

‘The Art of Commissioning’

Commissioning Management Strategy



What is Commissioning?

‘The advancement of an installation from static completion to full working order to the specified requirement. It includes the setting to work of an installation, the regulation of the system and the fine tuning of the system.’

Commissioning management

- Why adopt commissioning management?
- What are the benefits?

What is Commissioning Management?

“A systematic process of assuring by verification and documentation that all systems perform interactively in accordance with the design documentation and intent”

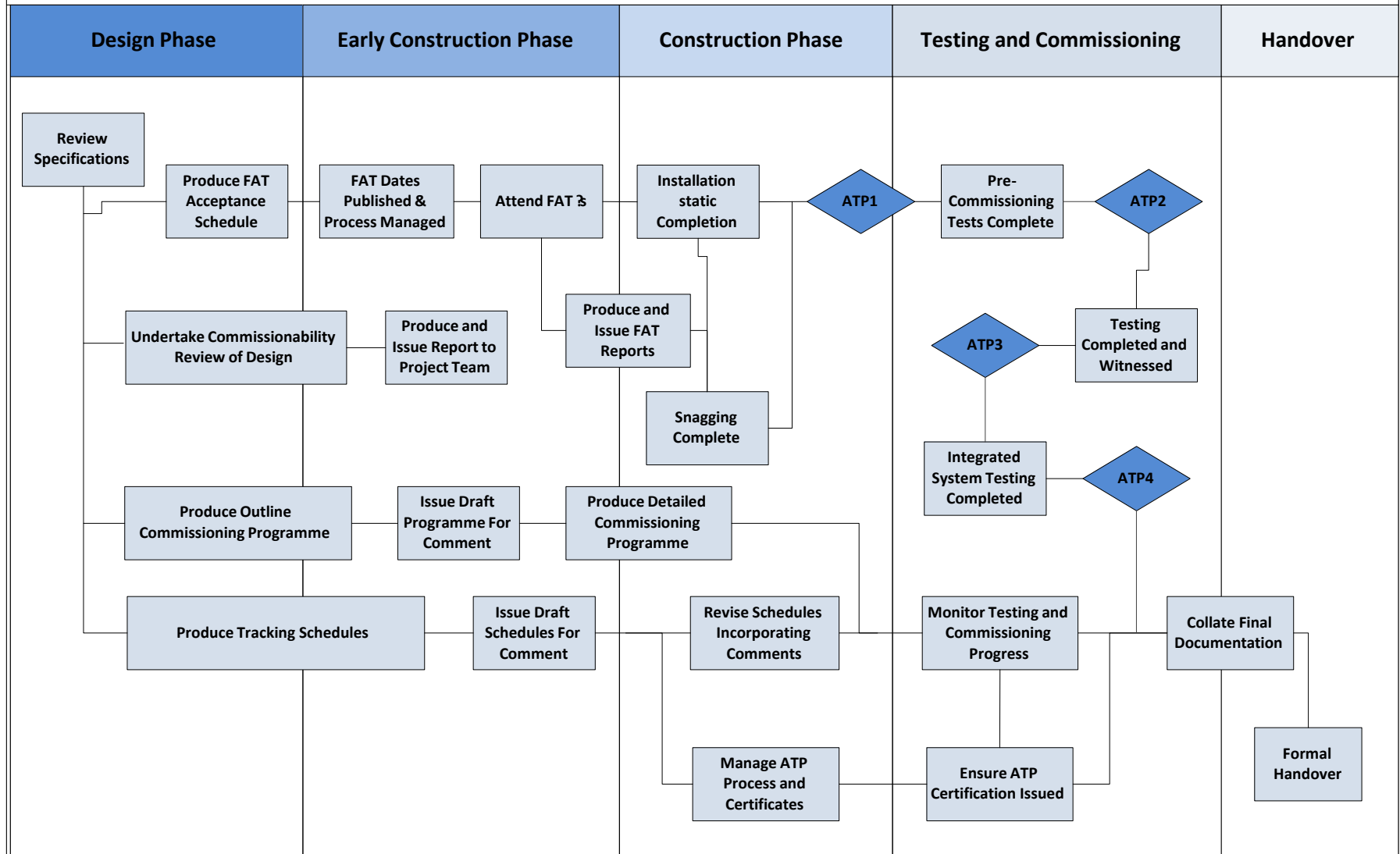


Commissioning management

CIBSE Commissioning Code M: 2003



