DX)

Computer Room Air Conditioner (CRAC) Level 2A Commissioning – Red Tag
Confirm the correct equipment as per design specification has been delivered
Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
Confirm the unit is correct dimensionally
Confirm installation location is correctly prepared – Level floor, no ongoing work
Confirm equipment has been installed / positioned as per approved shop drawings
Check equipment is properly mounted as per manufacturer's recommendations
Check adequate maintenance access has been provided for equipment
Confirm the face of each coil is clean and free from damage
Check no debris or foreign materials have entered the equipment
Confirm any internal cabling has appropriate strain relief in place.
Confirm all cabling has appropriate strain relief in place
Confirm system and equipment grounding installation is per approved Equinix Standards

Computer Room Air Conditioner (CRAC) Level 2B Commissioning – Yellow Tag
Confirm all earthing is completed and recorded
Confirm no damage to the electrical components
Electrical terminations are securely tightened
Confirm all insulation resistance testing of cable is as per specification and requirements
Confirm all electrical torque terminal records have been completed.
Confirm piping support are in accordance with the piping specification
Confirm that butterfly valves are provided with sufficient pipe lengths either side of the valve to enable operation.
Confirm ALL pipework flange bolts, are in place, show three (3) threads beyond the nut, and have been torqued correctly and documented accordingly.
Confirm external pipework and appropriate CRAH has appropriate leak pressure test documentation
Confirm that the electrical bonding joints are completed according to the project pipe specification
Confirm that all uninsulated pipework is painted in accordance with the piping specification
Confirm Local CRAH isolators are labelled accordingly
Confirm all CRAH air filters are clean and fitted.

Computer Room Air Conditioner (CRAC) Level 3 Commissioning – Green Tag
Confirm back flushing of coils has been performed and the strainers have been removed and cleaned
Confirm the CRAC has Equinix standard software and settings
Confirm PICV has the minimum pressure to operate and is set to the right flow rate
Verify and record ATS switch, if available, under-voltage and phase monitor relay settings per Equinix approved settings and operation with both supplies
Confirm all sensors have been calibrated in their final position with the relevant calibration certificates
Confirm 100% DCOS point to point & Point to graphics has been completed.
Verify the operation of the filter clog switch and verify setting is correct
Verify all alarms are operating correctly on HMI and DCOS graphics
Confirm compressor redundancy (if applicable)
Verify the operation of the filter clog switch and verify setting is correct

Computer Room Air Conditioner (CRAC) Level 4 Commissioning – Blue Tag
Verify & record Firmware version and ensure Equinix Approval Global settings
Verify Fan modulation control based on their respective sensors
Verify redundancy of CRAC units as per approved Sequence of Operations
Prove operation of air fail switch
Remove power and re-instate to verify that unit re-starts correctly and record unit restart / controller reboot time
Verify CHW valve position during power failure and upon power restored. Valves should hold last state during startup
Confirm no water flow through cooling coil when control valve is positioned at 0%
Verify network failure alarm.
Confirm Unit units running on N under loaded and verify that N supports the Design Load

15.7 Direct Expansion (DX) Split Units

Direct Expansion (DX) Split Units Level 2A Commissioning – Red Tag

Level 2A Commissioning – Red Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L2, with appropriate paperwork provided

- Confirm the correct equipment indoor and outdoor has been delivered per design specification has been delivered and record nameplate information (check serial numbers, other identification and appropriate warning labels are in place)
- Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed

- Confirm the unit is correct dimensionally
- Confirm the unit is handed correctly
- Confirm installation location is available and correctly prepared – Level floor, no ongoing works, etc
- Confirm no damage occurred between the loading bay and installation
- Confirm the DX outdoor unit has been secured on the appropriate floor / wall mountings using the appropriate bolt holes
- Confirm equipment has been installed / positioned as per approved shop drawings
- Check equipment is properly mounted as per manufacturer's recommendations, for example, anti-vibration mounts where required
- Check adequate maintenance ace
- ss has been provided for equipment
- Check no debris or foreign materials have entered the equipment
- Confirm all external accessories supplied, such as baffle plates / sensors / tubing, are securely mounted in appropriate containment
- Confirm all necessary cabling is correctly glanded to ensure the characteristics of the enclosure (e.g. IP56) which the cable enters can be maintained adequately.
- Confirm all cabling has appropriate strain relief in place.
- Confirm all device labelling is correct as per site labelling schedule.
- Confirm the face of each coil is clean and free from damage
- Confirm piping materials / components are fully in accordance with the relevant project piping specification for the piping specification
- Confirm system and equipment grounding installation is per approved Equinix grounding installation drawing
- Red tag applied to the equipment and signed, recorded accordingly.

Direct Expansion (DX) Split Units Level 2B Commissioning – Yellow Tag

Level 2B Commissioning – Yellow Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L3, with appropriate paperwork provided

- Confirm equipment has been installed within the correct position
- Confirm all external accessories supplied, such as controller, sensors, are securely mounted in appropriate containment
- Confirm the DX outdoor unit has been secured on the appropriate floor / wall mountings using the appropriate bolt holes.
- Confirm no damage occurred between the loading bay and installation
- Confirming all earthing is completed and recorded
- Confirm all insulation resistance testing of cable is as per specification and requirements.
- Confirm all electrical torque terminal records have been completed.
- Confirm refrigerant piping support are in accordance with the piping specification
- Confirm that the in-line piping components are mounted in the correct orientation and with regard to flow direction.
- Confirm that the refrigerant charge labelling is displayed according to F-Gas Legislation (kg)
- Confirm that all refrigerant pipework lagging integrity and completion

- Confirm refrigerant DX pipework has appropriate leak pressure test ~~documentation to 1.1x working pressure for a period of 30 minutes~~. (Test pressure and duration is subjected to region specific) ~~to 1.1x working pressure for a period of 30 minutes~~
- Confirm refrigerant DX pipework has appropriate strength pressure test documentation to 1.5x working pressure for a period of 24 hour (longer periods may be appropriate for larger systems)
- Confirm refrigerant DX pipework has appropriate evacuation of system documentation to a vacuum of at least 2 torr observed on the remote site calibrated vacuum gauge
- Confirm that any internal condensate drainage pipework is routed to provide a continuous fall to the drain point.
- Confirm that any internal condensate pumps have been installed correctly with appropriate leak detection in place (if applicable)
- Confirm that the electrical bonding joints are completed according to the project pipe specification
- Local DX isolators are labelled accordingly.
- Confirm any external condenser isolators electrical feeds are bottom entry.
- Confirm all DX air filters are clean and fitted.
- Confirm condenser coils are clean, no restricting air flow issues, damage free and appropriate protection guards in place.
- Yellow tag applied to the equipment and signed, recorded accordingly.

Direct Expansion (DX) Split Units Level 3 Commissioning – Green Tag

Level 3 Commissioning – Green Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L4, w*ith appropriate paperwork provided*

- Verify & record firmware version and ensure Equinix Approval Global settings
- Confirm refrigerant DX pipework has appropriate leak pressure test documentation to 1.1x working pressure for a period of 30 minutes. (Test pressure and duration is subjected to region specific) to 1.1x working pressure for a period of 30 minutes
- Confirm refrigerant DX pipework has appropriate strength pressure test documentation to 1.5x working pressure for a period of 24 hour (longer periods may be appropriate for larger systems)
- Confirm refrigerant DX pipework has appropriate evacuation of system documentation to a vacuum of at least 2 torr observed on the remote site calibrated vacuum gauge.
- Confirm that the refrigerant charge labelling is displayed according to F-Gas Legislation (kg)
- Confirm all refrigerant pipework have been pressure and vacuum tested
- Confirm refrigerant charge is correct
- Confirm the DX unit is in accordance to Equinix standard software and settings
- Confirm VFD settings per approved Equinix settings
- Confirm that the relevant BMS communication has been installed as per site specification.
- Confirm that the relevant hard-wired signals are installed as per site specification
- Confirm all level 3 vendor commissioning is completed at 100% load conditions (per circuit) to ensure stable pressures and accurate refrigerant charges.
- Confirm all vendor documentation including all pressures and temperatures recorded variables has been received (calculate subcooling and superheat).
- Confirm ATS settings have Equinix standards and confirmed operation with both supplies.
- Verify and record ATS switch, if available, under-voltage and phase monitor relay settings per Equinix approved settings
- Confirm ATS source seek function

- Confirm all sensors have been calibrated in their final position with the relevant calibration certificates.
- Confirm 100% BMS point to point has been completed.
- Confirm 100% BMS point to point to graphic and all alarms has been completed.
- Confirm CRAC air flow design vs actual
- Verify the operation of the filter clog switch and verify setting is correct
- Confirm air On/Off Temperatures across coil
  - Confirm phase rotation is correct (if applicable)
  - Confirm compressor redundancy (if applicable)
  - Green tag applied to the equipment, signed and recorded accordingly

Direct Expansion (DX) Split Units Level 4 Commissioning – Blue Tag

Level 4 Commissioning – Blue Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L5, with appropriate paperwork provided

- Fail 1 fan in external heat rejection unit and verify unit continues to run (if applicable)
- Fail 1 compressor and verify unit continues to run (if applicable)
- Confirm compressor redundancy (if applicable)
- If controlled by room temperature sensor, verify start/stop operation
- If part of run and standby fail 1 unit and verify redundant unit starts
- If part of backup system, fail associated cooling and verify that DX unit starts and maintains set point
- Verify auto restart following power utility failure
- Alarms back to BMS graphics-unit controller
- All sensor calibration
- Verify proper minimum supply fan speeds or that there is some type of coil freeze protection
- Fan modulation control based on return air or Based on GDC, we are going for supply air control mostly however fan speed will be controlled by underfloor pressure sensor their respective sensors (Eg: Supply / Return air sensor or pressure sensors). Need to verify proper fan control from selected SOO, whether it be cold aisle control, hot aisle control, return air temp, etc. Verify against SOO
- Short and long cycle power failure testing to confirm auto restart of VFD and Compressors
- Verify proper response to sensor failures (return air temp, supply air temp, humidity sensor, damper end switch, etc.)
- Verify VFD inverter bypass operation
- Verify economizer system functioning (ambient temps. Permitting)
- Blue tag applied to the equipment, signed and recorded accordingly

15.8 Dry Air Cooler (DAC) & Hybrid Dry Air Cooler (HDAC)

Dry & Hybrid Dry Air Cooler DAC & HDAC Level 2A Commissioning – Red Tag

Level 2A Commissioning – Red Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L2, with appropriate paperwork provided

- Confirm the correct unit has been delivered per design specification has been delivered and record nameplate information (check serial numbers, other identification and appropriate warning labels are in place)
- Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
- Confirm the unit is correct dimensionally
- Confirm the unit is handed correctly
- Confirm installation location is available and correctly prepared – Level floor, no ongoing works, etc
- Confirm no damage occurred between the loading bay and installation
- Confirm equipment has been installed / positioned as per approved shop drawings
- Check equipment is properly mounted as per manufacturer's recommendations, for example, anti-vibration mounts where required
- Check adequate maintenance access has been provided for equipment
- Check no debris or foreign materials have entered the equipment
- Confirm all external accessories supplied, such as baffle plates / sensors / tubing, are securely mounted in appropriate containment
- Confirm all necessary cabling is correctly glanded to ensure the characteristics of the enclosure (e.g. IP56) which the cable enters can be maintained adequately.
- Confirm all cabling has appropriate strain relief in place.
- Confirm pipework and drain lines are installed as per manufacturers guidance
- Confirm all device labelling is correct as per site labelling schedule
- Confirm the face of each coil is clean and free from damage
- Confirm piping materials / components are fully in accordance with the relevant project piping specification for the piping specification
- Confirm that any internal condensate drainage pipework is routed to provide a continuous fall to the drain point.
- Confirm that any internal condensate pumps have been installed correctly with appropriate leak detection in place (if applicable)
- Confirm any external condenser isolators electrical feeds are bottom entry.
- Confirm coils are clean, no restricting air flow issues, damage free and appropriate protection guards in place
- Confirm system and equipment grounding installation is per approved Equinix grounding installation drawing
- Red tag applied to the equipment and signed, recorded accordingly

Dry & Hybrid Dry Air Cooler DAC & HDAC Level 2B Commissioning – Yellow Tag

Level 2B Commissioning – Yellow Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L3, with appropriate paperwork provided

- Confirm unit has been installed within the correct position
- Confirm no damage occurred between the loading bay and installation
- Confirm all external accessories supplied, such as controller, sensors, are securely mounted in appropriate containment
- Confirming all earthing is completed and recorded
- Confirm all insulation resistance testing of cable is as per specification and requirements.
- Confirm all electrical torque terminal records have been completed Confirm cabling is connected, tested and LOTO in place.
- Confirm pipework has been tested and is clean
- Confirm fans are free to turn and correct rotation
- Confirm that the in-line piping components are mounted in the correct orientation and with regard to flow direction.
- Confirm ~~external~~ internal pipework and has appropriate leak pressure test documentation
- Confirm external pipework and has appropriate leak pressure test documentation (Pressure test duration is subjected to region specific)
- Confirm external pipework has appropriate strength pressure test documentation to 1.5x working pressure or 150Psi whichever is higher. (Pressure test duration is subjected to region specific)
- Yellow tag applied to the equipment and signed, recorded accordingly

Dry & Hybrid Dry Air Cooler DAC & HDAC Level 3 Commissioning – Green Tag

Level 3 Commissioning – Green Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L4, with appropriate paperwork provided

- Verify Setpoint and Setpoint movement
- Verify PID controller functionality
- Verify Hybrid-on setpoint
- Verify fan speed min / max, timer on/off and periodic fan operations
- Confirm delay timings are in accordance to approved settings

- Verify freeze protection on
- Check biocide dosing functionality
- Check for conductivity
- Verify basin heater On/Off functionality
- Verify pumps On/Off functionality
- Operation of UV lamps
- Level measuring sensor
- Frost mode valve positions
- Blow down operation
- Confirm external internal pipework and has appropriate leak pressure test documentation
- Confirm external pipework and has appropriate leak pressure test documentation (Pressure test duration is subjected to region specific)
- Confirm external pipework has appropriate strength pressure test documentation to 1.5x working pressure or 150Psi whichever is higher. (Pressure test duration is subjected to region specific)
- Confirm ALL pipework has been flushed and results are to BISRIA standards and recorded accordingly.
- Confirm ALL pipework has been balanced and results are recorded accordingly.
- Verify that the unit firmware, settings and configuration are as per Equinix approved settings
- Verify and record ATS switch, if available, under-voltage and phase monitor relay settings per Equinix approved settings
- Verify VFD settings are per approved Equinix settings
- Confirm that the relevant BMS communication has been installed as per site specification.
- Confirm that the relevant hard-wired signals are installed as per site specification
- Confirm all vendor documentation has been received.
- Confirm ATS operation with both supplies and source seek function
- Measurement of water flow rates at 100% design flowrate
- Vibration signature meets specification
- Confirm all sensors have been calibrated in their final position with the relevant calibration certificates.
- Confirm 100% BMS point to point to graphic and all alarms has been completed.
- Confirm equipment air flow design vs actual.
- Confirm air On/Off Temperatures across coil
  - Confirm phase rotation is correct (if applicable).
- Green tag applied to the equipment, signed and recorded accordingly

Dry & Hybrid Dry Air Cooler DAC & HDAC Level 4 Commissioning – Blue Tag

Level 4 Commissioning – Blue Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L5, with appropriate paperwork provided

- Verify & record Firmware version and ensure Equinix Approval Global settings
- Verify adiabatic functions and adiabatic pump failures
- Verify that setpoints are maintained in all scenarios via setpoint manipulation
- Verify fan ramping via manipulation of setpoints
- Verify unit redundancy
- Verify PID control loops achieve stability
- Verify all operations during headload test.
- Check verify transition to and from hybrid operation

- Verify anti-freeze and water dump operations
- Proper water and air flow distribution
- Verify makeup system control and basin level monitoring function per SOO
- Verify proper response to sensor failures (return air temp, supply air temp, humidity sensor, damper end switch, etc
- Verify proper staging if applicable per system SOO
- Short and long cycle power failure testing ensure auto restart
- Verify VFD inverter bypass operations
- Calibration of all sensors – spot check 10%
- Re-test due to seasonal conditions to be considered Every effort should be made to complete all seasonal condition testing during project commissioning to avoid having to re-commission systems once in service.
- Blue tag applied to the equipment, signed and recorded accordingly

15.9 Cooling Towers (Open Water Circuit)

Cooling Towers (Open Water Circuit) Level 2A Commissioning – Red Tag

Level 2A Commissioning – Red Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L2, with appropriate paperwork provided

- Confirm the correct unit has been delivered per design specification has been delivered and record nameplate information (check serial numbers, other identification and appropriate warning labels are in place)
- Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
- Confirm the unit is correct dimensionally
- Confirm the unit is handed correctly
- Confirm installation location is available and correctly prepared – Level floor, no ongoing works, etc
- Confirm no damage occurred between the loading bay and installation
- Confirm equipment has been installed / positioned as per approved shop drawings
- Check equipment is properly mounted as per manufacturer's recommendations, for example, anti-vibration mounts where required
- Check adequate maintenance access has been provided for equipment
- Check no debris or foreign materials have entered the equipment
- Confirm all external accessories supplied, such as baffle plates / sensors / tubing, are securely mounted in appropriate containment
- Check levelling and alignment of units are correct and acceptable
- Check pulley sizes are in accordance with the manufacturer's specification and that alignment and belt tension is correct
- Confirm ALL pipework has been flushed and results are to BISRIA standards and recorded accordingly
- Confirm all necessary cabling is correctly glanded to ensure the characteristics of the enclosure (e.g. IP56) which the cable enters can be maintained adequately.
- Confirm all cabling has appropriate strain relief in place.

