MARKET OVERVIEW CUM DETAILED TECHNO ECONOMIC FEASIBILITY REPORT

(PROJECT FEASIBILITY REPORT)

ON

PVC AND CPVC PIPE AND FITTINGS MANUFACTURING PLANT

INDENTIFICATION & EVALUATION DIVISION FOR HI-TECH PROJECTS

ENGINEERS INDIA RESEARCH INSTITUTE

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J.C.: XXXX
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Note:
All graphs, pictures, tables, statistics, machinery, and suppliers’ detail are mentioned here for sample purpose only. Data in proposed project report will be provided as per availability.
PVC AND CPVC PIPE AND FITTINGS MANUFACTURING PLANT

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PVC AND CPVC PIPE AND FITTINGS MANUFACTURING PLANT

INTRODUCTION

PVC (unplasticized polyvinylchloride) pipes and fittings exhibit excellent resistance to aggressive environments both naturally occurring and as a result of industrial activity. They are resistant to almost all types of corrosion, either chemical or electrochemical in nature. Since PVC is a non-conductor, galvanic and electrochemical effects do not occur in PVC pipes.

**PVC Pipes and fittings are often used in the following circumstances:**

- For drinking water pipe distribution systems, both main and supply lines
- Sewer and discharge pipe systems

Due to its non-metallic nature, the material used is totally resistant to all forms of metallic corrosion.

Aggressive water resulting from high sulphate soils and low hardness water will not attack PVC pipes.

Our pipes are therefore resistant to a wide range of industrial waters and chemicals and offer an advantage in long-term systems life and manufacture costs.

For more information on the resistance of PVC for specific chemical(s), do not hesitate to let Interplast know. We inform you of the suitable pipe solution necessary.

Being made of a tasteless and odorless material, PVC pipes remain neutral to all transported fluids.

PVC is completely inert and is widely used for transporting liquids made for human consumption.
Because of their mirror-smooth inside surface, PVC pipes have minimum flow head loss. There is also no buildup of inside deposits, a particular advantage in the construction of sewerage systems.

The physical properties of PVC pipes are not affected by neither direct sunshine, nor wind or rain.

However, to avoid surface browning due to long exposure to direct sunlight, it is recommended that the pipes are kept protected from direct sunlight.

Rigid PVC is not conductive to combustion. In the event of a fire, flames are unable to travel on PVC pipes. They therefore offer added safety when used for electrical installations, both domestic and industrial.

PVC pipes are relatively light. Their specific weight 1.43 is one-fifth that of steel pipes. This cuts down transportation costs and facilitates installation when in difficult and remote places. Installation is quick and easy with a complete line of fittings either with the solvent glue weld sockets or the rubber seal socket joints. In either case, a leak-proof joint is assured. Subsequent maintenance work is also carried out with a minimum of complication and cost.

PVC pipe which is made from polymerized vinyl chloride, a synthetic resin, which when plasticized or softened with other chemicals has some rubber-like properties. Derived from acetylene and anhydrous hydrochloric acid. PVC pipe has nominal sizes that are to be used with PVC socket fittings (schedule 40) and PVC socket or threaded fittings (schedule 80).

PVC Pipe and Fittings have got tremendous demand in India as well as in abroad. To manufacture this, all the machinery and raw materials are available indigenously.

A polyvinyl chloride (PVC) pipe is made from a plastic and vinyl combination material. The pipes are durable, hard to damage, and long lasting. A PVC pipe does not rust, rot, or wear over time. For that reason, PVC piping is most commonly used in water systems, underground wiring, and sewer lines.
PVC was first developed in 1925 when a BF Goodrich employee, Dr. Waldo Semon, attempted to invent a method for bonding metal and rubber. After blending materials together to create a strong and flexible material, Semon discovered PVC. Nonetheless, the product remained virtually useless for another decade. In the late 1930’s, PVC was found to have great shock absorbing abilities. This discovery led to the creation of long lasting PVC tire treads, which were created with flexible forms of PVC.

Two decades later, PVC pipe was invented. By heating the PVC material, a special machine called an extruder could be used to push the PVC into hollow pipes. This PVC pipe was extremely solid and virtually indestructible. Using PVC pipes for irrigation systems proved to be effective. PVC pipe has since been considered an affordable and reliable means for water piping.

Due to the ability of PVC pipe to withstand extreme movement and bending, it is also increasingly used in earthquake prone areas. PVC pipe can withstand the rigorous shaking of the earth without experiencing any damage. The smooth surface of the PVC pipe is also resistant to bacterial contamination, such as E. coli. Therefore, many water companies rely on PVC pipe in their systems in order to keep them free of contamination.

Unfortunately, the material used in PVC pipe appears to be detrimental to a person’s health and safety. Reported cases of PVC pipe shattering when used with high-pressured gases have increased drastically. The Federal Government has issued safety warnings, which strongly recommend using alternative piping material. In addition, the heavy metals used to create PVC pipe can leach out when heated. The vapors emitted from the heated PVC pipe are now being linked to certain forms of cancer, especially lung cancer.

CPVC Pipes and Fittings are manufactured from compound, CPVC- Chlorinated polyvinyl chloride is a thermoplastic used for hot and cold water lines. Chlorinated polyvinyl chloride (CPVC) is a thermoplastic produced by chlorination of polyvinyl chloride (PVC) resin used for hot and cold water lines. CPVC is the first choice of material for potable water supply across the world and is in use across the world for more than 50 years.
CPVC Industrial Pipe Applications Corrosion resistant pressure pipe, IPS sizes 1/4" through 24", for use at temperatures up to and including 200°F. Pressure rating (130 psi to 1130 psi) varies with schedule, pipe size, and temperature as stated in GF Harvel engineering bulletin (Product Bulletin 112/401). Generally resistant to most acids, bases, salts, aliphatic solutions, oxidants, and halogens. Chemical resistance data is available and should be referenced for proper material selection. Pipe exhibits excellent physical properties and flammability characteristics (independently tested flame and smoke characteristics ULC, 1993).

Typical applications include: chemical processing, plating, high purity applications, hot and cold potable water systems, water and wastewater treatment, and other industrial applications involving hot corrosive fluid transfer.

Specifications All CPVC Schedule 40 and schedule 80 pipe shall be manufactured from a Type IV, Grade I Chlorinated Polyvinyl Chloride (CPVC) compound with a Cell Classification of 23447 per ASTM D1784. The pipe shall be manufactured in strict compliance to ASTM F441, consistently meeting the Quality Assurance test requirements of this standard with regard to material, workmanship, burst pressure, flattening, and extrusion quality. The pipe shall be produced in the USA using domestic materials, by an ISO 9001 certified manufacturer, and shall be stored indoors after production, at the manufacturing site, until shipped from factory. This pipe shall carry the National Sanitation Foundation (NSF) seal of approval for potable water applications.
PROPERTIES OF PVC PIPES & FITTINGS

Sp. gr : 1.36 to 1.43
Tensile strength : 450 kg f/cm² 560 kg f/cm²
Elongation : 80%
Modulus of elasticity : 30,000-33,750 kg f/cm²
Compressive strength : 600-700 kg f/cm²
Heat distoration temperature at 18.5 kg f/cm² : 75 °C
Co-efficient of linear expansion : 55*10⁻⁵ m/m/ °C
Thermal conductivity : 4*10⁻⁴Cal/sec/cm²/°C/cm.
Flammibility : Self extinguishing
Impact strength °C : 0.5 -1 ft/lb/inch of notch.
Impact strength 20°C : 1-2 ft/lb/inch of notch.
S.P. heat : 0.24 kcal/kg/ °C
Water absorption at 20°C : 0.1 in * 3* 24 hours.
Electric constant (10 cycles/80°C) : 3.0
Softening point : 82 (Vioat)
Abrasion resistance : Good.
<table>
<thead>
<tr>
<th>Property</th>
<th>Flexible PVC</th>
<th>Rigid PVC</th>
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<td>1. Specific gravity</td>
<td>1.2 - 1.6</td>
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<td>2. Tensile strength (lb/in²)</td>
<td>1500 - 3000</td>
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<td>3. Elongation at break (%)</td>
<td>100 - 500</td>
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<tr>
<td>4. Compression strength (lb/in²)</td>
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<td>10,000</td>
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<td>5. Minimum operation Temperature (°C)</td>
<td>54 - 80</td>
<td>70</td>
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<tr>
<td>6. Water absorption (24 hr%)</td>
<td>0.25</td>
<td>0.1 - 0.4</td>
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<tr>
<td>7. Flammability</td>
<td>Self</td>
<td>Extinguishing</td>
</tr>
<tr>
<td>8. Effect of weak acids</td>
<td>Resistant</td>
<td>Resistant</td>
</tr>
<tr>
<td>9. Effect of strong acids</td>
<td>Resistant</td>
<td>Resistant</td>
</tr>
<tr>
<td>10. Effect of weak alkalis</td>
<td>Resistant</td>
<td>Resistant</td>
</tr>
<tr>
<td>11. Effect of strong alkalis</td>
<td>Resistant</td>
<td>Resistant</td>
</tr>
<tr>
<td>12. Solvents</td>
<td>Resistant to alcohols, aliphatic hydrocarbons and minerals eils, soluble in ketones, esters and to a certain degree in aromatic hydrocarbons and chlorinated hydrocarbons.</td>
<td></td>
</tr>
</tbody>
</table>
CHLORINATED POLYVINYL CHLORIDE (CPVC)

CPVC has been used successfully in residential, commercial and industrial applications for nearly 50 years. It is most commonly used in single-family and multi-family hot and cold water distribution systems. However, it can be used for residential fire sprinkler systems, chemical drain waste systems and industrial processing. Key advantages of CPVC include its resistance to corrosion, pitting, and scaling, ease of installation and light weight. CPVC pipe has a higher temperature resistance and is ideally suited for hot water plumbing. It can compete with Polybutene1 piping system in this application. The installation of CPVC pipe is as simple as that of PVC. It also requires solvent sealing instead of heat sealing required for PE pipe. CPVC is as safe as PVC pipe in its production, handling and installation.

Chlorinated PVC called CPVC is PVC with chlorine on its hydrocarbon backbone instead of one in PVC. It is therefore a heavier molecule and results into higher density compared to PVC, like PVC but even more difficult to process. CPVC is highly flame retardant. It has 60 Limiting Oxygen Index (LOI) indicating it requires 60% (or almost 3 times of normal atmospheric oxygen). Though PVC and CPVC belong to the plastics family and possess similar core materials, they perform very differently. The chlorination process used in making CPVC gives the material its superior performance in both high temperature and high pressure applications. The extra chlorine molecule makes CPVC very difficult to burn. CPVC will not sustain a flame on its own as there is not enough oxygen in the atmosphere to make it burn. When the flame source is removed, CPVC will self-extinguish. Additionally, CPVC should not be confused with polybutylene piping, which suffers from reliability issues because it could react unfavorably to some elements in various water systems. It’s manufacture is somewhat more difficult and is in the hands of a very few suppliers.
It was first commercialized by BF Goodrich that has now become Noveon. It then sold CPVC to Lubrizol in 2001. Lubrizol supplies CPVC compounds under Temprite and also supplies CPVC processed products under Corzan brand name. Compared to PVC which has the global consumption of more than 34-35 mln tons CPVC is a niche polymer & has small consumption in the World. Similarly there are very few processing industries involved in processing of CPVC. India has few well known processors of CPVC-Ajay Industrial Corporation, Ashirvad Pipes Pvt. Ltd., Astral Polytechnik Ltd.
ADVANTAGES & LIMITATIONS

1. PVC pipes are recommended only for water (cold) services and not the hot water supply.

2. Rigid PVC pipes are immune to corrosion and can be used in all types of corrosive soils which generally causes external corrosion in metallic pipes.

3. The specific gravity of PVC is 1.4, i.e. (5 times less than that of mild steel). Hence rigid PVC pipes can be transported easily at a lower cost handled and shaped easily. This property permits quicker and easier installation of PVC pipes.

4. The smooth well of the rigid PVC pipes reduces frictional loss to a minimum. It is about 40% lower than that of metallic pipes.

5. The thermal conductivity of PVC is some 2,650 times less than that of copper. This factor reduces insulation cost.

6. The coefficient of thermal expansion of rigid PVC is 5 to 6 * 10^-5 per 1oC. This means that in a hundred feet run the length of pipeline will alter by about one inch per 10oC change in temperature. Due allowance should be made, particularly in over ground pipelines, for any change in length of pipeline which may occur during installation of when pipeline is in service.
Handling & Storage:-

Rigid (unplasticized) PVC pipes are strong but light in weight. As a result, these pipes are easily handled and are likely to be thrown about. Reasonable case, however should be taken in handling and storage of these pipes while loading and unloading. On to and for the vehicles and these should be lowered and not dropped to the ground, to prevent damage to the pipes. These pipes are supplied in six meter lengths and above.