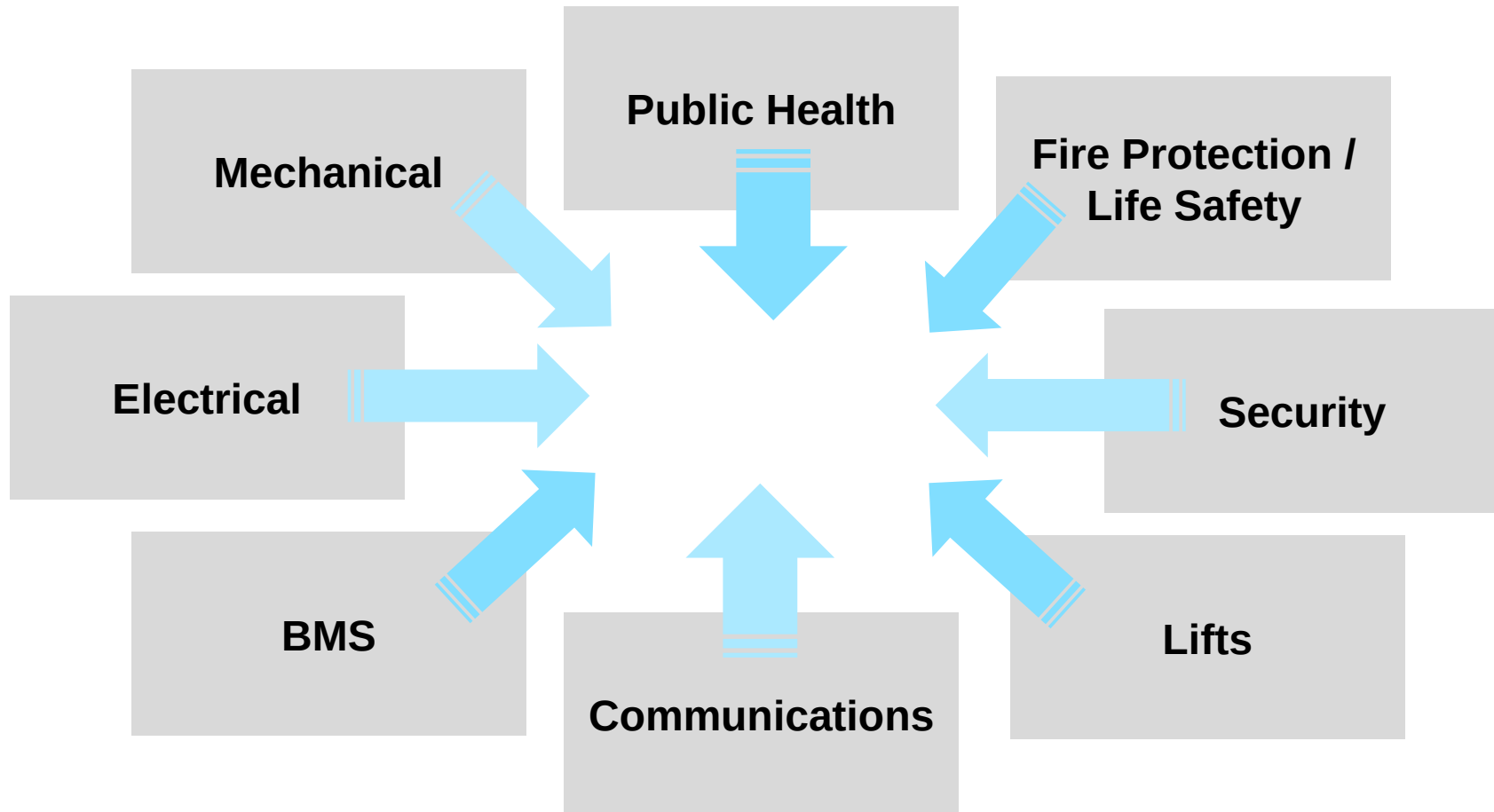
Commissioning Activity Timeline



Commissioning management – the process

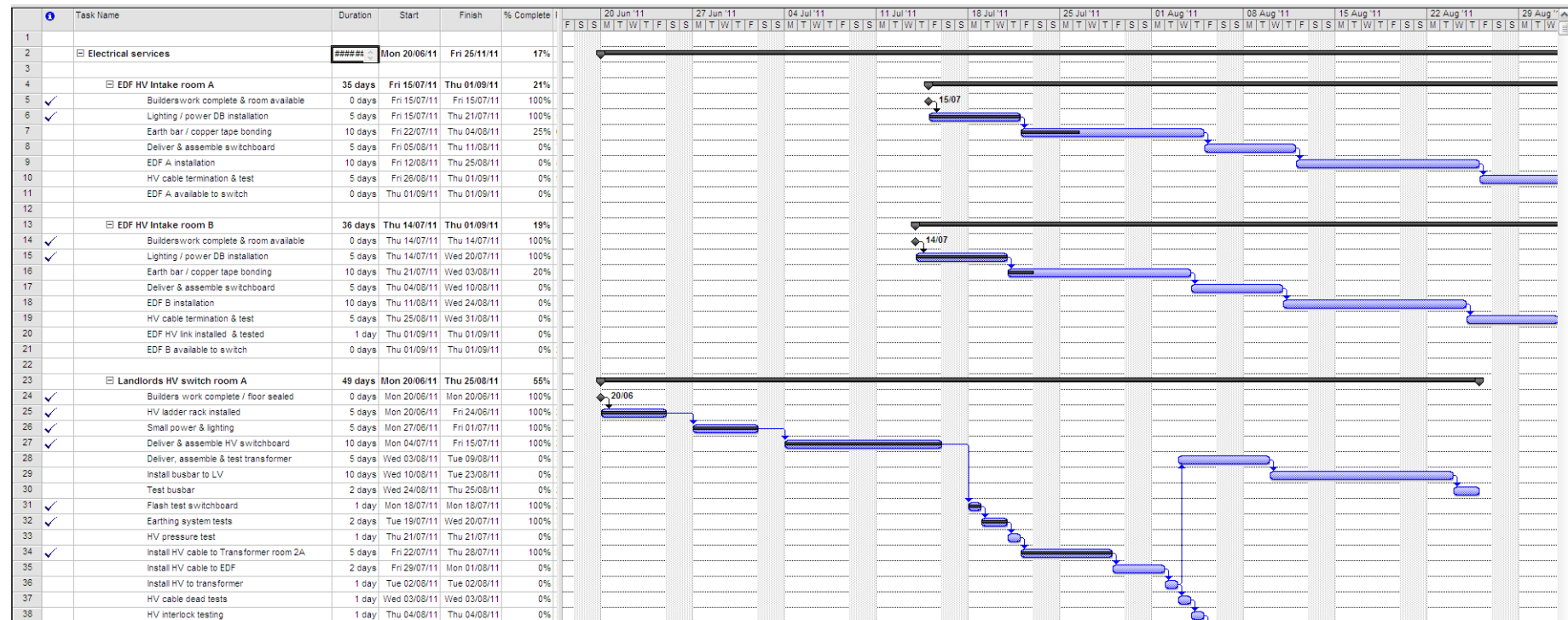
- Production and policing of commissioning programme
- Production of a comprehensive commissionability review
- Management of the factory acceptance test process
- Benchmarking and mock ups
- Progress management (Authority to proceed)
- Production and policing of commissioning trackers
- Creation of system specific commissioning files
- Witnessing of specialist commissioning
- Co-ordination and management of Integrated systems tests
- Review of the 'operation and maintenance' manuals
- Organisation of training and handover to the client

