EXPRO National Manual for Projects Management

Volume 6, chapter 7

Building Management System and Mechanical System Integration Guideline

Document No. EPM-KE0-GL-000009 Rev 002

Document Submittal History:

Revision:	Date:	Reason For Issue
000	04/01/2018	For Use
001	24/12/2018	For Use
002	15/08/2021	For Use

THIS NOTICE MUST ACCOMPANY EVERY COPY OF THIS DOCUMENT

IMPORTANT NOTICE

This document, ("Document") is the exclusive property of Government Expenditure & Projects Efficiency Authority.

This Document should be read in its entirety including the terms of this Important Notice. The government entities may disclose this Document or extracts of this Document to their respective consultants and/or contractors, provided that such disclosure includes this Important Notice.

Any use or reliance on this Document, or extracts thereof, by any party, including government entities and their respective consultants and/or contractors, is at that third party's sole risk and responsibility. Government Expenditure and Projects Efficiency Authority, to the maximum extent permitted by law, disclaim all liability (including for losses or damages of whatsoever nature claimed on whatsoever basis including negligence or otherwise) to any third party howsoever arising with respect to or in connection with the use of this Document including any liability caused by negligent acts or omissions.

This Document and its contents are valid only for the conditions reported in it and as of the date of this Document.

Table of Contents

1.0 PURPOSE 5

2.0 SCOPE 5

3.0 DEFINITIONS 5

4.0 REFERENCES 6

5.0 RESPONSIBILITIES 6

5.1 Owner/Entity 6
5.2 Commissioning Authority (CA) 6
5.3 Designer (Architect/Engineer) - A/E 6
5.4 Owner Representatives - Consultants, Project Management or Construction Management 6
5.5 T&C Agent - Main Construction Contractor In-house T&C Entity or Specialized Third Party 6
5.6 Operation and Maintenance Personnel (OMP) 7

6.0 BMS & MECHANICAL INTEGRATION DEVELOPMENT PROCESS 7

6.1 General 7
6.2 During Design Stage 8
6.3 During Construction Stage 8

7.0 ATTACHMENTS 9

7.1 Attachment 1 : EPM-KE0-TP-000017 – BMS and Mechanical System Integration Cheklist 10
7.2 Attachment 2 : EPM-KT0-TP-000053 - BMS and EPMS Point To Point and Loop Testing Template 13
7.3 Attachment 3 : EPM-KT0-TP-000051 - BMS Control Set-Point and Parameter Testing - Template 14
7.4 Attachment 4: EPM-KT0-TP-000051 - BMS Graphic Testing Template 15
7.5 Attachment 5 : EPM-KEE-13-000003 - BMS and Mechanical Integration Block Diagram 16

1.0 PURPOSE

To identify the Commissioning Process required by ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers) and LEED (Leadership in Energy and Environmental Design) for the Building Management System (BMS) and Mechanical System integration in any projects. Commissioning Process covers design and construction requirements to prove the functionality and reliability of the BMS and integrated mechanical systems.

2.0 SCOPE

This document defines requirements during the design stage to develop the BMS and mechanical system integration (as applicable). Construction phase testing requirements to ensure proper functionality of the BMS and integrated mechanical systems are also define. The procedure defines minimum requirements for integration, the scope of each entity required for successful integration, and the process of integration during the design and construction stage.

