




Bangladesh Power Development Board

**INTEGRATED MANAGEMENT SYSTEM
(BASED ON ISO 9001:2015, ISO 14001:2015 & ISO 45001:2018
STANDARDS)**

PREVENTION OF FIRE EXPLOSION

	INTEGRATED MANAGEMENT SYSTEM	Document No.: BPDB-IMS-PR-082
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1.0 Purpose

The purpose of this program is to inform all employees, vendors, and contractors of BPDB of our procedures and guidelines for fire protection and prevention.

2.0 Scope

This procedure applies to employees, contractors and visitors of BPDB.

3.0 Terms, Definition

None

Abbreviations

BPDB – Bangladesh Power Development Board

CCB - Central Control Building

CO₂ - Carbon Dioxide

F/F - Fire Fighting

KV - Kilo Volt

FACP - Fire Alarm Control Panel

4.0 Roles and Responsibility

BPDB employees are responsible for implementation of all requirements within the procedure as necessary to safeguard all personnel within their work area.

5.0 Procedures

5.1 FIRE FIGHTING AND CONTROL

Should a fire develop, you and the personnel in the work area are responsible for implementing the Emergency Action Plan along with procedures outlined herein.

5.2 CLASSIFICATION OF FIRES AND FIRE EXTINGUISHERS

Class A Fires are fires involving ordinary combustible materials such as wood, paper, rags, rubbish, etc. Water, with its cooling effect, is the most effective extinguishing agent. ABC Fire Extinguishers are also effective on this type of fire.

Class B Fires are fires involving flammable liquids such as gasoline, oil, etc. A blanketing or smothering effect is the most effective on this type of fire. The use of foam, or dry chemical fire extinguishers that provide the blanketing and smothering effect are effective Class B Fires.

Class C Fires are fires in or near live electrical equipment. A non-conductive extinguishing agent such as a dry chemical, or carbon dioxide fire extinguisher is satisfactory for Class C Fires.

Class D Fires are fires involving flammable metals. Generally, there are no flammable metals in the plant. If you suspect there may be flammable metals, notify your supervisors who will investigate.

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SINGLE PURPOSE EXTINGUISHERS

CLASS	SYMBOL AND COLOR CODE	USE FOR FIRES IN THESE MATERIALS	DO NOT USE FOR THESE FIRES
Class A	Green Triangle	Ordinary Materials	Flammable Liquids Electrical Equipment Combustible Materials
Class B	Red Square	Flammable Liquids	USE ONLY FOR Flammable Liquids
Class C	Blue Circle	Electrical Equipment	USE ONLY FOR Electrical Equipment
Class D	Green Star	Combustible Materials	USE ONLY FOR Combustible Materials
FOAM	AB*	Ordinary Materials Flammable Liquids	Electrical Equipment Combustible Materials
CO ₂	BC*	Electrical Equipment Flammable Liquids	Ordinary Materials Combustible Materials

MULTIPURPOSE DRY CHEMICAL EXTINGUISHERS


AB	AB*	Ordinary Materials Flammable Liquids	Electrical Equipment Combustible Materials
ABC	ABC*	Ordinary Materials Flammable Liquids Electrical Equipment	Combustible Materials
BC	BC*	Flammable Liquids Electrical Equipment	Ordinary Materials Combustible Materials

* Identification may also include the associated green, red or blue background.

5.3 FIRE PROTECTION RULES

- Never obstruct fire-fighting equipment in any way.
- Never manually administer water on fires associated with electrical equipment.
- Dispose of all flammable material properly. Use approved containers for disposing of rags soaked with oil or other flammable materials.
- Never pour gas, kerosene, oil, or other flammable materials down drains or sewers.
- Open fires or open-bucket type fires are not permitted in the plant.
- Change your clothes without delay if they become soaked with oil, kerosene, naphtha, or other flammable liquids.
- Obey "NO SMOKING" signs. Smoking is permitted in designated areas only.

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- Make sure “NO SMOKING” signs are displayed in areas where flammable liquids are stored or handled.
- Know the location of all the fire extinguishers, fire hoses and other fire protection equipment in your work area.
- Know how to use all the fire protection equipment in your work area, if in doubt check with your supervisor.
- Report all fires to the Control Room immediately.
- Know the location of all fire exits in your work area.
- If you use a fire extinguisher, notify your supervisor immediately and replace the extinguisher with a fully charged extinguisher. Lay the used extinguisher down horizontally on the ground.