Extreme cold and hot weather conditions pose limitations to the handling and storage of rigid PVC pipes, and these call for suitable precautions in handling and storage. Pipes should be given adequate support at all times, stacking in large pipes should be avoided, in particular during summer months in regions where the temperature goes upto 45°C and above, as the bottom of pipes may distort, thus giving rise to difficulty to pipe alignment and jointing. during summer months pipes should preferably be stored in shade. For long term storage, pipe racks provided continuous support. For temporary storage in the field, where racks are not provided, care should be taken that the ground is level and free from loose stones. Pipes stored thus should not exceed three layers high and should be stacked to prevent movement. During summer months the pipes stored in the field should be under shade.

The impact strength of the rigid PVC pipes is reduced somewhat in cold weather, thus more care in handling is required to be exercised in these pipes in regions where the temperature goes below zero degree centigrade. At 10°C, the reduction has become marked and PVC pipes should not be laid in such conditions. While in transit pipes should be well secured and supported over their entire length.
**WIDE RANGE OF APPLICATIONS OF CPVC PIPE**

CPVC Pipes and Fittings for potable water applications are available in CTS (Copper Tube Size) ½ through 2 inches and in IPS (Iron Pipe Size) ¼ through 12 inches. CPVC Pipes and Fittings are joined by solvent cementing and CPVC Pipe and other piping materials are connected by use of adapter fittings. These CPVC Pipes are available in wall thickness of either SDR 11(Copper Tube Size), SDR - PR, Schedule 40 or Schedule 80. These pipes and fittings are pressure rated as per ASTM D 2846 for continuous use at 100 psi at 180 degrees F and 400 psi at 73.4 degrees F.

These pipes should be designed with a water flow rate between 5 and 12 feet/sec and while laying them it must be remembered that CPVC Pipes expand and contract more than metallic pipes. Compensation must be provided for expansion and contraction, where they are installed in long, straight lengths, by using offset piping arrangements like loops or bends. Adequate horizontal supports and vertical hangers at appropriate distances must be provided.

For cutting CPVC Pipes fine tooth saws/simple hack-saws/rachet saws or a circular tubing cutter modified with a plastic cutting blade can be used. Care should be taken to avoid cracking of the pipe wall while cutting. For larger diameter pipes power tools are also used at major sites for cutting.

Only CPVC solvent cements which meet the specifications of ASTM F 493 should be used while installing CPVC Pipes. Orange CPVC solvent cement or Purple primers are used when required to facilitate identification and plumbing inspection. Unpigmented CPVC solvent cement/primer, clear cement/primer, one step cements are the other alternatives available for joining purposes. Teflon Tape can be used with CPVC threaded adapters very effectively. However before using paste or pipe dope, it is better to check with the manufacturer as some of these pastes or dopes may contain solvents incompatible with CPVC.

While connecting CPVC Pipes to gas water heaters, the pipe should not be located within 6” of the heater’s flue, to avoid the possibility of damage to the plastic pipes from the flue heat. A flexible appliance connector or metal nipple is used for the connecting. However the hot water from the heater does not affect the CPVC.
CPVC is affected by prolonged exposure to sunlight/ultraviolet radiation. Pigments are added to CPVC to make pipe and fitting resistant to degradation. CPVC pipes can be protected from sunlight /UV radiation by painting them by exterior grade latex paint.

If a section of the piping systems freezes in the cold, it can be thawed by wrapping it with a cloth saturated with hot water and keeping the cloth hot by re-dipping in hot water till required. Alternatively a low wattage heater/blower can used to blow heated air on the frozen area to thaw the pipe.

**Important CPVC related Standards**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANSI/NSF Standard 61</td>
<td>CPVC Pipes-Potable Water Supply This is a critical certification without which CPVC Pipes cannot be used for carrying potable water</td>
</tr>
<tr>
<td>ASTM D2840</td>
<td>CPVC Hot Cold Water Distribution Systems</td>
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<tr>
<td>ASTM F439</td>
<td>CPVC Schedule 80 CPVC Fittings</td>
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<tr>
<td>ASTM F441</td>
<td>CPVC Schedule 40 &amp; 80 Pipes</td>
</tr>
<tr>
<td>DIN-8079</td>
<td>CPVC Pipes Dimension</td>
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<tr>
<td>DIN-8080</td>
<td>CPVC Pipes General Quality Requirements and Testing</td>
</tr>
<tr>
<td>BS 7291/4</td>
<td>CPVC Pipes and Fittings for Hot and Cold Water Distribution</td>
</tr>
<tr>
<td>NFT 54-014-1/2</td>
<td>CPVC Pipes and Fittings for Hot and Cold Water Distribution</td>
</tr>
<tr>
<td>EN-ISO 15877:2003</td>
<td>Plastics Piping Systems for Hot and Cold Water Installations -Chlorinated Poly Vinyl Chloride (PVC - C)</td>
</tr>
</tbody>
</table>
BUREAU OF INDIAN STANDARDS SPECIFICATIONS
PLASTIC PIPES & FITTINGS


IS : 7834 - 1975 Specification for injection moulded PVC socket fittings With solvent cement joints for water supplies

Part - I General requirements.

Part - II Specific requirement for 450 elbows

Part - III " " 90°

Part - IV " " 90° Tees

Part - V " " 45°

Part - VI " " Sockets

Part - VII " " Unions

Part - VIII " " Caps

IS : 7634 - 1975 Coke of practice for plastic pipe work for potable water suppliers.

Part - I Choice of materials and general recommendations.

Part - II Laying and joining the unplasticized PVC pipes.

PVC pipes are manufactured in different standards to suit different and applications. The following table gives comprehensive standards to which these pipes are available for different applications.
For more information contact at:

Headquarters:

Manak Bhavan,  
9, Bahadur Shah Zafar Mag,  
New Delhi-110 002  
Phone: 91 11 23238821, 23233375, 23239402  
91 23238821, 23239399 (Fax)  
sales@bis.org.intandards Institution

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Sales Outlets Address</th>
<th>Telephone No/Fax/e-mail</th>
</tr>
</thead>
</table>
| 01.    | **Director (Sales)**  
         Manak Bhawan,  
         9, Bahadur Shah Zafar Marg, New Delhi-110 002 | 91-11-23238821, 23233375, 23239402  
         91-23238821, 23239399(Fax) |
| 02.    | **Western Regional Office**  
         Manakalaya, Plot No. E-9, MIDC, Road No. 8, Behind Telephone Exchange, Andheri (East), Mumbai-93 | Phone 022-28329295  
         Fax 28374231  
         Email: saleswro@bis.org.in |
| 03.    | **Eastern Regional Office**  
         5, Chowringhee Approach  
         P.O. Princep Street, Kolkata-700 012 | 033-232053243  
         91-33-23377459(Fax)  
         ero@bis.org.in |
| 04.    | **Northern Regional Office**  
         SCO 335-336, Sector 34-A Chandigarh-160 022 | 91-0172 2665512  
         91-0172 2602025 (Fax)  
         910172-2609285, 2664750,2624136(PBX)  
         nro@bis.org.in |
| 05.    | **Southern Regional Office**  
         C.I.T. Campus,  
         IV Cross Road  
         Chennai-600 013 | 91-044-22542315, 22541584,22541470  
         91-044-22541087 (Fax)  
         sro@bis.org.in |
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### PRESSURE PIPES FOR WATER SUPPLY & IRRIGATION
(TABLE OF DIMENSIONS OF PIPES TO IS : 4985-1968)

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## PLUMBING PIPES

<table>
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<tr>
<th>O.D. (mm)</th>
<th>Well thickness</th>
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<tr>
<td></td>
<td>Min</td>
<td>Max</td>
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</tr>
<tr>
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<tr>
<td>40</td>
<td>3.6</td>
<td>4.2</td>
</tr>
<tr>
<td>50</td>
<td>3.7</td>
<td>4.3</td>
</tr>
</tbody>
</table>
APPLICATIONS OF PVC PIPES & FITTINGS

The main application of rigid PVC pipes & fittings are:-

1. **For Transportation of Water:**

   Drinking water  
   Sewerage/waste  
   Rain water, and  
   Salt water.

   and is used:-

   in Building  
   In Laboratories  
   In canteens  
   In wash rooms etc.
2. **Tube wells** :-

   Hard rock and alluvial soils.

3. **Chemical processing Plants** :-

   For transport of acid - alkalies and of aggressive fluids and gases in chemical industries.

4. **Ducting for power and communication cables**:

   5. For ducts-exhaust vapour in plants/installations underground telephone cables.

**For transportation of pulverized materials.**

6. Electrical conduits,

7. For sprinkler irrigation.

8. Air/vent system.


10. Bore wall casting and suction pipes.

ADVANTAGES OF USING PVCPIPES

1. IT IS ECONOMICAL:

For medium sizes, PVC pipes are 10 to 30% cheaper, additional economics can be affected in installation so that the cost of large schemes can be brought down by as much as 10 to 40.

Therefore, given any allocation for water supply, more villages and more people can be provided with water supply through PVC pipes ensuring better utilization of resources.

2. IT RESISTS CORROSION:

Unlike most conventional materials, PVC is completely non corrosible. Therefore the life of the PVC system is much more than that of conventional materials, making it a more reliable and durable system. It also flows that PVC systems are ideally suitable for saline and other aggressive soils.

3. NON-ENRUSTATION:

Because of the smooth bore of PVC, there is no encrustation on the inner surface of the pipe, unlike conventional materials where the bore gets progressively smaller over a period time, owing to encrustation. This is of special advantage in congested cities, where removal and replacement of encrusted pipes from under paved streets become an extremely difficult and expansive proposition. The pressure in the distribution system laid with metal pipes also drops considerably after 20 to 25 years on account of which booster pumps have to be installed.
4. **LIGHT WEIGHT:**

The specific gravity is 5 times less than that of steel and therefore PVC pipes can be transported at low cost and handles with ease. Large lengths can be manually carried over long distances which is practically impossible with metal or asbestos cement pipes.

5. **EASE OF INSTALLATION:**

Of all plastic materials, PVC alone is capable of solvent jointing. A special solvent solution enables the piping system to be joined with greater ease in a matter of minutes. The installation staff needed training and thereafter have only to follow simple procedure. Various kinds of rubber ring joints are also used to make installation even simpler. In addition, the PVC system can easily be connected to any other system.
MARKET POSITION

Infrastructure development and urbanization in India has given a dynamic shape to the Indian construction industry. Various government initiatives like Smart City Mission, Housing for All, and Swatch Bharat Abhiyaan is creating business opportunities for construction industry. Pipes and fittings is one such essential part of the construction industry that is expected to gain momentum in the coming days due to faster developments. This industry has been segmented on the basis of types of PVC pipes and fittings (RPVC, PVC and CPVC pipes and fittings).

As per a report, PVC pipes and fittings market in India has grown at a Compound Annual Growth Rate (CAGR) of 12.5 per cent during the period from FY2009–FY2014. The PVC pipes and fittings market in India is poised to register a double digit growth over the period FY2014–FY2019 and is expected to reach Rs 391 billion in FY 2019 as compared to FY 2014. To achieve this growth, not only infra development but also progress in irrigation, waste water management, water supplies, sewage and plumbing etc is expected to play a huge role and are to be major growth drivers to spur the opportunities for pipes and fitting industry. Sharing his views about pipes and fittings industry market size and growth rate Rajesh Pajnoo, President of Hindware Pipes Division, HSIL Ltd says, “The plastic pipe and fittings industry is Rs 23,000 crore in size with a growth rate of 17 per cent in the last 7 years. With the impetus given for Real Estate/Infrastructure development and conversion from Galvanised Iron (GI), the growth rate will improve to 20 per cent.”
Impact of GST, Demonetisation, RERA on pipes and fittings Industry

Goods and Services Tax (GST), is hailed as most important tax system in India. With its implementation it has driven up the efficiencies by cutting out the multiple taxes that are charged. It has also got much ease and transparency in the business and also has been fair enough to curb down the unethical practices. The GST is an indirect tax levied on goods and services in India wherein the goods and services are divided into five tax slabs that is 0, 5, 12, 18, and 28 per cent.

On the other hand, the announcement Demonetisation made by the government created a big hullaballoo, prolonged cash shortages etc, which slowed down various markets and sectors. However, with time the impact of the same is reduced and the money circulation is in line. Briefing on the impact of Demonetisation, GST and Real Estate Regulatory Authority (RERA) on pipes and fittings industry Pajnoo states, “Demonetisation affected the money circulation which in turn slowed down the markets in most categories, which phase is over now. GST is a positive step and a major systemic change, the impact of this is felt in real estate sector too, but we are hopeful it will settle soon. RERA will benefit the Real Estate Industry in the long run. It will attract more investment by large players and this in turn will benefit the home buyers at large.”
Opportunities for the pipes and fittings segment from Budget 2018

During the budget 2017-18 for the infrastructure sector, the total allocation for the infrastructure development in 2017-18 was Rs 3, 96, 135 crore. For irrigation sector, the government announced Rs 20,000 crore to NABARD for long term irrigation funds, and 5000 crore for setting up of dedicated micro irrigation fund. On the other hand, Under Swatch Bharat Mission (rural) the government prioritised pipe water supply for open defecation free villages and safe sanitation.

