TRANSFORMER FIRE PROTECTION SYSTEMS

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HIGH VELOCITY WATER SPRAY (HVWS)

A **High Velocity Water Spray System** is a deluge-based fire protection system that uses high-pressure water discharge through specially designed nozzles to penetrate flames and rapidly cool transformer surfaces.

The system consists of a deluge valve, fire detection network (heat/flame detectors), piping system, and high-velocity spray nozzles. Upon fire detection, the deluge valve opens instantly, allowing water to flow through all nozzles simultaneously, covering the transformer and surrounding hazard area.

PURPOSE OF HVWS SYSTEM

The HVWS system is mainly used for:

- Fire extinguishment on oil-filled equipment
- Cooling of exposed surfaces
- Prevention of fire propagation
- Protection of electrical substations and transformers

It is commonly installed in:

- Power plants
- EHV substations
- Industrial plants
- Petrochemical facilities

MAJOR COMPONENTS

- Water Supply System
- Piping Network
- Deluge Valve Assembly
- Spray Nozzles
- Detection System
- Control Panel

WORKING PRINCIPLE

The system operates by discharging water through specially designed spray nozzles at high velocity.

Main fire suppression mechanisms:

1. **Cooling**
   - Reduces temperature below ignition point
2. **Emulsification**
   - Breaks burning oil into smaller droplets
3. **Oxygen displacement**
   - Steam generation helps reduce oxygen near flames
4. **Radiant heat absorption**
   - Prevents adjacent equipment ignition

MEDIUM VELOCITY WATER SPRAY (MVWS)

A **Medium Velocity Water Spray System** is designed to control fire and provide cooling using moderate pressure water discharge with controlled droplet size.

This system operates similarly to HVWS but uses medium velocity nozzles that produce a balanced spray pattern. It focuses on cooling the transformer surface and preventing fire escalation rather than aggressive flame penetration.

PURPOSE OF MVWS SYSTEM

The MVWS system is intended for:

- Fire control
- Fire extinguishment
- Cooling exposed surfaces
- Preventing fire spread
- Reducing radiant heat

It is especially effective for:

- Flammable liquid fires
- Transformer oil fires

MAJOR COMPONENTS

- Water Storage
- Pumping System
- Deluge Valve Assembly
- Detection System
- Piping Network
- MVWS Nozzles
- Control Panel

