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# Design of Fire Hydrant Facility On Export Plant At TVS Srichakra Limited

**K.R.Leena[1],***

*PG Scholar M.E-ISE, Bharath Niketan Engineering College, Tamil Nadu, India

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**Abstract**

A fire hydrant is an active fire protection measure and a source of water supply to assist in extinguishing a fire. The water supply may be of two types viz., pressurized and unpressurized. In the case of pressurized water supply, hydrants are connected to water mains buried in the street. In the case of unpressurized, the hydrants are connected to nearby ponds or cisterns. Every hydrant has one or more outlets to which a fire hose may be connected. This project aims to minimizing the property damage and fatalities in the industry. Normally, fire extinguishers are not enough to extinguish the large amount of fire. To overcome this problem the efficient fire hydrant system is designed and implemented in the industry.

***Keywords***: *Fire Hydrant System, Fire Protection Measure, Fire Hose System, Fire Extinguishers and Fire Protection System.*

## 1. Introduction

Fire was discovered by ancient man during the Lower Paleolithic period. Since then fire has been an important part of human settlements, cultures and religions. From pre-history to modern day, and was vital role for the development of civilization. It was commonly associated with the qualities of energy, assertiveness and passion. The word Agni is Sanskrit for “Fire”, and has three forms: Fire, Lightning and the Sun.

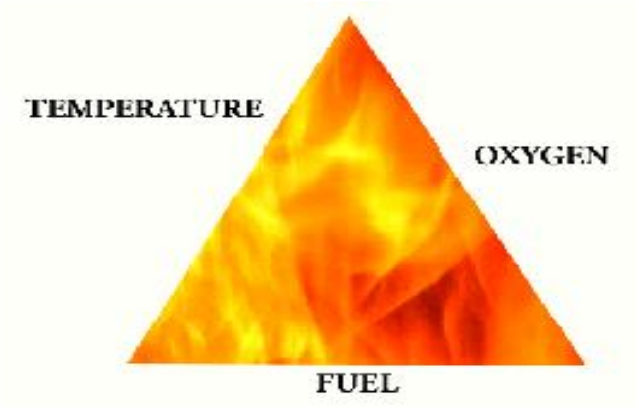


**Figure 1. Fire Triangle**

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The "Fire Triangle" identifies the three components of any fire.

- **Fuel:** Paper, wood, flammable gas, energized electrical equipment, etc.,
- **Energy (Heat):** Sufficient to support combustion. Often refer to as the ignition source.
- **Oxidizer:** Air.

### 1.1 Fire Hazard

A fire hazard is any situation in which there is a greater than normal risk of harm to people or property due to fire. Fire hazards includes things which, in the event of fire pose a hazard to people, such as material that produce toxic fumes when heated or objects that block fire exits.

Fire hazards can take the form of ways that fire can easily start, such as blocked cooling vent, or overloaded electrical system, ways fire can spread rapidly, such as an insufficiently protected fuel store or areas with high oxygen concentration.

## 2. Fire Hydrant

A fire hydrant is an active fire protection measure, and a source of water provided in most urban, suburban and rural areas with municipal water service to enable firefighters to tap into the municipal water supply to assist in extinguishing a fire. It is an above-ground connection that provides access to a water supply for the purpose of fighting fires. The water supply may be pressurized, as in the case of hydrants connected to water mains buried in the street, or unpressurized, as in the case of hydrants connected to nearby ponds or cisterns. Every hydrant has one or more outlets to which a fire hose may be connected. If the water supply is pressurized, the hydrant will also have one or more valves to regulate the water flow. In order to provide sufficient water for firefighting, hydrants are sized to provide a minimum flow rate of about 250 gpm (945 liters per minute), although most hydrants can provide much more.

### 2.1 Types of Hydrants

There are two types of pressurized fire hydrants: wet-barrel and dry-barrel. In a wet-barrel design, the hydrant is connected directly to the pressurized water source. The upper section, or barrel, of the hydrant is always filled with water, and each outlet has its own valve with a stem that sticks out the side of the barrel. In a dry-barrel design, the hydrant is separated from the pressurized water source by a main valve in the lower section of the hydrant below ground. The upper section remains dry until the main valve is opened by means of a long stem that extends up through the top, or bonnet, of the hydrant. There are no valves on the outlets. Dry-barrel hydrants are usually used where winter temperatures fall below 32°F (0°C) to prevent the hydrant from freezing. Unpressurized hydrants are always a dry-barrel design.

