# ASSET MANAGEMENT

# FACILITIES MAINTENANCE POLICY AND PROCEDURES MANUAL

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**Contents**







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# I. SECTION I: INTRODUCTION

## *I.1 INTRODUCTION*

Asset Management is the department responsible for the maintenance and management of all facilities at BUV. We adopt a proactive management approach to provide and maintaining a safe, orderly and respectful learning environment which will contribute to student and staff's best learning and working experience and achievements.

With BUV's commitments to bring a world-class campus facilities and services and to provide a happy, healthy, safe, and internationally oriented campus life for its students and community, it is important that any issues regarding the appropriate management of facilities and campus Health and Safety are resolved on an urgent basis. BUV seek regular feedback from key stakeholders, and any matters arising are discussed in weekly Senior Leadership Team (SLT) meetings by the Chief Operating Officer (COO) and Chief Academic Officer (CAO). Any issues and actions raised in these meetings are noted for follow up by the appropriate body. For issues and actions related to the management of any BUV facilities, Asset Management then leads in the creation of an action plan to address the issue which include identifying root causes, proposing solutions in consideration of costs and budgets, and seeking approval for rectification. Once approval has been gained, Asset Management will lead the implementation of the solution.

Frequent reviews of FD service performance are jointly discussed by all SLT members. The FD seeks to take a creative and innovative approach in proactively reviewing the ability of facilities to meet the needs of users, seeking solutions to any potential issues identified, and project managing any required implementations. This is a central tenet of the strategy of the FD, and contributes significantly to the excellence of University operations.

On an operational level, it should be noted that there are some property management and maintenance areas in which contracted services supplement and/or have major responsibilities for building and/or equipment maintenance. In those cases where contracted services have traditionally been utilised, such services have proven to be cost effective. However, the focus of Asset Management will remain as follows:

- Focus on Campus environmental issues in keeping with a safe learning/teaching environment.
- To ensure proper training for Campus personnel on the procedure to provide timely and efficient maintenance for all Campus buildings and grounds.

- To provide the means to save energy and improve the operating efficiency of all Campus facilities and to ensure proper air quality controls county wide.

The overall objective of Asset Management is to proactively manage and maintain, throughout its expected useful life, the interior and exterior of university buildings, the grounds, and the roadways, and all fixed and moveable equipment through preventive maintenance and repairs and being innovative in addressing potential and emerging issues. Further, this objective is specifically intended to provide:

1. High-quality and serviceable facilities (through a proactive approach considering risk management)
2. Buildings and their components that function safely and at top efficiency.
3. Facilities and equipment that minimise the possibility of fires, accidents, and safety hazards.
4. Continuous use of facilities without disruptions to the educational program.
5. Protection of public property through proper planning, scheduling, and preventive maintenance.
6. Quality management of maintenance projects and tasks.
7. Conservation of energy through utilisation of the latest technology and energy conservation measures.

## *I.2 LEVELS OF MAINTENANCE AND RELATED COST FACTORS*

There are a variety of factors associated with the desired level of Campus building maintenance that relate directly to the availability of resources. These include age of facility, age of equipment, available manpower, budget, and facility use beyond that of the regular Campus Day. To assess the impact of required Campus building maintenance efforts, the following factors are presented:

### I.2.1 Building Use

Campus buildings may require various levels of maintenance due to the varied use of the facilities. The maintenance effort and cost for Campus facilities can often be traced to the extent of the facilities use, the type of facilities use, an effective building supervisor.

Vandalism during occupied and unoccupied hours also places an additional cost burden on the Campus maintenance program.

### I.2.2 Building and Equipment Design

Another major factor that influences equipment and building maintenance is the design of the Campus facility. Facility designers can conserve public funds by incorporating design characteristics consistent with maintenance efficiency and longevity. During the design process, materials and equipment selected should demonstrate characteristics of:

- Design simplicity and equipment accessibility as related to performing repairs and preventive maintenance.
- Quality and maintainability.
- Ease of component replacement and repair parts availability.
- Maximum operating efficiency of all mechanical components and maximum energy efficiency of all mechanical/electrical systems.

### I.2.3 Advances in technology

New technology and energy saving measures related to building equipment and components need to be carefully considered and incorporated into the building maintenance program to insure a more cost-effective level of maintenance. These new technological advances may require the development of revised maintenance and operations procedures and may reduce operating costs. While such advances may show a first time or one time increase in the maintenance or construction budget, there may be a significant long-term decrease in the plant operations budget.

### I.2.4 Condition of existing Campus buildings

The condition of existing Campus facilities needs to be considered as well as frequency of use of facilities beyond the normal Campus Day when evaluating the overall maintenance effort. These factors create a significant impact to the plant maintenance program to provide adequate funding, staffing and effective building maintenance.

### I.2.5 Service standards

Maintenance service standards for university facilities are best established through adequate program administration and supervision, effective employee selection and training, and maintaining employee performance within the organisation. The overall scope necessary for adequate plant maintenance procedures and services is highlighted in the charts shown in Section II and





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Section III. These are intended to reflect scheduled service standards and routine preventive maintenance procedures.

### I.2.6 Operational considerations (preventive maintenance)

Asset Management is important in assessing overall maintenance levels and determining costs associated with building maintenance.

Asset Management has the prime responsibility for building/equipment maintenance based on specific areas of responsibilities. It should be noted that there are some maintenance areas in which contracted services supplement or have major responsibilities for building and/or equipment maintenance. In those cases where contracted services have traditionally been utilised, such services have proven to be cost effective.

In summary, all of the aforementioned factors have a direct impact on establishing a cost-effective maintenance program that meets the requirements of today's educational environment.

## II. SECTION II: GENERAL MAINTENANCE METHODS

There are three (3) methods for performing required building and equipment maintenance that have proven to be cost-effective and are presently being utilised in the British University Vietnam. They include:

- Assignment of Technical Team to perform daily maintenance tasks and preventive maintenance.
- Utilisation of maintenance service contracts.

The Technical Team provides the following services:

- Emergency response to power failures, plumbing, heat pump, and air conditioning failures.
- Electrical, plumbing, HVAC service and minor repairs
- Grounds maintenance, mowing, landscaping, etc.
- Minor building modifications
- Preventive maintenance

Asset Management also is responsible for contracted services in which contracted services supplement or have major responsibilities for building and/or equipment maintenance. These would include:





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| No | System | Maintenance Frequency |
|---|---|---|
| 1 | Low Voltage | Yearly |
| 2 | Transformer and MV Switch Board | Yearly |
| 3 | External Lighting | Semi - Yearly |
| 4 | Standby Generator | Quarterly |
| 5 | Uninterruptible Power Supply (UPS) | Quarterly |
| 6 | Building Management System | Semi - Yearly |
| 7 | Closed-circuit television (CCTV) | Semi - Yearly |
| 8 | Distribution Board | Semi - Yearly |
| 9 | Earthing and Lightning | Yearly |
| 10 | Split Air Conditioning | Semi - Yearly |
| 11 | Variable Refrigerant Volume Air conditioning (VRV) | Semi - Yearly |
| 12 | Precision Air Conditioning (PAC) | Quarterly |
| 13 | Fire Extinguisher | Semi - Yearly |
| 14 | Fire Fighting | Semi - Yearly |
| 15 | Fresh Water Pump | Quarterly |
| 16 | Sum Pump | Quarterly |
| 17 | Wastewater Treatment | Quarterly |
| 18 | Heat Pump | Quarterly |
| 19 | Ventilation Fan | Semi - Yearly |
| 20 | Access Control | Semi - Yearly |
| 21 | Fire Alarm | Semi - Yearly |
| 22 | Public Address | Semi - Yearly |
| 23 | FM 200 & CO2 | Semi - Yearly |
| 24 | Telephone | Semi - Yearly |
| 25 | Roller Shutter door | Quarterly |
| 26 | Liquefied Petroleum Gas | Semi - Yearly |