Scope of service

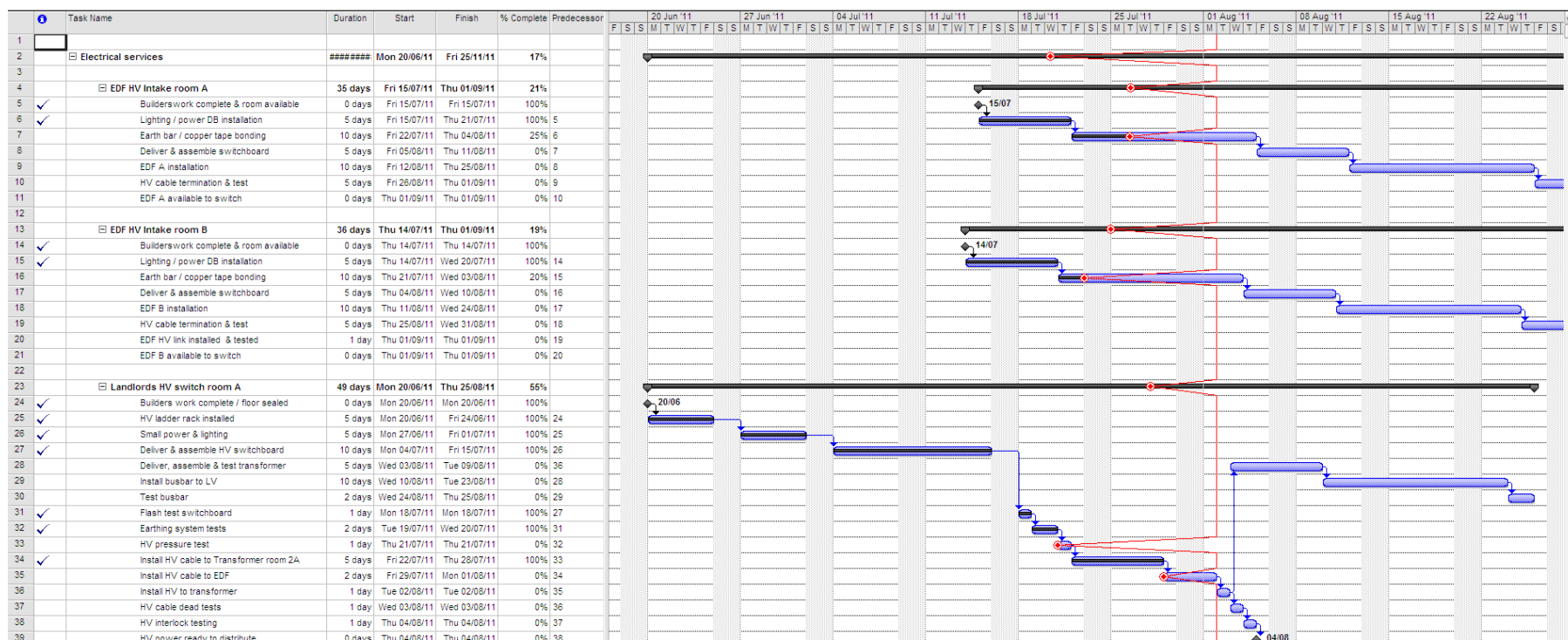


Compilation of commissioning programme

Once all commissioning related activities have been identified the commissioning programme can be built up using knowledge, timescales and dependencies obtained from the individual specialists.



Once 'baselined' the approved commissioning programme can then be used as a powerful tool for tracking progress, identifying potential slippage and for planning recovery.



Programme construction interfaces

The integration and co-ordination of the mechanical and electrical systems is vital to the overall success of the project. However, another fundamental aspect is the relationship between the services and the structure and finishes.

Major considerations are:

- Design freeze
- Shell and core / Fit-out interfaces
- Timely completion of slabs, walls and cores (will all impact on first fix)
- Completion of plant areas and roof
- Understanding of access requirements
- Co-ordination of horizontal construction with vertical services
- Finishes (windows, ceilings, floors, walls and doors)

What must be avoided at all cost is the **‘we are finished’** attitude.

Commissioning Management Teams

The benefits of an 'across the divide' commissioning management strategy:

- Knowledge of site wide design philosophy
- Familiarity with interface procedures & documentation
- Co-ordination & awareness of shell and core / fit out programmes
- Ease of communication & liaison
- Swift resolution of commissioning issues
- Accurate and coherent reporting

Commissionability Reviews

Commissionability reviews are undertaken to ensure that all systems are correctly designed and installed with sufficient facilities and devices to allow them to be fully and successfully commissioned.

This includes:

- Formal review of drawings
- Review of manufacturers' data sheets
- Review of technical submittals
- Review of contractor programmes
- Review of specifications and employers requirements to identify any 'grey areas' between specialists
- Identification of critical interfaces.

It is imperative that the commissioning manager reviews the latest installation drawings, technical submissions and specifications to formulate an overview of all services to ensure that the systems as a whole can be commissioned in accordance with the requirements of the contract.

Commissionability Review

Item Ref	System Ref	System Description	Source Reference	Item Description	Date Raised	Raised By	Reply Date	Status	Comments
1	SK2201AH001	Rm Area Ventilation	Rm Area Ventilation Plant Ground Floor Schematic: CB205-4DP-00-000-DR-MA-577900	No VCD shown fitted on SK2107 GR901	11/11/2015	DJ			
2	Rm Area Vent	RM Area Vent	Rm Area Vent Ground Floor CB205-4DP-00-000-DR-MA-577900	VCD located between 2 fire dampers as the supply duct comes onto floor? R2's shown be shown in compartmentation	12/11/2015	TD			
3	Rm Area Vent	RM Area Vent	Rm area vent ground floor CB205-4DP-00-000-DR-MA-577900	VCD located between 2 fire dampers as the extract duct comes onto floor? Terminal A_2107 has no VCD shown	12/11/2015	TD			
4	Rm Area Vent	RM Area Vent	Rm area vent ground floor CB205-4DP-00-000-DR-MA-577900	VCD's are shown with hard ducted primary air connection? Review installation as this creates difficulties when balancing	12/11/2015	TD			
5	Rm Area Vent	RM Area Vent	Rm area vent ground floor CB205-4DP-00-000-DR-MA-577900	Add drawing construction reference (currently states 'see')	12/11/2015	TD			
6	Rm Area Vent	RM Area Vent	Rm Area Vent Red Floor CB205-4DP-00-000-DR-MA-577910	VCD located between 2 fire dampers as the supply duct comes onto floor? Terminal ref J1108GR001 has no VCD shown. Terminal J1112GR002 has no VCD.	12/11/2015	TD			
7	SK2201AH001	Rm Area Ventilation	Rm Area Ventilation Plant Red Floor Schematic: CB205-4DP-00-000-DR-MA-577910	No VCD's shown fitted on SP1122GR002 or SP1108GR001	11/11/2015	DJ			
8	SK2201AH001	Rm Area Ventilation	Rm Area Ventilation Plant Red Floor Schematic: CB205-4DP-00-000-DR-MA-577910	Duct run serving SP1108R001 shows 2 VCD's, only 1 required? Secondary air side main VCD not required but VCD required at each terminal	11/11/2015	DJ			
9	SK2201AH001	Rm Area Ventilation	Rm Area Ventilation Plant Red Floor Schematic: CB205-4DP-00-000-DR-MA-577910	VCD's are shown with hard ducted primary air connection? Review installation as this creates difficulties when balancing	11/11/2015	DJ			
10	SK2201AH001	Rm Area Ventilation	Rm Area Ventilation Plant Red Floor Schematic: CB205-4DP-00-000-DR-MA-577910	Add drawing construction reference (currently states 'see' & 'from below'). Add AHD reference	11/11/2015	DJ			

Co-ordination of factory acceptance testing

It is important to ensure that, prior to any factory testing takes place, all aspects of the test and expectations are fully documented and that the methodology of how the tests will be conducted are fully agreed and approved.