3.0 DEFINITIONS

Definitions	Description
Data Point Schedule (DPS)	A representation of points to be controlled and monitor in table format. Functions such as control and monitoring (especially that of the HVAC) are listed and represented in I/O Points (Input and Output Point to and from the controller)
Sequence of Operation (SOO)	A written explanation and description how the HVAC equipment and system is intended to work in air side and water side distribution.
Process and Instrumentation Diagram (PID)	A schematic presentation showing the equipment, field devices, and input/output to the Direct Digital Controller (DDC) for the purpose of simplifying the functional description of the equipment and system.
Owner Project Requirements (OPR)	A client/owner generated mandatory pre-design document by ASHRAE, LEED, and NFPA, which is the basis of the Basis of Design (BOD) preparation, construction, acceptance, and operational requirements. The document contains the specific and detailed functional requirement (in less technical term) of the project and expectations how the project will be used and operate
Basis of Design (BoD)	An A/E generated mandatory pre-construction document by ASHRAE, LEED, and NFPA, which is the basis of preparation for the Systems Manual, Commissioning Plan, and Construction Documents. The BOD covers the OPR in a more detailed, specific, and technical terms.
Commissioning Record	Testing commissioning documents (T&C) documentation that Includes issues log, commissioning plan & methodology, progress reports, submittal and O&M manual reviews, training record, test schedules, construction checklists, start-up reports, functional tests, and trend log analysis.
Integration Testing Plan	Ths can be part of the overall T&C Plan, which is a strategic project specific procedure of documentation on how to complete the T&C for a given scope of work in a given project time duration. It outlines the scope and extent of the work, organization, schedule, recording, allocation of resources, and coordination planning.
Integration Methodology	This can be part of the over-all T&C Methodology which is a written protocol that defines procedures and expectations for test conducted on equipment, assemblies, systems, and interfaces (or integration). The document includes test prerequisites, test conditions, limitation and tolerance, tools and instruments to be used, schematics, and safety risk assessment.

4.0 REFERENCES

Document Number	Title of the Document
EPM-KT0-PR-000006	Project Testing and Commissioning Procedure
EPM-KT0-GL-000003	Project Testing and Commissioning Guideline
EPM-KE0-TP-000017	Checklist - BMS and Mechanical Integration
EPM-KEE-GL-000002	ELV Design System Guideline
EPM-KEE-TP-000022	Template – ELV System Design Criteria
EPM-KEE-RG-000002	List of ELV Design Aids
EPM-KEE-GL-000004	ELV System Guideline
EPM-KEE-TP-000012	Checklist – Structured Cabling System Layout
EPM-KEE-TP-000025	Checklist – Access Control System Layout
EPM-KEE-TP-000027	Checklist – Master Clock System Layout
EPM-KEE-TP-000030	Checklist – Fire Alarm System Layout

5.0 RESPONSIBILITIES

5.1 Owner/Entity

Establish an OPR and ensure scope includes a Commissioning Authority to review completeness of design and construction documents related to the requirements of the BMS, HVAC, and other Building Services System for control and monitoring. The document shall also include any applicable requirement for mechanical system integration. For the detailed SoW (Scope of Works) for the Owner during design, construction, and occupancy, refer to the Project Testing and Commissioning Guideline EPM-KT0-GL-000003.

5.2 Commissioning Authority (CA)

Assist the Owner/Entity to ensure that the OPR is completely developed and requirements for the BMS monitoring and control, as well as any mechanical integration requirements. For the detailed SoW of the CA during design, construction, and occupancy, refer to the Project Testing and Commissioning Guideline EPM-KT0-GL-000003.

5.3 Designer (Architect/Engineer) - A/E

Establish the BoD and requirements for HVAC and other Building Services control and monitoring for the BMS, as well as any mechanical integration (as applicable). Establish development of preliminary Data Point Schedule (DPS), Sequence of Operation (SOO) for HVAC equipment, air and water distribution, and Process and Instrumentation Diagram (PID). Provide clarification to all enquiries during the construction phase. For the detailed SoW of the A/E during design, construction, and occupancy, refer to the Project Testing and Commissioning Guideline EPM-KT0-GL-000003.

5.4 Owner Representatives - Consultants, Project Management or Construction Management

Participate in the review of the BMS and other mechanical integration documents and advise improvements to ensure compliance to Standards. Conduct site inspection and supervise the T&C implementation to ensure quality control. For the detailed SoW of the Owner Representative during design, construction, and occupancy, refer to the Project Testing and Commissioning Guideline EPM-KT0-GL-000003.

