

The page features several large, overlapping red circles of varying sizes and opacities, along with thin red lines that intersect and create a dynamic, abstract background. The main text is positioned in the lower-left quadrant of the page.

# Kajaria STAINLESS STEEL

Revolution in Plumbing Systems from



## Kajaria Pipes

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Introducing Stainless Steel Plumbing Systems  
Grade SUS 304 & SUS 316L  
PIPES as per JIS 3448 FITTINGS as per JWWA G116

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# Company Profile & History

## Kajaria Pipes

*Shri Padam Kajaria's* frequent visits to western India in connection with his well-set family business of manufacturing C.I. castings made him realize the business potential of Mumbai.

Shifting to Mumbai, in 1969, he quickly established the *Kajaria Group of Companies*. His early years in the plumbing industry were spent in establishing the business of cast iron pipes fittings and manhole covers. He soon grew into the hearts of his customers who lovingly called him the "*Cast iron King*". They are, even today, the largest distributors of cast iron in the whole of India.

Joining him was his equally industrious son *Shri Pankaj Kajaria*. With the induction of new blood came a flood of new ideas as well and soon the *Kajaria's* expanded into the fast growing PVC market. Armed with a postgraduate degree, *Shri Pankaj Kajaria* with his sharpness and excellent understanding of markets realizes that the business was changing from cast iron to PVC.

With his sharp judgment and business acumen, *Shri Pankaj Kajaria* identifies **PRINCE** as the premium best quality manufacturer. **PRINCE** he saw, had built in quality control measures every step of the production process, which he knew was of strategic importance. And so began the *Kajaria's* famed association with **PRINCE** in 1991.

Starting with a small turnover, *Shri Pankaj Kajaria*, because of his friendly nature, visionary management skills, value of commitment towards one and all increases his business manifold and goes on to win the prestigious "*PRINCE RATNA award in 2006-2007*" besting the toughest of competition and has since maintained this leadership position.

With the growing interaction among their customers, *M/s.Kajaria Pipes* saw the gradual shift of G.I. Pipes markets to CPVC for plumbing. He was quick to establish alliance with **M/S Astral Polytechnik Pvt Ltd**. Within a short span of time they grew to be their **Largest Distributor** for CPVC products (2010-2011).

Constant thirst for good quality products in the plumbing industry leads Kajaria Pipes to add on **Supreme Plastics at Pune** and **Everlast Composites** for **FRP Manhole covers**.

The product range includes **ISI** marked cast iron soil pipes as per IS 1729 specifications and **HEPCO** cast iron centrifugal pipe and fittings as per IS 3989. Excellent quality, fair prices, ready availability are the hallmark of a *Kajaria* product. They are the sole selling agent of **HEPCO** in the Maharashtra region.

Realizing that quick, efficient distribution is of paramount importance, **Kajaria Pipes** established a wide distribution network at places like Nerul, Kalyan, Thana, Bhiwandi, Nasik, Pune & Kolkata. This close proximity with the dealers resulted in even closer bonding with them. Today **Kajaria Group** has more than 3000 retail outlets under its fold. The network continues to grow day by day.

The Kurla godown provides an area of **15,000 square ft** to stock pipes of all sizes, various fittings, manhole covers of assorted shapes and sizes. 40,000 square ft. area is provided at other places like Nerul, Kalyan, Thana, Bhiwandi, Nasik, Pune and Kolkata to cater to every need of the client.

Assisting **Shri Pankaj Kajaria** ably and sharing his vision is his loyal and hardworking staff. Multi-tasking being the norm, each employee is worth its weight in gold. The family atmosphere and open door policy results in harmonious, synchronous working.

### **Latest Business Endeavour**

With the growth in economy and the economic development of India, there arises a need for a foolproof and International quality for plumbing products. Kajaria Pipes introduces to its clients, its very own product.

# Kajaria **STAINLESS STEEL**

## **“PLUMBING SYSTEMS”.**

Renowned the world over for its durability and hygienic standards, stainless steel plumbing seeks to provide the Indian consumer with the highest quality, latest technology and cost efficient product that is poised to revolutionize the industry.

