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Volume 6, Chapter 10

Communication Systems Maintenance Plan for Offices

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1.0 PURPOSE

The purpose of this document is to provide an Entity or Facilities Management Company (FMC) with guidelines, for the maintenance, improvement, and further enhancement of their Maintenance Management Plan (MMP) for communication systems, within offices. Guidelines incorporated into this document aim at further supporting The Entity and/or FMC, towards improving the overall condition of communication systems that fall under the remit of The Entity. In addition, best practices are intended to enable a structured approach towards developing communication systems, maintenance plans.

2.0 SCOPE

The scope of this document includes the infrastructure that will allow data, voice, and digital networks to operate within the Facility. The intricacies of individual systems, would generally be undertaken by specialist service providers due to their complexity being outside of the skills of site technical teams. Guidance is provided for systems effective maintenance considerations and practices, in order to maintain a high-level of efficiency and reduce disruption.

The 'internal communication assets' (Refer to Table 1), and 'specialist systems services', are provided and maintained by the Information Technology (IT) Department, or 3rd parties, and are dependent and supported by the 'core assets' (Refer to Table 2), that are maintained by the Entity. This document is primarily focused on the infrastructures' core assets, and shall require planned, maintenance regimes.

The information herein, is developed from international standards and best industry practices to further improve and enhance the communications systems maintenance plans, within "Offices" Entity. Furthermore, it will support the Entity towards a better understanding of the following:

- Elements involved in maintenance planning of the communications systems
- Maintenance task management, and execution to optimize the efficiency of communications systems
- Maintaining and demonstrating Quality Assurance and Quality Control (QA/QC) of the maintenance tasks
- Ensuring that all activities are undertaken with consultation of stakeholders ensuring that service impact is reduced or mitigated

For an engineering system to be efficient and utilized to its optimal life cycle, a 'Conduct of Maintenance' shall be established to effectively maintain communication assets and equipment.

For the purpose of this document, an "office facility" has been defined as a building, portion of a building or space where businesses operate including, but not limited to:

- High rise buildings
- Low rise buildings
- Commercial blocks
- Business centers/hub

2.1 List of Internal Communication Assets

As mentioned below, the maintenance of 'internal communication assets' shall be the responsibility of the IT department and/or 3rd Party suppliers.

Internal Communication Assets	Maintenance Responsibility
Attack Alarms	IT or 3rd Party responsibility
Audio Alarms (PAVA)	Life Safety System Maintainers
Digital Networks	IT or 3rd Party responsibility
Headsets	IT or 3rd Party responsibility
Integrated Communication Services	IT or 3rd Party responsibility
Intercom	IT or 3rd Party responsibility
Intruder Alarms	IT or 3rd Party responsibility

Mimic Indicators	IT or 3rd Party responsibility
Network Systems Infrastructure	IT or 3rd Party responsibility
Computers / Fax	IT or 3rd Party responsibility
Pocket Pagers	IT or 3rd Party responsibility
Pull Cord Units	IT or 3rd Party responsibility
Radio Services	IT or 3rd Party responsibility
Security of Communication	IT or 3rd Party responsibility
Telephone Systems	IT or 3rd Party responsibility
Televisions	IT or 3rd Party responsibility
Videoconferencing	IT or 3rd Party responsibility
Wi-Fi Network	IT or 3rd Party responsibility

Table 1: Communication Assets

2.2 Core Assets List

Core Assets	Comments
Building Management Office	Covered within this document
CCTV	More detail in document EOM-ZM0-PL-000037
Communication Risers	Covered within this document
Communication Room – Access Control	More detail in document EOM-ZO0-PR-000040
Communications Lines	Covered within this document
Data Cables	Covered within this document
Data Connectivity Management Systems	Covered within this document
Fiber and Analog within the Building	Covered within this document
HVAC	More detail in document EOM-ZM0-PL-000019
Lease Lines	Covered within this document
Lifts Communication – Auto Dialer	More detail in document EOM-ZM0-PL-000061
PAVA	More detail in document EOM-ZM0-PL-000043
PSTN	Covered within this document
Routers	Covered within this document
Telephone Infrastructure	Covered within this document
Tunnels from Street Levels to Communication Room	Covered within this document
Uninterruptible Power Supply (UPS) – Installed by Landlord/Tenants	More detail in document EOM-ZM0-PL-000025

Table 2: Core Assets

3.0 DEFINITIONS

Term	Definition
Basis of Design (BOD)	A mandatory, pre-construction document that is based on American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE), Leadership in Energy and Environmental Design (LEED), and National Fire Protection Association (NFPA), and used to prepare the Mechanical, Electrical, and Plumbing (MEP) systems', manual and commissioning documents.
Best Practice	A method or technique that has been generally accepted as superior to alternative practices because it produces better results than those achieved by a standard way of doing things (e.g., a standard way of complying with legal or ethical requirements).

Term	Definition
Calibrated Tools	Measurement tools that have a calibration requirement, either as a statutory, or risk-assessed requirement.
Consumable	Physical part of an engineered system, Personal Protective Equipment (PPE), cleaning treatment, or preservative liquid or compound, whose consumption or use is part of a maintenance task, is necessary and predictable.
Criticality	Typically, a 4-5 level ranking-system that categorizes the importance of the component, asset or maintenance task. (For more information, refer to Volume 2: Asset Management).
Data Point Schedule	A table which shows the monitoring and control points for the equipment and systems. Points such as control and monitoring as I/O points (Input and Output points, to and from the controller).
Facility	The term for the group of fixed, civil-engineering assets that are not a building e.g., a bridge, a mast, a harbor.
Frequency	Refers to a cyclic time period.
Maintenance Program/Schedule	Same as schedule. Refers to the time basis of the delivery activity.
Monitor/Head End PC	See engineering equipment's systems' status. for monitoring and control of operations.
Parameter	The name of a unit or metric e.g., pressure, hertz, temperature.
Point of Work Risk Assessment (POWRA)	A short checklist that operatives refer to at the 'location of', and immediately before carrying out a task.
Permit to Work (PTW)	A safety management documented system, adopted by most organizations for management of work activities.
Regime	The collective noun for Maintenance Plan applied to an asset, system, facility, or building.
Run to Failure (RTF)	A maintenance strategy where the asset is deliberately not maintained but allowed to run until it fails.
Sequence of Operation (SOO)	A written explanation and description of the MEP systems, on how the systems are intended to work.
Test	Confirming by means of observation or measurement, that a system meets the expected and/or acceptable requirements.
Threshold	Numerical value of a parameter at which a decision is made.
Acronyms	
AMS	Asset Management System
ASHRAE	American Society of Heating, Refrigerating, and Air-Conditioning Engineers
BACnet	Building Automation and Control networks
CPU	Central Processing Unit
DARS	Digital Audio Radio Service
DI	Digital Input
DO	Digital Output
EVC	Extra Low Voltage
FDD	Fault Detection and Diagnostics
FM	Facilities Management
FOC	Facilities Operating Company
GUI	Graphical User Interface
HMI	Human Machine Interface
HSSE	Health, Safety, Security, and Environment
I/O	Input/output
IT	Information Technology
JHA	Job Hazard Analysis (see Point of Work Risk Assessment (POWRA))
KPI	Key Performance Indicator