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# III. SECTION III: CAMPUS MAINTENANCE SCOPES OF WORK

## *III.1 MAINTENANCE SERVICE CONTRACT'S SCOPES OF WORK*

### III.1.1. Low Voltage

| MAINTENANCE SCOPE OF WORKS FOR LOW VOLTAGE | | | | | | |
|---|---|---|---|---|---|---|
| **No** | **Description of work** | **Routine** | | | | |
| **I** | **Switch board** | **Monthly** | **Quarterly** | **Semi Yearly** | **Yearly** | |
| 1 | Thermal scanning for low voltage switch board and all connection (scan all positions especially for bus bar, but report for typical and hottest positions only). | | | | □ | |
| 2 | General inspection for overheating all connection. | | | | □ | |
| 3 | General inspection for damage, noise or other abnormal phenomenom. | | | | □ | |
| 4 | Check pilot light, relays and switch | | | | □ | |
| 5 | Check funtion of ATS | | | | □ | |
| 6 | Check ACB interlock | | | | □ | |
| 7 | Check all the ACB & MCCB terminal | | | | □ | |
| 8 | Check the mechanical function of the equipment MCCB, MCB | | | | □ | |
| 9 | Check and the control wire | | | | □ | |
| 10 | Inspect and clean the switchboards. | | | | □ | |
| 11 | Power analysis (U, I, PF, THDv, THDi) to detect any abnormal phenomenon. Chưa bao gồm trong báo giá) | | | | | |
| 12 | Cleaning and lubrication for the moving parts. | | | | □ | |
| 13 | Check all the terminals and cable connectors, re-tightening by standard torque. | | | | □ | |
| 14 | Check earthing system of LV panel system. | | | | □ | |
| **II** | **Test ACB** | | | | | |
| 1 | Insulation resistance testing for ACB. | | | | □ | |
| 2 | Contact resistance testing for ACB. | | | | □ | |
| 3 | Protection funtion testing for ACB. | | | | □ | |
| **III** | **Capacitor panel** | | | | | |
| 1 | Check status of controller | | | | □ | |
| 2 | Check control cable and control circuit status | | | | □ | |
| 3 | Check earthling system at panel. | | | | □ | |
| 4 | Functional test of capacitor controller. | | | | □ | |
| 5 | Examine the contactors condition and function. | | | | □ | |
| 6 | General inspection for overheating all connection. | | | | □ | |
| 7 | Check the reactor for phisical dammaged | | | | □ | |
| 8 | Inspect and clean the switchboards. | | | | □ | |
| 9 | Inspect and measure capacitance of each capacitor. Measure the resistance of the filter reactor | | | | □ | |
| 10 | Re-tightening all connections by standard torque. | | | | □ | |
| 11 | Check ventilation fan of capacitor cubic. | | | | □ | |
| **IV** | **UPS of LV switchboards (if any)** | | | | | |
| 1 | Measure the input voltage of UPS. | | | | □ | |
| 2 | Measure the output voltage of UPS. | | | | □ | |
| 3 | On-load test UPS. | | | | □ | |
| **V** | **Issue technical report with advices (if any)** | | □ | □ | □ | |





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## III.1.2 Transformer and MV Switch Board

| MAINTENANCE SCOPE OF WORKS FOR POWER TRANSFORMER AND MV SWITCHBOARD SYSTEM | | | | | | |
|---|---|---|---|---|---|---|
| **No** | **Description of work** | **Routine** | | | | |
| | | **Monthly** | **Quarterly** | **Semi yearly** | **Yearly** | |
| **I** | **Switch gear** | | | | | |
| 1 | General inspection for sight of overheating, damage, arc discharge, unusual noise or other defects. | | | | □ | |
| 2 | Thermal scanning for MV switch board. | | | | □ | |
| 3 | Check meter, pilot light and control wire | | | | □ | |
| 4 | Check circuit breaker interlock | | | | □ | |
| 5 | Cleaning and lubrication for the moving parts. | | | | □ | |
| 6 | Cleaning of medium-voltage rooms, transformers, cleaning of electrical cabinets, equipment | | | | □ | |
| 7 | Check earthing of MV panel. | | | | □ | |
| **II** | **Testing switch gear** | | | | | |
| 1 | Test insulation of MV switch gears, MV busbar. | | | | □ | |
| 2 | Measure main contact resistance of MV switch gear. | | | | □ | |
| 3 | *Test CT/PT* | | | | □ | |
| 4 | Test power-frequency withstand for MV switch gear and busbar. | | | | □ | |
| **III** | **UPS of MV switchboards (if any)** | | | | | |
| 1 | Measure the input voltage of UPS. | | | | □ | |
| 2 | Measure the output voltage of UPS. | | | | □ | |
| **IV** | **Power transformer** | | | | | |
| 1 | Check all parameters of the unit: voltage, frequency and current input and output. | | | | □ | |
| 2 | Inspect for any abnormal noise, vibration, arc discharge and overheat. | | | | □ | |
| 3 | Thermal scanning for transformer. | | | | □ | |
| 4 | Check, clean all of the bushing, bus-bar of transformer. | | | | □ | |
| 5 | Check oil leakage | | | | □ | |
| 6 | Check the protection relays of transformer | | | | □ | |
| 7 | Check and retightening the control circuit. | | | | □ | |
| 8 | Check and clean ventilation fans. | | | | □ | |
| 9 | Check the protection relays of transformer, functions testing (nếu có). | | | | □ | |
| 10 | Check all measuring and indicating devices. Re-adjust zero if necessary. | | | | □ | |
| 11 | Check all of terminals and cable connectors, re-tightening by standard torque. | | | | □ | |
| 12 | Measure earthing resistance of transformer. | | | | □ | |
| 13 | Check for any corrosion and touch up painting. | | | | □ | |
| **V** | **Testing transformer** | | | | | |
| 1 | Test insulation of transformer and MV cable. | | | | □ | |
| 2 | No-load test. | | | | □ | |
| 3 | Test ratio and vector group. | | | | □ | |
| 4 | Test DC winding resistance of transformer. | | | | □ | |
| 5 | Test high voltage power-frequency withstand. | | | | □ | |
| **VI** | **Protection relay** | | | | | |
| 1 | Check status of relay. | | | | □ | |
| 2 | Check relay alarm/ trip history | | | | □ | |
| 3 | Check setting function of relay. | | | | □ | |
| 4 | Check control cable and control circuit status | | | | □ | |
| 5 | Over current protection test. | | | | □ | |
| 6 | Voltage protection test. | | | | □ | |
| **VII** | **Issue report with technical comment and advice (if any)** | | | | □ | |

## III.1.3 External Lighting

| MAINTENANCE SCOPE OF WORKS FOR EXTERNAL LIGHTING SYSTEM | | | | | |
|---|---|---|---|---|---|
| **No** | **Description of work** | **Routine** | | | |
| | | **Monthly** | **Quarterly** | **Semi yearly** | **Yearly** |
| 1 | Check operation status of control panel. | | | □ | |
| 2 | Adjustment the time (auto on-off) of the system. | | | □ | |
| 3 | Check status of lighting pole. | | | □ | |
| 4 | Check connection status of lamp. | | | □ | |
| 5 | Check status of supply power cable for lamp. | | | □ | |
| 6 | Replace lamp, if necessary (during maintenance, material will be additional quote) | | | □ | |
| 7 | Clean for lamp. | | | □ | |
| 8 | Issue report. | | | □ | |