5.5 T&C Agent - Main Construction Contractor In-house T&C Entity or Specialized Third Party

Develop and populate the preliminary DPS, SOO, and PID documents based on selected BMS Vendor and field devices such as sensors and actuators. Supervise Trade Contractor installation and testing activities based on approved T&C Plan and Methodology, and ensure that quality control measures are implemented. For the detailed SoW of the T&C Agent during design, construction, and occupancy, refer to the Project Testing and Commissioning Guideline EPM-KT0-GL-000003.

5.6 Operation and Maintenance Personnel (OMP)

Address operational and maintenance requirement of the systems and participate during testing of the systems as standalone and as integrated. For the detailed SoW of the OMP during design, construction, and occupancy, refer to the Project Testing and Commissioning Guideline EPM-KT0-GL-000003.

6.0 BMS & MECHANICAL INTEGRATION DEVELOPMENT PROCESS

6.1 General

Building Management System shall cover control and/or monitoring of the following HVAC Equipment and Systems as required by the OPR, BoD, and Project Specification:

Equipment Monitoring and Control:

- Air Handling Unit
- Fan Coil Unit
- Variable Air Volume Boxes
- Exhaust Fans
- Chilled Water Pumps
- Cooling Tower
- Condenser Water Pumps
- Hydronic Hot Water Pumps
- Chillers
- Boilers
- Condensate Recovery Unit
- Steam Generators

HVAC System Control and Monitoring for:

- Chilled Water Distribution – Primary or Primary/Secondary System
- Condenser Water Distribution
- Air Distribution System

Monitoring of Building Services System Equipment as follows:

- Electrical equipment (switchgear, switchboard, RMU, transformer, UPS, Batteries, Capacitor Bank, etc.) status (on/off) and trip
- Plumbing Booster and Sewage Pumps
- Fire Pumps (as applicable)
- Water Tank level status
- Fuel Tank level status

Extra Low Voltage (ELV) System integration to BMS shall include the following, as applicable to the contract:

- Security and Access Control System
- Voice and Data Infrastructure
- Master Clock System
- Fire Detection and Alarm System

Mechanical System Integration which includes:

- Emergency shutdown of AHU (Air handling unit) during shut-down of Negative Isolation Room Exhaust Fan for Healthcare.
- Control and monitoring of Mechanical Fire and Life Safety System such as (1) Zoned Smoke Control System, and (2) Staircase Pressurization utilizing VFD scheme.

- Monitoring of Mechanical Fire and Life Safety System such as (1) Lift Lobby or Lift Shaft Pressurization System, (2) Atrium Smoke Extraction System, and (3) Car Parking Smoke Extraction System.

Electrical System Integration which includes:

- Lighting System monitoring and control
- Electrical Power Management System monitoring