- Confirm pipework and drain lines are installed as per manufacturers guidance
- Confirm all device labelling is correct as per site labelling schedule.
- Confirm piping materials / components are fully in accordance with the relevant project piping specification for the piping specification
- Confirm strainer is installed on inlet water pipe to the cooling tower and that vents are installed at the highest point of the pipework
- Confirm that drain has been installed at the lowest point of equipment
- Confirm system and equipment grounding installation is per approved Equinix grounding installation drawing
- Red tag applied to the equipment and signed, recorded accordingly

Cooling Towers (Open Water Circuit) Level 2B Commissioning – Yellow Tag

Level 2B Commissioning – Yellow Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L3, with appropriate paperwork provided

- Confirm all external accessories supplied, such as controller, sensors, are securely mounted in appropriate containment
- Confirming all earthing is completed and recorded
- Confirm all insulation resistance testing of cable is as per specification and requirements
- Confirm cabling is connected, tested and LOTO in place
- Confirm external pipework and has appropriate leak pressure test documentation for 2 hours
- Confirm external pipework has appropriate strength pressure test documentation to 1.5x working pressure or 150Psi whichever is higher for 2 hours
- Confirm that the cooling tower basin leakage test have been completed
- Confirm pipework has been tested and is clean
- Confirm fans are free to turn and correct rotation
- Confirm filters are installed and undamaged
- Confirm water treatment has been completed
- Confirm drain/fill valves operated
- Yellow tag applied to the equipment and signed, recorded accordingly

Cooling Towers (Open Water Circuit) Level 3 Commissioning – Green Tag

Level 3 Commissioning – Green Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L4, with appropriate paperwork provided

- Confirm ALL pipework has been flushed and results are to BISRIA standards and recorded accordingly
- Confirm mains power is available to the motor at the correct voltage for the equipment. Check overload settings are in accordance with motor nameplate values
- Measure motor running current on all phases
- Confirm condenser water is distributed evenly
- Check make-up water supply is available to equipment
- Confirm ALL pipework has been balanced and results are recorded accordingly
- Measurement of water flow rates at 100% design flowrate
- Confirm cooling circuit has been vented of all air
- Vibration signature meets specification and ensure there is no signs of undue vibrations
- Verify cooling tower air flow is in accordance to manufacturers specifications
- Verify air flow failure and fan failure function
- Verify pump staging
- Confirm all sensors have been calibrated in their final position with the relevant calibration certificates
- All sensors
- Verify all cooling tower valve operations
- Verify that the unit firmware, settings and configuration are as per Equinix approved settings
- Verify VFD settings are per approved Equinix settings
- Cooling tower staging, water and fan control
- PID control loops achieve stability
- Cooling tower make-up water control functions correctly
- Condenser water temp setpoint reset strategy (if applicable)
- Chemical treatment systems are functioning correctly
- Water treatment plan is in place and operational
- Confirm 100% BMS point to point to graphic and all alarms has been completed
- Verify chemicals
- Green tag applied to the equipment and signed, recorded accordingly

Cooling Towers (Open Water Circuit) Level 4 Commissioning – Blue Tag

Level 4 Commissioning – Blue Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L5, with appropriate paperwork provided

- Verify & record Firmware version and ensure Equinix Approval Global settings
- Carry out fan failures test
- Carry out pump failures test
- Carry out staging in / out of cooling towers - load dependant
- Cooling tower failure scenarios
- Sequencer / plant manager / control plc master/slave failure
- Verify proper tower rotation sequences
- Staging in / out of pump with water temperature control
- Alarms back to BMS
- Cooling tower valves operation / failure scenarios

- Calibration of all sensors – spot check 10%
- Frost protection
- Carried out vibration test while cooldown is operating at full hertz
- Confirm operation of auto blowdown system (if applicable)
- Verify cooling tower make-up water system functionality
- Verify proper tower basin level setting and that pump doesn't pull air in at full speed
- Carry out cooling tower performance test and record all required information
- Blue tag applied to the equipment and signed, recorded accordingly

15.10 Chiller

Water & Air Cooled Chiller Level 2A Commissioning – Red Tag

Level 2A Commissioning – Red Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L2, w*ith appropriate paperwork provided*

- Confirm the correct chiller has been delivered per design specification has been delivered and record nameplate information (check serial numbers, other identification, appropriate warning labels are in place, integral pump packages, any loose items)
- Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
- Confirm the unit is correct dimensionally
- Confirm the unit is handed correctly
- Confirm installation location is available and correctly prepared – Level floor, no ongoing works, etc
- Confirm no damage occurred between the loading bay and installation
- Confirm equipment has been installed / positioned as per approved shop drawings
- Check equipment is properly mounted as per manufacturer's recommendations, for example, anti-vibration mounts where required
- Check adequate maintenance access has been provided for equipment
- Check no debris or foreign materials have entered the equipment
- Confirm all external accessories supplied, such as baffle plates / sensors / tubing, are securely mounted in appropriate containment
- Confirm all lifting eyes have been removed (if applicable)
- Confirm all necessary cabling is correctly glanded to ensure the characteristics of the enclosure (e.g. IP56) which the cable enters can be maintained adequately.
- Confirm all cabling has appropriate strain relief in place.
- Confirm all device labelling is correct as per site labelling schedule.
- Confirm piping materials / components are fully in accordance with the relevant project piping specification for the piping specification
- Confirm the correct BMS interface card has been supplied.
- Confirm system and equipment grounding installation is per approved Equinix grounding installation drawing
- Red tag applied to the equipment and signed, recorded accordingly.

Water & Air Cooled Chiller Level 2B Commissioning – Yellow Tag

Level 2B Commissioning – (Yellow Tag)

The following tests and checks to be undertaken and verified by contractor prior to continuing to L3, with appropriate paperwork provided

- Confirm chiller has been installed within the correct position
- Confirm no damage occurred between the loading bay and installation
- Confirm all external accessories supplied, such as baffle plates / sensors / tubing, are securely mounted in appropriate containment
- Confirming all earthing is completed and recorded
- Confirm all insulation resistance testing of cable is as per specification and requirements.
- Confirm all electrical torque terminal records have been completed.
- Confirm piping support are in accordance with the piping specification
- Check levelling and alignment of units are correct and acceptable
- Confirm that the in-line piping components are mounted in the correct orientation and with regard to flow direction.
- Confirm that butterfly valves are provided with sufficient pipe lengths either side of the valve to enable operation.
- Confirm the correct pipework orifice plate has been installed according to the project pipe specification.
- Confirm that the necessary binder points, temperature pockets, filters (if applicable), flush bypass leg, drain points have been installed as per design specification.
- Confirm that the electrical bonding joints are completed according to the project pipe specification
- Confirm that all uninsulated pipework is painted in accordance with the piping specification.
- Confirm all insulated pipework lagging integrity, completed and vapour sealed.
- Confirm ALL pipework flange bolts, are in place, show three (3) threads beyond the nut, and have been torqued correctly and documented accordingly
- Confirm refrigerant type used and charged are as per manufacturer / design specification
- Confirm external pipework and has appropriate leak pressure test documentation (Pressure test duration is subjected to region specific)
- Confirm external pipework has appropriate strength pressure test documentation to 1.5x working pressure or 150Psi whichever is higher. (Pressure test duration is subjected to region specific)
- Confirm that refrigerant pipework pressure, vacuum and leakage tests have been successfully completed and that there is no evidence of leakage from joints and valves
- Confirm that all chilled water pipework trace heating has been installed.
- Verify equipment grounding installation is per approved Equinix grounding installation drawing
- Yellow tag applied to the equipment and signed, recorded accordingly.

Water & Air Cooled Chiller Level 3 Commissioning – Green Tag

Level 3 Commissioning – Green Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L4, with appropriate paperwork provided

- Confirm ALL pipework flange bolts, are in place, show three (3) threads beyond the nut, and have been torqued correctly and documented accordingly
- Confirm refrigerant type used and charged are as per manufacturer / design specification
- Confirm external pipework and has appropriate leak pressure test documentation (Pressure test duration is subjected to region specific)
- Confirm external pipework has appropriate strength pressure test documentation to 1.5x working pressure or 150Psi whichever is higher. (Pressure test duration is subjected to region specific)
- Confirm that refrigerant pipework pressure, vacuum and leakage tests have been successfully completed and that there is no evidence of leakage from joints and valves
- Confirm external pipework and appropriate chiller has appropriate leak pressure test documentation to 1.1x working pressure for a period of 30 minutes.
- Confirm external pipework and appropriate chiller has appropriate strength pressure test documentation to 1.5x working pressure for a period of 1 hour
- Confirm ALL pipework has been flushed and results are to BISRIA standards and recorded accordingly.
- Verify that the unit firmware, settings and configuration are as per Equinix approved settings
- Verify and record ATS switch, if available, under-voltage and phase monitor relay settings per Equinix approved settings
- Verify VFD settings are per approved Equinix settings
- Verify and record under-voltage and phase monitor relay settings per approved relay settings
- Confirm the chiller has Equinix standard software and settings
- Confirm that the ambient sensor location is adequate (free-cooling chiller)
- Confirm that the relevant BMS communication has been installed as per site specification.
- Confirm that the relevant hard-wired signals are installed as per site specification
- Confirm all level 3 vendor commissioning is completed at 100% load conditions (per circuit) to ensure stable pressures and accurate refrigerant charges.
- Confirm glycol concentrations have been added according to design specification
- Confirm all sensors have been calibrated in their final position with the relevant calibration certificates.
- Confirm all chiller components are operational and chiller vendor commissioning records to include a full parameter list, including but not limited to:
- Auto/stop commands
- Demand limit setpoint
- Cooling modulation commands
- Evaporator water temp cut offs
- Min & max compressor speeds
- Control staging times
- High / low pressure settings
- Head pressure control setpoint and differential
- Free-cooling circuit operation and capacity
- Evaporator Entering / Leaving Fluid Temperature & Pressure
- Saturated Condenser Temperature (all circuits)
- Saturated Suction Temperature (all circuits)

- Discharge Superheat Temperature, Gas Temperature and Pressure (all circuits)
- Suction Pressure (all circuits)
- Oil Pressure and Oil Filter Differential Pressure (all circuit)
- Compressor Running Current
- Condenser Entering / Leaving Air Temperature (For air cool chiller)
- Condenser Entering / Leaving Water Temperature (For water cool chiller)
- Evaporator and condenser water flow rate
- Verify that the superheat is within acceptable parameters.
- Confirm hot gas bypass operations
- Confirm chiller valves operations
- Confirm all sensors have been calibrated in their final position with the relevant calibration certificates
- Confirm 100% BMS point to point has been completed.
- Confirm 100% BMS point to point to graphic and all alarms has been completed
  - Confirm phase rotation is correct (if applicable).
  - Confirm all refrigerant pipework is labelled accordingly
  - Green tag applied to the equipment, signed and recorded accordingly

Water & Air Cooled Chiller Level 4 Commissioning – Blue Tag

Level 4 Commissioning – Blue Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L5, with appropriate paperwork provided

- Verify & record firmware version and ensure Equinix Approval Global settings
- Verify & record chiller start-up to full load time timings
- Verify Short and long cycle power failure testing to confirm auto restart and record timing to achieve specified RLA
- Verify start up time (power return to full load) meets specification
- Apply 100% headload to chilled water and record supply & return temperatures, individual refrigerant pressures & temperatures, refrigerant & oil site glass observations.
- Carry out load tests to verify chiller capacity (25%, 50%, 75% load/1 hour and 100% load/8 hours region specific 8 Hours AP 4 Hours EMEA and NA)
- Confirm all chiller components are operational and chiller vendor commissioning records to include a full parameter list during the load test, including but not limited to:
- Chiller Sensible Cooling Capacity (kW)
- Chiller Total Cooling Capacity (kW)
- Evaporator and Condenser flow Rate inlet/outlet (L/S)
- Evaporator and Condenser Temp Inlet/Outlet (°C)
- Evaporator and Condenser circuit pressure drop and pressure differential (kPA)
- Oil pressure (kPa)
- Compressor Discharge / Suction Pressure (kPa)
- Compressor running current (Amps)
- Chiller plant efficiency
- Verify that the chiller can operate under low load condition without surging
- Carry out sound and vibration measurement under no load and full load condition
- Verify any component (compressor/fans/pumps/flow switch etc.) failure scenarios meets expected sequence of operations

- Verify transition to and from free-cooling, and confirm cooling capacity maintained through out
- Verify alarms through to BMS / Chiller graphics and alarm console
- Verify chiller plant operate in accordance with Equinix approved sequence of operations
- Sequencing of chillers for load (if applicable)
- Failure changeover of chillers (if applicable)
- Verify any adiabatic cooling / economizer function of the chillers (if applicable)
- Calibration of all sensors – spot check 10% (then if issues further 10% checked)
- Refrigerant leak detection to be tested and any associated systems
- Verify network and network controller failure alarm.
- Verify PLC / DDC failure and expected response from the chiller as per approved sequence of operations
- All field device control/monitoring points to be verified to the chiller controller and graphics
- CHW & Condenser

15.11 Pumps

CHW & Condenser Pumps Level 2A Commissioning – Red Tag

Level 2A Commissioning – Red Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L2, with appropriate paperwork provided

- Confirm the correct equipment has been delivered per design specification has been delivered and record nameplate information (check serial numbers, other identification, appropriate warning labels are in place, integral pump packages, any loose items)
- Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
- Confirm the unit is correct dimensionally
- Confirm the unit is handed correctly
- Confirm installation location is available and correctly prepared – Level floor, no ongoing works, etc
- Confirm no damage occurred between the loading bay and installation
- Confirm equipment has been installed / positioned as per approved shop drawings
- Check equipment is properly mounted as per manufacturer's recommendations, for example, anti-vibration mounts where required
- Check adequate maintenance access has been provided for equipment
- Check no debris or foreign materials have entered the equipment
- Confirm all external accessories supplied, such as baffle plates / sensors / tubing, are securely mounted in appropriate containment
  - Check no debris or foreign materials have entered the equipment
  - Confirm all lifting eyes have been removed (if applicable)
- Confirm all necessary cabling is correctly glanded to ensure the characteristics of the enclosure (e.g. IP56) which the cable enters can be maintained adequately.
- Confirm all cabling has appropriate strain relief in place.
- Confirm all device labelling is correct as per site labelling schedule.
- Confirm piping materials / components are fully in accordance with the relevant project piping specification for the piping specification
- Confirm the correct BMS interface card has been supplied.
- Confirm system and equipment grounding installation is per approved Equinix grounding installation drawing

- Red tag applied to the equipment and signed, recorded accordingly

CHW & Condenser Pumps Level 2B Commissioning – Yellow Tag

Level 2B Commissioning – Yellow Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L3, with appropriate paperwork provided