## III.1.4 Standby Generator

| MAINTENANCE SCOPE OF WORKS FOR STAND-BY GENERATOR | | | | | |
|---|---|---|---|---|---|
| No | Description of work | Routine | | | |
| | | Monthly | Quarterly | Semi Yearly | Yearly |
| A | **Engine** | | | | |
| 1 | Record operated hour meter. | | □ | | □ |
| 2 | Record pressure of lubricated oil when gen-set operating. | | □ | | □ |
| 3 | Record coolant water temperature. | | □ | | □ |
| 4 | Check for abnormal vibration. | | □ | | □ |
| 5 | Check tightness of mountings (if necessary). | | | | □ |
| 6 | Check speed sensor (if necessary). | | | | □ |
| 7 | Check actuator (if necessary). | | | | □ |
| 8 | Clean the engine body and the generator room. | | □ | | □ |
| B | **Lubricating** | | | | |
| 1 | Check for leakages. | | □ | | □ |
| 2 | Check lube oil level (when engine stop). | | □ | | □ |
| 3 | Check oil pressure sensor. | | □ | | □ |
| C | **Coolant** | | | | |
| 1 | Change coolant water. | | | | □ |
| 2 | Change water filter. | | | | □ |
| 3 | Check for leaks. | | □ | | □ |
| 4 | Check encrust. | | □ | | □ |
| 5 | Check flexible connections. | | □ | | □ |
| 6 | Check water coolant level. | | □ | | □ |
| 7 | Check radiator. | | □ | | □ |
| 8 | Check operation of coolant heater (if any). | | □ | | □ |
| 9 | Check belt condition & tension of fan. | | | | □ |
| 10 | Grease fan hub & pulley bearings (if necessary). | | | | □ |
| 11 | Check coolant temperature sensor. | | □ | | □ |
| 12 | Clean cooling system. | | □ | | □ |
| D | **Induction air** | | | | |
| 1 | Check air filter condition. | | □ | | □ |
| 2 | Replace air filter ( If neccessary). | | | | □ |
| 3 | Check intake air system. | | □ | | □ |
| 4 | Check pipe and connections. | | □ | | □ |
| E | **Daily fuel tank and fuel system** | | | | |
| 1 | Check for leakage. | | □ | | □ |
| 2 | Check hoses and connections. | | □ | | □ |
| 3 | Check fuel level. | | □ | | □ |
| 4 | Insulation resistance test for motor. | | | | □ |
| 5 | Check fuel supply and return pump operation. | | □ | | □ |
| 6 | Change fuel filter elements (every 250 hours running or 12 months). | | | | □ |
| 7 | Check/ Drain sediment in fuel tank daily. | | □ | | □ |
| 8 | Check oil level in automatic mode | | | | □ |
| 9 | Check oil level in manual mode | | □ | | □ |
| F | **Main fuel storage tank** | | | | |
| 1 | Check for leakage. | | □ | | □ |
| 2 | Check fuel level on indicator (if any). | | □ | | □ |
| 3 | Check air ventilation pipe. | | □ | | □ |
| G | **Exhaust** | | | | |
| 1 | Check for leakages. | | □ | | □ |
| 2 | Check outlet & exhaust system. | | □ | | □ |
| 3 | Check the working of turbocharger. | | | | □ |
| 4 | Check for abnormal vibration. | | | | □ |
| H | **Electrical** | | | | |
| 1 | Check battery charging alternator belt conditions & tension (if necessary). | | □ | | □ |
| 2 | Check batteries and battery charger condition, clean and tighten connectors. | | □ | | □ |
| 3 | Measure voltage battery when gen-set not operating. | | □ | | □ |
| 4 | Measure voltage battery when gen-set cranking. | | □ | | □ |
| 5 | Measure and record voltage and internal resistance of each batteries. | | □ | | □ |
| 6 | Tighten connectors . | | | | □ |
| I | **Alternator** | | | | |
| 1 | Clean windings, tighten connector. | | | | □ |
| 2 | Check excitation windings. | | | | □ |
| 3 | Check/ grease bearings (if necessary). | | | | □ |
| 4 | Continuity test and check earth resistance. | | | | □ |
| K | **Control box & electrical auxiliaries** | | | | |
| 1 | Vacuum/clean the switchboard. | | □ | | □ |
| 2 | Check condition of meters and indication devices & auxiliaries. | | □ | | □ |
| 3 | Tighten connectors. | | □ | | □ |
| 4 | Check the emergency shutdown functions. | | □ | | □ |
| 5 | Check working of AVR (if necessary). | | | | □ |
| L | **Air circuit breaker** | | | | |
| 1 | Visual check for condition of ACB if overheating. | | □ | | □ |
| 2 | Check/tighten connection (if necessary). | | □ | | □ |
| M | **Collecting data when gen-set on load (as actual working situation)** | | | | |
| 1 | No load running test | | □ | | □ |
| 2 | Check function changeover of ATS. | | □ | | □ |
| 3 | Voltage | | □ | | □ |
| 4 | Current | | □ | | □ |
| 5 | *HZ* | | □ | | □ |
| 6 | Oil pressure | | □ | | □ |
| 7 | Water temperature | | □ | | □ |
| N | **Replace equipment periodically** | | | | |
| 1 | Change lube oil (every 250hrs running or 12 months). | | | | □ |
| 2 | Replace filters (every 250hrs running or 12 months). | | | | □ |
| 3 | Replace cooling water (every 250hrs running or 12 months). | | | | □ |
| O | **Report with technical advice (if any)** | | □ | | □ |

## III.1.5 Uninterruptible Power Supply (UPS)

| MAINTENANCE SCOPE OF WORKS FOR UPS | | | | | |
|---|---|---|---|---|---|
| **No** | **Description of work** | **Routine** | | | |
| | | **Monthly** | **Quarterly** | **Semi yearly** | **Yearly** |
| **I** | **Preliminary checks** | | | | |
| 1 | Check alarm history of UPS (if any). | | □ | | |
| 2 | Check ventilation fan status | | □ | | |
| 4 | Check for corrosion on all the terminal and cable. | | □ | | |
| 5 | Check battery | | □ | | |
| 6 | Checks tighten of connection. | | □ | | |
| 7 | Clean UPS. | | □ | | |
| 8 | With customer approval, perform test unit transfer and battery discharge. | | □ | | |
| **II** | **Check & record calibration** | | | | |
| 1 | Supply Voltage | | □ | | |
| 2 | Battery Voltage | | □ | | |
| 3 | Measure and record internal resistance of each batteries (if possible). | | □ | | |
| 4 | Output voltage. | | □ | | |
| **III** | **General checks** | | □ | | |
| 1 | Check room temperature status. | | □ | | |
| 2 | Check status operation of air-con. | | □ | | |
| 3 | Check status operation of ventilation fan. | | □ | | |
| **IV** | **Issue report and advices (if any)** | | □ | | |

## III.1.6 Building Management System

| MAINTENANCE SCOPE OF WORKS FOR BMS SYSTEM | | | | | | |
|---|---|---|---|---|---|---|
| No | Description of work | Routine | | | |
| | | Monthly | Quarterly | Semi yearly | Yearly |
| **A** | **BMS Workstaion** | | | | |
| 1 | Check operation status Hardware of workstation | | | □ | |
| 2 | Check operation status Software of workstation | | | □ | |
| 3 | Check network connections of BMS system | | | □ | |
| 4 | Check function of system (function in use) | | | □ | |
| 5 | Check auto program, time schedule of system | | | □ | |
| 6 | Check system alarm, after that clear it or inform solution to clear it | | | □ | |
| 7 | Make backup of software before maintenance | | | □ | |
| 8 | Cleaning equipments | | | □ | |
| **B** | **Third party integrator or high level interface system** | | | | |
| 1 | Check communication line with BMS system, recommendation (if any) | | | □ | |
| 2 | Compare the value of integrator equipment and display on the BMS | | | □ | |
| **C** | **Direct digital control (DDC)** | | | | |
| 1 | Check all equipment inside the DDC panel: Power indicator, Power supply unit, Battery, controller devices | | | □ | |
| 2 | Check operation status of DDC controller | | | □ | |
| 3 | Check all signal are monitor or controlled by DDC controller | | | □ | |
| 4 | Check all termination and re-tighten if any loose connection | | | □ | |
| 5 | Cleaning equipments | | | □ | |
| **D** | **Field device or point to point connection** | | | | |
| **D1** | **Control or monitor device of HVAC system** | | | | |
| 1 | Check status temperature & humidity sensor outside of the building | | | □ | |
| 2 | Check status temperature sensor inside the room, water pipe, air duct | | | □ | |
| 5 | Check status pressure sensor inside the water pipe, air duct, stair case… | | | □ | |
| 6 | Check status smoke sensor inside air duct | | | □ | |
| 7 | Check status CO or $CO_2$ concentration sensor. | | | □ | |
| 8 | Check operation status of air pressure switch, difference pressure sensor | | | □ | |
| 9 | Check measurement status of flow meter. | | | □ | |
| 10 | Check operation status of all motorize valve of Chiller, PAU, AHU, FCU… | | | □ | |
| 11 | Check operation status of all motorize damper of air duct system | | | □ | |
| 12 | Check all connection from Chiller, Pump, Fan to BMS system | | | □ | |
| **D2** | **Control or monitor device of Fire Alarm (FA) system** | | | | |
| 1 | Check signal connect between FA system and BMS | | | □ | |
| 2 | Check interlock signal of BMS system in the fire mode | | | □ | |
| **D3** | **Control or monitor device of Power system** | | | | |
| 1 | Check signal status of ACB, MCCB… on the BMS monitor | | | □ | |
| 2 | Check measuring from power meter connect with BMS system | | | □ | |
| 3 | Check all connection from generator system to BMS system | | | □ | |
| 4 | Check all connection from UPS system to BMS system | | | □ | |
| **D4** | **Control or monitor device of Lighting system** | | | | |
| 1 | Check signal status of lighting display on the BMS monitor | | | □ | |
| 2 | Check control ability from BMS monitor to lighting line | | | □ | |
| **D5** | **Control or monitor device of remain system** | | | | |
| 1 | Check signal status of equipment display on the BMS monitor | | | □ | |
| 2 | Check control ability from BMS monitor | | | □ | |
| 3 | Submit maintenance report with recommendation (if any) | | | □ | |

