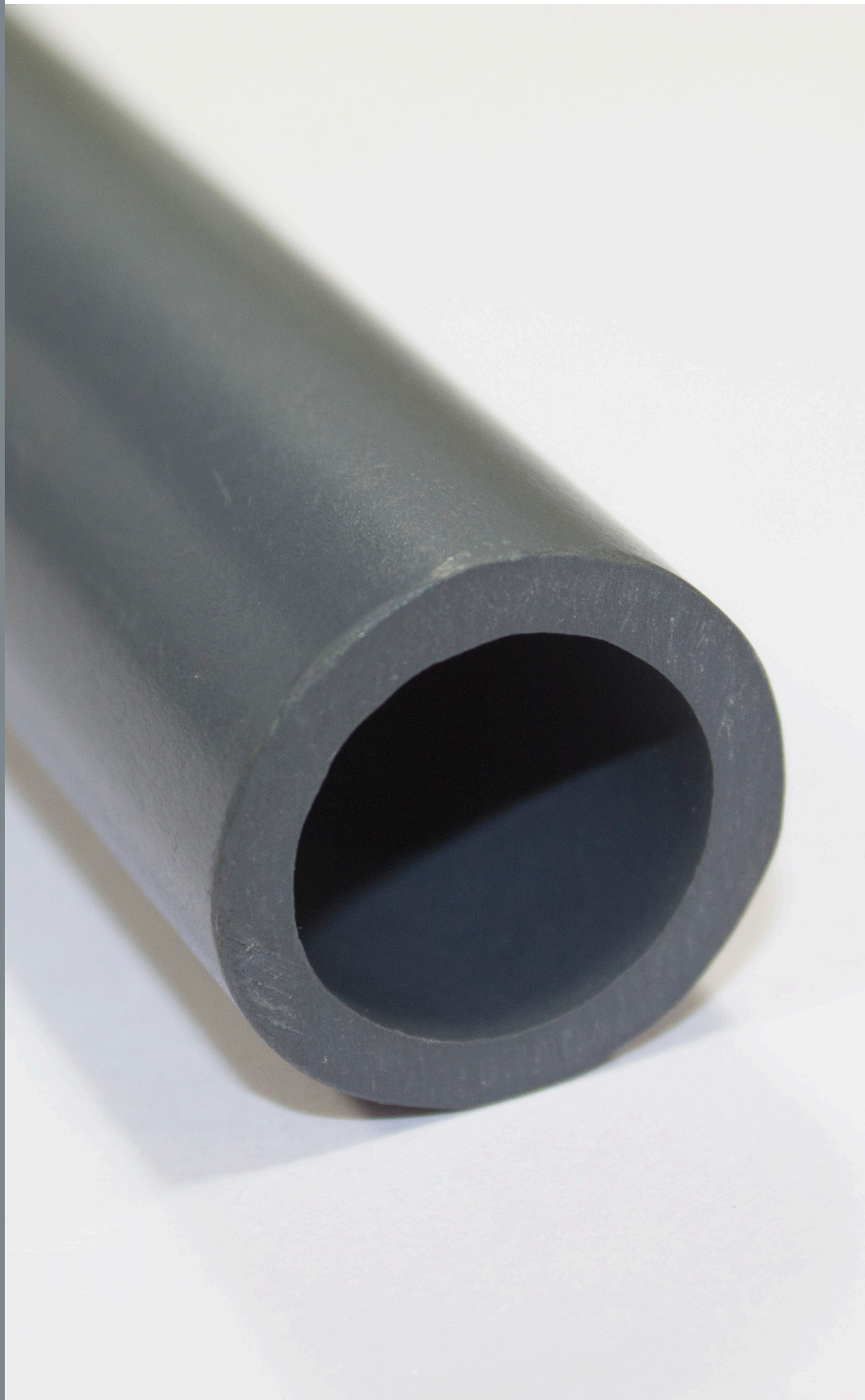
STEER

Glass Fiber Polyvinyl Chloride (GFPVC)

Innovating for sustainable growth



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Introduction to STEER

STEER is a world leader in materials platform technologies that transform and effectively functionalize materials in the fields of plastics, pharmaceuticals, food & nutraceuticals, biomaterials and biorefining.