Forever, creating and seizing new opportunities, looking ahead, **Kajaria Pipes** is on the fast track of development and progress. Poised to grow at a fast clip, father son duo of **Shri Padam Kajaria** and **Shri Pankaj Kajaria** are set to take the **Kajaria Pipes** to unparalleled heights.

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# Need For Stainless Steel

**Uniform Plumbing code India says:** “Water pipes and fitting made of galvanized iron shall not be recommended in piping systems used to convey potable water.” It is no wonder, given the leakage problems in our old buildings.

Galvanized Iron is being rapidly replaced by plastic pipes. The main problems are corrosion and discolored water. But plastic pipes also have problems. Thus stainless steel plumbing is gaining importance due to its hygiene and long life properties.

Although plastic is good alternative, but not without problems, Cheap quality plastic may have toxic ingredients too. So for use of plastic pipes in transporting potable water, plastic pipes must have certificate that material are free of toxic substances besides Plastic may not be suitable for installations with high pressure ratings and continuous high temperature. Plastic has high coefficient of expansion and pipes may develop stress and fatigue. So in some domestic applications like downstream plumbing of geysers, hot water piping of solar systems with uncontrolled heat source, stainless steel may be a better option.

Though copper can be used for high temperature applications, corrosion cannot be excluded. A metallic taste sometimes thus gets imparted to water because of this corrosion. It cannot be used for water with low PH levels, Besides it is a costly material.

## **DEFINITION OF STAIN LESS STEEL:**

Stainless steel is considered to be rustless or rust-resistant steel, but there is no explicit definition, and in general any alloy of iron that contains at least 12% chromium may be thought of as stainless steel.

Stainless steels are corrosion resistant steels, which are protected by the formation of a self-repairing passive oxide film. The resilience of this layer increases with chromium content and also with the addition of molybdenum. The presence of nickel encourages the formation of a crystalline structure call austenite, which aids ductility and formability. The standard stainless steel alloys used in plumbing applications typically contain 17-18% chromium and 8-12% nickel. The most commonly used grades are BSEN 1.4301 (304), 1.4307 (304L), 1.4401 (316) and 1.4404 (316L).

## **APPROVALS:**

Stainless steel plumbing has international approvals for use of public water supply from :-

1. National Sanitation Foundation - ANSI/NSF 61
2. International Building code
3. International Plumbing code. IPC
4. Japan Water Work Association - JWVA

It is widely used in Countries like Japan, Germany, UK, Australia, etc...

# Advantages of Kajaria Stainless Steel

## **CORROSION RESISTANCE**

The protective passive film layer makes Stainless steel inert in potable waters and as such Stainless steel has the lowest corrosion rate among metals. G I plumbing systems corrode very rapidly leading to quick replacement.

## **HYGENIC**

Due to its lower corrosion rate and unhindered flow Kajaria stainless steel plumbing systems prevents the buildup of algae. Smoother surface does not allow particles and salts deposits to buildup preventing blockages. Moreover it retards bacterial growth. These advantages ensure purity of water. This system meets all food grade standards and are thus preferred for Hospitals, Water Treatment Plants and Pharmaceutical industry.

## **SUPERIOR STRENGTH & LONG LIFE**

Stainless Steel is one of the strongest materials. This provides high durability to the pipes resulting in longer life. Stainless steel plumbing systems provide a maintenance free life of 50 to 100 years. Less repairs are needed as compared to alternate systems.

It withstands vibrations and shocks due to its ductile nature and superior impact resistance and can be termed as **EARTHQUAKE PROOF**.

The pipe and press fitting system has one of the **HIGHEST PRESURE RATING OF 25 BAR**.

## **TEMPERATURE & FIRE RESISTANCE**

Stainless Steel has a Extremely High Melting point of above 1000°C and can withstand high temperatures of over 100° C retaining its strength as also maintaining performance/flow. These pipes do not brittle at low temperatures like PVC and are recommended for usage for temperatures below - 50° C.

