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Life Safety Maintenance Plan for Healthcare

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1.0 PURPOSE

The purpose of this document is to provide guidance in developing and improving maintenance plans for Life Safety Systems (LSS) within the healthcare sector. These are minimum requirements for maintenance, inspection, and repair of the systems which the Entity and/or Facilities Management Company (FMC) shall modify specific to its needs. Furthermore, this document seeks to improve and enhance the Entity's overall understanding of LSS maintenance, convey best practice and guidance on the incorporation of international standards and regulations in conjunction with the Kingdom of Saudi Arabia's (KSA) established codes and decrees.

Successful maintenance planning of LSS relies on conducting maintenance at the right time to the right level, such that the performance may be optimized, and equipment life may be maximized.

By providing guidance on Planned Maintenance (PM) and supporting examples of maintenance scheduling frequencies, this document is intended to:

- Impart knowledge that enables the Entity and/or FMC, a base structure from which it can develop a set of documents and procedures
- Enable management, and engineers to have a clear understanding of the minimum maintenance requirements, along with Entity, client, FMC, staff roles, and responsibilities
- Identify the base analytical information that shall be recorded by engineers and technicians to ensure that discrepancies are pre-emptively identified and rectified through the maintenance management processes applied
- Guide the Entity and FMC service providers on how to develop the LSS maintenance management plans/manual
- Provide a structured flow and reliable reference points within the document that can be related back to the relevant sections
- Provide examples and guidance on how to formulate a facility specific set of documentation; developed against a What, Why, How, Who and When structure that includes the Shall, Should, Consider and Advise philosophy

2.0 SCOPE

The scope of this document is to guide those responsible for ensuring that LSS maintenance is carried out in a consistent and reliable manner, focusing on planned activities and the reduction of costly and disruptive reactive maintenance. The Entity, Facilities Management Company (FMC), and/or their specialist service providers shall take steps to enhance the current practice of developing a maintenance plan for efficient healthcare facility operations.

The information contained herein covers key elements of maintenance planning for LSS within healthcare facilities that shall be incorporated as a minimum into the finalized facility maintenance plan including, but not limited to:

- Key roles and responsibilities
- Details about the LSS, subsystems and equipment
- Equipment PM scheduling requirements
- Health and safety of stakeholders and the environment

For the purpose of this document, "a healthcare facility" has been defined as any location where healthcare is provided including, but not limited to:

- Hospitals
- Clinics
- Nursing homes
- Dental care facilities

Specialist healthcare facilities often include departments that will be equipped with or may be served by bespoke plant and equipment such as university hospital (e.g., surgeon teaching facilities), and healthcare research laboratory (e.g., bio-hazard extract, aseptic suite with specialist infection and access control),

palliative care (specialist environmental lighting), dialysis clinics (specialist environmental lighting and reverse osmosis (RO) plant.

Notwithstanding, the recommendations presented in this document, the final responsibilities for developing the final maintenances management plans/tasks as will be applied to the LSS shall remain with the Entity, FMC, and/or Maintenance Engineer (ME).

It must be understood that adopting or being requested by the client to adopt particular managing standards, e.g., National Fire Protection Association (NFPA) over Saudi Standards, Metrology and Quality Organization (SASO) shall affect how the roles and responsibilities are structured within the maintenance management process. When formulating this guide document, the NFPA standards have been adopted in the preparation, with additional referencing to demonstrate how the structure may be compiled.

Some parts of the maintenance plan may require scheduling to be calculated in run-hours rather than calendar-based activities. Additionally, specific engineering competency levels could be specified by the facility adopted standards or Original Equipment Manufacturer (OEM) guidelines or procedures. These requirements shall be covered by referencing the appropriate and specific regulations and standards**.**

For the facilities bespoke document, other standards shall be considered, and the most effective and/or stringent scheduling/planned maintenance elements be adopted as far as possible.

Only the systems found within the Entity's facilities shall be included into the facilities bespoke 'Life Safety Maintenance Plan' documents.

The finalized scheduling and task documents disseminated, as working documents shall be reviewed on a regular basis thereafter to ensure all information and process content are updated, relevant, and meet with the asset list for maintainable plant and equipment within the facility.

3.0 DEFINITIONS

Term	Definition
AHJ	Authority Having Jurisdiction
AP	Authorized Person
ATS	Auto Transfer Switch
BMS	Building Management System
CB	Capacitor bank
CBAHI	Saudi Central Board for Accreditation of Healthcare Institutions
CBS	Central Battery System
CMMS	Computer Maintenance Management System
COSHH	Control of Substances Hazardous to Health Regulations
CP	Competent Person
CSSD	Central Sterile Services Department
DALI	Digital Addressable Lighting Interface
DB	Distribution Board
DSP	Distribution Service Provider (electrical generation entity)
ECRA	Electricity & Co-Generation Regulatory Authority
ELV	Extra Low Voltage (classified as below 50V)
EPDS	Emergency Power Distribution System
EPS	Emergency Power System
EPSS	Emergency Power Supply System
FM	Facilities Manager
FMC	Facilities Management Company (facilities maintenances)
FOC	Facilities Operating Client (client/building owner)
FOM	Facilities Operations Management (client/building owner representative)
HBN	Health Building Note
HC	Healthcare

Term	Definition
HF	Harmonic Filter
HTM	Health Technical Memoranda
HV	High Voltage {classified as above 13.8KV (an allowable variance of between 13.1kV to 14.5kV is applicable}
IBC	International Building Code
IEC	International Electro technical Commission
IEEE	Institute of Electrical and Electronic Engineers
IET	Institute of Engineering & Technology
IFC	International Fire Code
IPS	Isolated Power Supply
LV	Low Voltage (classified as being above 50V and below 600V)
MDB	Main Distribution Boards
ME	Maintenances Engineer
MEWP	Mobile Equipment Work Platform (Scissor/Boom Lift)
MGCP	Medical Gas control panels
MS	Method Statement
MSDS	Materials Safety Data Sheet
MV	Medium Voltage (classified as being above 600V and below 13.8KV)
MVS	Medium Voltage Substation
MVSN	Medium Voltage Supply Network
NCP	Nurse Call Panels
NEMA	National Electrical Manufacturers Association
NFPA	National Fire Protection Association
NSF	National Standards Foundation
O&M	Operations and Maintenance
OEM	Original Equipment Manufacturer
OSHA	Occupational Safety and Health Administrations
PDS	Pneumatic Delivery Station
PPE	Personal Protective Equipment
PM	Planned Maintenance
QPM	Quarterly Preventative Maintenance
RA	Risk Assessment
RAMS	Risk Assessment & Method Statement
RMU	Ring Main Unit
RO	Reverse Osmosis
SASO	Saudi Standards, Metrology and Quality Organization
SEC	Saudi Electrical Company
SMDB	Sub-Main Distribution Board
SOP	Standard Operating Procedure
SS	Substation
TR	Transformers
UL	Underwriters Laboratories, Inc.
UPS	Uninterruptable Power Supplies
VESDA	Very Early Smoke Detection Apparatus
VFD	Variable Frequency Drive

