FIREPROOFING

Intumescent coating - Flexible jacket - Steel enclosure - Intumescent board

- Valve actuator
- Valve body
- Cable tray
- Junction box
- Air tank
- Steel structure
MOV Limited founded in 1997 is the market leader in manufacturing and supplying engineered fire protection enclosures for valve actuators (Electric & Pneumatic). We also manufacture specialized fire protection boards for Cable Tray and Structural Steel.

In addition to our quality products, we provide value-added services including design engineering, fabrication and installation support. We maintain a high ethical and moral standard with regard to our customers, suppliers and employees.

PASSIVE FIRE PROTECTION

PASSIVE FIRE PROTECTION (PFP)

Passive fire protection (PFP) is one of the three components of structural fire protection and fire safety of a building structure or process equipment. The other two are Active Fire Protection (AFP) and Active Fire Suppression (AFS). PFP is an insulating system designed to prevent heat transfer from a fire to the structure or equipment being protected. These systems may be made from various materials and prominent among them are spray applied (or fluid cast) coatings / panels made from intumescent epoxy. Other PFP systems may include cementitious insulating panels or fibrous insulation blankets. In many cases PFP systems are used in conjunction with AFP / AFS systems such as water sprays, sprinklers and deluge, foam generation and inert gas suppression.

STANDARDS AND TYPES OF FIRES

Four Types of Fires are normally considered.

CELLULOSIC FIRE TESTS: The source of thermal energy comes from wood, pulp or paper (cellulose)
In a cellulosic fire test the furnace temp rises to 538°C (1000°F) in the first 5 minutes while the typical radiation value is 5 minutes after ignition is 50 kw/m². The most prominent cellulosic fire time-temp curve comes from International Standards Organization (ISO) R 834. This curve has been adopted by various National and International organizations and is known as ASTM E-119, BS 476, and IMO Resolution AS17(13) and SOLAS.

HYDROCARBON FIRE TESTS: The source of thermal energy is from Petroleum Hydrocarbons, gases and liquids from Petroleum process industry.
In contrast with Cellulosic fire tests the furnace temperature in a Hydrocarbon fire test rises to 1093°C (2000°F) in the first five minutes. The most prominent Hydrocarbon Fire Tests are known as UL/ANSI 1709, BS 476 Part 20 and others.

JET FIRE TESTS: The source of thermal energy is hydrocarbon but it is ignited under pressure thereby creating a “Jet” like flame pattern with high impingement velocity.
Jet fires have turbulent diffusing flames, resulting from the combustion of a steady release of pressurized liquid or gaseous hydrocarbon fuel. These fires present one of the most severe fire scenario that PFP materials are required to withstand, especially considering the effect of thermal shocking and physical matrix disintegration. Thermal Intensity of Jet Fires is high caused by the supply of abundant secondary air and almost optimum fuel / air mix.

BLAST OVERPRESSURE TESTS: Boiling liquid expanded vapor explosion (BLEVE) is an example. The overpressure boundary front causes structural damage then the ensuing fire substantially increases the risks to a catastrophic level.
Sometimes PFP systems are required to withstand the effects of typical hydrocarbon explosions and subsequent blast overpressures. PFP systems selected for this type of environment must have demonstrable explosion resistance that can be supported by relevant testing. Preference should be given to those systems that have been subjected to a dynamic explosion testing by a recognized independent establishment immediately followed by a Hydrocarbon Pool fire test. The PFP manufacturer must certify the maximum acceptable deflection value (straining) of structural members that would not degrade the system’s fire resistive performance.
PASSIVE FIRE PROTECTION

PFP MATERIALS

INTUMESCENT MATERIAL: Materials that provide thermal insulation by means of a barrier char formation. Intumescent materials are supplied in two distinct forms; either intumescent mastic or thin film intumescent coatings. Intumescent mastics are usually based on epoxy, vinyl or other elastomeric resins and contain an agent that intumesces when exposed to heat. Similar compositions can be cast into panels for creating secure fire Resistive enclosures such as Cable Trays and Valve / Equipment protection "Boxes".

Intumescence is a complex process in which, when exposed to sufficiently high temperatures, the solid coating changes phase to a highly viscous liquid. Simultaneously, endothermic reactions are initiated that result in the release of inert gases (with low thermal conductivity). These gases are then trapped inside the viscous fluid where cross-linking reactions take place between the polymer chains.

