ASTRAL PIPES

Aquarius+

uPVC SCH 40 & SCH 80 INDUSTRIAL PIPING SYSTEM

PRODUCT CATALOGUE



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1st TO INTRODUCE CPVC IN INDIA

1st TO INTRODUCE UPVC LEAD FREE PIPES IN INDIA

1st TO INTRODUCE LOW NOISE PP DRAINAGE PIPES IN INDIA

1st TO INTRODUCE FOAMED PVC DRAINAGE PIPES IN INDIA



1st TO INTRODUCE LEAD FREE COLUMN PIPES IN INDIA

1st TO INTRODUCE POLYMER BASED INDUSTRIAL PIPING SYSTEM IN INDIA

1st TO INTRODUCE NSF APPROVED SOLVENT CEMENT IN INDIA

1st TO INTRODUCE CPVC PIPING FOR AUTOMATIC FIRE SPRINKLER SYSTEM IN INDIA

Astral, India's Progressive Building Materials Company

Established in 1996 with the aim to manufacture best-in-globe plastic piping systems, Astral Pipes fulfils emerging piping needs of millions of houses and adds extra mileage to India's developing real estate fraternity with the hallmark of unbeaten quality and innovative piping solutions. Keeping itself ahead of the technology curve, Astral has always been a front runner in the piping category by bringing innovation and getting rid of old, primitive and ineffective plumbing methods. Bringing CPVC in India, and pioneering in this technology, have set Astral apart and its highest quality enabled it to obtain NSF approval for its CPVC pipes and fittings. Astral went beyond the category codes by launching many industry firsts, like launching India's first lead-free uPVC pipes for plumbing as well as for stream water, just to name a few.

Astral Pipes offers the widest product range across this category when it comes to product applications. Astral Pipes is equipped with production facilities at Santej and Dholka in Gujarat, Hosur in Tamil Nadu, Ghiloth in Rajasthan, Sangli & Aurangabad in Maharashtra, Cuttack in Odisha and Sitarganj in Uttarakhand, Guwahati in Assam, Kanpur in Uttarpradesh, Hyderabad in Telangana to manufacture plumbing systems, drainage systems, agriculture systems, fire sprinkler piping systems, industrial piping and electrical conduit pipes with all kinds of necessary fittings.

Astral Pipes' Infrastructure division offers a comprehensive product range including corrugated piping for drainage and cables, polyolefin cable channels, sewage treatment plants, plastic sheathing ducts, suction hoses, and sub-surface drainage systems. This range helps Astral to establish a strong foothold in infrastructure and agriculture sector in the constantly evolving business of piping.

In 2014, Astral forayed into the adhesives category by acquiring UK-based Seal It Services Ltd. and Kanpur based Resinova Chemie Ltd., which manufacture adhesives, sealants and construction chemicals. With five manufacturing facilities now in this business segment, Astral has strengthened its presence in the category and made rapid inroads.

In the year 2020, Astral has expanded its product portfolio and entered into the Water Tanks Segment. The water tank segment is an expanded domain of plumbing and water supply with a huge nationwide potential. Astral Pipes manufactures water tanks from its Santej, Aurangabad, Cuttack, Hosur & Ghiloth manufacturing facilities. A wide range of water storage tanks has helped Astral to become a versatile player in the industry.

Extending the product portfolio further, in the year 2022 Astral forayed into the categories of Faucets and Sanitaryware, followed by acquisition of Bangalore based Gem Paints to enter in the Paints category. This expansion will help Astral march firmly towards becoming a holistic building materials company.

ADHESIVES

- EPOXY ADHESIVES & PUTTY
- SILICONE SEALANTS
- CONSTRUCTION CHEMICALS
- PVA
- CYANOACRYLATE
- SOLVENT CEMENTS
- TAPES
- POLYMERIC FILLING COMPOUND
- ANAEROBIC ADHESIVES
- INDUSTRIAL ADHESIVES

PIPING

- PLUMBING PIPES & FITTINGS
- SEWERAGE DRAINAGE PIPES & FITTINGS
- AGRICULTURE PIPES & FITTINGS
- INDUSTRIAL PIPES & FITTINGS
- FIRE SPRINKLERS PIPES & FITTINGS
- CONDUIT & CABLE PROTECTION
- ANCILLARY PRODUCTS
- URBAN INFRASTRUCTURE
- DUCTING

WATER TANKS

PAINTS

FAUCETS

SANITARYWARE



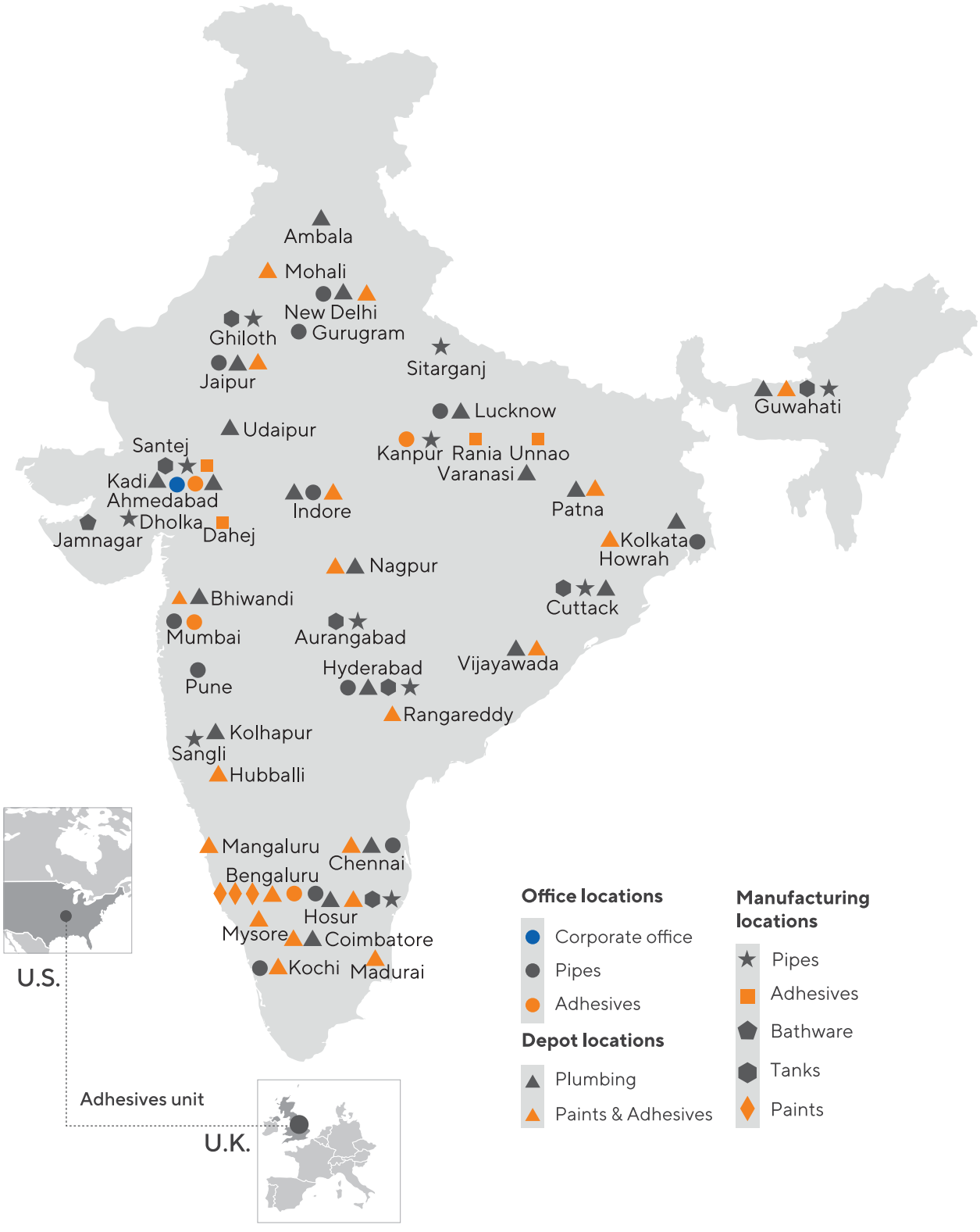


INNOVATION & RECOGNITIONS

- First to introduce CPVC piping system in India (1999)
- First to launch lead free uPVC piping system in India (2004)
- Corp Excel- National SME Excellence Award (2006)
- First to get NSF Certification for CPVC piping system in India (2007)
- First to launch lead-free uPVC column pipes in India (2012)
- Enterprising Entrepreneur of the year (2012-13)
- Business Standard Star SME of the year (2013)
- Inc. India Innovative 100 for Smart Innovation under category of 'Technology' (2013)
- India's Most Trusted Pipe Brand Award (2016, 2019-25)
- Fortune India 500 Company (2016)
- India's Most Desired Pipe Brand Award (2022)
- Consumer Validated Superbrands India (2017, 2019-26)

