AMERICAN Journal of Science on Integration and Human Development
Volume 2, Issue 8, 2024 ISSN (E): 2993-2750

Medical Equipments Characteristics and Maintenance

Sukaina Wahb Ali
Graduation Project Submitted to College of Science Univirsity of Baghdad, In Partial Fulfillment of the Requiremwnts for the Degree of Bachelors in Physics

Abstract: Maintenance is a crucial topic in the life cycle management of medical equipment. Evidence-based maintenance consists of continuous monitoring of equipment perfor- mance, starting from evidence—the current state from the point of view of fault his- tory—and improving its efficiency through the necessary modifications. This process is very important for optimizing the use and allocation of the resources available by the clinical engineering departments. Maintenance of medical equipment consists of two basic activities: scheduled maintenance and corrective maintenance. The purpose of this chapter is to present document-based methods to evaluate every aspect of the medical equipment maintenance process and to provide a correct, objective and standardized approach that supports clinical engineering activities. Following the analysis, the results show that the combination of the use of the two methods provides an overview, in a periodic manner, of maintenance performance that indicates the use of the most appropriate procedures.

Keywords: medical equipment, maintenance strategies, life cycle, health technology management, prioritization.

Introduction:-

Within the large and modern hospitals, an increasingly common problem is the efficient management of the maintenance of the medical equipment, the quality of the assistance and the profitability. If effective management of medical equipment maintenance is to be applied, the management structure should apply appropriate planning, management and implementation processes. This is essential for provid- ing quality health services while saving resources. Medical equipment management includes inspection and preventive and corrective maintenance operations [1].

The efficient management of maintenance and repair work must be planned and implemented using appropriate maintenance strategies to keep the devices safe and functional in accordance with the basic functional specifications. In addition to the high initial investments, medical equipment requires continuous and costly maintenance during its useful life. The issue of maintenance is the main point of discussion of the management of medical devices. Studies have shown that the most frequent cause of stopping of medical equipment is poor maintenance, planning and management. To solve this problem, it is necessary to establish and regulate an adequate system for the proper maintenance and use of medical equipment. Perfect maintenance is the equation of performance, risk, resources and costs to achieve this goal [2, 3].

The first maintenance policies developed consist of interventions on equipment, which run until it stops accidentally (breakdown) in place due to wear or because of defects. The intervention is considered satisfactory as long as the equipment/system is operating at a minimum acceptable

level (reactive maintenance). The develop- ment and increase of the complexity of medical equipment and devices have led to modernizing and updating maintenance techniques and policies. Depending on the costs related to the spare parts and materials, respectively to the losses due to the time spent in repair, several types of maintenance policies have been developed [4].

Due to the way the health services are organized, the technical staff in the health units should not only perform maintenance and repair work but also be actively involved in the acquisition and management of the equipment. For example, they can plan equipment services and manage stocks; they can provide technical con- sultancy for procurement and can develop technical cost estimates. I can also make budget forecasts regarding the maintenance costs of medical equipment.

6I (4). MAINTENANCE OF THE EQUIPMENT:-

Proper maintenance of medical equipment is essential to obtain sustained benefits and to preserve capital investment. Medical equipment must be maintained in working order and periodically calibrated for effectiveness and accuracy of the results.

The Maintenance consists of:

a. Planned Preventive Maintenance

b. Breakdown Maintenance

a. Planned Preventive Maintenance (PPM)

Planned Preventive Maintenance involves maintenance performed to extend the life of the equipment and prevent its failure. Planned Preventive Maintenance is usually scheduled at specific intervals and includes specific maintenance activities such as lubrication, calibration, cleaning (e.g. filters) or replacing parts that are expected to wear (e.g. bearings) or which have a finite life (e.g. tubing). The procedures and intervals are usually established by the manufacturer. In special cases the user may change the frequency to accommodate local environmental conditions.Planned Preventive maintenance will be a statutory requirement for most of the medical equipments. It will enhance the efficiency, effectiveness and reliability of medical equipment and must be carried out at appropriate frequency as suggested by the manufacturer/service provider.

Each equipment on the inventory will show whether it is

a. maintained in-house

b. maintained by external agency or manufacturer.

The conditions for preventive maintenance required for medical equipment can vary due to factor such as type of equipment, age of the equipment, frequency of use of the equipment, etc.

The record of Planned Preventive Maintenance should be maintained department wise and must include following details:-

1. Reference ID as per inventory
2. Equipment Name
3. Company/Make
4. Serial No.
5. Date of Installation
6. Warranty Period
7. Under AMC/CMC
8. Frequency of Preventive Maintenance/Calibration

a. as per manufacturer guidelines

b. presently being followed

9. Preventive Maintenance/Calibration Done On

10. Preventive Maintenance/Calibration Due On

11. Expenditure with cost and details

12. Remarks with Functional Status

The record should be maintained in table form as given in Annexure-II.