- Confirm equipment has been installed within the correct position
- Confirm no damage occurred between the loading bay and installation
- Confirm all external accessories supplied, such as baffle plates / sensors / tubing, are securely mounted in appropriate containment
- Confirming all earthing is completed and recorded
- Confirm all insulation resistance testing of cable is as per specification and requirements.
- Confirm all electrical torque terminal records have been completed.
- Confirm piping support are in accordance with the piping specification
- Check levelling and alignment of units are correct and acceptable
- Confirm that the in-line piping components are mounted in the correct orientation and with regard to flow direction.
- Confirm that butterfly valves are provided with sufficient pipe lengths either side of the valve to enable operation.
- Confirm the correct pipework orifice plate has been installed according to the project pipe specification.
- Confirm that the necessary binder points, temperature pockets, filters (if applicable), flush bypass leg, drain points have been installed as per design specification.
- Confirm that the electrical bonding joints are completed according to the project pipe specification
- Confirm that all uninsulated pipework is painted in accordance with the piping specification.
- Confirm all insulated pipework lagging integrity, completed and vapour sealed.
- Confirm that all chilled water pipework trace heating has been installed.
- Confirm pipework has been hydrostatically tested and that there is no evidence of leakage at joints or valves
- Confirm pump alignment test have been carried out.
- Confirm Motor/pump lubrication has been carried out as per manufacturer recommendations
- Yellow tag applied to the equipment and signed, recorded accordingly

CHW & Condenser Pumps Level 3 Commissioning – Green Tag

Level 3 Commissioning – Green Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L4, with appropriate paperwork provided

- Confirm pipework has been flushed and cleaned with the required test results documentation
- Confirm system and pump casing is vented of air
- Check power supply is available at the correct voltage
- Verify VFD settings are as per approved Equinix settings
- Verify vibration signature meets specification
- Verify pump rotation / direction is correct
- Verify pump head and flow meets pump curve
- Carry out closed head test and check against the pump curve to confirm the impeller size coresponds to the curve
- Verify pump flow at 30Hz, 40Hz and 50Hz.
- Measure motor running current on all phases
- Confirm that pump pressure developed does not exceed system design pressure
- Confirm system flow rate is balance and the correct different pressure used for control purposes are setup according
- Confirm all sensors have been calibrated in their final position with the relevant calibration certificates
- Confirm 100% BMS point to point to graphic and all alarms has been completed
- Green tag applied to the equipment and signed, recorded accordingly

CHW & Condenser Pumps Level 4 Commissioning – Blue Tag

Level 4 Commissioning – Blue Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L5, with appropriate paperwork provided

- Verify all pump automation change over
- Verify all pump failure scenarios
- Verify all associated sensors failure scenarios
- Verify all BMS controls and monitoring points
- Blue tag applied to the equipment and signed, recorded accordingly

15.12 Cooling Control System

Cooling Control System Level 2A Commissioning – Red Tag

Level 2A Commissioning – Red Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L2, with appropriate paperwork provided

- Confirm the correct equipment has been delivered per design specification has been delivered and record nameplate information (check serial numbers, other identification, appropriate warning labels are in place, integral pump packages, any loose items)
- Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
- Confirm the unit is correct dimensionally
- Confirm the unit is handed correctly
- Confirm installation location is available and correctly prepared – Level floor, no ongoing works, etc
- Confirm no damage occurred between the loading bay and installation
- Confirm equipment has been installed / positioned as per approved shop drawings
- Check equipment is properly mounted as per manufacturer's recommendations, for example, anti-vibration mounts where required
- Check adequate maintenance access has been provided for equipment
- Check no debris or foreign materials have entered the equipment
- Confirm all external accessories supplied, such as baffle plates / sensors / tubing, are securely mounted in appropriate containment
  - Check no debris or foreign materials have entered the equipment
  - Confirm all lifting eyes have been removed (if applicable)
- Confirm all necessary cabling is correctly glanded to ensure the characteristics of the enclosure (e.g. IP56) which the cable enters can be maintained adequately.
- Confirm all cabling has appropriate strain relief in place.
- Confirm all device labelling is correct as per site labelling schedule.
- Confirm the correct BMS interface card has been supplied

Cooling Control System Level 2B Commissioning – Yellow Tag

Level 2B Commissioning – Yellow Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L3, with appropriate paperwork provided

- Confirm equipment has been installed within the correct position
- Confirm no damage occurred between the loading bay and installation
- Confirm all pipework have been pressure tested and cleaned with test results documentation
- Confirm all associated equipment have completed Level 3 or Level 4 Commissioning where necessary
- Confirm all associated equipment electrical testing have completed with test results documentation
- Confirm associated equipment firmware version and settings are as per Equinix approved settings
- Confirm that the relevant devices hard-wired signals are installed as per site specification
- Confirm that the relevant BMS communication has been installed as per site specification
- Confirm all control devices are installed as per design installation drawing
- Verify control devices matches approved system architecture
- Yellow tag applied to the equipment and signed, recorded accordingly

Cooling Control System Level 3Commissioning – Green Tag

Level 3 Commissioning – Green Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L4, with appropriate paperwork provided

- Confirm all sensors have been calibrated in their final position with the relevant calibration certificates
- Confirm 100% BMS point to point to graphic and all alarms has been completed
- 100% Field Instrument Point to Point Testing
- 100% Field Instrument Failure / Alarms Testing
- 100% 3rd Party Equipment Point to Point Testing
- 100% 3rd Party Equipment Failure / Alarms Testing
- Verify BMS graphics matches site installation and approved schematics / graphics
- Verify trending and logging are available on the BMS
- Verify that system can control to required setpoints
- Graphics and point to point testing will need to be verified on both Master / Slave controllers
- Green tag applied to the equipment and signed, recorded accordingly

Cooling Control System Level 4 Commissioning – Blue Tag

Level 4 Commissioning – Blue Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L5, with appropriate paperwork provided

- Verify control test sequence is in accordance with Equinix approved sequence of operations including but not limited to:
- Verify system able to response to setpoint adjustment
- Verify pumps VSD speed controls
- Verify VSD bypass function (If applicable)
- Chilled Water and Condenser Water pump automation and failure scenarios
- Chiller automation and failure scenarios
- Cooling tower automation and failure scenarios
- Full cooling block failure scenarios
- All sensors control and failure scenarios
- Bypass valve operations
- Buffer tank operations during various mode (Eg: Charging / Discharging mode)

- Master / Slave controllers' operations and failures
- Verify system operations on both Master and Slave controllers
- Network and servers' failures
- All devices failures (Eg: PLC / DDC / Controllers)
- System operations under generator source
- Verify system operations under low load condition
- Verify Chiller and Cooling tower optimization functions
- Verify equipment rotation based on manual initiation and automation
- Staging in / out of equipment based on Equinix approved sequence of operations
- Verify & record Firmware version and ensure Equinix Approval Global settings
- Verify all CHW primary pump automation change over
- Verify all CHW Primary pump failure scenarios
- Verify all Condenser pump automation
- Verify all Condenser pump failure scenarios
- Verify all chiller automation
- Verify all chiller failure scenarios
- Verify all CHW secondary pump automation
- Verify all CHW secondary pump failure scenarios
- Verify all full cooling block failure scenarios
- Verify all BMS controls and monitoring points
- Calibration of all sensors – spot check 10%, then if issues further 10%
- Master to Slave failures
- Restoration of master
- Mains to gen fail overs on master/then slave only
- Failure of slave whilst master ok
- Restoration of Slave following slave failure
- 100% Field Instrument Failure Testing
- 100% Field Instrument Alarms Testing
- 100% 3rd Party Equipment Failure Testing
- 100% 3rd Party Equipment Alarms Testing
- 100% Setpoint Testing
- 100% Alarms Testing
- 100% Communication Failure Testing
- 100% Communication Alarm Testing
- 100% Operational Testing
- 100% Trend Testing
- 100% Server Failure Testing
- 100% Server Alarms Testing
- Blue tag applied to the equipment and signed, recorded accordingly

15.13 Cool Array (Cool Wall)

Cool Array (Cool Wall) Level 2A Commissioning – Red Tag

Level 2A Commissioning – Red Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L2, with appropriate paperwork provided

- Confirm the correct equipment has been delivered per design specification has been delivered and record nameplate information (check serial numbers, other identification, appropriate warning labels are in place, integral pump packages, any loose items)
- Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
- Confirm the coil sections are correct dimensionally
- Confirm the coil sections are handed correctly
- Confirm installation location is available and correctly prepared – Level floor, no ongoing works, etc
- Confirm no damage occurred between the loading bay and installation
- Confirm equipment has been installed / positioned as per approved shop drawings
- Check levelling and alignment of units are correct and acceptable
- Check equipment is properly mounted as per manufacturer's recommendations, for example, anti-vibration mounts where required
- Check adequate maintenance access has been provided for equipment
- Confirm that the coil sections and fan assemblies have been installed and bolted down correctly as per manufacturer guidelines
- Confirm all external accessories supplied, such as sensors / transmitters, are securely mounted in appropriate containment
  - Check no debris or foreign materials have entered the coil sections or headers
  - Confirm all lifting eyes have been removed (if applicable)
- Confirm all necessary cabling is correctly glanded to ensure the characteristics of the enclosure (e.g. IP56) which the cable enters can be maintained adequately.
- Confirm all cabling has appropriate strain relief in place.
- Confirm all device labelling is correct as per site labelling schedule.
- Confirm the face of each coil is clean and free from damage
- Confirm piping materials / components are fully in accordance with the relevant project piping specification for the piping specification
- Confirm the correct BMS interface card has been supplied.
- Confirm system and equipment grounding installation is per approved Equinix grounding installation drawing
- Red tag applied to the equipment and signed, recorded accordingly.

Cool Array (Cool Wall) Level 2B Commissioning – Yellow Tag

Level 2B Commissioning – Yellow Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L3, with appropriate paperwork provided

- Confirm the coil sections are the correct location
- Confirm coil sections have been installed within the correct position
- Confirm that the coil sections and fan assemblies have been installed and bolted down correctly as per manufacturer guidelines
- Confirm all external accessories supplied, such as sensors / transmitters, are securely mounted in appropriate containment
- Confirming all earthing is completed and recorded
- Confirm all insulation resistance testing of cable is as per specification and requirements.
- Confirm all electrical torque terminal records have been completed.

- Confirm piping support are in accordance with the piping specification
- Confirm that the in-line piping components are mounted in the correct orientation and with regard to flow direction.
- Confirm that butterfly valves are provided with sufficient pipe lengths either side of the valve to enable operation.
- Confirm the correct pipework orifice plate has been installed according to the project pipe specification.
- Confirm that the necessary binder points, temperature pockets, filters (if applicable), flush bypass leg, drain points have been installed as per design specification.
- Confirm loose items are fitted in correct location and orientation.
- Confirm fans can rotate freely within their casings.
- Confirm control valves can operated freely under hand control.
- Confirm that the electrical bonding joints are completed according to the project pipe specification
- Confirm that all uninsulated pipework is painted in accordance with the piping specification.
- Confirm all insulated pipework lagging integrity, completed and vapour sealed.
- Confirm that all chilled water pipework trace heating has been installed.
- Confirm ALL pipework flange bolts, are in place, show three (3) threads beyond the nut, and have been torqued correctly and documented accordingly.
- Confirm ~~external~~ internal pipework and appropriate chiller has appropriate leak pressure test documentation.
- Confirm external pipework and appropriate equipment has appropriate strength pressure test documentation to 1.5x working pressure or 150Psi whichever is higher for a period of 2 hour
- Confirm ALL pipework has been flushed and results are to BISRIA standards and recorded accordingly. Back flushing of coils has been performed and the strainers have been removed and cleaned
- Verify equipment grounding installation is per approved Equinix grounding installation drawing
- Yellow tag applied to the equipment and signed, recorded accordingly.

Cool Array (Cool Wall) Level 3Commissioning – Green Tag

Level 3 Commissioning – Green Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L4, with appropriate paperwork provided

- Confirm ALL pipework flange bolts, are in place, show three (3) threads beyond the nut, and have been torqued correctly and documented accordingly.
- Confirm external internal pipework and appropriate chiller has appropriate leak pressure test documentation to 1.1x working pressure for a period of 30 minutes.
- Confirm external pipework and appropriate equipment has appropriate strength pressure test documentation to 1.5x working pressure or 150Psi whichever is higher. for a period of 2 hour
- Confirm ALL pipework has been flushed and results are to BISRIA standards and recorded accordingly. Back flushing of coils has been performed and the strainers have been removed and cleaned
- Confirm ALL pipework has been balanced and results are recorded accordingly.
- Verify that the equipment firmware, settings and configuration are as per Equinix approved settings
- Verify and record ATS switch, if available, under-voltage and phase monitor relay settings per Equinix approved settings
- Confirm ATS settings have Equinix standards and confirmed operation with both supplies.
- Confirm ATS source seek function
- Measurement of CHW at 100% design flowrate

- Confirm no water flow through cooling coil when control valve is positioned at 0%
- Verify that the air volume meets 100% of design volume
- Confirm all sensors have been calibrated in their final position with the relevant calibration certificates
- Confirm the cool wall controller has Equinix standard software and settings
- Confirm that the relevant BMS communication has been installed as per site specification.
- Confirm that the relevant hard-wired signals are installed as per site specification
- Confirm all cool wall components are operational and vendor commissioning records to include a full parameter list, including but not limited to:
- Auto/stop commands
- Demand limit setpoint
- Cooling modulation commands
- Cooling water temp cut offs
- Min & Max fan speeds
- Control staging times
- High & Low Temperature settings
- High & Low Pressure settings control setpoint and differential
- Free-cooling circuit operation and capacity
- Confirm equipment air flow design measurement is carried out and is as per design specification
- Confirm air On/Off Temperatures across coil
- Verify the operation of the filter clog switch and verify setting is correct (If applicable)
- Confirm 100% BMS point to point to graphic and all alarms has been completed
  - Confirm fan phase rotation is correct (if applicable).
  - Confirm all fan assemblies run in unison.
  - Green tag applied to the equipment, signed and recorded accordingly

Cool Array (Cool Wall) Level 4 Commissioning – Blue Tag

Level 4 Commissioning – Blue Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L5, with appropriate paperwork provided

- Verify & record cool wall start-up to full load time timings
- Apply 100% headload to the cool wall and record supply & return temperatures, pressures & temperatures, fan speeds.

  Note: Due to the design of the cool wall assembly and its control, temporary Hot Aisle/Cold Aisle containment must be set up in order to prove the correct operation. Rack Emulators or Low DT 15-20kW heat to be placed in locations of racks with any spaces blocked off to simulate final set up
- ATS supply failures & source seek function
- Verify any component failure scenarios meets expected design
- Verify alarms through to BMS graphics and alarm console
- Sequencing of cool wall sections for load as per approved Sequence of Operations (if applicable)
- Failure changeover of cool wall sections as per approved Sequence of Operations (if applicable)
- Fan modulation control based on their respective sensors (Eg: Supply / Return air sensor or pressure sensors)
- Supply air control (valve modulation) from supply air sensors

- Verify proper response to sensor failures (return air temp, supply air temp, humidity sensor, damper end switch, etc
- Verify during high/low temperature and water leak alarms present on system, that operation of the equipment is not affected – continues to run
- Remove power and re-instate to verify that unit re-starts correctly and record unit restart / controller reboot time
- Verify CHW valve position during power failure and upon power restored. Record valve opening timing
- Prove operation of air fail switch (If fitted)
- Smoke detector interface with unit (If fitted)
- Verify group controls of equipment (If applicable)
- Verify network failure alarm.
- Verify network switch and group controller failure
- Blue tag applied to the equipment, signed and recorded accordingly

15.14 Generators Fuel Oil Storage Systems

Generators Fuel Oil Systems Level 2A Commissioning – Red Tag

Level 2A Commissioning – Red Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L2, w*ith appropriate paperwork provided*

- Confirm the correct equipment has been delivered per design specification has been delivered and record nameplate information (check serial numbers, other identification, appropriate warning labels are in place, integral pump packages, any loose items)
- Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
- Confirm installation location is available and correctly prepared – Level floor, no ongoing works, etc
- Confirm no damage occurred between the loading bay and installation
- Confirm equipment has been installed / positioned as per approved shop drawings
- Check levelling and alignment of units are correct and acceptable
- Check equipment is properly mounted as per manufacturer's recommendations, for example, anti-vibration mounts where required
- Check adequate maintenance access has been provided for equipment
- Confirm that the coil sections and fan assemblies have been installed and bolted down correctly as per manufacturer guidelines
- Confirm all external accessories supplied, such as sensors / transmitters, are securely mounted in appropriate containment
- Check levelling and alignment of units are correct and acceptable
  - Check no debris or foreign materials have entered the equipment
  - Confirm all lifting eyes have been removed (if applicable)
- Confirm all necessary cabling is correctly glanded to ensure the characteristics of the enclosure (e.g. IP56) which the cable enters can be maintained adequately.
- Confirm all cabling has appropriate strain relief in place.
- Confirm all device labelling is correct as per site labelling schedule.
- Confirm piping materials / components are fully in accordance with the relevant project piping specification for the piping specification
- Confirm the correct BMS interface card has been supplied.