## III.1.7 Closed-circuit television (CCTV)

| MAINTENANCE SCOPE OF WORKS FOR CCTV SYSTEM | | | | | |
|---|---|---|---|---|---|
| **No** | **Description of work** | **Routine** | | | |
| | | **Monthly** | **Quarterly** | **Semi yearly** | **Yearly** |
| 1 | Carry out a visual inspection of all major components (including cabling and connections) for signs of deterioration or damage and report to client as necessary. | | | □ | |
| 2 | Examine supporting brackets. | | | □ | |
| 3 | Check physical condition of cameras and housings. | | | □ | |
| 4 | Check that field of view is correct. | | | □ | |
| 5 | Check that all camera bracket fittings and clamping bolts are tight. | | | □ | |
| 6 | Check that lenses are correctly focused. | | | □ | |
| 7 | Check operation of auto-iris lenses as appropriate. | | | □ | |
| 8 | Clean housing windows as necessary. | | | □ | |
| 9 | Check operation of infrared units. (If any) | | | □ | |
| 10 | Check physical condition and cable connections. | | | □ | |
| *11* | Check operation of controls and adjust for best picture. | | | □ | |
| 12 | Check operation of keyboard controllers. | | | □ | |
| 13 | Check time/ date settings and adjust if necessary. | | | □ | |
| 14 | Check & clean hard disk recorder, card, LCD | | | □ | |
| 15 | *Check proper operation of UPS (If any)* | | | □ | |
| 16 | Complete maintenance report and discuss work conducted with client. | | | □ | |

## III.1.8 Distribution Board

| MAINTENANCE SCOPE OF WORKS FOR DISTRIBUTION BOARD | | | | | |
|---|---|---|---|---|---|
| **No** | **Description of work** | **Routine** | | | |
| | | **Monthly** | **Quarterly** | **Semi yearly** | **Yearly** |
| 1 | General inspection for damage, unusual noise of all connections, equipment or other abnormal phenomenom. | | | □ | |
| 2 | Thermal scanning for electrical cabinets | | | □ | |
| 3 | Check the abnormal colour of wires and cables at connection point. | | | □ | |
| 4 | Check all connection and re-tighten connection. | | | □ | |
| 5 | Check switches, pilot lights and selectors. | | | □ | |
| 6 | Check earthing connection of panel. | | | □ | |
| 7 | Clean inside and outside of panel. | | | □ | |
| **8** | **Issue report and advices (if any).** | | | □ | |

## III.1.9 Earthing and Lightning

| MAINTENANCE SCOPE OF WORKS FOR EARTHING AND LIGHTNING SYSTEM | | | | | | |
|---|---|---|---|---|---|---|
| **No** | **Description of work** | **Routine** | | | |
| | | **Monthly** | **Quarterly** | **Semi yearly** | **Yearly** |
| 1 | Check the copper tape status | | | | ☐ |
| 2 | Line check for copper tape. | | | | ☐ |
| 3 | Visual check lightning rod. | | | | ☐ |
| 4 | Measure earth resistance. | | | | ☐ |
| 5 | Check rusty, clean & retighten connections | | | | ☐ |
| 6 | **Issue report with advice (if any).** | | | | ☐ |

## III.1.10 Split Air Conditioning

| MAINTENANCE SCOPE OF WORKS PARKAGE AIR CONDITIONER | | | | | |
|---|---|---|---|---|---|
| **No** | **Description of work** | **Routine** | | | |
| | | **Monthly** | **Quarterly** | **Semi yearly** | **Yearly** |
| **I** | **Units check** | | | | |
| 1 | Check alarm code appeared on the remote controller screen before maintenance. | | | ☐ | |
| 2 | Check indoor and outdoor unit for noise and vibration. | | | ☐ | |
| 3 | Check magnetic contactor, electrical capacitor and electrical connections, and then retighten. | | | ☐ | |
| 4 | Check all safe devices. | | | ☐ | |
| 5 | Check leakage of refrigerant on the system. | | | ☐ | |
| 6 | Check state of thermal insulation. | | | ☐ | |
| 7 | Check operation of fans and compressors. | | | ☐ | |
| 8 | Function test of the unit | | | ☐ | |
| 9 | Check operation of all valves (solenoid valve and service valves) and condition of mechanical connection. | | | ☐ | |
| 10 | Check conditions of drain pipe. | | | ☐ | |
| 11 | Check operation of drain pump (if any). | | | ☐ | |
| 12 | Check operation of belt, adjust if necessary | | | ☐ | |
| **II** | **Clean and others** | | | | |
| 1 | Clean the coils of Indoor unit and Outdoor unit by HP water Pump. | | | ☐ | |
| 2 | Clean air filters by water. | | | ☐ | |
| 3 | Clean Condensing water tray, drain pump & drain pipe by HP water pump. | | | ☐ | |
| 4 | Clean electrical box and other parts of the unit by suitable tool. | | | ☐ | |
| 5 | Check state of evaporator and condenser fins. Report to client if necessary | | | ☐ | |
| **III** | **Data log** | | | | |
| 1 | Rated voltage and current. | | | ☐ | |
| 2 | Voltage supply and consumption current of Unit. | | | ☐ | |
| 4 | Measure discharge pressure (if necessary). | | | ☐ | |
| 5 | Measure suction pressure. | | | ☐ | |
| 6 | Measure temperature of air - inlet & outlet at indoor unit. | | | ☐ | |
| 7 | Test electrical insulation of compressor. | | | ☐ | |
| **IV** | **Submit maintenance report with recommendation (if any)** | | | ☐ | |

## III.1.11 Variable Refrigerant Volume Air conditioning (VRV)

| MAINTENANCE SCOPE OF WORKS FOR VRV AIR CONDITIONER | | | | | | |
|---|---|---|---|---|---|---|
| **No** | **Description of work** | **Routine** | | | |
| | | **Monthly** | **Quarterly** | **Semi yearly** | **Yearly** |
| **I** | **Units check** | | | | |
| 1 | Check alarm code appeared on the remote controller screen before maintenance. | | | □ | |
| 2 | Check indoor and outdoor unit for noise and vibration. | | | □ | |
| 3 | Check magnetic contactor, electrical capacitor and electrical connections, and then retighten. | | | □ | |
| 4 | Check all safe devices. | | | □ | |
| 5 | Check leakage of refrigerant on the system. | | | □ | |
| 6 | Check state of thermal insulation. | | | □ | |
| 7 | Check operation of fans and compressors. | | | □ | |
| 8 | Function test of all indoor units. | | | □ | |
| 9 | Check condition of communication between indoor unit & Outdoor unit, central control. | | | □ | |
| 10 | Check operation of all valves (reversible valve, solenoid valve and service valves) and condition of mechanical connection. | | | □ | |
| 11 | Check conditions of drain pipe. | | | □ | |
| 12 | Check state of evaporator and condenser fins. Report to client if neccessary. | | | □ | |
| 13 | Check operation of drain pump (if any). | | | □ | |
| **II** | **Clean and others** | | | | |
| 1 | Clean the coils of Indoor unit and Outdoor unit by HP water Pump. | | | □ | |
| 2 | Clean air filters by water. | | | □ | |
| 3 | Clean Condensing water tray, drain pump & drain pipe by HP water pump. | | | □ | |
| 4 | Clean electrical box and other parts of the unit by suitable tool. | | | □ | |
| **III** | **Data log** | | | | |
| 1 | Rated voltage and current. | | | □ | |
| 2 | Voltage supply and consumption current of compressors. | | | □ | |
| 4 | Measure discharge pressure (if necessary). | | | □ | |
| 5 | Measure suction pressure. | | | □ | |
| 6 | Measure temperature of air - inlet & outlet of indoor unit. | | | □ | |
| 7 | Measure temperature of air - inlet & outlet of outdoor unit. | | | □ | |
| 8 | Test electrical insulation of compressor. | | | □ | |
| **IV** | **Submit maintenance report with recommendation (if any)** | | | □ | |