5.4 FIRE EXTINGUISHER INSPECTION


Each fire extinguisher in the plant is to be inspected on a monthly basis to make sure the extinguishers are reliable should a fire develop. Checks include:

- Make certain the extinguisher is mounted properly for easy removal and is not sitting on the floor.
- Make certain each fire extinguisher is in its proper location and free and clear access is available.
- Make certain that the seal has not been removed or broken.
- Make certain that the pressure gauge indicates a fully charged extinguisher.
- Make certain that the nozzles are free of trash and foreign material.
- Make certain that there is no build-up of foreign material around the handle or valve.
- Make certain the cover is on the extinguisher.
- Make certain an annual maintenance inspection is conducted on each fire extinguisher.

5.5 FLAMMABLE AND COMBUSTIBLE LIQUIDS

- The use of open flames, sparks, or any ignition source must never exist near flammable and combustible liquids.
- Always make sure that flammable materials are carried, stored, etc. in approved containers bearing the “Factory Manual” or “Underwriters Laboratories (UL)” decal and clearly marked to identify contents.
- Always keep flammable and combustible liquids in close, approved containers. Be sure all spills are cleaned up immediately.
- NEVER use gasoline for any reason other than motor fuel.
- NEVER use plastic containers for handling or storing flammable materials.

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- A falling liquid can generate a static electric charge; therefore, metal-to-metal contact must be maintained or a bonding wire must be attached between the containers when transferring flammable and combustible materials. Make sure all storage containers are grounded.
- Always keep the plugs tight on drums filled or partially filled with flammable liquids.
- Always clean immediately any container that has been emptied of flammable materials.
- When you are transferring flammable or combustible liquids from a tank or drum, you must use either a pump designed for this purpose or by gravity with an approved self-closing valve.
- Always make sure proper fire protection equipment is available where flammable and combustible materials are stored. This applies to permanent and temporary storage facilities.

5.6 FIRE PROTECTION IMPAIRMENT PROGRAM

An impairment of the fire protection system or equipment occurs when that protection system, alarm or detection device is removed from service partially or completely. This includes planned or emergency outages of the systems or devices. The probability of losses from a fire or explosion is increased whenever a system, alarm or detection device is impaired; and the longer the protection is impaired the greater the probability becomes. Therefore, it is necessary to minimize the duration and scope of any impairment. A protection system may become impaired for a number of reasons, such as maintenance, renovation, construction, equipment failure or just forgetting to activate the system or device.

The responsibility and the authority to control the impairment is assigned to the Operations Manager. Only in an extreme emergency situation, the Shift Charge Engineer may have the authority to impair the system but should be informed as soon as practically possible to the operation manager, but the overall responsibility of the impairment remains with the Plant Manager.

To minimize the risks associated with impairment, the following will be implemented:

- Educate plant personnel in basic precautions when a protection system or equipment is impaired.
- Limit the number, scope and duration of impairment.
- Supplement manual fire protection with extra extinguishers.
- Limit any unnecessary cutting and welding or other hazardous process that would increase the probability of an occurrence.
- Make the impairment work a priority and complete it in a timely manner.
- Restore fire protection system upon completion of work.
- Verify by testing that the protection system is operational.


Whenever an impairment of the fire protection system occurs, the Operations Manager or Plant Manager should contact the plants insurance company, and the local fire department.

After completing the work, it is important to assure that the fire protection system has been properly restored. This takes several steps to accomplish. Each step should be verified by at least two employees (preferably the Shift Charge Engineer and one I&C Engineer).

The steps to restore the fire protection system are:

- Open all valves that were secured during the impairment. Verify that the system is properly lined up and valves are open by conducting a drain test. (Note: if during

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the test the pressure drops below normal, the system may have a restriction or partially closed valve.)

- Place all alarms or detection devices back in service.
- Restore any fire protection equipment to “AUTOMATIC” that was secured or placed in “MANUAL”.
- Verify that portable fire extinguishers are in place and are fully charged. Notify the appropriate parties that the fire protection system has been restored to service, such as Control Room, Risk Management (and/or the plant’s insurance company), and/or the local fire department.

5.7 FIRE PROTECTION SYSTEM

5.7.1 MANUAL SUPPRESSION SUBSYSTEMS AND EQUIPMENT

The plant yard fire main supplies water to the yard hydrants used for the manual fire-fighting throughout the plant, including indoor and outdoor areas. The hydrants are located to provide complete coverage of site areas that contain equipment or buildings. Each hydrant may be isolated for maintenance from the yard main by an underground box valve that must be operated by a special tool provided in the hydrant hose houses.

Portable fire extinguishers are provided throughout the plant buildings to enable plant personnel to extinguish small fires.

5.7.2 DELUGE SYSTEMS

A deluge spray system is used for equipment protection where an engulfing water spray is required for fire control. Deluge spray systems are provided for the GT, ST and auxiliary transformers, steam turbine lube oil console, steam turbine control oil unit and steam turbine governing valves (operating floor).