Table 1: Definitions

4.0 REFERENCES

- Saudi Central Board for Accreditation of Healthcare Institutions (CBAHI)
- Health Building Note (HBN 00-07)
- Health and Safety Executive (HSE) – Electricity at Work Safe Working Practices (HSG 85)
- Health and Safety Executive (HSE) – Memorandum of guidance on the Electricity at Work Regulations:1989 (HSR 25)
- Health and Safety Executive (HSE GS38) – Electrical test equipment for use on low voltage electrical systems
- Health and Safety Executive (HSE L22) – Safe use of work equipment – Provision and Use of Work Equipment Regulations 1998 (PUWER)
- Healthcare Technical Memoranda (HTM 00 2015)
- Healthcare Technical Memoranda (HTM 06-01 2015)
- Healthcare Technical Memoranda (HTM 06-02 2015)
- Healthcare Technical Memoranda (HTM 06-03 2015)
- Institute of Engineering Technology (IET) – Guide to Electrical Installations in Medical Locations:2017
- Institute of Engineering Technology (IET) – BS 7671:2018
- National Fire Protection Association (NFPA 1) – Fire Code
- National Fire Protection Association (NFPA 4) – Standard for Integrated Fire Protection and Life Safety System Testing
- National Fire Protection Association (NFPA 12A) – Standard on Halon 1301 Fire Extinguishing Systems
- National Fire Protection Association (NFPA 25) – Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems
- National Fire Protection Association (NFPA 50) – Standard for Bulk Oxygen Systems at Consumer Sites
- National Fire Protection Association (NFPA 70) – National Electrical Code
- National Fire Protection Association (NFPA 70A) – National Electrical Code Requirements for One, and Two-Family Dwellings
- National Fire Protection Association (NFPA 70B) – Recommended Practice for Electrical Equipment Maintenance
- National Fire Protection Association (NFPA 70E) – Standard for Electrical Safety in the Workplace
- National Fire Protection Association (NFPA 73) – Standard for Electrical Inspections in the Workplace
- National Fire Protection Association (NFPA 78) – Guide to Electrical Inspections
- National Fire Protection Association (NFPA 79) – Electrical Standard for Industrial Machinery
- National Fire Protection Association (NFPA 101) – Life Safety Code
- National Fire Protection Association (NFPA 110) – Standard for Emergency and Standby Power Systems {Chapter 5 and 8 – Emergency Power System (EPS), Chapter 8 – Emergency Power Supply System (EPSS)}
- National Fire Protection Association (NFPA 111) – Standard on Stored Electrical Energy Emergency and Standby Power Systems
- National Fire Protection Association (NFPA 418) – Standard for Heliports
- National Fire Protection Association (NFPA 496) – Standard for Purged and Pressurized Enclosures for Electrical Equipment
- National Fire Protection Association (NFPA 497) – Recommended Practice for the Classification of Flammable Liquids, Gases, or Vapors and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas
- National Fire Protection Association (NFPA 791) – Recommended Practice and Procedures for Unlabeled Electrical Equipment Evaluation
- National Fire Protection Association (NFPA 853) – Standard for the Installation of Stationary Fuel Cell Power Systems
- National Fire Protection Association (NFPA 1078) – Standard for Electrical Inspector Professional Qualifications
- National Fire Protection Association (NFPA 99) – Health Care Facilities Code
- Saudi Standards, Metrology and Quality Organization (SASO)
- Saudi Building Codes (SBC)

- Saudi Electrical Codes
- Saudi Electrical Company (SEC) – Electrical Standard
- Standard for Facilities Management Solutions Guide/Software (SFG20 BESA)
- The Electricity at Work Regulations Act 1989
- The Electricity Safety, Quality and Continuity Regulations Act:2002
- The Electricity Safety, Quality and Continuity Regulations Act 2002 – URN 02/144 (Guidance)

These standards shall be selectively applied based on the evaluation of individual requirements. Where the standards stipulated conditions conflict, the most stringent shall govern, unless otherwise noted herein. When there is any conflict with the Saudi Building Code (SBC), only the Saudi Building Code will be applied.

5.0 RESPONSIBILITIES

The Entity is the final Authority Having Jurisdiction (AHJ) unless specifically stated otherwise in other sections of the National Manual of Assets and Facilities Management. If a conflict is discovered between these guidelines and other operations management documents, it shall be brought to the attention of the Entity, who will provide a resolution or direction to ensure that all electrical systems' goals and requirements have been met.

The responsibilities of the roles mentioned in the above chart are as follows:

Role	Description
Entity	Governmental Entity having Jurisdiction over schools and universities
Entity Representative {Facilities Operating Client (FOC)}	Entity representative having overall management of the facility
Electrical Safety Group	Committee appointed by, and representing the FOC
Facilities Operations Management (FOM)	Discipline certified managers and engineers appointed by FOC to oversee any appointed Facilities Management Company (FMC) activities
Designated Responsible Person (Multi-disciplines)	The Responsible Person is employed directly by the Entity/FOC and is the "Duty Holder" of the engineering systems and is responsible and accountable for the design, installation, operations, maintenance and ensuring control of those systems The Responsible Person has a responsibility for ensuring that the Entity has complied with the relevant legal and statutory regulations pertaining to those engineering systems and the staff involved. The Responsible Person shall ensure that the systems are kept up to date with the latest relevant legal regulations and decrees
Facilities Management Company (FMC)	The FMC is an appointed Entity/FOC representative who, in collaboration with the Entity/FOC, controls the operational engineering departments; and who is responsible and accountable for the staffing as well as the site engineering systems, their operations, and maintenance and ensuring control of those systems are in line with the Entity/FOC SOP for the maintenance activities

Role	Description
Designated Authorizing Person (Multi-disciplined)	The Designated Authorizing Person, AP, is appointed by the FMC (normally under the recommendation of the operating client), to take responsibility for the effective management of the safety guidance. The AE should possess a degree of independence from local management and be authorized to act Where necessary alert the chief executive, should local management not take action to avoid harm The Authorizing Person is also responsible for ensuring the relevant governing body is kept up to date and that the FOC is informed of any known anomalies that may pose a safety risk to the facility or staff and students
Qualified Person (MV/LV/ELV Electrical)	FOC/FMC approved persons. Certified, competent and experienced. Possess the necessary site knowledge to formulate and/or follow the necessary FOC SOP documentation. Also oversee the FMC's activities
Qualified Person (Mechanical/HVAC/Plumbing)	A FOC/FMC approved person. Certified, competent and experienced. Possess the necessary site knowledge to formulate and or follow the necessary FOC SOP documentation. Oversees the FMC's activities
Competent Person (Multi-Disciplined)	An individual with the necessary training, and who has been appointed by an Authorized Person (or by an authorizing body within the Entity), after confirmation of competence, knowledge, skill, and experience. The Competent Person can execute the required actions within a Permit To Work (PTW) and/or any other directional document as may be assigned to him/her

Table 2: Roles and Responsibilities

5.1 Electrical Safety Group

As per HTM, an Electrical Safety Group (ESG) needs to be established. The role of this group is to discuss current issues, solutions, and forthcoming potential problems (i.e., with new projects or dealing with new legislation), to assist in avoiding project clashes, outages, and taking/formulating mitigating actions.