The budget of this year is good for the infrastructure sector, specially water and energy. The Rs.19,428 core allocation for water supply projects under AMRUT schemes will help in providing drinking water facilities to urban and semi urban households. The increase from Rs. 20,000 crore to Rs 40,000 crore for irrigation projects and dedicated micro irrigation fund of Rs 5,000 crore will help the agriculture sector to grow and have good production that will contribute to the growth in our economy. “These projects will require huge quantity of bulk pipeline to be laid for transporting water from source to destinations thus having opportunities for pipe manufacturers in India. The demand for pipes from oil and gas sector will also increase with the several development schemes by the government comes under implementation,” says Subhash Sethi, Chairman, SPML Infra Ltd.

This year’s Budget will encourage economy and also will have positive impact believes Pajnno. On the budget expectations he states, “We expect a business friendly budget which will spur economic growth and bring a positive impact on most/all industries.”

This year’s budget with progressive thinking will lead India to an inclusive growth path with clear focus to develop robust infrastructure and lift the economy to achieve the target for next fiscal.
Imported or indigenous pipes

Like in any other country, India also has different quality of pipes and other mechanical fittings available across the market. There are good manufacturers who produce quality products which are priced comparatively higher than other manufacturers and also the Chinese imports available freely. Over the past few months, global steel prices have jumped by nearly 30 per cent thus putting pressure on pipe manufacturers. Apart from rising cost, India has also witnessed growing imports of steel and pipes from countries like China, South Korea and Ukraine despite it has got the surplus steel production. After the New Steel Policy rolled out by the government in May 2017, it helped in keeping a check on imports which reduced to only 10.9 per cent during April-December 2017.

Sethi adds, “When SPML Infra received order for phase 1 of Saurashtra Narmada Avtran Irrigation (SAUNI Yojana) in Gujarat, which required procuring high capacity 3000 mm dia MS pipes with 17.5 mm thickness, no manufacturer was having the production capacity to provide such pipes which ultimately they upgraded their facilities to manufacture and supply.”

India has about six million tonnes of pipe making capacity and imports 50-60 per cent of its raw material. China has started focusing on Indian market for pipes (after Europe imposed anti-dumping duty and the US started investigation on their exports for a possible trade barrier) and has managed to get good amount of Indian business with value-added steel pipes which are 20 per cent cheaper than Indian producers. China is able to manage the cheaper rates due to special incentives provided by their government for exports besides they enjoy lower interest and logistic costs compared to their Indian counterpart. Though the New Steel Policy mandates use of ‘Made in India’ steel for pipe manufacturing, but it still requires lot of clarifications and faces big challenges on implementation due to limited resources available.
Sharing his views on SPML Infra's preference on indigenous pipes Sethi says, “As an Indian Company working in infrastructure sector for past over three decades, SPML Infra is mainly using pipes and fitting manufactured in India. The preference is purely based on quality either for imported or indigenously manufactured with proper delivery commitment by the supplier as per our project execution schedules. We have seen Indian pipe manufacturers transformed from their conventional pipe making methods to adopting technology and modern technique to implementing stringent quality control for producing high capacity advanced pipes like MS and HDPE with large diameters. Earlier we used to lay PSC and RCC pipes which have given way to modern HDPE, DI and MS pipes with high tensile strengths. Sometimes the home grown manufacturers are not able to meet the committed dates due to their limited production capacities and gap between demand and supply. In such cases, companies like us have to look for other options in line with quality and quantity requirements.”

SPML Infra has extensive experience in laying, jointing, testing and commissioning of bulk and distribution pipeline network for domestic and industrial water supply, treating water for reuse from sewage, effluent, irrigation, institutional, power etc. It has achieved a major position in the segment and already laid more than 10,000 km of pipeline up to 3,500 mm diameters in different geographical regions of India. It has developed expertise for both the business and technical management of large pipe networks with planning, laying and managing cross-country pipelines of any length and size (up to 4000 mm diameter) in all terrain conditions for drinking water, wastewater, irrigation, power and flood water transportation and management.

SPML Infra has earlier completed laying of 41 km of 3000 mm dia MS pipeline with 17.5 mm thickness with external 3LPE coating and internal food grade epoxy coating under the Saurashtra Narmada Avtran Irrigation (SAUNI Yojana) in Gujarat. It is currently executing another package for laying of 36 km pipeline with same specifications. It has also executed 21 km of 2764 mm MS pipes with 18 mm shell thickness under Cauvery Water Supply Scheme for water supply augmentation to Bangalore city.
The over 9 km 2,420 mm to 3,100 mm dia MS pipeline was laid by the company in Delhi to improve raw water supply arrangement for the treatment plant at Wazirabad.

While stating on whether the industry imports only components of the product or the entire product Pajnoo says, “Few MNCs which are importing their products, but the volumes are low. In addition on suggesting how to avoid imports he says, “We are focussed on giving the Best Quality products manufactured here, given the low volumes of imported products, it is not a worry for us.”

**New venture in pipes and fitting segment**

It is very important that India has good number of manufacturers and HSIL Ltd who has recently ventured into the household plumbing pipes segment with the inauguration of their manufacturing facility in village Isnapur, District Medak, Telangana. The move is aimed at providing integrated solution for home building, enhancing customer convenience, facilitating cross-sale and extending the existing building products distribution chain to the hardware channel distribution chain for the pipes sub-segment.

Briefing about the facility’s production capacity Pajnoo says, “The HSIL plant currently has a total production capacity of 30,000 metric tonne with plans to scale up the production capacity to up to 60,000 metric tonne by 2020 in order to emerge as a key player in the CPVC and UPVC pipes and fittings segment. This plant is the epitome of the best manufacturing practices accumulated and market understanding from HSIL’s existing operations.”

The plant will manufacture all types of CPVC and UPVC pipes and fittings, suitable for potable water transportation, water harvesting and sanitation applications, primarily in building construction segment.
Future growth of India PVC pipes and fittings Market is expected to be led by the rising construction of much required residential units and inclining demand of PVC pipes and fittings in agricultural sector to bring in more area under cultivation. This will also be bolstered by the government projects for clean environment and housing for all which includes a large focus on the sanitation facilities for the people.

The market leader, Finolex Industries Limited is expected to maintain focus on research and development in its manufacturing plants to develop new products and widen its distribution reach, to stay ahead of its rivals in the market especially in rural segment.

The Indian PVC pipes and fittings industry, which comprises of segments such as RPVC, PVC and CPVC pipes and fittings has grown significantly over the last few years due to the increase in the demand from irrigation sector on account of the burgeoning population and uncertain weather conditions in the country. The PVC pipes and fittings industry in India is highly fragmented. The market revenues have grown at a CAGR of 13.4% from FY’2010-FY’2015. There is a stiff competition in the market with a large number of organized and unorganized players engaged in the manufacturing and distribution of PVC pipes and fittings in the country. Jain Irrigation Limited dominated the market in terms of production capacity in FY’2015.

“PVC pipes will gradually replace conventional piping systems in the market due to their lower cost and higher durability. CPVC pipes are expected to register fastest growth in terms of the production capacity in the next 5 years from FY’2015-FY’2020. Rising acceptance of CPVC pipes over galvanized or PVC pipes will lead to the growth in the future. The organized segment of the market is predicted to grow at a faster rate in the coming years with shifting preferences towards branded and quality products being witnessed in the domestic market”.

Currently in India approximately 73% of PVC is consumed by the pipe & fitting industries with the other sectors comprising only 27%.

Globally pipes & fitting account for only 43% of the PVC consumption showing PVC application in India other than pipe & fitting are still in the early stages and are primed for growth.
Although CPVC pipes & fittings contributed just 10% to the overall production capacity in 2017. It is the fastest growing segment of the PVC pipes and fittings industry in India.

An entrepreneur can well venture into this field.

The Reliance group, through Reliance and IPCL, accounts for two-thirds of the market share. The next largest player is Finolex group, which has a 16 per cent market share. The next two DCW and Chemplast have shares of 8 per cent apiece. The remaining share is catered to by DCM Shrirams. PVC has a unique position in the plastics sector on account of its unique features, and is headed for robust long-term...

India PVC pipes and fittings Market is expected to reach INR 391 billion by FY’2019

Future growth of India PVC pipes and fittings Market is expected to be led by rapidly increasing population leading to increased demand for agricultural production, expanding housing sector and significant role played by the government in the development of irrigation infrastructure and real estate sector in the country.

The market leader, Finolex Industries Limited is expected to maintain focus on research and development in its manufacturing plants to develop new products and widen its distribution reach, to stay ahead of its rivals in the market.

The Indian PVC pipes and fittings industry, which comprises of segments such as RPVC, PVC and CPVC pipes and fittings has grown significantly over the last few years due to the increase in the demand from irrigation sector on account of the burgeoning population and uncertain weather conditions in the country. The PVC pipes and fittings industry in India is highly fragmented. The market revenues have grown at a CAGR of 12.5% from FY’2009-FY’2014. There is a fierce competition in the market with a large number of organized and unorganized players engaged in the manufacturing and distribution of PVC pipes and fittings in the country. Finolex Industries Limited dominated the market in terms of production capacity in FY’2014.

The India PVC pipes and fittings market will grow at a double digit CAGR over the period FY’2014-FY’2019 and is projected to reach INR 391 billion by FY’2019. Increased government’s thrust on infrastructure development, rising demand from construction sector, expansion in the housing sector and burgeoning population leading to increased demand for agricultural production, will drive the market growth in the coming years.
“PVC pipes will gradually replace conventional piping systems in the market due to their lower cost and higher durability. CPVC pipes are expected to register fastest growth in terms of the production capacity in the next 5 years from FY’2014-FY’2019. Rising acceptance of CPVC pipes over galvanized or PVC pipes will lead to the growth in the future. The organized segment of the market is predicted to grow at a faster rate in the coming years with shifting preferences towards branded and quality products being witnessed in the domestic market.

The PVC pipes are as an ideal arbetitute for conventional pipes such as galvanized iron pipes, Cast Iron spun pipes and cement pipes in many areas. PVC pipes is latest innovation and have several advantages over our conventional pipes. PVC pipes score over other pipes by virtue of this following properties.

1) Non collision.
2) Light weight.
3) Low cost of Transportation handling, and storage.
4) Low Installation costs.
5) Smooth Interval and external surface, thus ensuring negligible friction resistance of fluids.
6) High inertners to chemical reaction.
7) Bad conductors of electricity.
8) Low thermal conductivity.
9) Self extinguishing characteristics.
## PRODUCTION OF PVC AND CPVC PIPES FROM 2007 TO 2017

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<th>Year</th>
<th>Quantity (MT.)</th>
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<td>56,000</td>
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<tr>
<td>2008-09</td>
<td>64,400</td>
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<td>2009-10</td>
<td>74,060</td>
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<td>2010-11</td>
<td>85,169</td>
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<td>2011-12</td>
<td>97,944</td>
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<td>2012-13</td>
<td>1,11,656</td>
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<td>1,25,054</td>
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<td>2015-16</td>
<td>1,56,868</td>
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<tr>
<td>2016-17</td>
<td>1,65,740</td>
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</table>
PVC pipes offers the following advantages:-

- Low Cost of materials.
- Low installation cost.
- Easy handling and joining light weight.
- Non-toxic
- Resistant to most chemical
- Low hydraulic losses - smooth bore.
- Low operating and maintenance cost.
- Resistance to abrasion.
- Non conductor of electricity.
- No deposit formation.
- Low thermal conductivity.
- Can be joined to other materials.
- Low energ cost in manufacturing.
- Self colours grey - no painting or colour blending of system is required.

Today, the per capita consumption of plastics in India is only 6 Kilos, against the world average of 27 kilos. The per capita consumption of plastics is more than 100 kilos in developed countries.
TREND IN INCREASE IN DEMAND

Trend growth rate in increase of demand = 15%

The use of plastics pipes and fittings in all regions of the world continues to grow with PVC representing over 60% of the plastic pipe used. The cost performance benefits and decades of successful use make PVC the logical material of choice for pipe applications such as drainage, sewage drinking water and irrigation.

Within the PVC pipe market, lead based heat stabilizers are still the most widely used heat stabilizer accounting for nearly 50% of the worldwide volume. In fact, lead based stabilizers dominate the PVC stabilizer market in all regions except the North American, where lead stabilizers were phased out in the 1970s and tin stabilizers predominant. Within the Asian region including India, China, Japan and Australia lead based stabilizers still predominate but the move away from lead has accelerated.

Although the move away from lead based stabilizers in North America started in the 1970s, only recently have other regions started to initiate a move away from lead. In Europe, environmental concerns and regulatory issues have pushed for the elimination of lead based heat stabilizers over the next five years. European heat stabilizer manufacturers have made a voluntary commitment, called Vinyl 2010* to achieve a 50% reduction in lead stabilizer use by 2010 and to be lead free in 2015. This commitment also applies to the plastic pipes and fittings industry represented by TEPPFA (i). TEPPFA calls for a phase out of lead stabilizers in the EU for pipes and fittings made of virgin PVC targeting 25% reduction in 2005, 75% in 2010 and 100% in 2015. Other regions including the countries of Australia, Japan and South Africa have even more aggressive time tables for the elimination of lead stabilizers. It is expected that the rest of the world will follow with a progressive elimination of the lead based stabilizers.