Term	Definition
LEED	Leadership in Energy and Environmental Design
LV	Low Voltage
MEP	Mechanical, Electrical, and Plumbing
NAE	Network Automation Engine
NFPA	National Fire Protection Association
NIST	National Institute of Standards and Technology
O&M	Operations and Maintenance
OEM	Original Equipment Manufacturer
PAR	Periodic Automatic Replenishment
PAT	Portable Appliance Test
PC	Personal Computer
PdM	Predictive Maintenace
PM	Planned Maintenance
PPE	Personal Protective Equipment
PTW	Permit to Work
RAMS	Risk Assessment and Method Statement
RTF	Run to Failure
SC	Statutory Compliance
SOO	Sequence of Operation
UPS	Uninterruptible Power Supply
VDU	Visual Display Unit

Table 3: Definitions

4.0 REFERENCES

- American National Standards Institute (ANSI)
- British Standard Institute (BSI) – BS 5839
- Chartered Institution of Building Service Engineers (CIBSE) – Guide M
- EOM-ZW0-GL-000002 - Maintenance Procedure Writers Guide
- Offices Technical Memorandum (HTM) – HTM 05-03/08-3
- International Electro technical Commission (IEC) – IEC 60870
- ISO 55000
- ISO 9001: Quality Management Systems
- National Institute of Standards and Technology (NIST)
- National Manual of Assets and Facilities Management - Volume 10: Health, Safety, Security, and Environment (HSSE)
- National Manual of Assets and Facilities Management - Volume 11 Chapter 5: Quality Control Procedures
- National Manual of Assets and Facilities Management - Volume 12: Risk Management
- National Manual of Assets and Facilities Management - Volume 6 Chapter 9: Electrical Systems Maintenance Plan for Offices - EOM-ZM0-PL- 000027
- National Manual of Assets and Facilities Management - Volume 6 Chapter 8: Mechanical Systems Maintenance Plan for Offices - EOM-ZM0-PL-000021
- National Manual of Assets and Facilities Management - Volume 6 Chapter 12: Life Safety Systems Maintenance Plan for Offices - EOM-ZM0-PL-000045
- National Manual of Assets and Facilities Management - Volume 6 Chapter 11: Security Systems Maintenance Plan for Offices - EOM-ZM0-PL-000039
- National Manual of Assets and Facilities Management - Volume 6 Chapter 17: Escalators & Lifts Maintenance Plan for Offices - EOM-ZM0-PL-000063
- National Manual of Assets and Facilities Management - Volume 6 Chapter 3: Preventive and Predictive Maintenance Program Procedure - EOM-ZM0-PR-000003
- National Manual of Assets and Facilities Management - Volume 6 Chapter 3: Description and Definitions - EOM-ZM0-PR-000002
- National Manual of Assets and Facilities Management - Volume 8: Supply Chain Management

- National Manual of Assets and Facilities Management Volume 4 Chapter 2: Obsolescence Management - EOM-ZL0-PR-000003
- NFPA 297 (National Fire Protection Association) – Communication Systems
- Occupational Safety and Health Administration (OSHA) - Occupational Safety and Health
- SFG 20 (Services and Facilities Group within Building Engineering Services Association)
- Volume 3 Chapter 3: Conducting Condition Assessments - EOM-ZC0-PR-000004

5.0 RESPONSIBILITIES

Only trained and competent persons shall be appointed by management to perform maintenance tasks on Communication Systems.

Role	Description
Facilities Operating Client (FOC)	The Entity governing body responsible for setting the objectives and standards of the FMC and ensuring that they are met. Imposing and monitoring scope KPI's that are agreed at the inception, and throughout the contract term.
Facilities Management Company (FMC)	An appointed Client representative, who in collaboration with the client, controls the Maintenance & Engineering Departments. The FMC is responsible and accountable for the APs and CPs, the maintenance of site engineering systems, and ensuring that control of these systems is in line with the Client's Standard Operating Procedures (SOPs) for the maintenance activities.
Authorized Person (AP)	An individual who has been appointed by the Authorizing Engineer (AE), or by an authorizing body within the Entity who is trained, competent, skilled, responsible, and has gained necessary site knowledge to operate and maintain the system in a controlled and safe manner. The AP is responsible for work, or testing carried out on the system.
Communication System Operator	An authorized individual who operates the communication system.
Competent Person – Communications Engineer	An individual who is appointed by the AP, and competent to work on communications systems.
Designated Person (Communications Systems)	An individual who has overall authority and responsibility for the premises containing the communications systems within Offices, and has a duty to prepare and issue a general policy statement on Offices, in relation to communications systems.
Duty Holder	An individual who is responsible for the Operations and Maintenance (O&M) of the communications systems within the organization.
Operations and Maintenance (O&M) Person (communication systems)	A member of the engineering team, communication, manufacturer, or O&M organization, employed by management to carry out duties on communication assets.
Subcontractor	A subcontractor assists in the maintenance of a Facility. The subcontractor is managed by a Building or Facility Manager, and is given specific duties to ensure that the building is properly functioning. Subcontractors normally supply their own tooling and supplies to operate and maintain a building, which is detailed in a contractual agreement.

Table 4: Responsibilities

Proper training and certifications of the Competent Persons (CP) responsible for the maintenance should be verified, and routine audits completed to ensure that training is current, whilst also identifying refresher and/or continuous training requirements.

5.1 Roles and Responsibilities: Planned Maintenance (PM)

Figure 1 below depicts a process flow chart, which maps the responsibilities of scheduling and implementing a PM regime within an Entity.