- Confirm system and equipment grounding installation is per approved Equinix grounding installation drawing
- Red tag applied to the equipment and signed, recorded accordingly

Generators Fuel Oil Systems Level 2B Commissioning – Yellow Tag

Level 2B Commissioning – Yellow Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L3, with appropriate paperwork provided

- Confirm associated rooms ventilation system installation is completed
- Confirm bunds/drains/vents installation is completed
- Confirm adequate access to filters/strainers
- Confirm the equipment have been installed within the correct position
- Confirm the system is installed as per approved drawings
- Confirm that the equipment assemblies have been installed and bolted down correctly as per manufacturer guidelines
- Confirm all external accessories supplied, such as sensors / transmitters, are securely mounted in appropriate containment
- Confirming all earthing is completed and recorded
- Confirm all insulation resistance testing of cable is as per specification and requirements.
- Confirm all electrical torque terminal records have been completed.
- Confirm piping support are in accordance with the piping specification
- Check levelling and alignment of units are correct and acceptable
- Confirm that the in-line piping components are mounted in the correct orientation and with regard to flow direction.
- Confirm that butterfly valves are provided with sufficient pipe lengths either side of the valve to enable operation.
- Confirm the correct pipework orifice plate has been installed according to the project pipe specification.
- Confirm that the necessary binder points, temperature pockets, filters (if applicable), flush bypass leg, drain points have been installed as per design specification.
- Confirm loose items are fitted in correct location and orientation.
- Confirm control valves can operated freely under hand control.
- Confirm that the electrical bonding joints are completed according to the project pipe specification
- Confirm that all uninsulated pipework is painted in accordance with the piping specification.
- Confirm all insulated pipework lagging integrity, completed and vapour sealed.
- Confirm bulk fuel tanks and underground storage tanks (Primary & Secondary Layer) have been pressure tested to the appropriate pressure / duration and test results documented
- Confirm fuel pipe welded joint test, pressure test and flushing have been completed and test results documented
- Confirm ALL pipework flange bolts, are in place, show three (3) threads beyond the nut, and have been torqued correctly and documented accordingly.
- Confirm fuel pipework and appropriate equipment has appropriate strength pressure test documentation to 1.5x working pressure or 150Psi whichever is higher. for a period of 2 hour
- Confirm fuel pumps and its associated accessories installation have been completed and documented
- Confirm all pipe joints are inspected and brackets secure
- Confirm all electrical and control cabling are installed correctly for application
- Confirm all control devices are installed as per design installation drawing

- Verify control devices matches approved system architecture
- Confirm system installed as per DGS and to manufacturers specification
- Confirm ventilation system is installed
- Confirm adequate access to filters/strainers
- Confirm Bunds/drains/vents installed
- Pipework pressure test certificates
- Access control measures in place
- Joints inspected and brackets secure
- Cabling installed correctly for application
- Yellow tag applied to the equipment and signed, recorded accordingly

Generators Fuel Oil Systems Level 3 Commissioning – Green Tag

Level 3 Commissioning – Green Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L4, with appropriate paperwork provided

- Confirm ALL pipework flange bolts, are in place, show three (3) threads beyond the nut, and have been torqued correctly and documented accordingly.
- Confirm fuel pipework and appropriate equipment has appropriate strength pressure test documentation to 1.5x working pressure or 150Psi whichever is higher for a period of 2 hour
- Confirm ALL pipework has been flushed and test results are documented.
- Confirm pump performance test have been completed and the flow rates are verified against design specification
- Confirm all sensors have been calibrated in their final position with the relevant calibration certificates
- Confirm 100% BMS point to point to graphic and all alarms has been completed
- 100% Field Instrument / Sensors Point to Point Testing
- 100% Field Instrument / Sensors Failure / Alarms Testing
- 100% 3rd Party Equipment Point to Point Testing
- 100% 3rd Party Equipment Failure / Alarms Testing
- Verify BMS graphics matches site installation and approved schematics / graphics
- Verify trending and logging are available on the BMS
- Verify that the equipment firmware, settings and configuration are as per Equinix approved settings
- Verify and record ATS switch, if available, under-voltage and phase monitor relay settings per Equinix approved settings
- Confirm ATS settings have Equinix standards and confirmed operation with both supplies.
- Confirm ATS source seek function
- Green tag applied to the equipment and signed, recorded accordingly

- ATS operation
- 100% Field Instrument Failure Testing
- 100% Field Instrument Alarms Testing
- 100% 3rd Party Equipment Failure Testing
- 100% 3rd Party Equipment Alarms Testing
- 100% Setpoint Testing
- 100% Alarms Testing
- 100% Communication Failure Testing

- 100% Communication Alarm Testing
- Flow switches
- Differential pressure
- Discharge pressure
- Water separator
- Check monitoring/Alarms of day tanks
- Check Monitoring/Alarms of Bulk tanks
- Full design flow rate prove, including Day 1 flow rates

Generators Fuel Oil Systems Level 4 Commissioning – Blue Tag

Level 4 Commissioning – Blue Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L5, with appropriate paperwork provided

- Verify control test sequence is in accordance with Equinix approved sequence of operations including but not limited to:
- Verify bulk tank operates according to approved sequence of operations
- Verify bulk tank sequences in maintenance and overfill alarm modes
- Verify manual and automatic bulk tank to bulk tank transfer
- Verify lead/lag assignment for fuel requests to respective day tank according to approved sequence of operations
- Verify pump assignment starts on fuel request according to approved sequence of operations
- Record fuel filling flow rate and timing based on individual tank “call for fuel” request and all tanks “call for fuel” request
- Verify all pumps manual start operations
- Verify pumps VSD speed controls
- Verify VSD bypass function (If applicable)
- Verify all “Hands Over Auto” switches
- Fuel pumps automation and failure scenarios to prove system redundancy
- All valves automation and failure scenarios (Eg: power failures, fail open / close)
- Verify fuel dump strategy operations and record timing for fuel to be fully drained back to bulk tanks
- Verify fuel overflow system
- Verify operation of level switches
- Verify ALL fuel leak detection alarms (Eg: Bund, Pipe in Pipe etc)
- Verify water detection alarms
- Verify fuel polishing and water separator operations
- Verify fuel cooling operations (If applicable)
- Verify equipment rotation based on manual initiation and automation (If applicable)
- Verify that the power source to primary and secondary fuel system are from separate power blocks
- Demonstrate all auxiliary alarms and shutdowns function properly
- Master / Slave controllers’ operations and failures
- Verify system operations on both Master and Slave controllers
- Network and servers’ failures
- All devices failures (Eg: PLC / Controllers)
- Blue tag applied to the equipment and signed, recorded accordingly

- Graphics and point to point testing will need to be verified on both Master / Slave controllers (If applicable)
- Verify & record Firmware version and ensure Equinix Approval Global settings
- Bulk tank sequences in maintenance and overfill alarm modes
- Manual bulk tank to bulk tank transfer
- Lead/lag assignment for fuel requests
- Lead/Lag Tank failures (valves/pumps)
- Valve power failures, fail close/open scenarios
- Pump assignment starts on fuel request
- Pump failure testing
- Leak detect and pump switch over scenarios
- Fuel filling flow rate allows all tanks to fill at same time. - confirm
- Fuel flow rate check to design
- Fuel cooling operation
- Manual pump Changeover
- Fuel dump strategy operation
- Fuel polishing operation
- Verify operation of level switches
- Water detection in bulk tanks
- Bund leak detection operation,
- If Pipe in Pipe installed, leak detection system check
- Redundancy testing including PLC
- Check all relevant alarms are available to BMS

15.15 Leak Detection System

Leak Detection System Level 2A Commissioning – Red Tag
Confirm the correct equipment has been delivered per design specification
Confirm equipment has been installed within the correct position
Check adequate maintenance access has been provided for equipment
Confirm all cabling has appropriate strain relief in place
Verify equipment grounding installation is per approved Equinix Standards

Leak Detection System Level 2B Commissioning – Yellow Tag
Confirm all associated equipment electrical testing have completed with test results documentation
Confirm that the relevant DCOS communication has been installed as per site specification
Verify that the leak sensing cables are installed and labelled as per approved drawing
Verify that the leak sensing cables are properly secured and undamaged
Confirm all insulation resistance testing of cable is as per specification and requirements.
Confirm Drawings of tape locations mounted next to panel
Verify DCOS point to Point has been undertaken
Record Firmware version

Leak Detection System Level 3 Commissioning – Green Tag
Verify DCOS Point to graphics has been undertaken
Verify DCOS graphics matches site installation and approved schematics / graphic
Verify individual zone mapping on the panel and DCOS is as per approved drawings
Simulate cable break and verify alarm is activated shows on Panel & DCOS

Leak Detection System Level 4 Commissioning – Blue Tag
Simulate a leak alarm. Ensure that the alarm and correct distance is reflected on the panel and DCOS
Simulate a cable break. Ensure that the alarm and correct distance is reflected on the panel and DCOS
Carry out multiple leak alarms. Ensure that the alarm and correct distance is reflected on the panel and DCOS
Carry out communication failure between the system and DCOS
Verify that system restarts correctly after power loss
Verify that the battery backup is operational autonomy is within specification

15.16 Pressurisation Units

Pressurisation Units Level 2A Commissioning – Red Tag
Confirm the correct equipment has been delivered per design specification
Confirm equipment has been installed within the correct position
Check adequate maintenance access has been provided for equipment
Confirm all cabling has appropriate strain relief in place
Verify equipment grounding installation is per approved Equinix Standards

Level 2A Commissioning – Red Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L2, w*ith appropriate paperwork provided*

- Confirm the correct equipment has been delivered per design specification has been delivered and record nameplate information (check serial numbers, other identification, appropriate warning labels are in place, integral pump packages, any loose items)
- Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
- Confirm the unit is correct dimensionally
- Confirm the unit is handed correctly
- Confirm installation location is available and correctly prepared – Level floor, no ongoing works, etc
- Confirm equipment has been installed within the correct position
- Confirm no damage occurred between the loading bay and installation
- Check adequate maintenance access has been provided for equipment
- Confirm all external accessories supplied, such as baffle plates / sensors / tubing, are securely mounted in appropriate containment
- Check equipment is properly mounted as per manufacturer's recommendations, for example, anti-vibration mounts where required
  - Check no debris or foreign materials have entered the equipment
  - Confirm all lifting eyes have been removed (if applicable)
- Confirm all necessary cabling is correctly glanded to ensure the characteristics of the enclosure (e.g. IP56) which the cable enters can be maintained adequately.
- Confirm all cabling has appropriate strain relief in place.
- Confirm all device labelling is correct as per site labelling schedule.
- Confirm piping materials / components are fully in accordance with the relevant project piping specification for the piping specification
- Confirm the correct BMS interface card has been supplied.
- Verify system and equipment grounding installation is per approved Equinix grounding installation drawing
- Red tag applied to the equipment and signed, recorded accordingly

- Installation is complete
- Record pressure vessels are set to design pressure
- Equipment undamaged
- Pipework and power installed and tested

Pressurisation Units Level 2B Commissioning – Yellow Tag
Confirm the correct equipment has been delivered per design specification
Confirm equipment has been installed within the correct position
Check adequate maintenance access has been provided for equipment
Confirm all cabling has appropriate strain relief in place
Verify equipment grounding installation is per approved Equinix Standards

Level 2B Commissioning – Yellow Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L3, with appropriate paperwork provided

- Confirm equipment has been installed within the correct position
- Confirm no damage occurred between the loading bay and installation
- Check adequate maintenance access has been provided for equipment
- Confirm all external accessories supplied, such as baffle plates / sensors / tubing, are securely mounted in appropriate containment
- Check equipment is properly mounted as per manufacturer's recommendations, for example, anti-vibration mounts where required
- Confirming all earthing is completed and recorded
- Confirm all insulation resistance testing of cable is as per specification and requirements.
- Confirm all electrical torque terminal records have been completed.
- Confirm piping support are in accordance with the piping specification
- Check levelling and alignment of units are correct and acceptable
- Confirm that the in-line piping components are mounted in the correct orientation and with regard to flow direction.
- Confirm that butterfly valves are provided with sufficient pipe lengths either side of the valve to enable operation.
- Confirm the correct pipework orifice plate has been installed according to the project pipe specification.
- Confirm that the necessary binder points, temperature pockets, filters (if applicable), flush bypass leg, drain points have been installed as per design specification.
- Confirm that the electrical bonding joints are completed according to the project pipe specification
- Confirm that all uninsulated pipework is painted in accordance with the piping specification.
- Confirm all insulated pipework lagging integrity, completed and vapour sealed.
- Confirm pump alignment test have been carried out.
- Confirm Motor/pump lubrication has been carried out as per manufacturer recommendations
- Confirm all tanks are leakage free
- Confirm make up water is available
- Confirm all gauges are reading accurately
- Confirm top up water is available
- Confirm drains installed and run free
- Confirm gauges read correctly
- Yellow tag applied to the equipment and signed, recorded accordingly

Pressurisation Units Level 3 Commissioning – Green Tag
Confirm the correct equipment has been delivered per design specification
Confirm equipment has been installed within the correct position
Check adequate maintenance access has been provided for equipment
Confirm all cabling has appropriate strain relief in place

Verify equipment grounding installation is per approved Equinix Standards

Pressurisation Units Level 3 Commissioning – Green Tag
Confirm the correct equipment has been delivered per design specification
Confirm equipment has been installed within the correct position
Check adequate maintenance access has been provided for equipment
Confirm all cabling has appropriate strain relief in place
Verify equipment grounding installation is per approved Equinix Standards

Level 3 Commissioning – Green Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L4, with appropriate paperwork provided

- Confirm pipework has been hydrostatically tested and that there is no evidence of leakage at joints or valves
- Confirm pipework has been flushed and cleaned with the required test results documentation
- Confirm system and pump casing is vented of air
- Check power supply is available at the correct voltage
- Verify VFD settings are as per approved Equinix settings (If applicable)
- Verify vibration signature meets specification
- Verify pump rotation / direction is correct
- Verify pump head and flow meets pump curve
- Carry out closed head test and check against the pump curve to confirm the impeller size coresponds to the curve
- Verify pump flow at 30Hz, 40Hz and 50Hz. (If applicable)
- Measure motor running current on all phases
- Confirm that pump pressure developed does not exceed system design pressure
- Confirm that the water supply to the system shut off at the correct level.
- Confirm correct pressure is achieved and adjust the high / low pressure cut-out switches to the correct pressures
- Confirm make up water flow exceeds or matches pump delivery volumes
- Confirm operations of dry running cut off switch
- Confirm all sensors have been calibrated in their final position with the relevant calibration certificates
- Confirm 100% BMS point to point to graphic and all alarms has been completed
- Green tag applied to the equipment and signed, recorded accordingly

- Operation of both pumps and they are not airlocked
- Record cut in and cut out pressure switches on both pumps
- Over and under pressure alarms on unit operate correctly
- Make up water flow exceeds or matches pump delivery volumes
- Operation of dry running cut off switch
- Tank high level alarm
- Tank low level alarm

Pressurisation Units Level 4 Commissioning – Blue Tag
Confirm the correct equipment has been delivered per design specification
Confirm equipment has been installed within the correct position
Check adequate maintenance access has been provided for equipment
Confirm all cabling has appropriate strain relief in place
Verify equipment grounding installation is per approved Equinix Standards

Level 4 Commissioning – Blue Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L5, with appropriate paperwork provided