Founded in 1993 by Dr. Babu Padmanabhan, with a vision to 'STEER A NEW WORLD,' the company is driven by innovation, and holds over 60 patents for breakthrough technology, with significant contributions in the field of polymer processing. Operating 6 global offices, 10 satellite offices and with a talented workforce of over 500 engineers, scientists and technicians, STEER supports customers in over 39 countries across the globe with advanced co-rotating twin screw extruders, extruder processing zone elements and components and turnkey plant engineering projects.

As a pioneer in Intelligent Compounding, STEER also invests in materials sciences with focused Application Development Centers in India, USA and Japan to help fuel the creation of new age or advanced materials, compounds, applications and processes that drive better products, deliver greater efficiencies, reduce the impact on environment and improve overall quality of life.

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Scope of the Project Report

This report aims to provide a complete overview of GFPVC to position it as an alternative to CPVC and Aluminium for various profiles. The report captures all aspects of GFPVC, its evolution, characteristics, manufacturing process, applications and projected market size.

The objective for pursuing GFPVC is to incubate a new business / product line-up around GFPVC by demonstrating technology and prototypes of end-user applications. The technology for the production line will be developed in-house. Eventually, the standalone business / business unit is to be disposed as a separate entity or through technology transfer for a profit to companies interested in GFPVC manufacturing. The whole concept is start-up-driven – create a market-disrupting technology and sell it at a crucial time.

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Introduction to Glass Fibre PVC (GFPVC)

To start the story about GFPVC, one needs to understand about STEER a little. To understand STEER, one must start at the vision statement of STEER which says, "At STEER, we envisage a brave new world steered by intelligent technology, paving the way ahead for humanity. Our mission is to drive the world towards a simpler, better and more evolved tomorrow. We strive to make this a reality with state-of-the-art technology that helps create a better quality of life and enables quantum leaps in the way we live, work and play."

This is the philosophy behind the development of GFPVC, the next generation material, which has the potential to revolutionize the industry and the world. GFPVC enables you to create a simpler, better and more evolved tomorrow... And GFPVC will significantly improve humanity's quality of life and at the risk of sounding grandiloquent, it surely is a quantum leap in material technology.

GFPVC is a revolutionary technology invented by STEER for manufacturing of various products (profiles). The salient feature of this technology is its extra rigidity, toughness, modulus and high tensile strength. The enhanced metallurgical properties are achieved by reinforcing the plastic pipe with continuous glass roving. The specially designed extruders ensure continuous glass roving without breakage of the glass. In the final product, longer the glass fiber, better is the tensile property.

GFPVC, as the name suggests, has a tensile strength of up to 80 mpa (megapascal), which exceeds 60 mpa, the current strength of CPVC pipes. The high tensile strength and toughness of GFPVC makes it ideal for high-pressure pipes used in various applications.

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Overview of Competing Materials – CPVC

GFPVC directly competes with CPVC and Aluminium in the pipes space. Let us see some important characteristics of the competition.

CPVC

CPVC stands for Chlorinated Polyvinyl Chloride. With its strong build and flexibility, CPVC does what PVC cannot – it can withstand higher temperatures. Chlorinated Polyvinyl Chloride is a more stable compound that is corrosion-free and requires less installation time. But in a regularly changing climate, CPVC is not so suitable because of its high thermal expansion coefficient. Chlorinated polyvinyl chloride (CPVC) is a chlorinated form of PVC that is typically initiated by application of thermal or UV energy utilizing various approaches. In the process, chlorine gas is decomposed into free radical chlorine, which is then reacted with PVC in a post-production step, essentially replacing a portion of the hydrogen in the PVC with chlorine.

Depending on the method, a varying amount of chlorine is introduced into the polymer allowing for a measured way to fine-tune the final properties. The chlorine content may vary from manufacturer to manufacturer; the base can be as low as PVC 56.7% to as high as 74% by mass, although most commercial resins have chlorine content from 63% to 69%. As the chlorine content in CPVC is increased, its glass transition temperature (Tg) increases significantly. Under normal operating conditions, CPVC becomes unstable at 70% mass of chlorine.

Various additives are also introduced into the resin to make it a processed product. These additives may consist of stabilizers, impact modifiers, pigments and lubricants.

CPVC shares most of the features and properties of PVC. It is also readily workable, including machining, welding, and forming. Because of its excellent corrosion resistance at elevated temperatures, CPVC is ideally suited for self-supporting constructions where temperatures up to 200 °F (90 °C) are present. The ability to bend, shape, and weld CPVC enables its use in a wide variety of processes and applications. It exhibits fire-retardant properties.