CaZn stabilizers are already proposed as alternatives to lead based stabilizers for pipe applications. However, the performance/price ratio of CaZn stabilizers has often not been viewed as being attractive enough to accelerate the phase out of lead stabilizers before regulations mandate a total change.

In an effort to produce an alternative to lead stabilizers and to overcome the deficiencies associated with traditional CaZn stabilizers, the Rohm and Haas Company has developed a new system. AdvapackTM NEO Heat Stabilizer, that is based on a derivative of the mercaptan chemistry which has been used
for decades with conventional tin mercaptide stabilizers. This patented technology includes organic based, heavy metal free compositions that contain blocked thiols, which under vinyl processing conditions, generate highly active stabilizing components.

**Enhanced recycling properties for PVC pipes**

The recycling of PVC pipes is important to maintaining the environmental and financial sustainability of PVC. For example in 2006, PVC recycling in Europe doubled and the European Plastic pipe industry represented by TEPPFA continues to push for even more recycling of pipe products in the coming year.

The use of recycled PVC materials can lead to several complications including color variation and rheological difficulties due to advanced decomposition of PVC.

To evaluate stabilizer impact on the ability for recycling, PVC pipe formulations were processed, ground and re-processed several times, using either 100% recycled material or 20% recycled material mixed with 80% fresh dry blend. The Advapack TM NEO system has been compared to a commercial CaZn one pack. The impact on rheology and color has been evaluated under the test conditions.
OVERVIEW OF PVC

Fundamentally, PVC is a synthetic resin made from the polymerization of vinyl chloride. It is the third largest plastic in production and consumption. Technology has gradually improved over time with improvements in safety, product quality, production volume, environmental issues and cost. A key feature of PVC is that it can be combined with additives and fabricated into a wide variety of forms. These include pipes and fittings, profiles and tubes, windows and doors, sidings, wires and cables, film and sheets, toys and other moulded products and floorings. This quality, together with features such as durability, self-extinguishing property, resistance to most chemicals and oil, mechanical strength and ease of processing, means that PVC is a competitive and attractive option for many end uses in construction and infrastructure, agriculture, electrical products and healthcare. Further, only 43% of PVC’s content comes from oil. The balance 57% comes from salt, meaning that PVC is less dependent on fossil fuels compared to other materials. This feature, coupled with the fact that PVC products can last up to 100 years, can be recycled and can provide products with good quality to price ratio, greatly reduces life cycle costs of PVC.

Global scenario

Globally, the growth of the industry over the last 100 years has been spectacular. Production capacity has grown from a few thousand tons in the 1930s to over 50 million tons today. The global capacity break-up is given below.

Growth in demand will be concentrated in developing countries in Asia, Africa, Latin America and the BRICS. The per capita consumption in India of 2kg is low compared to 11.8kg per capita in the US and 10.3 kg per capita in China. The forecasts for the PVC industry are bright. The global market, currently at US$ 56 billion, is expected to reach revenue of US$65 billion in 2019, with average annual demand expected to increase at 3.9%.

The global consumption of PVC in 2014 was estimated at 40 million tons. The region wise break-up is given below.
Indian Scenario

India has been producing PVC for over 50 years now, with the first plant of 6ktpa capacity set up by Calico Mills Ltd., in Mumbai in 1961. After this, India never looked back till about the mid-2000s.

The figure below illustrates how, after the drop in duty levels in mid 2000s, capacity addition completely lagged demand growth, resulting in the zooming import numbers.

Currently, in India, approximately 73% of the PVC is consumed by the Pipes & Fittings industries with the other sectors comprising only 27%. Globally, Pipes & Fittings account for only 43% of the PVC consumption, showing that PVC applications in India other than Pipes & Fittings are still in the early stages and are primed for growth. This, along with the relatively low per capita PVC consumption in India, shows that future prospects for the Indian PVC processing industry are bright.
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PVC PIPE MANUFACTURERS/EXPORTERS
RAW MATERIAL SECTION

PVC RESIN:

Polyvinyl chloride (PVC) is one of the most important thermo-plastics in the world to-day.

Though polyvinyl chloride was made in the laboratory more than a century ago, commercial exploitation of the chemical came only in the 1930’s especially with the discovery of plasticizer by B.F. Goodrich Chemical Co. U.S.A. because use of plasticizer made it possible to convert the otherwise horny and difficult materials, viz. PVC into a workable plastic. Efforts during the second world war days for finding substitute for conventional materials like natural rubber, which were in short supply gave a boost for intensive research and development of various synthetic materials, especially polymers. In the process, plasticized PVC got considerable importance as the nearest substitute for rubber.
DIMENSION OF PVC PIPE

PVC Pipe & Fittings Dimensions (Sch 40 / Sch 80)

<table>
<thead>
<tr>
<th>Nom. Pipe Size (in)</th>
<th>O.D.</th>
<th>Average I.D.</th>
<th>Min. Wall</th>
<th>Nominal Wt./Ft.</th>
<th>Maximum W.P. PSI*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8</td>
<td>0.405</td>
<td>0.249</td>
<td>0.068</td>
<td>0.051</td>
<td>810</td>
</tr>
<tr>
<td>1/4</td>
<td>0.540</td>
<td>0.344</td>
<td>0.088</td>
<td>0.086</td>
<td>780</td>
</tr>
<tr>
<td>3/8</td>
<td>0.675</td>
<td>0.473</td>
<td>0.091</td>
<td>0.115</td>
<td>620</td>
</tr>
<tr>
<td>1/2</td>
<td>0.840</td>
<td>0.602</td>
<td>0.109</td>
<td>0.170</td>
<td>600</td>
</tr>
<tr>
<td>3/4</td>
<td>1.050</td>
<td>0.804</td>
<td>0.113</td>
<td>0.226</td>
<td>480</td>
</tr>
<tr>
<td>1</td>
<td>1.315</td>
<td>1.029</td>
<td>0.133</td>
<td>0.333</td>
<td>450</td>
</tr>
<tr>
<td>1-1/4</td>
<td>1.660</td>
<td>1.360</td>
<td>0.140</td>
<td>0.450</td>
<td>370</td>
</tr>
<tr>
<td>1-1/2</td>
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<td>1.590</td>
<td>0.145</td>
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<td>330</td>
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<tr>
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<td>0.720</td>
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<tr>
<td>2-1/2</td>
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<td>1.136</td>
<td>300</td>
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<tr>
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<tr>
<td>3-1/2</td>
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<td>3.521</td>
<td>0.226</td>
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<tr>
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<tr>
<td>24</td>
<td>24.000</td>
<td>22.544</td>
<td>0.687</td>
<td>33.652</td>
<td>120</td>
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## Schedule 80 PVC Pipe Dimensions

<table>
<thead>
<tr>
<th>Nominal Pipe Size (in)</th>
<th>O.D.</th>
<th>Average I.D.</th>
<th>Min. Wall</th>
<th>Nominal Wt./ft.</th>
<th>Maximum W.P. PSI*</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8</td>
<td>0.405</td>
<td>0.195</td>
<td>0.095</td>
<td>0.068</td>
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<tr>
<td>1/4</td>
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<td>0.282</td>
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<td>1130</td>
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<tr>
<td>3/8</td>
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<td>21.418</td>
<td>1.218</td>
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</table>
FORMULATION FOR PVC RIGID PIPES

Formulation - I

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. PVC</td>
<td>100</td>
</tr>
<tr>
<td>2. DIOP &amp; DAP</td>
<td>42</td>
</tr>
<tr>
<td>3. Lead Stearate</td>
<td>3</td>
</tr>
<tr>
<td>4. Calcium Stearate</td>
<td>1</td>
</tr>
<tr>
<td>5. Mineral Precipitated Calcium carbonate</td>
<td>2.5</td>
</tr>
<tr>
<td>6. Colour</td>
<td>1.5</td>
</tr>
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</table>

PVC FLEXIBLE PIPES
(Agricultural Pipes)

Formulations

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Parts</th>
</tr>
</thead>
<tbody>
<tr>
<td>PVC resin (K - value 70)</td>
<td>100</td>
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<tr>
<td>Dioctyl Phthalate</td>
<td>40</td>
</tr>
<tr>
<td>Chlorinated Paraffin wax</td>
<td>5</td>
</tr>
<tr>
<td>Ba - Cd liquid Stabilizer</td>
<td>3</td>
</tr>
<tr>
<td>Stearic Acid</td>
<td>1</td>
</tr>
<tr>
<td>Colors &amp; Dyes</td>
<td>0.2</td>
</tr>
</tbody>
</table>
**Process of Manufacture**

(1) Compounding PVC and other ingredients.
(2) Extrusion Forming.
(3) Sizing of Extruded Pipe.
(4) Cooling of Pipe in cooling bath.
(5) Pulling of Pipe.
(6) Cutting to length or winding in coil form.

PVC compounds is prepared by mixing in a high speed mixer after which the mix is fed into the extruder for forming pipe. The flexible PVC pipes is processed at 170°C to 190°C. The same extruder can be used for different size of pipes. The flexible pipe is pulled out of the die and cooled with chilled water in the cooling tank by the haul off unit. The cooling tank is continuously circulated with cold water to cool the processed pipes.

The hoses formed are Cvt into specific lengths, depending upon the requirement by a cutting device. The product is rolled by a winding machine.

**PLUMBING PIPES**

<table>
<thead>
<tr>
<th>O.D. (mm)</th>
<th>Min</th>
<th>Well thickness</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>2.8</td>
<td></td>
<td>3.3</td>
</tr>
<tr>
<td>25</td>
<td>2.9</td>
<td></td>
<td>3.4</td>
</tr>
<tr>
<td>32</td>
<td>3.4</td>
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<td>3.9</td>
</tr>
<tr>
<td>40</td>
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<td>4.2</td>
</tr>
<tr>
<td>50</td>
<td>3.7</td>
<td></td>
<td>4.3</td>
</tr>
</tbody>
</table>
USES & APPLICABILITY OF PVC COMPOUNDS

To-day among various thermoplastics, PVC occupies a front line with respect to its utility and diversity of applications. This is due to remarkable and unique versatiscility of PVC. From the basic polymer to the working formulation which contains other chemical and additives, one has a large spectrum of choice to tailor the material to suit any specific and use. Thus PVC finds applications in almost, all the major areas of importance in the human society following are some of the important in the human society.

Following are some of the important applications of PVC compound and its formulations.

Building and construction:

PVC pipes for water supply, pressure pipes, for DWV roofing, wall covering hand rails, sidings, claddings floor tiles, water stopps, door and windows frames, swimming pool liners, weather strippings etc. Wires and cables conduits, plugs and sockets, other electrical accessories and fittings.

Packaging:

Film for shrink wrapping, socks and liners, bottles and containers, sachets pouches for toiletries, blister packs and vacuum forming, closure liners and gaskets.

Miscellaneous:

Rain wear goods, peneties, refrigerator door liners, book covers and stationary supplies tools and hardware, coating for protection and decorative purpose, battery separators etc.
MANUFACTURING PROCESS OF PVC PIPES

The plastic raw materials required to obtain desired product properties are mixed and heated. Depending on the raw material mix, the melting process requires a temperature of approx 200°C. The material mix is heated in an extender when the presses the hot moldable plastic mass through a die to shape the pipes. The calibrator in the casing head is adjusted to the desired pipe diameter. Pipe accessories are shaped in molds from the heated raw materials.

After shaping, the pipes are cooled and hardened or a water bath. The continuous pipe string is then cut to the desired length.

PVC pipes are created by starting with a molten mixture of the material and shaping them around a cast. The casts are made to be the exact width of the pipe. The mixture is poured into a cast and surrounded by an outer shell. The complete set is then placed into an oven to be cooked. Once the pipe has solidified, it is cooled and moved into finishing. Sections of the pipe are then cut based on common sizes and needs. The sections are then coated in a chlorine solution to prevent harmful bacteria from growing during shipping and use. Once the coating is dried, the ends of each section are finished. If the pipe is a smooth connection, the top of the pipe is sanded down to ensure a perfectly flat surface. For fitted pipes, a machine engraves a series of grooves into the pipe. As the grooves are cut, high-pressured water is sprayed on the pipe to remove excess PVC fragments. After the grooves are added, the ends are smooth and the sections are sent into testing.

Because PVC pipes are used in many housing and commercial construction applications, it is important that each pipe is tested to ensure quality. To do so, the pipes are tested for their seal, connection (on grooved sections), and strength. The seal tests are conducted by adding special cement to the pipe and allowing it to dry. Once this is complete, a series of liquids are passed through the pipe at high pressure. If no leaks occur, the cement is removed and the section is cleaned. For fitted pipes, a similar process takes place without the cement. The final test of the pipes is to ensure their strength. This is completed by using several presses that push weight down on the pipe. If the section does not break or show stress points, it is sent for packaging and shipping. If a section fails at any point in the process, it is sent back to be melted down and re-constructed."
PROCESS OF MANUFACTURE OF RIGID PIPES

Rigid or unplasticized PVC pipes are made from polyvinyl chloride (PVC) which in resin form is hard and rigid material. This rigidity can be controlled by controlling the percentage of plasticizer at the time of compounding. The production of rigid PVC pipes consists of plasticizing and homogenizing PVC compound and metering through and extruder. This hot molten PVC compound is extruded by the extruder through a circular slit. This circular slit governs the size of the pipe to be extruded. Different dies are used for manufacturing different sizes of pipes.