- Verify that the pressurization unit pump cuts-in and refills the system to the correct pressure and the pumps cut-out at the correct system pressure
- Verify system low pressure cut-out setting and ensure the system operates as per design sequence of operations
- Verify system high pressure cut-out setting and ensure the system operates as per design sequence of operations
- Blue tag applied to the equipment and signed, recorded accordingly
- Verify alarms back to BMS graphics and alarm console

15.17 Water treatment – Reverse Osmosis (RO)

Water treatment – Reverse Osmosis (RO) Level 2A Commissioning – Red Tag

Level 2A Commissioning – Red Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L2, with appropriate paperwork provided

- Confirm the correct equipment has been delivered per design specification has been delivered and record nameplate information (check serial numbers, other identification, appropriate warning labels are in place, integral pump packages, any loose items)
- Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
- Confirm the unit is correct dimensionally
- Confirm the unit is handed correctly
- Confirm installation location is available and correctly prepared – Level floor, no ongoing works, etc
- Confirm equipment has been installed within the correct position
- Confirm no damage occurred between the loading bay and installation
- Check equipment is properly mounted as per manufacturer's recommendations, for example, anti-vibration mounts where required
- Check adequate maintenance access has been provided for equipment
- Confirm all external accessories supplied, such as baffle plates / sensors / tubing, are securely mounted in appropriate containment
  - Check no debris or foreign materials have entered the equipment
  - Confirm all lifting eyes have been removed (if applicable)
- Confirm all necessary cabling is correctly glanded to ensure the characteristics of the enclosure (e.g. IP56) which the cable enters can be maintained adequately.
- Confirm all cabling has appropriate strain relief in place.
- Confirm all device labelling is correct as per site labelling schedule.
- Confirm piping materials / components are fully in accordance with the relevant project piping specification for the piping specification
- Confirm the correct BMS interface card has been supplied.
- Verify system and equipment grounding installation is per approved Equinix grounding installation drawing
- Red tag applied to the equipment and signed, recorded accordingly

- Provisions exist for sampling permeate from individual modules
- Provisions exist for sampling raw water, feed, permeate and concentrate streams from each stage and the total plant permeate stream
- Pressure relief protection is installed and correctly set

Water treatment – Reverse Osmosis (RO) Level 2B Commissioning – Yellow Tag

Level 2B Commissioning – Yellow Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L3, with appropriate paperwork provided

- Confirm equipment has been installed within the correct position
- Confirm no damage occurred between the loading bay and installation
- Check adequate maintenance access has been provided for equipment
- Confirm all external accessories supplied, such as baffle plates / sensors / tubing, are securely mounted in appropriate containment
- Confirm all piping and equipment is compatible with designed pressure, PH range, and protected from galvanic corrosion
- Confirm feed line, including RO feed manifold, is purged and flushed, before pressure vessels are connected
- Check equipment is properly mounted as per manufacturer's recommendations, for example, anti-vibration mounts where required
- Confirming all earthing is completed and recorded
- Confirm all insulation resistance testing of cable is as per specification and requirements.
- Confirm all electrical torque terminal records have been completed.
- Confirm piping support are in accordance with the piping specification
- Check levelling and alignment of units are correct and acceptable
- Confirm that the in-line piping components are mounted in the correct orientation and with regard to flow direction.
- Confirm that butterfly valves are provided with sufficient pipe lengths either side of the valve to enable operation.
- Confirm the correct pipework orifice plate has been installed according to the project pipe specification.
- Confirm that the necessary binder points, temperature pockets, filters (if applicable), flush bypass leg, drain points have been installed as per design specification.
- Confirm that the electrical bonding joints are completed according to the project pipe specification
- Confirm that all uninsulated pipework is painted in accordance with the piping specification.
- Confirm all insulated pipework lagging integrity, completed and vapour sealed.
- Confirm pump alignment test have been carried out.
- Confirm Motor/pump lubrication has been carried out as per manufacturer recommendations
- Confirm all tanks are leakage free
- Confirm make up water is available
- Confirm all gauges are reading accurately
- Confirm all instrument calibration certificates are available
- Confirm provisions exist for proper mixing of chemicals in the feed stream
- Confirm chemical addition points are at the correct location
- Confirm new/clean cartridge filter is installed directly upstream of the high-pressure pump
- Confirm dosage chemical tanks are filled with the right chemicals
- Confirm provisions exist for sampling permeate from individual modules
- Confirm provisions exist for sampling raw water, feed, permeate and concentrate streams from each stage and the total plant permeate stream
- Confirm pressure relief protection is installed and correctly set
- Yellow tag applied to the equipment and signed, recorded accordingly
-
- All piping and equipment is compatible with designed pressure, PH range, and protected from galvanic corrosion

- Media filters are backwashed and rinsed
- Feed line, including RO feed manifold, is purged and flushed, before pressure vessels are connected
- Calibration certificates
- Cleaning system is installed and operative
- Provisions exist for proper mixing of chemicals in the feed stream
- Chemical addition points are properly located
- New/clean cartridge filter is installed directly upstream of the high-pressure pump
- Dosage chemical tanks are filled with the right chemicals
- Provisions exist for sampling permeate from individual modules
- Provisions exist for sampling raw water, feed, permeate and concentrate streams from each stage and the total plant permeate stream
- Pressure relief protection is installed and correctly set

Water treatment – Reverse Osmosis (RO) Level 3 Commissioning – Green Tag

Level 3 Commissioning – Green Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L4, with appropriate paperwork provided

- Verify that the equipment firmware, settings and configuration are as per Equinix approved settings (If applicable)
- Confirm pipework has been hydrostatically tested and that there is no evidence of leakage at joints or valves
- Confirm pipework has been flushed and cleaned with the required test results documentation
- Confirm system and pump casing is vented of air
- Check power supply is available at the correct voltage
- Verify vibration signature meets specification
- Verify pump rotation / direction is correct
- Verify pump head and flow meets pump curve
- Verify pump flow rates are as per design specifications
- Carry out closed head test and check against the pump curve to confirm the impeller size coresponds to the curve
- Verify pump flow at 30Hz, 40Hz and 50Hz. (If applicable)
- Measure motor running current on all phases
- Confirm that pump pressure developed does not exceed system design pressure
- Confirm media filters are backwashed and rinsed
- Confirm cleaning system is installed and operative
- Check/anti-siphon valves are properly installed in chemical addition lines
- Provisions exist for preventing the RO system from operating when the dosage pumps or RO system are shut down
- Confirm planned instrumentation allows proper operation and monitoring of the pre-treatment and RO system
- Confirm interlocks, time delay relays and alarms are properly set
- Confirm membranes are protected from temperature extremes (freezing, direct sunlight, heater exhaust, etc.)
- Confirm permeate line is open
- Confirm reject flow control valve is in open position
- Confirm all sensors have been calibrated in their final position with the relevant calibration certificates
- Confirm 100% BMS point to point to graphic and all alarms has been completed
- Green tag applied to the equipment and signed, recorded accordingly

- Check/anti-siphon valves are properly installed in chemical addition lines
- Provisions exist for preventing the RO system from operating when the dosage pumps or RO system are shut down
- Planned instrumentation allows proper operation and monitoring of the pre-treatment and RO system
- Instrument calibration is verified with a calibrated meter
- Interlocks, time delay relays and alarms are properly set
- Membranes are protected from temperature extremes (freezing, direct sunlight, heater exhaust, etc.)
- Fittings are tight
- Permeate line is open
- Reject flow control valve is in open position

Water treatment – Reverse Osmosis (RO) Level 4 Commissioning – Blue Tag

Level 4 Commissioning – Blue Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L5, with appropriate paperwork provided

- Verify system functionality and operations are as per approved sequence of operations
- Blue tag applied to the equipment and signed, recorded accordingly
- Verify & record Firmware version and ensure Equinix Approval Global settings
- Ensure flow rates match design
- Verify alarms back to BMS graphics and alarm console

16.0 Monitoring and Network Systems

CMS / EMS / BCM / DCOS / DCIM

Level 2A Commissioning – Red Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L2, with appropriate paperwork provided

- Confirm the correct equipment has been delivered per design specification has been delivered and record nameplate information (check serial numbers, other identification, appropriate warning labels are in place, any loose items)
- Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
- Confirm the unit is correct dimensionally
- Confirm the unit is handed correctly
- Confirm installation location is available and correctly prepared – Level floor, no ongoing works, etc
- Confirm equipment has been installed within the correct position
- Confirm no damage occurred between the loading bay and installation
- Check adequate maintenance access has been provided for equipment
  - Check no debris or foreign materials have entered the equipment
  - Confirm all lifting eyes have been removed (if applicable)
- Confirm all necessary cabling is correctly glanded to ensure the characteristics of the enclosure (e.g. IP56) which the cable enters can be maintained adequately.
- Confirm all cabling has appropriate strain relief in place.
- Confirm all device labelling is correct as per site labelling schedule.
- Confirm the correct BMS interface card has been supplied
- Confirm approved FAT Testing Documentation is available

- Confirm approved Control panel General Arrangement and Schematic Drawings is available
- Confirm approved Server panel General Arrangement and Schematic Drawings is available
- Verify system and equipment grounding installation is per approved Equinix grounding installation drawing
  - Approved Instrument List
  - Approved Equipment List
  - Approved 3rd Party Equipment Interface Drawings
  - Approved I/O List
  - Approved SOO
  - Approved RTO
  - Approved FAT Testing Documentation
  - Approved Control Panel General Arrangement Drawings
  - Approved Control Panel Schematic Drawings
  - Approved Control Panel I/O List
  - Approved Software
- Approved Graphics
  - Approved Alarm List
  - Approved Communication Drawings
  - Approved Server Panel General Arrangement Drawings
  - Approved Server Panel Schematic Drawings
  - Approved Workstation Drawings
  - Red tag applied to the equipment and signed, recorded accordingly

Level 2B Commissioning – Yellow Tag
The following tests and checks to be undertaken and verified by contractor prior to continuing to L3, w*ith appropriate paperwork provided*

- Confirm equipment has been installed within the correct position
- Confirm no damage occurred between the loading bay and installation
- Check adequate maintenance access has been provided for equipment
- Confirm all associated equipment electrical testing have completed with test results documentation
- Confirm associated equipment firmware / software version and settings are as per Equinix approved settings
- Confirm that the relevant devices hard-wired signals are installed as per site specification
- Confirm that the relevant communication has been installed as per site specification
- Confirm all control devices are installed as per design installation drawing
- Verify control devices matches approved system architecture
- Confirm the following drawings are available and checked against:
  - Approved Instrument List
  - Approved Equipment List
  - Approved 3rd Party Equipment Interface Drawings
  - Approved I/O List
  - Approved SOO
  - Approved RTO
  - Approved Graphics
  - Approved Point List and Alarm List are in accordance to approved Global Point List
  - Approved Communication Drawings
  - Approved Workstation Drawings
- Confirm all cables point to point test is carried out
- 3rd Party Cable Testing Documentation Complete & Signed Off
- Yellow tag applied to the equipment and signed, recorded accordingly

Level 3 Commissioning – Green Tag
The following tests and checks to be undertaken and verified by contractor prior to continuing to L4, with appropriate paperwork provided

- Confirm all sensors have been calibrated in their final position with the relevant calibration certificates
- Verify communication between devices and server is establish
- Verify graphics matches site installation and approved schematics / graphics
- Verify graphics between Primary and Secondary server is correct
- Verify trending and logging are available and tested
- Verify all High & Low level interface cable point to point test have been completed
- Check all point and trunk wiring for shorts, grounds and induced/stray voltages
- Verify that the power source to all devices including server is correct
- Green tag applied to the equipment and signed, recorded accordingly

Level 4 Commissioning – Blue Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L5, with appropriate paperwork provided

(Testing to be from Field to final headend/graphics)

- Confirm 100% BMS point to point (High & Low Level Interface) to graphic and all alarms has been completed
    - 100% I/O Testing
    - 100% Field Instrument Point to Point Testing
    - 100% Field Instrument Failure / Alarms Testing
    - 100% 3rd Party Equipment Point to Point Testing
    - 100% 3rd Party Equipment Failure / Alarms Testing
    - 100% Communication Failure / Alarms Testing
    - 100% Server Failure / Alarms Testing
    - 100% Alarms Testing To Page Out System
    - 100% Command and Status Point to Point Testing
- Verify that system can control to required setpoints
- Verify recovery form complete power failure
- Verify devices and equipment redundancy
- Verify speed report and network functionality
- Verify firewall configuration certificate
- Verify auto response systems
- Verify that the failure of 1 network does not affect any other networks
- Graphics and point to point testing will need to be verified on both Master / Standby servers
- Blue tag applied to the equipment and signed, recorded accordingly

Communication Network

- Redundancy failure testing
- Speed report and network functionality
- Firewall configuration certificate
- Auto response systems
- Test failure of 1 network does not affect other networks

Installation Expectations

Critical asset devices monitoring customer load usage must have asset documentation provided 90 days prior to RFS to enable activation of circuits through correct channels in time;

Please see Appendix 03 for required templates.

10.2.1 - Appendix for Asset list for PDUs/Gateways/etc.….

10.2.2 - Appendix for Circuit layout of PDUs for circuit config

17.0 Life Safety Systems

17.1 Dry / Wet Sprinkler System

Level 2A Commissioning – Red Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L2, with appropriate paperwork provided

- Confirm the correct equipment has been delivered per design specification has been delivered and record nameplate information (check serial numbers, other identification, appropriate warning labels are in place, integral pump packages, any loose items)
- Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
- Confirm the unit is correct dimensionally
- Confirm the unit is handed correctly
- Confirm installation location is available and correctly prepared – Level floor, no ongoing works, etc
- Confirm equipment has been installed within the correct position
- Confirm no damage occurred between the loading bay and installation
- Check adequate maintenance access has been provided for equipment
- Check equipment is properly mounted as per manufacturer's recommendations, for example, anti-vibration mounts where required
- Confirm all external accessories supplied, such as baffle plates / sensors / tubing, are securely mounted in appropriate containment
  - Check no debris or foreign materials have entered the equipment
  - Confirm all lifting eyes have been removed (if applicable)
- Confirm all necessary cabling is correctly glanded to ensure the characteristics of the enclosure (e.g. IP56) which the cable enters can be maintained adequately.
- Confirm all cabling has appropriate strain relief in place.
- Confirm all device labelling is correct as per site labelling schedule.
- Confirm piping materials / components are fully in accordance with the relevant project piping specification for the piping specification
- Confirm the correct BMS interface card has been supplied.
- Verify system and equipment grounding installation is per approved Equinix grounding installation drawing
- Red tag applied to the equipment and signed, recorded accordingly.

Level 2B Commissioning – Yellow Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L3, with appropriate paperwork provided

- Confirm equipment has been installed within the correct position
- Confirm no damage occurred between the loading bay and installation
- Check adequate maintenance access has been provided for equipment
- Check equipment is properly mounted as per manufacturer's recommendations, for example, anti-vibration mounts where required
- Confirm all external accessories supplied, such as baffle plates / sensors / tubing, are securely mounted in appropriate containment
- Confirming all earthing is completed and recorded
- Confirm all insulation resistance testing of cable is as per specification and requirements.
- Confirm all electrical torque terminal records have been completed.
- Confirm piping support are in accordance with the piping specification
- Check levelling and alignment of units are correct and acceptable
- Confirm that the in-line piping components are mounted in the correct orientation and with regard to flow direction.
- Confirm that butterfly valves are provided with sufficient pipe lengths either side of the valve to enable operation.