Figure 1 provides an example of structure that shall be employed as best practice; ESG designations may change dependent on the FMC organization structure:

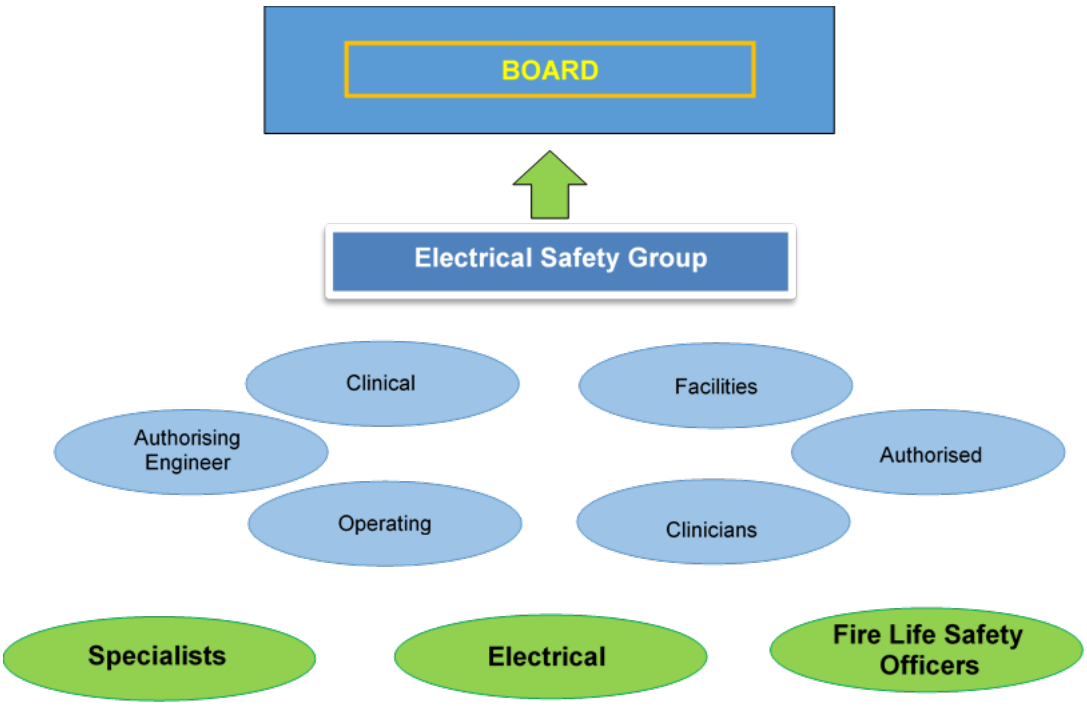

Figure 1: Electrical Safety Group

5.2 Roles and Responsibilities for Schedules & PM Task Implementation

Figure 2 given below highlights the responsibilities and flow process for the formulation of maintenance plans and activities. The diagram highlights the organizations' responsibilities in the formulation of a maintenance strategy that will assist the Entity in achieving corporate goals in enhancing the facility operations with the following benefits:

- Reducing breakdowns of plant and equipment through robust maintenance process
- Early identification of faults or degraded equipment to allow contingency planning
- Efficient utilization of manpower to undertake preventive maintenance activities, rather than reactive or corrective tasks
- Planning of spare parts and consumables to be available for maintenance activity
- Reduction in warehouse stock and obsolescence
- Accurate reporting to senior management and stakeholders. Especially if used in conjunction with CMMS systems
- Better utilization of utilities (e.g., power, water) through an efficient use of plant

Further detail on the formulation of strategic plans can be found within the NMA & FM, Volume 6 Chapter 4 – Financial Planning.