**FIRE RESISTANCE** characteristics give advantage over carbon steel pipes used in fire fighting sprinklers, where the corrosion block nozzles preventing outflow in case of fire. The material does not burn and no toxic substances or fumes are produced while burning.

## **EASE OF INSTALLATION**

The greatest advantage of the Pressfit technology is that it is one of the fastest methods and requires very low skill in installation. No heat or electricity is required for making joints. No toxic chemical are required for its jointing. No curing time is required as the joints are made instantly.

As high flow velocities can be accommodated of over 30m/s with minimal erosion smaller diameter pipes can be used. In addition lower wall thickness allows minimum requirement for conduiting (jhari). The pipes are light in weight and easy to handle while installation.

## **COST EFFECTIVENESS**

Due to its higher strength and absence of need to thread the pipes. The wall thickness can be reduced to 1/3 as compared to G I. Hence pipes can be available at rates similar to a good quality G I pipe besides lower diameter of pipes can be used due to corrosion resistance at high flow rates.

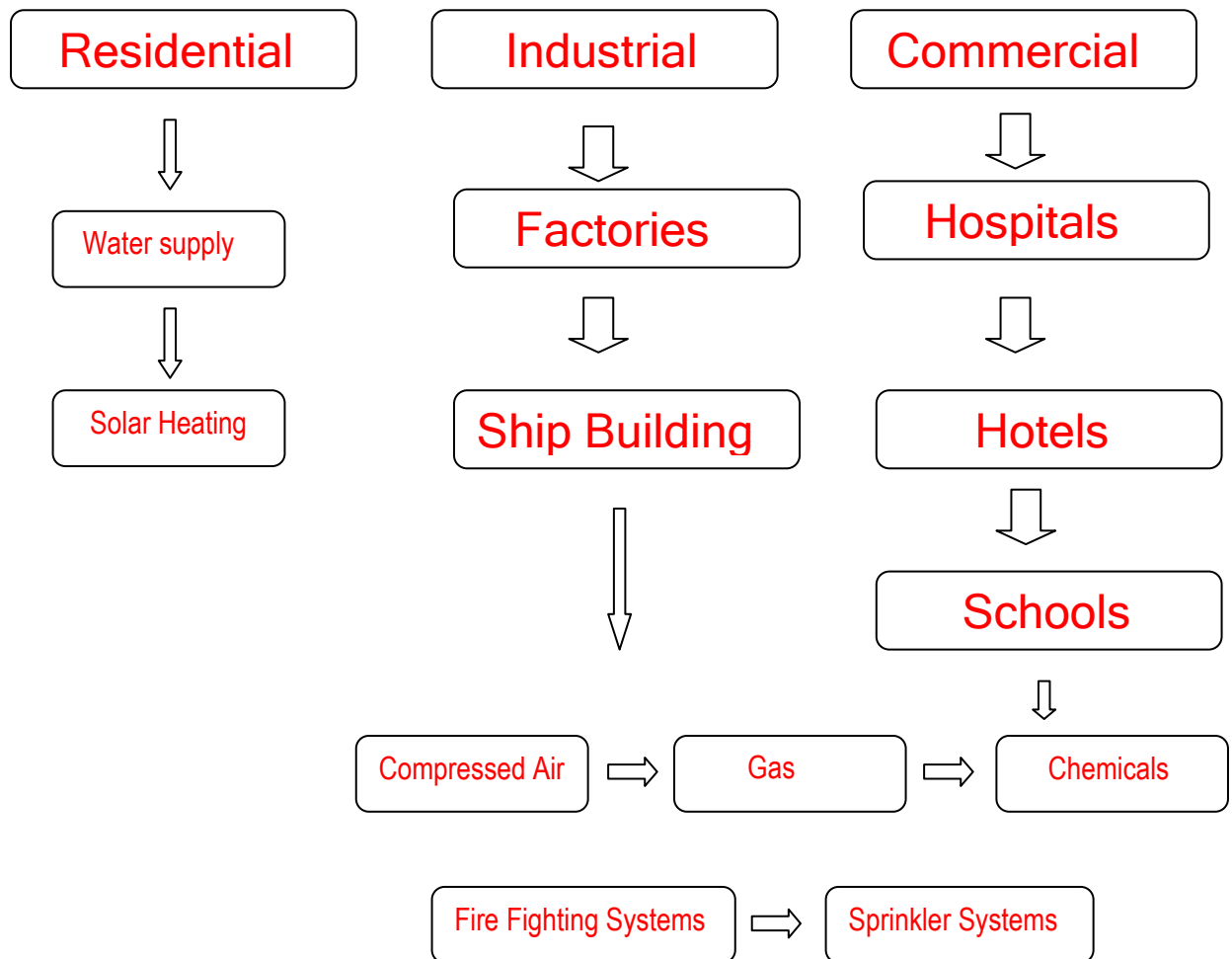
Pressfit Technology saves labour cost drastically. Low skilled worker can be used