- Confirm the correct pipework orifice plate has been installed according to the project pipe specification.
- Confirm that the necessary binder points, temperature pockets, filters (if applicable), flush bypass leg, drain points have been installed as per design specification.
- Check all sprinkler heads are properly installed and are of the correct ratings
- Check all smoke detectors are properly installed and are of the correct ratings
- Check all Dry / Wet control valves are properly installed and are in accordance with design specification
- Confirm that the electrical bonding joints are completed according to the project pipe specification
- Confirm continuity and insulation resistance test control cable for Dry / Wet system components including, Smoke Detectors, Manual Operation Button, Compressor Control Panel, Pump Control Panel, Solenoid Valve and Pressure Switches are completed
- Confirm that all uninsulated pipework is painted in accordance with the piping specification.
- Confirm pump alignment test have been carried out.
- Confirm Motor/pump lubrication has been carried out as per manufacturer recommendations
- Confirm batteries are installed for all panels as per approved design drawing
- Yellow tag applied to the equipment and signed, recorded accordingly

Level 3 Commissioning – Green Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L4, with appropriate paperwork provided

- Confirm pipework has been hydrostatically tested and that there is no evidence of leakage at joints or valves
- Confirm pipework has been flushed and cleaned with the required test results documentation
- Confirm gradient check is performed and that water can be drained off from the system
- Confirm system and pump casing is vented of air (If applicable)
- Confirm pump performance test is completed with test results documented
- Confirm all electrical checks have been completed with test results documented
- Confirm AC and DC power is available at the correct voltage for the equipment installed.
- Confirm panel is in service to charge batteries for 24 hours before proceeding with tests.
- Carry out battery autonomy test to rated duration followed by simulation of an alarm to verify that the battery can still support the system (Battery voltage to be recorded before and after test)
- Sound levels measurements and/or voice intelligibility meets specification and standards
- Confirm all required system pressure settings have been setup and documented
- Confirm High-Low pressure for pumps / compressors / nitrogen generator cut in / out functionality is tested and test results documented
- Confirm all smoke detectors point to point test (alarm & fault) have been tested and test results documented
- Confirm all sensors have been calibrated in their final position with the relevant calibration certificates (If applicable)
- Confirm 100% BMS point to point to graphic and all alarms has been completed (This include Fire Monitoring System Graphics)
- Green tag applied to the equipment and signed, recorded accordingly

Level 4 Commissioning – Blue Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L5, with appropriate paperwork provided

- Confirm 100% equipment / devices point to point (High & Low Level Interface) to graphic and all alarms has been completed
- Verify Dry / Wet sprinkler system activation functionality are as per approved sequence of operations
- Verify recovery form complete power failure
- Verify devices and equipment redundancy
- Verify failsafe operations of solenoid valves (If applicable)
- Verify speed report and network functionality
- Verify firewall configuration certificate
- Verify auto response system
- Verify and record all system final settings

- Verify that the failure of 1 network does not affect any other networks
- Graphics and point to point testing will need to be verified on both Master / Standby servers (If applicable) and to Fire Command Centre
- Green tag applied to the equipment and signed, recorded accordingly

17.2 Fire Alarm

Level 2A Commissioning – Red Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L2, with appropriate paperwork provided

- Visual inspection (Beacons/sounders/break glass)
- Point to point checks
- Full Cause and affect matrix documentation to be in place.
- Confirm the correct equipment has been delivered per design specification has been delivered and record nameplate information (check serial numbers, other identification, appropriate warning labels are in place, any loose items)
- Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
- Confirm the unit is correct dimensionally
- Confirm the unit is handed correctly
- Confirm installation location is available and correctly prepared – Level floor, no ongoing works, etc
- Confirm equipment has been installed within the correct position
- Confirm no damage occurred between the loading bay and installation
- Check adequate maintenance access has been provided for equipment
- Check equipment is properly mounted as per manufacturer's recommendations, for example, anti-vibration mounts where required
  - Check no debris or foreign materials have entered the equipment
  - Confirm all lifting eyes have been removed (if applicable)
- Confirm all necessary cabling is correctly glanded to ensure the characteristics of the enclosure (e.g. IP56) which the cable enters can be maintained adequately.
- Confirm all cabling has appropriate strain relief in place.
- Confirm all device labelling is correct as per site labelling schedule.
- Confirm piping materials / components are fully in accordance with the relevant project piping specification for the piping specification
- Confirm the correct BMS interface card has been supplied.
- Verify system and equipment grounding installation is per approved Equinix grounding installation drawing
- Red tag applied to the equipment and signed, recorded accordingly

Level 2B Commissioning – Yellow Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L3, with appropriate paperwork provided

- Cable testing (continuity, Insulation resistance)
- Confirming all earthing is completed and recorded
- Confirm all insulation resistance testing of cable is as per specification and requirements.
- Confirm all electrical torque terminal records have been completed.
- Check levelling and alignment of units are correct and acceptable
- Confirm that the in-line piping components are mounted in the correct orientation and with regard to.
- Check all sprinkler heads are properly installed and are of the correct ratings
- Check all smoke detectors are properly installed and are of the correct ratings
- Check all Dry / Wet control valves are properly installed and are in accordance with design specification
- Confirm continuity and insulation resistance test control cable for Dry / Wet system components including, Smoke Detectors, Manual Operation Button, Compressor Control Panel, Pump Control Panel, Solenoid Valve and Pressure Switches are completed

- Confirm all alarm loops are tested for open loop, short circuit and ground fault
- Confirm batteries are installed for all panels as per approved design drawing
- Yellow tag applied to the equipment and signed, recorded accordingly

Level 3 Commissioning – Green Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L4, with appropriate paperwork provided

- Confirm AC and DC power is available at the correct voltage for the equipment installed.
- Confirm panel is in service to charge batteries for 24 hours before proceeding with tests
- Carry out battery autonomy test to rated duration followed by simulation of an alarm to verify that the battery can still support the system (Battery voltage to be recorded before and after test)
- Battery back-up autonomy meets specification (isolate mains supply for '24' hours then operate fire detection and ensure sounders operate for specified time)
- Sound levels measurements and/or voice intelligibility meets specification and standards.
- Visual indicators correct allocation (xenon beacons and indicator lights)
- Inputs/outputs from other systems (e.g. Aspiration systems, fire protection systems, Lifts, Mechanical plant, BMS, Damper controls, security systems)
- Ensure "smoke travel" times for aspiration systems, thresholds and settings to be checked
- Point to graphic checks (detection or manual device operation)
- Text and indication at fire main and mimic panels (detection or manual device operation)
- Confirm all smoke detectors point to point test (alarm & fault) have been tested and test results documented
- Confirm all manual release / break glass have been tested and test results documented
- Confirm all sensors have been calibrated in their final position with the relevant calibration certificates (If applicable)
- Confirm 100% BMS point to point to graphic and all alarms has been completed (This include Fire Monitoring System Graphics)
- Green tag applied to the equipment and signed, recorded accordingly

Level 4 Commissioning – Blue Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L5, w*ith appropriate paperwork provided*

- Confirm 100% equipment / devices point to point (High & Low Level Interface) to graphic and all alarms has been completed
- Perform Cause and Affect Testing against the approved Cause and Affect Matrix for every zone and every cause on the matrix
- Mechanical Plant Shutdowns
- Damper operations
- Control and monitoring interfaces such as BMS
- Security and CCTV Interfaces
- Lifts to ground (or next safest level)
- External connections (e.g. adjacent buildings, Fire service call out, paging system)
- Ensure "smoke travel" times for aspiration systems, thresholds and settings to be checked
- Verify recovery form complete power failure
- Verify devices and equipment redundancy
- Verify failsafe operations of solenoid valves (If applicable)
- Verify speed report and network functionality
- Verify firewall configuration certificate
- Verify auto response system
- Verify and record all system final settings
- Verify that the failure of 1 network does not affect any other networks
- Graphics and point to point testing will need to be verified on both Master / Standby servers (If applicable) and to Fire Command Centre

- Blue tag applied to the equipment and signed, recorded accordingly

17.3 Water Mist Fire Suppression System

Level 2A Commissioning – Red Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L2, with appropriate paperwork provided

- Labels as per specification
- As Built/installed drawings issued.
- Install is free from issues.
- Confirm the correct equipment has been delivered per design specification has been delivered and record nameplate information (check serial numbers, other identification, appropriate warning labels are in place, integral pump packages, any loose items)
- Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
- Confirm the unit is correct dimensionally
- Confirm the unit is handed correctly
- Confirm installation location is available and correctly prepared – Level floor, no ongoing works, etc
- Confirm equipment has been installed within the correct position
- Confirm no damage occurred between the loading bay and installation
- Check adequate maintenance access has been provided for equipment
- Check equipment is properly mounted as per manufacturer's recommendations, for example, anti-vibration mounts where required
- Confirm all external accessories supplied, such as baffle plates / sensors / tubing, are securely mounted in appropriate containment
  - Check no debris or foreign materials have entered the equipment
  - Confirm all lifting eyes have been removed (if applicable)
- Confirm all necessary cabling is correctly glanded to ensure the characteristics of the enclosure (e.g. IP56) which the cable enters can be maintained adequately.
- Confirm all cabling has appropriate strain relief in place.
- Confirm all device labelling is correct as per site labelling schedule.
- Confirm piping materials / components are fully in accordance with the relevant project piping specification for the piping specification
- Confirm the correct BMS interface card has been supplied.
- Verify system and equipment grounding installation is per approved Equinix grounding installation drawing
- Red tag applied to the equipment and signed, recorded accordingly

Level 2B Commissioning – Yellow Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L3, with appropriate paperwork provided

- Pressure Test and report issued.
- Check distribution system pressure ahead of start up to ensure piping is not filled and discharge through a bulb broken during installation
- Confirming all earthing is completed and recorded
- Confirm all insulation resistance testing of cable is as per specification and requirements.
- Confirm all electrical torque terminal records have been completed.
- Confirm piping support are in accordance with the piping specification
- Check levelling and alignment of units are correct and acceptable
- Confirm that the in-line piping components are mounted in the correct orientation and with regard to flow direction.
- Confirm the correct pipework orifice plate has been installed according to the project pipe specification.
- Confirm that the necessary binder points, temperature pockets, filters (if applicable), flush bypass leg, drain points have been installed as per design specification.
- Check all sprinkler heads are properly installed and are of the correct ratings
- Check all smoke / flame / heat detectors are properly installed and are of the correct ratings
- Check all control valves are properly installed and are in accordance with design specification

- Confirm pipe pressure test have been completed in accordance to international standards or statutory requirements
- Confirm that the electrical bonding joints are completed according to the project pipe specification
- Confirm continuity and insulation resistance test control cable for Dry / Wet system components including, Smoke Detectors, Manual Operation Button, Compressor Control Panel, Pump Control Panel, Solenoid Valve and Pressure Switches are completed
- Confirm that all uninsulated pipework is painted in accordance with the piping specification.
- Confirm pump alignment test have been carried out.
- Confirm Motor/pump lubrication has been carried out as per manufacturer recommendations
- Confirm batteries are installed for all panels as per approved design drawing
- Yellow tag applied to the equipment and signed, recorded accordingly

Level 3 Commissioning – Green Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L4, with appropriate paperwork provided

- Pump failover – redundancy
- Tank leak detection
- Pump Control
- Confirm AC and DC power is available at the correct voltage for the equipment installed.
- Confirm panel is in service to charge batteries for 24 hours before proceeding with tests
- Carry out battery autonomy test to rated duration followed by simulation of an alarm to verify that the battery can still support the system (Battery voltage to be recorded before and after test)
- Sound levels measurements and/or voice intelligibility meets specification and standards.
- Visual indicators correct allocation (xenon beacons and indicator lights)
- Inputs/outputs from other systems (e.g. Aspiration systems, fire protection systems, Lifts, Mechanical plant, BMS, Damper controls, security systems)
- Point to graphic checks (detection or manual device operation)
- Text and indication at fire main and mimic panels (detection or manual device operation)
- Confirm all smoke / flame / heat detectors point to point test (alarm & fault) have been tested and test results documented
- Confirm all manual release / break glass have been tested and test results documented
- Confirm all sensors have been calibrated in their final position with the relevant calibration certificates (If applicable)
- Verify and record ATS switch, if available, under-voltage and phase monitor relay settings per Equinix approved settings
- Confirm 100% BMS point to point to graphic and all alarms has been completed (This include Fire Monitoring System Graphics)
- Green tag applied to the equipment and signed, recorded accordingly

Level 4 Commissioning – Blue Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L5, with appropriate paperwork provided

- Confirm 100% equipment / devices point to point (High & Low Level Interface) to graphic and all alarms has been completed
- Verify Pump auto Start on PD
- Verify & record Firmware version and ensure Equinix Approval Global settings
- Verify alarm and points to BMS
- Verify that the volume meets 100% of design at the end of line
- Verify ATS functionality on Pump Control Panel
- Verify ATS source seek functions
- Verify Control from Fire Alarm C&E
- Perform Cause and Affect Testing against the approved Cause and Affect Matrix for every zone and every cause on the matrix
- Verify equipment shutdown as per approved sequence of operations (If applicable)
- Verify failsafe operations of solenoid valves (If applicable)

- Confirm 100% equipment / devices point to point (High & Low Level Interface) to graphic and all alarms has been completed
- Verify recovery form complete power failure
- Verify devices and equipment redundancy
- Verify failsafe operations of solenoid valves (If applicable)
- Verify and record all system final settings
- Graphics and point to point testing will need to be verified on both Master / Standby servers (If applicable) and to Fire Command Centre
- Blue tag applied to the equipment and signed, recorded accordingly

17.4 Fire Dampers

17.5 Smoke extract fans

Level 2A Commissioning – Red Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L2, with appropriate paperwork provided

- Confirm the correct equipment has been delivered per design specification has been delivered and record nameplate information (check serial numbers, other identification, appropriate warning labels are in place, any loose items)
- Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
- Confirm the equipment is correct dimensionally
- Confirm the equipment is handed correctly
- Confirm installation location is available and correctly prepared – Level floor, no ongoing works, etc
- Confirm equipment has been installed within the correct position
- Confirm no damage occurred between the loading bay and installation
- Check adequate maintenance access has been provided for equipment
- Check equipment is properly mounted as per manufacturer's recommendations, for example, anti-vibration mounts where required
- Confirm equipment has been installed within the correct position and orientation.
- Check no debris or foreign materials have entered the equipment
- Confirm all lifting eyes have been removed (if applicable)
- Confirm all necessary cabling is correctly glanded to ensure the characteristics of the enclosure (e.g. IP56) which the cable enters can be maintained adequately.
- Confirm all cabling has appropriate strain relief in place and free from any moving parts.
- Confirming all earthing is completed and cable shielding is earthed (if using a cable without a separate PE conductor) accordingly at the required end and recorded.
- Confirm all device labelling is correct as per site labelling schedule.
- Confirm that the inlet damper is correctly fitted (if applicable)
- Confirm that the VFD has been mounted vertically on a solid surface or frame (if applicable)
- Confirm that the VFD if mounted on a solid service has the appropriate heatsink plate (if applicable)
- Confirm that all VFD electrical cabled is shielded to manufacturer guidelines.
- Confirm all control cabling is separate / segregated from any power cabling.
- Confirm the correct BMS interface card has been supplied
- Verify system and equipment grounding installation is per approved Equinix grounding installation drawing
- Red tag applied to the equipment and signed, recorded accordingly.

Level 2B Commissioning – Yellow Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L3, with appropriate paperwork provided

- Confirm no damage to the electrical components
- Electrical terminations are securely tightened
- Confirming all earthing is completed and recorded

- Confirm all insulation resistance testing of cable is as per specification and requirements.
- Confirm all electrical torque terminal records have been completed.
- Check levelling and alignment of units are correct and acceptable
- Duct connected, clean and leakage tested (Leakage test applicable to medium and high-pressure ducts only)
- Confirm that the electrical bonding joints are completed according to the project specification
- Power and controls cabling connected and tested
- Yellow tag applied to the equipment and signed, recorded accordingly

Level 3 Commissioning – Green Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L4, with appropriate paperwork provided

- Confirm the following information has been inputted into the inverter from the fan motor identification plate: voltage, nominal motor current, nominal frequency, nominal speed and nominal power.
- Confirm fan direction of rotation.
- Verify VFD settings are as per approved Equinix settings
- Confirm fan volume & pressure readings, any pressure drops (if applicable)
- Confirm the equipment air flow design measurement is carried out and is as per design specification
- Inlet / outlet damper operating correctly
- Operational checks completed as per sequence of operation
- Verify pump flow at 30Hz, 40Hz and 50Hz.
- Measure motor running current on all phases
- Confirm 100% BMS point to point to graphic and all alarms has been completed
- Green tag applied to the equipment, signed and recorded accordingly

Level 4 Commissioning – Blue Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L5, with appropriate paperwork provided

- Confirm 100% equipment / devices point to point (High & Low Level Interface) to graphic and all alarms has been completed
- Verify units operation via the correct start commands and that the require dampers open / close in accordance with unit start / stop
- Check unit runs via the correct C&E BMS start command and the require damper opens prior to fan enabling.
- Graphics and point to point testing will need to be verified on both Master / Standby servers (If applicable) and to Fire Command Centre
- Blue tag applied to the equipment and signed, recorded accordingly

17.6 Air Damper Controls

Level 2A Commissioning – Red Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L2, with appropriate paperwork provided

- Confirm the correct dampers has been delivered per design specification has been delivered and record nameplate information (check serial numbers, other identification, appropriate warning labels are in place, any loose items)
- Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
- Confirm the damper is correct dimensionally for the required application
- Confirm the equipment is handed correctly
- Confirm installation location is available and correctly prepared – Level floor, no ongoing works, etc
- Confirm equipment has been installed within the correct position
- Confirm no damage occurred between the loading bay and installation
- Check adequate maintenance access has been provided for equipment

- Check equipment is properly mounted as per manufacturer's recommendations, for example, anti-vibration mounts where required
- Check no debris or foreign materials have entered the equipment
- Confirm all lifting eyes have been removed (if applicable)
- Confirm damper has been installed within the correct position and orientation.
- Confirm all necessary cabling to the actuator is correctly glanded to ensure the characteristics of the enclosure (e.g. IP56) which the cable enters can be maintained adequately (if applicable).
- Confirm all cabling has appropriate strain relief in place and free from any moving parts.
- Confirm all control cabling is separate / segregated from any power cabling.
- Verify system and equipment grounding installation is per approved Equinix grounding installation drawing (If applicable)
- Red tag applied to the equipment and signed, recorded accordingly.