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Overview of Competing Materials – CPVC

Important CPVC related Standards

Standard	Description
ANSI/NSF Standard 61	CPVC Pipes-Potable Water Supply This is a critical certification without which CPVC Pipes cannot be used for carrying potable water
ASTM D2840	CPVC Hot Cold Water Distribution Systems
ASTM F439	CPVC Schedule 80 CPVC Fittings
ASTM F441	CPVC Schedule 40 & 80 Pipes
DIN-8079	CPVC Pipes Dimension
DIN-8080	CPVC Pipes General Quality Requirements and Testing
BS 7291/4	CPVC Pipes and Fittings for Hot and Cold Water Distribution
NFT 54-014-1/2	CPVC Pipes and Fittings for Hot and Cold Water Distribution
EN-ISO 15877:2003	Plastics Piping Systems for Hot and Cold Water Installations -Chlorinated Poly Vinyl Chloride (PVC - C)

The advantages of using CPVC include:

- All-conditions resistant – It can withstand harsh weather conditions and low pH water levels, salt water, etc because of its tough build and self-insulating properties
- Easy to handle and install, as it is lightweight and hence used extensively for domestic plumbing
- It can handle both cold and hot water effectively
- Fire resistant and leak-proof
- Eco-friendly, cost-effective production and low price

Applications

- Apartments, high-rises, hotels, and commercial establishments
- Water treatment plants
- Centralized heating applications

Market Size

With increasing awareness and rising capacities of CPVC pipes in India, this segment has been growing at the fastest rate among other existing plastic piping systems. While PVC plumbing systems (white plumbing and drainage pipes) are growing at 20% CAGR, CPVC piping systems has grown at a five-year CAGR of 40%. Current size of the CPVC pipes segment is estimated at INR 15 bn.

Major Players

The major players include APTL, Ashirvad Pipes, SIL, and Ajay Industrial Corporation. The top four players account for over 80-85% of CPVC pipes sales in India. Apart from these, over 25 new players have entered this segment in the last two-to-three years.

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Aluminium

Aluminium is a relatively young metal when compared to other metals like copper, bronze, iron and steel, which have been in use for thousands of years now. In 1825, Aluminum was first refined using processes consisting of rolling, casting, and forging. Aluminium extrusion is largely used in manufacturing doors and windows, followed by passenger vehicles. Other major extrusion products and applications are consumer staples and the construction of bridges and highways. In the packaging industry, aluminium is used to manufacture foils, cans, tubes, etc. As aluminium is also light in nature, it is used in the aircraft and automotive industry.

The advantages of using Aluminium include:

- Easy to handle and install as it is lightweight and hence used extensively for various applications
- No threading or soldering required
- Corrosion-resistant resulting in optimal air flow and reduced energy costs
- Secure with very less leakage

Applications

- Industries such as Transport, Marine, Military, Defence, Construction, etc
- Solar and renewable energy
- Electrical bus conductors
- Compressed gas storage

Market Size

The aluminium pipe industry is forecast to reach 5.3% with an average annual growth of 0.9%. The global demand is such that it accounts for nearly 60% of the market currently. China, France, Germany, Russia, and the United States represent the largest aluminium pipe and tube markets while the strongest annual growth is forecast to occur in Greece (45.1%), Armenia (32.1%), Poland (28.5%), Ireland (27.7%), and Turkey (19.9%).

Major Players

The major players include Hindalco, Jindal, Century, and Valco. The top four players account for over 80-85% of Aluminium pipes sales in India.

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Navigating the right course can be a challenge, and each turn you make may lead you down a path you never thought you would take. That's the beauty of embracing new ideas and meeting new people, and along the way some dead ends - to get you back on track.

And if all this spells success in the end, then it is a job well done nonetheless!

STEER and its team is doing just that – STEERing their way to success – exemplified by their vision of Steering a new world and to help create a better tomorrow through engineering, research and innovation!

Origin & History

For the past two decades, STEER has created history by using high-end technology to deliver exceptional compounds, peripherals that are crafted for perfection, and application that are precisely engineered for creating a lot of value to clients around the globe. Another one of its innovative products is the GFPVC, a revolutionary technology for manufacturing plastic pipes. GFPVC pipes are known for their rigidity, toughness, modulus and high tensile strength. GFPVC, as the name suggests, has a tensile strength of up to 80 mpa (megapascal) which exceeds 60 mpa, the current strength of CPVC pipes. The high tensile strength and toughness of GFPVC makes it ideal for high-pressure pipes used in various applications.