6.2 During Design Stage

1. Preliminary Data Point Schedule shall be defined in the OPR during the pre-design stage to provide client and OMP requirements for monitoring and control of HVAC equipment, electrical equipment, and other Building Services equipment. The CA and the Owner Representative shall assist the Owner in establishing the requirements.
2. Based on the selected and Client accepted HVAC equipment and system as applicable for the project type, the A/E in coordination with the CA and Owner Representative shall further develop the DPS, SOO, and PID for equipment, air side distribution, and water side distribution system.
3. Particular Specifications shall be developed by the A/E for the BMS and mechanical system integration (as applicable) to indicate method of connectivity between systems, quantity and level of operator interface, types and level of controllers and field devices, method of connection between client and server controllers, inclusive of the preferred communication protocols. It is advised that the BMS System to be native BACNet (void of gateways) as possible where building/network controllers are BACNet compliance, or controllers (Building/Network Controllers to Advance Application Controllers) operates in communication protocols that are truly inter-operable in terms of Data Sharing, Alarm and Event Management, Trending, Device and Network Management, and Scheduling. Field devices or Application Specific Controllers shall be BACNet compliance for inter-operability, which do not require gateways. If the contract requires limited inter-operability for the field controllers or devices (at the link layer) for the purpose of security, LON shall be given preference. The Specification shall include PoE requirement for level controllers and it shall be coordinated with the Voice and Data Infrastructure PoE switch cassis. PoE and Non-PoE controllers shall in no case be mixed. For BMS and other Integration Specification requirements during the design phase, refer to checklist BMS & Mechanical System Integration Checklist EPM-KE0-TP-000017.
4. BMS and Mechanical System integration diagram shall be developed and prepared by the design team to aid the Main Contractor and BMS Trade Contractor with regards to the requirements for systems connectivity (e.g. to Voice and Data Infrastructure and wireless network via TCP/IP Ethernet, interface to Security and Access Control System, lighting system controls, Master Clock, etc.).
5. The design team shall stablish method of operation and connectivity for the AHU serving any Negative Isolation Rooms to the isolation exhaust fan and exhaust system, as the contract requires (applicable for healthcare projects). Option shall include the following;
    - A direct electro-mechanical link from a duct flow switch, pressure sensor, or differential pressure sensor to the starter panel of the AHU thru relays and auxiliary contacts
    - A digital input to the AHU DDC (Air Handling Unit Direct Digital Control System) direct from the filed device (flow switch, pressure sensor, etc.)
    - A global communication between the Exhaust Fan DDC and AHU DDC
6. Cyber Security needs to be addressed, assigned responsibility, and direction for codes to follow shall be included.

6.3 During Construction Stage

1. The Main Contractor and his T&C Agent shall prepare a comprehensive Testing Plan and Methodology for BMS System and Mechanical Integration (as applicable) to be approved by the CA and the Owner Representatives.
2. The Main Contractor T&C Agent shall coordinate with Trade Contractors to populate and develop the BMS DPS, SOO, and PID based on selected vendor and field devices (such as sensors and actuators).

3. The Main Contractor T&C Agent in coordination with selected Trade Contractors (or Specialist) for ELV Systems shall develop and update connectivity between systems and provide gateways as appropriate for the required integration.
4. The Main Contractor shall ensure that field devices procurement shall be coordinated with the T&C schedule and re-certification shall be based on date of installation or use and not on the date of last test. All required testing shall immediately commence upon installation.
5. The BMS and any mechanical system shall pass all required testing as standalone system prior to any integration works. The BMS shall undergo the following test and be substantiated by Tend Log prints. The T&C Agent shall refer to document EPM-KT0-GL-000003 Project Testing and Commissioning Guidelines:
    a. Point to Point Testing
    b. Loop Testing
    c. Graphic Functional Testing
    d. System Performance Testing, Fine Tuning, and Optimization
    e. Seasonal Performance Testing
6. The Main Contractor with his T&C Agent shall conduct testing for BMS and integrated mechanical system to be witnessed and accepted by the CA and Owner's Representative prior to the preliminary project handover.
7. Integrated Testing and Commissioning records, to prove the completeness of the BMS and Integrated Testing works shall be submitted by the Main Contractor and his T&C Agent to the Client duly approved by the Commissioning Authority and Client Representatives.
8. All Integrated Testing Plan and Procedures shall conform to best construction practices.