5.7.3 WET PIPE SPRINKLER SYSTEMS

Automatic wet pipe sprinkler systems are provided for general fire suppression in the plant where fixed suppression is required and where there are no special considerations that restrict its use. Wet pipe sprinkler systems are provided for the cable spreading room, workshop and warehouse. Each wet pipe sprinkler system consists of a network of piping that distributes water throughout the protected space.


The system includes a check valve, a water flow alarm, and a normally open system isolation valve. A test connection with valve is provided at the most remote point in the network of piping that supplies the individual sprinkler heads.

5.7.4 GAS TURBINE CO2 SYSTEM

Automatic carbon dioxide system provided for the protection of:

- GTG enclosure
- Local electrical & control enclosure for GT

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The Carbon Dioxide Fire Protection System extinguishes fires by reducing the oxygen content of the air in the compartment from an atmospheric normal of 21% to below the level necessary to support combustion (normally 15%).

To reduce the oxygen content, a quantity of carbon dioxide (CO₂) equal to or greater than 34% of the compartment volume is discharged into the compartment in one minute and, recognizing the re-flash potential of combustibles exposed to high temperature and metal, an extended discharge is provided to maintain an extinguishing concentration for a prolonged period to minimize potential re-flash conditions.

The fire protection system design conforms to the requirements specified in NFPA 12 Standard on Carbon Dioxide Extinguishing Systems.

The fire protection system is contained inside cylinders, as liquid and at a charge pressure of 55.7 bar. Carbon dioxide inside cylinders 45 Kg. Valves on pilot cylinders are provided with electrical and pneumatic opening devices. The other cylinders are complete with pneumatic controlled valves which are servo-operated by carbon dioxide. All cylinders are connected with a collecting manifold which is connected to a distribution system manifold provided with relevant valves. The distribution network pipes are provided with discharge nozzles.

The fire protection control panel is mounted near the storage cylinder.

The interconnected field piping delivers the CO₂ from the storage cylinder to the gas turbine enclosure compartments and GT auxiliary compartment (separate line), where it connects to the on base piping that distributes the CO₂ into the compartments through nozzle orifices.

The Fire Protection is designed using two zones of fire protection, with each zone consisting of an initial and extended discharge.

The heat-sensitive fire detectors provided, where automatic extinguishing system is installed, are connected in a "Cross-Zoned" mode to prevent false actuation of the system. This means that if only one detector detects fire, then only the alarm will be given. If two or more detectors detect fire, the discharge of CO₂ will start after 60 sec. delay.

NOTE: Flashing lights and sound alarm, as well as CO₂ warning signs are strategically positioned on the outside and/or inside of the appropriate compartments to warn personnel of CO₂ discharge.


The system may also be activated manually using toggle switches located on fire protection (electrical) and manually using pilot valves upon loss of electrical power.

All ventilation systems are automatically shut down whenever a zone is activated.

5.7.5 CO₂ FIRE FIGHTING SYSTEM

The F/F system of CCB is protected by pressurized CO₂ gas. The gas cylinders are situated in a room at ground floor adjacent to cable spreading room.

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The system monitor the fire condition through smoke / heat detectors placed on the ceiling of the room to be protected. When the CO₂ operational panel has received a signal (at least) two detectors of two different lines, it starts the timing for the discharge procedure. The supervision unit raise a fire alarm and after 30 sec. The CO₂ discharge starts.

Automatic actuation system is electrically powered from the fire detection CO₂ Operation panel and pneumatically powered from the Nitrogen pilot cylinder.

The solenoid valve of nitrogen pilot cylinder is connected to an output circuit of the CO₂ operation Panel. The CO₂ operation panel is so designed that after a signal has been received from the detectors, it actuates the audible and visible alarm inside and outside the protected area.

The CO₂ system can be operated with a manual call point also.

CO₂ protected rooms in Central control building are as follows:

1. Central Control Room
2. Switchgear Room
3. Electronic room
4. Battery room.

The remaining rooms in the CCB are not CO₂ protected but equipped with fire monitoring system. If there is any fire in those rooms fire alarm will activate in the main panel with location indication.

5.7.6 FIRE ALARM SYSTEM

The fire alarm system incorporates a central Fire Alarm Control Panel (FACP) for fire alarm annunciation, and remote control panels or modules for proper surveillance of all associated alarm initiating devices and alarm annunciation appliances. Alarm initiating devices consist of components such as fire or smoke detectors, manual pull stations, water flow switches, and tamper switches. Alarm annunciation devices consist of horns and/or strobe lights.