The idea of GFPVC was forged as early as 2008 when Mr. Raman and Dr. Babu Padmanabhan of STEER started discussing about the possibility of using continuous glass reinforcement in plastics to improve its rigidity and tensile strength.

An early development prototype using Polypropylene (PP) was showcased in the 2009 Plast India Foundation. However, the development did not commercialize because PP is a difficult material to form as a pipe. Further, a very high molecular weight resin was required for the process. A high molecular weight resin does not allow the glass to get dispersed well.

Though STEER produced small quantities, it could not manufacture long pipes using this technology. Using the learning from this experience, STEER decided to use PVC because of its high melt viscosity. The beginning also saw the use of smaller compounding machines.

The past eight years have been spent in various trials and experiments, which have enabled STEER to successfully create a process that allows it to produce a continuous stream of pipes with diameter of 1", 2" and 3".

Research

After experimenting with the use of various materials, finally, in 2009, a decision was taken to go ahead with glass, as the tensile strength it yields is phenomenal and promised to be a game-changer.

The trials involved experimenting with various brands of glass from Chinese and German manufacturers. Finally, the best glass applicable for GFPVC came from Owens Corning. The trials provided an impressive result. This has become the cornerstone of the product.

Almost 50 to 60 experiments were conducted to determine the time of viscosity drop. Another challenge the team faced was with the various additives used. PVC requires a good stabilizer to prevent quick degradation. Baerlocher (World leader in PVC additives) markets a pack containing the stabilizer, internal and external lubricants. The internal lubricant helps to fuse the PVC in the desired zone of extruders and the external lubricant helps in preventing the PVC from sticking onto the metal surfaces. The more the delay in fusion, the better were the results. The additives determined where to delay the fusion.

The turning point of the research came when the team decided not to use pipe grade PVC but injection moulding grade PVC. This was decided as the team did not want the molecular weight to be high. The lower the molecular weight, the better it is for mixing of the glass. Another noteworthy innovation came in when Acrylonitrile butadiene styrene (ABS) was added to PVC. Thus, the final product is an alloy of PVC and ABS with glass.
A lot of time and effort were spent in arriving at a process that could effectively convey the melt. Initially, the team used a twin-screw extruder but as it could not push the pipe out, a baby-extruder was used to take the hot melt out from the twin screw and use it as a pump to push the melt out.

STEER has applied for the patent for this Product and Process. Usage of patented elements within the process greatly reduces the breakage of the glass fibre.

Manufacturing Process

By now, it was known that leveraging high tensile strength and toughness of GFPVC makes it ideal for high-pressure pipes used in various applications. The enhanced metallurgical properties are achieved by reinforcing the plastic pipe with the continuous glass roving. The specially designed extruders ensure continuous glass roving without breakage of the glass. In the final product, longer the glass fiber, better is the tensile property.
The key to continuous manufacturing of GFPVC is the use of a co-rotating twin-screw extruder with special geometry as op-

posed to a counter-rotating twin-screw extruder. A counter rotating twin-screw extruder tends to break the glass fiber. The process used mixes the glass in the extruder, takes the melt out, passes it through the pipe-forming die, sizes it with the pressure of vacuum and then hauls it out with a caterpillar. A continuous glass feed and prevention of glass fiber breakage was achieved by attaching the pipe die directly to the DAC. Another noteworthy improvement in the process was affected by using a caterpillar at the end of the process to pull the tube out at the right speed. People with the know-how of the industry will agree that the speed at which the tube is pulled out is critical - if you pull it too fast, it snaps and it you pull it too slowly, the material accumulates and the tube collapses.

A certain school of thought in the organization wanted to use pultrusion. Pultrusion is a continuous process for manufacture of composite materials with a constant cross-section. The term is a portmanteau word, combining “pull” and “extrusion”. As opposed to extrusion, which pushes the material, pultrusion works by pulling the material. This was ruled out as this is used for solid strands and cannot be used for pipes.