When initial cost is divided by the lifecycle of 50-100 years and future maintenance cost. This system provides definitely the lowest lifecycle cost. Avoiding expensive replacement and interior costs.

### GREEN MATERIAL

Stainless steel helps saves pumping energy. It is totally recyclable hence environment friendly. It provides a glossy metallic look "steel finish" which goes well with the exterior and interior appearance. Moreover the lower coefficient of expansion results in straight lines without snaking as in plastics.

## Applications of SS Plumbing



# Properties of Stainless Steel

## a) Physical Properties of Stainless Steel:

AISI TYPE No.	Melting point range (°C)	Density (g/cm <sup>3</sup> )	Average coefficient (X 10 <sup>-6</sup> /°C)		Thermal conductivity (cal/ cm-sec°C)		Specific Heat (cal/g°C)	Electric resistivity (Ω.cm) R-T	Vertical modulus of elasticity	magnetism
			0-100°C	0-650°C	100°C	500°C				
304	1399-1454	8.03	17.3	18.7	0.0388	0.0512	0.12	72	19.700	no
316	1371-1399	8.03	16.0	18.5	0.0388	0.0512	0.12	72	19.700	no

## b) Mechanical Properties of Stainless Steel:

AISI TYPE No.	Tensile strength (kg/mm <sup>2</sup> )	Proof stress 0.2% (kg/mm <sup>2</sup> )	Elongation %	Hardness HRB	Fatigue strength (kg/mm <sup>2</sup> )
304	59	29	55	80	24
316	59	29	50	79	27

## c) Chemical Composition of Stainless Steel:

Symbols of types	C	Si	Mn	P	S	Ni	Cr	Mo
SUS 304	≤0.08	≤1.00	≤2.00	≤0.045	≤0.030	8.00-10.50	18.00-20.00	-
SUS 316L	≤0.030	≤1.00	≤2.00	≤0.045	≤0.030	12.00-15.00	16.00-18.00	2.00-3.00



**d) Choice of Materials:**

“Selection depends both on the environment and chloride content - 316 is recommended for a coastal environment-and the operating conditions, in particular the chloride level in ppm. At temperatures normally encountered in drinking water treatment & supply, 1.4301 (304) is recommended for chloride levels upto 200ppm and 1.4401/ 4436 (316) for chloride levels up to1000ppm.”

**e) Tolerance / Weight & Pressure:**

Nominal Diameter (mm)	Outside Diameter (mm)	Allowable difference in Outside diameter (mm)		Thickness	Tolerance on thickness (mm)	Unit Mass (kg/m)		Maximum allowable pressure (kg/cm <sup>2</sup> )
		Outside diameter	Circumference			SUS 304 TPD	SUS 316 TPD	
13	15.88	+0 -0.37	-	0.8	±0.12	0.301	0.303	111.3
20	22.22	+0 -0.37	-	1.0	±0.12	0.529	0.532	99.4
25	28.58	+0 -0.37	-	1.0	±0.12	0.687	0.691	77.4
30	34	+0.34	±0.20	1.2	±0.12	0.98	0.986	78
40	42.7	±0.43	±0.20	1.2	±0.12	1.24	1.25	62.1
50	48.6	±0.49	+0.25	1.2	±0.12	1.42	1.43	54.6
60	60.5	±0.6	±0.25	1.5	±0.15	2.2	2.21	54.8
75	76.1	±1%	±0.8%	2.0	±0.15	3.69	3.71	43.4
80	88.9	±1%	±0.8%	2.0	±0.30	4.33	4.37	49.6
100	108.0	±1%	±0.8%	2.0	±0.30	5.28	5.52	38.6
150	165.2	±1%	±0.8%	3	±0.40	12.1	12.2	40.1