MARKETING NETWORK

Astral has a marketing network of more than 800 distributors and 30,000 dealers spread all over India with branch offices at Mumbai, Pune, Delhi, Bengaluru, Chennai, Hyderabad, Jaipur, Lucknow and Kochi. Apart from that Astral has its own warehouses at Vijaywada, Hyderabad, Delhi, Kolhapur, Kolkata, Nagpur, Indore, Patna, Varanasi, Jaipur, Hosur & Guwahati to deliver the material as quick as possible. More than 400 techno marketing professionals and administrative personnel are on the board to coordinate with architects, plumbing contractors and plumbers to utilize the best plumbing techniques and to get the best from the products.



INTRODUCTION

Astral has been relentless in its commitment to quality and service. Over the years, Astral has broadened and enhanced its product portfolio to serve its customers better.

Continuing its tradition of innovation, Astral is proud to introduce the Lead-Free ASTM uPVC Solvent Weld Industrial Piping System under the brand name Aquarius+.

Astral Aquarius+ ASTM uPVC pipes and fittings are lead-free and non-toxic, easy to install, and designed for long-lasting, trouble-free service. Astral Aquarius+ piping system is available in size ranging from 15 mm (½") to 300 mm (12"),

Pipes: Schedule 40 and Schedule 80, Fittings: Schedule 80 .

As a leading manufacturer offering a comprehensive range of uPVC pipes and fittings for residential and industrial applications, including ASTM uPVC pressure pipes and fittings, Astral can be your one-stop source for plastic piping systems for reliable, long-lasting plumbing solutions.

uPVC – UNPLASTICIZED POLYVINYL CHLORIDE

uPVC is one of the most widely specified thermoplastics for piping system components, including pipes, valves, fittings, flanges and many speciality products. uPVC offers excellent chemical and corrosion resistance against a broad range of fluids.

Astral uPVC materials conform to ASTM Cell Classification 12454-B of ASTM D1784, formerly designated as Type I, Grade I.

The maximum recommended service temperature for uPVC products is 45°C (113°F).

WHAT MAKES uPVC IMPORTANT?

uPVC makes a major contribution to the quality, safety and cost-effectiveness of construction materials while also helping reduce the environmental impact of completed projects.

uPVC is one of the most widely used polymers across various industrial applications, and over 50% of Western Europe's annual uPVC production is used in this sector.

uPVC offers the versatility required to meet both modern and future design requirements.

CE CERTIFICATION :



Attestation – Аттестация – 证明 – Attestation – 증명서 – شهادة

Form QAT_10-M06, version 02, effective since October 07th, 2022

ATTESTATION

No. 2P251009.ACS55

Technical File No.: AL-1000/CE/16, Rev.: 00, Date: 01/09/2025

Attestation's Holder: Astral Limited
Registered & Corporate Office: 207/1, Astral House, B/H. Rajpath Club, Off. S. G. Highway, Ahmedabad – 380059, Gujarat, India.
Works: Plot no - 1206, 1210, 1212, 1253 & 1264, Santej-Namsed Road, Taluka - Kalol, Dist. – Gandhinagar – 382721, Gujarat, India.

Attestation ECM Mark:

Product, Brand, Model(s): *(see the following annex)*

Verification to: Standard:
ASTM F441:2023, ASTM F439: 2024, ASTM D1785:2021, ASTM D2467: 2024, ASTM F1970:2024
related to Regulation (EU):
R.305/2011 Marketing of Construction Products (CPR)

This document has been issued in accordance with the European Commission's note of 14 September 2022 ref. Ares (2022) 6342894 concerning voluntary certifications with a non-notified procedure as it does not fall within the scope of Ente Certificazione Macchine notification under harmonised Union and for products intended for third countries outside the EU market.

The manufacturer has voluntarily decided to submit its documents concerning the above-mentioned product for verification. Ente Certificazione Macchine confirms that the documentation made available and immediately returned to it, as containing sensitive data, meets the essential requirements of the above-mentioned directives. The verification activity carried out exclusively concerned the technical documentation and no verification was carried out on the product. This document cannot replace the EC Declaration of Conformity. The above conformity mark can be affixed to the technical documentation in accordance with the ECM regulation on its issue and use, published on the website www.entecerma.it

Issuance date: 09 October 2025

Expiry date: 08 October 2030

For online check:

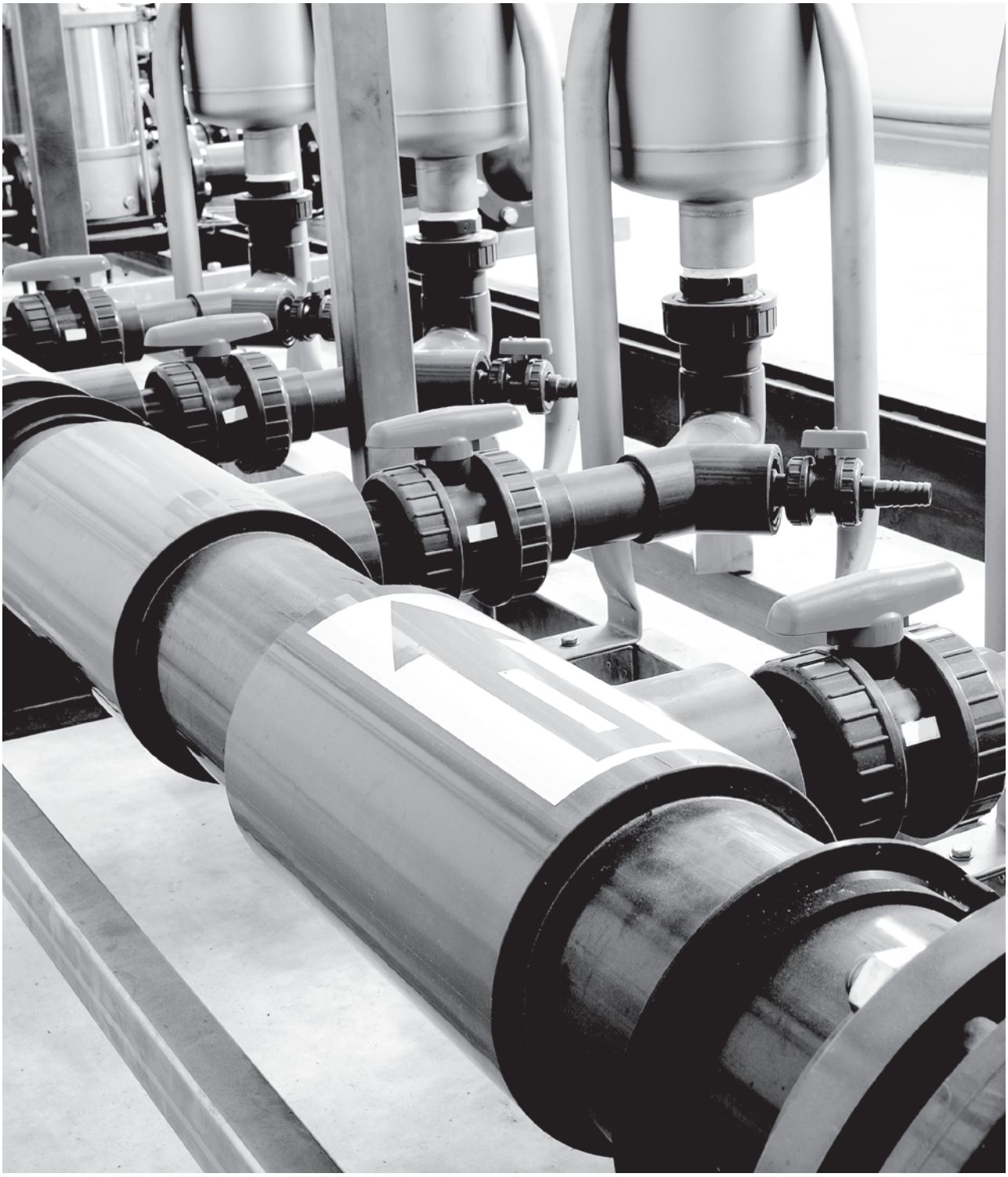
Approver
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THE DIFFERENCE
BETWEEN uPVC AND PVC