Market Opportunity Overview

With the product in place, there needs a buyer. And who else but the construction industry. In general, plastic pipes are easy to handle, have simple joining techniques and avoid leakages. Hence, they are a favourite among the construction industry. CPVC is the most popular among the lot in usage currently. They are easy to install, do not require solvents for joining, and are welding-free. But the most important aspect is its ability to handle both hot and cold water. It also has the lowest Coefficient of Linear Thermal Expansion (CLTE). But CPVC pipes cannot withstand temperature greater than 700 and this is where GFPVC steps in. It has been tested for water temperature greater than 800.

It has also been determined that GFPVC is ideal to replace pressure pipes that are used for sprinklers and fire hydrants. Currently, the market is using metal pipes for these applications. Recently, we have seen the entry of CPVC in this market too. But CPVC has a strength of 60 mpa whereas GFPVC has a strength of 80 mpa.

Another classic application is in bore wells. Currently, bore wells below a depth of 800 ft cannot use CPVC pipes as CPVC does not have the required tensile strength. Thus, steel pipes are used instead. But, steel pipes are corrosive in nature and have a higher pumping cost due to friction. This is another area where GFPVC can make a mark for itself due to its high tensile strength.

In simple terms, a space frame is a three-dimensional structure. To quote a definition given by a Working Group on Spatial Steel Structures of the International Association:

"A space frame is a structure system assembled of linear elements so arranged that forces are transferred in a three-dimensional manner. In some cases, the constituent element may be two-dimensional. Macroscopically a space frame often takes the form of a flat or curved surface."

Generally, space frames are used to cover large areas that need little support. They can be called an engineering marvel. Space frames follow a geometric interlocking pattern and are very rigid in nature; hence, they can bend easily, are lightweight in nature and can withstand tension. Mostly made of aluminium, they appear to be conjoined squares repeating many times. However, they can assume different geometrical shapes, with more complex variations.

Applications

Space frames offer an alternative structural option for various buildings, enclosures, etc. as they are ready to use with little or no welding required because they are assembled and brought to the site. Some places where they are prominently seen are stadiums, airports, big commercial and industrial buildings, exhibitions, entertainment centres, etc.

Advantages

The obvious benefits of using space frames include:

- Exceptional roof quality
- Assembled and ready to use, hence reducing the time to install
- Better utilization because of its rigidity
- Different geometric designs possible because of its structural property

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Irrigation Sprinkler Systems

Irrigation sprinklers are used to irrigate crops just like rainfall, by spraying water through spray heads. They distribute water uniformly over the entire surface, providing ample coverage. Sprinklers reduce the wastage of water due to evaporation and seepage. Water is mostly pumped from a source and supplied to sprinklers. They can be used for all kinds of crops. Even though they are suitable for most soil types, they are highly used for sandy soil.

Applications

Industrial

Sprinklers that are designed to operate at high pressure are usually referred to as Industrial sprinklers as they are mostly used in fire protection systems, mills, warehouses, factories, or other applications like dust suppression and logging. They cover a lot of ground, by sprinkling water to a large area, by rotating their spray heads in a uniform circular motion. Most of such sprinklers operate using the electric or hydraulic technology.

Residential

Sprinklers that are designed to operate at small dwellings and used extensively to water lawns etc., are referred to as residential sprinklers. They are mostly used in homes, hostels, social housing and residential care premises, etc. Residential sprinklers can be of different types like drip, underground, or oscillating. Such sprinklers are usually available at the local hardware shops for a smaller cost. They can be moved from one place to another and can be fitted to the home plumbing system.

Underground

Sprinklers that are designed to operate using electronic or hydraulic technology are referred to as underground sprinklers. Pressurized water is discharged and flushed to the ground through pipes made of PVC or polyethylene using spaced out sprinklers. They are mostly used to irrigate delicate plants, flowers, and shrubs by releasing a steady stream of water at a fixed interval. When used properly, underground sprinklers conserve water by properly directing water to the desired location, in a desired quantity.

Agricultural Science

Sprinklers that are designed for use in farmlands to cultivate crops follow the rolling pipe type irrigation system. In this system, wheels are attached to big pipes, with spray heads spraying water across the field. They are usually controlled by using a pumping unit.

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Advantages

- Easy water measurement
- High application efficiency

Market Size

According to estimates, the market for such small irrigation systems is expected to grow at a CAGR of 18.3% from 2016 to 2021, to reach US $6.81 Billion by 2021. The base year considered for the study is 2015 and the forecast years include 2016 to 2021. With water becoming scarce, such small irrigation systems are starting to find favour in countries like South Africa, Saudi Arabia, India, China, and Brazil.