Roles & Responsibilities for PM Scheduling and Implementation

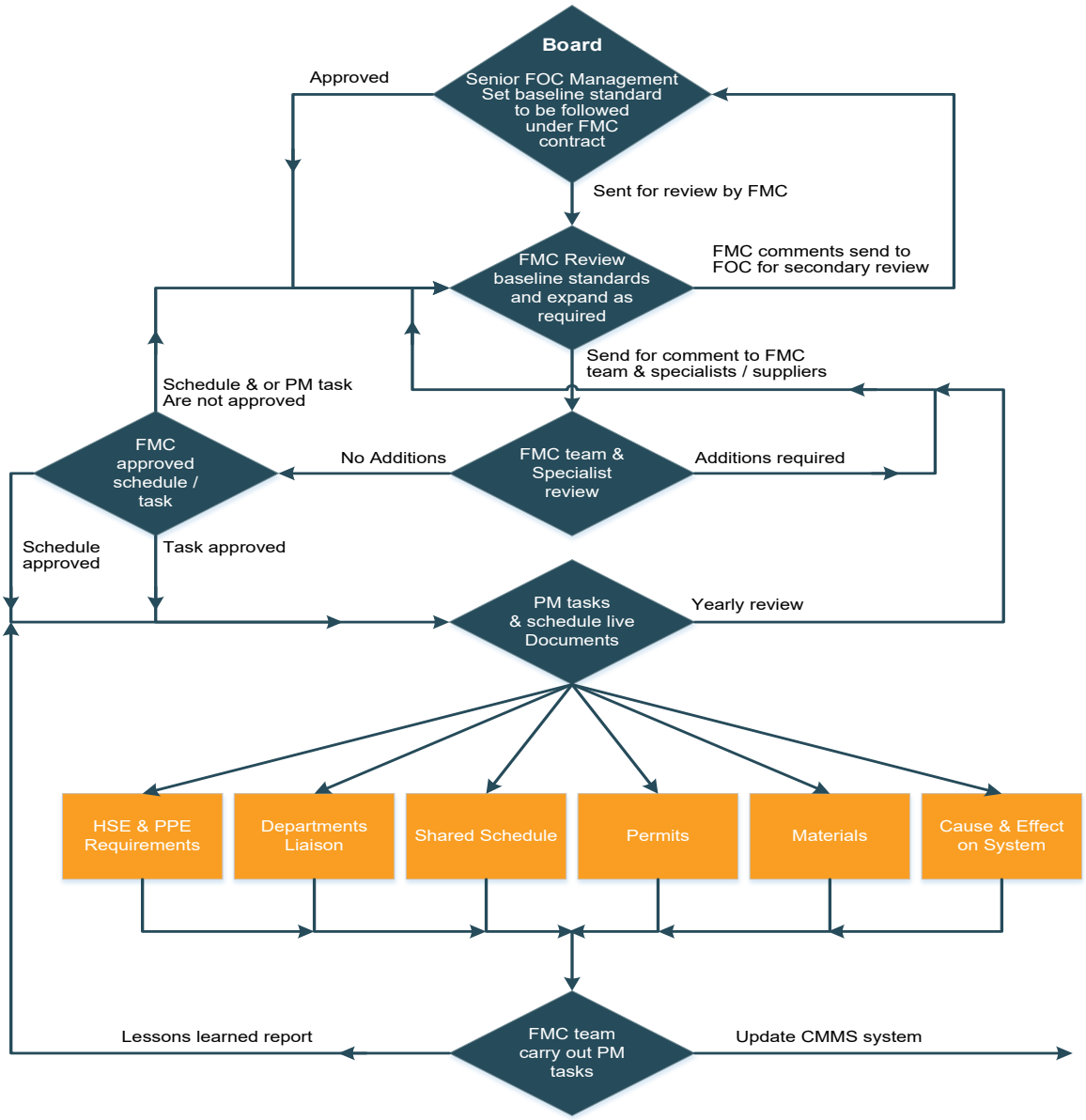

Figure 1: PM Scheduling and Implementation

6.0 PROCESS

6.1 Introduction to Communications Systems

New technologies are challenging the existing principles of communication, which operate and maintain office services. The primary purpose of communications systems is to provide effective, secure, and resilient audio, visual, and data systems, to support the operations and maintenance (O&M) of the Offices. Reliable communications systems are critical to the effective and safe operation of office services. To allow for the best decisions or actions to be taken, these systems must deliver the right information effectively. The overall system is considered “fit for purpose”, when all elements collectively work as expected.

There is a possibility that all elements, collectively, may not result in “fit for purpose”, and thus deliver a poor performance. This is where the planned maintenance regime of those elements and systems becomes absolutely crucial to critical services. This helps maintain a department’s critical services to a level of high readiness, and reduce downtime which could otherwise affect patrons’ welfare, and facility operations.

New communications systems will also offer opportunities in other areas, such as flexible office functions and operations, reduced asset-base, and lower operating costs. Consequently, a whole system approach will be the best way to deploy solutions for these issues, and for related technological developments.

In Offices services, there are many professionals wishing to share information via various communication protocols, resulting in an increased need for IT to support services. Though IT data-networks are not covered within this document, external resources should be consulted to better understand these areas, especially with respect to data confidentiality.

6.1.1 Strategic Approach

Secure and effective communications systems and data are required to provide a quality service across the offices services, as well as support other shared services. The need for more efficient use of offices staff, requires communications systems to have the flexibility and expansion capability to cost-effectively cater to new and changing business requirements. Consequentially, existing systems that no longer meet the performance requirements, or are operationally obsolete should be considered for removal. Consideration should also be given to the removal of obsolete data cabling in risers and trunks, to free up space for alternative systems, without the need to install expensive infrastructure.

Advantages of effective communications systems include, but are not limited to:

- Improvement of staff and inter-departmental communication
- Reduction of decision-making time during incidents, ensuring a swift return to normal service
- Users being provided with quality information
- Improved real-time information that enables staff to make effective decisions

6.1.2 Communication Systems Maintenance Strategy

Maintenance is a combination of all technical, administrative, and managerial actions, during the lifecycle of a device. A maintenance strategy is intended to retain or restore a device or piece of equipment, to a new or as new condition, in which it can perform its required function. Communications systems maintenance shall cover tests, measurements, replacements, adjustments, and repairs intended to retain or restore a piece of equipment to a state where it can perform its function. It is essential to keep and preserve equipment, and maintain the facility in a good, functional state. Maintenance of systems should only be undertaken by trained and competent personnel failure to adhere to this can lead to extended downtime and expensive repair costs, due to the need to hire third-party specialists to complete the repair. A maintenance plan shall include the following stakeholders to ensure that all responsibilities are being fulfilled:

- Asset Management Team
- Facilities Management Team
- Store/Procurement Personnel
- Computerized Maintenance Management System (CMMS) Program
- Qualified and Competent Maintenance Teams

As stated, a maintenance plan may not always be necessary, however, to ensure consistent Quality Assurance (QA) and Quality Control (QC), proper records and documentation ensure that the Entity operates on practices that can be tracked through a documented process. A maintenance plan is a document which will address what systems or assets need to be maintained, based on the work required. The plan will include, but not be limited to:

- Work with clear descriptions
- Job plans, including a sequence of events, checks and measures

- Maintenance Procedures, including Safe Work Procedures (SWP) and Job Hazard Analysis (JHA)
- Procured parts and consumables for the task
- Required tools, and any specialty tools required to complete the work

The maintenance plan should:

- Identify the work to be undertaken
- Identify stakeholders that need to be informed, approvals obtained
- Plan the work efficiently to minimize operational downtime
- Schedule the work to be undertaken, involving all necessary tools, manpower, and resources for successful execution
- Execute the work activity to be undertaken in a safe environment
- Record the work that was undertaken tracking maintenance, ensures history and consistency
- Conduct failure analysis to prevent problems from reoccurring

A Quality Management System is shown below in **Figure 2**.