PVC (Poly Vinyl Chloride) is an amorphous thermoplastic material that can be compounded with additives to provide desirable properties to target a specific application. uPVC- unplasticized Poly Vinyl Chloride means Rigid PVC Pipe. Thus any Rigid PVC Pipe can be called either PVC or uPVC Pipe. PVC, uPVC or PVC-U all are different nomenclature of same material.



The images are put for representational purpose only

KEY PROPERTIES

The key properties of Astral **Aquarius+** high pressure Lead Free Industrial Piping System are significant with following features :



STRONG AND LIGHT WEIGHT

ASTRAL Aquarius+ Lead Free Industrial Piping System is tough, durable with high tensile and impact strength. The system is light in weight and can be transported easily from one place to another.



UV STABILIZED

Astral Aquarius+ Lead Free Industrial Piping System can be used in sunlight exposed conditions. However, Astral recommends a standard grade of exterior latex paint (water base) which will protect the system adequately.



FIRE RESISTANT

Astral Aquarius+ Lead Free Industrial Piping System is inherently difficult to ignite and stops burning once the source of heat is removed. Compared to its common plastic alternatives uPVC performs better in terms of lower combustibility, flammability, flame propagation and heat release. Newly developed advantages in terms of lower acid emissions, smoke generation and enhanced fire resistance.



SAFE MATERIAL FOR DRINKING WATER

Astral Aquarius+ pipes are non-toxic and lead free which makes them a safe material for potable water. It is also the world's most researched and thoroughly tested material for uPVC which meets all international standards for safety and health for both the products and applications.



DURABLE

Astral Aquarius+ Lead Free Industrial Piping System is durable and free from weakness caused by rusting, weathering and chemical action and hence last for life time.



SIMPLE AND LEAK PROOF JOINTS

Jointing can be done speedily with special IPS solvent cement supplied by the company which ensures 100% leak proof joints.



EASY TO INSTALL

Astral Aquarius+ Lead Free pipes can be cut, shaped, welded and jointed easily.



MAXIMUM FLOW RATE

Smooth inner surface ensures high flow rate and low frictional losses. The system is leach and scale free.

CHEMICAL RESISTANCE

uPVC is generally inert to most mineral acids, alkalies, salts and paraffinic hydrocarbon solutions. For more information on uPVC chemical resistance refer to Chemical Resistance of Rigid Vinyls Based.

GOOD INSULATOR

uPVC pipe is non conductor of electricity. Astral Aquarius+ pipes are non conductor of electricity so it make the Industrial Piping System safe when working with electrical tools or equipments.

WIDE RANGE

Astral Aquarius+ Lead-Free Industrial Piping System is available in sizes ranging from ½" (15 mm) to 12" (300 mm), along with a wide range of fittings, transition fittings, valves and NRV to suit diverse design requirements.

BENEFITS OF ASTRAL AQUARIUS+ SYSTEM OVER OTHER uPVC SYSTEMS

Astral Aquarius+ uPVC pipes being lead free are non-toxic and hence favoured for use in applications such as potable water pipes.

Astral Aquarius+ uPVC Industrial Piping System utilizes NSF (National Sanitation Foundation) approved one - step solvent cement, specifically formulated for the use. Joining is accomplished quickly and efficiently utilizing inexpensive tools thereby greatly reducing labor and installation costs.

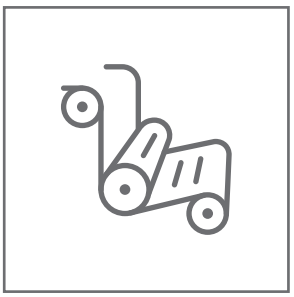
Astral Aquarius+ uPVC solvent joint Industrial Piping System makes its pressure bearing capacity twice than that of the threaded pipe.

Astral Aquarius+ uPVC pipes & fittings exhibit the well-known physical characteristics and other benefits of conventional PVC piping such as good chemical and corrosion resistance, low thermal conductivity, high strength-to-weight ratio, good impact resistance and ease of installation.

FIELDS OF APPLICATION



METAL TREATING



PULP AND PAPER



SUGAR INDUSTRIES



POWER SECTOR



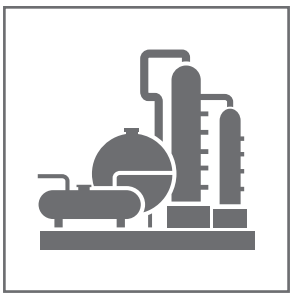
FERTILIZER



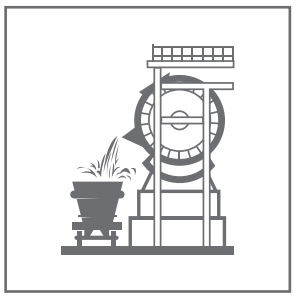
MINING



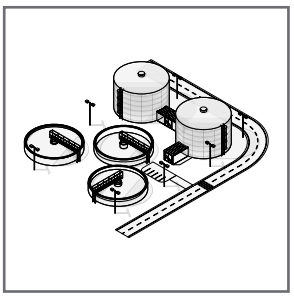
SHIPPING INDUSTRIES



CHEMICAL PROCESSING



STEEL INDUSTRIES



WATER TREATMENT PLANTS

STANDARDS & SPECIFICATIONS

ASTM D 1784 - Rigid Poly Vinyl Chloride (PVC) Compounds.

ASTM D 1785 - Poly Vinyl Chloride (PVC) Plastic Pipes, SCH 40 & SCH 80.

ASTM D 2466 - Socket type Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, SCH 40.

ASTM D 2467 - Socket type Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, SCH 80.

ASTM D 2564 - Solvent Cements for Plastic Pipes & Fittings

ASTM F 1498 - Taper Pipe threads 60° for Thermoplastics Pipe & Fittings

ASTM D 2774 - Underground Installation of Thermoplastic Pipes.

ISO 7/1 - Pipe threads where pressure joints are made on threads -
Part 1 : Designation, Dimension & Tolerances.

DESCRIPTIVE CODES

ASTM - American Society for Testing & Materials.

ANSI - American National Standards Institute

BSP - British Standard Pipe

IPS - Iron Pipe Size (ASTM)

NPT - National Pipe Threads (ANSI)

FIPT - Female Iron Pipe Threads

MIPT - Male Iron Pipe Threads

SOCKET - Solvent Weld Socket

SPIGOT - Spigot End (IPS)

FBSP - Female BSP Threads

MBSP - Male BSP Threads

NSF - National Sanitation Foundation

PVC - Poly Vinyl Chloride

EPDM - Ethylene Propylene Diene Monomer Rubber

IMPORTANT NOTE FOR INSTALLERS & USERS

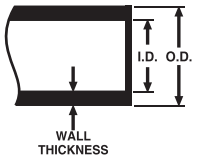
WATER HAMMER : Astral recommends that all uPVC Plastic piping systems be designed and constructed to avoid excessive WATER HAMMER. Water hammer can cause damage and failure to pipe, valves and fittings within the piping system.