The pipe thus extruded through the die is then passed through a vacuum sizing tank where the dimensions of the pipe can be accurately set. This also helps in the surface finish of the pipe. Vacuum sizing which is more sophisticated than other types of forming operations reduces the percentage of wastage considerably.

TWIN SCREW EXTRUDERS

The various design changes for the counter rotating intermeshing Twin Screw Extruders, which are predominantly used for the processing of PVC powder mixed are as follows:

Introduction of modular construction systems for entire type series.

Increasing of barrel lengths.

Increasing of the screw speed range,

Increasing the torque for the screws.

Improved drives and reduction gears,

Reliable long life radial load bearings for the screw drive shafts with improved axial load bearings (cylindrical roller bearings in single and random arrangement).
Metallurgically optimized steel alloys for screws and barrels with special heat treatment, partly with surface protection coatings also.

The outstanding processing developments in respect of twin screw extruders are:

Introduction and improvements of barrele venting.

Lengthening of screws and thereby more clearly defined energy transfer,

Improved temperature control systems for screws a barrels,

Introduction of mixing zones of screws,

Use of polyolefin’s in powder form with fillers.

EXTRUSION DIES

The compilation of numerous computer programmes to assist design calculations for melt flow channels has been a decisive contribution towards the development of extrusion dies.

Calculations and practical values permits the manufacture of dies independent of melt viscosities. The application range of one extrusion die is increased so that various thermoplastics resins at high output rates can be extruded without losing their requirements for uniformity and dimensional precision.

As far as calculation is concerned, the consideration of the extruder and die as one unit has become of increasing importance in order to calculate output rates more precisely.

Extrusion dies used for the co extrusion process have kept their unchanged position compared to the adopter technology. The dominating use concerning the extrusion of different melt viscosities at various output rates is obvious.
EXTRUSION LINES:-

The extrusion line passes through very different steps of development dependent on the product quality and the thermoplastic resin to be processed.

In general, an extrusion line can be divided into three operation section, to evaluate and to determine these section parameters with their limit values influencing the product quality.

a) Extrusion section:

Feeding of the materials, extruder with auxiliary equipments.

b) Melt forming section:

Die head and sizing die.

c) Conversion into the final product:

Cooling and calibrating units, transport, cutting and stacking.

In recent years, there was an increased use of measurement and control technology. Additionally the advanced penetration by micro-electronics results in the application of specified process control systems.

In this respect, a main selection criteria is the acceptable price/performance relationship between the additional costs involved and the improvement in technique achieved in combination with the rate of product quality improved. Therefore the automation system has to match the particular plant type and desired degree of automation.

As the pipe being extruded is rigid in form they cannot be wound into coils, so as in line motorized cutting device should be provided for cutting the pipes into required sizes.
Since the performance requirement for the rigid pipes are quite critical the unit should preferably be equipped with process control laboratory for the preliminary testing of raw materials for asserting the consistency in their quality. The unit may also have arrangement for quality testing of pipes. Details of testing equipment have been given under machinery and equipments.

**PVC PIPE FITTINGS:-**

For manufacturing same procedure is applied as in the case of pipe manufacture. Fittings are manufactured by using different dies made for different kinds of fittings. These dies are fitted on the moulding machine and molten PVC is charged in them. The dies are removed and the produced form is removed and the die is again set on the moulding machine. The same process is repeated.

Elbows and T-joints are manufactured using elbow moulding machine in which molten PVC is charged in the die and compressed air is injected in the die to get the desired product.
PLASTICIZER OF PVC

Plasticizers are used to modify the hardness of unplasticized PVC so as to produce flexible products. The main points to consider while selecting plasticizers are: compatibility, solvating characteristics, permanence efficiency and economy.

If the solvating rate of plasticizer is higher, the fusion temperature of the compound is lower. But plasticizers with high solvating rate do not necessarily have higher compatibility e.g. BBp has very high solvating rate but lower compatibility as compared to DOP.

Simple diester plasticizers like DOP do not present heat stability problems. Phosphate plasticizers like TCP increase flame resistance but decreases the heat stability of product. Higher than normal epoxy and stabilizer level are required while using phosphate plasticizers.
FILLERS OF PVC

Fillers are added in PVC compound to reduce the latter's cost. While adding fillers care should be taken to add about 0.1 part extra lubricants with every 8 parts of fillers. Activated calcium carbonate, calcium silicate and whiting are the most commonly used fillers at present for the manufacture of PVC leather cloth, industrial sheets and flexible sheets.
STABILIZERS

Stabilizers are added to PVC compound to prevent discoloration during processing and to maintained product properties during service life. Stabilizers do not prevent degradation process. The function of stabilizer in PVC compound is very important because even if 0.01 per cent of the total PVC degrades, the entire color of the compound or product may become black.

There are over 2,000 stabilizers are available for use in PVC compounding and practically all are manufactured in India. Regardless of their large number, the stabilizers can be grouped according to their chemical composition and use into (a) lead compounds (b) organotin compounds (c) barium-cadmiums (d) stabilizers for non-toxicity (e) epoxy compounds, and (f) UV stabilizers etc.
PROCESS FLOW SHEET FOR THE MANUFACTURE OF PVC PIPES

PVC RESIN → MIXER → EXTRUSION → COOLING & CUTTING

INGREDIENTS

SCRAP GRINDER

P.V.C. PIPEES OF 4.5mm THICKNESS

INSPECTION & TESTING

PACKING & STORAGE
PROCESS FLOW SHEET FOR THE MANUFACTURE OF PVC FITTINGS

1. PVC RESIN
2. MIXER
3. INJECTION MOULDING M/C
4. PHYSICAL INSPECTION & TESTING OF FILLING
5. INGREDIENTS (OTHERS)
MANUFACTURING PROCESS
OF PVC & CPVC PIPE FITTING

PVC and CPVC pipe fitting are made on the injection moulding machine. The PVC & CPVC Compounds are fed into the hopper of the injection moulding machine which essentially has a mould locking and injection arrangements. The mould is held in between the platens, which are kept closed by the locking pressure and the materials, which get plasticized by the heating arrangements, is injected under this pressure into moulds which result, into a moulded and high quality product. Mould should have proper injection arrangement for consistent high production.
The pressure generated can be changed by varying screen pack composition either by changing the number of screens or by adjusting wire weave size or also by changing other parameters. The function of converting rotational of the molten plastic into longitudinal memory is done by breaker plate and screen pack combination. After passing through the breaker plate, molten plastic enters the die.

The die gives the final product. The die profile must be designed effectively such that the molten plastic evenly flows from a cylindrical profile to the profile shape of the product. Uneven flow at this stage would produce the product with unwanted stresses at certain points in the profile. These stresses can cause warping upon cooling. Almost any imaginable shape can be created so long as it is a continuous profile. The product must now be cooled and this is usually achieved by pulling the extrudate through a water bath.

Plastic is a very good thermal insulator and therefore it is difficult to cool quickly. When compared with the conduction of heat in plastic it is 2000 times much slower than steel. In a plastic extrusion line, a sealed water bath is acted upon by a carefully controlled vacuum to keep the newly formed and still molten tube or pipe from collapsing. Once the product is cooled, it can be spooled, or cut into desired length for further use.

**Plastic Extrusion Screw**

The screw design is an important factor to produce a quality product. Different types of polymer will have different screw designs.
Often the screw length, when it is referenced to its diameter is given by L: D ratio. For instance, a 6-inch (150 mm) diameter screw at 24:1 will be 144 inches (12 ft) long, and at 32:1 it is 192 inches (16 ft) long. An L: D ratio of 24:1 is common, but at the same screw diameter in some machines goes upto 32:1 for more mixing and more output. Two-stage (vented) screws are typically 36:1 to account for the two extra zones. Depending on the number of heaters used for controlling the temperature, each zone is equipped with one or more thermocouples. The flow of heat from one stage to another causes bad transient response for the heating process under set point and load variation is not indicated with the papers. The varying parameters and the system complexity and the need of mathematical model are the problem of the PID controllers.

The PID controllers are with more transient state at the time of set point changes because the plastic extruder is with more set point temperatures and take more time to stable in the set point temperature.
DETAILS OF INJECTION MOLDING FOR PIPE FITTINGS

Injection molding is the most commonly used manufacturing process for the fabrication of plastic parts. A wide variety of products are manufactured using injection molding, which vary greatly in their size, complexity, and application. The injection molding process requires the use of an injection molding machine, raw plastic material, and a mold. The plastic is melted in the injection molding machine and then injected into the mold, where it cools and solidifies into the final part.
Process Cycle

The process cycle for injection molding is very short, typically between 2 seconds and 2 minutes, and consists of the following four stages:

1. **Clamping** - Prior to the injection of the material into the mold, the two halves of the mold must first be securely closed by the clamping unit. Each half of the mold is attached to the injection molding machine and one half is allowed to slide. The hydraulically powered clamping unit pushes the mold halves together and exerts sufficient force to keep the mold securely closed while the material is injected. The time required to close and clamp the mold is dependent upon the machine - larger machines (those with greater clamping forces) will require more time. This time can be estimated from the dry cycle time of the machine.

2. **Injection** - The raw plastic material, usually in the form of pellets, is fed into the injection molding machine, and advanced towards the mold by the injection unit. During this process, the material is melted by heat and pressure. The molten plastic is then injected into the mold very quickly and the buildup of pressure packs and holds the material. The amount of material that is injected is referred to as the shot. The injection time is difficult to calculate accurately due to the complex and changing flow of the molten plastic into the mold. However, the injection time can be estimated by the shot volume, injection pressure, and injection power.

3. **Cooling** - The molten plastic that is inside the mold begins to cool as soon as it makes contact with the interior mold surfaces. As the plastic cools, it will solidify into the shape of the desired part. However, during cooling some shrinkage of the part may occur. The packing of material in the injection stage allows additional material to flow into the mold and reduce the amount of visible shrinkage. The mold cannot be opened until the required cooling time has elapsed. The cooling time can be estimated from several thermodynamic properties of the plastic and the maximum wall thickness of the part.
4. **Ejection** - After sufficient time has passed, the cooled part may be ejected from the mold by the ejection system, which is attached to the rear half of the mold. When the mold is opened, a mechanism is used to push the part out of the mold. Force must be applied to eject the part because during cooling the part shrinks and adheres to the mold. In order to facilitate the ejection of the part, a mold release agent can be sprayed onto the surfaces of the mold cavity prior to injection of the material. The time that is required to open the mold and eject the part can be estimated from the dry cycle time of the machine and should include time for the part to fall free of the mold. Once the part is ejected, the mold can be clamped shut for the next shot to be injected.

After the injection molding cycle, some post processing is typically required. During cooling, the material in the channels of the mold will solidify attached to the part. This excess material, along with any flash that has occurred, must be trimmed from the part, typically by using cutters. For some types of material, such as thermoplastics, the scrap material that results from this trimming can be recycled by being placed into a plastic grinder, also called regrind machines or granulators, which regrinds the scrap material into pellets. Due to some degradation of the material properties, the regrind must be mixed with raw material in the proper regrind ratio to be reused in the injection molding process.

**Equipment**

Injection molding machines have many components and are available in different configurations, including a horizontal configuration and a vertical configuration. However, regardless of their design, all injection molding machines utilize a power source, injection unit, mold assembly, and clamping unit to perform the four stages of the process cycle.
Injection unit

The injection unit is responsible for both heating and injecting the material into the mold. The first part of this unit is the hopper, a large container into which the raw plastic is poured. The hopper has an open bottom, which allows the material to feed into the barrel. The barrel contains the mechanism for heating and injecting the material into the mold. This mechanism is usually a ram injector or a reciprocating screw. A ram injector forces the material forward through a heated section with a ram or plunger that is usually hydraulically powered. Today, the more common technique is the use of a reciprocating screw. A reciprocating screw moves the material forward by both rotating and sliding axially, being powered by either a hydraulic or electric motor. The material enters the grooves of the screw from the hopper and is advanced towards the mold as the screw rotates. While it is advanced, the material is melted by pressure, friction, and additional heaters that surround the reciprocating screw. The molten plastic is then injected very quickly into the mold through the nozzle at the end of the barrel by the buildup of pressure and the forward action of the screw. This increasing pressure allows the material to be packed and forcibly held in the mold. Once the material has solidified inside the mold, the screw can retract and fill with more material for the next shot.

Injection molding machine - Injection unit
Clamping unit

Prior to the injection of the molten plastic into the mold, the two halves of the mold must first be securely closed by the clamping unit. When the mold is attached to the injection molding machine, each half is fixed to a large plate, called a platen. The front half of the mold, called the mold cavity, is mounted to a stationary platen and aligns with the nozzle of the injection unit. The rear half of the mold, called the mold core, is mounted to a movable platen, which slides along the tie bars. The hydraulically powered clamping motor actuates clamping bars that push the movable platen towards the stationary platen and exert sufficient force to keep the mold securely closed while the material is injected and subsequently cools. After the required cooling time, the mold is then opened by the clamping motor. An ejection system, which is attached to the rear half of the mold, is actuated by the ejector bar and pushes the solidified part out of the open cavity.