The schedule should include:

- Determine and establish test schedule
- 'Acceptance Criteria' document detailing the criteria for the success of the tests
- Approval of test methodology
- Confirmation that the proposed test facility is suitable for the test
- Itinerary and dates of proposed tests
- Required attendees
- Collation and signoff of FAT documentation.

Benchmarking and mock ups

The ultimate goal of benchmarking is to set and define the required standard for installation, testing and commissioning.

Typically a representative section, system or item of equipment will be selected and will be inspected and tested and offered to the witnessing team to ensure complete compliance with the specification and codes.

Mock ups are an essential method of confirming the successful integration and going maintainability of services , equipment and structure at an early stage of the project.

- Fan coil access
- Acoustic treatments
- Acoustic room integrity
- Access to smoke control dampers Service riser access / maintenance issues
- Integration of IT/AV / Video entry
- AHU relocation to permit coil withdrawal

Progress management & commissioning trackers

A logical system of progressive inspection and witnessing sign offs will be established whereby an activity cannot commence until all proceeding tasks have been satisfactorily completed. (Authority to proceed)

Typically a sign off will be required at:

- 1.The completion of static testing
- 2.The completion of pre-commissioning
- 3.The completion of commissioning
- 4.The completion of integrated system tests

Commissioning system trackers will be produced which will be used to monitor and manage progress of each system.

Whilst the commissioning files will contain the detail for each stage of the commissioning process the tracker will graphically display the current status across all systems.

1. The completion of static testing



Standard Method

ATP 1 – STATIC COMPLETION FORM

Before progressing any pre-commissioning activity the trade contractor will verify that an individual system has been fully installed, inspected, and statically tested prior to reaching permit to progress pre-commissioning. The trade contractor must provide all necessary documentation to demonstrate the necessary level of attainment for static completion of system and the issue of this ATP.

ATP Reference No.	
Trade Contractor / Package Ref	
System	
Location + Zone / Area	
Date	

ATP 1a: Documentation Checks
 Provide or identify the document references within the following table to satisfy the necessary criteria for issue of an ATP 1.

Factory test certification	
Equipment Schedule (Reference No. & status)	
Trade Contractor Quality Inspection / sign-off	
Static testing complete (attach signed test sheets & marked up schematics)	
Commissioning Method statement (Reference No. & status)	
Marked up P&ID Drawings	

ATP 1b: Inspection & Sign off
 The relevant site holders shall inspect the system and satisfy themselves that relevant usage have been completed for commission and commissioning.

Role	Given	Observed	Date
Trade Contractor			
Project Team			
Burgess Group			
Comment			

Attach comment sheets to the ATP where required.

Document Control
Burgess Group
Page 1 of 1

2. The completion of pre-commissioning



Standard Method

ATP 2 – Pre Commissioning Form

Before progressing any dynamic commissioning activity the trade contractor shall verify that all necessary Pre-Commissioning checklists and tests have been satisfactorily completed and the Commissioning Method and criteria for progression has been agreed. The trade contractor must provide all necessary documentation to demonstrate the necessary level of attainment for the completion of Pre-commissioning and the issue of this ATP.

ATP Reference No.	
Trade Contractor / Package Ref	
System	
Location + Zone / Area	
Date	

ATP 2a: Documentation / Progress Checks
 Provide or identify the test sheets references and check the validity of the Commissioning documents following the pre-commissioning for issue of an ATP 2.

Pre-Commissioning check sheets	
Pre-Commissioning test sheets (where applicable)	
Pre-commissioning report / sign off	
Commissioning Method statement approved	
Power on request form	
Commissioning test sheets approved	

ATP 2b: Inspection & Sign off
 The relevant site holders shall inspect the system and satisfy themselves that relevant usage have been completed for commission dynamic commissioning.

Role	Given	Observed	Date
Trade Contractor			
Project Team			
Burgess Group			
Comment			

Document Control
Burgess Group
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3. Completion of commissioning



Standard Model

ATP 3 – Commissioning Completion Form

Commissioning of a system will require offloading initially to the Commissioning Management team, then followed if successful to the clients' team. (This may be carried out concurrently depending on confidence levels with the trade contractor).

The trade contractor shall verify that all commissioning checks and tests are satisfactorily completed, results submitted and the system demonstrated as a stand alone system prior to any integration testing with other connected systems. The trade contractor must provide all necessary documentation to demonstrate the necessary level of attainment for the completion of commissioning and the issue of this ATP.

ATP Reference No.	
Trade Contractor / Package Ref	
System	
Location / Zone / Area	
Date	

ATP 3s Test Sheet Documentation and Demonstration Checks

Provide or identify the test sheets references and check the validity of the Commissioning documents following the pre commissioning for issue of an ATP 3.

Commissioning Test Sheets	
Commissioning Report	
Performance acceptable (Yes/No)	
Witness / Demonstration	
Commissioning scope	
BT method statement (Reference for A Status)	
Client Training Pack	

ATP 3s System Commissioning Sign off

The relevant stake holders shall satisfy themselves that relevant commissioning checks and tests have been completed prior to any integration tests with other systems.

Role	Given	Accepted	Date
Trade Contractor			
Project Team			
Burgess Group			
Consultant			

ATP 3s Test Sheet
Signatures
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4. Completion of integrated system tests



Standard Model

ATP 4 – Integrated Systems Testing and Handover Completion Form

This form represents the final sign off that systems have been fully commissioned, integrated and demonstrated to perform in accordance with the project specifications and requirements.

The IOT's are specific tests undertaken with all other connected systems integrated and operating in automatic condition with temporary loads provided where necessary to demonstrate performance. The trade contractor must provide all necessary documentation to demonstrate the necessary level of attainment for the completion of the IOT and the issue of this ATP.

ATP Reference No.	
Trade Contractor / Package Ref	
System	
Location / Zone / Area	
Date	

ATP 4s IOT Complete and Commissioning Handover Checks (s)

Provide or identify the IOT documents and signed off documentation for the issue of ATP 4.

IOT Test Sheet	
IOT Report	
Performance acceptable (Yes/No)	
Witness / Demonstration	
IOT scope	
CBM Manual	
Client Training Pack	

ATP 4s System Commissioning Sign off

The relevant stake holders shall satisfy themselves that relevant Integrated System Tests and/or performance tests have been completed.

Role	Given	Accepted	Date
Trade Contractor			
Project Team			
Burgess Group			
Consultant			

Attach comment sheets to the ATP where required.