THREADED CONNECTIONS : Use a quality grade thread sealant. Do not use substances that could cause stress cracking to plastic. Major attention must be given while making plastic thread joints. 1 to 2 turns beyond FINGER TIGHT is generally all that is required to make a sound plastic connection. Unnecessary OVER TIGHTENING will cause DAMAGE TO BOTH PIPES & FITTINGS. Also give proper attention while selecting the threaded fittings, as Astral manufacture some fittings with NPT threads & some fittings with BSP threads to give more versatility to customer NPT threads are not compatible with BSP threads.

SEAL & GASKET LUBRICANTS : Some Lubricants, including vegetable oils are known to cause stress cracking in thermoplastics materials. A mild soap or commercially available pipe gasket lubricants suitable for uPVC is recommended where lubrication is required for installation or maintenance service (especially with Flange joints). Choice of lubricant is at the discretion of the installer.

FLOW VELOCITY : System should not be operated or flushed out at flow velocity greater than **5 feet per second.**

TECHNICAL SPECIFICATION



PRESSURE RATING @23°C - uPVC PIPE SCHEDULE 40 (GREY)

Product Code	Nominal Size		Avarage OD		Minimum Wall Thickness		Maximum Work Pressure at 73°F (PSI)	Maximum Work Pressure at 23°C (kg/cm²)
	in	mm	in	mm	in	mm		
M061400501	½	15	0.840	21.34	0.109	2.77	600	42.19
M061400502	¾	20	1.050	26.67	0.113	2.87	480	33.75
M061400503	1	25	1.315	33.40	0.133	3.38	450	31.64
M061400504	1¼	32	1.660	42.16	0.140	3.56	370	26.01
M061400505	1½	40	1.900	48.26	0.145	3.68	330	23.20
M061400506	2	50	2.375	60.32	0.154	3.91	280	19.69
M061400507	2½	65	2.875	73.02	0.203	5.16	300	21.09
M061400508	3	80	3.500	88.90	0.216	5.49	260	18.28
M061400509	4	100	4.500	114.30	0.237	6.02	220	15.47
M061400516	5	125	5.563	141.30	0.258	0.55	190	13.10
M061400510	6	150	6.625	168.28	0.280	7.11	180	12.66
M061400511	8	200	8.625	219.08	0.322	8.18	160	11.25
M061400512	10	250	10.750	273.05	0.365	9.27	140	9.84
M061400513	12	300	12.750	323.85	0.406	10.31	130	9.14

MPa = Mega Pascal 1 MPa = 10 kg / cm² 1 kg / cm² = 14.223343 PSI.

PRESSURE RATING @23°C - uPVC PIPE SCHEDULE 80 (GREY)

Product Code	Nominal Size		Avarage OD		Minimum Wall Thickness		Maximum Work Pressure at 73°F (PSI)	Maximum Work Pressure at 23°C (kg/)
	in	mm	in	mm	in	mm		
M061800501	½	15	0.840	21.34	0.147	3.73	850	59.76
M061800502	¾	20	1.050	26.67	0.154	3.91	690	48.51
M061800503	1	25	1.315	33.40	0.179	4.55	630	44.29
M061800504	1¼	32	1.660	42.16	0.191	4.85	520	36.56
M061800505	1½	40	1.900	48.26	0.200	5.08	470	33.04
M061800506	2	50	2.375	60.32	0.218	5.54	400	28.12
M061800507	2½	65	2.875	73.02	0.276	7.01	420	29.53
M061800508	3	80	3.500	88.90	0.300	7.62	370	26.01
M061800509	4	100	4.500	114.30	0.337	8.56	320	22.50
M061800516	5	125	5.563	141.30	0.375	9.62	290	20.00
M061800510	6	150	6.625	168.28	0.432	10.97	280	19.69
M061800511	8	200	8.625	219.08	0.500	12.7	250	17.57
M061800512	10	250	10.750	273.05	0.593	15.06	230	16.17
M061800513	12	300	12.750	323.85	0.687	17.45	230	16.17

MPa = Mega Pascal 1 MPa = 10 kg / cm² 1 kg / cm² = 14.223343 PSI.

TEMPERATURE PRESSURE DE-RATING FACTOR

The operating pressure of PVC pipe will be reduced as the operating temperature increases above 23°C (73° F). To calculate this reduction, multiply the operating pressure with the correction factors shown below at a operating temperature of system :

Operating Temp. °C (F)	23° (73)	27° (80)	32° (90)	38° (100)	43° (110)	49° (120)	54° (130)	60° (140)
PVC	100%	90%	75%	62%	50%	40%	30%	22%

PHYSICAL PROPERTIES OF uPVC MATERIALS

Property	Units	Value	ASTM Test Method
Specific Gravity	g / cc	1.41 - 1.46	D792
Tensile Strength (23°C)	PSI	7,200	D638
Modulus of Elasticty in Tension (23°C)	PSI	4,60,000	D638
Flexural Strength (23°C)	PSI	13,200	D790
Izod Impact (Notched at 23°C)	ft lb/in.	0.65	D256
Hardness (Durometer D)	---	80 ± 3	D2240
Hardness (Rockwell R)	---	110 - 120	D785
Compressive Strength (23°C)	PSI	9,000	D695
Hydrostatic Design Stress	PSI	2,000	D1598
Coefficient of Linear Expansion	in./in./°F	3.1 x 10-5	D696
Heat Deflection Temperature at 66 psi	degrees °F	165	D648
Coefficient of Thermal Conductivity	BTU/hr/sq. ft/°F/in.	1.2	D177
Specific Heat	BTU/F/lb	0.25	D2766
Limiting Oxygen Index	%	43	D2863
Water Absorption (24 hrs at 23°C)	% weight gain	0.05	D570
Cell Classification-Pipe	---	12454-B	D1784
Cell Classification-Fittings	---	12454-B	D1784

Above data is based upon information provided by the raw material manufacturers. It should be used only as a recommendationand not as a guarantee of performance.

EXPANSION AND CONTRACTION

uPVC pipes, like other piping materials, undergo length changes as a result of temperature variations above and below the installation temperature. They expand and contract 4.5 to 5 times more than steel or iron pipe. The extent of the expansion - contraction depends upon the coefficient of linear expansion of piping material. The length of pipe between directional changes, and the temperature differential.

The coefficient of thermal expansion (Y) for uPVC is 3.1 x 10-5 in./in./°F.

The amount of expansion or contraction can be calculated using the following formula :

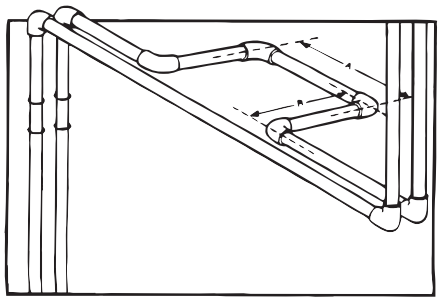
$\Delta L = Y (T1-T2) \times L$

ΔL = Dimensional change due to thermal expansion or contraction (in.)

Y = Expansion coefficient (in./in./°F)

(T^1-T^2) = Temperature differential between the installation temperature and the maximum or minimum system temperature, whichever provides greatest differential (°F).

L = Length of pipe run between changes in direction (ft)



There are several ways to compensate for expansion and contraction. The most common methods are :

1. Expansion loops which consist of pipe and 90° elbows
2. Piston type expansion joints*
3. Flexible bends*
4. Bellows and rubber expansion joints*

*The manufacturers of these devices should be contacted to determine the suitability of their products for the specific application.

Expansion loops are a simple and convenient way to compensate for expansion and contraction when there is sufficient space for the loop in the piping system. A typical expansion loop design is shown below.