This results in the expansion or foaming of the coating, sometimes up to 8 times the initial thickness, to form a low density, carbonaceous insulation char. This layer of char absorbs a large part of the heat generated by the fire. This endothermic reaction maintains the protected substrates at target temperatures that are within the critical limit established for the specific assembly for specific time endurance.

The coating continues to react until all its components are used up. In subsequent assessment, the original coating thickness is established as the target for the required protection rating.

Intumescent mastics are hard and durable and the epoxy resin based products in particular provide exceptional protection from corrosion. This is due to their very high adhesion to the substrate and resistance to impact, abrasion and vibration damage. High tensile and compressive strengths can be obtained and weather resistance is excellent.

Reinforcement mesh is normally installed to ensure that the material stays in place during the intumescent reaction and to reduce the possible shear stresses along the coating/substrate interface.

Intumescent mastics are costlier than cementitious products, and skilled operators must carry out the application in carefully controlled conditions.

Furthermore, these coatings require more stringent surface preparation than cementitious materials, and their reactivity makes them unsuitable for certain applications, such as enclosed living areas.

Thin film intumescents were introduced as early as the 1930’s and are generally solvent or water based single pack coatings, applied by spray or brush-roller at thickness close to 3mm (⅛ inch). Their fire resistive performance is not as good as Epoxy Intumescent Mastics. Many thin film intumescent coatings are unsuitable for exterior use and test ratings are limited to cellulosic fires only. Advantages of these products include:

- Availability in a wide range of colors
- Relatively easier to apply.
**Compliance Criteria for Valve Actuators**

The PFP system is required to be tested at independent internationally recognized fire testing laboratories in accordance with ANSI/UL 1709 methodology. This ensures that the actuators are capable of providing a minimum 30 minutes of endurance (while maintaining circuit / control system integrity) in petroleum and hydrocarbon processing facilities both on and off shore. The PFP system should provide the valve actuators an endurance period of 30 minutes under UL1709 methodology.

**Fire Protection Requirements for Valve Actuators**

Generally, the equipment located in or above the identified fire hazard zones are required to be fireproofed. These are:

- Emergency valve actuators
- Components of valve actuator’s electrical system
- Local control panels
- Air reservoirs
- Power and control cables that pass through the fire hazardous zone

**Design Software**

- 3D Modeler: Space-E
- 3D Drawing: AutoCAD | AutoDesk Inventor

**Quality Control**

A Quality Control Manual guides the entire manufacturing and assembly operation. This Manual is a certified document under ISO 9001:2008. Each and every design and manufacturing step is carefully controlled to ensure complete compliance with the Quality Assurance Manual. Our specific steps include (but not limited to):

- Raw Material inspection and certification
- Parts list compliance and marking
- Cross checking of Bill of Materials with Design Drawings
- and others
FR COATING (REMOVABLE / DEMOUNTABLE SYSTEM)

Is latest product designed for fire protection of valve actuators, using high performance industry proven intumescent epoxy coating.

FEATURES
- The FR Coating consists of 15mm thick epoxy intumescent pre-cut sections with steel mesh reinforcement at mid depth.
- It is a removable / demountable type of intumescent PFP system, very effective for any kind of valve actuator and equipment.
- This product completely eliminates the need for transporting the valve actuator to a faraway assembly location saving substantial logistics costs, project delays and related complexities.
- FR Coating can be installed onto existing and/or new actuators at site without any modification of the actuator.
- The FR Coating is supplied in pre-engineered sections which are then assembled onto the valve actuator in the field. Component sections are attached using Stainless Steel (SS304) bolts.
- FR Coating may be painted with an approved paint to provide UV resistance and long-term service durability.
- The pre engineered component sections can be “Dis-Assembled” to allow for inspection and maintenance and re-assembled to resume safe PFP service.

ACCESS DOOR
FR Coating Access door is provided on the pushbutton and lamp for easy operation.

MANUAL HANDWHEEL
Manual hand wheel and hand / auto declutch lever is located outside of removable intumescent coating.

USES / APPLICATIONS
- Electric actuator
- Pneumatic actuator
- Junction box
- Valve body

INSTALLATION
It is recommended that FR Coating be installed at the site after the valve is installed in place. Pre-Engineered FR Coating components can be easily assembled by site technicians.