7.0 ATTACHMENTS

1. EPM-KE0-TP-000017 - BMS and Mechanical System Integration Chechlist
2. EPM-KT0-TP-000053 - BMS and EPMS Point to Point and Loop Testing Template
3. EPM-KT0-TP-000052 - BMS Control Set-Point and Parameter Testing Template
4. EPM-KT0-TP-000051 - BMS Graphic Testing Template
5. EPM-KEE-13-000003 - BMS and Mechanical Integration Block Diagram

7.1 Attachment 1 : EPM-KE0-TP-000017 – BMS and Mechanical System Integration Checklist

PROJECT NAME:		DISCIPLINE:	REV.
EQUIPMENT TYPE: **BMS & Mechanical System Integration**	EQUIPMENT TAG:	EQUIPMENT LOCATION:	

No.	QUESTIONS	ORIGINATOR		
		N/A	YES	NO
Building Management System				
	General Specification Requirements and Standard Compliance			
1	The BMS Specification included statements to ensure compliance to the following:	☐	☐	☐
	a. The requirements of prEN 13646:1999 Building Control Systems - Equipment characteristics are met.	☐	☐	☐
	b. The requirements of prEN ISO 16484-2: Building Control Systems - Part 2: HVAC Control System functionality are met.	☐	☐	☐
	c. The BMS design complies with the Low Voltage Directive 73/23/EEC and amendment 93/68/EEC, Construction Product Directive 89/106/EEC, and General Product Safety Directive 92/59/EEC.	☐	☐	☐
	d. The BMS Control panels comply with EN 60439-1: Low Voltage Switchgear and control assemblies.	☐	☐	☐
	e. The BMS can operate with the supplied electricity conforming to BSEN 50160 - Voltage characteristics of electricity supplied by public distribution system or as per Saudi Arabian Distribution Code.	☐	☐	☐
	f. The BMS complies with the electromagnetic Compatibility (EMC) Directives 89/336/EEC.	☐	☐	☐
	g. The BMS complies with BSEN 50081-1: Generic Emission Standard and BSEN 50082 Part 1 & 2: Generic Immunity Standard.	☐	☐	☐
	h. BMS fully restores all control and monitoring functions following an emergency shutdown condition.	☐	☐	☐
	i. Uninterruptible Power Supply (UPS) facility conforms to the requirements of the Specification.	☐	☐	☐
	j. All time-dependent BMS components are time synchronized via the operator workstation. Provisions are made for synchronization with Master Clock System as applicable.	☐	☐	☐
	k. Minimum password protected operator access are provided for the following levels:	☐	☐	☐
	Level 1 - ability to display all point data	☐	☐	☐
	Level 2 - as level 1, with the ability to initiate data logging functions	☐	☐	☐
	Level 3 - as level 2, with the ability to change user-adjustable set points and time schedules	☐	☐	☐
	Level 4 - as level 3, with the ability to change control strategies, schematics/graphics functions and password assigned.	☐	☐	☐
	l. The BMS and its operation performed under any maintenance contract complies with BS 7799 Parts 1 and 2 – Information Security Management, Part 1 – Code of Practice for information security management, Part 2- Specification for Information Security Management System.	☐	☐	☐
	m. Latest IT Industry Standard Operating System and softwares (user-interface and control application software) are used.	☐	☐	☐
	n. Copies of all BMS vendor-specific software are held by an independent third party and that this software can be released to the client. Ensure that an ESCROW Agreement is completed and signed. All license to use software applications are owned by the Client.	☐	☐	☐
	o. A viable strategy is in place to fully support the BMS for the minimum 10-year period from the date of practical completion.	☐	☐	☐
	Specification Requirements for System Architecture			
2	System architecture, design, and installation shall comply with BSRIA AG 9/2001 or other reputable standards such as NEC, NEMA, etc. System components shall have UL 916 listing.	☐	☐	☐
3	Statement is included in the Specification that the BMS is designed for commission ability, maintainability, and future system expansion. System architecture shall incorporate distributed control techniques and intelligence and shall comprise of following logical layers; • Management level processor • Operations level processor • System level controllers • Zoe level controllers and field layer for field devices	☐	☐	☐
4	Designer considered and coordinate aspects of system design such as workstation requirements (processor, operating system, connectivity ports, Ethernet connection speed, hard disc and CD-RW drive capacity, panel resolution, sound card, browser, and GUI), Web-based connectivity, security, bandwidth, scalability, time sync, information storage, authorization level, and redundancy.	☐	☐	☐