Table above lists the maximum allowable pressure calculated for various outside diameters and thickness of stainless steel pipe, for general service 10kg/cm<sup>2</sup> design internal pressure is a value set as an upper limit for the proof stress during design and should be considered separately from the calculated values listed in Table above.

# Comparison of Stainless Steel & other pipe materials

## a) Dimension and weight comparison with other pipe materials

Nominal bore size			Stainless pipe as per (JIS 3448)				Copper pipe for construction -Table X				Carbon steel pipe for ordinary piping (IS 1239 Medium)			
Su	A	B	Outside dia (mm)	Thickness (mm)	Actual Inside Dia (mm)	Weight (Kg/m)	Outside dia (mm)	Thickness (mm)	Actual Inside Dia (mm)	Weight (Kg/m)	Outside Dia (mm)	Thickness (mm)	Actual Inside Dia (mm)	Weight (Kg/m)
15	15	½	15.88	0.8	14.28	0.30	15.00	0.70	13.60	-	21.7	2.8	16.1	1.31
20	20	¾	22.23	1.0	20.23	0.53	22.00	0.90	20.20	-	27.2	2.8	21.6	1.68
25	25	1	28.58	1.0	26.58	0.69	28.00	0.90	26.20	-	34.0	3.2	27.6	2.43
40	32	1 ¼	34.0	1.2	31.60	0.98	35.00	1.20	32.60	-	42.7	3.5	35.7	3.38
50	40	1 ½	42.7	1.2	40.3	1.24	42.00	1.20	39.60	-	48.6	3.5	41.6	3.89
60	50	2	48.6	1.2	46.2	1.41	54.00	1.20	51.60	-	60.5	3.8	52.9	5.31
75	65	2 ½	76.1	2.0	72.1	3.68	67.00	1.20	64.60	-	76.3	4.2	67.9	7.47
80	80	3	88.9	2.0	84.9	4.34	76.10	1.50	73.10	-	89.1	4.2	80.7	8.79
100	100	4	108.0	2.0	104.0	5.28	108.00	1.50	105.00	-	114.3	4.5	105.3	10.1

The stainless steel is lighter than carbon steel pipe for general service, having about a third of the weight in thin walled pipes. Since Stainless steel pipe is thinner, its inside diameter is greater than that of other types of pipe having the same nominal bore size, and its smooth surface allows a greater flow of water for a given head.

## b) Mechanical Comparison of Pipe Materials:

	Tensile strength (Kg/mm <sup>2</sup> )	Elongation (%)	Flow Coefficient C: Value
Carbon steel pipe for ordinary piping	35.5	46.4	100
Phosphorous deoxidized seamless copper pipe	24.7	53	130
Unplasticized polyvinyl chloride pipe	5.3	100	150
Heat -resistant unplasticized polyvinyl chloride pipe	5.3	30	150
Stainless steel pipes for ordinary piping	73.6	47.5	150

**c) Physical Comparison of Pipe Materials:**

Physical properties of pipe materials (reference values)