## III.1.12 Precision Air Conditioning (PAC)

| MAINTENANCE SCOPE OF WORKS PRECCISION AIR CONDITIONER | | | | | |
|---|---|---|---|---|---|
| **No** | **Description of work** | **Routine** | | | |
| | | **Monthly** | **Quarterly** | **Semi yearly** | **Yearly** |
| **I** | **Units check** | | | | |
| 1 | Check alarm code appeared on the remote controller screen before maintenance. | | □ | □ | □ |
| 2 | Check indoor and outdoor unit for noise and vibration. | | □ | □ | □ |
| 3 | Check magnetic contactor, electrical capacitor and electrical connections, and then retighten. | | □ | □ | □ |
| 4 | Check operation of water level switch, solenoild valve for humidifier: turn ON/OFF properly | | □ | □ | □ |
| 5 | Check operation of electrical heater (reheater) | | □ | □ | □ |
| 6 | Check operation of oil heater of compressor | | □ | □ | □ |
| 7 | Check all safe devices. | | | □ | □ |
| 8 | Check leakage of refrigerant on the system. | | □ | □ | □ |
| 9 | Check state of thermal insulation. | | | | □ |
| 10 | Check operation of fans and compressors. | | □ | □ | □ |
| 11 | Function test of the unit | | □ | □ | □ |
| 12 | Check operation of all valves (solenoid valve and service valves) and condition of mechanical connection. | | | □ | □ |
| 13 | Check conditions of drain pipe. | | □ | □ | □ |
| 14 | Check operation of drain pump (if any). | | □ | □ | □ |
| 15 | Check operation of belt, adjust if necessary | | □ | □ | □ |
| **II** | **Clean and others** | | | | |
| 1 | Clean the coils of Indoor unit and Outdoor unit by HP water Pump. | | □ | □ | □ |
| 2 | Clean air filters by water. | | □ | □ | □ |
| 3 | Clean Condensing water tray, drain pump & drain pipe by HP water pump. | | □ | □ | □ |
| 4 | Clean electrical box and other parts of the unit by suitable tool. | | | □ | □ |
| 5 | Check state of evaporator and condenser fins. Report to client if necessary | | | | □ |
| **III** | **Data log** | | | | |
| 1 | Rated voltage and current. | | □ | □ | □ |
| 2 | Voltage supply and consumption current of Unit. | | □ | □ | □ |
| 4 | Measure discharge pressure (if necessary). | | □ | □ | □ |
| 5 | Measure suction pressure. | | □ | □ | □ |
| 6 | Measure temperature of air - inlet & outlet at indoor unit. | | □ | □ | □ |
| 7 | Test electrical insulation of compressor. | | | | □ |
| **IV** | **Submit maintenance report with recommendation (if any)** | | □ | □ | □ |

## III.1.13 Fire Extinguisher

| MAINTENANCE SCOPE OF WORKS FOR FIRE EXTINGUISHER | | | | | |
|---|---|---|---|---|---|
| **No** | **Description of work** | **Routine** | | | |
| | | **Monthly** | **Quartery** | **Semi yearly** | **Yearly** |
| 1 | Check seals and safety devices to determine if fire extinguisher has been used. | | | □ | |
| 2 | Check body of the fire extinguisher for corrosion or damage. | | | □ | |
| 3 | Test & clean the pipe system connected from fire extinguisher tank to nozzle. | | | □ | |
| 4 | Tighten the bolt on tank's nut, tank's valve also as checking the tightness of the tank and valve. | | | □ | |
| 5 | Test the quality of tank's support stand, tank's hanger, and equipment that spread CO2 powder. | | | □ | |
| 6 | Check and record pressure of fire extinguisher. | | | □ | |
| 7 | Check and record weight of fire extinguisher. | | | □ | |
| 8 | Check quantity & position of fire extinguisher system. | | | □ | |
| 9 | Clean fire extinguisher. | | | □ | |
| **10** | **Issue maintenance report with recommendation (if any)** | | | □ | |

## III.1.14 Fire Fighting

| MAINTENANCE SCOPE OF WORKS FOR FIRE FIGHTING SYSTEM | | | | | | |
|---|---|---|---|---|---|---|
| No | Description of work | Routine | | | | |
| | | Monthly | Quarterly | Semi yearly | Yearly | |
| A | **Bơm diesel** | | | | | |
| I | **Engine** | | | | | |
| 1 | Record operated hour meter | | | □ | | |
| 2 | Record pressure of lubricated oil when operating | | | □ | | |
| 3 | Record water temp | | | □ | | |
| 4 | Check for abnormal vibration | | | □ | | |
| 5 | Check tightness of mountings | | | □ | | |
| 6 | Check/Clean crankcase breather pipe | | | □ | | |
| 7 | Clean the engine and the storage | | | □ | | |
| 8 | Check and replace fuel filter (every 250 hour or 12 months) | | | □ | | |
| II | **Lubricating** | | | | | |
| 1 | Check for leaks | | | □ | | |
| 2 | Check engine oil level (when engine stop) | | | □ | | |
| 3 | Replace filters (every 250 hour /12 months). Part will be supplied by customer | | | □ | | |
| 4 | Change engine oil (every 250 hour or 12 months). Parts will be supplied by customer | | | □ | | |
| 5 | Check and clean sensor oil pressure | | | □ | | |
| 6 | Clean crankcase heater (if any) | | | □ | | |
| III | **Coolant** | | | | | |
| 1 | Check for leaks | | | □ | | |
| 2 | Check for radiator air restriction | | | □ | | |
| 3 | Check operation of coolant heater (if any) | | | □ | | |
| 4 | Check hoses and connections | | | □ | | |
| 5 | Check water coolant level | | | □ | | |
| 6 | Check inhibitor concentration | | | □ | | |
| 7 | Check belt condition & tension | | | □ | | |
| 8 | Grease fan hub & jockey pulley bearings | | | □ | | |
| 9 | Clean cooling system | | | □ | | |
| 10 | Check and clean sensor heater | | | □ | | |
| IV | **Induction air** | | | | | |
| 1 | Check for leaks | | | □ | | |
| 2 | Check inlet air system | | | □ | | |
| 3 | Check air cleaner restriction | | | □ | | |
| 4 | Check pipe and connections | | | □ | | |
| 5 | Replace air cleaner element (after 12 months of use). Part will be supplied by customer | | | □ | | |
| V | **Power supply part** | | | □ | | |
| 1 | Visual check | | | □ | | |
| 2 | Operation check of Relay | | | □ | | |
| 3 | Operation check of Delay Relay | | | □ | | |
| 4 | Lighting check of gas discharge pilot light | | | □ | | |
| 5 | Check of Solenoid operation voltage and current | | | □ | | |
| 6 | Operation check of PA for save | | | □ | | |
| 7 | Tightening check of terminal of cable joint | | | □ | | |
| 8 | Check of Regulated value of each meter | | | □ | | |
| VI | **Pump** | | | □ | | |
| 1 | Check and inspect of pump for any abnormal noise, vibration. | | | □ | | |
| 2 | Check for any shaft seal leakage. | | | □ | | |
| 3 | Check condition of impeller. | | | □ | | |
| 4 | Lubricate bearing. | | | □ | | |
| 5 | Check pressure meter and water pressure. | | | □ | | |
| 6 | Clean pump and pump room. | | | □ | | |
| B | **Electric Pump** | | | | | |
| I | **Pump** | | | | | |
| 1 | Check and inspect of pump for any abnormal noise, vibration. | | | □ | | |
| 2 | Check for any leakage on piping and connection. | | | □ | | |
| 3 | Inspection rubber connection. | | | □ | | |
| 4 | Check for any shaft seal leakage. | | | □ | | |
| 5 | Check condition of impeller. | | | □ | | |
| 6 | Check the condition and retighten all connections. | | | □ | | |
| 7 | Lubricate bearing. | | | □ | | |
| 8 | Check pressure meter and water pressure. | | | □ | | |
| 9 | Clean pump and pump room. | | | □ | | |
| II | **Motor** | | | | | |
| 1 | Check and inspect of motor for any abnormal noise, vibration or overheating. | | | □ | | |
| 2 | Lubricate bearing. | | | □ | | |
| 3 | Winding insulation test by megaom | | | □ | | |
| 4 | Record running current, compare with rate value. | | | □ | | |
| 5 | Clean motor. | | | □ | | |
| III | **Control panel** | | | | | |
| 1 | Check proper function of control, safety and associated devices. | | | □ | | |
| 2 | Check security of wires and cables inside panel. | | | □ | | |
| 3 | Re-tighten terminal, MCB and connections. | | | □ | | |
| 4 | Clean control panel. | | | □ | | |
| IV | ***Fire service valve & piping system (Sprinkler, drencher, fire hydrand)*** | | | | | |
| 1 | Check for free operation of each valve. | | | □ | | |
| 2 | Clean, adjust gland packing for leakage. | | | □ | | |
| 3 | Check the condition and security for all fixing screws. | | | □ | | |
| 4 | Clean any corrosion and apply touch up rust proof paint (if neccessary) – valve only. | | | □ | | |
| 5 | Check piping system, sprinkler head, valves, for leaking | | | □ | | |
| 6 | Check tamper switch by closing and opening valve. Send signal to fire alarm panel.( if any) | | | □ | | |
| 7 | Test fire fighting system. | | | □ | | |
| 8 | Visual check water pressure at nozzle. | | | □ | | |
| C | **Issue report with technical advice (if any).** | | | □ | | |