ATP 4s Test Sheet
Signatures
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Commissioning Method Statements

Commissioning Method Statements Site Wide & Residential	Total	Issued	Accepted	Uploaded
Mechanical & Public Health	65	100%	100%	63%
Electrical	33	100%	100%	52%
BMS	8	100%	100%	71%
Communications	8	100%	100%	38%
Life Safety	23	100%	100%	35%
Commissioning Method Statements Office Block 01 & 02	Total	Issued	Accepted	Uploaded
Mechanical & Public Health	43	100%	100%	63%
Electrical	20	100%	100%	90%
BMS	7	100%	100%	86%
Communications	2	100%	100%	100%
Life Safety	17	100%	100%	76%
Project Total - Commissioning Method Statements	226	100%	100%	67%

Grosvenor Crescent Authorisation To Proceed Status

Building	Total ATP Required	ATP1 Required	ATP1 Complete	ATP1 % Complete	ATP2 Required	ATP2 Complete	ATP2 % Complete	ATP3 Required	ATP3 Complete	ATP3 % Complete	Total % Complete
Office Block 01	549	165	165	100%	225	225	100%	159	159	100%	100%
Office Block 02	423	158	158	100%	123	123	100%	142	142	100%	100%
Site Wide	609	294	293	100%	97	97	100%	218	213	98%	99%
Chapel, Residential Facilities, Education & Primary Care Trust Areas	106	36	36	100%	30	30	100%	40	40	100%	100%
Residential Buildings	9133	13	3062	100%	5	863	99%	450	4740	91%	95%
Total	10820	3728	3714	100%	1343	1338	100%	6748	6294	92%	98%

Project Name: Grosvenor Crescent

18/02/2016

Authorisation To Proceed

System	Total ATP Required	ATP1 Required	ATP1 Complete	ATP1 % Complete	ATP2 Required	ATP2 Complete	ATP2 % Complete	ATP3 Required	ATP3 Complete	ATP3 % Complete	Total % Complete
LTHW System	27	9	9	100%	9	9	100%	9	9	100%	100%
CHW System	27	9	9	100%	9	9	100%	9	9	100%	100%
Domestic Water Services	18	9	9	100%	0	0	N/A	9	9	100%	100%
Electrical Testing (Including Equipment Functional Testing)	27	9	9	100%	9	9	100%	9	9	100%	100%
Condensate Drainage Testing - MVHR & FCU	9	0	0	N/A	0	0	N/A	9	9	100%	100%
Evinox Interface Units including Pre Payment Metering	0	0	0	N/A	0	0	N/A	0	0	N/A	N/A
Fan Coil Unit	9	0	0	N/A	0	0	N/A	9	9	100%	100%
Whole House Ventilation Unit	9	0	0	N/A	0	0	N/A	9	9	100%	100%
Trace Heating	0	0	0	N/A	0	0	N/A	0	0	N/A	N/A
Slack Test	18	9	9	100%	0	0	N/A	9	9	100%	100%
Sprinkler System	9	9	9	100%	0	0	N/A	0	0	N/A	100%
Leak Detection	18	9	9	100%	0	0	N/A	9	9	100%	100%
Fire Alarm (Smoke / Heat Detectors)	9	0	0	N/A	0	0	N/A	9	9	100%	100%
Lighting System	9	0	0	N/A	0	0	N/A	9	9	100%	100%
Security & Access Control	18	9	9	100%	0	0	N/A	9	9	100%	100%
TV System	0	0	0	N/A	0	0	N/A	0	0	N/A	N/A
Telephone	9	0	0	N/A	0	0	N/A	9	9	100%	100%
Data	18	9	9	100%	0	0	N/A	9	9	100%	100%
Kitchen Extract Hood	9	0	0	N/A	0	0	N/A	9	9	100%	100%
Apartment Controls (including Description of Operation)	0	0	0	N/A	0	0	N/A	0	0	N/A	N/A
Environmental Testing	9	0	0	N/A	0	0	N/A	9	9	100%	100%
Lifts	2	0	2	N/A	1	2	200%	1	2	200%	300%

TOTAL	254	81	83	102%	28	29	104%	145	146	101%	102%
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System specific ‘Commissioning Document Files’

It is very important that, at any stage of the project, there is a central depository whereby all documentation relating to a specific system can be both stored and accessed.

To facilitate this we have devised a set of ‘system specific’ commissioning document files which will be managed by the commissioning management team.

Contents

- 1.0 - System Identification
- 2.0 - System Description and Function
- 3.0 - System Control
- 4.0 - Commissioning Activity Flow Chart
- 5.0 - Summary Commissioning Index and
Completion Matrix
- 6.0 - Commissioning Method Statements and
Test Sheets

The commissioning document files

1.0 - System Identification

Describe specific details regarding location, identification, areas served and general performance objectives

2.0 - System Description and Function

Description of the specific system and its components

3.0 - System Control

Record of the systems 'description of operation' for the controls system

4.0 - Commissioning Activity Flow Chart

Activity flow chart uniquely identifying every testing related activity and test 'hold points'

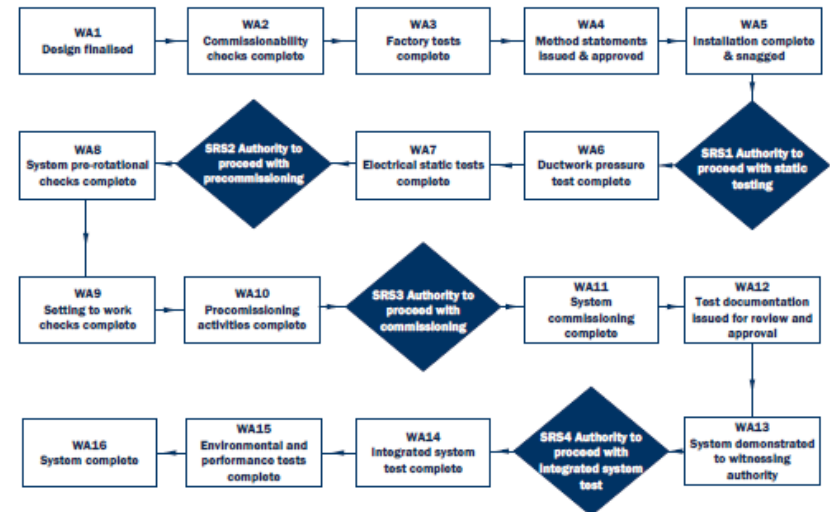
5.0 - Summary Commissioning Index and Completion Matrix