The fire alarm system includes the fire/smoke detectors, alarms, and manual pull stations, as well as the central fire protection system alarm panel in the control room.

Audible alarms are provided to alert plant personnel of suppression system actuation and fire detection. The alarms can also be activated by the manual pull stations installed near building exits. Horns in the buildings include a strobe light, to provide both a visible and audible alarm. An alarm bell is provided on the exterior wall of the control room to alert plant personnel outdoors that a fire alarm has been activated.

The central fire suppression alarm panel in the control room provides a visual and audible alarm when any of the detection and/or suppression systems are activated. The panel also provides a trouble alarm visual signal whenever there is a fault in a detection or suppression system.

5.8 IMPAIRMENTS TO FIRE PROTECTION SYSTEMS

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An impairment is defined as a shutdown (in whole or in part) of a fire protection system. Fire protection systems include sprinkler systems, deluge system, standpipe/hose systems, fire pumps, fire protection water supplies, fire mains, fire alarm systems, and fixed CO₂ extinguishing system.

When an impairment is planned or occurs accidentally, precautions must be taken to minimize the duration and extent of the impairment, ensure prompt restoration, provide temporary protection and supervision, and reduce hazards in the affected area.

It should be notified of any significant fire protection system impairment when the impairment extends beyond 24 hours Notification should be made via Insurance Brokers in their designated form kept in Form and master list.

Internal notification should be provided to management and O&M personnel for all impairments and can be via meetings, planning sessions, group emails etc. by shift charge engineer and need documentation in plant status and shift handover logs. A white board in the Main Control room is recommended for the display of any active impairment of the fire protection system.

Any protective system can be impaired. Proper impairment planning is essential. Some items easily impaired are:


- Automatic sprinkler systems
- Deluge system
- Fire pump, fire hydrant
- Fixed CO₂ extinguishing systems
- Alarm, alarm supervisory, and detection systems

5.8.1 EMERGENCY IMPAIRMENT

An emergency Impairment occurs when a facility loses part or all of a fire protection system. Broken sprinkler piping and damaged fire alarm panels are examples. If there is an emergency impairment:

- Shut down any hazardous operations or take extra necessary pre-question in the area affected in orderly fashion. If possible, remove combustibles.
- Begin necessary repairs immediately. An up-to-date list of emergency phone numbers should be available.
- Notify the following:
 - Department heads, briefing them of the problem.
 - Insurance Brokers using the Impairment Notification Form in electronic format.
 - Enforce no smoking and no hot work regulations in all affected areas.
- Any fire impairments to be recorded in plant status and shift handover logs. A white board in the Main Control room is recommended for the display of any active impairment of the fire protection system.

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- Have responsible individuals tour the affected areas as often as needed, but never less than every hour.
- Extra portable extinguishers should be installed and hoses lay out during the time of the closure.
- Use emergency measures to keep items such as sprinklers and water supplies active.
- Restore normal protection as quickly as possible, working continuously through all shifts until repairs are complete. When the system is placed back in operation, the above parties should again be notified.

5.8.2 PLANNED IMPAIRMENT

A Planned Impairment is one that is needed to extend or adjust fire protection systems for any reason. For planned impairments:

- Must control the impairment.
- Schedule only one impairment at a time.
- Notify the following at least 24 hours in advance:
 - Department heads, briefing them of the problem
 - Insurance Brokers
- Keep as much fire protection in service as possible or practical.
- Plan the work and arrange all needed items in advance to keep the impairment as short as possible.
- Shut down any hazardous operations or take extra necessary pre-question in orderly fashion before impairing fire protection. If possible, remove combustibles.
- Enforce no smoking and no hot work regulation in all affected areas.
- Any fire impairments to be recorded in plant status and shift handover logs. A white board in the Main Control room is recommended for the display of any active impairment of the fire protection system.
- Have responsible individuals tour the affected areas as often as needed, but never less than every hour.
- Extra portable extinguishers should be installed and hoses lay out during the time of the closure.
- Use emergency measures to keep items such as sprinklers and water supplies active.

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- Restore normal protection as quickly as possible, working continuously through all shifts until repairs are complete. When the system is placed back in operation, the above parties should again be notified.

5.8.3 HIDDEN IMPAIRMENT

A Hidden Impairment is one not known to management, but found through a good self-inspection programmed.

When you find a hidden impairment:

- Restore protection immediately.
- Report the discovery to the management.
- Attempt to learn why it occurred.

Notify site operations personnel and workgroups of any hidden impairments found.

6.0 Reference

ISO 45001: 2018 Standard

7.0 Appendix

None

8.0 REVISION HISTORY

SI No.	Revision Number	Section	Change Made	Date of Creation

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