The length of leg "R" can be determined by using the following formula to ensure that it is long enough to absorb the expansion and contraction movement without damage. The length of leg "A" should be 1/2 the length of leg "R"

$R = 1.44\ D \Delta L$

R = Expansion loop leg length (ft)

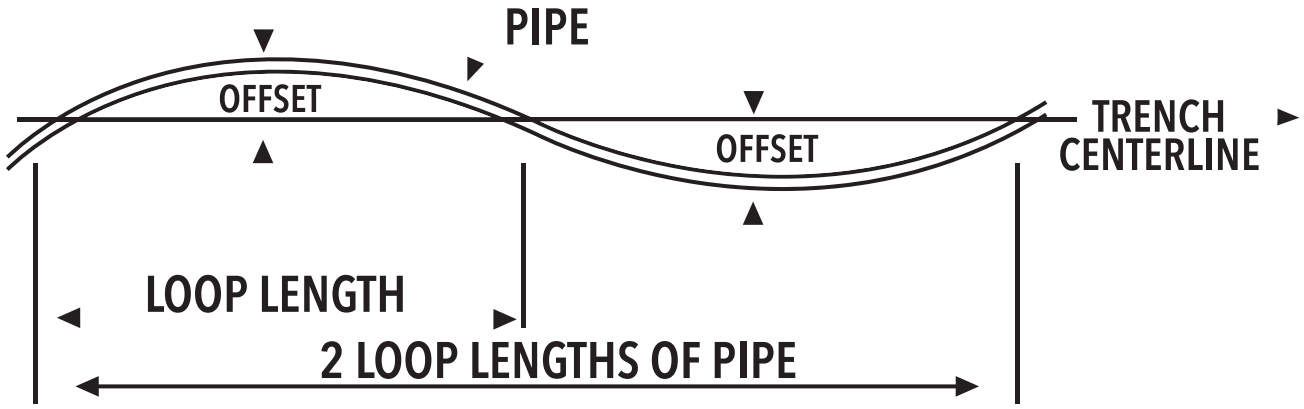
D = Nominal outside diameter of pipe (in). (See table below)

ΔL = Dimensional change due to thermal expansion or contraction (in).

When installing the expansion loop, no rigid or restraining support should be placed within the leg lengths of the loop. The loop should be installed as closely as possible to the mid-point between anchors. Piping support guides should restrict lateral movement and direct axial movement into the loop. Lastly, the pipe and fittings should be solvent cemented together, rather than using threaded connections.

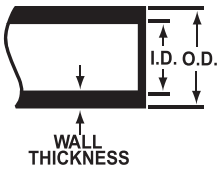
Compensation for expansion and contraction in underground application is normally achieved by snaking the pipe in the trench. Proper trenching and burial procedures must be followed to protect the piping system.

The table below shows recommended offsets and loop lengths for piping up to 2½" nominal size.



Loop Length in Feet	MAX. TEMP. VARIATION °F, BETWEEN INSTALLATION									
	10°	20°	30°	40°	50°	60°	70°	80°	90°	100°
	LOOP OFFSET IN INCHES									
20	3.0	3.5	4.5	5.0	6.0	6.5	7.0	7.0	8.0	8.0
50	7.0	9.0	11.0	13.0	14.0	15.5	17.0	18.0	19.0	20.0
100	13.0	18.0	22.0	26.0	29.0	31.5	35.0	37.0	40.0	42.0

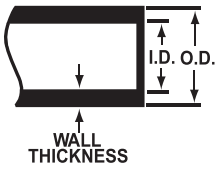
uPVC SCHEDULE 40



PIPE DIMENSIONS

Nominal Pipe Size		Mean Outside Diameter		O.D. Tolerance		Minimum Wall Thickness	
in	mm	in	mm	in	mm	in	mm
½	15	0.840	21.34	.004	0.10	0.109	2.77
¾	20	1.050	26.67	.004	0.10	0.113	3.38
1	25	1.315	33.04	.005	0.13	0.133	3.38
1¼	32	1.660	42.16	.005	0.13	0.140	3.56
1½	40	1.900	48.26	.006	0.15	0.145	3.68
2	50	2.375	60.33	.006	0.15	0.154	3.91
2½	65	2.875	73.03	.007	0.18	0.203	5.16
3	80	3.500	88.9	.008	0.20	0.216	5.49
4	100	4.500	114.3	.009	0.23	0.237	6.02
5	125	5.563	141.3	.010	0.25	0.258	6.55
6	150	6.625	168.28	.011	0.28	0.280	7.11
8	200	8.625	219.08	.015	0.38	0.322	8.18
10	250	10.750	273.05	.015	0.38	0.365	9.27
12	300	12.750	323.85	.015	0.38	0.408	10.36

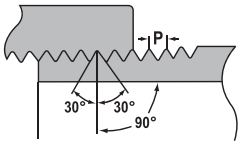
uPVC
SCHEDULE 80



PIPE DIMENSIONS

Nominal Pipe Size		Mean Outside Diameter		O.D. Tolerance		Minimum Wall Thickness	
in	mm	in	mm	in	mm	in	mm
½	15	0.840	21.34	.004	0.10	0.14	3.73
¾	20	1.050	26.67	.004	0.10	0.15	3.91
1	25	1.315	33.04	.005	0.13	0.17	4.54
1¼	32	1.660	42.16	.005	0.13	0.19	4.85
1½	40	1.900	48.26	.006	0.15	0.20	5.08
2	50	2.375	60.33	.006	0.15	0.21	5.53
2½	65	2.875	73.03	.007	0.18	0.27	7.01
3	80	3.500	88.9	.008	0.20	0.30	7.62
4	100	4.500	114.3	.009	0.23	0.33	8.55
5	125	5.563	141.3	.010	0.25	0.37	9.52
6	150	6.625	168.28	.011	0.28	0.43	10.97
8	200	8.625	219.08	.015	0.38	0.50	12.7
10	250	10.750	273.05	.015	0.38	0.59	15.06
12	300	12.750	323.85	.015	0.38	0.68	17.44

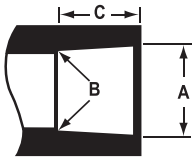
Moulded Schedule 80 fittings are manufactured to ASTMD 2467 for use with pipe manufactured to ASTM D1785.



BSPT THREAD DIMENSIONS

Nominal Pipe Size		Threads Per Inch	Pitch of Thread P	
in	mm	in	in	mm
½	15	14	0.0714	1.814
¾	20	14	0.0714	1.814
1	25	11	0.0909	2.309
1¼	32	11	0.0909	2.309
1½	40	11	0.0909	2.309
2	50	11	0.0909	2.309
2½	65	11	0.0909	2.309
3	80	11	0.0909	2.309
4	100	11	0.0909	2.309
5	125	11	0.0909	2.309
6	150	11	0.0909	2.309
8	200	10	0.100	2.540
10	250	10	0.100	2.540
12	300	8	0.125	3.175

uPVC
SCHEDULE 80



SOCKET DIMENSIONS OF FITTINGS

Nominal Pipe Size		Diameter						Socket Length Minimum C	
		Entrance A		Bottom B		Tolerance A			
in	mm	in	mm	in	mm	in	mm	in	mm
½	15	0.848	21.54	0.836	21.23	.004	0.10	0.688	17.48
¾	20	1.058	26.87	1.046	26.57	.004	0.10	0.719	18.26
1	25	1.325	33.66	1.310	33.27	.005	0.13	0.875	22.23
1¼	32	1.670	42.42	1.655	42.04	.005	0.13	0.938	23.83
1½	40	1.912	48.56	1.894	48.11	.006	0.15	1.094	27.79
2	50	2.387	60.63	2.369	60.17	.006	0.15	1.156	29.36
2½	65	2.889	73.38	2.868	72.85	.007	0.18	1.750	44.45
3	80	3.516	89.31	3.492	88.7	.008	0.20	1.875	47.63
4	100	4.518	114.76	4.491	114.07	.009	0.23	2.000	50.8
5	125	5.583	141.81	5.553	141.05	.010	0.25	3.000	76.2
6	150	6.647	168.83	6.614	168.00	.011	0.28	3.000	76.2
8	200	8.655	219.84	8.610	218.69	.015	0.38	4.000	101.6
10	250	10.780	273.81	10.735	272.67	.015	0.38	5.000	127.0
12	300	12.780	327.61	12.735	323.47	.015	0.38	6.000	152.4

Moulded Schedule 80 fittings are manufactured to ASTMD 2467 for use with pipe manufactured to ASTM D1785.