Tracking checklist for unique activities

6.0 - Commissioning Method Statements and Test Sheets

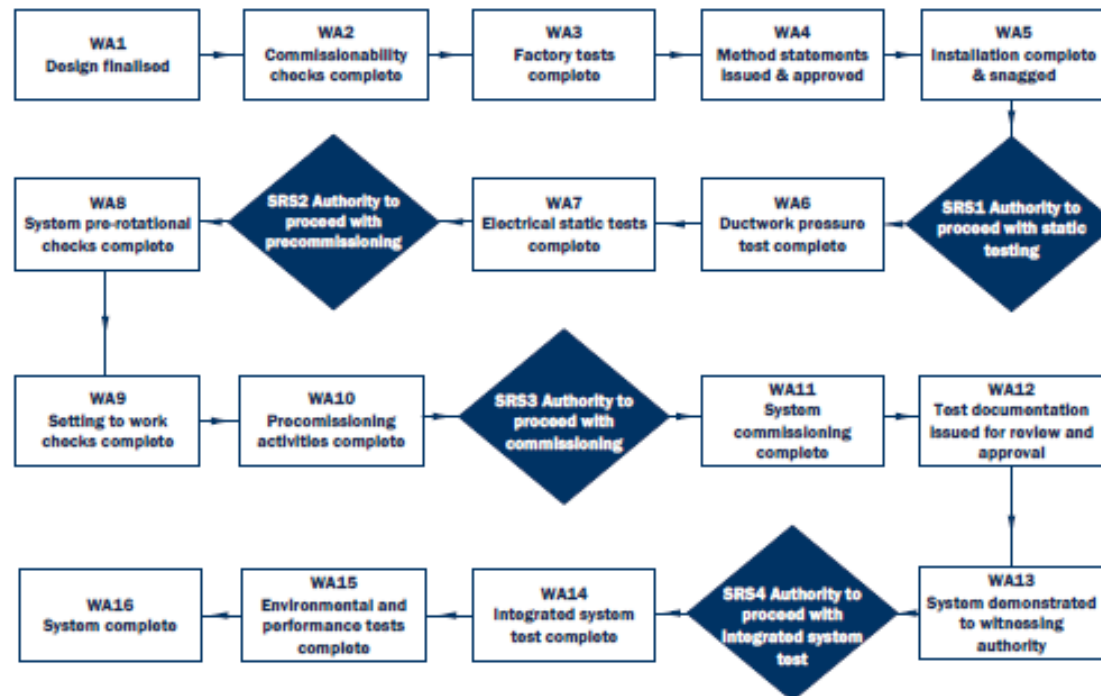
Section to deposit all approved method statements and commissioning and testing test record sheets

Sample activity flow chart identifying unique activity referencing



WA = Work activity
SRS = System release status

5.0 Commissioning Activity Flow Chart



WA = Work activity
SRS = System release status

Construction / Commissioning phase activities

The commissioning management team will be responsible for the following activities during the construction phase:

- Chair commissioning meetings
- Witness all static testing
 - Bench mark all tests, random sectional witnesses and all final system witnesses
- Witness all standalone system commissioning
 - 10 -20% witness of all systems, main volumes and random terminals
 - 100% witness of all life safety systems
- Organisation of witnessing to the clients team / Statutory authority
- Production of look ahead schedules
- Update and maintain commissioning trackers
- Update and police commissioning programme

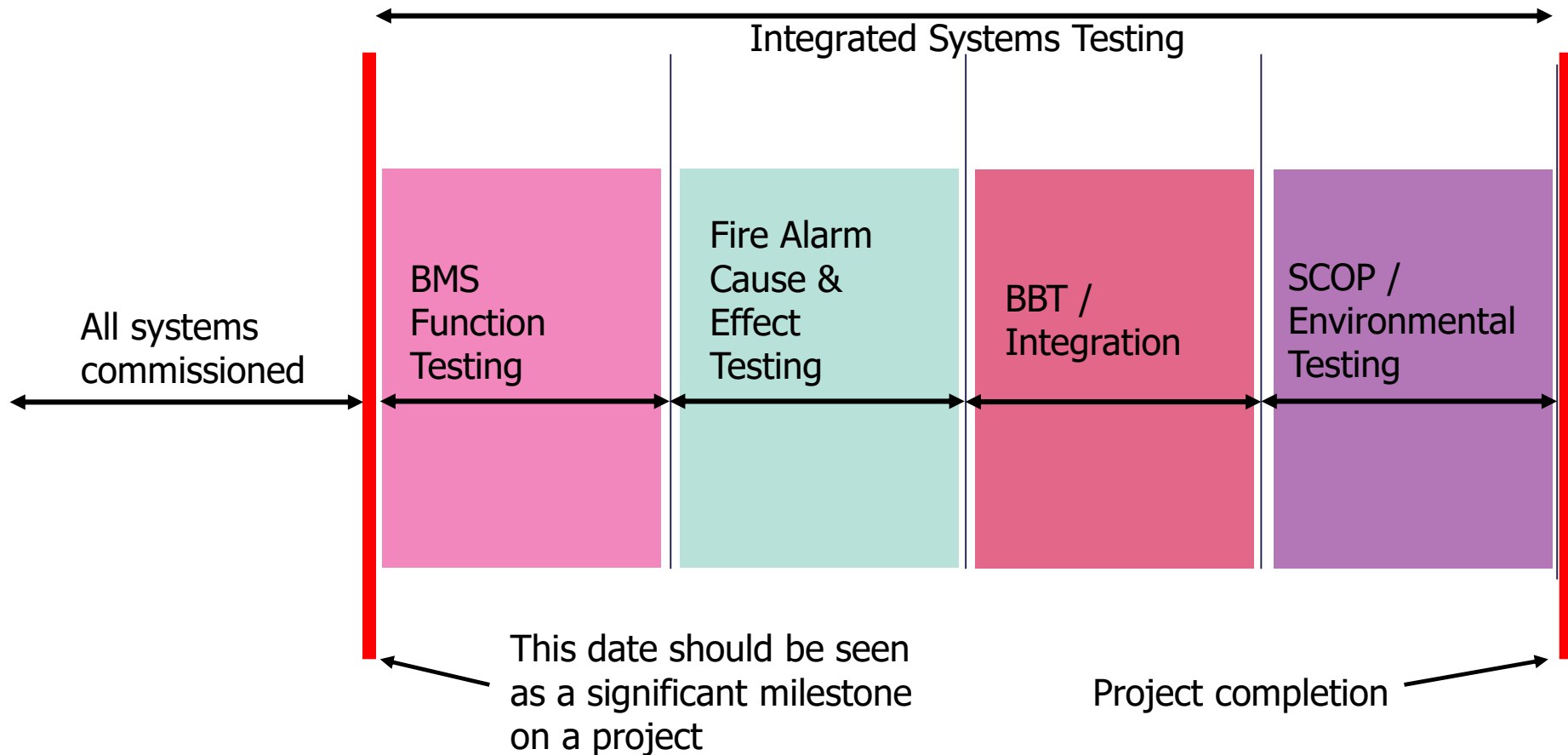
Integrated Systems Test (IST)