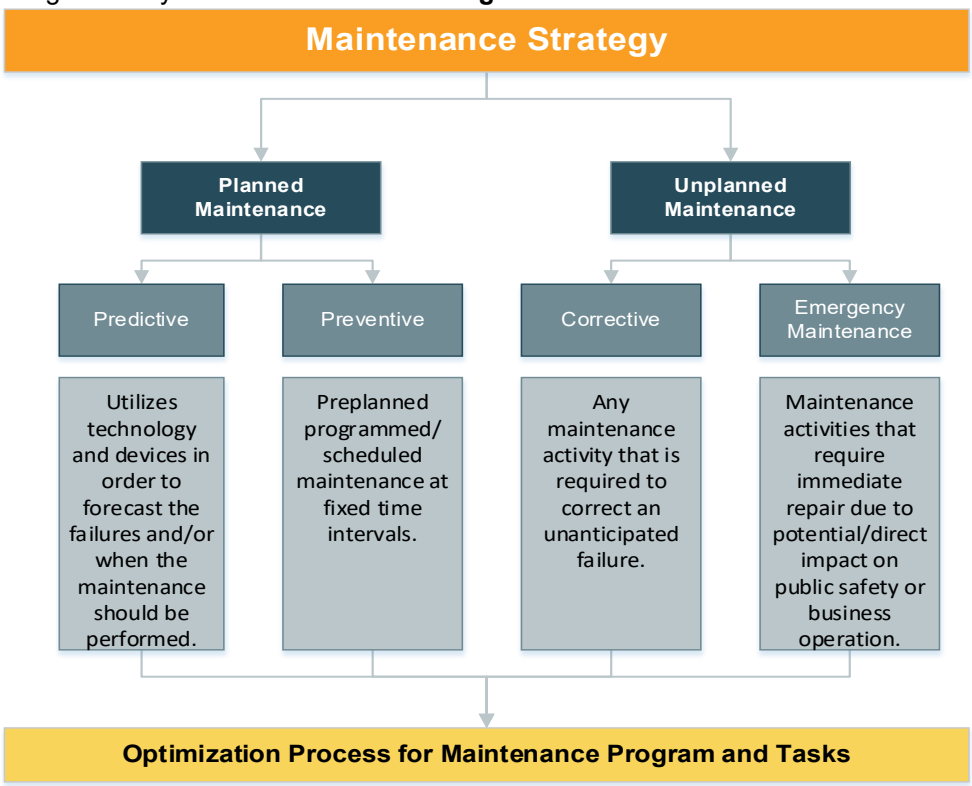

Figure 2: Relationship of Maintenance Concepts and Activities

6.2 Types of Maintenance

Communication devices are found in all the engineering disciplines of a building, and shall need applicable maintenance based on the OEM specifications, recommendations and guidelines. The maintenance types are described in more detail within the following sections, but the focus on this program is to work towards developing a proven maintenance strategy that is based on collecting data and planning ahead. A planned maintenance (PM) program is a proven strategy to reduce costs and be effective and efficient at ensuring the longevity of any asset. Although Corrective Maintenance (CM) is discussed below, the goal is to work towards a planned strategy.

Depending on the Entity's asset management strategy, organizational maturity and funding, the following types of maintenance may be applied to communications systems within a Facility:

- Planned Maintenance: Preventive and Predictive (PM, PdM)

- Unplanned Maintenance: Corrective and Emergency (CM, EM)

This document focuses primarily on Planned Maintenance, other maintenance types are described within NMA & FM, Volume 6 Chapter 3 – Descriptions and Definitions (EOM-ZM0-PR-000002).

6.2.1 Planned Maintenance (PM)

Planned maintenance is a regime that is carried out on an asset at predetermined intervals or frequencies, to lessen the likelihood of failure by maintaining the equipment's safe running conditions and efficiencies. A PM is performed before equipment failure takes place and assists by eliminating unexpected breakdowns. Condition monitoring is often used as part of the PM, which allows for real-time, trend analysis of communication devices.

Key elements and advantages of scheduling and executing PM are:

- Ensures consistent practices designed to improve the performance and safety of the equipment
- Reduces major repairs and failures, and ensures equipment availability
- Allows for better management and increased life expectancy of assets
- -Allocation of manpower resources based upon their level of competency to undertake prescribed maintenance tasks.
- Reduces costs and ensures efficient utilization of maintenance staff, by working on a scheduled, pro-active, rather than reactive basis
- Improves safety and quality conditions for stakeholders and those coming into contact with maintenance activities

For more information on specific requirements, refer to:

- National Manual of Assets and Facilities Management, Volume 6: Preventive and Predictive Maintenance Program Procedure
- National Manual of Assets and Facilities Management, Volume 6: Post Maintenance Testing procedure (PMT)
- National Manual of Assets and Facilities Management, Volume 6: Maintenance Plan Writers Guide

Utilization of a PM strategy in combination with a CMMS system will assist the Entity in following a proven strategy that can be demonstrated to internal and external stakeholders. The use of QA/QC will further assist with continuous improvement and review processes.

6.2.2 Corrective Maintenance (CM)

CM may be due to failed components that lead to un-programmed downtime, and cause disruption to the Entity. CM may be performed during a planned, maintenance schedule, where a failed part/ piece of equipment is found to be defective while undertaking a maintenance activity, and is repaired/replaced to restore a system to normal operating conditions. If a failed component is found during a PM schedule, it can help to avoid further downtime during normal, operating conditions. This also includes Run-to-Failure (RTF) maintenance which should be discouraged, as this type of maintenance is not an efficient means of controlling quality in an engineering system. RTF could seriously disrupt important communication in the Offices sector, and is therefore not recommended.

6.2.3 Predictive Maintenance (PdM)

Condition-Based Monitoring (CBM) of system's equipment/assets, is an effective way for using data to study and predict when a component failure is likely to happen. Numerous methodologies for CBM and Reliability Centered Maintenance (RCM) exist, and can be used either as an alternative, or in addition to PM activities. Below are some key elements of PdM:

- **Condition based Predictive Maintenance:** This maintenance strategy depends on continuous or periodic condition-monitoring of equipment, to detect signs of failure

- **Statistical based Predictive Maintenance:** This maintenance strategy depends on statistical data from the meticulous recording/results of the stoppages/breakdowns of a facilities' equipment, assets and/or components, in order to develop models for predicting failures

6.2.4 Statutory Compliance (SC) Requirements

It is mandatory that the maintenance of communication systems and assets requiring regular maintenance/inspections, be performed at set intervals, as specified by both the Original Equipment Manufacturers' (OEMs') recommendations, and the Statutory Compliance (SC) requirements.

There are a number of communication assets and systems that require statutory maintenance and inspections. These assets are normally associated with life, safety and security, such as PAVA and Fire detection systems.