STANDARD COMPARISONS

JIS K6741 (mm)		DIN 8062 (mm)		ASTM F 441 (in)		NPT – ANSI B1.20.1** Tapered Thread		BSP – BS21, DIN 2999, ISO 7/1 Thread	
Nominal	Actual*	O.D.	Actual*	Nominal	Actual*	Designation	Threads/in.	Designation	Threads/ 25.4mm
16	22	20	20	½	0.840	½	14.0	½	14.0
20	26	25	25	¾	1.050	¾	14.0	¾	14.0
25	32	32	32	1	1.315	1	11.5	1	11.0
30	38	40	40	1¼	1.660	1¼	11.5	1¼	11.0
40	48	50	50	1½	1.900	1½	11.5	1½	11.0
50	60	63	63	2	2.375	2	11.5	2	11.0
75	89	90	90	3	3.500	3	8.0	3	11.0
100	114	110	110	4	4.500	4	8.0	4	11.0

*Specified dimention, certain tolerances apply

**NPT and BSP have different thread angles and not compatible.

uPVC INJECTION MOULDED CLASS 150 FLANGES

TECHNICAL INFORMATION

APPLICATION

CLASS 150 Flange fittings are coupling devices designed for joining IPS (Iron Pipe Size) plastic piping systems, where frequent disassembly may be required, and can be used as a transitional fitting for joining plastic to metal piping systems. Suitability of application is at the discretion of the user.

PRESSURE RATING

150 psi, water at 73°F.

FLANGE TYPES

One Piece — Available in socket configuration, sizes ½" through 12".

Van Stone Style — Two-piece design with rotating flange ring, available in socket configurations, sizes ½" to 12".

Blind — Closed ring design for capping off a mating flange, flanged fitting or flanged valve, available in sizes ½" to 12".

MATERIALS

All injection mould flanges are produced from uPVC materials approved for potable water use.
Glass-filled uPVC mould materials may be used in certain Van Stone Style flange-rings and large diameter Blind flanges where additional reinforcement is deemed necessary.

CONFORMANCE STANDARDS

Socket & Spigot — ASTM D2467 (uPVC)

Threads — ASTM F1498

Bolt Hole Pattern — ANSI B16.5; ASTM D4024

Material — ASTM D1784 (uPVC Cell Classification 12454-B)

FLANGING OF ASTRAL AQUARIUS+ uPVC PIPE

Flanging can be used to provide temporary disassembly of a piping system or when it is not possible to make up solvent cemented joints at the assembly site. Flanges are joined to the pipe by solvent cement or threaded joints. Refer to the sections on solvent cementing or threading of Astral Aquarius+ uPVC pipe for the proper techniques. Flanged joints incorporate an elastomeric gasket between the mating faces to provide for a seal. The gasket selected must be full-faced and have a hardness of 55-80 durometer A. Typically, gaskets are 1/8" thick. The gasket material must be resistant to the chemical environment. Many manufacturers of gasketing materials supply this kind of information. If the piping system is for potable water service, the gasket must also be approved for potable water. The flanges should be carefully aligned and the bolts inserted through matching holes. A flat washer should be used beneath each nut and bolt head. Each bolt should be partially tightened in the alternating sequence indicated here. A torque wrench should be used for the final tightening of the bolts. The bolts should be tightened to the torque recommended as per the table in the same alternating sequence used previously. Flange joints are typically rated to 150 psi at 23°C. For systems operating at higher temperatures, the flange pressure rating should be derated with the same derating factors which apply to the piping system pressure rating. system pressure rating.

uPVC SCH 40 & SCH 80 PIPES
FITTINGS SCH 80



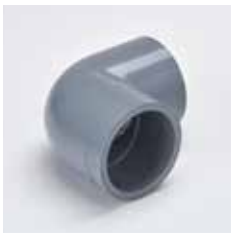
SCH-40



SCH-80

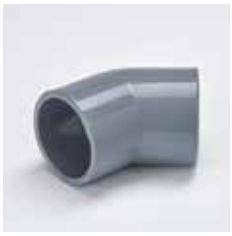

TEE (SOC)


REDUCER TEE (SOC)


90° ELBOW - SOC


CROSS (SOC)

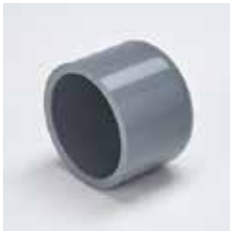

REDUCER COUPLING (SOC)


ELBOW 45° (SOC)


COUPLER (FAPT)


MAPT (PVC THREAD)


COUPLER (SOC)


CAP (SOC)


FLANGE HUB SOC


CLAMP SADDLE


REDUCER BUSHING (SPIG x SOC)


UNION


BLIND FLANGE


VANSTONE FLANGE (SOC)


FLANGE - SPIG


TRUE UNION INDUSTRIAL CHECK VALVES (NRV)


TRUE UNION BALL VALVE COMPACT SERIES


TRUE UNION BALL VALVE INDUSTIAL SERIES


SINGLE UNION BALL VALVE


BUTTERFLY VALVE VITON W/HANDLE


DIAPHRAGM VALVE FLANGED EPDM


BALL VALVE



P-70 PRIMER



705 PVC



717 PVC

INSTALLATION PROCEDURE

Systems should be installed in a good and workmanlike manner consistent with normal industry standards and in conformance with all local safty, fire and Industrial code requirements. Failure to follow proper installation practices, procedures or techniques can result in system failure, property damage or personal injury.
Follow manufacturers' instructions for all related products.

PIPE CUTTING



Cut pipe square. As joints are sealed at the base of the fitting socket. An angled cut may result in joint failur.
Acceptable tools include miter saw, mechanical cut off saw or wheel cutter. Wheel type cutters must employ a blade designed for plastics.



REMOVE BURR AND BEVEL

Remove all burr from inside and outside of pipe with a file, or deburring tool. Chamfer(bevel) the end of the pipe 10°-15°
CLEAN : Remove surface dirt, grease, or moisture with a clean dry cloth.

DRY FIT



With light pressure, pipe should go one third to one half of the way into the fitting socket. Pipes and fittings that are too tight or too loose should not be used.



APPLICATOR

Use an applicator that is one half the pipe diameter.

• Too large an applicator will force excessive cement into the inside of small diameter fittings. Too small an applicator will not apply sufficient cement to large diameter systems.

CEMENT



Apply a full even layer of cement to the outside of a pipe and medium layer of cement to the inside of a fitting.



JOIN PIPE AND FITTINGS

Assemble pipe and fitting socket till it contacts socket bottom. Give pipe a quarter turn. Hold pipe and fitting together until the pipe does not back out.

• Remove excessive cement from the exterior. A properly made joint will show a continuous bead of cement around the perimeter.

uPVC CEMENT FOR SCH 40 AND INTERFERENCE FIT

Pipe Size		Cement Type	Min. Vis. (CP)	IPS Weld on
	mm			
½ - 2	15 - 50	Medium Bodied	500	705
2½ - 12	65 - 300	Heavy Bodied	1600	717

uPVC CEMENT FOR SCH 80 AND NON INTERFERENCE FIT

Pipe Size		Cement Type	Min. Vis. (CP)	IPS Weld on
	mm			
½ - 1¼	15 - 32	Medium Bodied	500	705
1½ - 12	40 - 300	Heavy Bodied	1600	717

N.B. : Primers must be used in solvent cement joints of uPVC plastic pipe and fittings for size above 2".

JOINT CURING

RECOMMENDED INITIAL SET TIMES

TEMPERATURE RANGE	PIPE SIZE			
	½" to 1¼"	1½" to 3"	4" to 8"	10" to 12"
	15 to 32 mm	40 to 80 mm	100 to 200 mm	250 to 300 mm
15.5°C - 37.7°C	15 min.	30 min.	1 hrs.	2 hrs.
4.4°C - 15.5°C	1 hrs.	2 hrs.	4 hrs.	8 hrs.