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## III.1.15 Fresh Water Pump

| MAINTENANCE SCOPE OF WORKS FOR FRESH WATER PUMP | | | | | |
|---|---|---|---|---|---|
| **No** | **Description of work** | **Routine** | | | |
| | | **Monthly** | **Quarterly** | **Semi yearly** | **Yearly** |
| **A** | **Pump** | | | | |
| 1 | Check and inspect of pump for any abnormal noise, vibration. | | □ | | □ |
| 2 | Check for any leakage on piping and connection. | | □ | | □ |
| 3 | Inspection rubber connection. | | □ | | □ |
| 4 | Check for any shaft seal leakage. | | | | □ |
| 5 | Check condition of impeller. | | □ | | □ |
| 6 | Check the condition and retighten all connections. | | □ | | □ |
| 7 | Lubricate bearing. | | | | □ |
| 8 | Check pressure meter and water pressure. | | □ | | □ |
| 9 | Clean pump and pump room. | | □ | | □ |
| **B** | **Motor** | | | | |
| 1 | Check and inspect of motor for any abnormal noise, vibration or overheating. | | □ | | □ |
| 2 | Lubricate bearing. | | | | □ |
| 3 | Winding insulation test by megaom | | | | □ |
| 4 | Record running current, compare with rate value. | | □ | | □ |
| 5 | Clean motor. | | □ | | □ |
| **C** | **Control panel** | | | | |
| 1 | Check proper function of control, safety and associated devices. | | □ | | □ |
| 2 | Check security of wires and cables inside panel. | | □ | | □ |
| 3 | Re-tighten terminal, MCB and connections. | | □ | | □ |
| 4 | Clean control panel. | | □ | | □ |
| **D** | **Issue report with technical advice (if any).** | | □ | | □ |

## III.1.16 Sum Pump

| MAINTENANCE SCOPE OF WORKS FOR SUM PUMP | | | | | |
|---|---|---|---|---|---|
| **No** | **Description of work** | **Routine** | | | |
| | | **Monthly** | **Quarterly** | **Semi yearly** | **Yearly** |
| 1 | Check and inspect of system for any abnormal noise, vibration. | | □ | | □ |
| 2 | Check the pump drain line for damage or blockage. | | □ | | □ |
| 3 | Check proper function of elec. control, safety and associated devices. | | □ | | □ |
| 4 | Check water flow on drain pipe (if any). | | □ | | □ |
| 5 | Re-tighten terminal, MCB Main breaker in and out going. | | □ | | □ |
| 6 | Vacuum clean motor starter panel. | | □ | | □ |
| 7 | Check security of wires and cables inside panel. | | □ | | □ |
| 8 | Check earthing system at panel. | | □ | | □ |
| 9 | Winding insulation test by megaom | | | | □ |
| 10 | Fuction test for sum pump | | □ | | □ |
| 11 | Record running amperes, voltage compare and against rated figure. | | □ | | □ |
| **12** | **Issue report with technical advice (if any).** | | □ | | □ |

## III.1.17 Wastewater Treatment

| MAINTENANCE SCOPE OF WORKS FOR WASTE WATER TREATMENT SYSTEM | | | | | |
|---|---|---|---|---|---|
| **No** | **Description of work** | **Routine** | | | |
| | | **Monthly** | **Quarterly** | **Semi yearly** | **Yearly** |
| **I** | **Air Blowers** | | | | |
| 1 | Check for any abnormal vibration, overheating, noise or smell. | | □ | | □ |
| 2 | Check and tigten electrical and mechanical connections. | | | | □ |
| 3 | Measure insulation. | | | | □ |
| 4 | Measure current when the air blower in operation. | | □ | | □ |
| 5 | Measure voltage when air blower in operation. | | □ | | □ |
| 6 | Check air diffusers for damages and blockage. | | □ | | □ |
| 7 | Dismantle and clean the suction pipe, air silencer. | | □ | | □ |
| 8 | Check oil level, oil quality and replace if necessary. (oil supply by client) | | | | □ |
| 9 | Check drives and controls as in good condition and function. | | □ | | □ |
| 10 | Check pressure gauge of air blower | | □ | | □ |
| 11 | Check and lubricate for oil, greasing (if necessary). | | □ | | □ |
| **II** | **Piping** | | | | |
| 1 | Check for damages, leaks, clogs and completeness. | | □ | | □ |
| 2 | Check and clean air pipes. | | □ | | □ |
| **III** | **Tank/ Pump pits/ Containers** | | | | |
| 1 | Inspect humus tank and note visual appearance of final effluent and absence (or otherwise) of sludge build up. | | | | □ |
| 2 | Pick up garbage and clean anti-garbage Mesh or Cages. | | □ | | □ |
| 3 | Check water level of chemical tank and mixing new chemical if needed. | | □ | | □ |
| 4 | Check for leaks, water proofing, lining material. | | □ | | □ |
| 5 | Grease all bearing & chain couplings through nipples (if necessary). | | | | □ |
| 6 | Run each pump and observe any abnormal noise. | | □ | | □ |
| 7 | Check proper function of elec. control, safety and associated devices. | | □ | | □ |
| 8 | Re-tighten terminal, MCB, Main breaker. | | | | □ |
| 9 | Perform and record insulation test to the motor winding insulation. | | □ | | □ |
| 10 | Record running amperes, voltage compare against rated figure. | | □ | | □ |
| 11 | Remove sludge (not included the quotation) | | | | □ |
| **IV** | **Mixer, Chemical pump** | | | | |
| 1 | Check aeration motor overheating. | | □ | | □ |
| 2 | Perform and record insulation test to the motor winding insulation. | | □ | | □ |
| 3 | Record running amperes, voltage compare against rated figure. | | □ | | □ |
| **VI** | **Electric box & Control panel** | | | | |
| 1 | Check security of wires and cables inside panel. | | □ | | □ |
| 2 | Check for any abnormal noise or overheating. | | □ | | □ |
| 3 | Check earth system at panel. | | □ | | □ |
| 4 | Vacuum clean motor starter panel. | | □ | | □ |
| **VII** | **Analyze the quality of waste water after treatment** | | | | |
| 1 | Test parameters as complying with Vietnamese Standard QCVN 40:2011- BTNMT. | | | | □ |
| **VIII** | **Report with technical advice (if any)**<br>***Báo cáo và khuyến cáo kỹ thuật (nếu có)*** | | □ | | □ |

**STANDARD OF WATER TESTING**

| ***No*** | ***Parameter*** | | ***Unit*** | ***Standard*** |
|---|---|---|---|---|
| 1 | PH | - | - | **5-Sep** |
| 2 | $BOD_5$ | Mg/l | Mg/l | **≤50** |
| 3 | TSS | Mg/l | Mg/l | **≤100** |
| 4 | Total dissolved solid | Mg/l | Mg/l | **≤1000** |
| 5 | Sunfua | Mg/l | Mg/l | **≤4** |
| 6 | Amoni | Mg/l | Mg/l | **≤10** |
| 7 | Nitrat | Mg/l | Mg/l | **≤ 50** |
| 8 | Lipit | Mg/l | Mg/l | **≤ 20** |
| 9 | Surface activity material | | Mg/l | **≤ 10** |
| 10 | Phosphat | Mg/l | Mg/l | **≤ 10** |
| 11 | Total Coliform | MPN/100 ml | MPN/100 ml | **≤ 5.000** |