The Entity shall ensure that these assets are well identified, in order to plan and schedule maintenance activities when required. In addition to the required maintenance being planned, it is also crucial that the contractors and staff carrying out these maintenance tasks are competent to undertake the maintenance tasks assigned.

For further information on defined maintenance disciplines may be found within the following chapters of the National Manual of Assets and Facilities Management

- EOM-ZM0-PL-000025 – Electrical
- EOM-ZM0-PL-000019 – Mechanical
- EOM-ZM0-PL-000043 – Life Safety
- EOM-ZM0-PL-000037 – Security
- EOM-ZM0-PL-000061 - Lifts and Escalators

(Refer to Attachment 1: Communication Planned Maintenance Schedule)

6.3 Maintenance Planning and Scheduling

Planning determines 'what', 'how', and the 'estimated time required' for maintenance tasks. Schedules decide 'when' and 'who' will perform these maintenance tasks. Proper planning is a vital part in successfully managing the maintenance of equipment. Planners must collaborate with internal or external stakeholders to achieve optimum results. A comprehensive maintenance schedule should be developed, and equipment and/or assets, should be listed in the maintenance schedule. When compiling communications systems maintenance schedules, all maintenance activities, along with other department's recommendations, personal experiences, equipment history, and OEM recommendations shall be considered. Moreover, the schedule shall clearly define the types of maintenance activities such as: corrective maintenance, preventive maintenance, predictive maintenance, 'run to fail' checks, and planned shutdowns.

In **Figure 3**, the following elements shall be taken into consideration when planning and scheduling communication assets and systems, maintenance tasks:

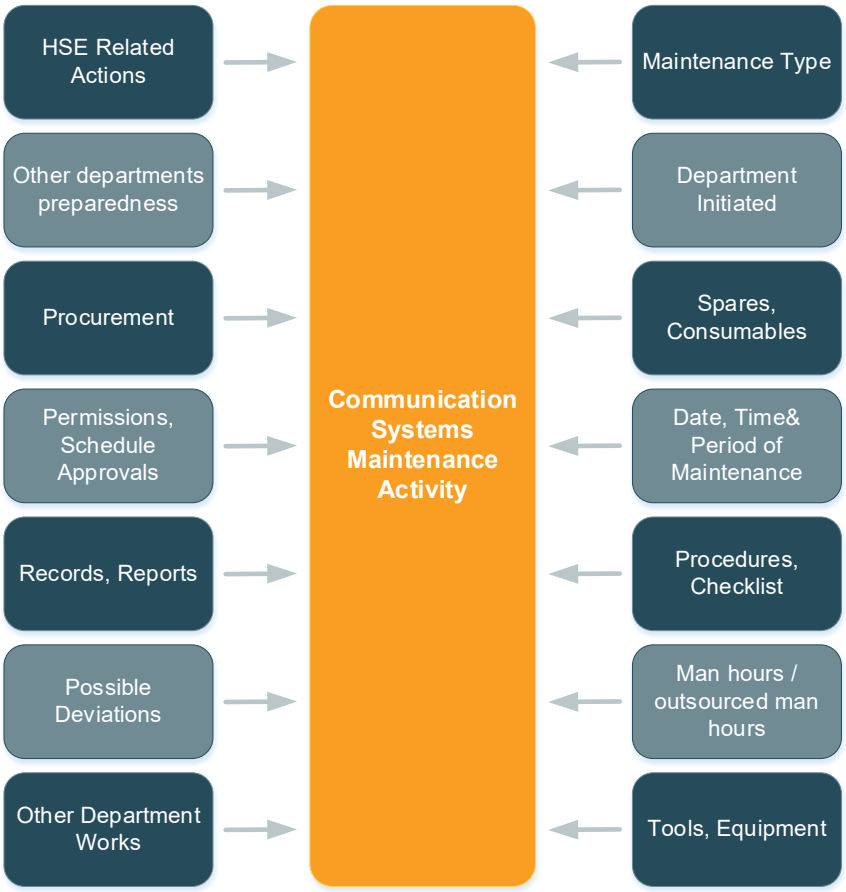

Figure 3: Pictorial Representation of Links of Maintenance Activity

6.4 Asset Management System (AMS) Requirements

- Communications systems' maintenance plans shall include a list of tasks and likely/recommended/compliant frequencies.
- Communications systems' plans may refer to an industry resource, with specific task requirements as defined within the O&M or additional documentation provided from time to time, for instance following software amendments.
  Communications system plans should recommend the storage method for recorded values (data points) within the AMS, or other approved centralized recording and analysis medium, when trend-analysis or threshold values are applicable. Where additional data is required following analysis these should be incorporated within the storage medium and include a description and purpose for their collection.
- Communications system plans should identify potential opportunities for cost and efficiency savings where system / software updates are available. These must have passed a level of UAT testing that is acceptable to the Entity prior to implementation.

6.5 Health and Safety

There are always risks associated with any working environment. These risks involve working alongside equipment, a running system, or close contact with live communications systems devices. There could be likelihood or possibility of human error that can lead to accidents and system malfunctions.

With maintenance tasks, working under time constraints is common, especially where shutdowns or high-priority maintenance work is involved. Attention to the management of risks associated with maintenance works must be fully assessed, in order to prevent unnecessary harm.

Below elements shall be considered while assessing the risks involved with communications systems maintenance:

- Identify potential hazards involved during maintenance activity
- Risk to the other operational Offices utilities during maintenance work on communications systems or any associated systems
- Risk to the philosophy of design, and cause and effect programs
- Risk to data loss
- Risk to communications systems software, configurations, and applications
- Risk to equipment
- Reputational risk to the Entity for loss of service/availability
- Others
- Identify stakeholders that might potentially be harmed, and highlight greater risks involved
- Evaluate the risks involved, and eliminate/mitigate. to ensure that safe work is completed
- Involve the maintenance team, specialist engineers, and the HSSE team (when required), in the risk-assessment process
- Take Action decide on measures needed, a plan, and how to implement the plan
- Monitor and review the process
- Record the findings

Maintenance teams or their representatives shall be involved in the process. There shall be a comprehensive Risk Assessment and Method Statement (RAMS) available during maintenance tasks on communications systems. A JHA (Job Hazard Analysis) must also be conducted for visitors, contractors, and others working under site-specific, Health and Safety plans.

(Refer to the National Manual of Assets and Facilities Management - Volume 10: HSSE and Volume 12: Risk Management for more information on specific requirements).

6.5.1 Risk Management

Risk Management is defined as, identifying undesirable occurrences that could have an impact on communications systems and associated equipment. Therefore, gaps shall be assessed to avoid such hazards and risks.

Below are examples of some risks:

- Fire Hazard to Electrical Systems
- Excess Heat in Electrical and/or Utility Services Rooms
- Equipment Overload
- Inaccessible Devices, Assets, and/or Panels
- Others

The maintenance team shall complete a comprehensive set of RAMS, covering each communication system within the Offices Facility. For task-specific activities, a JHA shall be conducted, using the content of RAMS as the basis. Visitors, contractors, and others working under site-specific Health and Safety plans shall all be included within all RAMS, and shall sign the JHA, as required.