RECOMMENDED INITIAL CURE TIMES

TEMPERATURE RANGE	PIPE SIZE			
	½" to 1¼"	1½" to 3"	4" to 8"	10" to 12"
	15 to 32 mm	40 to 80 mm	100 to 200 mm	250 to 300 mm
15.5°C - 37.7°C	6 hrs.	12 hrs.	24 hrs.	48 hrs.
4.4°C - 15.5°C	12 hrs.	24 hrs.	48 hrs.	96 hrs.

TESTING PRESSURE SYSTEM

1. Conduct pressure testing with water. DO NOT USE AIR OR OTHER GASES for pressure testing.
2. The piping system should be adequately anchored to limit movement. Water under pressure exerts thrust forces in piping systems. Thrust blocking should be provided at changes of direction, change in size and at dead ends.
3. Please refer tables given for initial set & cure times before pressure testing.
4. The piping systems should be slowly filled with water, taking care to prevent surge and air entrapment. The flow velocity should not exceed 1 feet per second.
5. All trapped air must be slowly released. Vents must be provided at all high points of the piping system. All valves and air relief mechanisms should be opened so that the air can be vented while the system is extremely dangerous and it must be slowly and completely vented prior to testing.
   For sizes 4" & above, Astral recommends to use automatic air relief valves at every 300 - 400 mtr. distance & at furthest & highest points of pipeline to avoid any damage to the piping system.
6. The piping system can be pressurized to 125% of its designed working pressure. However care must be taken to ensure the pressure does not exceed the working pressure of the lowest rated component in the system (valves, unions, flanges, threaded parts etc.)
7. The pressure test should not exceed one hour. Any leaking joints or pipe must be cut out and replaced and the line recharged and retested using the same procedure.

SUPPORT SPACING
FOR uPVC PIPE

Adequate supports for any piping system is a matter of great importance. In practice, support spacings are a function of pipe size operating temperatures, the location of heavy valves or fittings and the mechanical properties of the pipe material.

To ensure the satisfactory operation of a Astral Aquarius+ uPVC piping system, the location and type of hangers should be carefully considered. Hangers should not compress, distort, cut or abrade the piping.

All piping should be supported with an approved hanger at intervals sufficiently close to maintain correct pipe alignment and to prevent sagging or geade reversal. Pipe should also be supported at all branch ends and at all changes of direction. Support trap arms as close as possible to the trap.

(1) Concentrated loads should be supported directly so as to eliminate high stress concentrations. Should this be impractical then the pipe must be supported immediately adjacent to the load.

(2) In systems where large fluctuations in temperature occur, allowances must be made for expansion and contraction of the piping system. Since changes in direction in the system are usually sufficient to allow for expansion and contraction hangers must be placed so as not to restrict this movement.

(3) Since plastic pipe expands or contracts approximately five times greater than those of steel, hangers should not restrict this movement.

(4) Hangers should provide as much bearing surface as possible. To prevent damage to the pipe, file smooth any sharp edges or burrs on the hangers or supports.

(5) Support spacing for horizontal piping systems is determined by the maximum operating temperature the system will encounter. The piping should be supported on uniform centers with supports that do not restrict the axial movement.

(6) For vertical lines, it is recommended that an engineer should design the vertical supports according to the vertical load involved.

SCHEDULE - 40 RECOMMENDED SUPPORT SPACING (IN FEET)

Nom. Pipe Size		TEMPERATURE °C				
(in)	(mm)	15.5	26.6	37.7	48.8	60
½	15	4½	4½	4	2½	2½
¾	20	5	4½	4	2½	2½
1	25	5½	5	4½	3	2½
1¼	32	5½	5½	5	3	3
1½	40	6	5½	5	3½	3
2	50	6	5½	5	3½	3
2½	65	6½	6	5½	4	3
3	80	7	7	6	4	3½
4	100	7½	7	6½	4½	4
6	150	8½	8	7½	5	4½
8	200	9½	9	8½	5½	5
10	250	10½	9½	9	6½	5½
12	300	12	10½	9½	7	6

SCHEDULE - 80 RECOMMENDED SUPPORT SPACING (IN FEET)

Nom. Pipe Size		TEMPERATURE °C				
(in)	(mm)	15.5	26.6	37.7	48.8	60
½	15	5	4½	4½	3	2½
¾	20	5½	5	4½	3	2½
1	25	6	5½	5	3½	3
1¼	32	6	6	5½	3½	3
1½	40	6½	6	5½	3½	3½
2	50	7	6½	6	4	3½
2½	65	7½	7½	6½	4½	4
3	80	8	7½	7	4½	4
4	100	9	8½	7½	5	4½
6	150	10	9½	8½	6½	5½
8	200	11	10	9½	7½	6
10	250	12½	11	10½	8	7
12	300	13	12	10½	7½	6½

NOTE : The above information provides general guidelines. It should be used only as a reference and not as a guarantee of performance. Specific installation instructions and techinques may be required as a result of local plumbing and building codes, engineering specifications and instructions.

CHEMICAL RESISTANCE CHART - PVC

REAGENT	TEMPERATURE	
	23°C (73°F)	45°C (113°F)
[A]		
Acetaldehyde	NR	NR
Acetic Acid, pure	NR	NR
Acetic Acid, 10%	R	R
Acetic Acid, 20%	R	R
Acetic Acid, 80%	R	R
Acetic Acid, Glacial	R	NR
Acetic Anhydride	NR	NR
Acetone	NR	NR
Acetyl Nitrile	NR	NR
Acetylene	R	R
Acrylic Acid Ethyl Ester	NR	NR
Adipic Acid	R	R
Alcohols Methyl	R	R
Butyl	R	NR
Propyl	R	R
Allyl Alcohol, 96%	R	NR
Allyl Chloride	R	R
Alum	R	R
Alum, Chrome	R	R
Alum, Potassium	R	R
Aluminum Alum	R	R
Aluminum Chloride	R	R
Aluminum Fluoride	R	R
Aluminum Hydroxide	R	R
Aluminum Oxylchloride	R	R
Aluminum Nitrate	R	R
Aluminum Sulfate	R	R
Ammonia (Gas-dry)	R	R
Ammonia (Liquid)	NR	NR
Ammonium Acetate	R	R
Ammonium Alum	R	R
Ammonium Bifluoride	R	R
Ammonium Bisulfate	R	R
Ammonium Carbonate	R	R
Ammonium Chloride	R	R
Ammonium Dichromate	R	NR
Ammonium Fluoride, 25%	R	NR
Ammonium Hydroxide	R	R
Ammonium Hydroxide, 10%	R	R
Ammonium Hydroxide, 28%	R	R
Ammonium Metaphosphate	R	R
Ammonium Nitrate	R	R
Ammonium Persulfate	R	R
Ammonium Phosphate	R	R
Ammonium Sulfate	R	R
Ammonium Sulfide	R	R
Ammonium Thiocyanate	R	R

REAGENT	TEMPERATURE	
	23°C (73°F)	45°C (113°F)
[A]		
Amyl Acetate	NR	NR
Amyl Alcohol	R	NR
Amyl Chloride	NR	NR
Aniline	NR	NR
Aniline Chlorohydrate	NR	NR
Aniline Hydrochloride	NR	NR
Anthraquinone	R	NR
Anthraquinonesulfonic Acid	R	R
Antimony Trichloride	R	R
Aqua Regia	NR	NR
Aromatic Hydrocarbons	NR	NR
Arsenic Acid, 80%	R	R
Arylsulfonic Acid	R	R
[B]		
Barium Nitrate	R	R
Barium Carbonate	R	R
Barium Chloride	R	R
Barium Hydroxide (10%)	R	R
Barium Sulfate	R	R
Barium Sulfide	R	R
Beer	R	R
Beet Sugar Liquors	R	R
Benzaldehyde, 10%	R	NR
Benzaldehyde, above 10%	NR	NR
Benzene	NR	NR
Benzoic Acid	R	R
Bismuth Carbonate	R	R
Black Liquor	R	R
Bleach (12% Cl)	R	R
Borax	R	R
Boric Acid	R	R
Breeder Pellets (Fish deriv.)	R	R
Brine (Acid)	R	R
Bromic Acid	R	R
Bromine, Liquid	NR	NR
Bromine, Vapor (25%)	R	R
Bromine Water	R	R
Bromine Water	NR	NR
Bromobenzene	NR	NR
Bromotoluene	NR	NR
Butadiene	R	R
Butane	R	R
Butanol, Primary	R	R
Butanol, Secondary	R	NR
Butyl Acetate	R	NR
Butyl Alcohol	R	R
Butyl Cellosolve	R	NR