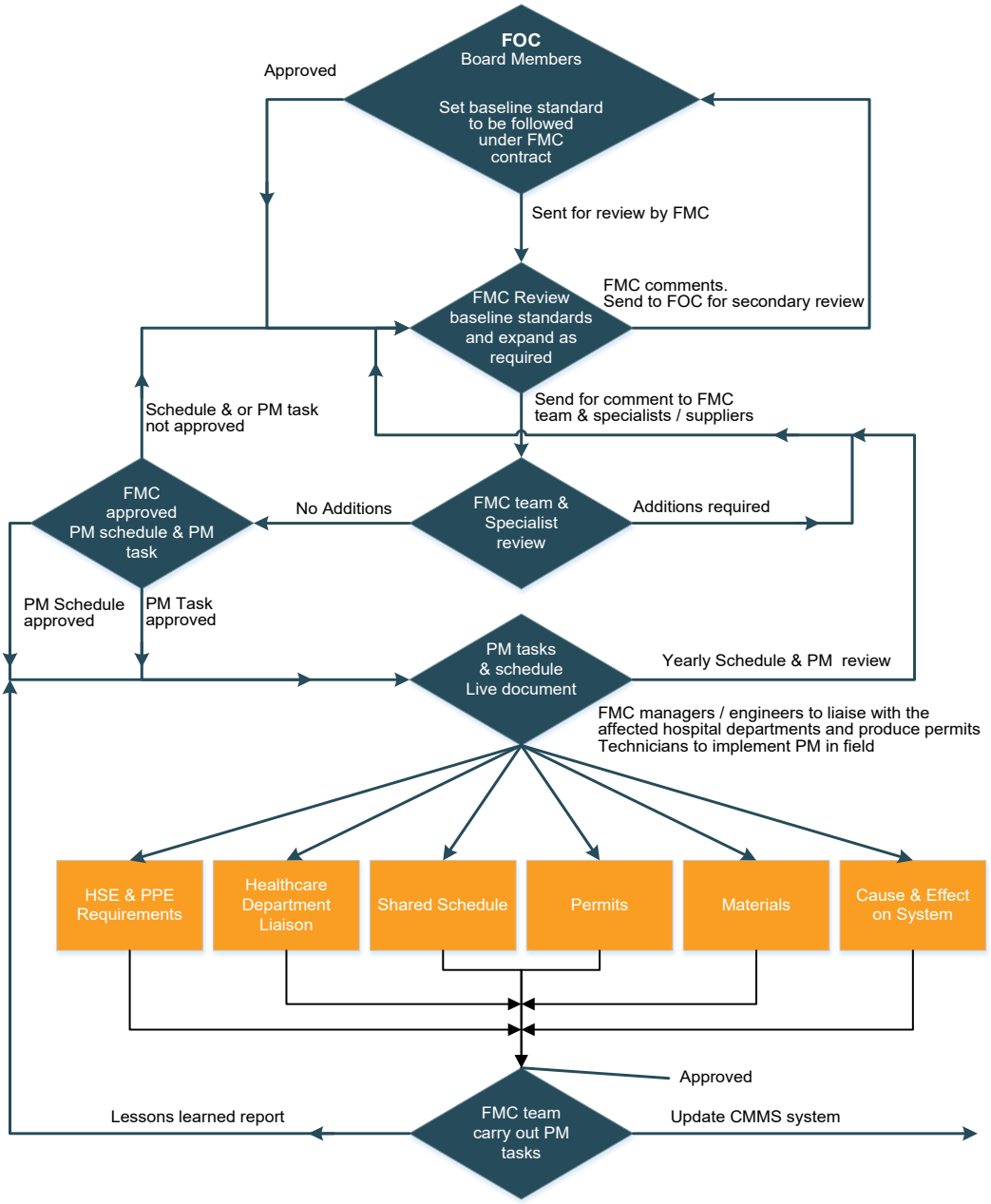

Figure 2: Roles & Responsibilities for Schedules & PM task implementation

6.0 PROCESS

Maintenance of LSS is considered as a mandatory activity to ensure that the systems installed within a facility are correctly and regularly maintained, often as per the statutory requirement of the KSA civil defense.

The Responsible Person shall ensure the following:

- Competent staff monitor the LSS
- Site staff or specialist contractors maintain records for outcomes of the LSS maintenance

Asset lists held at site shall indicate LSS maintenance as critical activities that shall be undertaken when due. Deviations from stipulated maintenance frequency of tasks shall only be the decision of Responsible Person.
In this document the following systems are considered within the LSS' division in this document, whereas the specialist systems that may be installed in a facility as per the local requirements shall be captured within the overall facility maintenance plan and schedule.

It is a recommendation that the entity have in place a dedicated Fire Logbook that shall be used to record all LSS specific activities, as a single point of reference. This will detail all systems requiring periodic checks, operation, and maintenance activity. Many versions are available from commercial sources or can be compiled locally by the Entity. An example of the types of checks to be undertaken and recorded are contained within **Attachment 4**.

Many of these systems require specialist knowledge and the FMC shall consider manufacturer/supplier maintenance procedure training on the systems to better enable the responsible maintenance staff, or engaging a specialist suppliers' assistance. This will be dependent on the KSA civil defense and or regulatory/standard requirements. Refer to **Attachment 2** for basic guidance.

6.1 Systems Overview

The Entity and/or FMC shall define the facilities hierarchical LSS structure/headings.

- Emergency power distribution
- Emergency power generation
- Fire alarm
- Fire ancillary
- Fire detection
- Fire egress safety and communications
- Fire suppression
- Fuel delivery
- Fuel storage
- Medical gas including oxygen delivery
- Medical gas including oxygen storage
- Medical water plant and equipment
- Medical specialist electrical infrastructure and delivery equipment
- Medical specialist electrical clinical equipment
- Smoke control
- Specialist emergency lighting
- Specialist secondary emergency power backup
- Water delivery (firefighting)
- Water storage (firefighting)

6.1.1 Life Safety Systems Components

The Entity and/or FMC shall define the facilities' life safety sub systems, in relation to the hierarchal headings (equipment associations and PM requirements).

6.1.1.1 Emergency Power Distribution

- Emergency Power Distribution System (EPDS) generator panels
- Auto transfer switches
- Ring main units
- MV to LV transformers
- Emergency power main distribution board
- Emergency power sub-main distribution board
- Emergency power local distribution board
- Monitoring
- Scheduled PM and testing to standard/regulation

6.1.1.2 Emergency Power Generation

- Fuel supply delivery system (external to internal)
- Fuel supply delivery system infrastructure (e.g., pumps, piping, suspension systems)
- Fuel supply, filtration, storage, delivery, recovery: control and monitoring systems
- Generator fuel delivery system
- Generator liquid cooling filtration, storage, delivery, recovery: control and monitoring systems
- Generator liquid cooling supply delivery system infrastructure (e.g., pumps, piping, suspension systems)
- Generator liquid cooling system plant
- Generator sets
- Local fuel filtration (e.g., strainers)
- Local fuel storage tank (e.g., cleaning, sampling)
- Main fuel filtration
- Main fuel storage tank
- Monitoring
- Scheduled PM and testing to standard/regulation

6.1.1.3 Fire Alarm

- Beacon
- Bell
- Fire annunciator panels
- Sounder
- Sounder/Beacon
- Voice evacuation (dedicated fire address or public address system announcement)
- Monitoring
- Scheduled PM and testing to standard/regulation

6.1.1.4 Fire Ancillary

- Fire command center
- Fire personnel elevators
- Fire vehicle access route
- Medical emergency helipad
- Monitoring
- Scheduled PM and testing to standard/regulation

6.1.1.5 Fire Detection

- Aspiration particulate
- VESDA (variation of aspiration for inaccessible areas)
- Heat
- Ionization

- Ionization/Photoelectric
- Laser/IR (e.g., beam detectors)
- Linear heat cable
- Optical
- Photoelectric
- Monitoring
- Scheduled PM and testing to standard/regulation

6.1.1.6 Fire Egress Safety and Communications

- Fire door
- Fire dampers
- Fire roller shutter
- Fire rated wall
- Fire rated covering (e.g., flame retardant, low smoke materials)
- Fire rated penetration (e.g., sealer, specialist raceway cable cradles, expansion blocks)
- Hold open devices
- Electromagnetic locks
- Fire curtain
- Smoke guard
- Elevators and lifts (See associated NMA & FM Chapter 6.17.2)
- Refuge area telephones
- Fire telephone systems
- PMR systems
- Monitoring
- Scheduled PM and testing to standard/regulation

6.1.1.7 Fire Suppression

- Sprinkler
- Wet riser system
- Dry riser facilities
- Foam
- Gaseous
- Water mist
- Hose reel and cabinets
- Hydrant
- Extinguisher
- Blanket
- Monitoring
- Scheduled PM and testing to standard/regulation

6.1.1.8 Fuel Delivery

- Pumps
- Strainers
- Flow meters
- Monitoring
- Scheduled PM and testing to standard/regulation

6.1.1.9 Fuel Storage

- Tanks
- Cleaning
- Monitoring
- Scheduled PM and testing to standard/regulation