PROJECT NAME:	DISCIPLINE:			REV.
1	Particular Specification is provided for Building Management System which includes the following.	☐	☐	☐
	a. Design Data Point Schedule which includes:			
	• Signal type matching by voltage (0-10 v, 0-5v, 2-10 volts), or current signal (4-20mA) between devices and zone level controllers.	☐	☐	☐
	• Required equipment functions/description	☐	☐	☐
	• Field device requirement	☐	☐	☐
	• Equipment included in the BMS control and monitoring.	☐	☐	☐
2	Mains power supplies for controllers and devices are included (24v DC, 24v AC, or 220 v AC) in the Specification or POE (Power Over Ethernet) is required. Requirements for essential power are included.	☐	☐	☐
3	If POE is required, BMS controllers and field devices power requirements matches the POE Switch Chassis power availability. Up to 15 watts for POE switch, up to 30 watts for POE plus, and up to 60 watts for Universal POE.	☐	☐	☐
4	Passive and active components of the Voice and Data Infrastructure is selected for the combined capacity for all IP Based Low Current Systems.	☐	☐	☐
5	Operator works stations level (management and operation level) shall be defined by the designer. Level of information, security, and access detained in the operation level workstation shall be defined.	☐	☐	☐
6	Specification clearly defines communication protocol between the network controllers, controller hierarchies, and field devices. BMS System shall be Native BACNet as possible where network controllers are BACNet compliance that do not require gateways, and communication protocols between controllers are truly inter operable at the link layer.	☐	☐	☐
7	If the OPR, BoD, and Specification calls for limited inter-operability in field device levels (at link layer) for security purposes. LON or other reputable propriety flat form shall be provided.	☐	☐	☐
8	Field devices (sensors, measuring devices, actuators, etc.) are NIST calibrated. Required criteria for the accuracy of field devices stated in the specification including device drift (during storage and during use) to identify re-calibration/replacement requirements.	☐	☐	☐
9	Provision for integration with FDAS, Security and Access Control, Master clock, Wireless Network, and Lighting System is provided thru software integration.	☐	☐	☐
10	Requirement for BMS graphics provided from over-all system management, water distribution, air distribution, steam distribution, electro-mechanical equipment, building floor levels, etc.	☐	☐	☐
11	Requirement for trend logging, alarm/event routing and notification, and data archiving are incorporated.	☐	☐	☐
12	A Commissioning Authority employed by the Client to provide comprehensive review and recommendation for all documents related to BMS (e.g. BMS Specification, BOD, OPR, etc.) to comply with the Client's requirements and Standards during the stages of design development.	☐	☐	☐
13	Clear description of division of responsibilities between integrating parties provided.	☐	☐	☐
14	Testing and Commissioning requirements are defined in the Specification such as:	☐	☐	☐
	a. Comprehensive methodology for Integrated Testing.	☐	☐	☐
	b. Integration Testing Plan to include:	☐	☐	☐
	• Identification of procedure, limits, and process of inspection.	☐	☐	☐
	• Scope and list of systems, equipment, devices, and other items covered under the FLS Integration Program.	☐	☐	☐
	• Overview of the Integration Strategy.	☐	☐	☐
	• Milestone schedule.	☐	☐	☐
	• FLS Integrator Third Party Agent Organizational Chart.	☐	☐	☐
	• Reporting procedure for progress, defects, and corrections	☐	☐	☐
	• Division of Responsibilities between Trade Contractors.	☐	☐	☐
	• Integration checklist and templates.	☐	☐	☐
15	Training requirements for Maintenance Staff identified in the Specification (duration, programming, hands-on, external or local training, etc.)	☐	☐	☐
	Drawings, Tables and Diagrams			
16	Separate HVAC control schematic diagram is provided which indicates the following:	☐	☐	☐
	a. Sequence of operation for the AHU and air distribution system.	☐	☐	☐
	b. Sequence of operation for the pumps and chilled water distribution system.	☐	☐	☐
	c. Sequence of operation for hydronic hot water distribution system	☐	☐	☐
	d. Sequence of operation for exhaust fan and exhaust ducting system.	☐	☐	☐
	e. Sequence of operation for the boiler and steam distribution system.	☐	☐	☐
	f. Process and instrumentation diagram for HVAC Equipment such as AHU, pumps, chillers, fans, boiler, CRUs, and heat exchangers.	☐	☐	☐