## III.1.18 Heat pump

| MAINTENANCE SCOPE OF WORKS FOR HEATPUMP | | | | | |
|---|---|---|---|---|---|
| **No** | **Description of work** | **Routine** | | | |
| | | **Monthly** | **Quarterly** | **Semi yearly** | **Yearly** |
| **I** | **Units check** | | | | |
| 1 | Check unit for noise and vibration. | | □ | | |
| 2 | Check magnetic contactor, capacitor and electrical connections, and then retighten. | | □ | | |
| 3 | Check all safe devices. | | □ | | |
| 4 | Check leakage of refrigerant on the system. More charge or readjust. | | □ | | |
| 5 | Check state of thermal insulation. | | □ | | |
| 6 | Check operation condition of heatpump & circulating pump. | | □ | | |
| 7 | Check any corrosion & touchup painting. | | □ | | |
| 8 | Check state of heat exchanger. | | □ | | |
| 9 | Check proper operation of thermal sensors. | | □ | | |
| 10 | Check condition of flow switch. | | □ | | |
| **II** | **Clean and others** | | | | |
| 1 | Clean the coils of evaporator by HP water Pump. | | □ | | |
| 2 | Clean electrical box by suitable tool. | | □ | | |
| 3 | Clean other component by suitable tool. | | □ | | |
| **III** | **Data log** | | | | |
| 1 | Rated current and voltage. | | □ | | |
| 2 | Consumption voltage and current. | | □ | | |
| 3 | Measure Suction & discharge pressure (if neccessary). | | □ | | |
| 4 | Measure temperature of water inlet & outlet at condenser. | | □ | | |
| 5 | Measure temperature of air inlet & outlet at evaporator. | | □ | | |
| 6 | Test electrical insulation of compressor. (If necessary) | | □ | | |
| **IV** | **Submit maintenance report with recommendation (if any)** | | □ | | |

## III.1.19 Ventilation Fan

| MAINTENANCE SCOPE OF WORKS FOR VENTILATION FAN | | | | | |
|---|---|---|---|---|---|
| **No** | **Description of work** | **Routine** | | | |
| | | **Monthly** | **Quarterly** | **Semi yearly** | **Yearly** |
| **I** | **Units check** | | | | |
| 1 | Check noise and vibration of fan. | | | □ | |
| 2 | Check electrical connections, Flexible connections. | | | □ | |
| **II** | **Clean and others** | | | | |
| 1 | Clean casing, fan and fan motor. | | | □ | |
| 2 | Clean Insect catching nets (if any) | | | □ | |
| 3 | Clean all air filters. | | | □ | |
| 4 | Clean other part by suitable tool. | | | □ | |
| 5 | Lubricate fan motor bearings (if any). | | | □ | |
| **III** | **Data log** | | | | |
| 1 | Check rated current and voltage. | | | □ | |
| 2 | Measure current of Fan motor. | | | □ | |
| 3 | Measure voltage supply. | | | □ | |
| 4 | Check state of electrical insulation of motor windings. | | | □ | |
| **IV** | **Submit maintenance report with recommendation (if any)** | | | □ | |





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## III.1.20 Access Control

| MAINTENANCE SCOPE OF WORK FOR ACCESS CONTROL SYSTEM (ACS) | | | | | | |
|---|---|---|---|---|---|---|
| **No** | **Description of work** | **Routine** | | | |
| | | **Monthly** | **Quarterly** | **Semi yearly** | **Yearly** |
| **A** | **Access workstation** | | | | |
| 1 | Check operation status Hardware of workstation | | | □ | |
| 2 | Check operation status Software of workstation | | | □ | |
| 3 | Check function of system (function in use) | | | □ | |
| 4 | Check system alarm, after that clear it or inform solution to clear it | | | □ | |
| 5 | Make backup of software before maintenance | | | □ | |
| 6 | Cleaning equipments | | | □ | |
| **B** | **Main Controller Panel (if have)** | | | | |
| 1 | Check the function & status of main controller | | | □ | |
| 2 | Check communication links between main controller and work staion | | | □ | |
| 3 | Check communication links between main controller and local controller | | | □ | |
| 4 | Check the output voltage of power adaptor | | | □ | |
| 5 | Check the back-up battery of controller by shutting down main supply | | | □ | |
| 6 | Cleaning equipments | | | □ | |
| **C** | **Door Controller Panel** | | | | |
| 1 | Check the function & status of card access controller | | | □ | |
| 2 | Check communication links between card readers and main controller (or workstation) | | | □ | |
| 4 | Check the output voltage of power adaptor | | | □ | |
| 5 | Check the back-up battery of controller by shutting down main supply | | | □ | |
| 7 | Cleaning equipments | | | □ | |
| **D** | **Field Device** | | | | |
| 1 | Visual check status of card reader: Possion, sensibility | | | □ | |
| 2 | Check function of card reader with a valid card and invalid card | | | □ | |
| 3 | Visual check operation status of electromagnetic lock or electrical lock | | | □ | |
| 4 | Visual check operation status of Emergency button (if have) | | | □ | |
| 5 | Visual check operation status of door contacts | | | □ | |
| 6 | Check the function & status of flap barrier (if have) | | | □ | |
| 7 | Cleaning equipments | | | □ | |

## III.1.21 Fire Alarm

| MAINTENANCE SCOPE OF WORKS FOR FIRE ALARM SYSTEM | | | | | | |
|---|---|---|---|---|---|---|
| **No** | **Description of work** | **Routine** | | | |
| | | **Monthly** | **Quarterly** | **Semi yearly** | **Yearly** |
| 1 | Visual checking the main panel for damage, alarm on the panel, cable defect, loosing connection. | | | □ | |
| 2 | Measuring batteries voltage, internal resistance of each batteries. | | | □ | |
| 3 | Check operation of batteries charger. | | | □ | |
| 4 | Turn off electric power supply to test operation of fire alarm system by battery in 10 minute | | | □ | |
| 5 | Check the buzzer of main panel. | | | □ | |
| 6 | Check the led light of main panel. | | | □ | |
| 7 | Check function of manual call point on each floor. | | | □ | |
| 8 | Checking bell on each floor. | | | □ | |
| 9 | Cleaning in/ outside the panel. | | | □ | |
| 10 | Manual alarm test for the alarm system. | | | □ | |
| 11 | Automatic alarm test for the alarm system. | | | □ | |
| 12 | Check and clean heat detectors and smoke | | | □ | |
| 13 | Random test for fire alarm system by smocke detector & heat detector | | | □ | |
| 14 | Interlock test fire alarm system with others system (if any) | | | □ | |
| 15 | Issue an auditing report on the system. | | | □ | |

## III.1.22 Public Address

| MAINTENANCE SCOPE OF WORK FOR PUBLIC ADDRESS SYSTEM | | | | | |
|---|---|---|---|---|---|
| **No** | **Description of work** | **Routine** | | | |
| | | **Monthly** | **Quarterly** | **Semi yearly** | **Yearly** |
| **A** | **Public address** | | | | |
| 1 | Cleaning main panel & amplify with suitable cloth – Adjusted the volume if require | | | □ | |
| 2 | Check the power cable connector of amplifies system. | | | □ | |
| 3 | Clean & tighten connection for cable of speaker | | | □ | |
| 4 | Checking the voltage signal and current of loudspeaker to find problem | | | □ | |
| 5 | Clean cover of all speakers | | | □ | |
| 6 | Check quality sound of each loudspeaker | | | □ | |
| **B** | **Intercom system** | | | | |
| 1 | Check operation of microphone | | | □ | |
| 2 | Check the sound quality of the speakers, amplifier by music | | | □ | |
| 3 | Function test for P/A system | | | □ | |

## III.1.23 FM 200 & CO2

| MAINTENANCE SCOPE OF WORKS FOR FM 200, NN 100, CO2 | | | | | |
|---|---|---|---|---|---|
| No | Description of work | Routine | | | |
| | | Monthly | Quarterly | Semi yearly | Yearly |
| 1 | Visual checking the control panel for damage, alarm on the panel, cable defect, loosing connection. | | | □ | |
| 2 | Measuring batteries voltage. | | | □ | |
| 3 | Measuring voltage of batteries charger and check battery alarm indication. | | | □ | |
| 4 | Test batteries and specific gravity of electrolyte. | | | □ | |
| 5 | Checking the buzzer of main panel. | | | □ | |
| 6 | Checking the led light of main panel. | | | □ | |
| 7 | Checking the bells & horns of main panel. | | | □ | |
| 8 | Test speakers. | | | □ | |
| 9 | Verify monitoring connection. | | | □ | |
| 10 | Inspect annunciator. | | | □ | |
| 11 | Check smoke detector sensitivity. | | | □ | |
| 12 | Check duct detectors. | | | □ | |
| 13 | Check thermal detectors. | | | □ | |
| 14 | Test flow switches. | | | □ | |
| 15 | Check valves. | | | □ | |
| 16 | Check piping. | | | □ | |
| 17 | Check pressure of cylinder, actuating cylinder. | | | □ | |
| 18 | Check ground fault detection circuitry. | | | □ | |
| 19 | Cleaning in/ outside the panel. | | | □ | |
| 20 | Detectors cleaned. | | | □ | |
| 21 | Issue report and advice (if any). | | | □ | |