6.1.1.10 Medical Gas Including Oxygen Delivery

- Monitoring panel
- Infrastructure
- Purging
- Monitoring
- Scheduled PM and testing to standard/regulation
- Pharmacy third party testing

6.1.1.11 Medical Gas Including Oxygen Storage

- Pressurized tanks
- Cleaning
- Monitoring
- Scheduled PM and testing to standard/regulation
- Third party certification

6.1.1.12 Medical Water Plant and Equipment

- Reverse osmosis (RO) water storage tank
- Reverse osmosis (RO) water delivery infrastructure
- Cleaning
- Scheduled PM and Testing to Standard/Regulation
- Third party certification

6.1.1.13 Medical Specialist Electrical Infrastructure and Delivery Equipment

- Isolated Power Supply (IPS)
- Magnetic Resonance Imaging (MRI) cooling and control panel
- MEIGaN Earthing
- Equipotential bonding/potential equalization
- Medical equipment only power outlets
- Monitoring
- Scheduled PM and testing to standard/regulation
- Third party certification

6.1.1.14 Medical Specialist Electrical Clinical Equipment

- Theatre light
- Medical pendants
- Medical panels
- Monitoring
- Scheduled PM and testing to standard/regulation

6.1.1.15 Smoke Control

- Extract (HVAC)
- Curtains
- Doors
- Fire/Smoke dampers
- Hold open devices
- Electromagnetic locks
- Monitoring
- Scheduled PM and testing to standard/regulation

6.1.1.16 Specialist Emergency Light

- Central Battery Lighting System (CBS)
  - Monitoring
  - Computerized control system (head end)
  - Control Panel (e.g., monitoring and auto transfer unit)
  - Battery Cabinets/room (e.g., battery strings monitoring unit)
  - Batteries (battery strings)
  - Scheduled PM and testing to standard/regulation
- Emergency light
  - Non maintained
  - Maintained
  - DALI Emergency
  - Sustained
  - Monitoring
  - Scheduled PM and testing to standard/regulation

6.1.1.17 Specialist Secondary Emergency Power Backup

- Central Uninterruptable Power Supply (CUPS)
- Local Uninterruptable Power Supply (UPS)
- Computerized control system (head end)
- Control panel (e.g., monitoring and auto transfer unit)
- Battery cabinets/room (e.g., battery strings monitoring unit)
- Batteries (e.g., battery strings)
- Monitoring
- Scheduled PM and testing to standard/regulation

6.1.1.18 Water Delivery (Fire Fighting)

- Dedicated EMDB (red)
- Fire pumps
- Fire make-up pumps
- Pre action unit
- Deluge unit
- Infrastructure (e.g., pipes)
- Monitoring
- Scheduled PM and testing to standard/regulation

6.1.1.19 Water Storage (Fire Fighting)

- Tanks
- Monitoring
- Scheduled PM and testing to standard/regulation
- Cleaning

This is not a fully comprehensive list and shall be compiled dependent on the facilities installed equipment being maintained.

It is the Entities and/or FMC's responsibility to ensure that only the life safety elements within the FMC controlled facility are fully covered and compliant.

6.2 Equipment Maintenance Frequencies and Requirements

The Entity and/or FMC shall define the facilities' life safety hierarchical/parent systems, sub systems, equipment maintenance frequencies and requirements.

6.2.1 Daily

Daily maintenance shall be carried out as PM tasks controlled via the Computer Maintenance Management System (CMMS), or as a monitoring function only. This will however be dependent on the adopted operating standards and the FOC's SOP. Daily checks and monitoring are key for any Entity to ensure that plant and services are available for the designed function. Ideally a check shall be undertaken at the start of the working day and periodically throughout the shift or working cycle. Simple log sheets can be used to record parameters and demonstrate the areas and equipment that have been visited and inspected respectively.

The systems, areas, and equipment that shall be monitored on a daily basis within a healthcare facility and as good practice are:

- Emergency lighting
- Fire related equipment (e.g., fire pump plant/controls, Novec/FM200 gas suppression plant/ controls)
- Helipad lighting and controls including building aircraft warning lights
- IPS units (normally located within e.g., theaters, intensive care units)
- LV main distribution boards
- Medical gas plant/controls
- Oxygen plant/controls
- Theater and specialist department monitoring plant/controls/panels
- Other critical system monitoring control panels

This is not a fully comprehensive list and shall be compiled dependent on the facilities installed equipment being maintained.

Findings shall always be recorded into the maintenance log system either hard copy or via a software based system. All records shall be maintained at site for a minimum of three (3) years and then archived.

6.2.2 Weekly

Weekly maintenance carried out as PM tasks are controlled via the CMMS, these may be operational checks or observations being recorded within a local logbook or registered within the CMMS. The results and observations from these checks allow senior management to make fact based decisions on the strategy for planned maintenance and future financial decisions and budgets.

The systems, areas, and equipment that shall be monitored on a weekly basis as an addition to the daily tasks within a healthcare facility and as good practice are:

- IPS systems
- LSS for fire detection and suppression (further information is contained within NMA & FM, Volume 6 Chapter 12)
- Lighting and distribution networks
- MV/LV emergency generation plant/controls
- MV/LV EPS (emergency power system)
- Theater and specialist department monitoring plant/controls/panels
- UPS and CBS battery systems
- Other critical system monitoring control panels (further information on EPS and EPSS scheduling guidance is contained within NFPA 110, Chapter 5 & 8)

Findings shall always be recorded into the maintenance log system either in a hard copy or via a software based system. Some PM weekly tasks shall be included as specific PM tasks within the CMMS again, these are documented within NFPA.

6.2.3 Monthly

Monthly maintenance tasks are generally classified as “intrusive maintenance” and may involve partial shutdown of systems. Therefore, they shall be included as part of the Maintenance plan in the CMMS, within a paper or software based system. However, the roles and responsibilities, required competencies, site specific SOPs, cause and effect, and risk management need to be considered when formulating these PM tasks. Staff competencies must align with the equipment being maintained and tested, as incorrect operation or maintenance could lead to system unavailability which may have a detrimental effect upon the facility (e.g., inability to utilize essential departmental facilities, if sprinkler system is unavailable). Additionally, stakeholder engagement shall be part of the process so that the staff, departments, and end users affected may be consulted or informed prior to the activity.

Mandatory regulatory and/or adopted standards compliances shall be taken into consideration, along with any HTM, NFPA, and CBAHI references. These shall be part of a ‘Criticality Assessment’ undertaken at the inception of the maintenance plan to identify those items of plant that have a significant effect upon operations, or attributable to a compliance/statutory requirement. The OEM service manuals shall be included within the PM task procedures to ensure equipment is correctly serviced to reduce potential outages and improve reliability and lifecycle. Further guidance on maintenance tasks can be found within **Section 4.0**.