	a. Control strategy such as reset strategy, proportional control, rate-of-change, control set-points, control points, etc.	☐	☐	☐
1	HVAC drawings indicates equipment labelling which coincides with control schematics and Data Point schedule labelling.	☐	☐	☐
2	BMS Network Diagram is developed and provided by the designer, which includes system architecture and methods of connection between zone level controllers and devices, controller hierarchy, Data Infrastructure, inclusive of gateways as required.	☐	☐	☐
3	Cyber Security needs to be addressed, assigned responsibility, and direction for codes to follow shall be included.	☐	☐	☐
Mechanical System Integration				
	Integration of AHU to the Exhaust System of Negative Isolation Room for Healthcare			
4	Negative Isolation Rooms are grouped in reference to the Centralized Air Handling Unit supplying cold and treated air and exhaust air system, or dedicated cooling units ad exhaust air system are provided for each Neg. Isolation Room. AHU to shut down in any case of failure of the exhaust fan to run, thus ensuring that the room will not turn into positive pressure.	☐	☐	☐
5	Negative Isolation Rooms are integrated to the exhaust systems via the following method:	☐	☐	☐
	a. By BMS integration globally or locally thru DDC.			
	b. Electro-mechanical interlink thru flow switch, relays, and contactors.			
6	A schematic and control diagram is developed and provided by the designer for the system integration.	☐	☐	☐

No.	Reviewer's Comments	Resolution

Originator's Name / Signature and Date:	Checker's Name / Signature and Date:

7.2 Attachment 2 : EPM-KT0-TP-000053 - BMS and EPMS Point To Point and Loop Testing Template

Project:										Panel Location:			
Package No.										Asset Code:		Sheet No.	
Building:										Plant Ref:		Rev.	
SR No.	Equipment & Functional Description	Analog		Digital			Peripheral			Cable Termination		Continuity	Comments
		I/P	O/P	STS	ALM	O/P	Device	Inst'n		Panel	Field		
Tested by: ..... Date:										Witnessed by: ..... Date:			Accepted by: ..... Date: .....

7.3 Attachment 3 : EPM-KT0-TP-000051 - BMS Control Set-Point and Parameter Testing - Template

Project:					Panel Location:		
Package No.					Asset Code:		Sheet No.
Building:					Plant Ref:		Rev.
Point Name (AS 1000 Acronym)	Description Control Function	Control Setpoint Value	P-Band Value	Integral Time	Alarm Limits		Comments
					High	Low	
Tested by:			Witnessed by:			Accepted by:	
Test Instruments Sr No.			Date:			Date:	

7.4 Attachment 4: EPM-KT0-TP-000051 - BMS Graphic Testing Template

Project:										Panel Location:			
Package No.										Asset Code:		Sheet No.	
Building:										Plant Ref:		Rev.	
SR No.	Equipment & Functional Description	Analog		Digital			Peripheral			Cable Termination		Continuity	Comments
		I/P	O/P	STS	ALM	O/P	Device	Inst'n		Panel	Field		
Tested by: ..... Date:										Witnessed by: ..... Date:			
Accepted by: ..... Date:													

7.5 Attachment 5 : EPM-KEE-13-000003 - BMS and Mechanical Integration Block Diagram