Fire Sprinkler Systems

A fire sprinkler system is equipped with a robust system wherein water with controlled pressure and flowrate is let into a distribution piping system, which in turn relates to sprinklers. Commonly found in large commercial buildings, it is an effective fire protection method. They are very popular in dousing fires in buildings, with a high (96%) rate of protection. Some tall buildings have mandated the use of fire sprinkler systems to reduce the potential damage to life and property.

A typical fire sprinkler consists of a glass bulb that is sensitive to heat and activates as soon as a predetermined level of heat is reached around it. It then sprinkles water around the area of fire, with maximum water pressure around it. All this happens in less than four minutes of the start of fire, thus showing quick response time.

Applications

Wet pipe systems

The most commonly found type of sprinklers, they are also the most efficient in terms of cost and low on maintenance. They constantly have water supplied to them through piping and consist of a built-in automatic alarm-check valve.

Dry pipe systems

Dry pipe sprinklers are the next most commonly found type of sprinklers that use pressurized air in the pipe to douse fires. Water is not stored in the pipes connecting the sprinklers till it becomes active; rather it is filled with air whose pressure is just below that of water. As and when the air pressure starts to reduce, water discharge starts.

There is a slight delay in discharge of water in this case, but is very useful in places that are very cold and freeze the water, in which case the system is rendered inoperable. They have a mechanism where air escapes early and speeds up the water flow. A typical example maybe a warehouse located in an area that regularly experiences below normal temperatures.

On the downside, dry pipe systems require constant maintenance of a level of air pressure, which increases the maintenance cost, further adding to the complexity. There is also a possibility of the pipe getting corroded, because of the presence of moisture and oxygen compressed in the piping.

Deluge systems

These types of fire sprinkler systems have a smoke or heat detector with open nozzles connected to the water piping system. As the nozzles are always open, air pressure exists in the piping. A special valve is used in the water supply connection to prevent

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the water supply pressure from forcing water into the piping. They are mostly used in areas where fire spreads rapidly or where flammable liquids are spread across a floor. In that case, buildings such as industrial parks and buildings with many tanks have deluge fire sprinkler systems installed.

Pre-action systems

Pre-action fire sprinkler systems are a combination of both wet and dry systems – in the sense that it is filled with both air and water. This type of system requires two triggers – a fire detection trigger and a water flow trigger. So, as the name suggests, there is a pre-detection event (fire) and an action event (water flow). Pre-action sprinklers help in preventing water from spouting in case of a false alarm or a mechanical failure, where accidental activation is undesired. They are very useful in libraries, data centres, museums, and places where electronic goods are stored.

Foam water sprinkler systems

Foam water fire sprinkler systems discharge both water and a low concentrate foam. They are used to prevent occupational hazards of high challenge fires, flammable liquids, and airport hangars.

Water spray systems

They are like deluge systems, but different in the fact that they use unique nozzles to spray water in different patterns, as per the nature of hazard. They are used to prevent transformer bursts, where the electric transformers are filled with oil.

Water mist systems

In areas where water supply is limited and there is a need to create a heat absorbent vapor, water mist systems are extensively used. Water mist is basically water sprayed as a droplet. By adjusting the discharge pressure, the droplet creates a mist-like system using compressed gas, while exiting the nozzle. These systems use less water, while at the same time penetrating deeply into the seat of fire.

Advantages

- Relatively inexpensive
- Quick and effective
- Automatic activation in case of fire
- Low maintenance costs

Market Size

According to estimates, the market for fire sprinkler systems is expected to grow at a CAGR of 9.36% from 2015 to 2020, to

reach US $11.04 Billion by 2021. With fire-related accidents becoming very common, fire sprinkler systems find favour in countries like North America, Europe, Asia-Pacific, and RoW (rest of the world). North America is the largest market for fire sprinklers and is expected to continue to hold the largest market size till 2020.

The competitive landscape of the market provides valuable information about the various players in the fire sprinkler market. The global fire sprinkler market report profiles 10 promising players in the market and further details their business overview, product portfolio, recent developments, and key strategies adopted by the same. The market is witnessing new product developments, partnerships, agreements, and mergers & acquisitions across the value chain and between companies.