Nevertheless, depending on the criticality of the maintenance and its cause and effect (e.g., its effect on upstream and downstream services, patient wellbeing, clinical lead, estates, facilities staff) the managing departments shall be informed, and prior approval be sought in advance; to circumvent potential risks or potential outages affecting patients, staff, and healthcare operations.

When formulating the schedule and/or PM task in-line with these considerations, it shall be noted that seasonal variances need to be incorporated. Refer to NMA & FM, Volume 5 Chapter 2 – Seasonal Operations Planning, for further guidance.

The maintenance management team shall be aware of and liaise with discipline managers to ensure that multi shutdowns for specific plant and/or equipment are minimalized. The coordination of PM tasks, engineering staff resource sharing, and work permits will enable the FMC to obtain staff efficiencies and cause, as minimal as possible, disruption to the healthcare facility departments and patients wellbeing.

It is also the FMC’s responsibility to track/log and update records, review and ensure that licensing, certification, staff competencies, training, and PM compliance to standards and/or regulations are continually reviewed and updated, relevant to the latest editions/versions. This is a required action that shall be scheduled into the maintenance plan and entered into the CMMS as an action point.

Within a healthcare environment, where high levels of safety are required for patients and staff. The equipment and tools required for maintenance shall also be maintained for their use, and where applicable, be tested and met with calibration or compliance requirements. Personnel shall be trained in their use, particularly when high level access of LSS is required. In particular, if Mobile Elevating Work Platforms (MEWPs) are being utilized then staff shall be trained and certified in their use, and areas of segregation are provided to prevent inadvertent access to the work area by those not involved. Personal Protective Equipment (PPE), must be in good condition and any deficiencies or damaged items must be replaced.

It is good practice to include these checks within the Risk and Method Statements (RAMS) to ensure that these are recorded, and formal inspection takes place. Additionally, recording this within the CMMS allows for historical data to be tracked, and consumable or perishable stock to be ordered and delivered in good time, as to avoid delays or postponement of activities. These tasks shall be scheduled one to two weeks prior to the validity end date, or more for longer lead items, to enable continuity and efficiency of use.

When structuring the maintenance plan, it shall be noted that the HTM standards give a comprehensive operations guidance, however, the NFPA standards provide PM examples including compliant scheduling guide tables.

As an example for the EPS, a tabulated baseline requirement with daily, weekly monitoring, and monthly, biannual, annual, biennial, quinquennial PM tasks that shall be carried out, are available within the NFPA guidance.

It is the PM tasks and scheduling owner's responsibility to ensure that all standard/regulatory and/or compliance activities are covered for the facilities assets and recorded in the facilities database. Refer to **Attachment 3** for further details.

The checklist shall include, but not be limited to, the systems mentioned below:

- Carbon monoxide detection and warning equipment
- Emergency generation and associated systems – NFPA 110, 72 & 70B
- Fire Pumps
- Fire systems
- Firefighting lifts and controls
- Fuel storage and delivery systems
- Generators and associated EPS
- Lightning protection system
- Medical related plant and equipment
    - NFPA 70 & 720
    - NFPA 70 & 780
    - NFPA 70, 70B 110 & 111
- Smoke control
- Stored electrical energy systems emergency lighting and central battery systems
- Theatre and specialist department areas
- UPS & CBS
- Water-based fire systems – NFPA 12, 72, 20 & 25

NFPA references mentioned above are for guidance only and do not contain exhaustive standard list to be applied.

6.2.4 Quarterly

Quarterly PM tasks usually involve extended downtime of plant during maintenance activities. The maintenance tasks that are scheduled on monthly basis or greater period will generally take additional time to complete. There may also be a requirement to isolate the equipment from service which may also require switching operations to take place, involving multiple members of staff.

It is of prime importance that the following is undertaken prior to this activity:

- Clinical/Stakeholder engagement
- Competent personnel to undertake the task
- Consumables, spare parts availability
- Isolation facility and associated LOTO equipment
- Permit To Work (PTW)
- Segregation and barriers available to prevent intrusion into the work area

The above list is not exhaustive and local requirements may require further considerations. These shall be included within the maintenance instruction guide/task instruction sheet.

To understand the additional requirements and how they shall be scheduled within the monthly PM tasks or as a separate action; a cross referencing, review exercise, and approval process shall be undertaken by the FMC team. Refer to Figure 2 above, for roles and responsibilities flow chart.

When the quarterly additions have been established, are in line with compliance, standards and regulation, and approved as per the process, the CMMS managing party need to understand how to input information into the system. This could be the current condition as an assessment for future planning; or where deficiencies may exist, will require a maintenance task to be created for follow up action. Parameters for input logging need to be set and those associations with other tasks that need to be made, must also be defined.

It is important, during the further development of PM tasks and input into the adopted CMMS system, to establish what output reports the FMC and/or client/Entity will require from the information and how they could be gathered and reported. Guidance shall be sought from the software developer or included manuals, where bespoke reports may be required.

As with the monthly scheduling and PM tasks, a good guide reference for the maintenance plan are the NFPA standards.

6.2.5 Biannual

Biannual PM tasks may be standalone or may include the quarterly PM tasks formulated with additional requirements. It shall be noted that six monthly (biannual) PM tasks will often require manufacturer recommended or standard mandated equipment and/or consumable part replacements (NFPA 110 demonstrates this within the PM frequency and task tables at annex A for EPS).

Where scheduled maintenance will have a significant impact upon the operation of the facility, the scheduled periods may need to be brought in advance or deferred to meet with term requirements of the facility. These changes shall be agreed with any third party support where delaying maintenance could have financial implications upon warranty or contractual comprehensive agreements. Senior management of the facility shall have the approval of the Ministry to make these decisions at a local level.

Reporting for biannual activities shall follow the same process for recording and reporting functions, as the above recommendations for monthly maintenance activity.

6.2.6 Annual

These procedures may again be standalone tasks or be inclusive of the biannual procedures formulated with additional requirements. Some of these tasks may need high level FOC management approval well in advance (depending on the cause and effect on the building operations), to enable adequate resources to be available.

The same considerations shall be undertaken for annual activities described above for biannual as this may require the manufacturer or his agent to complete the activity. The maintenance team shall record all activities and retain copies of service documentation on site for future reference or compliance. Where possible, the service record shall be recorded within the CMMS as a signed copy by both the service technician (OEM/agent) and approved technician or operation engineer at site, upon handover.

There may also be a requirement for Post Maintenance Testing (PMT) to take place, and be demonstrated to site FOC/FMC staff, upon completion. The procedure for recording and witnessing those activities can be found in the within NMA & FM Volume 6 Chapter 27 – Post Maintenance Testing (PMT).

6.2.7 Biennial

These procedures shall normally include the annual procedures and replace the annual PM tasks, however, they may also be a separate standalone PM tasks that shall involve integrated system shutdown and testing.