Level 2B Commissioning – Yellow Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L3, with appropriate paperwork provided

- Confirm no damage to the electrical components
- Electrical terminations are securely tightened
- Confirm all continuity testing of cable of necessary controls cabling.
- Confirming all earthing is completed and recorded
- Confirm all insulation resistance testing of cable is as per specification and requirements.
- Confirm all electrical torque terminal records have been completed
- Check levelling and alignment of units are correct and acceptable
- Duct connected, clean and leakage tested (Leakage test applicable to medium and high-pressure ducts only)
- Yellow tag applied to the equipment and signed, recorded accordingly.

Level 3 Commissioning – Green Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L4, with appropriate paperwork provided

- Confirm the installation is complete.
- Confirm the damper operational on the required control signal (0-100%)
- Stroke damper and check for full range of travel and no binding
- Verify fail open or in place upon loss of power or control signal
- Confirm the dampers operate to site approved cause and effect matrix
- Confirm that the required damper feedbacks are being received on the BMS (if applicable)
- Confirm 100% BMS point to point to graphic and all alarms has been completed
- Green tag applied to the equipment, signed and recorded accordingly
- Damper operating correctly 0 to 100% via the relevant control signal
- Damper operating as per the site approved cause & effect matrix
- Damper feedback is reading on the BMS (if applicable)

17.7 Emergency Lighting

Level 2A Commissioning – Red Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L2, with appropriate paperwork provided

- Confirm installation location is correct and as per drawings
- Confirm lighting has been installed within the correct position and orientation.
- Confirm the correct equipment has been delivered per design specification has been delivered and record nameplate information (check serial numbers, other identification, appropriate warning labels are in place, any loose items)
- Confirm no damage has occurred in transit and all transit bolts, wedges etc. have been removed
- Confirm the equipment is correct dimensionally for the required application
- Confirm the equipment is handed correctly
- Confirm installation location is available and correctly prepared – Level floor, no ongoing works, etc
- Confirm equipment has been installed within the correct position
- Confirm no damage occurred between the loading bay and installation
- Check adequate maintenance access has been provided for equipment
- Check equipment is properly mounted as per manufacturer's recommendations
- Confirm all necessary cabling to the lighting is correctly glanded to ensure the characteristics of the enclosure (e.g. IP56) which the cable enters can be maintained adequately (if applicable).
- Confirmation of running man idents are to the emergency escape plan.
- Confirm all cabling has appropriate strain relief in place and free from any moving parts.
- Confirm all control cabling is separate / segregated from any power cabling.
- Verify system and equipment grounding installation is per approved Equinix grounding installation drawing (If applicable)
- Red tag applied to the equipment and signed, recorded accordingly

Level 2B Commissioning – Yellow Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L3, with appropriate paperwork provided

- Continuity testing of cables and reports shared.
- Confirm no damage to the electrical components
- Electrical terminations are securely tightened
- Confirm all continuity testing of cable of necessary power and controls cabling.
- Confirming all earthing is completed and recorded
- Confirm all insulation resistance testing of cable is as per specification and requirements.
- Confirm all electrical torque terminal records have been completed
- Yellow tag applied to the equipment and signed, recorded accordingly

Level 3 Commissioning – Green Tag

The following tests and checks to be undertaken and verified by contractor prior to continuing to L4, with appropriate paperwork provided

- Functional testing of switches, PIR's & lighting control systems
- Check Lux level against global standards and local statutory requirements during normal operations and emergency operations (normal lighting)
- Battery discharge test for emergency lighting to prove autonomy meets specification and global standards
- Green tag applied to the equipment and signed, recorded accordingly
- Lux level checks against global standards (emergency lighting)

18.0 Heat Load Test (HLT)

Pre-requisite to Level 5 Commissioning – Mechanical (Heat Load) Test

The follow scenarios shall be included but not limited to:

- White Space + EPRs Heat Load Test
- Apply head load at 25%, 50%, 75% & 100% for 1 hours at each stage other than 100% where 4 hours is required. When sourcing heaters ensure there is 15-20% allowance for voltage drop and failed elements
- Record all sensor reading / trending via BMS controls and visual checks
- Check all redundancy failure testing down to N to verify cooling meets design

- Cool Array/CRAH redundancy N+2
- CHW pipework redundancy test (Ring Mains and Riser Failures)
- Cool Array/CRAH N-1 test with Load in Data Hall (thermal runaway)
- CRAH N-2 test with Load in Data Hall (Thermal runaway test)
- Perform rate of temperature rise for Data Halls (Mechanical Failure) to 27.0° and 35°C followed by rate of normalize to acceptable SLA temperature limits. Record all required timing, trending and BMS print screens
- Perform rate of temperature rise for Data Halls (Electrical Failure) to 27.0° and 35°C followed by rate of normalize to acceptable SLA temperature limits. Record all required timing, trending and BMS print screens
- Simulate primary source failure to Cooling equipment (Eg: CRAHs, FCUs etc) and observe ATS transfer to secondary source
- Simulate CRAH network controller failures to verify that there will be no impact to the Data Halls and EPRs
- Verify system response with CRAH sensor failures
- Cooling Plant Failure and Out of service Scenarios Maintenance
- BMS Comms Network Main switch failure
- Plant manager PLC redundancy failures
- Cooling plant Sequencer failure
- Verify proper CRAH system operation per selected SOO (teaming, staging, etc. as applicable).
-

19.0 Integrated System Testing (IST)

Level 5 Commissioning – White Tag – Electrical System Tests

The follow scenarios shall be included but not limited to:

- HV A supply to be failed by removing mains sensing fuse or switching off utility incoming in HV A. Simulating total failure of Utility A with Load in Data Hall connected to power source A
- HV B supply to be failed by removing mains sensing fuse or switching off utility incoming in HV B. Simulating total failure of Utility B with Load in Data Hall connected to power source B.
- HV A & B supply to be failed by removing mains sensing fuse in HV A& B. Simulating total failure of Utility A & B simultaneously with Load in Data Hall connected to power source A and B.
- Dead Bus Test:
- Fail Utility
- Fail Utility
- Transfer to generator
- Fail generators
- Main board has no supply on either Gen or utility – Dead Bus
- Reinstate utility to prove auto restoration to utility
- Dual Mains Failure followed by cascade generator failure - avoid Gen set overload scenario
- Utility BLIP Test (Before starting test ensure all systems are in normal operation with timers and settings confirmed), perform within the 3 conditions below
    a. During Generator engine cool down
    b. After transfer to generators to check mains prove timer reset
    c. Before transfer to generators, to see if system commits to generators or stays on utility
- Swing generator failure scenarios – if applicable
- NER failure scenarios – if applicable
- Simulate UPS inverter failures and verify ASTS holds on same source
- Simulate complete loss of utility and verify generator N+X capacity, ATS transfers per SOO
- Ensure that all cooling equipment restarts per SOO and cooling is fully restored within time duration specified in test script

Level 5 Commissioning – White Tag – Mechanical System Tests

- Simulate MCC failures and verify that the chiller plant operates in accordance to approved sequence of operations
- Simulate chiller plant equipment failure and verify chiller plant response is in accordance to approved sequence of operations
- Verify cooling system staging and replacement is in accordance to approved sequence of operations during all equipment failure scenarios
- Verify system response with sensor failures (chilled water temp, flow, etc)
- Buffer tank discharge test to verify thermal capacity time
- Chiller rapid recovery / restart test
- Plant manager PLC redundancy failures
- Plant manager system controllers / sequence / network ring failures to verify redundancy
- Cooling Plant Failure and Out of service Scenarios-Maintenance
- BMS communication network main switch and ring failure
- Fail primary BMS or BCU controllers and ensure bump-less transfer to backup controller

Level 5 Commissioning – White Tag – Fire Protection System Tests

The follow scenarios shall be included but not limited to:

- Verify dry sprinkler system activation is in accordance with approved sequence of operations and local statutory requirements

- Verify gas suppression system activation is in accordance with approved sequence of operations and local statutory requirements
- Verify the fire alarm system interface with cooling equipment and security system are in accordance with approved sequence of operations and local statutory requirements
- The test is to be conducted for all areas / rooms

Maintenance scenarios

- HV A Maintenance (use Bus coupler)
- HV B Maintenance (use Bus coupler)
- Maintenance of Generator/ Gen Panels and load banking of Generator
- Transformer failure using LV Bus coupler – [Source failure due to thermal trip of Main LV board feeder]
- SCADA PLC failure (Master/Slave transfer and Network Failure]
- Mechanical UPS failure to prove ATS changeover
- IT and Mechanical UPS Bypass for Maintenance
- Machinal UPS Bypass for Maintenance
- Generator shunt trip

Note:

1- Install load banks / heaters on the Colo floor to closely simulate actual server heat loads
2- Additional data loggers, PQA and thermohydro-graphs will be required
3- Capture and record PUE values and related data at each load step
4- Ensure all related trending are enable prior to the commencement of the test
5- Perform print screens on the required monitoring system before and after each test

20.0 Handover – Ready for RFS

Go Live Process

As part of the Testing and Commissioning and Operational Readiness, of all new IBX Data Centres, significant expansion to existing IBX Data Centres and standalone equipment replacement. All below points must be conducted;

1. Review SAT/IST documentation prior to testing.

2. Test scenarios are relevant to the equipment and systems being tested and includes testing based on Equinix's operational experiences. As well as lessons learnt from Physical Audits, are incorporated/tested in future projects from day one such as specific parameter settings, latest firmware revisions etc.

3. Witness scenarios as part of SAT/IST to ensure systems works as expected in accordance with the original design specification and Global Design Standards.

4. Review of Test and Commissioning documents/records, Operation & Maintenance Manuals and asset data base (format ready for upload into Maximo) is in accordance with the outputs from the project team.

5. Work closely with local TFM teams as part of the go live/handover process. This will include phased expansion and standalone equipment replacement for existing IBX Data Centres to support the local teams to ensure existing operations is not compromised and maintain availability to customers.

6. Review Maximo data sheets

Commissioning/Project Close Out

List below is the expected output in regard to project close out:

1. Complete documentation turnover including;
    a. Final Commissioning Report from Commissioning Authority
    b. O&M Manuals

c. Recommended spare parts lists
d. Warranty information
e. All drawings in “As Built” Revision, detailing previous phases so that drawings cover entirety of installed equipment (inclusive of previous phases, and any non Equinix controlled equipment, where relevant.
f. Coordination study with breaker settings
g. Test and Balance Reports
h. All testing and inspections performed including procedures used
i. Test results with supporting data
j. Final deficiency list including all closed and remaining open items
k. Data sheets verifying as left settings on all circuit breakers, UPS, ATS, STS, VFDs, etc.
l. Carry out Lesson Learned workshop

2. Operations Readiness
    a. Training – All facility team members trained on new equipment
    b. All equipment is properly labelled
    c. Safety procedures in place

3. Maximo Implementation
    a. All assets uploaded into Share Point
    b. PMs created for all assets

Please refer to Appendix 04 to find the Go-Live Checklist.

Example Agenda – Preparation for Go Live / Handover

1. IST Testing and Witnessing, any concerns or issues in the operation of the plant to date?

2. Resource and Training of Equinix Team on Critical Plant and systems in preparation for RFS
    a. Resource plan
    b. Review of training program
    c. Outstanding training requirements
    d. Identified Risks

3. Remedial Actions and deficiency List – Review of list to date, any other items for inclusion before the agreed cut-off

4. Placement of Maintenance Contracts for Critical Plant and Systems
    a. Contracts Signed and in place with PO issued
    b. Remaining Contracts (if any) requiring signature and PO to be issued.
    c. Identified risks at point of handover without Maintenance Contracts in place

5. Placement of contracts for soft services:
    a. Security – Access badges in preparation for RFS how will these be issued and stored on site. Storage of keys and key control, how will this be done?
    b. Cleaning Contract – Waste Disposal, Recycling (e.g. Cardboard Compactor), Cleaning of General Areas (Front of House) and Offices, Sanitary Services and Pest Control (Rodents and Birds)
    c. External Maintenance – Gardening, Cleaning/Sweeping of Car Park Area
    d. Vending Machine/s
    e. Is there any leased office equipment? e.g. printers, fax, photocopiers, shredders, etc.
    f. Portable Fire Extinguishers

6. Maximo – Assets database, setting up maintenance plans and Job Plans ready for handover
    a. Statutory Maintenance – Emergency Lighting, Water Systems (tap temperatures, chlorination of shower heads), fire detection, lightning protection, smoke extract Fans, log books and maintenance records.

7. Corporate branding and marketing

8. H&S
    a. Signage (Statutory)
    b. AOB under H&S

9. AOB

Appendix 02 – Critical Asset List template

PDU Asset Information template - Required 90 days prior to RFS.

Example Information included for reference only

					Gateway			BCPM Board					
Asset Description	**Number of Circuit Breakers**	**Panel Type**	**BCM Enabled**	Data Correct?	Manufacturer / Model	IP Address	Capable of multiple Modbus Masters	Manufacturer / Model	Addresses	Modbus Register Provided	**Layout Drawing Ref.**	**Install Type**	**Notes**
Electrical panel/RPD		Panel Type									(to be provided if not		
Panel Name											a current Layout)		
PA3-PDU-1.10	84	AC	N	Yes									no BCM
PA3-PDU-1.12	84	AC	N	Yes									no BCM
PA3-PDU-1.24	84	AC	Y	Yes	Schneider / EGX150	10.20.14.213	Yes	Schneider / A084S	1,2	Yes	S 84Way-42Pan	Retrofit	
PA3-PDU-1.25	84	AC	Y	Yes	Schneider / EGX150	10.20.14.216	Yes	Schneider / A084S	1,2	Yes	S 84Way-42Pan	Retrofit	
PA3-PDU-1.26	84	AC	N	No	Schneider / EGX150	10.20.14.172	Yes	Schneider / A084S	1,2	Yes	S 84Way-42Pan		Maximo needs changing
PA3-PDU-1.27	84	AC	N	No	Schneider / EGX150	10.20.14.174	Yes	Schneider / A084S	1,2	Yes	S 168Way-42Pan		Maximo needs changing
PA3-PDU-4.86	168	AC	Y	Yes	Schneider / EGX100	10.20.14.57	Yes	SCA2S	1,2,3,4	No	S 168Way-42Pan	Retrofit	

Excel template can be provided on request from Commissioning Authority or Central Ops Engineering team.