The major players in the global fire sprinkler market include Tyco (Switzerland), API Group, Inc. (U.S.), Honeywell International, Inc. (U.S.), Johnson Controls, Inc. (U.S.), United Technologies Corporation (U.S.), Hochiki Corporation (Japan), Robert Bosch GmbH (Germany), Siemens AG (Germany), Minimax GmbH & Co. KG (Germany), and VT MAK (US).

Drop Pipes

Drop pipes are big diameter uPVC pipes that used to erect bore-hole pumps, up to 1,000 feet into the ground. Also, called riser or column pipes, they come in different diameter sizes. They usually have a long life, lightweight, corrosion and rust-free, and discharge more water when compared with steel pipes. They are designed in a unique thick and thin version. The thin pipes are thicker at the edges where threads are rolled, thereby ensuring higher tensile strength. It also saves on the raw material consumption.

The threads are perfectly rolled for accuracy to withstand tightening and loosening several times. They are constructed using the latest extrusion technologies. The first pipe on the top bears the entire load of the column, in addition to withstanding high electrostatic pressure.

Applications

- Submersible pumps for both domestic and industrial usage

Advantages

- Cost-effective
- Lightweight
- Simple installation process
- Rust and corrosion-free

Total Market Size

US$ 353.25 billion or INR 23,76,401 crore (excluding Aluminium pipes & profiles)

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GFPVC vs CPVC

Parameter	CPVC	GFPVC
Temperature	Withstands high temperature	Up to 10% improvement over CPVC
Thermal expansion coefficient	High – unsuitable for regularly changing climate	Exceeds CPVC values
Polymer	Becomes unstable at 70% mass of Chlorine	Significantly lower Chlorine content
Corrosion resistance	Excellent at elevated temperature	Like CPVC
Physical characteristics	Possible to bend, shape and weld	Possible to bend & shape, specific to application
Fire Retardant	Yes	Yes
Suitability	For self-supporting constructions where temperatures up to 200 °F (90 °C) are present	Can support applications in high temperature environments (Use highest temperature enabled using greatest amount of PVC)
All weather resistance	Yes	Same as CPVC

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GFPVC vs Aluminium

Parameter	Aluminium	GFPVC
Temperature	Suitable for high temperature applications	Suitable for high temperature application
Linear coefficient	Relatively large coefficient of linear expansion	Same as Aluminium
Strength	Tensile strengths of between 70 and 700 MPa	Tensile strength of up to 80 MPa
Corrosion resistance	Can corrode with exposure to air and moisture, prone to stress cracking in a chlorine environment (salt water)	Very corrosion resistant to the environment and many chemicals, will not form an oxidation layer when exposed to adverse
Physical characteristics	Easy to mill, drill, cut, punch and bend, if over stressed will deform and maintain deformed shape	Can be worked similar to Aluminium, possesses memory, when exposed to high stress will deform however will resume original shape when stress is relieved
Suitability	Suitable for the extrusion of shapes and forms	Suitable for the extrusion of shapes and forms
Suitability	For self-supporting constructions where temperatures up to 200 °F (90 °C) are present	Can support applications in high temperature environments (Use highest temperature enabled using greatest amount of PVC)
All weather resistance	Yes	Same as CPVC

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Comparison of Plant Cost Estimation – CPVC, Al & GFPVC

	CPVC	Aluminium	GFPVC
Plant Capacity	5.00 Ton/day		
Land & Building (2000 Sq.mtr)	Rs. 2.56 Cr		
Plant & Machinery	Rs. 98.00 Lacs		
W.C. for 1 Month	Rs. 1.22 Cr		
Total Capital Investment	Rs. 4.93 Cr		
Rate of Return	31.00%		
Break Even Point	51.00%		

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MARKET PROJECTION for GFPVC

Sl No	Application	"India Market size (INR in crores)"	"Global Market size"	
			US$	INR (In crores)
1	CVPC Pipes	15000	65 Bn	437547
2	Irrigation Sprinkler systems	20,500 (by 2018)	6.81 Bn	47124
3	Fire Sprinkler systems	NA	11.04 Bn (by 2020)	74053
4	Aluminium pipes	NA	NA / Growing at 5.3% PA	NA
5	Space frames (Roofing)	NA	270.40 Bn (by 2026)	1817677

Total Market Size (excluding Aluminium Pipes) – US$ 353.25 billion

OR

INR 23,76,401 crore

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