Here is given the frequency of Planned Preventive Maintenance (PPM) of some of the medical equipment as a guideline

S.No.	Equipment Name	Frequency*
1	X-Ray (Complete System)	Quarterly
2	CT Scanner (Complete System)	Quarterly
3	MRI Scanner (Complete System)	Quarterly
4	Mammography (Complete System)	Quarterly
5	Cath Lab System	Quarterly
6	C-Arm Machine	Quarterly
7	Heart & Lung Machine	Quarterly
8	Arterial Blood Gas analyzer	Quarterly
9	Electrosurgical Unit	Quarterly
10	Autoclave	Quarterly
11	Ultrasonic Washer	Quarterly
12	Dental X-Ray Machine	Quarterly
13	Ultrasound Machine	Half Yearly
14	IABP (Intra aortic balloon pump)	Half Yearly
15	Echocardiography Machine	Half Yearly
16	TMT Machine	Half Yearly
17	PFT Machine	Half Yearly
18	Patient Monitor	Half Yearly
19	Cardiac Monitor	Half Yearly
20	ECG Machine	Half Yearly
21	Defibrillator	Half Yearly
22	Anesthesia Machine	Half Yearly
23	Ventilator	Half Yearly

** These are broad guidelines. However, frequency can be altered depending upon manufacturer's guidelines*

S.No.	Equipment Name	Frequency
24	OT Table	Half Yearly
25	OT Light	Half Yearly
26	Suction Machine	Half Yearly
27	Insufflators	Half Yearly
28	Endoscope/Laparoscope	Half Yearly
29	Syringe & Infusion Pump	Half Yearly
30	Infant Warmer	Half Yearly
31	Phototherapy Unit	Half Yearly
32	Fetal Doppler	Half Yearly
33	Patient Bed	Half Yearly
34	Pulse Oximeter	Half Yearly
35	ACT Machine	Half Yearly
36	Tourniquet System	Half Yearly
37	Blood and Fluid Warmer	Half Yearly
38	Electromyogram Machine	Half Yearly
39	Electroencephalogram Machine	Half Yearly
40	Bi-Pap Machine	Half Yearly
41	Humidifier	Half Yearly
42	Holter System	Half Yearly
43	Pace Maker	Half Yearly
44	Bubble CPAP (Continuous positive airway pressure) System	Half Yearly
45	Infant Resuscitator	Half Yearly
46	Microwave Diathermy	Half Yearly
47	Hot Pack Unit	Half Yearly
48	Traction Unit	Half Yearly
49	Continuous Passive Motion System	Half Yearly

S.No.	Equipment Name	Frequency
50	Cold Pack unit	Half Yearly
51	Ultrasonic Tens System	Half Yearly
52	Hemodialysis Machine	Half Yearly
53	Continuous renal replacement therapy (CRRT) Machine	Half Yearly
54	Donor Couches	Half Yearly
55	Microscopes	Half Yearly
56	Centrifuge/Cryofuge	Half Yearly
57	Hot Plate	Half Yearly
58	Cell Counter	Half Yearly
59	Cell Separator	Half Yearly
60	PH Meter	Half Yearly
61	Refrigerator	Half Yearly
62	Deep Freezer	Half Yearly
63	Bio-safety Cabinet	Half Yearly
64	Water Bath	Half Yearly
65	Laminar Flow	Half Yearly
66	Incubator	Half Yearly
67	Urine Analyzer	Half Yearly
68	Micropipettes	Half Yearly
69	Weighing Balance	Half Yearly
70	Plasma Thawing Bath	Half Yearly
71	Platelet Agitator	Half Yearly
72	Tube Sealer	Half Yearly
73	ELISA Reader	Half Yearly
74	Immuno Assay System	Half Yearly
75	Microtome	Half Yearly

S.No.	Equipment Name	Frequency
76	Refractometer	Half Yearly
77	Ophthalmoscope	Half Yearly
78	Slit Lamp	Half Yearly
79	Keratometer	Half Yearly
80	Auto Perimeter	Half Yearly
81	Image Capturing system	Half Yearly
82	Dental Chair	Half Yearly
83	Dental Sterilizer	Half Yearly
85	Lithotripsy Machine	Half Yearly
86	Lithotripsy Table	Half Yearly
87	Uroflowmeter	Half Yearly
88	ENT Examination Unit	Half Yearly
89	Harmonic Scalpel System	Half Yearly
90	Chest Vibrator	Half Yearly
91	Fibrillator	Half Yearly
92	VDRL Rotator	Half Yearly
93	Hormone Analyzer	Half Yearly
94	Air Sampler	Half Yearly
95	Wax Bath	Half Yearly
96	Surgical/Operating Microscope	Half Yearly
97	Phaco-emulsification Machine	Half Yearly
98	Tissue Flotation Bath	Half Yearly
99	Vortex Mixer	Half Yearly
100	Transport Incubator	Half Yearly

This is not the end of the list; other equipments may also be added in the list as per the requirement of the ESIC Health Institution(s).

For above and rest of the Medical Equipment, advice of manufacturer/supplier/ service provider should also be taken into consideration.

Note:-

1. Preventive Maintenance of all the equipments whether in use or not shall be done periodically as advised by manufacturer/supplier, so that functioning status of the equipment could be known and equipment is readily available whenever its use is needed.
2. In critical care areas like Casualty, ICU, OT etc., if the number of equipments are less (one or two), then authority may look into that a standby active unit should be kept ready so that patient does not suffer in case the equipment in use goes out of order.
3. Life of equipment and quality of testing: Ensure usage of good quality consumables for prolonging life of equipment and maintaining quality of testing.

*Service report after every repair or schedule service (PPM) should be taken by the user in which all the details like warranty on spare parts need to be added and same should be updated in the inventory register as well as in the Maintenance Register. If any deficiency is observed, the

same may be communicated to service provider and Head of the institution for necessary action. (Performance Bank Guarantee is meant for such problems)

b. Breakdown Maintenance

Breakdown Maintenance is a task performed to identify, isolate, and rectify a fault so that the out of order equipment, machine, or system can be restored to an operational condition.

All medical equipment in use should be free from any fault or defect and all repair work should be carried out to accepted standards by competent person(s).

Faulty or defective equipment shall not be used regardless of how minor is the problem and must be reported in the first instance to the manufacturer/supplier/agency hired for maintenance of the equipment as soon as possible.

User department should:-

1. Record details of the defect(s).
2. Attach label to the faulty equipment(s).
3. Contact Service engineer of manufacturer/supplier/hired agency by telephone number/fax/email supplied and keep a record of the same.
4. Ensure that information regarding breakdown is passed to all staff, including any shift changes and head of the institution. All the breakdowns occurring in the department should be maintained on record and must include following details:-

1. Reference ID as per inventory
2. Equipment Name
3. Company/Make
4. Serial No.
5. Date of Installation
6. Warranty period
7. Under AMC/CMC
8. Breakdown Date and Time
9. Breakdown Details (Technical fault or other reasons)
10. Date and Time of Rectification
11. Total Time Taken (Rectification Time – Breakdown Time) 12. Rectification Details with expenditure including cost (if any) 13. Remarks with functional status The record should be maintained in the table form as given in Annexure-II Note:- The replacement of the defective part(s) should be done at the earliest feasible after taking the necessary concurrence from the finance department and sanction from the Competent Authority. The reason(s) for the delay if any, should be recorded.

Information regarding Planned Preventive Maintenance and Breakdown Maintenance can be kept on a single sheet. The desired information recorded and analyzed are as given below (also given in Annexure – II)

S.No.	Information	
1.	Reference ID	"Information about the equipment"
2.	Equipment Name	
3.	Company/Make	
4.	Serial No.	
5.	Date of Installation	
6.	Warranty Period	
7.	Under AMC/CMC (with cost)	
8.	Average Life (as per manufacturer)	
9.	Contact details of the company (manufacturer/supplier)	
10.	Location of the equipment	
11.	Contact details of External contractor (if any)	
12.	Frequency of Preventive Maintenance/Calibration	"Information about PPM of the equipment"
	a. as per manufacturer guidelines	
	b. presently being followed	
13.	Preventive Maintenance/Calibration Done On	
14.	Preventive Maintenance/Calibration Due On	
15.	Expenditure with cost and details	
16.	Remarks of Service Engineer	
17.	Remarks of HOD/User	
18.	Breakdown Date and Time	"Information about Breakdown of the equipment"
19.	Breakdown Details (Technical fault or other reasons)	
20.	Date and Time of Rectification	
21.	Total Time Taken (Rectification Time – Breakdown Time)	
22.	Rectification Details with expenditure including cost (if any)	
23.	Remarks of Service Engineer	
24.	Remarks of HOD/User	

Note: - ***Due care should be given for the safety and security of the equipment so as to prolong its active life.***