COMPLIANCE CERTIFICATE
- Lloyds Register Certified UL1709 hydrocarbon fire tested for a fire endurance of 30 minutes
**FR COATING (FIREPROOFING REMOVABLE COATING)**

![Images of FR COATING]

**MATERIAL PHYSICAL DESCRIPTION**

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>Intumescent epoxy based reinforced panels</th>
</tr>
</thead>
<tbody>
<tr>
<td>COLOR</td>
<td>Grey (other topcoat colors available on request)</td>
</tr>
<tr>
<td>VOLUME SOLIDS</td>
<td>100%</td>
</tr>
<tr>
<td>TYPICAL THICKNESS</td>
<td>15mm</td>
</tr>
<tr>
<td>CURED DENSITY</td>
<td>1000 kg/m³ casting</td>
</tr>
<tr>
<td>METHOD OF FABRICATION</td>
<td>Fluid Casting and air curing</td>
</tr>
</tbody>
</table>

**SPECIFIC ADVANTAGES**

- Light weight, durable system
- Quick delivery turn-around from factory – low Lead-Time Item
- Can be easily installed on existing actuator
- No modification to the actuator required
- Easy to install / remove / re-install
- No special tools are required
- Can be re-used in the event of actuator replacement
- In case of actuator motor damage, re-coating is not required after motor repair
- Excellent finishes in decorative grade
- No additional “lay-down or Installation” space is required at site
- Virtually maintenance FREE even in the hardest climatic conditions
- Cost Savings – Life Cycle Cost, year on year maintenance expenditure

**AMBIENT / SERVICE TEMPERATURE TOLERANCE RANGE**

- -30°C to +85°C
- -45°C to +150°C (option)
**FR JACKET (FIREPROOFING REMOVABLE JACKET)**

High quality fire protection Jacket for valve actuator, valve body and equipment.

**FEATURES & BENEFITS**
- FR Jacket is a flexible system that consists of multi layers of thick ceramic fiber separated by aluminum foil. The density of ceramic fiber and compressed thickness depends on the fire protection criteria.
- FR Jacket is pre-fabricated, consisting of two or more sections, easily assembled on the valve actuators at site.
- FR Jacket can be easily disassembled and assembled for Inspection and maintenance purpose.
- Meets or exceeds fire test requirements
- Custom designed to meet site conditions
- Easy installation, does not require special tools
- Ultra violet (UV) resistant, weatherproof and chemical resistant.

**ACCESS DOOR**
- Access door is provided to monitor the solenoid valve, filter regulator, control unit and limit switch without fully removing the jacket from the valve actuator.
- Velcro and stainless steel band is provided on the access door for quick open and close.

**MANUAL HANDWHEEL**
Manual hand wheel is located outside of removable jacket. It is required when emergency operation is called for.

**USES / APPLICATION**
- Electric actuator
- Pneumatic actuator
- Junction box
- Cable tray
- Air tank

**COMPLIANCE CERTIFICATES**
- UL1709 hydrocarbon fire
- Jet fire (ISO 22899-1)

**ASSEMBLY**
- Stainless steel 304 (SS304) angle frame is secured and installed on the valve actuator prior to jacket installation. The angle frame is secured with SS304 bolts and nuts.
- The angle frame is required to protect the limit switches and other accessories.
- After the jacket is installed on the angular frame, it is stitched by using PVC coated stainless steel wire. It is rigid enough after installation is completed.
MATERIAL DESCRIPTION
The jacket material is asbestos free. The outer and inner material are PVC coated, having good weather and chemical resistance.

Our selection of quality materials for FR Jacket is as follows

<table>
<thead>
<tr>
<th>MATERIAL DESCRIPTION</th>
<th>AMBIENT / SERVICE TEMPERATURE TOLERANCE RANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CERAMIC FIBRE</td>
<td>• - 30°C to +90°C</td>
</tr>
<tr>
<td>NUMBER OF LAYERS</td>
<td>•  - 45°C to +150°C (option)</td>
</tr>
<tr>
<td>ALUMINUM FOIL</td>
<td></td>
</tr>
<tr>
<td>INNER CLOTHES</td>
<td></td>
</tr>
<tr>
<td>OUTER CLOTHES</td>
<td></td>
</tr>
<tr>
<td>LACING WIRE</td>
<td></td>
</tr>
<tr>
<td>FRAME</td>
<td></td>
</tr>
<tr>
<td>BOLT / NUT</td>
<td></td>
</tr>
<tr>
<td>BAND</td>
<td></td>
</tr>
<tr>
<td>FINAL THICKNESS</td>
<td></td>
</tr>
<tr>
<td>multi layers</td>
<td></td>
</tr>
<tr>
<td>multi layers</td>
<td></td>
</tr>
<tr>
<td>multi layers</td>
<td></td>
</tr>
<tr>
<td>PVC coated material, green, 0.35 mm</td>
<td></td>
</tr>
<tr>
<td>PVC coated material, grey, 0.55 mm</td>
<td></td>
</tr>
<tr>
<td>PVC coated stainless steel wire, 3 mm</td>
<td></td>
</tr>
<tr>
<td>SS304, 50L angle</td>
<td></td>
</tr>
<tr>
<td>SS304</td>
<td></td>
</tr>
<tr>
<td>SS316</td>
<td></td>
</tr>
<tr>
<td>50 to 60 mm</td>
<td></td>
</tr>
<tr>
<td>[depends on fire protection]</td>
<td></td>
</tr>
</tbody>
</table>