This is due to the biennial tasks being in general more internally intrusive to the equipment and may require extended shutdown and parts replacement. The FOC and FMC must access the cause and effect on the building operations, staff and patients, and schedule appropriately. An example of a biennial task is transformer maintenance requiring a full shutdown and isolation at MV and LV level. This may require standby systems to be brought into service for extended periods to allow maintenance activities to be performed. It is therefore of paramount importance that these LSS be maintained prior to the biennial activity to allow maintenance to proceed without interruption.

High level FOC management and clinical department approval well in advance (depending on the cause and effect on the facility operations), shall be gained to ensure that adequate resources are available, and that the departmental stakeholder engagement process has been followed.

6.2.8 Quinquennial

These procedures shall normally include the biennial procedures formulated with additional requirements, however, in some cases the quinquennial tasks may be scheduled separately to the annual or biennial PM tasks and will often involve integrated system testing.

The FMC must assess the cause and effect on the building operations and schedule appropriately.
High level FOC management and clinical department approval well in advance (depending on the cause and effect on the facility operations), shall be gained to ensure adequate resources are available, and that the departmental stakeholder engagement process has been followed.

As described in **Section 6.2.3**, subsequent biannual through to quinquennial scheduled maintenance planning for PM tasks shall comply with NFPA standards as a minimum. The FMC shall then expand on this baseline to deliver an efficient, fully compliant, and comprehensive maintenance plan to the Entity and/or FOC.

6.2.9 General Notes

Some annual, biannual and quinquennial tasks are standalone compliance procedures such as periodic life safety system mandated testing and inspection. These task procedures shall be planned and scheduled separately to the normal equipment PM, and may require dedicated engineering staff, multiple specialist supplier support, third party verification/certification.

Dependent upon the facility size, some life safety system PM tasks will normally be scheduled to take place throughout the facility area by area, against an agreed plan of action, and may be scheduled to take place weekly, monthly, quarterly etc., or over a one to five year scheduling period (depending on the volume of assets to be tested).

An example of maintenance activity may include the following:

- Fire Door quarterly PM (every three months)
    - Five hundred (500) number of assets throughout the FMC facility
        - Two (2) quarterly PM tasks per year per asset

Each Fire Door quarterly integrated system testing PM takes one (1) hour. Therefore, to accomplish just the Fire door quarterly integrated system testing PM tasks, Quarterly Preventative Maintenance (QPM) will need to be scheduled within the maintenance plan over an extended period throughout the year. This does not allow for the weekly monitoring, monthly standalone and yearly integrated tasks. Therefore, the maintenance plan must integrate as far as possible the PM tasks, and schedule manpower accordingly for optimum efficiency enablement. Refer to **Attachment 1**, for further guidance.

The attachments within this document shall enable the Entity, FOC and FMC to understand the fundamentals required when compiling the maintenance plan, or these baseline requirements that may already form the foundation of an existing document needing development.

They are not an exhaustive set of documents but an example. Much analysis of the facilities adopted standards and asset PM requirements will need to be compiled to deliver a final maintenance plan. However, the attached shall guide the FMC on how to gather and record data, enabling them to deliver a maintenance plan schedule and a compliant, comprehensive set of lifecycles, PM tasks and others. In all circumstances due to the nature of the equipment and in many cases – specialist nature, the OEM manuals and guides shall be referenced when compiling maintenance activities and frequency.

7.0 ATTACHMENTS

Attachment 1: EOM-ZM0-TP-000136 – Fire Door Yearly Maintenance Plan Template
Attachment 2: EOM-ZM0-TP-000137 – Maintenance Skill Level Requirements Matrix
Attachment 3: EOM-ZM0-TP-000138 – LSS PM Type Compliance Matrix Template
Attachment 4 – EOM-ZM0-TP-000191 Life Safety System Equipment Checklist

Attachment 1 – EOM-ZM0-TP-000136 – Fire Door Yearly Maintenance Plan Template

Fire Door yearly maintenance plan (EXAMPLE)								
Last revision date: 10/05/2021								
FIRE DOOR yearly maintenance plan example (insert "X" into cell as appropriate)								
Asset No/Tag	**MONTH**	**WEEKLY** Inspection	**MONTHLY** Fire system integrated	**QUARTERLY** Life Safety cause & effect integrated testing	**BIANNUAL** Fire system integrated	**ANNUAL** Life Safety cause & effect integrated testing	**Expand as Required**	
Fire Door 1	1	x						
		x						
		x						
			x					
Fire Door 1	2	x						
		x						
		x						
			x					
Fire Door 1	3	x						
		x						
		x						
				x				
Fire Door 1	4	x						
		x						
		x						
			x					
Fire Door 1	5	x						
		x						
		x						
			x					
Fire Door 1	6	x						
		x						
		x						
					x			
Fire Door 1	7	x						
		x						
		x						
			x					
Fire Door 1	8	x						
		x						
		x						
			x					
Fire Door 1	9	x						
		x						
		x						
				x				
Fire Door 1	10	x						
		x						
		x						
			x					
Fire Door 1	11	x						
		x						
		x						
			x					
Fire Door 1	12	x						
		x						
		x						
						x		
YEARLY TOTAL PM's FOR ASSET FIRE DOOR 1		WEEKLY	MONTHLY	QUARTERLY	BIANNUAL	ANNUAL	XXXX	
		36	8	2	1	1	0	
TOTAL FACILITY FIRE DOOR ASSETS		500						
YEARLY TOTAL PM's FOR FIRE DOOR 500 ASSETS		WEEKLY	MONTHLY	QUARTERLY	BIANNUAL	ANNUAL	XXXX	TOTAL FIRE DOOR PM TASK's PER YEAR
		18,000	**4,000**	**1000**	**500**	**500**	**0**	**24,000**

Attachment 1 continued

Fire Door yearly maintenance plan (EXAMPLE)								
Last revision date: 10/05/2021								
FIRE DOOR yearly maintenance plan example (insert "X" into cell as appropriate)								
Asset No/Tag	**MONTH**	**WEEKLY** Inspection	**MONTHLY** Fire system integrated	**QUARTERLY** **Life Safety cause & effect integrated testing**	**BIANNUAL** Fire system integrated	**ANNUAL** Life Safety cause & effect integrated testing	**Expand as Required**	
Fire Door 1	1							
Fire Door 1	2							
Fire Door 1	3							
Fire Door 1	4							
Fire Door 1	5							
Fire Door 1	6							
Fire Door 1	7							
Fire Door 1	8							
Fire Door 1	9							
Fire Door 1	10							
Fire Door 1	11							
Fire Door 1	12							
YEARLY TOTAL PM's FOR ASSET FIRE DOOR 1		WEEKLY	MONTHLY	QUARTERLY	BIANNUAL	ANNUAL	XXXX	
		0	0	0	0	0	0	
TOTAL FACILITY FIRE DOOR ASSETS		000						
YEARLY TOTAL PM's FOR FIRE DOOR 000 ASSETS		WEEKLY	MONTHLY	QUARTERLY	BIANNUAL	ANNUAL	XXXX	TOTAL FIRE DOOR PM TASK's PER YEAR
		0	**0**	**0**	**0**	**0**	**0**	**24,000**

Attachment 2 – EOM-ZM0-TP-000137 – Maintenance Skill Level Requirements Matrix

NOTE:

1/ This matrix is a guide representation only and should not be replicated as a true illustration of the system competency level requirements

2/ This matrix guide is not a final and comprehensive table and requires further development in line with the facilities LSS assets.