*Injection molding machine - Clamping unit*
**Machine specifications**

Injection molding machines are typically characterized by the tonnage of the clamp force they provide. The required clamp force is determined by the projected area of the parts in the mold and the pressure with which the material is injected. Therefore, a larger part will require a larger clamping force. Also, certain materials that require high injection pressures may require higher tonnage machines. The size of the part must also comply with other machine specifications, such as shot capacity, clamp stroke, minimum mold thickness, and platen size.

Injection molded parts can vary greatly in size and therefore require these measures to cover a very large range. As a result, injection molding machines are designed to each accommodate a small range of this larger spectrum of values. Sample specifications are shown below for three different models (Babyplast, Powerline, and Maxima) of injection molding machine that are manufactured by Cincinnati Milacron.

*Injection molding machine*
Tooling

The injection molding process uses molds, typically made of steel or aluminum, as the custom tooling. The mold has many components, but can be split into two halves. Each half is attached inside the injection molding machine and the rear half is allowed to slide so that the mold can be opened and closed along the mold’s parting line. The two main components of the mold are the mold core and the mold cavity. When the mold is closed, the space between the mold core and the mold cavity forms the part cavity, that will be filled with molten plastic to create the desired part. Multiple-cavity molds are sometimes used, in which the two mold halves form several identical part cavities.
Mold base

The mold core and mold cavity are each mounted to the mold base, which is then fixed to the platens inside the injection molding machine. The front half of the mold base includes a support plate, to which the mold cavity is attached, the sprue bushing, into which the material will flow from the nozzle, and a locating ring, in order to align the mold base with the nozzle. The rear half of the mold base includes the ejection system, to which the mold core is attached, and a support plate. When the clamping unit separates the mold halves, the ejector bar actuates the ejection system. The ejector bar pushes the ejector plate forward inside the ejector box, which in turn pushes the ejector pins into the molded part. The ejector pins push the solidified part out of the open mold cavity.
Mold channels

In order for the molten plastic to flow into the mold cavities, several channels are integrated into the mold design. First, the molten plastic enters the mold through the sprue. Additional channels, called runners, carry the molten plastic from the sprue to all of the cavities that must be filled. At the end of each runner, the molten plastic enters the cavity through a gate which directs the flow. The molten plastic that solidifies inside these runners is attached to the part and must be separated after the part has been ejected from the mold. However, sometimes hot runner systems are used which independently heat the channels, allowing the contained material to be melted and detached from the part. Another type of channel that is built into the mold is cooling channels. These channels allow water to flow through the mold walls, adjacent to the cavity, and cool the molten plastic.
Mold design

In addition to runners and gates, there are many other design issues that must be considered in the design of the molds. Firstly, the mold must allow the molten plastic to flow easily into all of the cavities. Equally important is the removal of the solidified part from the mold, so a draft angle must be applied to the mold walls. The design of the mold must also accommodate any complex features on the part, such as undercuts or threads, which will require additional mold pieces. Most of these devices slide into the part cavity through the side of the mold, and are therefore known as slides, or side-actions. The most common type of side-action is a side-core which enables an external undercut to be molded. Other devices enter through the end of the mold along the parting direction, such as internal core lifters, which can form an internal undercut. To mold threads into the part, an unscrewing device is needed, which can rotate out of the mold after the threads have been formed.
Mold - Exploded view
UNBEATABLE HYDRAULIC PROPERTIES

Hydraulic Capacity

Comparison of hydraulic capacity: TOM© PVC-O PN16 pipes vs other materials (constant load loss)

Using pipes with a lower hydraulic capacity involves necessarily using a larger nominal diameter, which has a negative effect on both profitability and infrastructure investment costs. Using TOM© means you get more hydraulic capacity for your investments costs.

Water Hammer

Water hammers occur when liquid flowing through piping stops suddenly when a valve is open or closed, if a pump is stopped or started or by airlocks shifting within the pipe. Water hammers can place greater pressure on a pipe’s working pressure and lead to breakage, particularly when the pipe has already been damaged by impacts or corrosion.

Water hammers \( (P) \) depend on the celerity \( (a) \), which is the wave speed, and the fluid’s change of speed \( (V) \). The celerity depends basically on the pipe’s dimensions (the relationship between the external diameter and the minimum thickness) and the specifications of the material with which the tube is made (Young’s \( E \) module).

\[
P = \frac{a \cdot V}{g}; \quad a = \frac{1420}{\sqrt{1 + \left(\frac{k}{E} \cdot \frac{D_a}{\varepsilon_{min}}\right)^2}}
\]

PVC-O pipes have a significantly lower celerity than pipes made from other materials, particularly so with metal piping.
A range for all kinds of applications

Dimentions

PVC-O pipes are supplied in total lengths of 6 metres (socket included). For other lengths for special projects, price on request. Dimensions in inches are approximately.

Packaging

Joints and Water tight Seals

TOM© PVC-O pipes use the sector’s most reputable seal for high pressure drinking water pipes: the Anger-LockTM, by Trelleborg Forsheda Pipe Seals. The seal comprises a PP ring and a synthetic rubber lip that is an integrated part of the pipe, avoiding displacement from its setting or movement when installation is taking place.
FITTINGS

TAPPING SADDLES

Allow connecting the pipe in the perpendicular direction to all kinds of fittings (house connections, valves, purges, vents, etc. They are available with screws ends and flange ends.

FLANGE WITH ANTI-TRACTION SYSTEM

Allows connecting the spigot ends to all kinds of fittings with connection to a flange (valves, elbows, t´s, DN reductions, caps, etc).

FITTINGS WITH PLUGS EURO TYPE

Connected directly with the pipe allow to have deviations, reductions and connections on the net (elbows, t´s, DN reductions, etc).

Applications

Conduits for potable water transport. It is included both water abstraction and water distribution network to city centers, urban network and industrial areas, and water transfer to tanks and reservoirs. Pipelines for transport of water that have been treated to remove impurities. Water transport pipes for irrigation purposes. It includes irrigated land pipelines, water transfer to tanks and reservoirs.

OTHER APPLICATIONS

Sewage
Fire Protection Nets
Industrial Applications
Infrastructural Nets
PLANT LAYOUT

Raw Material storage 500 sq.mt.

Finished Product storage 500 sq.mt.

Testing Lab 100 sq.mt.

Processing Area 2000 sq.mt.

Administrative Building 200 sq.mt.

Total Land Area = 2 Acre (8000 sq.mt.)
SUPPLIERS OF PLANT AND MACHINERY

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WZ-523/28A, Basai Darapur, Near Bali Nagar,
Raja Garden, New Delhi - 110 015, Delhi, India
Phone: +(91)-(11)-25930536 / 25414789
Fax: +(91)-(11)-25423327

M/s Global Power Corporation
Shop no. 1, 8/16, Sector-3, Rajendra Nagar ,
Sahibabad, Ghaziabad - 201 005,
Uttar Pradesh, India
Phone: +(91)-(120)-6523437
Fax: +(91)-(120)-4573437
Website: www.globalpowercorporation.com/

Eskay Engineering System
No. 484-C, NH-47, Airport Road,
Opposite Suguna Kalyana, Mandapam,
Peelamedu, Coimbatore - 641 004,
Tamil Nadu, India
Phone: +(91)-(422)-6532890 / 4397495
Website: www.eskaycarwashers.com/air-compressors.html

Sony Systems
C-153, Sector-10,
Noida - 201 301, Uttar Pradesh, India
Phone: +(91)-(120)-2547899 / 3262845
Fax: +(91)-(120)-4223899
Website: www.launryequipmentsindia.com/turnkey-projects-machines.html
SUPPLIERS OF RAW MATERIALS

PVC RESIN

Tarang Exports P Ltd
Rk Poddaar (Director)
117, Jolly Bhavan-1, New Marine Lines
Mumbai - 400020, Maharashtra, India
Mobile: +(91)-9769000033, +(91)-8879003200
Telephone: +(91)-(22)-66512700, +(91)-(22)-66518094

Fine Flow Plastic Industries
Amrish Aggarwal (Partner)
No. 301, Almar Arcade, Marve Road,
Orlem, Above Punjab National Bank,
Near Borivali Briyani Centre, Malad (West)
Mumbai - 400064, Maharashtra, India
Mobile: +(91)-9892951218, +(91)-9321012301
Telephone: +(91)-(22)-28650970, +(91)-(22)-28650977

Aditya Molecules
401/C, Hetal Arch Premises,
Opposite Natraj Market, Malad West
Mumbai - 400064, Maharashtra, India
Mobile: +(91)-9987132089
Telephone: +(91)-(22)-28806344, 28805863

Jai Enterprises
Office No. 300, Building No. H- 2,
Apra North Extension Plaza,
Netaji Subhash Place, Pitampura
New Delhi - 110034, Delhi, India
Mobile: +(91)-9811610823, 9811610973
Telephone: +(91)-(11)-45596775, +(91)-(11)-65800980
CALCIUM STEARATE

Lumega Industries
Ramesh Mehendale (Proprietor)
Lumega Industries, Flat No. 401/402 4th Floor,
Jeevan Deep Building, Baburao Parulekar Marg,
Off Gokhale Road S, Dadar West, Mumbai - 400028,
Maharashtra, India
Mobile: +(91)-9820963816
Telephone: +(91)-(22)-24363008

Eklingjee Polymers Private Limited
Ashish Aggarwal (Director)
27/14, 2nd Floor, Nangia Park, Shakti Nagar.
Nearest Metro Is Vishvividya, Subhash Nagar,
Delhi, India
Mobile: +91-9310691474, +91-9910233904
Fax: +91-11-23936365

Remedy Labs
Hemant Joshi (CEO)
Plot No. 260, Phase - I, G. I. D. C.,
Naroda, Ahmedabad - 382330, Gujarat, India
Mobile: +91-9825060087, +91-9375060087
Telephone: +91-79-22810517, +91-79-40080087

Global Medicines Limited
Mukesh Vaswani
N. H. 8, Near Gutal Crossing Gutal-
Uttarsanda Road, Uttarsanda,
Nadiad - 387370, Gujarat, India
Mobile: +91-9824041895, 91-9377445454
Telephone: +91-268-2588066, +91-268-2588606
Fax: +91-268-2588606
LEAD STEARATE

Eklingjee Polymers Private Limited
Ashish Aggarwal (Director)
27/14, 2nd Floor, Nangia Park,
Shakti Nagar. Nearest Metro Is Vishwavidya,
Subhash Nagar, Delhi - , India
Mobile: +91-9310691474, +91-9910233904
Fax: +91-11-23936365

Jai Enterprises
Himanshu Aggarwal
Office No. 300, Building No. H- 2,
Apra North Extension Plaza,
Netaji Subhash Place, Pitampura,
New Delhi - 110034, Delhi, India
Mobile: +91-9811610823, +91-9811610973
Telephone: +91-11-45596775
Fax: +91-11-45596775

Styro Chemical Industries
Nitin Maheshwari (Owner)
Works 280 Chhapraula Gb Nagar,
Office E-132 Shastri Nagar Merrut,
Ghaziabad - 201301, Uttar Pradesh, India
Mobile: +91-9808172830, +91-9897686470

Pocl Enterprises Limited
Y. V. Raman(Director - Marketing)
New No.4, Old No.319, Valluvarkottam High Road,
2nd Floor, Nungambakkam, Nungambakkam High Road,
Chennai - 600034, Tamil Nadu, India
Mobile: +91-9884231431
Telephone: +91-44-49145454, +91-44-28251418
Fax: +91-44-49145455
PRECIPITATED CALCIUM CARBONATE

Gangotri Inorganic (p) Ltd.
Rajesh Tiwari (Director)
Mr. Archit Pokar
No. 311, Anand Mangal- 1,
Behind Femina Town Near Stadium Circle,
C. G. Road, Navrangpura, Ahmedabad - 380009,
Gujarat, India
Mobile: +91-9725738888, +91-9898237777
Telephone: +91-79-30026789, +91-79-40077772

Lime Chemicals Limited
Rahim Dawoodani (Director)
Neco Chamber Premises Cooperative Society Limited,
Off. No. 404/405, 4th Floor, Plot No. 48 Sector- 11,
C.B.D. Belapur, Navi Mumbai - 400614, Maharashtra, India
Mobile: +91-9820849869, +91-9891499004
Telephone: +91-22-27561977, +91-22-27561980

Suday Minerals & Chemicals Private Limited
Gopal Agrawal (Managing Director)
T-5, Panoramic Apartment, Fatehsagar Road,
Dewali, Udaipur - 313001, Rajasthan, India
Mobile: +(91)-9829044395, +(91)-9414157615
Telephone: +(91)-(294)-2451615, +(91)-(294)-2650267

Kunal Calcium Limited
Puneet Nayyar (CEO)
SCO-17-20F, Dav Market, Opposite Madhu Hotel
Yamunanagar - 135001, Haryana, India
Mobile: +(91)-9896391205, +(91)-8800208822
Telephone: +(91)-(1732)-222797, +(91)-(1732)-235797
Fax: +(91)-(1732)-222796
PIGMENT DYE

Kolorjet Chemicals Pvt Ltd.
B/5, Raj Ratan Industrial Estate,
Next To American Spring,
Liberty Garden Road, Malad West
Mumbai - 400064, Maharashtra, India
Mobile: +(91) - 9920645611, +(91) - 9867650609
Phone: +(91) - (22) - 28826803, +(91) - (22) - 28826795

A. B. Enterprises
Manoharlal Bang (Partner)
No. 202, Shradanand Building,
No. 272/ 274, Samuel Street,
Mumbai - 400003, Maharashtra, India
Mobile: +(91)-9892424605, +(91)-9869434794
Telephone: +(91)-(22)-23435097, +(91)-(22)-66312586

Nitin Dye Chem Pvt. Ltd.
Mukesh Parekh (Marketing)
Plot No. 195, Phase II,
GIDC Estate, Vapi - 396195, Gujarat, India
Mobile: +(91)-9820369520
Telephone: +(91)-(22)-24083334, +(91)-(22)-24035006
Fax: +(91)-(22)-24083672

Khatau Valabhdas & Company
No. 142, D. N. Road, No. 102,
First Floor, Indian Globe Chambers,
Opposite McDonald, C.S.T.,
Mumbai - 400001, Maharashtra, India
Mobile: +91-9322507259, +91-9821223508
Telephone: +91-22-22611655, +91-22-22611656
Please note: Cost Economics shall be provided in Excel Format. Here data has been provided for samples purpose and copied from excel to this document for your reference only.