ADVANTAGES
• Site installation is possible
• Site modification is possible

DISADVANTAGES
• Installation space is required
• Heavier than epoxy intumescent coating system weight
**FR STEEL ENCLOSURE**

**FR STEEL ENCLOSURE (FIREPROOFING REMOVABLE STEEL ENCLOSURE)**

**FEATURES**
- FR Steel Enclosure is stainless steel fireproofing box to protect valve actuators from the fire.
- FR Steel Enclosure is designed for a fire endurance rating for the period of 30 minutes in accordance with UL1709 methodology with a 0.8 mm thickness of stainless steel (304) box in filled with ceramic fiber.
- Ceramic fiber is installed between inside and outside steel enclosure.
- FR Steel Enclosure panels are removable on either side.
- FR Steel Enclosure is easily dis-assembled and re-assembled for maintenance.
- To access the pushbutton or indication lamp of the valve actuator through FR Steel Enclosure, an access door is provided.
- Toggle clamps are provided on top side for quick disassembly.
- Only the top side of the FR Steel Enclosure needs to be removed for quick maintenance work. The top side of FR Steel Enclosure can be disassembled easily by releasing toggle clamps and remove from the body of FR Steel Enclosure.

**ASSEMBLY**
- FR Steel Enclosure can be assembled on site after valve and actuators are installed on pipeline.
  It is not necessary to dis-assemble actuator and valve body to install the FR Steel Enclosure.
- Each side of FR Steel Enclosure is assembled by bolts and nuts.
- Installation space should be considered for site modification of FR Steel Enclosure.

**ACCESS DOOR**
Access door is provided for pushbutton and lamp where operation and monitoring is required.
MANUAL HANDWHEEL
- Manual hand wheel is located inside of FR Steel Enclosure. Our design ensure that the manual hand wheel and hand / auto declutch lever has enough clearance and working space.
- Optionally, manual hand wheel can be extended to be located outside of FR Steel Enclosure. The handwheel stem extension work should be done by the plant operator / client.

USES / APPLICATION
- Electric actuator
- Pneumatic actuator
- Valve body

COMPLIANCE CERTIFICATES
UL1709 hydrocarbon fire, 30 minutes

MATERIAL

<table>
<thead>
<tr>
<th>BODY</th>
<th>Stainless Steel (SS) 304 sheet @ 0.8 mm nominal thickness</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOLT/ NUT</td>
<td>SS304</td>
</tr>
<tr>
<td>FRAME</td>
<td>SS304</td>
</tr>
</tbody>
</table>

ADVANTAGES
- Can be installed on site
- Good / excellent weather protection
- Rigid and excellent life span.

DISADVANTAGES
- Installation space is required
- Heavier than intumescent epoxy
- Site modifications are tedious

Ambient / Service Temperature Tolerance Range
- -30°C to +90°C
- -45°C to +150°C (option)
FR BOARD (FIREPROOFING REMOVABLE BOARD)

FEATURES

- If cable tray is required for fireproofing, it should be considered that the fireproofing is removable for future cable installation. The spray type fireproofing is not acceptable for the purpose.
- FR Board is good fireproofing product to meet customer’s requirements.
- FR Board is press-molded Calcium Silicate board with intumescent epoxy.
- FR Board can be installed after cable tray and cables are completely installed. Any modification is not required of existing cable tray.