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### 2.1.1 Wet Hydrant

Wet barrel hydrants have water charged at full pressure in the hydrant barrel at all the times. Each outlet has its own valve, and all of what you see here is above ground. Originally developed in California, wet barrel hydrants are found in warm climates throughout the world.

### 2.1.2 Dry Hydrant

In rural areas where municipal water systems are not available, dry hydrants are used to supply water for fighting fires. A dry hydrant is analogous to a standpipe. A dry hydrant is usually an unpressurized, permanently installed pipe that has one end below the water level of a lake or pond. This end usually has a strainer to prevent debris from entering the pipe. The other end is above ground and has a hard sleeve connector. When needed, a pumper fire engine will pump from the lake or pond by drafting water. This is done by vacuuming the air out of the dry hydrant, hard sleeve, and the fire engine pump with a primer. Because lower pressure exists at the pump intake, atmospheric pressure on the pond or lake forces water into part of the dry hydrant above water, into the hard sleeve, and finally into the pump. This water can then be pumped by the engine's centrifugal pump.

## 2.2 Design of Fire Hydrant

### 2.2.1 About Export Plant

The TVS Srichakra Limited has five different maufacturing plants. They are, Mixing Plant, Domestic Tyre Plant, New Tyre Plant, Export Tyre plant and Tube Plant. In the Export Tyre Plant, OTR (Off The Road Tyres) are manufactured. These tyres are used to heavy vehicles such as Trucks, JCBs etc.,The Fire hydrant is designed and implemented in the Export Plant because Behind the Export Tyre Plant there are three wood boilers. One of the wood boiler's capacity is 6 tonnes and the other two boiler's capacity is 4 tonnes and also near by the Export Tyre Plant, the export finished goods are stored. Fire protection equipments are already present in the Export Tyre Plant but these are not sufficient to protect the plant from the fire accident.

### 2.2.2 Designing Procedures

The basic design and construction of pressurized fire hydrants which sets general standards for hydrant size, operating pressure, number of outlets, and other requirements. Unpressurized hydrants may be the same design as the pressurized hydrants within a city or fire district in order to maintain commonality, or they may be a simple capped pipe design with no valves. The main body of the hydrant is called the barrel or upper standpipe. It may consist of a single piece or it may be made in two pieces. If it is made in two pieces, the upper portion with the outlets is called the head and the lower portion is called the spool.

Although the basic components of all fire hydrants are similar, the shape of hydrants varies from one manufacturer to another. Some hydrants have the classical round body with a domed bonnet. Others have square or hexagonal

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bodies. Some areas that are undergoing urban renewal have hydrants that are low and modern looking.

### 2.2.3 Fire Protection Systems

In accordance with NBC, NFPA, applicable IS Codes & Standards and Tamil Nadu Fire Services requirements, the following Fire Protection systems need to be designed and implemented.

- Automatic Fire Pumps
- External Hydrant System
- Hose Reel Drum
- Hose Box

**Fire Hydrant Valve**

### 2.2.4 Hose Box

Fire Hose Box that are highly known for their superior quality parameters. These are made using high quality raw material sourced from highly reckoned vendors, who are known for the quality raw material. These box are available with inside arrangement for hose pipe and copper branch pipe. It is also available with a glass door frame.

## 3. Standards For Fire Hydrant

The Fire protection system for TVS SRICHAKRA LTD, will be designed and installed as per the norms and standards:

**Table 1. Water Tank Capacity as per the NBC norms**

| S.No | Nature of risk | Capacity of static storage exclusively reserved for hydrant service |
|---|---|---|
| 1. | Light hazard | Not less than 1 hour aggregate pumping capacity with a minimum of 1,35,000 litres. |
| 2. | Ordinary hazard | Not less than 2 hour's aggregate pumping capacity . |
| 3. | High hazard (a) | Not less than 3 hour's aggregate pumping capacity. |
| 4. | High hazard (b) | Not less than 4 hour's aggregate pumping capacity. |