## III.1.24 Telephone

| MAINTENANCE SCOPE OF WORK FOR TELEPHONE SYSTEM | | | | | |
|---|---|---|---|---|---|
| No | Description of work | Routine | | | |
| | | Monthly | Quarterly | Semi yearly | Yearly |
| **I** | **Switchboard** | | | | |
| 1 | Cleaning equipment and main parts. | | | □ | |
| 2 | Re-arrange the main cable (if possible). | | | □ | |
| 3 | Check general engine room systems and machinery together with the accessories accompanying equipment, including inspection immediately the whole system hardware. | | | □ | |
| **II** | **Telephone** | | | | |
| 1 | Clean & check all terminal connection | | | □ | |
| **III** | **Make report with advice (if any)** | | | □ | |

## III.1.25 Roller Shutter door

| MAINTENANCE SCOPE OF WORKS FOR ROLLER SHUTTER DOOR SYSTEM | | | | | |
|---|---|---|---|---|---|
| No | Description of work | Routine | | | |
| | | Monthly | Quarterly | Semi yearly | Yearly |
| 1 | Check smooth operation (up and down) of the shutter. | | □ | | □ |
| 2 | Check proper function of the micro-switches. | | □ | | □ |
| 3 | Check manual operation device. | | □ | | □ |
| 4 | Lubricate bearings, gears and all lub points. | | □ | | □ |
| 5 | Measure motor voltage and current | | □ | | □ |
| 6 | Carry out insulation test to motor winding insulation (yearly). | | | | □ |
| 7 | Clean and remove dust at motor, gear and guard rail. | | □ | | □ |
| 8 | Clean and descale any grease, dust, rust and apply touch up rust proof painting. | | | | □ |
| 9 | Issue report and advices (if any). | | □ | | □ |

### III.1.26 Liquefied Petroleum Gas

| MAINTENANCE SCOPE OF WORKS FOR LPG SYSTEM | | | | | |
|---|---|---|---|---|---|
| **No** | **Description of work** | **Routine** | | | |
| | | **Monthly** | **Quarterly** | **Semi yearly** | **Yearly** |
| **I** | **Visual Inspection** | | | | |
| 1 | Examine room ventilation | | | □ | |
| 2 | Ensure clear access to plant and equipment | | | □ | |
| 3 | Check for abnormal smells. | | | □ | |
| **II** | **Piping** | | | | |
| 1 | Check for corrosion and damage | | | □ | |
| 2 | Ensure that terminals are not blocked or obstructed | | | □ | |
| 3 | Clean piping system if necessary | | | □ | |
| 4 | Examine for leaking on the system | | | □ | |
| **III** | **Kichen equipments** | | | | |
| 1 | Check gas leak at conecting point from gas pipe to Kitchen equipment. | | | □ | |
| **IV** | **Safety divice** | | | | |
| 1 | Check operation condition of presure reducing valve, safety valve | | | □ | |
| 2 | Test the system's gas leak protection function | | | □ | |
| **IV** | **Submit maintenance report with recommendation (if any)** | | | □ | |

## *III.2 PREVENTIVE MAINTENANCE PROGRAM*

Preventive maintenance generally refers to routine inspections, adjustments, lubrication and cleaning of fixed and movable equipment, machinery and appliances utilised in the daily operation of a facility.

Performing regular routine preventive maintenance keeps equipment in good running order, reducing the possibility of equipment failure thus insuring and extending expected equipment life. Through regular preventive maintenance, potential problems can be detected early thus reducing time and preventing more expensive repairs.

The supervisor of performance of routine preventive maintenance in Campus is the responsibility of Asset Management. The following document is designed to give building supervisors the guidance necessary to perform basic routine preventive maintenance checks and tasks. These checks are to be performed throughout the campus building, both interior and exterior, including the grounds. The preventive maintenance duties incorporated in this package are an expected function of Asset Management supervisor's normal duties.

The enclosed P.M. program provides an outline and checklist of the items to be inspected and performed by the Technical Team. The frequency that the items are to be checked, and the procedures required for each item are also detailed in the program.





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Check sheets are provided for daily, weekly, monthly, quarterly and annual preventive maintenance tasks.

It is the responsibility of Asset Management to see that these preventive maintenance tasks are performed and properly recorded on the appropriate check sheet. The original check sheet shall be posted at a visible location in the technical office. Completed reports shall be forwarded to the Facilities Manager by every Mondays. The reports expected at that time include the daily, weekly and monthly check sheets.

The quarterly and annual check sheets are to be forwarded by the 10th of the month following the conclusion of the performance period.

Problems found during the preventive maintenance inspections should be noted in the inspector's comments section on each check sheet. Problems that cannot be repaired by the in-house technician should be reported to the Facilities Manager, or by telephone if considered an emergency.

Check sheets require either a visual inspection, a specific task to be performed or the recordation of information. Most of the routine inspections are primarily visual inspections that should be incorporated into the Facilities Supervisor's daily travels throughout the campus facility.

| CAMPUS PREVENTIVE MAINTENANCE PROGRAM | | |
|---|---|---|
| **No** | **PROGRAM** | **Frequency** |
| 1. Medium voltage system | | |
| 1.1 | Daily preventive maintenance as designated checklist | Daily |
| 1.2 | Cleaning | Monthly |
| 2. Substation system | | |
| 2.1 | Daily preventive maintenance as designated checklist | Daily |
| 3. Low voltage system | | |
| 3.1 | Daily preventive maintenance as designated checklist | Daily |
| 3.2 | Cleaning | Monthly |
| 4. Generator system | | |
| 4.1 | Daily preventive maintenance as designated checklist | Daily |
| 4.2 | Periodic test run without load | Weekly |
| 4.3 | Cleaning | Monthly |

| | | |
|---|---|---|
| 4.4 | Periodic test run with load (75%) | Quarterly |
| 5. Room for pumping water for domestic use and fire prevention | | |
| 5.1 | Daily preventive maintenance as designated checklist | Daily |
| 5.2 | Test run the fire protection pump periodically | Weekly |
| 5.3 | Check the equipment inside the electrical cabinet periodically | Monthly |
| 5.4 | Clean the surface of electrical cabinets, pump control cabinets, clean walls and ceilings | Monthly |
| 5.5 | Check the equipment inside the electrical cabinet periodically | Monthly |
| 6. Rainwater pumping room | | |
| 6.1 | Daily preventive maintenance as designated checklist | Daily |
| 6.2 | Check the equipment inside the electrical cabinet periodically | Monthly |
| 6.2 | Cleaning the rainwater pump room | Monthly |
| 7. Landscape lighting system | | |
| 7.1 | Check outdoor lighting equipment (damaged, burned out) | Daily |
| 7.2 | Check the outdoor lighting electrical cabinet system according to the checklist | Daily |
| 7.3 | Clean and check electrical cabinets periodically | Weekly |
| 8. System of technical rooms (Electrical engineering room, light electricity, network room ...) | | |
| 8.1 | Periodically check the status of the electrical engineering room | Weekly |
| 8.2 | Cleaning the technical rooms | Monthly |
| 9. Aquarium system | | |
| 9.1 | Daily preventive maintenance as designated checklist | Daily |
| 9.2 | Clean the surface of the tank: pick up trash on the surface, bottom of the tank, push moss … | Daily |
| 9.3 | Periodically clean the bottom of the tank: vacuum the bottom of the tank | Weekly |
| 9.4 | Clean the surface of electrical cabinets, pump control cabinets, clean walls and ceilings | Monthly |
| 9.5 | Periodic repair: redo tiles, patching, plastering… | Yearly |
| 10. Air conditioning system | | |
| 10.1 | Daily preventive maintenance as designated checklist | Daily |





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| | | |
|---|---|---|
| 10.2 | Cleaning the cold side of the air conditioner: cleaning according to actual inspection | Up to actual inspection |
| 11. Kitchen exhaust fan system, exhaust system | | |
| 11.1 | Daily preventive maintenance as designated checklist | Daily |
| 12. Data centre area | | |
| 12.1 | Daily preventive maintenance as designated checklist | Daily |
| 13. Equipment, facilities, other items | | |
| 13.1 | Periodic preventive maintenance as designated checklist | Weekly |
| 14. CCTV room | | |
| 14.1 | Daily preventive maintenance PA system as designated checklist | Daily |
| 14.2 | Daily preventive maintenance CCTV system as designated checklist | Daily |
| 14.3 | Daily preventive maintenance Access Control system as designated checklist | Daily |
| 14.4 | Daily preventive maintenance Panic system as designated checklist | Daily |
| 14.5 | Daily preventive maintenance Central fire alarm system system as designated checklist | Daily |
| 14.5 | Periodic cleaning of surfaces | Monthly |