	Specific gravity	Average coefficient of thermal enlarging ( $\times 10^{-6}/^{\circ}\text{C}$ )	Thermal conductivity ( $\text{cal/cm}\cdot\text{sec}\cdot^{\circ}\text{C}$ )	Specific heat ( $\text{cal/g}\cdot^{\circ}\text{C}$ )	Electric resistivity ( $\mu\Omega\cdot\text{cm}$ )	Young's modulus ( $\text{kg/mm}^2$ )	Magnetism
		(0-100 $^{\circ}\text{C}$ )	(100 $^{\circ}\text{C}$ )	(0-100 $^{\circ}\text{C}$ )	Room temperature		
Carbon steel pipe for ordinary piping	7.86	11.6	0.142	0.115	14.2	21,000	yes
Phosphorus deoxidized seamless copper pipe	8.96	17.6	0.934	0.092	1.71	11,000	no
Unplasticized polyvinyl chloride pipe	1.43	70	$0.12 \times 10^{-3}$	0.035	$\leq 10 \times 10^{14}$	-	no
Heat-resistant unplasticized polyvinyl chloride pipe	1.56	70	$0.11 \times 10^{-3}$	0.25	$\leq 10 \times 10^{14}$	-	no
Stainless steel pipes for ordinary piping	7.93	17.3	0.039	0.12	72	19,700	no

**d) Corrosion resistance of stainless steel & other materials:**

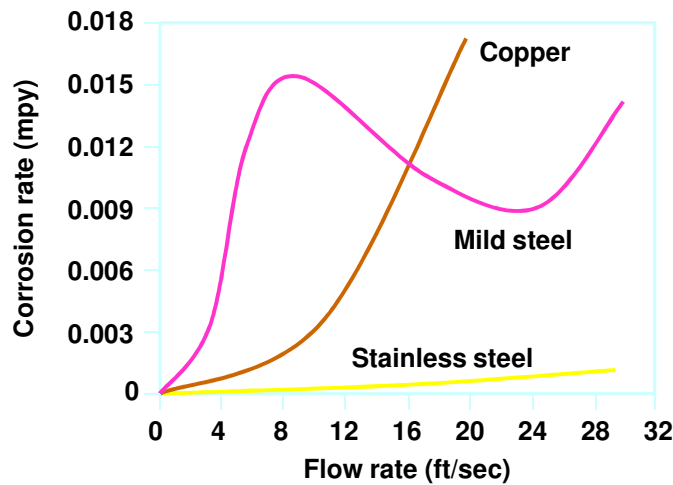
The stainless steel Association on corrosion testing methods conducted immersion tests on stainless steel and other materials in hot water is an excerpt from the data in its report. The dissolution of stainless steel is very small, and in both dissolved on concentration and corrosion weight loss we have the relationship SUS 304 < copper < galvanized sheet. The quantity of dissolved iron ions is 107 times greater, and the corrosion rate is 77 times greater with galvanized sheet than SUS 304.

Results of (5- week) immersion tests in tap water (80 $^{\circ}\text{C}$ )

Material	Concentration of dissolved metallic ions		Maximum corrosion rate for the five weeks (g/m-hr)
	Ion	Maximum in each week (mg/l)	
304	Fe	0.4	0.0003
Copper	Cu	3.0	0.003
Galvanized sheet	Fe	43	0.0231

e) Effect of Velocity:

## Effect of water velocity on corrosion rate



Stainless steel corrodes least at highest flow rates

f) Economics of Stainless steel Pipe

It is very difficult to decide what criteria to adopt in considering the economics of stainless steel pipe, that is, its life cycle costs of money to be expended versus its expected useful lifetime. This decision is made mostly comparison with other types of pipe one by one.

Comparison of Pipe Prices of Various Products

		GI Pipes 'C' Class		Copper Pipes	CPVC	SS 304 Pipes
		JINDAL	TATA	RAJCO	Astral	Kajaria
S.No.	Description	Rate/Ft	Rate/Ft	Rate/ Ft (NET)	Rate/Ft (NET)	Rate/Ft
1	15 mm	31	47	54	12	34
2	20 mm	38	53	103	16	60
3	25 mm	54	70	131	23	78
4	32 mm	69	73	219	34	111
5	40 mm	80	83	264	47	140
6	50 mm	110	119	342	76	161
<b>Estimated Cost of Plumbing in a Typical Bathroom</b>						
Material		4000	5000	10000	2000	7000
Labour		4000	4000	5000	3000	3000
Total		8000	9000	15000	5000	10000
Average Life		10 Years	15 Years			50 Years