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**Table 2. Hose Stream allowance and Water supply duration**

| | Inside Hose | | Total combined Inside and Outside Hose | | |
|---|---|---|---|---|---|
| **Occupancy** | **Gpm** | **L/m** | **Gpm** | **L/m** | **Duration (mins)** |
| Light Hazard | 0, 50 or 100 | 0, 189, 379 | 100 | 379 | 30 |
| Ordinary Hazard | 0, 50 or 100 | 0, 189, 379 | 250 | 946 | 60 – 90 |
| High Hazard | 0, 50 or 100 | 0, 189, 379 | 500 | 1893 | 90 – 120 |

**Table 3. Number and Distribution of hydrants**

| Fire flow requirements (gpm) | Minimum number of hydrants | Average spacing between hydrants (ft) | Maximum distance from any point on street or road frontage to hydrant (ft) |
|---|---|---|---|
| 1750 or less | 1 | 500 | 250 |
| 2000 - 2250 | 2 | 450 | 225 |
| 2500 | 3 | 450 | 225 |
| 3000 | 3 | 400 | 225 |
| 3500 – 4000 | 4 | 350 | 210 |
| 4500 – 5000 | 5 | 300 | 180 |
| 5500 | 6 | 300 | 180 |
| 6000 | 6 | 250 | 150 |
| 6500 – 7000 | 7 | 250 | 150 |
| 7500 or more | 8 or more | 200 | 120 |

## 5. Super Jet Water Monitor

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- Super Jet Water Monitor Stand Post Type made out of IS:1239
- **Features** : Seamless Steel tubes, Hot dip galvanized, flanged inlet, G.M. Ball bearings Swivel joints with brass locking arrangements, permitting 360 deg. Horizontal, 80-45 deg. Vertical traverse, with Aluminum Alloy Nozzle with male threaded inlet as per IS:8442 with ISI Mark. (Available in GM Nozzle or with 63mm G.M. Female inst. Outlet)

**Figure 4. Super Jet Water Monitor**

## 6. Testing Methods

Manual Testing is carried out for the analysis of Fire Hydrant. Minimum residual pressure is measured at 20 psi. Testing is carried out by using this equipment.

**Figure 5. Pressure Testing Equipment**

## 7. Conclusion

Fire Hydrant system is implemented in the Export Plant of TVS SRICHAKRA LTD. The fire risk in the Export Plant is very high. Therefore, this Fire hydrant system is useful to company for protecting their finished goods in the Export Plant. The Export Plant plays a vital role in TVS SRICHAKRA LTD, and in this plant the entire finished goods are stored.

## 8. References

[1] Carmen G. Rodriguez, "Location of fire hydrant system", *National Fire*

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International Journal of Research in Mechanical, Mechatronics and Automobile Engineering (IJRMMAE)

*Academy(NFA)*, pp. 10-15, 2002.

[2] Chow, W.K., "Discussion of applying the American fire safety evaluation system for business occupancies in Hong Kong", *International Journal on Engineering Performance Based Fire codes*, Vol. 2, No. 4, pp. 92-97, 2001.

[3] David M. Banwath, Ivan J. Humberson, Greg Jakubowski and Chris Jelenewicz, "Fire service features of buildings and fire protection systems", *OSHA 3256-07N*, pp. 18, 2006.

[4] Fawaz K. Sweis, "Fires and related incidents in Jordan", *Fire Safety Journal*, Vol. 41, Issue. 5, pp. 370 – 376, 2006.

[5] Fowler, A.H.K., and Baxter, A., "Fires, explosions and related incidents at work", *Journal of Loss Prevention in the Process Industries*, Vol. 13, Issue. 6, pp. 547-554, 2000.

[6] James I. Chang., and Chang – Chung Lin, "A Study of storage tank accidents", *Journal of loss prevention in the process industries*, Vol. 19, pp. 51-59, 2006.

[7] Jian Wang., Zhenkum Wu., Lu Hu., Yi Xiong., and Weicheng Fan, "Smoke venting and fire safety in an industry", *Fire Safety Journal*, Vol. 37, Issue. 2, pp. 191-215, 2002.

[8] John Pohlman and Robert White, "Planning and Installing dry fire hydrants", *Publn. FR-044 97REV*, pp. 3, 2003.

[9] Ramesh babu. J., *Fire Audit – A Forward looking approach*, 2008.

[10] Ramprasad, K., Ashis kumar panda and Diptendu Das, *Industrial Plants Safety Division,* pp. 11, 2008.