- **BMS Functional Testing**
- **Fire Alarm Cause & Effect Testing**
- **Black Building / Integration**
- **Environmental / SCOP Testing**

Integrated Systems Testing - definition

- “Integrated systems testing (IST) is a term used to summarise the testing of systems to demonstrate how a building works in different operational scenarios and to verify that the interactions between systems are in accordance with specified requirements”
- It summarises the following: -
 - BMS function testing
 - Fire alarm cause and effect testing
 - Black building testing (electrical failure scenarios) / Integration testing (load shedding etc)
 - Environmental / System Continuous Operation Proving (SCOP) testing
 - At which point all individual system commissioning and all building works should be complete

IST Sequence



BMS function testing – M&E pre-requisites

- What status is required to commence BMS function testing?

BMS Point to graphic testing	100% complete and witnessed	Chilled water system	Commissioned & witnessed as a stand-alone system & in auto mode of control
BMS description of operation	100% complete on each individual stand-alone system & witnessed	Low temperature hot water system	Commissioned & witnessed as a stand-alone system & in auto mode of control
BMS Room	Complete, final clean and signed off	Vent systems	Commissioned & witnessed as a stand-alone systems
BMS head end	Head end permanently fixed with printer for screen shots to record events	MFSD systems	Commissioned & witnessed as a stand-alone system
BMS head end	All alarms cleared from Trend log and system in 'auto'	ION Meters	Calibration proven back to BMS head end
BMS head end	Access rights to software restricted	LV Switchgear	Interlocks proven – all operational & in auto
BMS head end	Trend logs set up as specified to capture all 'test events'	Fire alarm	All interfaces to BMS controllers proven
Access	Permit to access procedure operational & limited personnel within building	Electrical loadbank	Connected to relevant systems to prove extreme control of system design
Heat load	Connected to relevant systems to prove extreme control of system design	Sprinklers	System commissioned and in 'auto'
Lighting Control	System commissioned and in 'auto'		

BMS function testing – Construction pre-requisites

- What status is required to commence BMS function testing?

Security doors	100% installed and tested	Staircases	Completed – no outstanding building works or fire stopping. Demo stair pressurisation / AV system
Internal doors	Installed and spring balance tested	Lifts	EN certified and in auto (must demonstrate operation in fire mode)
Revolving doors	100% installed and tested (means of escape)	BMU	EN certified
External fire escape doors	Installed with push bars – clear escape path externally	Cladding	100% installed (may affect extract volumes)
Inlet / extract plenums	Louvres fitted and cleaned	Fixed louvres	Installed and tested with vent (prevents sign off of smoke extract system volumes)
Automatic opening vents (including windows)	Installed and tested with vent	Ceilings	All service tiles fitted with devices, lights, sounders, detectors sprinkler heads

BMS function testing – Common Problems

BMS room not ready – temporary head end	Need to replicate tests, permit to access areas (cannot easily produce screen dumps)
Fire Command Centre not ready – temporary head end	Need to replicate tests, permit to access areas – 2nd BMS head end often in FCC (cannot easily produce screen dumps)
BMS point to graphic testing not 100% complete	Ancillary systems often deemed ‘not important’ and are left behind such as pumping station level switches, permanent weather station
Inlet plenums incomplete / still too dirty	Prevents running main air plant continuously Filters getting blocked / too many alarms
Lighting control generally not finished	Too many lights not fitted all over the building
Riser works still ongoing	Network continuously interrupted by ‘breaks’ ie. damage or power being turned off
Too much builders work outstanding	C&E / IST is pushed to out of hours working. But tests still need to be repeated when key building works are completed
Spending too much money on repeat tests	Witnessing is often outsourced, so commissioning companies need to be instructed to repeat the tests – risk of claims from supply chain testing systems twice

Fire Alarm cause & effect testing - definition

- **“Proving what happens (the effect) when a fire alarm device is activated (the cause)”**
- **The cause and effect testing of fire alarm systems are heavily regulated by statute and must be proven to the building Control Officer (BCO) prior to occupation being determined, usually 100%.**
- **Building regulations must be strictly adhered to.**

Fire Alarm cause & effect testing

- Small Example of a C&E Spreadsheet

Effect	Staircase Pressurisation	Door releases	Roof vents	Plant shutdown	Fire Pumps	Fire/smoke dampers open/close	Sounders	Voice alarm
Cause								
Sprinkler flow switch	X	X	X	X	X	X	X	X
Smoke detection 1 st event								X
Smoke detection 2 nd event	X	X	X	X	X	X	X	X
Gas suppression smoke detector			X	X		X	X	X
Hydrants					X			
Hose reels					X			
Kitchen fire suppression		X		X		X	X	X

- Schedules out exact scenarios that need to be tested and proven
- 100% test and witness to CMT and BCO
- Utilised to record all tests proven

Fire alarm cause & effect testing – M&E pre-requisites

- What status is required to commence testing?

System	Note
Combined network	100% tested and back up power supplies proven
BMS Room	Complete, final clean and signed off
BMS System	Head end permanently fixed with printer for screen shots to record events
BMS System	All alarms cleared from Trend log and system in 'auto'
BMS System	Access rights to software restricted
Access	Permit to access procedure operational & limited personnel within building
Sprinklers	System live, commissioned and in auto. All floor switches / tamper valves proven
Damper Control Systems	Dampers proven in 'normal' and 'smoke' mode
Generator fuel system	Dump lines proven and sufficient fuel to test system

System	Note
HV / LV Rooms	All HV & LV switchrooms are live and operational. Castel proven, SCADA and EMS tested and proven
Fire Command	Complete, final clean and signed off
Fire Alarm	All devices permanently fixed and 100% point to point testing proven
Fire Alarm	All faults & alarms cleared log and system in 'auto'
Main Plant (Htg/CHW/Cond/Air)	All commissioned and in auto
Lighting General	All lights permanently fixed and system commissioned and in auto.
Smoke Extract Systems (Car Park / Stairs)	Systems commissioned, balanced, witnessed and in 'auto'
Windows (if opened on alarms)	Vent make up & or smoke extract proven
Access Control	Permit to access procedure operational & limited personnel within building

Fire Alarm cause & effect testing pre-requisites

- What status is required to commence testing?