In-house Skill:

Level 1 – manufacturer trained & or Engineer **level 2 –** certified Discipline trained, **level 3 -** competency assessed operative, **level 4 –** assessed helper

Specialist Skill:

Level 1 specialist – life safety licensed company and operatives, **Level 2 specialist** – Manufacturer / manufacturer trained and certified

Type of maintenance task	Service provision by		Required competency level
Emergency Power Distribution System	**In-house**	**Specialist Supplier**	
Generator Panels (EPDS)	☑	☑	**Level 1 / 2 in-house & Level 1 specialist**
Auto Transfer Switches		☑	**Level 1 specialist**
Ring Main Units		☑	**Level 1 specialist**
MV to LV Transformers		☑	**Level 1 specialist**
Emergency Power Main Distribution Board	☑	☑	**Level 1 / 2 in-house & Level 1 specialist**
Emergency Power Sub-Main Distribution Board	☑		**Level 1 / 2 in-house**
Emergency Power Local Distribution Board	☑		**Level 1 / 2 in-house**
Monitoring	☑		**Level 1 / 2 in-house**
Scheduled PM and Testing to Standard/Regulation	☑	☑	**Level 1 / 2 in-house & Level 1 specialist**
Fire Suppression	**In-house**	**Specialist**	
Sprinkler	☑	☑	**Level 1 / 2 in-house & level 1 specialist**
Foam		☑	**Level 1 specialist**
Gaseous		☑	**Level 1 specialist**
Water Mist		☑	**Level 1 specialist**
Hose Reel and Cabinets		☑	**Level 1 specialist**
Hydrant		☑	**Level 1 specialist**
Extinguisher		☑	**Level 1 specialist**
Blanket	☑		**Level 1 / 2 in-house**
Monitoring	☑		**Level 1 / 2 in-house**
Scheduled PM and Testing to Standard/Regulation	☑	☑	**Level 1 / 2 in-house & level 1 specialist**
Fuel Storage			
Tanks		☑	**Level 1 / 2 in-house**
Cleaning		☑	**Level 1 specialist**
Monitoring	☑		**Level 1 / 2 in-house**

Scheduled PM and Testing to Standard/Regulation	☑	☑	**Level 1 / 2 in-house & level 1 specialist**

Attachment 2 continued

NOTE:

1/ This matrix is a guide representation only and should not be replicated as a true illustration of the system competency level requirements

2/ This matrix guide is not a final and comprehensive table and requires further development in line with the facilities LSS assets

In-house Skill:

Level 1 – manufacturer trained & or Engineer **level 2 –** certified Discipline trained, **level 3 -** competency assessed operative, **level 4 –** assessed helper

Specialist Skill:

Level 1 specialist – life safety licensed company and operatives, **Level 3 specialist** – Manufacturer / manufacturer trained and certified

Type of maintenance task	**Service provision by:**		**Required competency level**
Emergency Power Distribution System	**In-house**	**Specialist Supplier**	
Generator Panels(EPDS)			
Auto Transfer Switches			
Ring Main Units			
MV to LV Transformers			
Emergency Power Main Distribution Board			
Emergency Power Sub-Main Distribution Board			
Emergency Power Local Distribution Board			
Monitoring			
Scheduled PM and Testing to Standard/Regulation			
Fire Suppression	**In-house**	**Specialist Supplier**	
Sprinkler			
Foam			
Gaseous			
Water Mist			
Hose Reel and Cabinets			
Hydrant			
Extinguisher			
Blanket			
Monitoring			
Scheduled PM and Testing to Standard/Regulation			
Fuel Storage			
Tanks			
Cleaning			
Monitoring			

Scheduled PM and Testing to Standard/Regulation			

Attachment 3 – EOM-ZM0-TP-000138 – LSS PM Type Compliance Matrix Template

NOTE:

1/ This matrix is a guide representation only and should not be replicated as a true illustration of the designated system categories or inclusion elements such as compliance, standard, regulatory, manufacturer and best practice

2/ This matrix is not a final and comprehensive table and requires further development in line with the facilities LSS assets

Description				Life safety Branch category				Compliant to					
Discipline	System	Sub System	Equipment	Patient Critical	Medical equipment	Essential	Utility	Compliance	Standard	Regulatory	Manufacturer	Best Practice	KSA / NFPA / HTM etc.

Attachment 4 – EOM-ZM0-TP-000191 Life Safety System Equipment Checklist

System	Description of test	Frequency				Remarks
		Daily	Weekly	Monthly	Annual	
Fire Detections	Sounder Test		X			
Fire doors Hold Backs	Check release upon activation		X			
Fire Escape routes / final exit	Check clear of obstruction	X				
Stair Pressurization system	Check fans run on Activation			X		
Elevators	Check proceed to Escape level and doors open		X			
Security Barriers	Check that all open upon activation		X			
Escalators & Moving walkways	Check that they come to stop		X			
Emergency Generator	Operate generator OFF LOAD for maximum of 15 minutes			X		
Emergency Generator	Carry out ON LOAD test of Generator with building or Emergency load				X	
Emergency Lighting	Operate lights for short period to ensure remain illuminated			X		
Emergency lighting	Operate Lighting for full 3 Hour duration test				X	
Sprinkler Pumps	Undertake 'Bell Test' of sprinklers and record cut in pressure		X			
Dry Riser	Check all landing valves and caps are in place			X		
Dry Riser	Check using system pressure and drain down on completion				X	
Fire Dampers	Check operation of fire dampers (visually or confirmation on BMS			X		
Plant & Equipment	Check associated plant shutters down in the event of a fire activation (AHU/TEF/ Kitchen fans)			X		
Fire suppression system	Check panel outputs to 'House Alarm'			X		
Fire Suppression Bottle storage	Check system pressure within limits			X		
Fire Extinguishers check	Check in correct location pins in place and pressure correct			X		
Fire Extinguishers check	Carry out Annual Maintenance				X	
PAVA System Check	Operate TEST message where fitted		X			
PAVA- Carry out dBA test of speakers	Undertake test using calibrated meter of speakers to meet designed output				X	