The elements below shall be considered when carrying out Risk Assessments for communications systems maintenance:

- Identify hazards associated with each maintenance activity, e.g., loss of critical systems, impact on operation of facilities, and equipment failure
- Establish maintenance personnel, service providers, and building users who might be at risk as a result of the maintenance activity
- Identify competency requirements, for personnel undertaking maintenance activities
- Quantitatively evaluate risks using a risk matrix by involving the maintenance team, subject matter experts (SMEs), and the HSSE team, in the risk assessment process hold a Risk Workshop as necessary
- Take action decide on any mitigation measures needed, required investment, responsibilities, and timelines
- Identify and implement any alternative systems for the duration of the maintenance
- Review the risk evaluation, following the implementation of mitigation measures
- Record findings, and implement improvements following the experience

(Refer to the National Manual of Assets and Facilities Management - Volume 10: HSSE and Volume 12: Risk Management for further information on specific requirements).

6.5.2 Quality Control and Quality Assurance

The Entity shall ensure, that in the maintenance of a building or facility, quality standards are built into the maintenance processes, and the quality of workmanship. For QA, the Facilities Manager would set expectations that all maintenance is performed as per the standards and guidelines set out by the NMA & FM. Knowing that the work has a form of QC, means that consistent maintenance is being completed. The following points should be followed to ensure QA/QC:

- Develop a PTW, which shall be followed for maintenance tasks
- Perform all maintenance activities as per manufacturer manuals and recommendations
- Follow PM strategies as per manufacturer guidelines, which will differ based on the equipment used
- Archive all maintenance records manually, or through the CMMS (if available) both hard and soft copies shall be maintained for reference

(Refer to the National Manual of Assets and Facilities Management, Volume 11: Quality Control and ISO 9001: Quality Management Systems for further information on specific requirements).

6.5.3 Spares/ Consumables/ Inventory

Unlike buildings, communications systems technology can quickly become unusable. This is primarily due to the short lifespan, rapid obsolescence, and the critical need to stay up to date with technologies, that may not be supported by vendors in the future, and thus render the technology unusable or degraded.

A standard practice shall be in place to refer to the Bill of Material (BOM) for the communications systems and associated equipment, including a spare/consumable tracker list. Clear descriptions of part number, make, model, and quantity, shall ideally be a part of the AMS information, to help retrieve material details whenever required. However, in case of unavailability of AMS/CMMS, a soft copy of all materials installed along with necessary details, shall be available with the Facilities team, who will be responsible for determining Periodic Automatic Replenishment (PAR) levels.

Whilst developing inventory details, inventory control processes should define critical and non-critical items, as well as consider the following elements:

- High-cost spares/consumables
- Long lead items
- Items obsolete in the market

Replacement of the communications systems components -that are no longer in production by the original manufacturer, and according to the original specifications - shall be assessed carefully, without compromising quality, efficiency, and Process and Instrument Design (P&ID) functions, in an office facility. Factors to consider include:

- High use/ Low use items
- Alternate material-selection options
- Technical Specifications
- Others

Parts/consumables with a high-failure rate should be highlighted during a maintenance activity, and further failure-analysis should be performed to identify root-cause analysis (RCA) of the components failure. These components shall run up to their designed life, in order to optimize costs. Maintenance schedules might require alteration to prevent unwanted breakdown and further design-analysis should be considered following the results obtained from RCA techniques.

(Refer to National Manual of Assets and Facilities Management - Volume 8: Supply Chain Management and Volume 4 Chapter 2: Obsolescence Management for further information on specific requirements).

6.5.4 Communication Assets and Systems Maintenance Methodology

6.5.4.1 Communications Systems Maintenance

Communications systems and assets maintenance shall cover all communications assets and systems used in an office facility, to ensure that they are well-maintained and in good, working condition.

To ensure communication assets and systems perform efficiently and effectively, a periodic maintenance schedule will be put in place by the Entity's O&M teams. This schedule will fully comply with all statutory requirements, local regulations, and OEM guidelines, as well as cover routine checks and PM frequencies. Communications systems maintenance consists primarily of inspection, testing, adjustments, calibrations, and the replacing of minor components and parts.

The timely completion of planned maintenance tasks, without compromising quality of work, increases equipment reliability and service life. Depending on the safety implications inherent in potential malfunction or breakdown, and/or the cost of equipment replacement, planned maintenance tasks shall typically be scheduled at a prescribed frequency, by either the manufacturer, or statutory requirement in the office facility. In case there are no defined guidelines set by the manufacturer, maintenance schedules shall cover weekly, monthly, quarterly, biannual, or annual maintenance as a minimum, in consideration of criticality assessment of the communication assets and systems.

The testing and maintenance guidelines mentioned below shall be followed as a minimum, to operate and maintain the integrity of the system on the Basis of Design (BOD), and Sequence of Operations (SOO). Communication assets and systems maintenance schedules shall cover the integrity test and functionality check of devices, assets, application software, and associated hardware.

At a minimum, the below recommended inspections and planned maintenance, should be performed at the local-site levels:

- Check and confirm each Input/output (I/O) points, for proper terminations from end-to-end during planned maintenance activity
- Check that panels are free from dust and debris
- Check for connectivity and cabling integrity
- Check sensors for expected operation
- Check route, ducting, equipment, housings, and conductor conditions
- Check whether communication operation at nodes and End user services confirms operating parameters
- Perform equipment and system checks, as recommended by OEMs
- Check for Human Machine Interface (HMI) required functionality
- Check whether Personal Computer (PC) software is loaded, and functioning correctly
- Check for cooling in communication rooms
- Check that cabling is appropriately routed and protected
- Check servers and fire-wall protection
- Conduct Cyber and Data security checks

- Verify controller's network communication
- Check and verify the reliability and functionality of all communications systems' workstations graphics and applications
- During maintenance, check and verify that the communication system PC is free from unwanted programs and temporary files
- Fill all gathered results and data in PM sheets for references and use at a later date

6.5.4.2 Condition Assessments (CA)

In order to ensure that the assets are in good condition, the Entity shall make planned provisions to carry out condition assessments (CA) as per the NMA & FM standards, contained in Volume 3 Chapter 3: Conducting Condition Assessments. The CA shall confirm the condition of the assets, as indicated below. The items include, but are not limited, to:

- Antennas and antenna bracing – confirm the condition of antennas and their braces/supports
- Low-voltage systems (Internet and telephone connections/cables) – confirm that cables are properly connected in strategic areas, to avoid system overload
- Alternative communications systems – confirm the condition of other communications systems, namely radio communications, satellite telephone, and Internet
- Anchors and braces for telecommunications equipment and cables – confirm that telecommunications equipment (DARS and satellite telephone system) are anchored for increased security
- External telecommunications systems installed on office grounds – confirm that external telecommunications systems infrastructure does not interfere with communications of the office telecommunications systems
- Sites and communications rooms – confirm that MEP services and backup systems are available and in operation
- Where installed changeover and UPS systems are in the correct configuration to provide resilient services to the end users
- Internal communications systems – confirm the condition of the public address system and speaker systems

6.5.4.3 Pre-Requisites of the Maintenance

Before maintenance activities are carried out, it is vital for the Entity to ensure that all stakeholders are informed and engaged at an early and appropriate stage, prior to any maintenance activities.