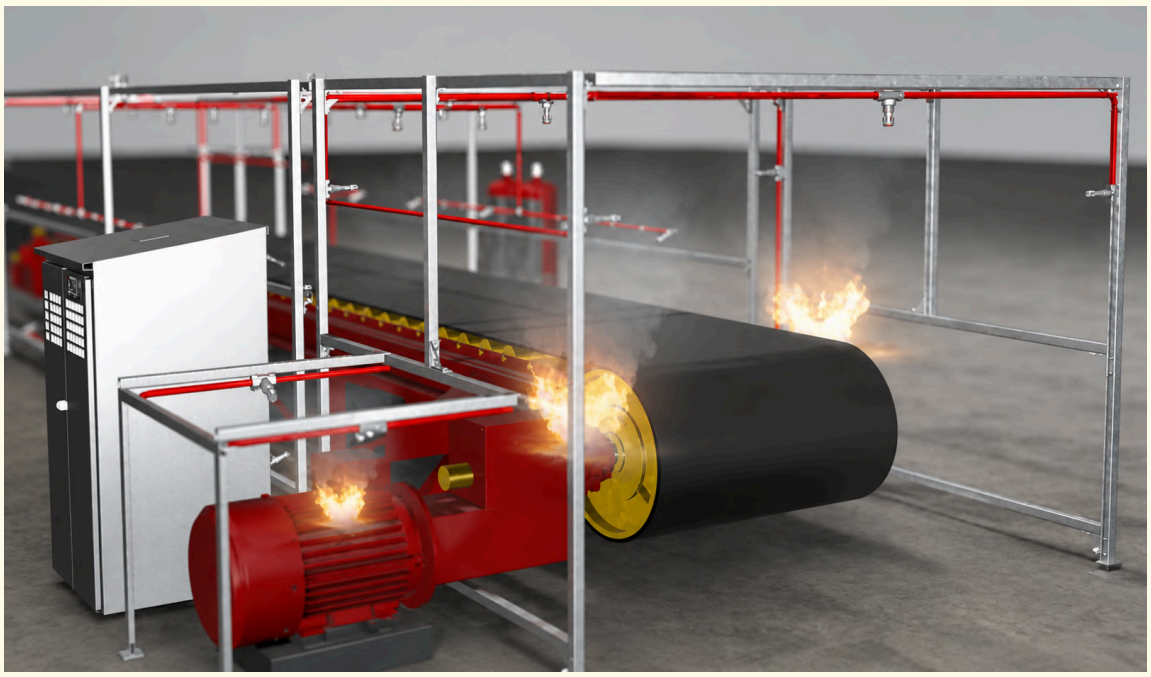
WORKING PRINCIPLE

The system uses open spray nozzles to discharge water droplets at medium velocity over protected equipment.

The water spray :

- Cools hot surfaces
- Controls flames
- Suppresses oil fires
- Prevents re-ignition

CONVEYOR BELT



A **Conveyor Belt** Fire Suppression System is designed to detect and control fires on conveyor systems quickly and efficiently. It provides automatic fire detection and suppression to protect conveyor belts, motors, rollers, and surrounding equipment from fire hazards caused by overheating, friction, electrical faults, or material ignition.

These systems help minimize downtime, prevent equipment damage, and improve safety in industrial environments such as manufacturing plants, warehouses, mining, and material handling facilities.

PURPOSE OF CONVEYOR BELT FIRE PROTECTION

- Detect fire at an early stage
- Suppress flames automatically
- Prevent fire spread along conveyor lines
- Protect equipment and structures
- Minimize production shutdown
- Reduce damage to cables and motors

WORKING PRINCIPLE

- Fire/heat detected
- Detection panel activates
- Alarm generated
- Conveyor trip signal activated
- Deluge valve opens
- Water sprays on affected conveyor section

ADVANTAGES

- Early fire detection
- Fast automatic suppression
- Prevents major plant shutdown
- Reduces equipment damage
- Integrates with plant automation
- Reliable for outdoor conveyors

NITROGEN INJECTION FIRE PROTECTION SYSTEM (NIFPS)

A **Nitrogen Injection Fire Protection System (NIFPS)** is a specialized fire protection system primarily used for protecting oil-filled power transformers against internal fires and explosions.

The system works by injecting nitrogen gas into the transformer conservator or oil tank during fault/fire conditions to suppress combustion and isolate oxygen from transformer oil vapors.

PURPOSE OF NIFPS

The system is designed to:

- Suppress transformer internal fire
- Prevent transformer explosion
- Reduce oxygen concentration
- Isolate transformer oil from atmosphere
- Minimize fire escalation
- Protect adjacent equipment

ADVANTAGES

- Prevents transformer explosion
- Rapid fire suppression
- Reduces catastrophic damage
- Minimal water damage
- Suitable for energized transformers
- Automatic operation
- High reliability

ADVANTAGES

Automatic Operation

Step 1 – Fault Occurs

- Internal arcing or severe fault develops

Step 2 – Detection

The system senses:

- Sudden pressure rise
- Buchholz relay operation
- Pressure Relief Device (PRD) activation
- High temperature/fire condition

Step 3 – Isolation

- Conservator isolation valve closes
- Oil movement restricted

Step 4 – Nitrogen Injection

- Nitrogen gas injected into transformer tank
- Oil vapors become inert

Step 5 – Fire Suppression

- Fire extinguished/prevented
- Explosion risk minimized

APPLICATIONS

Power Sector

- 220 kV transformers
- 400 kV ICTs
- Generator transformers

Industrial Sector

- Steel plants
- Petrochemical plants
- Refineries
- Heavy industries

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