USES / APPLICATIONS

- Cable tray
- Conduit

COMPLIANCE CERTIFICATES

- UL1709 hydrocarbon fire, 30 minutes
- ASTM E119, 1 hour

MATERIAL DESCRIPTION

- Composite of CSB (Calcium Silicate Board) and intumescent material.
- Dead Load : 22kg/m² (Approximately)

AMBIENT / SERVICE TEMPERATURE TOLERANCE RANGE

- -30°C to +85°C
- -45°C to +150°C (option)

ADVANTAGES

- Easy to install
- Easy to removal for maintenance
- Modification is not required of existing cable tray
- Site modification is easy
- Special tool is not required
- Good weather protection
- Additional steel jacketing is not required
**JUNCTION BOX**

**JUNCTION BOX FIREPROOFING**

**REMOVABLE TYPE OF INTUMESCENT COATING**
- Intumescent fireproofing box is available for junction boxes.
- The junction boxes can be installed in the fireproofing box.
- Intumescent fireproofing box has access door to access the junction box without removing fireproofing box.
- Intumescent fireproofing box can be removed for maintenance of junction box.
- Incoming and outgoing cables should be considered additional fireproofing by customer.

**DIRECT INTUMESCENT COATING (OPTIONAL SYSTEM)**
- Direct intumescent coating on the junction box body can be applied as an option.
- Both of EExd and EExe junction box can be protected with intumescent coating.
- The junction boxes should be sent to our factory for coating.

**APPLICATION**
- EExd junction box
- EExe junction box

**COMPLIANCE CERTIFICATES**
- UL1709 hydrocarbon fire, 30 minutes
- ASTM E119, 1 hour

**MATERIAL DESCRIPTION**
- Composite of CSB (Calcium Silicate Board) and intumescent material.

**AMBIENT / SERVICE TEMPERATURE TOLERANCE RANGE**
- -30°C to +85°C
- -45°C to +150°C (option)

**ADVANTAGES**
- Easy to install
- Easy removal for maintenance
- Special tools are not required
- Excellent weather protection.
VALVES AND FLANGES

PFP FOR VALVES AND FLANGES

FEATURES
• Intumescent material or flexible jacket type of fireproofing can be applied for valves and flanges.
• The fireproofing can be removed for maintenance of valve and flanges.

USES / APPLICATIONS
• Valve body
• Flanges
• Equipment

COMPLIANCE CERTIFICATES
• UL 1709 hydrocarbon fire, 30 minutes
• ISO 22899-1 jet fire J90 with blast test 2.0 bars

MATERIAL (INTUMESCENT) DESCRIPTION
• Intumescent epoxy
• (Max. surface temperature of valve and flange is 150°C. If surface temperature is higher than 150°C, conventional insulation is required before apply of intumescent)

MATERIAL (FLEXIBLE JACKET) DESCRIPTION
• Ceramic fibre: multi layers
• Number of layers: multi layers

AMBIENT / SERVICE TEMPERATURE TOLERANCE RANGE
• - 30°C to +85°C (Intumescent material)
• - 30°C to +90°C (Jacket)
• - 45°C to +150°C (option)

ADVANTAGES
• Easy to install
• No installation space is required
• Easy to removal for maintenance
• Modification is not required of existing pipe flange
• Site modification is easy.
• Special tools are not required
• Good weather protection.
• Additional steel jacketing is not required
FEATURES
• Removable type of intumescent castings are available for jet fire and blast overpressure rated areas
• The removable type of intumescent casting can be installed on existing steel structure without extensive surface preparations.
• Not necessary to remove existing paint from the steel structures.
• Removable types of intumescent castings are made in site-specific designed molds.
• H beam, I beam, deck, ceiling and every kinds of equipment can be protected by removable type of intumescent castings.
• Installation spaces should be considered for the free from obstruction at mold design stage.
• Structure or equipment drawings are necessary to develop mold designs.
• Installation detail drawings are provided for site installations.
• Site survey is required to manufacture removable type of intumescent casting. After site surveying, manufacturing drawings can be produced.
• Stainless steel perforated mesh is installed in mid depth of removable type of intumescent casting.
• Finished feature is decorated grade.

USES / APPLICATIONS
• Steel structures
• Vessel supports
• Valve bodies
• Valve actuators
• Riser clamps

COMPLIANCE CERTIFICATES
• ISO 22899-1 jet fire J90 with blast test 2.0 bars

MATERIAL (INTUMESCENT) DESCRIPTION
• Intumescent epoxy 20mm thickness
• 20kg/m²

MATERIAL (FLEXIBLE JACKET) DESCRIPTION
• Ceramic fibre : multi layers
• Number of layers : multi layers

AMBIENT / SERVICE TEMPERATURE TOLERANCE RANGE
• -30°C to +85°C (Intumescent material)
• -30°C to +90°C (Jacket)
• -45°C to +150°C (option)

ADVANTAGES
• Removable type
• Not necessary to remove of existing paint
• Rigid feature after installation.
• Decoration grade finish.