PVC AND CPVC PIPE AND FITTINGS MFG. PLANT [EIRI/EDPR/3527] J.C.1613
J.C.  1613
Page A- 1

PLANT ECONOMICS

Rated Plant capacity  =  13.00 MT/day
                       = 3900.00 MT/annum

PVC & CPVC PIPES & FITTING

Basis

No. of working days   =  25 days/month
                       = 300 days/annum

No. of shifts         =  3 per day

One shift             =  8 hours

4000 Kgs/Day=PVC Pipe
4000 Kgs/Day=cPVC Pipes
2500 Kgs/Day = PVC Pipes Fitt
2500 Kgs/Day = cPVC Pipes Fitt

Currency - Rs.
LAND & BUILDING

1. Land area 2 Acres (8000 sq.mtrs) on lease  
2. Processing area 2000 sq.mtrs  
   @Rs. 10,000/-sq.mtrs.  
   Rs. 2,00,00,000.00
3. Raw material storage 500 sq.mtrs.  
   @Rs. 8,000/-sq.mtrs.  
   Rs. 40,00,000.00
4. Finished Product storage 500 sq.mtr  
   @Rs. 8,000/-sq.mtrs.  
   Rs. 40,00,000.00
5. Testing Lab 100 sq.mtrs.  
   @Rs. 10,000/-sq.mtrs.  
   Rs. 10,00,000.00
6. Administrative Building 200 sq.mtrs  
   @Rs. 10,000/-sq.mtrs.  
   Rs. 20,00,000.00
7. Misc. Boundary wall, Gate etc.  
   Rs. 10,00,000.00

------------------------  
TOTAL Rs. 3,20,00,000.00  
------------------------
## PLANT & MACHINERY

1. Twin screw CPVC pipe plant  
   Polymer used-CPVC Dry Blend  
   Cap: 300 kg/hr consist of 66mm/30  
   D x 2 Twin screw extruder, Diehead  
   for CPVC (Double Exit), Set of Pin  
   Bush and Calibrator, Vacuum sizing.  
   Tank, Haul off unit, cutting saw  
   unit, Tripping chute, Touch screen  
   process control panel etc.  
   Pipe Dia Range-15-63mm  
   1 No. Rs. 1,00,00,000.00

2. Twin screw PVC pipe plant  
   Polymer used-PVC Dry Blend  
   Cap: 400 kg/hr consist of 66mm/30 L/D Ratio x 2  
   Twin screw extender, Die head, Set  
   of Pin, Bush and calibrator,  
   Vacuum sizing tank, Haul off unit,  
   cutting saw unit, Tripping chute,  
   touch screw process control panel  
   pipe Dia range-63 to 200 mm  
   1 No. Rs. 80,00,000.00

3. Automatic Horizontal Injection  
   Moulding Machine of shot capacity  
   up to 500 gm with hydraulic pumps  
   & Motor and Mould clamping force  
   of 180 Metric Tons  
   1 No. Rs. 35,00,000.00

4. Chilling Plant  
   1 No. Rs. 10,00,000.00

5. Air Compressor  
   1 No. Rs. 3,00,000.00

6. High speed compounding mixer  
   1 No. Rs. 8,00,000.00

7. Hopper Loader Cum Dryer  
   1 No. Rs. 3,00,000.00

8. Dies & Moulds (Assorted)  
   Rs. 55,00,000.00
<table>
<thead>
<tr>
<th>Item Description</th>
<th>Cost (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Material Handling Equipment</td>
<td>7,00,000.00</td>
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<tr>
<td>Scrap Grounder (18&quot;)</td>
<td>1,00,000.00</td>
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<tr>
<td>D.G.Set 400 KVA</td>
<td>25,00,000.00</td>
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<tr>
<td>Laboratory Equipments</td>
<td>4,00,000.00</td>
</tr>
<tr>
<td>Hot Embossing Printing Machine</td>
<td>7,00,000.00</td>
</tr>
<tr>
<td>Misc. pipes &amp; pipe fitting, Tools etc</td>
<td>10,00,000.00</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>3,48,00,000.00</strong></td>
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</tbody>
</table>
OTHER FIXED ASSETS

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Office equipment, furniture plus other equipment &amp; accessories</td>
<td>Rs. 5,00,000.00</td>
</tr>
<tr>
<td>Erection, Installation &amp; Electrification</td>
<td>Rs. 10,00,000.00</td>
</tr>
<tr>
<td>Consultancy &amp; Technical Know How</td>
<td>Rs. 5,00,000.00</td>
</tr>
<tr>
<td>Pre operative &amp; Preliminary Expenses</td>
<td>Rs. 3,00,000.00</td>
</tr>
<tr>
<td>Official Vehicle</td>
<td>Rs. 12,00,000.00</td>
</tr>
<tr>
<td>Misc.</td>
<td>Rs. 2,00,000.00</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>Rs. 37,00,000.00</strong></td>
</tr>
</tbody>
</table>
### FIXED CAPITAL

1. **LAND & BUILDING**  
   Rs. 3,20,00,000.00
2. **PLANT & MACHINERY**  
   Rs. 3,48,00,000.00
3. **OTHER FIXED ASSETS**  
   Rs. 37,00,000.00

-------------------------------
**TOTAL**  
Rs. 7,05,00,000.00
WORKING CAPITAL REQUIREMENT/MONTH

RAW MATERIALS

1. PVC Compounded Granules 166MT  
   @Rs. 80,000/-Ton  
   Rs. 1,32,80,000.00

2. CPVC (Chlorinated Polyvinyl Chloride) Compound 166MT  
   @Rs. 1,50,000/-Ton  
   Rs. 2,49,00,000.00

3. Packaging materials & Misc. Consumables  
   Rs. 10,00,000.00

---

TOTAL  Rs. 3,91,80,000.00
<table>
<thead>
<tr>
<th>Position</th>
<th>No.</th>
<th>Salary (Rs.)</th>
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</thead>
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<td>Manager Cum Technologist</td>
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<td>90,000.00</td>
</tr>
<tr>
<td>Shift Supervisors</td>
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<td>90,000.00</td>
</tr>
<tr>
<td>Chemist</td>
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<td>40,000.00</td>
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<tr>
<td>Assistant Chemist</td>
<td>1</td>
<td>30,000.00</td>
</tr>
<tr>
<td>Skilled Workers</td>
<td>18</td>
<td>3,24,000.00</td>
</tr>
<tr>
<td>Unskilled Workers</td>
<td>18</td>
<td>2,52,000.00</td>
</tr>
<tr>
<td>Accountants</td>
<td>2</td>
<td>50,000.00</td>
</tr>
<tr>
<td>Marketing Personnels</td>
<td>4</td>
<td>1,20,000.00</td>
</tr>
<tr>
<td>Administrative Staffs</td>
<td>10</td>
<td>2,00,000.00</td>
</tr>
<tr>
<td>Peon/Security Guards</td>
<td>12</td>
<td>1,68,000.00</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>13,64,000.00</strong></td>
</tr>
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</table>

Plus perks @ 33% p.a.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>Rs.</th>
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</thead>
<tbody>
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<td></td>
<td></td>
<td>4,50,120.00</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td><strong>18,14,120.00</strong></td>
</tr>
</tbody>
</table>
UTILITIES AND OVERHEADS

1. Power Consumption of 100000 Kwatt hrs @ Rs. 8.00 per Kwatt hr. Rs. 8,00,000.00
2. Water Consumption of 3000 KLs @ Rs. 5.00 per KL Rs. 15,000.00
3. Repair & Maintenance Rs. 1,00,000.00
4. Conveyance & Transportation Rs. 3,00,000.00
5. Advertisement & Publicity Rs. 2,00,000.00
6. Lease Rent Rs. 1,00,000.00
7. Administrative Expenses Rs. 2,00,000.00
8. Fuel for D.G.Set 5000 Ltrs @ Rs. 70/- Ltr Rs. 3,50,000.00
9. Misc. Rs. 80,000.00

------------------------
TOTAL Rs. 21,45,000.00
------------------------

Total load is 183 Kwatts
TOTAL WORKING CAPITAL/MONTH

1. RAW MATERIAL Rs. 3,91,80,000.00
2. SALARY & WAGES Rs. 18,14,120.00
3. UTILITIES & OVERHEADS Rs. 21,45,000.00

------------------------
TOTAL Rs. 4,31,39,120.00

-------------------

1. WORKING CAPITAL FOR 3 MONTHS Rs. 12,94,17,360.00
2. MARGIN MONEY FOR W/C LOAN Rs. 3,23,54,340.00

COST OF PROJECT

TOTAL FIXED CAPITAL Rs. 7,05,000,000.00
MARGIN MONEY Rs. 3,23,54,340.00

------------------------
TOTAL Rs. 10,28,54,340.00
TOTAL CAPITAL INVESTMENT

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>TOTAL FIXED CAPITAL</td>
<td>Rs. 7,05,00,000.00</td>
</tr>
<tr>
<td>TOTAL WORKING CAPITAL FOR 3 MONTHS</td>
<td>Rs. 12,94,17,360.00</td>
</tr>
<tr>
<td>TOTAL</td>
<td>Rs. 19,99,17,360.00</td>
</tr>
</tbody>
</table>
COST OF PRODUCTION/ANNUM

1. Working Capital for 1 year          Rs. 51,76,69,440.00
2. Interest @ 13.50% on T.C.I          Rs. 2,69,88,843.61
3. Depreciation @ 10.00% on buildings Rs. 32,00,000.00
4. Depreciation @ 20.00% on Plant     Rs. 69,60,000.00
   and Machinery
5. Depreciation @ 20.00% on office     Rs. 1,00,000.00
   equipment & furnitures

------------------------
TOTAL                      Rs. 55,49,18,283.62
------------------------
TURN OVER/ANNUM

1. By sale of PVC pipes of different sizes 1200MT @Rs.1,20,000/-Ton (Avg) Rs.14,40,00,000.00

2. By sale of CPVC Pipes of different sizes 1200MT @Rs. 1,85,000/-Ton (Avg) Rs.22,20,00,000.00

3. By sale of PVC pipe fitting (Assorted) 750 MT @Rs. 1,30,000/-Ton (Avg) Rs. 9,75,00,000.00

4. By sale of CPVC pipe fitting (Assorted) 750 MT @Rs. 1,90,000/-Ton (Avg) Rs.14,25,00,000.00

------------------------
TOTAL Rs.60,60,00,000.00
------------------------
PROFIT = RECEIPTS - COST OF PRODUCTION
= 60,60,00,000.00 - 55,49,18,283.62
= 5,10,81,716.38

PROFIT SALES RATIO = Profit / Sales x 100
= 5,10,81,716.38
= ----------------------------- x 100
60,60,00,000.00
= 8.43 %

RATE OF RETURN = Operating profit / T.C.I x 100
= 5,10,81,716.38
= ----------------------------- x 100
19,99,17,360.00
= 25.55 %
BREAK EVEN POINT (B.E.P)

Fixed Costs of the plant are as under -

1. Interests Rs. 2,69,88,843.61
2. Depreciation Rs. 1,02,60,000.00
3. 40.00% of salaries Rs. 87,07,776.00
4. 40.00% of overheads Rs. 1,02,96,000.00

TOTAL Rs. 5,62,52,619.62

B.E.P. = \frac{\text{FIXED COSTS}}{\text{FIXED COSTS} + \text{PROFIT}} \times 100

= \frac{5,62,52,619.62}{5,62,52,619.62 + 5,10,81,716.38} \times 100

= 52.41 \%

LAND MAN RATIO = \frac{\text{Total land}}{\text{Manpower}}

0 : 70 :: 0 : 1
RESOURCES FOR FINANCE

1. Term loans from Financial institutions
   (65.00 % of fixed capital)
   at @13.50% p.a rate of interest  Rs. 4,58,25,000.05