Appendix 03 - Soft Handover Pre-Requisites Check List

White Space Power

	Power Path 'X'
1. Check and verify labelling of all cables from Incoming Transformers / Generators, to Main Switchgear to UPS/DC rectifier to SMDB's to PDU's (AC/DC).	
2. DC Rectifier operation and distribution checked and verified.	
3. Visual inspection and thermo graphic survey of all customer connected final distribution boards (PDU- AC/DC)	
4. Visual inspection and thermo graphic survey of all Sub Main Distribution Boards (SMDB) feeding item 1	
5. Isolation and physical check and clean of all UPS's & STS's (to be completed by Emerson).	
6. Isolation and physical check and clean of all ATS's.	
7. Isolation, physical check and clean of all Main Switchgear, thermo graphic survey under load to be carried out.	
8. Generator and fuel system functional operation (Needs to be proven with generator under full load to prove the fuel system can maintain the demand for each generator).	
9. All critical deficiency's and SOR related items to be resolved (See section I for definition of deficiency's).	
10. Mains failure test to be carried out for each electrical system/generator to prove the automatic and safe transfer to generator during a utility failure and automatic recovery when mains supply is restored. Expectation would be a minimum of 60 minutes proving time to ensure the utility supply is stable (Hz & V are within normal limits) before reverting back to utility.	
11. On completion of the individual utility tests, a building utility test is to be carried out to prove the site in its entirety during a power failure to transfer automatically to generators but all critical systems such as chillers, pumps, CRACs etc. will restart. UPS Systems should unaffected and capable to maintain load during the safe transfer to generator and, after the 60-minute proving time, back to utility.	
12. All generators before being run-up or tested shall have the alternator termination section visually inspected to check for foreign objects, swarf, cable terminations etc.	
13. Where breakers have been identified as being under specified for the rated fault current of the electrical system, these must be replaced with breakers of the correct rating. The existing breakers in operation (live) are a H&S Risk and need to be replaced with the correct rating for the system to ensure they can operate safely in accordance with their design and to ensure compliance with Statutory Regulations and Equinix's Duty of Care (DC PDU breakers issue to be resolved with replacement).	
14. Electrical Installation Certificates to be provided for all Distribution Boards and Electrical Systems. NB – Earth Loop Impedance needs to be checked and verified on the certificates with the physical readings on site to prove the integrity of the earthing system. Previous certificates issued in the past have not had this information. Similarly, cabling to the earth rods were not mechanically protected prior to being buried and we have provided records of earth cabling being physically damaged during construction.	
15. Internal visual inspection and Installation Test Certificates to be provided of the MV Switchgear and Transformers.	

16. SAT approval from ENGINEER OF RECORD for all above (to include signed-off test sheets for each SAT- signatures from M+W and ENGINEER OF RECORD along with dates).	

Cooling Systems

1. SAT approval from ENGINEER OF RECORD for 2 of the Chillers and associated pump sets /controls.	
2. Network CRAC control to be removed and interdependencies (No CRAC controls to affect other CRAC's operations).	
3. Chilled Water Flow Rates to all CRAC' s and chillers to be verified and signed off by ENGINEER OF RECORD	
4. All critical deficiency's and SOR related items to be resolved (See section I for definition of deficiency's).	
5. SAT approval from ENGINEER OF RECORD for FAHU and fresh Air systems including humidifiers.	
6. SAT approval from ENGINEER OF RECORD for CRAC systems (white space and plant room areas).	
7. Prove one chiller can maintain cooling with the current building load for 48hrs.	
8. All chillers and pumps supporting the agreed critical areas must be tested to ensure auto change-over of standby pumps, or pumps ramp-up to maintain duty of the affected system.	
9. Leak Detection for operational areas to be put into service and tested to ensure alarms are back onto the BMS.	
10. Handover documents required for the Cooling Towers and closed loop systems under our control. Please see attached e-mail of expected requirement (NB- No information has been provided to date on the current condition of the system), we will also need to setup an immediate regime for the regular monitoring and management of the cooling towers (under ACOP L8 for guidance).	

Fire Safety/Security

1. SAT approval for all Fire Detection system from ENGINEER OF RECORD.	
2. SAT approval for Fire Suppression systems from ENGINEER OF RECORD.	
3. Air Integrity Test Certificate for rooms with Gas Suppression.	
4. Pressure test certificate for testing the integrity of the pipework for water suppression systems.	
5. Cause and effect test and sign-off from ENGINEER OF RECORD.	
6. All critical deficiency's and SOR related items to be resolved (See section I for definition of deficiency's).	
7. SAT approval for Security system from ENGINEER OF RECORD.	

BMS/CMS/EMS

1. For systems coming under the remit for early handover we will require accurate visibility of all readings, set points and their operation proven to be monitored/controlled via the BMS/CMS/EMS.	
2. Alarming on the BMS plus Remote Alarming is a requirement to ensure the site team have a fighting chance to proactively react to the early signs of a failure or fault.	

Testing

1. Successful Blackout test of all Transformers feeding IT services.	
2. Successful Blackout test of all Transformers feeding Mechanical services.	
3. Testing and signoff from ENGINEER OF RECORD for CMS/BMS/EMS systems relating to above.	
4. ISAT completed for all above systems.	

Training

1. Prior to early handover of the expected areas, the site team will need to have appropriate training of each system	
2. Training should cover; • First level fault investigation and diagnosis • Immediate actions to recover a system or piece of equipment in the event of a failure • Sequence required to make equipment available for maintenance and the maintenance activities to be carried out.	
3. Prior to training below documentation should be issue to each trainee; • A detailed schematic of the overall system • Detailed schematic of the section of the system being trained on • Description covering the method of operation under normal conditions as well as under various failure scenarios	

Water Analysis

We would expect for each of the closed and open water systems on site to ensure these systems are within normal operating parameters prior to taking ownership. Water samples should be taken at least 1 week prior to handover to allow time for test results to be returned in time for the Soft Launch dates.	

Conditions for sampling: • Each sample must be collected in a sterile container. Samples must be stored at a temperature between 6-8˚C and must be tested within 24 hours of being removed from the system. Tests should be performed by an accredited laboratory. Test results must be interpreted making allowance for the accuracy of test procedures. Any variation in results from samples taken at different points around the system should be investigated and, if necessary, further samples taken.	
Items for analysis; • Total alkalinity (ppm CaCO3) • Molybdate (ppm MoO4) • Nitrite (ppm NaNO2) • Conductivity (µS/cm) • Total dissolved solids (TDS) • Suspended solids (mg/l) • pH • Soluble Iron (mg/l) • Total Iron (mg/l) • Total Copper (mg/l) • Soluble Copper (mg/l) • Glycol (%) – Where Applicable • Bacteriological Analysis (to include test for pseudomonas)	

Appendix 04 – Go-Live Checklist

Below is current version of the Go-Live checklist. An excel template can be provided on request from Commissioning Authority or Central Ops Engineering team

CONSTRUCTION CHECKLIST

Project:

31/05/2018 **Construction Manager:**

-60 DAYS PRE RFS				DATE:			
Item	**Description**	**Target Date**	**Actual Comp.**	**Comments**	**Handover Checklist**	**GC Deliverables**	**Reference**
1.1.1	Agree to Operations acceptance signoff participants and criteria					X	
1.1.2	Provide site safety orientation to Operation personnel					X	
1.1.3	Approve alarms, set points, and alarms to be paged with Operations					X	
1.1.4	Confirm all alarm and set points to be paged are included for commissioning, testing pre-IST and IST.					X	
1.1.5	Agree to punchlist process and participants					X	
1.1.6	Complete roof and flood tests (if applicable)					X	
1.1.7	Log fuel fills per environmental jurisdiction standards and collect individual tickets.					X	
1.1.8	Confirm all IT equipment (computers, phones, BMS servers, etc.) is purchased and track delivery					X	
1.1.9	Ensure environmental jurisdiction (i.e. Department of Environmental Quality or local environmental Protection Agency) are satisfied including generator run time for testing information to landlord and/or city.					X	
1.1.10	Review utility agreement including load ramp letter, exemptions, rebates, and contract review						
1.1.11	Initiate coordination with BCM Development team and Operations in order to bring the system online						
1.1.12	Establish permit signoff sequence and schedule					X	Municipality does not follow same process in states. Random checks, but there is no formalised gating/signoff process in some countries
1.1.13	Identify purchased critical spare parts to operations for acceptance					X	May or may not be part of GC
1.1.14	Provide leasing requirements (if applicable)						
1.1.15	Provide Ops with landlord personnel and set up recurring meeting						
1.1.16	Provide Ops list of existing IBX's with similar BMS and MEP systems for review and training						
1.1.17	Provide a list of all critical warranties, defect liability periods, and maintenance agreements to Site Ops for gap analysis.				X	X	'Warranties' section 5 Handover Checklist
1.1.18	Update Capacity Management Forecasting tool with project specific engineering data etc.						*New Item* - under development with Infra Eng

1.1.19	White Space Available (Early Access for customers)					X	*New Item* - Agree via STC, the sales pipeline, urgent customer installations and planned early access date / expectations with the contractor(s).
1.1.20	FM Global Checklist Submission					X	*New Item*
-30 DAYS PRE RFS				**DATE:**			
1.2.1	Create GC critical (delays CRD) and non-critical punchlists					X	
1.2.2	Receive startup and functional test reports and certifications				X	X	'Certifications' section 4 Handover Checklist
1.2.3	Environmental protection in place (spill kits, spill prevention plan)					X	
1.2.4	Set up BMS email account and provide ISPs to BMS contractor					X	May or may not be part of GC
1.2.5	EQIX cage, network connectivity up & running					X	May or may not be part of GC
1.2.6	Turn up Equinix Wi-Fi network					X	May or may not be part of GC
1.2.7	Set up EQIX work stations and telephones						
1.2.8	Create single point of entry for construction personnel					X	
1.2.9	Provide Operations EQIX storage room (keyed separately)					X	
1.2.10	Obtain approval of security site acceptance/commissioning script (CCTV, Access Control) from Operations					X	
1.2.11	Provide method statements (i.e. Methods of Procedures, Standard Operating Procedures, and/or Sequences of Operation) for all electrical and mechanical equipment.					X	
1.2.12	Provide commissioning agent's MOP, test scripts and list of expected alarms according to MOP and test scripts.					X	
1.2.13	Test air balancing at minimum and maximum capacity and document results with all related set points for recommended optimization.					X	
1.2.14	Security guarding to protect assets						
1.2.15	Coordinate carrier cage buildout with IT (if required)					X	
1.2.16	Establish Day 2 construction activities to be completed				X	X	'Out of Scope' section 7 Handover Checklist
1.2.17	Provide critical contracted spare parts, breakers, fuses					X	
1.2.18	Provide spare PDUs and Cage Mesh Material						EMEA revision (no RPPs)
1.2.19	Successfully complete pre-IST					X	
1.2.20	Provide marketing fact sheet to Operations including building and roof wind speed rating, and 100/500 year flood elevations relative to slab.						
1.2.21	Provide Operations IST Training Day				X	X	'Training' section 3 Handover Checklist
RFS				**DATE:**			
1.3.1	Successfully complete IST				X	X	'Certifications' section 4 Handover Checklist
1.3.2	Successfully complete security commissioning				X	X	'Certifications' section 4 Handover Checklist
1.3.3	Provide all permits and certificates of occupancy to Ops for posting						
1.3.4	Receive comprehensive project directory including vendor/general contractor/sub-contractor contacts.				X		'Contracts' section 5 Handover Checklist
1.3.5	Provide "as-left" or final settings after commissioning for circuit breakers, relays, and VFD's.						

Uncontrolled once printed

1.3.6	Provide backup copies of PLCs (if applicable)						
1.3.7	Single line electrical and mechanical diagrams posted in respective rooms						
1.3.8	Final fill fuel tanks						
1.3.9	Agree on daily process for contractor personnel access						
1.3.10	Provide Operations with redline as-builts and any specifically requested O&Ms				X		'O&M Manuals' section 2 Handover Checklist
1.3.11	Provide operations with hourly contractor rates and contract terms for any future expansions or customer fit-outs				X		'Contracts' section 5 Handover Checklist
1.3.12	Provide any information regarding discounts or exemptions from tax (sales, material, etc.) to Operations (i.e. Capital Improvement Projects).						
1.3.13	Provide Operations with arc flash label forms for future installs						
1.3.14	Issue final updated BOD including phasing plan.						
1.3.15	Provide local IBX Ops and Document Management with CD of MEP drawings and set of as-built prints on racks as well as all MEP, BMS, Security systems				X		'Drawings' section 1 Handover Checklist
1.3.16	Provide construction standby personnel (mech, elec, BMS) 1 week after CRD						
1.3.17	Transfer BMS to EQIX Operations and delete temp accounts						
1.3.18	Hand over any and all keys.						
1.3.19	Inform relevant business groups such as regional finance and compliance departments (i.e. NAIBXCompliance@win.equinix.com) on Equinix "customer ready" project completion email announcement.						EMEA revision for email account?
+45 DAYS POST RFS (Ops Handover)				**DATE:**			
1.4.1	Provide Operations with Day 2 construction activity progress				X		
1.4.2	Provide final subcontractor payment lien waivers (if applicable) and execute substantial completion letter for bond release (if applicable)						
1.4.3	Issue LEED certification plaque			+ 100 days			
1.4.4	Commission economizer mode for mechanical equipment (if applicable, season dependent)						
1.4.5	Confirm and provide regional jurisdiction flood elevation certifications (i.e. Federal Emergency Management Agency).						
1.4.6	Provide FINAL comprehensive closeout package, reviewed by internal/external engineering teams and Operations.				X		Handover Checklist deliverables + additional 'Files' column on this sheet
1.4.7	Provide landlord as-built drawings and post condition survey.						

OPERATIONS CHECKLIST

Project:

Facilities Manager:

-60 DAYS PRE RFS				**DATE:**			
Item	**Description**	**Target Date**	**Actual Comp.**	**Comments**			
2.1.1	Incremental resources hired and in place (technicians & engineers)						Section still under review with stakeholders to provide comment;
2.1.2	Familiarization of leasing requirements (if applicable) provided by Construction						Minimum effort will be to delineate between Ops and TFM
2.1.3	Familiarization of landlord personnel including regular meeting forums, as relevant						
2.1.4	Familiarization of BMS system including review and training of similar installation at alternative site. Request CM assistance as necessary						
2.1.5	Familiarization of MEP systems including review and training of similar installation at alternative site. Request CM assistance as necessary						
2.1.6	Participation in project construction OAC meetings						
2.1.7	Participation in project construction Commissioning meetings						
2.1.8	Participation in project construction Security meetings						
2.1.9	Participation in project construction BMS meetings						
2.1.10	Participation in equipment startup in order to generate questions ahead of training						
2.1.11	Participation in IST Script Review (as a means of further understanding operations and failure modes of system)						
2.1.12	Plan and coordinate office relocation (if applicable)						
2.1.13	Review and approve SOO's						
2.1.14	Adhere to sign-in procedure for any construction site tours (investors, sales, customers)						
2.1.15	Prepare Gap Analysis of critical warranties/Defects Liability Periods and maintenance agreements, and engage vendors to quote.						
-30 DAYS PRE RFS				**DATE:**			
2.2.1	Participation in project construction Commissioning process including functional testing, Pre-IST, and IST						
2.2.2	Participation in security commissioning process						
2.2.3	Establish security personnel schedule						
2.2.4	Implementation of operations and maintenance services contracts including cleaning (green if required by LEED), landscaping, baler, etc.						
2.2.5	Order vending machines, games, coffee, office supplies, etc.						
2.2.6	Populate EQIX storage room with Day 1 supplies						
2.2.7	Implementation of Maximo				X		Asset list template from Ops Eng (Gaby)
2.2.9	Establish MOP/engineering script and CMR process for post CRD activities (if applicable)						
2.2.10	Provide staff information and photos for customer welcome signage						

2.2.11	Issue access cards to any remaining construction personnel and commissioning team.						
2.2.12	Identify project specific high priority training requested prior to CRD						
2.2.13	Attend Operations IST Training Day						
2.2.14	Prepare maintenance schedule across all critical equipment and services for 1st Year of operation.						
RFS				**DATE:**			
2.3.1	Acceptance of all building systems (BMS, security, mechanical, electrical, etc.)						
2.3.2	Attend any requested early systems and equipment training and submit attendee logs						
2.3.3	Sign off on completion of critical punchlist items (Commissioning, QA/QC deficiencies)						
2.3.4	Replace temporary construction door key cores with permanent cores and return temporaries to construction.						
2.3.5	Operational security personnel in place						
+45 DAYS POST RFS (Ops Handover)				**DATE:**			
2.4.1	Attend systems and equipment training and submit attendee logs						
2.4.2	Sign-off completed non-critical items punchlist						
2.4.4	Receive and inventory non-critical attic stock						
2.4.5	Contribute and participate in lessons learned process						
2.4.6	Confirm BMS settings are per SOO						
2.4.7	Cancel construction personnel access cards						