Note: Prices subject to change by respective manufacturers. These prices are indicative. Updated as on 01/05/2012

# Method of installation



Cut the tube to length



Push the tube in fitting till the tube stops



Mark the tube for reference during pressing



Open the jaws of the pressing tool and insert the assembled tube and fitting to be pressed



Press the lever and make a joint



Check the Completed Joint

## Joining Tools



## Matters to note when using stainless steel pipe:

**Storage:** Storage and transportation should take care to avoid deformation (ensuring of roundness).

**Pipe cutting:** Maintenance of roundness, elimination of flash (prevention of damage to gaskets, etc.)

### a) Expansion & Contraction of piping:

The expansion or contraction of piping caused by heat occurs in the piping as the thermal stress can bring about rupture of the support points, buckling of the pipes itself, or breakage of the equipment connected to the piping.

#### Expansion per 10-m length of pipe (mm/10 m) (set to 0 at 0°C)

Temperature° C	50 °C	100 °C
Stainless steel pipe for general service (SUS 304)	8.4 mm	16.7mm
Carbon steel pipe for general service	5.8 mm	11.5mm
Copper pipe	8.3 mm	16.6mm
Plastic Pipes	-	70.0mm

### b) Prevention of Corrosion:

- 1) Use heat insulation material that does not include halogen ions, especially chloride ions (refer manufacturer).
- 2) For gaskets, use materials intended especially for stainless steel piping. (Eg EPDM rings).
- 3) **Galvanic Corrosion:** Joining stainless steel pipe directly to some other kind of pipe could cause galvanic corrosion.

With respect to stainless steel pipe	Other kind of material	pipe	Remarks
		Yes/no	
	Lead pipe	Yes	Contains lead in the solder components
	Copper pipe	Yes	As a practical matter, no problem, because the electric potential is similar.
	Unplasticized polyvinyl chloride pipe	Yes	No problem, because plastic is a poor conductor of electricity
	Galvanized steel pipe	No	Must be electrically insulated, because there is a big difference in electric potential with galvanized steel pipe.

- 4) **Atmospheric Corrosion:** In outdoor exposed piping such as in cooling water piping near the seashore or in industrial regions, airborne salt particulars from the ocean, chloride ions, sulfur dioxide, or iron dust can cause rust on the surface of the pipe and destroy the characteristic luster of stainless steel. The atmospheric corrosion, though it presents no problems for the functioning of the piping outdoors in ducts.

To prevent atmospheric corrosion, the surface of the exposed piping is periodically washed with water. In particular, piping outdoors in ducts that is not met directly by rain or not effectively washed by the rain; must be washed frequently.

### c) Embedding Pipe:

#### In the Ground:

In regular soils, stainless steel pipe exhibits excellent resistance to corrosion and can be used without treating the outer surface of the pipe. But if laid in such areas as wet coastal regions where sea water wells up or volcanic hot springs regions where gas comes out of the ground, stainless steel must always be wrapped with corrosion protective sheet and then wound with anticorrosion vinyl adhesive tape.

Normally SUS 304 is used, but the adoption of other types, such as the more corrosion-resistant SUS 316, should also be considered.

#### In concrete:

Stainless steel pipe generally exhibits corrosion resistance with respect to concrete and therefore it may be used in concrete-embedded piping, but contact with the steel reinforcement in buildings must be avoided, and insulation measures must be taken. Temperature fluctuations cause about the same degree of expansion and contraction in stainless steel pipe as in copper pipes it should be encased in thermal insulation so that it can expand and contract as much as possible.

### d) Press type Junctions Problems:

#### Points to note in the joining operation

(a) A special tightening tool must be used.

(b) **Cleaning:** Before insertion it into the joint, the surface of the part to be joined is checked, any grease, dirt or other adhering matter is removed, and any die wear or flash is removed. In particular, care must be taken that the rubber ring does not get scratched or damaged.