2. Bank loans for 3 months
   (65.00 % of working capital)
   at @ 13.50% p.a rate of interest  Rs. 8,41,21,284.00

3. Self raised capital from even funds & loans from close ones to
   meet the margin money needs at a
   @ 13.50% p.a rate of interest  Rs. 6,99,71,076.02

-------------------------------
TOTAL  Rs. 19,99,17,360.00
-------------------------------
### INSTALLMENT PAYABLE IN 5 YEARS

<table>
<thead>
<tr>
<th>Year</th>
<th>To Financial institutions (Rs. 45825000)</th>
<th>To Commercial banks (Rs. 84121284)</th>
<th>To others (Rs. 69971076)</th>
<th>Total</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>91,65,000.00</td>
<td>1,68,24,256.80</td>
<td>1,39,94,215.20</td>
<td>3,99,83,472.00</td>
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<tr>
<td>2</td>
<td>91,65,000.00</td>
<td>1,68,24,256.80</td>
<td>1,39,94,215.20</td>
<td>3,99,83,472.00</td>
</tr>
<tr>
<td>3</td>
<td>91,65,000.00</td>
<td>1,68,24,256.80</td>
<td>1,39,94,215.20</td>
<td>3,99,83,472.00</td>
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<tr>
<td>4</td>
<td>91,65,000.00</td>
<td>1,68,24,256.80</td>
<td>1,39,94,215.20</td>
<td>3,99,83,472.00</td>
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<tr>
<td>5</td>
<td>91,65,000.00</td>
<td>1,68,24,256.80</td>
<td>1,39,94,215.20</td>
<td>3,99,83,472.00</td>
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</tbody>
</table>

### INTEREST PAYABLE IN 5 YEARS

<table>
<thead>
<tr>
<th>Year</th>
<th>On term loans (Rs. 45825000)</th>
<th>On bank loans (Rs. 84121284)</th>
<th>On self loans (Rs. 69971076)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>61,86,375.00</td>
<td>1,13,56,373.34</td>
<td>94,46,095.26</td>
<td>2,69,88,843.61</td>
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<tr>
<td>2</td>
<td>49,49,100.00</td>
<td>80,85,098.67</td>
<td>75,56,876.21</td>
<td>2,15,91,074.89</td>
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<tr>
<td>3</td>
<td>37,11,825.00</td>
<td>68,13,824.00</td>
<td>56,67,657.16</td>
<td>1,61,93,306.17</td>
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<tr>
<td>4</td>
<td>24,74,550.00</td>
<td>45,42,549.34</td>
<td>37,78,438.11</td>
<td>1,07,95,537.44</td>
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<tr>
<td>5</td>
<td>12,37,275.00</td>
<td>22,71,274.67</td>
<td>18,89,219.05</td>
<td>53,97,768.72</td>
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### TOTAL REPAYMENT SCHEDULE FOR 5 YEARS

<table>
<thead>
<tr>
<th>Year</th>
<th>Interest</th>
<th>Instalments</th>
<th>Total</th>
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<tbody>
<tr>
<td>1</td>
<td>2,69,88,843.61</td>
<td>3,99,83,472.00</td>
<td>6,69,72,315.62</td>
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<td>2</td>
<td>2,15,91,074.89</td>
<td>3,99,83,472.00</td>
<td>6,15,74,546.90</td>
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<tr>
<td>3</td>
<td>1,61,93,306.17</td>
<td>3,99,83,472.00</td>
<td>5,61,76,778.18</td>
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<tr>
<td>4</td>
<td>1,07,95,537.44</td>
<td>3,99,83,472.00</td>
<td>5,07,79,009.46</td>
</tr>
<tr>
<td>5</td>
<td>53,97,768.72</td>
<td>3,99,83,472.00</td>
<td>4,53,81,240.74</td>
</tr>
</tbody>
</table>
### DEPRECIATION CHART FOR 5 YEARS

<table>
<thead>
<tr>
<th>Year</th>
<th>Building costs (Rs. 32000000.00)</th>
<th>Plant &amp; Machinery (Rs. 34800000.00)</th>
<th>fur. &amp; office equip. (Rs. 500000.00)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>32,00,000.00</td>
<td>69,60,000.00</td>
<td>1,00,000.00</td>
<td>1,02,60,000.00</td>
</tr>
<tr>
<td>2</td>
<td>28,80,000.00</td>
<td>55,68,000.00</td>
<td>80,000.00</td>
<td>85,28,000.00</td>
</tr>
<tr>
<td>3</td>
<td>25,92,000.00</td>
<td>44,54,400.00</td>
<td>64,000.00</td>
<td>71,10,400.00</td>
</tr>
<tr>
<td>4</td>
<td>23,32,800.00</td>
<td>35,63,520.00</td>
<td>51,200.00</td>
<td>59,47,520.00</td>
</tr>
<tr>
<td>5</td>
<td>20,99,520.00</td>
<td>28,50,816.00</td>
<td>40,960.00</td>
<td>49,91,296.00</td>
</tr>
</tbody>
</table>
### PROFIT ANALYSIS FOR 5 YEARS

<table>
<thead>
<tr>
<th>YR UTIL</th>
<th>Cap.</th>
<th>Sales</th>
<th>Mfg. Expenses</th>
<th>Gross Profit</th>
<th>Depreciation</th>
<th>Interest</th>
<th>Net profit before tax</th>
<th>Net profit after tax @ 35.00%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 70%</td>
<td>424200000</td>
<td>362368608</td>
<td>61831392</td>
<td>10260000</td>
<td>26988844</td>
<td>24582548</td>
<td>15978656</td>
<td></td>
</tr>
<tr>
<td>2 80%</td>
<td>484800000</td>
<td>414135552</td>
<td>70664448</td>
<td>8528000</td>
<td>21591075</td>
<td>40545373</td>
<td>26354493</td>
<td></td>
</tr>
<tr>
<td>3 80%</td>
<td>484800000</td>
<td>414135552</td>
<td>70664448</td>
<td>7110400</td>
<td>16193306</td>
<td>47360742</td>
<td>30784482</td>
<td></td>
</tr>
<tr>
<td>4 90%</td>
<td>545400000</td>
<td>465902496</td>
<td>79497504</td>
<td>5947520</td>
<td>10795537</td>
<td>62754447</td>
<td>40780390</td>
<td></td>
</tr>
<tr>
<td>5 100%</td>
<td>606000000</td>
<td>517669440</td>
<td>88330560</td>
<td>4991296</td>
<td>5397769</td>
<td>77941495</td>
<td>50661972</td>
<td></td>
</tr>
</tbody>
</table>

### CASH FLOW STATEMENT FOR 5 YEARS

<table>
<thead>
<tr>
<th>YR UTIL</th>
<th>Net profit (after tax)</th>
<th>Depreciation</th>
<th>Cash in hand</th>
<th>Repayment of Instalment</th>
<th>Net surplus</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 70%</td>
<td>15978656</td>
<td>10260000</td>
<td>26238656</td>
<td>25989257</td>
<td>249400</td>
</tr>
<tr>
<td>2 80%</td>
<td>26354493</td>
<td>8528000</td>
<td>3482493</td>
<td>25989257</td>
<td>893236</td>
</tr>
<tr>
<td>3 80%</td>
<td>30784482</td>
<td>7110400</td>
<td>37894882</td>
<td>25989257</td>
<td>11905625</td>
</tr>
<tr>
<td>4 90%</td>
<td>40780390</td>
<td>5947520</td>
<td>46737910</td>
<td>25989257</td>
<td>20748653</td>
</tr>
<tr>
<td>5 100%</td>
<td>50661972</td>
<td>4991296</td>
<td>55653268</td>
<td>25989257</td>
<td>29664011</td>
</tr>
</tbody>
</table>
PVC AND CPVC PIPE AND FITTINGS MFG.PLANT [EIRI/EDPR/3527] J.C.1613

PROJECTED BALANCE SHEET FOR ( 5 YEARS)

<table>
<thead>
<tr>
<th>LIABILITIES</th>
<th>ASSETS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Promoters Capital</td>
<td>1. Fixed Assets</td>
</tr>
<tr>
<td>6,99,71,076</td>
<td>6,73,00,000</td>
</tr>
<tr>
<td>2. Term loans</td>
<td>2. Interest during Construction period @ 13.50 p.a.</td>
</tr>
<tr>
<td>4,58,25,000</td>
<td>69,42,667</td>
</tr>
<tr>
<td>3. W/C loan</td>
<td>3. Surplus funds</td>
</tr>
<tr>
<td>8,41,21,284</td>
<td>12,56,74,693</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>19,99,17,360</td>
<td>19,99,17,360</td>
</tr>
</tbody>
</table>

1 Year 70 % Capacity

<table>
<thead>
<tr>
<th>LIABILITIES</th>
<th>ASSETS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Promoters capital</td>
<td>1. Depreciated value</td>
</tr>
<tr>
<td>6,99,71,076</td>
<td>5,70,40,000</td>
</tr>
<tr>
<td>2. Net Surplus</td>
<td>2. Working Capital</td>
</tr>
<tr>
<td>2,49,400</td>
<td>9,05,92,152</td>
</tr>
<tr>
<td>3. Term loans</td>
<td>3. Surplus funds</td>
</tr>
<tr>
<td>3,66,60,000</td>
<td>2,65,45,352</td>
</tr>
<tr>
<td>4. W/C loans</td>
<td></td>
</tr>
<tr>
<td>6,72,97,028</td>
<td></td>
</tr>
<tr>
<td>----------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>17,41,77,504</td>
<td>17,41,77,504</td>
</tr>
</tbody>
</table>

2 Year 80 % Capacity

<table>
<thead>
<tr>
<th>LIABILITIES</th>
<th>ASSETS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Promoters capital</td>
<td>1. Depreciated value</td>
</tr>
<tr>
<td>7,02,20,476</td>
<td>4,85,12,000</td>
</tr>
<tr>
<td>2. Net Surplus</td>
<td>2. Working Capital</td>
</tr>
<tr>
<td>2,74,95,000</td>
<td>10,35,33,888</td>
</tr>
<tr>
<td>3. Term loans</td>
<td>3. Surplus funds</td>
</tr>
<tr>
<td>5,04,72,772</td>
<td>50,35,597</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>15,70,81,485</td>
<td>15,70,81,485</td>
</tr>
</tbody>
</table>

3 Year 80 % Capacity

<table>
<thead>
<tr>
<th>LIABILITIES</th>
<th>ASSETS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Promoters capital</td>
<td>1. Depreciated value</td>
</tr>
<tr>
<td>7,91,13,713</td>
<td>4,14,01,600</td>
</tr>
<tr>
<td>2. Net Surplus</td>
<td>2. Working Capital</td>
</tr>
<tr>
<td>1,19,05,626</td>
<td>10,35,33,888</td>
</tr>
<tr>
<td>3. Term loans</td>
<td>3. Surplus funds</td>
</tr>
<tr>
<td>1,83,30,000</td>
<td>-19,37,633</td>
</tr>
<tr>
<td>4. W/C loans</td>
<td></td>
</tr>
<tr>
<td>3,36,48,516</td>
<td></td>
</tr>
<tr>
<td>----------------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>14,29,97,855</td>
<td>14,29,97,855</td>
</tr>
</tbody>
</table>
### PVC AND CPVC PIPE AND FITTINGS MFG. PLANT [EIRI/EDPR/3527] J.C.1613

#### 4 Year 90% Capacity

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promoters capital</td>
<td>9,10,19,339</td>
</tr>
<tr>
<td>Net Surplus</td>
<td>2,07,48,654</td>
</tr>
<tr>
<td>Term loans</td>
<td>91,65,000</td>
</tr>
<tr>
<td>W/C loans</td>
<td>1,68,24,260</td>
</tr>
</tbody>
</table>

#### 5 Year 100% Capacity

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Promoters capital</td>
<td>11,17,67,993</td>
</tr>
<tr>
<td>Net Surplus</td>
<td>2,96,64,016</td>
</tr>
<tr>
<td>Term loans</td>
<td>0</td>
</tr>
<tr>
<td>W/C loans</td>
<td>0</td>
</tr>
</tbody>
</table>

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### 4 Year 90% Capacity

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Depreciated value of Fixed Assets</td>
<td>3,54,54,080</td>
</tr>
<tr>
<td>2. Working Capital</td>
<td>11,64,75,624</td>
</tr>
<tr>
<td>3. Surplus funds</td>
<td>-1,41,72,451</td>
</tr>
<tr>
<td></td>
<td>-------------</td>
</tr>
<tr>
<td></td>
<td>13,77,57,253</td>
</tr>
</tbody>
</table>

### 5 Year 100% Capacity

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Depreciated value of Fixed Assets</td>
<td>3,04,62,784</td>
</tr>
<tr>
<td>2. Working Capital</td>
<td>12,94,17,360</td>
</tr>
<tr>
<td>3. Surplus funds</td>
<td>-1,84,48,135</td>
</tr>
<tr>
<td></td>
<td>-------------</td>
</tr>
<tr>
<td></td>
<td>14,14,32,009</td>
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</tbody>
</table>