The maintenance team or contractor shall ensure that all planned work has been reviewed, approved, and been given permission by the Entity, prior to commencing any maintenance activities.

The Entity shall notify all stakeholders of any planned work and advise them of any potential impact, if any, to their operations. In addition, the Entity shall review, approve and ensure that adequate contingency plans are in place, prior to maintenance. A list of pre-requisites is given below:

- Tools/ Specialized Tool Kits/ Personal Protective Equipment (PPE)
  - All software, databases, configuration tools, and analysis tools shall be used as needed during inspection and performance testing
  - Measurement and calibration tools shall be Portable Appliance Test (PAT) tested, and certified through the National Institute of Standards and Technology (NIST) or similar

- Risk Assessment Methods Statement (RAMS)
  - RAMS shall be in use as a safe practice of work. All results identified from risk assessments shall be documented and referred back to a method statement for the completion of maintenance tasks
  - A person performing maintenance activities shall be deemed competent to carry out maintenance tasks on communication assets and systems
  - An engineer/technician shall have recognized qualifications, relevant to communication assets and systems
  - A JHA shall be completed by personnel carrying out the required maintenance

- As part of RAMS, housekeeping of the work area should be undertaken throughout the activity, and upon completion

- Permit to Work (PTW)
  - Switching off any fuse, power circuits, breakers, distribution boards, or mains circuit boards that may affect any of the equipment associated with communication assets and systems. Controllers and servers shall be subject to PTW, authorized by an engineer or manager of the Facility.
  - All PTW shall include an approved RAMS to perform the maintenance tasks
  - Authorized approvals and permissions should be in place before a task is started subsequently, archive approved completion certificates as proof of completed works/activities

- Drawings/Schematics
  - The drawings/schematics shall be included and referenced, along with a PTW to identify the point of maintenance activities and consequences at a planning stage
  - Drawings/documentation shall be updated following upgrades, enhancements and/or modifications

- Sequence of Operations (SOO)
  - Maintenance tasks shall include SOO, so that the process and system's cause and effect is clearly understood by all parties involved in the maintenance tasks to be completed
  - The maintenance activity shall be reviewed and adapted following lessons learned

- Redundancy Planning
  - Offices facilities will predominantly contain critical equipment and systems, and therefore, it is essential to keep backup or standby equipment ready whenever needed While planning maintenance, a substantial level of preparation should be performed, and redundant equipment or systems should be made available during emergencies
  - Communication assets and systems equipment such as, but not limited to, supervisory control PC, communication controllers, main server, temporary server, and other essential equipment shall be brought into operation, and available to manage communication assets and systems functions during any emergency. In case of component failure during a planned maintenance activity, the cause and effect shall be referenced during all scenarios and contingency plans put in place

- Documentation
  - Documentation is an essential element of maintenance tasks. Facilities operations teams shall ensure that relevant documentation of the pre-maintenance tasks and post-maintenance tasks is available with the Facility's technicians, supervisors, and engineers, in order to track maintenance logs/records. The below documents shall be available within the Facility's team and include, but are not limited, to:

    - Written Maintenance Procedures and RAMS
    - SOO
    - PTW
    - Drawings/Schematics
    - Task Sheets
    - Work Orders to Record Non-Conformities
    - Other applicable data required by the Entity (Communication Systems and Other Associated Systems

The below mentioned communication assets and systems maintenance fundamentals, shall be covered while developing task sheets and maintenance schedules for communication assets and systems, but are not limited to:

- Control strategy or application software functionality check
- Communication assets and systems functionality check
- Set Points check–all set points shall be checked to ensure realistic values, thresholds, and operating ranges

- Time control check–all schedules to be checked against user requirements
- Interlocks Check - Installed interlocking and associated equipment dependencies are checked to be operative as part of the maintenance strategy
- Digital Input (DI)/Digital Output (DO) ranges check-for voltage and current, according to OEM standard and in line with BOD parameters
- Digital/Analog inputs on field devices such as sensors
- Cause and effect check according to the BOD
- Monitoring status of sensors and devices
- Field wiring connections, interlock connections, and hard wire connection checks
- Software points check
- Alarm Functions check
    - The operation of each alarm function
    - Time delay on each alarm function
    - Level of category of alarm, its destination, and reporting method shall be checked
    - Operation of alarm masking
- Graphical User Interface(GUI)/Supervisory/Field Inspection and Check Points
    - Cyber security taken into consideration
    - Application/Software check/Firmware updates
        - Status (ON/OFF) and Commands status
        - Alarms, trends, and communication
        - Passing Bus Address
        - Thermostats functionality and calibration
        - Temperature set points
        - Local controller operation
    - Fault status
    - Device counts/Overload
    - Online/Offline status
    - NAE (Network Automation Engine) object counts
    - Central Processing Units (CPU) temperatures
    - Board temperature

6.5.4.4 Access to Infrastructure Assets/Communication Rooms

It is the responsibility of the Entity to ensure that all assets are protected and secured from unauthorized entry. The Entity shall ensure that processes and systems are in place for surveillance and for entering communication rooms and other communication associated assets. Additionally, ducts that are external to the facility should be monitored for building works that may affect communications ducts, entry points, or infrastructure.

Personnel attending the facility should be vetted to ensure that they are familiar with any site restrictions, and special policies. They should be registered with site-security, so that untrained personnel do not access vulnerable areas. All contractors are to report to site-security upon arrival at site.

Communication rooms and risers should be locked at all times, and where access control is applied, regular reviews should be undertaken to ensure staff access is still warranted. Access should immediately be cancelled following the termination or resignation of staff.

7.0 ATTACHMENTS

1. Attachment 1 – EOM-ZM0-TP-000179 - Communication Planned Maintenance Schedule for Offices

Attachment 1 – EOM-ZM0-TP-000179 Communication Planned Maintenance Schedule for Offices

The below schedule is a sample of Planned Maintenance activities. The Entity shall proactively source from the manufacturer for the maintenance requirements of each asset.