(c) **Right amount of insertion is verified:** If when the pipe is fully inserted into the the coupling there is a gap between the line marked on the pipe and the end of the coupling, the insertion is insufficient, and the pipe is reinserted.

(d) **Inspection of Tools:** The fastening groove of the special tightening tool must be inspected once in a year, because when it is used many times it could make an incomplete junction.

### e) Spacing between supports (m) in stainless steel pipe:

Nominal bore (Su)	13	20	25	30	40	50	60	75	80	100	150
Minimum spacing between supports vertical piping (m)	0.9	1.0	1.2	1.3	1.4	1.5	1.7	1.9	2.1	2.3	2.8
Minimum spacing between supports horizontal piping (m)	1.5	2.0	2.0	2.5	2.5	3.0	3.0	3.0	4.0	4.0	5.0

Adaptation: JWWA Piping Manual

# Technical Comparison

	FEATURE	STAINLESS STEEL PIPE	COPPER	GALVANISED IRON	PLASTICS
1	Installation Time & Cost	Fastest with press fitting at no extra cost	Soldering has to be done with care requires time & skilled labour	Threading and fitting is time consuming	Costly solvent requires curing time
2	Pressure handling capacity (at 60 <sup>o</sup> C)	Highest Capacity of 25 kg/cm <sup>2</sup> system pressure	Excellent	Good but reduced due to corrosion	7 kg/ cm <sup>2</sup> @ 82 <sup>o</sup> C. Leaves little scope for error
3	Expansion @ temp. of 82.00 <sup>o</sup> C.	1.7mm/mtr(100 <sup>o</sup> C. very negligible).	1.7 mm/mtr @ 100 <sup>o</sup> C.	Low	7 mm/ mtr. Causes stress and fatigue in joints. Snaking of pipes
4	Jointing System	Press fit, Easy and simple, Low skilled labour needed	Soldering & brazing requires skilled labour / Electric / Heat	Threaded joints get weak in time (due to corrosion). Labour Intensive	Solvent based requires curing. Low labour cost
5	Temperature & Fire Resistance	Highest Melting Point, above 1000 <sup>o</sup> C .Does not burn, nor produces fire can be used between - 50 <sup>o</sup> to 100 <sup>o</sup> C .	Excellent. High melting point.	Good resistance to fire	Low melting point. and produces toxic gases in fire. Recommended up till 82 <sup>o</sup> C.
6	Durability & Long Life	Will outlive the life of building usually 50-100 yrs.	Excellent	Requires frequent replacements	Becomes brittle in hot and cold supply water
7	Concealed Plumbing	Low expansion and fool proof jointing gives a maintenance free life.	Good Properties but soldered joints require skill	Corrosion and depth of chase (Jhari) is higher	High Thermal expansion causing stress and leakage
8	Corrosion Resistance	Highly anti corrosive due to passive layer	Good but lower than SS	Poor track record on performance for corrosion. Almost 50 times SS	Good Plastics not generally corrosive
9	Approvals by various national and international standards	Widely approved by IPC, NSF etc. And in many developed Nations.	Widely approved by almost all the national standards.	Not Recommended in many countries for plumbing applications including India IPC	Only approval in Limited applications
10	UV stability	Excellent no change in sunlight.	Excellent	Good	Very low, Discoloration takes place and shaking due to heat
11	Recyclability	100% recyclable smooth, saves electricity during pumping.	ECO- Friendly	Good	Non Recyclable Not eco friendly
12	Life Cycle cost (Cost of material & labour / years of use)	Medium Cost and extremely long life and maintenance free	High Cost of goods but good life	Requires replacement within 10/15 yrs. Hence overall, cost high	Lower Life than, SS.
13	Hygienic	Non reaction to most types of water suitable for any PH level.	Sometimes gives bad taste to water and is unsuitable for Low PH levels.	Scaling / bacteria formation / algae deposits, Not recommended.	Algae formation Bacteria and salt deposits not ruled out.