Security doors	100% installed and tested
Security gates	100% installed and tested
Security maglocks	100% installed and tested (means of escape)
Internal doors	Installed and spring balance tested
Revolving doors	100% installed and tested (means of escape)
External fire escape doors	Installed with push bars – clear escape path externally
On site accommodation	Site teams move to off-site accommodation
Inlet / extract plenums	Louvres fitted and cleaned

Staircases	Completed – no outstanding building works or fire stopping. Demo stair pressurisation / AV system
Lifts	EN certified and in auto (must demonstrate operation in fire mode)
BMU	EN certified
Cladding	100% installed (may affect extract volumes)
Fixed louvres	Installed and tested with vent (prevents sign off of smoke extract system volumes)
Automatic opening vents (including windows)	Installed and tested with vent
Permit to access	Limited persons within the building, managed access to all areas
Ceilings	All service tiles fitted with devices, lights, sounders, detectors

Fire Alarm cause & effect testing – Common problems

Issue	Impact
BMS room not ready – temporary head end	Need to replicate tests, permit to access areas (cannot easily produce screen dumps)
Fire Command Centre not ready – temporary head end	Need to replicate tests, permit to access areas (cannot easily produce screen dumps)
Fire alarm heads not permanently fixed	Cannot sign off system until mounted in permanent position (will always be a caveat requiring re-visits)
Sprinkler heads not permanently fixed	Cannot sign off system until mounted in permanent position (will always be a caveat requiring re-visits)
Too many building works outstanding	C&E / IST is pushed to out of hours working. But tests still need to be repeated when key building works are completed
IT Rooms not 5micron clean prior to fit-out	Client insists sensitive equipment such as security IT switches etc are replaced
Door closures needing adjustment or changing in smoke extract mode	Often takes 4 or 5 times to test. Needs BMS/Power/Fire Alarm contractors in attendance
Spending too much on repeat tests	Witnessing is often outsourced, so commissioning companies need to be instructed to repeat the tests – risk of claims from supply chain testing systems twice

Cause & Effect testing Common problems

Issue	Impact
Air intake plenums generally last to be built	Air balance cannot be signed off as the pressure profile on the inlet / discharge AHU fans will change and system will require rebalance (smoke extract)
Ceilings not all installed to enable lights to be installed	Lighting control cannot be set up until all lights in each area are installed (C&E needs to dim or brighten the lights)
Fire stopping not completed	Supply & Extract air systems cannot be signed off until fire stopping is complete
Too many temporary doors too late leading to permanent doors & door closures not set up correctly	Staircase pressurisation does not work, door closures need to be reset, staircase pressurisation needs to be retested
Fire alarm audibility either too loud or too quiet	Doors need to be undercut or ceiling tile acoustic lining hasn't been cut. Fire alarm sounders need to be rewired
Too much temporary power is used as building not ready to accept HV or power on	Systems need to be commissioned on permanent power Too many temporaries remain affecting fire stopping and the like
Too many people in the building	Testing has to be repeated as doors are opened, risers are open security is breached

Black Building / Integration- definition

- **BBT – “The controlled manual switching of electrical supplies to prove that the building operates in all possible planned failure scenarios”**
- **i.e. Switching off the main incoming electrical utility feed. Monitoring and proving that the building provides back up power to the intended systems**

- **Integration – “The controlled manual switching of all systems to prove the interrelationships between one another, typically for maintenance procedures.**
- **i.e. Taking a pump off-line for maintenance and see the system switch from run to standby pumps**

Black Building / Integration– pre-requisites

- What status is required to commence testing? Note: for this test the power is turned off.

BMS System	BMS function testing 100%	Electrical system	LV switchboards switching system tested and signed off
BMS System	Head end faults cleared, ALL plant running in auto, operational and proven to descriptions of operation	Switchgear	Trip batteries charged, all outgoing circuits live, LV switching schedule and AP to be present
Fire alarm system	Fire alarm tested and signed off to the C&E document, soak test complete	Smoke damper control panel and MFSDs	Commissioned & fully operational
Fire alarm PA/VA	No faults, paper in print roll	Lifts	Operational and in automatic mode
Mechanical plant	Fully operational; hand & auto; mains and generator proven	All digital displays	All clocks synchronised, all panels fault free
Sprinkler system	No faults, system charted, tamper & flow switches operational	Critical spares	Delivered and stored in case of critical failure
Information	All specifications and contractor design available	Test equipment	All necessary equipment to operate the testing procedures

Environmental / SCOP - definition

- **“Running an empty building for a set period of time to prove that it has been set up to the design parameters”**
- **For example, setting up a data logger in an open plan office and monitoring the temperature minute by minute for 48 hours, presenting the results on a graph to demonstrate that it doesn't deviate at any stage beyond the set point limit (e.g. $\pm 2^{\circ}\text{C}$), whilst simultaneously monitoring the noise of the engineering services operating within the space and in tandem with the architectural finishes ensuring that the noise is within the design sound spectrum**

Environmental / SCOP – pre-requisites

- **What M&E status is required to commence environmental / SCOP testing?**
- **MEP**
- **BMS function testing complete, witnessed and signed off**
- **Cause & effect complete, witnessed and signed off**
- **IST / BBT complete, witnessed and signed off**
- **Building**
- **Decoration complete**
- **Installation complete, clean, minimal people in the building**
- **Doors closed and under control**

The IST document files

1.0 – Overview

The purpose of this document is to expand upon the specifications to provide a building and system wide narrative and testing schedule of the operation of plant and equipment under different combinations of power loss / reinstatement scenarios.

2.0 – System Status / pre-requisites

Prior to the commencement of the integrated system tests there is the need to identify which systems need to have been installed, commissioned and tested on a stand-alone basis as a minimum. (Some interfaces and switching sequencing will no doubt have been included during these tests).

3.0 – Personnel location / reporting strategy

This section details the key personnel that will be required during the IST sequencing and their specific roles and responsibilities.

4.0 – Schedule of test scenarios

This section describes all test scenarios.

Managing the production of the O&Ms

To oversee the production of the following documentation prepared by the various work package contractors and the professional team:-

- **Operating and Maintenance Manuals.**
- **As Built Drawings**

Final handover

The culmination of a successful project is the handover to the client of a fully operational building that is fully compliant in all respects.

- **Statutory inspections complete and signed off**
- **Witnessing complete**
- **Integrated system tests complete**
- **Environmental performance tests complete**
- **Zero or minimal snags outstanding**
- **Training complete**
- **Soft landing approach adopted**
- **Operation and Maintenance Manuals complete with all test documentation**
- **As Built Drawings complete reviewed and placed in O&M**

Thank you

Questions?