Building Name:			Reference No.		EOM-ZM0-TP-000179		
Functional Critical Planned Maintenance Communication System							
Sr. No.	**Item**	**Frequency (FQ)**	**Action**	**Notes**	**CHECKED SATISFACTORY**		
					N/A	**Yes**	**No**
1.1	Diagnostic Routine on Computer (where appropriate)	Biannual	Perform diagnostic tasks and check computer operations.	This routine will check all aspects of computer hardware and software.	☐	☐	☐
1.2	Wireless Systems	6 Monthly	Clean and examine bells, buzzers, pull cords, pushes, indicators, relays, contact boxes and fuses. Ensure terminal connections are sound.	Visually inspect printed circuit boards. Clean, examine, and test all components of the system and reset as required. Examine antennae.	☐	☐	☐
1.3	System Checks	6 Monthly	Clean, examine and test all components of the system and reset as required. Examine antennae.		☐	☐	☐
1.4	Batteries	6 Monthly	Test dry batteries, renew as necessary, and ensure their security.		☐	☐	☐
1.5	Filters	Biannual	Check condition, clean and lubricate, if necessary.		☐	☐	☐
1.6	Software Archives	Biannual	Take back-up copy of site-specific data files. Confirm operating programs and functionality.	Ensure that security is retained and that any updating of files is incorporated. It is recommended that a copy of the back-up data is stored in a fireproof safe or off-site.	☐	☐	☐
1.7	Cables	Annual	Check for security, integrity, and physical damage.		☐	☐	☐
1.8	Discs and Drives	Annual	Clean according to the manufacturer's instructions.		☐	☐	☐
1.9	Clock Battery	Annual	Check and replace, if necessary.	Battery disposal should be in accordance with regulations and environmental requirements.	☐	☐	☐
1.10	Connectors	Annual	Check connectors for security and integrity.		☐	☐	☐
1.11	Mouse	Annual	Check for smooth operation and clean ball as necessary.	More frequent cleaning can be implemented, if needed.	☐	☐	☐
1.12	Visual Display Unit (VDU)/Monitors	Annual	Check: • Focus • Contrast • Brightness • For correct operation		☐	☐	☐
1.13	Keyboard	Annual	Check for correct operation and clean.		☐	☐	☐
1.14	Cables and Connectors	Annual	Check for security, integrity, and physical damage.		☐	☐	☐
1.15	Cleaning	Annual	Use recommended cleaning agent.	Remove paper or tape debris.	☐	☐	☐
1.16	Data Communications	Annual	Check integrity of data flow in both directions.	If more than one path exists, all must be verified.	☐	☐	☐

Building Name:			Reference No.		EOM-ZM0-TP-000179		
Functional Critical Planned Maintenance Communication System							
Sr. No.	**Item**	**Frequency (FQ)**	**Action**	**Notes**	**CHECKED SATISFACTORY**		
					N/A	**Yes**	**No**
1.17	Closed Circuit Television (CCTV) System check	Twice Annually	Check systems for functionality and operability.		☐	☐	☐
1.18	Connectors	Annual	Check for security, integrity, and damage.		☐	☐	☐
1.19	Remote Video Response Centre	Twice Annually	Checks to confirm remote operation.		☐	☐	☐
1.20	Lift Auto Dialer	Every three days checks	Input signal of alarm checks.		☐	☐	☐
1.21	Alarms Receiving	Annual	Confirm that all critical alarms are received by the central supervisor. Check spurious alarms and report faults (as incurred).		☐	☐	☐
1.22	Alarms Generating	Annual	Check generation of alarms from all input and output devices.		☐	☐	☐
1.23	Network	Annual	Check communications between central supervisory computer and outstations, and other networked devices.		☐	☐	☐
1.24	Outstation Hardware	Annual	Check mechanical and environmental conditions.	Environmental conditions, such as temperature and humidity should be within the manufacturer's recommended limits.	☐	☐	☐
1.25	Connectors	Annual	Check for security, integrity, and damage.	Includes security of incoming cables, prevention of ingress of moisture, door seals.	☐	☐	☐
1.26	Digital Inputs (DIs)	Annual	Check by activating sensing/control devices in field.	Care shall be taken to isolate local operation.	☐	☐	☐
1.27	Digital Outputs (Dos)	Annual	Check operation of output stopping by operating routine (where appropriate). Check switching by software interlocks.		☐	☐	☐
1.28	Vented Batteries	Quarterly	Vented batteries should be examined to ensure that the specific gravity of each cell is correct.	Electrolyte levels should be checked and topped up as necessary, and the specific gravity of the electrolyte in each cell should be checked to ensure that it is correct.	☐	☐	☐
1.29	User Checks – Outstation	Weekly	An outstation should be operated.	It should be confirmed that the call is correctly received at the master station.	☐	☐	☐
1.30	User Checks – Master Station	Weekly	In premises in which the location of the master station is such that the audible fault warning signal could go unnoticed for longer than 24 hours.	A special check should be carried out each day to confirm that either the equipment indicates normal operations, or that any fault indication is receiving necessary attention.	☐	☐	☐
1.31	Analogue Inputs	Annual	Read and check calibration of analogue inputs.		☐	☐	☐
1.32	Analogue Outputs	Annual	Check for accuracy of output signal.		☐	☐	☐

Building Name:			Reference No.		EOM-ZM0-TP-000179		
Functional Critical Planned Maintenance Communication System							
Sr. No.	**Item**	**Frequency (FQ)**	**Action**	**Notes**	**CHECKED SATISFACTORY**		
					N/A	**Yes**	**No**
1.33	Installed Program	Annual	Check integrity, alarms, interlocks, and optimization.		☐	☐	☐
1.34	Time Clock	Annual	Check real time clock and date for accuracy throughout system.		☐	☐	☐
1.35	Time Switching	Annual	Review current operating parameters according to site needs.	For example, Time settings and schedules	☐	☐	☐
1.36	Data Logging	Annual	Review the need for existing data logs. Delete/archive logs as required.	Report to Management on the need to review existing arrangements	☐	☐	☐
1.37	Alarm Management and Report	Annual	Review frequencies of generated alarms. Review alarm log records for indication of untoward conditions.	Report and record if any non-conformance, as appropriate.	☐	☐	☐
1.38	Software Interlocks	Annual	Check and confirm operation.	Report and record if any non-conformance, as appropriate.	☐	☐	☐
1.39	Electrical Test on Communication Systems	3 Yearly	Carry out a periodic inspection with associated circuit tests in accordance with BS7671.		☐	☐	☐
1.40	Communication Rooms and Server Rooms CO_2 and Inert Gas Systems	6 Monthly	Panel Test, Inspect, and Test and Enclosure integrity.		☐	☐	☐
1.41	CCTV	Annually	Inspection and testing of all associated equipment.	Full inspection and testing. Written records including date of test, next test date, defects found, and record of repairs.	☐	☐	☐
1.42	Testing of Sounders and Call Points		Activation of manual call point to confirm system operations of the indicative equipment.		☐	☐	☐
1.43	Security/Access Systems	Annually	Carry out a full test, inspection, service, and maintenance of system.		☐	☐	☐
2.0	Specific Planned Maintenance (PM) Notes				☐	☐	☐

No.	Reviewer's Comments	Resolution
	Originator's Name/Signature and Date:	Checker's Name/Signature and Date: