भारतीय मानक

इमारतों के रखरखाव की व्यवस्था के लिए मार्गदर्शी सिद्धांत

भाग 1 सामान्य

Indian Standard

GUIDELINES FOR MAINTENANCE MANAGEMENT OF BUILDINGS

PART 1 GENERAL

ICS 91.040.01

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BUREAU OF INDIAN STANDARDS
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FOREWORD

This Indian Standard (Part 1) was adopted by the Bureau of Indian Standards, after the draft finalized by the Building Construction Practices Sectional Committee had been approved by the Civil Engineering Division Council.

Maintenance management in building industry is the art of preserving over a long period what has been constructed. It is as important as construction management or even more. Whereas construction stage lasts for a short period of 2 to 5 years, maintenance continues for at least 20-30 times the construction phase. Bad practice of maintenance adversely affects the environment in which people work, thus affecting the overall output.

It is clearly impractical and even undesirable to replace all older buildings at once. Everyone concerned with buildings whether as owners, engineers, designers, constructors or users should take a serious interest in this problem of building maintenance.

In the post-construction stage, the day-to-day maintenance or upkeep of the building shall certainly delay the decay of the building structure. Though the buildings may be designed to be very durable, it needs maintenance to keep it in good condition. It has been planned to publish Guidelines for Maintenance Management of buildings in the following three parts:

a) Part 1 General,

b) Part 2 Finance, and

c) Part 3 Labour.

This part covers the general aspects related to maintenance management of buildings.

This standard keeps in view the practices in the field of building maintenance management in the country. Assistance has been derived from BS 8210 : 1986 'Guide for Building Maintenance Management', issued by the British Standards Institution.

The composition of the technical Committee responsible for formulation of this standard is given at Annex D.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

GUIDELINES FOR MAINTENANCE MANAGEMENT OF BUILDINGS

PART 1 GENERAL

1 SCOPE

This standard provides general guidelines for maintenance management of building fabric including services (electrical and mechanical).

2 REFERENCE

The following Indian Standard contains provisions which through reference in this text, constitutes provision of this standard. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below:

IS No.	*Title*
IS 15183 (Part 2) : 2002	Guidelines for maintenance management of buildings: Part 2 Finance

3 TERMINOLOGY

For the purpose of this standard, the following definitions shall apply.

3.1 Maintenance — The combination of all technical and associated administrative actions intended to retain an item in or restore it to a state in which it can perform its required function.

3.2 Maintenance Management — The organisation of maintenance within an agreed policy. Maintenance can be seen as a form of 'steady state' activity.

3.3 Building Fabric — Elements and components of a building other than furniture and services.

3.4 Building Maintenance — Work undertaken to maintain or restore the performance of the building fabric and its services to provide an efficient and acceptable operating environment to its users.

3.5 House Keeping — House keeping maintenance can be defined as a routine recurring work which is required to keep a structure in good condition so that it can be utilized at its original capacity and efficiency along with proper protection of capital investment, throughout its economic life.

3.6 Owner — Person or body having a legal interest in a building. This includes free holders, lease holders or those holding a sub-lease which both bestows a legal right to occupation and gives rise to liabilities in respect of safety or building condition.

In case of lease or sub-lease holders, as far as ownership with respect to the structure is concerned, the structure of a flat or structure on a plot belongs to the allotee/ lessee till the allotment/lease subsists.

3.7 Confined Space — Space which may be inadequately ventilated for any reason and may result in a deficiency of oxygen, or a build-up of toxic gases, for example, closed tanks, sewers, ducts, closed and unventilated rooms, and open topped tanks particularly where heavier than air gases or vapours may be present.

4 BUILDING MAINTENANCE

4.1 General

Any structure, building or service when built has certain objectives and during the total economic life of that structure or service, it has to be maintained. Maintenance is a continuous process requiring a close watch and taking immediate remedial action. It is inter-woven with good quality of house keeping. It is largely governed by the quality of original construction. The owners, engineers, constructors, occupants and the maintenance agency are all deeply involved in this process and share a responsibility. Situation in which all these agencies merge into one is ideal and most satisfactory.

There are two processes envisaged, that is, the work carried out in anticipation of failure and the work carried out after failure. The former is usually referred to as preventive maintenance and the latter as corrective maintenance. The prime objective of maintenance is to maintain the performance of the building fabric and its services to provide an efficient and acceptable operating environment to its users.

4.1.1 Maintenance, in general term, can be identified in the following broad categories.

4.1.1.1 *Cleaning and servicing*

This is largely of preventive type, such as checking the efficacy of rain water gutters and servicing the mechanical and electrical installations. This covers the house keeping also.

4.1.1.2 *Rectification and repairs*

This is also called periodical maintenance work undertaken by, say, annual contracts and including external replastering, internal finishing, etc.

4.1.2 *Replacements*

This covers major repair or restoration such as re-roofing or re-building defective building parts.

4.2 Factors Affecting Maintenance

4.2.1 Maintenance of the buildings is influenced by the following factors:

a) *Technical factors* — These include age of building, nature of design, material specifications, past standard of maintenance and cost of postponing maintenance.

b) *Policy* — A maintenance policy ensures that value for money expended is obtained in addition to protecting both the asset value and the resource value of the buildings concerned and owners.

c) *Financial and economic factors* [*see* IS 15183 (Part 2)].

d) *Environmental* — All buildings are subject to the effects of a variety of external factors, such as, air, wind precipitation, temperature, etc, which influence the frequency and scope of maintenance.

The fabric of building can be adversely affected as much by the internal environment as by the external elements. Similarly, factors of humidity, temperature and pollution should be considered. Industrial buildings can be subject to many different factors, subject to processes carried out within. Swimming pool structures are vulnerable to the effects of chlorine used in water.

e) *User* — The maintenance requirements of buildings and their various parts are directly related to the type and intensity of use they receive.

4.2.2 *Influence of Design*

The physical characteristics, the life span and the aesthetic qualities of any building depend on the considerations given at the design stage. All buildings, however well designed and conscientiously built, will require repair and renewal as they get older.

However, for better performance of the building envelop, the following are the ways to minimize troubles at the later stage.

a) Minimize defects during construction and design.

b) Detail and choose materials during construction so that the job of maintenance is less onerous.

4.2.2.1 In addition to designing a building for structural adequacy, consideration should also be given to environmental factors, such as, moisture, natural weathering, corrosion and chemical action, user wear and tear, pollution, flooding, subsidence, earthquake, cyclones, etc.

4.2.2.2 A list of common causes for maintenance problems is given in Annex A for guidance. However, no such list is likely to be entirely comprehensive.

4.3 Maintenance Policy

The policy should cover such items as:

The owner's anticipated future requirement for the building taking account of the building's physical performance and its functional suitability. This may lead to decisions regarding:

a) the present use of the building anticipating any likely upgradings and their effect on the life cycles of existing components or engineering services; and

b) a change of use for the building and the effect of any conversion work on the life cycles of existing components or engineering services.

4.4 Maintenance Work Programmes

The programming of maintenance work can affect an owner or his activities in the following ways:

a) Maintenance work should be carried out at such times as are likely to minimize any adverse effect on output or function.

b) Programme should be planned to obviate as far as possible any abortive work. This may arise if upgrading or conversion work is carried out after maintenance work has been completed or if work such as rewiring is carried out after re-decorations.

c) Any delay in rectifying a defect should be kept to a minimum only if such delay is likely to affect output or function. The cost of maintenance increases with shortening response times.

d) Maintenance work, completed or being carried out should comply with all statutory and other legal requirements.

4.5 Maintenance Guides

An owner responsible for a large number of buildings may have established procedures for

maintenance. When an owner is responsible for the maintenance of only one building or a small number of buildings, the preparation of a guide tailored to suit each particular building, can offer significant advantages. Such a guide should take into account the following:

a) type of construction and residual life of the building, and

b) environment and intensity of use (*see* **4.2**).

The guide may form part of a wider manual covering operational matters.

4.6 Planning of Maintenance Work

Work should take account of the likely maintenance cycle of each building element and be planned logically, with inspections being made at regular intervals. Annual plans should take into account subsequent years' programmes to incorporate items and to prevent additional costs. It should be stressed that the design of some buildings can lead to high indirect costs in maintenance contracts and therefore, careful planning can bring financial benefits. Decisions to repair or replace should be taken after due consideration.

4.7 Feedback

4.7.1 Feedback is normally regarded as an important procedure of providing information about the behaviour of materials and detailing for the benefit of the architect/ engineer designing new buildings, which will result in lessening maintenance costs. It is an equally valuable source of information for the persons responsible for maintenance. Every maintenance organisation should develop a simple way of communicating its know-how, firstly for benefit of others in the organization and secondly for the benefit of the building industry as a whole. There should be frank and recorded dialogue on an on-going basis between those who occupy and care for buildings and those who design and construct them.

4.7.2 Feedback should aim at the following:

a) User satisfaction,

b) Continuous improvement, and

c) Participation by all.

4.7.3 *Source of Information*

The information on feedback can be obtained from the following:

a) Occupants,

b) Inspections,

c) Records, and

d) Discussions.

4.8 Means of Effecting Maintenance

4.8.1 *Responsibility*

Some maintenance work will be carried out by the occupier of a building or by the occupier's representative. In the case of leasehold or similar occupation, not all maintenance may be the responsibility of occupier. Responsibility of common areas may be clearly defined.

4.8.2 Maintenance work sub-divided into major repair, restoration, periodical and routine or day-to-day operations will be undertaken by one of the following:

a) Directly employed labour,

b) Contractors, and

c) Specialist contractors under service agreement or otherwise.

4.8.3 The merits of each category for typical maintenance work must be considered because optimum use of resources appropriate to tasks in a given situation is an important element of policy.

4.8.4 The success of contracting out depends on the nature of the services, conditions in which contracting is undertaken (the tendering process), how the contract is formulated and subsequent monitoring of service quality. The important consideration in the decision to contract out is whether a contractor can ensure a socially desirable quantity and quality of service provision at a reasonable cost to the consumers.

5 ACCESS

5.1 General

All maintenance activities including any preliminary survey and inspection work require safe access and in some situations this will have to be specially designed. Maintenance policy and maintenance costs will be much influenced by ready or difficult access to the fabric and to building services. Special precautions and access provisions may also need to be taken for roof work or for entry into confined spaces, such as, ducts or voids.

5.2 Access Facilities

5.2.1 Permanent accessibility measures should be provided at the design stage only for all the areas for safe and proper maintenance. It is a matter on which those experienced in the case of the building can make an important contribution at design stage in the interest of acceptable maintenance costs.

5.2.2 A wide variety of temporary access equipment may appropriately be provided for maintenance work, ranging from ladders to scaffoldings or powered lift platforms.

5.2.3 Wherever possible, it is better to provide permanent access facilities such as fixed barriers, ladders and stairways. When such permanent access facilities are provided, necessary arrangement may be included in maintenance plans for their regular inspection, maintenance and testing.

5.2.4 All personnel employed for carrying out maintenance should be provided with the necessary protective clothing and equipment, and instructed in its use.

5.2.5 When physical access is not possible in situations, such as, wall cavities, drains, etc, inspections may be made with the aid of closed circuit television or optical devices, such as, endoscopes.

5.3 Access to Confined Spaces

5.3.1 *Ventilation*

Special precautions need to be taken when entering a confined space. Such confined spaces should be adequately ventilated, particularly before being entered, to ensure that they are free from harmful concentrations of gases, vapours other airborne substances and that the air is not deficient in oxygen.

5.3.2 *Lighting*

Good lighting is necessary in order that maintenance work can be carried out satisfactorily. This is particularly important in confined spaces. When the normal lighting is inadequate, it should be supplemented by temporary installations. These should provide general and spot illumination as appropriate.

6 RECORDS

6.1 General

Good records can save owners and users/occupiers much unnecessary expense and reduce potential hazards in exploration work when faults arise.

6.2 Use of Building Records

6.2.1 All personnel involved in the maintenance of the building should be made aware of the existence of the building records.

6.2.2 Known hazardous areas should be explicitly marked on the records as well as being marked on site and should be pointed out to such personnel together with any system of work adopted for use in such areas.

6.2.3 Records are of value only if they are kept up-to-date and arrangements for this should be included in any provision that may be made for records.

6.2.4 Records should be readily accessible for use and the place of storage should take into account the form of the records and the conditions needed to keep them from damage of any kind. It is recommended that a duplicate set of records is kept in a secure place other than building itself and is kept up-to-date.

6.3 Following should be typical contents of the maintenance records:

a) A brief history of property, names and addresses of consultants and contractors.

b) Short specifications, constructional processes, components, material finishes, hidden features, special features, etc.

c) 'As built' plans and as subsequently altered with sections, elevations and other detailed drawings.

d) Foundation and structural plans/sections such as concrete reinforcement drawings.

e) Detail specification of all materials incorporated, for example, concrete mix, species and grades of timber, etc. Potentially hazardous materials and types or methods of construction that under some circumstances become hazardous may be identified.

f) Information on house keeping and routine maintenance with details of internal and external surfaces and decorations, schedule of cleaning, inspection and maintenance.

g) Means of operating mechanical, electrical and plumbing installations.

h) Description of renovations, extensions, adaptations and repair to each elements.

j) All plant, machinery and propriety articles including manufacturer's trade literature and instructions for installation, use and maintenance.

k) Methods of work used in construction, such as, assembly of prefabricated units.

m) All information related to fire, such as:

   1) Location and service arrangements of all fire alarm and call points;

   2) Location and service arrangements of all extinguishers, hose reels and other fire fighting installations;

   3) Location of all fire compartment walls, doors, floors and screens;

   4) Location of all areas of exceptional fire hazard,

   5) Fire escape routes;

   6) Details of application of any fire protection treatment; and

   7) Location details and description of any

installation for smoke control or protection of escape routes.

n) There should be a wall chart showing at a glance the various operations which have to be undertaken. Line drawings of buildings are always useful.

p) Records of security measures should be known to authorised personnel only.

q) Where no records exist, information should be slowly built up as it becomes available during the course of maintenance work.

r) Use of computers for storing information may be preferred.

6.4 Mechanical Records

6.4.1 *Documentation*

Documentation should record the following as installed:

a) The location including level, if buried, of all public service connections (for example, fuel gas and cold water supplies) together with the points of origin and termination, size and materials of pipes, line pressure and other relevant information.

b) The layout, location and extent of all piped services showing pipe sizes, together with all valves for regulation, isolation and other purposes as well as the results of all balancing, testing and commissioning data.

c) The location, identity, size and details of all apparatus and all control equipment served by or associated with each of the various services together with copies of any test certificates for such apparatus where appropriate. The information with respect to size and details may be presented in schedule form.

d) The layout, location and extent of all air ducts showing dampers and other equipment, acoustic silencers, grills, diffusers or other terminal components. Each duct and each terminal component should be marked with its size, the air quantity flowing and other relevant balancing data.

e) The location and identity of each room or space housing plant, machinery or apparatus.

6.4.2 *Drawings*

Drawings should record the following as installed:

a) Detailed general arrangements of boiler houses, machinery spaces, air handling plants, tank rooms and other plant or apparatus, including the location, identity, size and rating of each apparatus. The information with respect to the size and rating can be presented in schedule form.

b) Isometric or diagrammatic views of boiler houses, plant rooms, tank rooms and similar machinery, including valve identification charts. It is useful to frame and mount a copy of such drawings on the wall of the appropriate room.

c) Comprehensive diagrams that show power wiring and control wiring and/or pneumatic or other control piping including size, type or conductor or piping used and identifying the terminal points of each.

6.5 Electrical Records

Documentation should record the following including locations as installed:

a) Main and sub-main cables showing origin, route, termination, size and type of each cable; cables providing supplies to specialist equipment, for example, computers, should be identified separately.

b) Lighting conduits and final sub-circuit cables showing origin, route, termination and size of each, together with the number and size of cables within each conduit. The drawings should indicate for each conduit or cable, whether it is run on the surface or concealed, for example, in a wall chase, in a floor screed, cast *in-situ*, above a false ceiling, etc.

These drawings should also indicate the locations of lighting fittings, distribution boards, switches, draw-in-boxes and point boxes, and should indicate circuitry.

c) Location and purpose of each emergency lighting fitting including an indication of the circuit to which it is connected.

d) Single and three phase power conduits and final sub-circuit cables showing locations of power distribution boards, motors, isolators, starters, remote control units, socket outlets and other associated equipment.

e) Other miscellaneous equipment, conduits and cables.

f) Lightening conductor, air terminals, conductors, earth electrodes and test clamps.

g) Location of earth tapes, earth electrodes and test points other than those in (f); cables providing earth circuits for specialist equipment, for example, computers, should be identified separately.

Documentation should also include, when applicable the following:

a) Distribution diagrams or schedules to show size, type and length (to within 1 m) of each main and sub-main cable together with the measured earth continuity resistance of each.

b) Schedule of lighting fittings installed stating location, manufacturer and type or catalogue number together with the type or manufacturer's reference, voltage and wattage of the lamp installed.

c) Schedule of escape and emergency lighting fittings installed stating location, manufacturer, type or catalogue number together with the type or manufacturer's reference, voltage and wattage of the lamp installed. For battery systems, the position of the battery, its ampere hour rating and battery system rated endurance in hours should be stated.

d) Records of smoke detectors, sprinklers, fire precautions.

e) Incoming supply details, the type of system, voltage, phases, frequency, rated current and short circuit level with details of the supply protection and time of operation as appropriate.

f) Main switchgear details; for purpose made equipment, this should include a set of manufacturers' drawings and the site layout.

g) Transformer, capacitor and power plant details. The leading details should be given, for example, for transformers, the VA rating, voltages and type of cooling.

h) Completion certificate, according to the *Indian Electricity Act*.

7 INSPECTIONS

7.1 General

Regular inspections are actual part of the procedures for the maintenance of buildings. They are needed for a variety of purposes and each purpose requires a different approach if it is to be handled with maximum economy and efficiency. A more detailed inspection covering all parts of a building is needed to determine what work should be included in cyclic and planned maintenance programme.

7.2 Frequency of Inspection

Inspection should be carried out at the following frequencies:

a) *Routine* — Continuous regular observations should be undertaken by the building user as part of the occupancy of building. Feedback resulting from this type of observation should be encouraged.

b) *General* — Visual inspections of main elements should be made annually under the supervision of suitably qualified personnel at appropriate times.

c) *Detailed* — The frequency of full inspection of the building fabric by suitably qualified personnel should not normally exceed a 5-year period.

7.2.1 *Inspection Schedule*

The preparation of a specific schedule should be encouraged. Once prepared, it can be used for subsequent inspections.

7.3 Inspection of Engineering Services

Engineering services generally have a shorter life expectancy than building fabric and because of their dynamic function, should be subjected to more frequent inspections and maintenance.

7.3.1 Inspection of services should be carried out for three purposes as follows:

a) to check if maintenance work is required;

b) to check if maintenance work is being adequately carried out; and

c) for safety reasons to comply with statutory requirements and if required, with recommendations of other relevant organisations.

7.3.2 The frequency of inspections for purpose (a) will depend upon types of plant and system, manufacturer's recommendations and subjective judgement. Frequencies for purpose (b) should be carried out on an annual basis.

7.3.3 *Method of Inspection*

The limited life of building services means it is important to record their residual life so that their replacement can be budgeted for and inspection methods should be arranged accordingly.

A check list of items of plant to be inspected should be considered. Detailed specifications of how inspections should be carried out are necessary because a simple visual inspection is unlikely to show whether plant is operating correctly and efficiently.

Inspections frequently necessitate the use of appropriate instruments by competent persons. An example of this is the inspections carried out to check compliance with statutory requirements.

When instruments are used, it is important that adequate training is provided in the use of instruments and the interpretation of the results.

7.4 Records of all inspections should be kept.

7.5 Inspection Report

Inspection report may be prepared in the format as given in Annex B.

8 MAINTENANCE OF ELECTRICAL APPLIANCES

8.1 Planning of Maintenance Work

8.1.1 If the authorized person has complete knowledge of the electrical appliances to be worked upon, then safety will be more assured. If the person attending to the job is not technically competent to handle the job, then more careful planning is required before hand.

8.1.2 Repetitive nature of jobs involve little or no pre-planning whereas infrequent nature of jobs may need careful planning even if the person attending the job is technically competent.

8.1.3 Planned routine maintenance will facilitate continued safe and acceptable operation of an electrical system with a minimum risk of breakdown and consequent interruption of supply.

8.1.4 As far as the electrical equipments/installations are concerned, it is not possible to lay down precise recommendations for the interval between the maintenance required. The recommendation for frequency of maintenance in this regard from the manufacturer is more relevant. The manufacturer should be requested to specify minimum maintenance frequency under specified conditions. These intervals depend greatly upon the design of the equipment, the duty that it is called on to perform and the environment in which it is situated.

8.2 The following two types of maintenance are envisaged.

8.2.1 *Routine Maintenance*

Routine maintenance of the electrical equipments goes alongwith the regular inspections of the equipments. Inspections shall reveal the undue damage and excessive wear to the various components. Examination of the equipment shall reveal any need for conditioning of the contact system, lubrication and adjustment of the mechanisms.

8.2.2 *Post-Fault Maintenance*

When there is a breakdown in the system and certain parts are identified for the replacement and then the maintenance/repair of the defective part away from the operating environment is covered under post-fault maintenance.

8.3 Guidelines for the Maintenance of Electrical Appliances

8.3.1 Uninterrupted and hazard-free functioning of the electrical installations are the basic parameters of maintenance. The equipment should be restored to correct working conditions. Special attention should be paid to the items and settings that might have been disturbed during the operational phase. Loose and extraneous equipment or wiring give rise to potential safety hazards. All covers and locking arrangements should be properly checked and secured to achieve original degree of protection.

8.3.2 Guidelines to be followed for the maintenance of electrical equipment to ensure their smooth functioning are given in Annex C.

9 OPERATING AND MAINTENANCE MANUALS

The engineering services within buildings frequently are dynamic, involving complex systems of integrated plant items. Operation of such plant can require detailed knowledge and direction. Maintenance can also require extensive information to be available. It is, therefore, important to have suitable operating and maintenance manuals to provide the necessary guidance. These should be included as part of the contractual requirements for new installations and should ideally be prepared as reference documents for existing installations where no such information exists.

ANNEX A

(*Clause* 4.2.2.2)

COMMON CAUSES FOR MAINTENANCE PROBLEMS

A-0 MAJOR CAUSES FOR MAINTENANCE PROBLEMS

A-1 FLOORS

a) Poor quality of construction which includes quality of construction material and workmanship.

b) Improper slopes, mainly in kitchen, bathrooms/toilets, etc.

c) Lack of rounding at junctions of walls with floors.

d) Lack of damp-proof course treatment in walls and particularly in sunken floors.

e) Poor design of building.

A-2 ROOFS

a) Inadequate roof slopes.

b) Inferior quality of construction.

c) Cracks on roof surfaces.

d) Inadequate provision of rain water spouts.

e) Blockages in gratings/rain water pipes.

f) Worn out felts.

g) Bubbling up of tarfelt and separation of joints.

h) Leakage from the openings provided on the roof.

A-3 PLUMBING

a) Inadequate slopes in soil/waste pipes.

b) Improper lead joints.

c) Joints in walls.

d) Improper junctions of stacks.

e) Inadequate cleaning eyes at junctions.

f) Inadequate slopes in sewage pipes.

g) Throwing of solid wastes in WC's.

h) Lack of periodical checking and cleaning.

j) Lack of motivation/education to users for proper use.

k) Overflow from service tanks.

m) Inferior quality of fittings and fixtures.

n) Inadequate design.

A-4 DRAINAGE

a) Improper surface dressing around buildings and improper upkeep of surroundings.

b) Growth of wild grass and vegetation.

c) Inadequate drainage system around the building.

d) Inadequate slope of the drains or drainage pipes.

e) Inadequate number of inspection chambers.

f) Theft of manhole covers, etc.

g) Throwing of solid waste in the open surface drains.

A-5 ELECTRICAL

a) Loose connections.

b) Improper earthing and earth connections.

c) Damages to wires, cables and other installations.

d) Under rated cables/wires and other installations.

ANNEX B

(*Clause* 7.5)

FORMAT FOR INSPECTION REPORT

Date :.....

Building/Block :.....

	Condition		
	Sound	Suspect	Defective
Floors and Staircases			
a) *Ground floor*			
Finish			
Skirting			
Structure			
Damp-proofing			
Ceiling			
Under floors, spaces (suspended floors)			
Termites/insects			
b) *Upper floors*			
Finish			
Structure			
Ceiling			
Suspended ceiling			
c) *Staircases*			
Structure			
Treads			
Finishes			
Balustrade			
Soffits			
Finish			
Roofing			
Flat/Pitched			
Finish			
Insulation			
Structure			
Roof lights/glazing			
Parapets			
Cutters			

Date :.....

Building/Block :.....

	Condition		
	Sound	Suspect	Defective
Rain water.pipes			
Mud phuska			
Roof interiors (pitched)			
Growth of vegetation			
Sanitary Installations			
a) *Plumbing*			
Fittings/pipings, WC's			
Taps			
Sinks			
Basins			
Urinals			
Cisterns			
Geysers			
b) *Sewage disposal*			
Soil pipes			
Manholes			
Sewer lines			
c) *Drainage*			
Gully chambers			
Sewers			
Surface drains			
Inspection chambers			
Structural movement			
Failure of material			
Design or construction defects			
Overhead tanks/underground			
Sumps/terrace tanks			
Septic tanks			
Remarks			

ANNEX C

(*Clause* 8.3.2)

GUIDELINES FOR MAINTENANCE OF ELECTRICAL EQUIPMENTS

C-1 In case of electrical appliances, manufacturer's instructions for the usage and maintenance of the equipment should be strictly followed.

C-2 The detailed/working drawings of all the components of electrical installations should always be available with the maintenance unit. The following records should be available:

a) Manufacturer's name;

b) Name-plate of the equipment and its sailent features, such as, capacity, rating, etc;

c) Manufacturer's recommendations regarding availability/usage of spare parts;

d) Manufacturer's recommendations for periodical maintenance and post-fault maintenance; and

e) Details of the maintenance operations performed in the past.

C-3 Care should be taken while selecting replacement parts. The spare parts should be correct and suitable, preferably as recommended by the manufacturer of the installation. During the placement of order for the supply of spare parts, name-plate particulars and serial number should be quoted.

C-4 The space where the equipment is kept should be clean and properly ventilated. Equipment should not be disturbed needlessly. Before cleaning, the equipment should be made dead. For internal cleaning, a section cleaner should be used.

C-5 Covers and doors should not be left open unnecessarily during maintenance. Afterwards they should be promptly and correctly closed and locked.

C-6 Before removing the covers and connections, all covers and cable terminations should be marked to ensure correct replacements. Disturbed connections and temporary connections should be marked to facilitate reconnection. Temporary connections and markings should be removed before the installation is put to use.

C-7 Those connections, which have not been disturbed, should also be checked for soundness and overheating.

C-8 All insulations should be regularly checked. Solid insulations should be checked for cracks and other defects. Fibrous and organic insulations should be checked for sign of blistering, delamination and mechanical damage. For insulating oils, the interval between tests should be carried out as per the recommendations of the manufacturer and keeping the adverse environmental conditions in mind.

C-9 It should be ensured that the earthing connections are sound and all contact screws are tight.

C-10 During the examination of interlocks, it is necessary to take precautions to prevent danger to plant or persons in the event of malfunction or inadvertent operation. A person responsible for checking and maintaining any interlock system should have thorough knowledge of the extent, nature and function of the interlock.

C-11 If the equipment is ventilated then it should be ensured that the air-flow is smooth and not restricted. If filters are provided, they should be cleaned or replaced as necessary.

C-12 The standby system for tripping and closing supplies should always be kept in good order. Indicators and alarms should be maintained in time with the manufacturer's instructions.

C-13 Tools, spares and instruments should be stored near to the installation. These should be regularly checked against an inventory.

C-14 Before the start of maintenance of the circuit switches, it should be ensured that all incoming and outgoing main auxiliary circuits are dead and remain so during the maintenance. Overheating of the circuit switches is the root cause for faults. Overheating may be caused by inadequate ventilation, overloading, loose connection, insufficient contact force and mal-alignment.

C-15 Some circuit breakers are not intended to be maintained, such as, miniature circuit breakers (MCBs). Such items should not be dismantled for maintenance. These should be renewed periodically.

C-16 For the maintenance of fuses, periodical inspection should be done for correct rating, security, overheating and correct location/orientation. Element of renewable fuses should be renewed when the deterioration is apparent. The availability and correct replacement of fuse links should be ensured.

C-17 If a fuse link of certain rating has failed and is replaced, then all fuse-links of same rating apparently subjected to the fault should be destroyed and replaced by new fuse-links.

C-18 In order to be reasonably sure that circuit breaker is capable of operation when required, these should be tripped and reclosed at regular intervals. Tripping should be proved manually and where possible electrically via the protective relay contacts. The leakage of oil, sign of corrosion and any unusual smell which may indicate overheating should be detected through inspections.

C-19 Timing devices are mostly designed for specialist maintenance. These should not be dismantled for maintenance or overhaul purposes unless specifically recommended by the manufacturers. Actual timing periods should be verified with set values and application requirements.

C-20 In case of cable boxes and terminations, security of mounting and earthing should be examined. Exposed tails should be inspected for good conditions of insulation and freedom from moisture.

C-21 Battery cells should be inspected for shedding of active material, sedimentation and buckling of plates. Level of electrolyte should be regularly checked and the level should be corrected with distilled water.

ANNEX D

(*Foreword*)

COMMITTEE COMPOSITION

Building Construction Practices Sectional Committee, CED 13

Organization	*Representative(s)*
In personal capacity (*D-6, Sector 55, Noida-201301*)	SHRI A. K. SARKAR (***Chairman***)
Bhabha Atomic Reseach Centre, Mumbai	SHRI K. S. CHAUHAN SHRI K. B. MEHRA (*Alternate*)
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Building Materials and Technology Promotion Council, New Delhi	SHRI J. K. PRASAD SHRI S. K. GUPTA (*Alternate*)
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Central Public Works Department, New Delhi	CHIEF ENGINEER (CDO) SUPERINTENDING ENGINEER (CDO) (*Alternate*)
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Life Insurance Corporation of India, New Delhi	CHIEF ENGINEER DEPUTY CHIEF ENGINEER (*Alternate*)
Ministry of Railways, Lucknow	DEPUTY CHIEF ENGINEER (CONSTRUCTION) EXECUTIVE ENGINEER (CONSTRUCTION) (*Alternate*)
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(*Continued on page* 14)

(*Continued from page* 13)

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Assistant Director (Civ Engg), BIS

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