REAGENT	TEMPERATURE	
	23°C (73°F)	45°C (113°F)
[B]		
Butyl Mercaptan	NR	NR
Butyl Phenol	R	NR
Butyl Stearate	R	NR
Butynediol	R	NR
Butyric Acid	R	NR
[C]		
Cadmium Cyanide	R	R
Calcium Bisulfide	R	R
Calcium Bisulfite	R	R
Calcium Bisulfite Bleach Liquor	R	R
Calcium Carbonate	R	R
Calcium Chlorate	R	R
Calcium Chloride	R	R
Calcium Hydroxide	R	R
Copper Hypochlorite	R	R
Calcium Nitrate	R	R
Calcium Oxide, Type I	R	R
Calcium Sulfate	R	R
Camphor (Crystals)	R	NR
Cane Sugar Liquors	R	R
Carbitol	R	NR
Carbon Dioxide	R	R
Carbon Dioxide-Aqueous Solution	R	R
Carbon Disulfide	NR	NR
Carbon Monoxide	R	R
Carbon Tetrachloride	R	NR
Carbon Tetrachloride	NR	NR
Carbonic Acid	R	R
Castor Oil	R	R
Caustic Potash	R	R
Cellosolve	R	NR
Cellosolve Acetate	R	NR
Chloracetic Acid, Type I	R	R
Chloracetic Acid, Type II	R	NR
Chloral Hydrate	R	R
Chloramine	R	NR
Chloric Acid, 20%	R	R
Chloride (Water)	R	R
Chlorinated Solvents	NR	NR
Chlorine (Dry-liquid)	NR	NR
Chlorine (Liquid) (under pressure)	NR	NR
Chlorine Gas (Dry)	NR	NR
Chlorine Gas (Wet)	NR	NR
Chlorine Water	R	NR
Chloroacetic Acid	R	R
Chloroacetyl Chloride	R	NR
Chlorobenzene	NR	NR
Chloroform	NR	NR
Chloropicrin	NR	NR
Chlorosulfonic Acid	R	NR

REAGENT	TEMPERATURE	
	23°C (73°F)	45°C (113°F)
[C]		
Chlorox Bleach Solution	R	R
Chrome Alum	R	R
Chromic Acid, 10%	R	NR
Chromic Acid, 50%	NR	R
Chromic/Nitric Acid	R	NR
15%-35%	NR	NR
Chromic/Sulfuric/Water	R	NR
50/15/35	R	R
Citric Acid	R	R
Coconut Oil Alcohol	R	R
Copper Carbonate	R	R
Copper Chloride	R	R
Copper Cyanide	R	R
Copper Fluoride	R	R
Copper Nitrate	R	R
Copper Sulfate	R	R
Corn Syrup	R	R
Cottonseed Oil	R	NR
Cresol	NR	R
Cresylic Acid, 50%	R	NR
Crotonaldehyde	NR	R
Crude Oil	R	R
Cupric Fluoride	R	R
Cupric Sulfate	R	R
Cuprous Chloride	R	R
Cyclanones	R	NR
Cyclohexane	NR	NR
Cyclohexanol	NR	NR
Cyclohexanone	NR	NR
[D]		
D.D.T. (Xylene Base)	NR	NR
Desocyephedrine Hydrochloride	R	R
Detergents	R	R
Dextrin	R	R
Dextrose	R	R
Diacetone Alcohol	R	R
Diazo Salts	R	NR
Dibutoxy Ethyl Phthalate	NR	NR
Dibutyl Phthalate	NR	NR
Dibutyl Sebacate	R	NR
Dichlorobenzene	NR	NR
Diesel Fuels	R	R
Diethyl Ether	R	R
Diglycolic Acid	R	NR
Dimethyl Hydrazine	NR	R
Dimethylamine	R	NR
Dioctylphthalate	NR	NR
Disodium Phosphate	R	R
Distilled Water	R	R

REAGENT	TEMPERATURE	
	23°C (73°F)	45°C (113°F)
[E]		
Esters	NR	NR
Ethers	NR	NR
Ethyl Acetate	NR	NR
Ethyl Acrylate	NR	NR
Ethyl Alcohol	R	R
Ethyl Chloride	NR	NR
Ethyl Chloroacetate	NR	NR
Ethyl Ether	NR	NR
Ethylene Bromide	NR	NR
Ethylene Chlorohydrin	NR	NR
Ethylene Dichloride	NR	NR
Ethylene Glycol	R	R
Ethylene Oxide	NR	NR
[F]		
Fatty Acids	R	R
Ferric Acetate	R	NR
Ferric Chloride	R	R
Ferric Hydroxide	R	R
Ferric Nitrate	R	R
Ferric Sulfate	R	R
Ferrous Chloride	R	R
Ferrous Hydroxide	R	NR
Ferrous Nitrate	R	R
Ferrous Sulfate	R	R
Fish Solubles	R	R
Fluoroboric Acid	R	R
Fluorine Gas (Wet)	R	NR
Fluorine Gas	R	NR
Fluorine Gas, T	NR	NR
Fluorosilicic Acid, 25%	R	R
Formaldehyde	R	R
Formic Acid	R	NR
Fructose	R	R
Fruit Juices and Pulp	R	R
Furfural	NR	NR
Freon II	R	R
Freon 12	R	R
Freon 21	NR	NR
Freon 22	NR	NR
Freon 113	R	NR
Freon 114	R	R
[G]		
Gallic Acid	R	R
Gas (Coke Oven)	NR	NR
Glucose	R	R
Glycerine	R	R
Glycol	R	R
Glycolic Acid	R	R
Grapesugar	R	R
Green Liquor	R	R

REAGENT	TEMPERATURE	
	23°C (73°F)	45°C (113°F)
[H]		
Heptane	R	R
Hexane	R	NR
Hexanol, Tertiary	R	R
Hydrobromic Acid, 20%	R	R
Hydrochloric Acid, 10%	R	R
Hydrochloric Acid, 30%	R	R
Hydrochloric Acid	R	R
Conc.	R	NR
Hydrochloric Acid Pickling	R	R
Hydrocyanic Acid	R	R
Hydrofluoric Acid, 48%	R	NR
Hydrofluoric Acid, 50%	R	NR
Hydrofluoric Acid, 70%	NR	NR
Hydrofluorsilicic Acid	R	R
Hydrogen	R	R
Hydrogen Peroxide, 30%	R	R
Hydrogen Peroxide, 50%	R	R
Hydrogen Peroxide, 90%	R	R
Hydrogen Phosphide	R	R
Hydrogen Sulfide	R	R
Hydroquinone	R	R
Hydroxylamine Sulfate	R	R
Hypochlorine Acid	R	R
Hypochlorous Acid	R	R
Hydrazine (Anhydrous) 97%	NR	NR
[I]		
Iodine	NR	NR
Iodine Solution (10%)	NR	NR
[K]		
Kerosene	R	R
Ketones	NR	NR
Kraft Liquors	R	R
[L]		
Lactic Acid, 25%	R	R
Lactic Acid, 80%	R	R
Lard Oil	R	R
Lauric Acid	R	R
Lauryl Chloride	R	R
Lead Acetate	R	R
Lead Chloride	R	R
Lead Nitrate	R	R
Lead Sulfate	R	R
Linoleic Acid	R	R
Linoleic Oil	R	R
Linseed Oil	R	R
Liquors	R	R
Lithium Bromide	R	R

REAGENT	TEMPERATURE	
	23°C (73°F)	45°C (113°F)
[M]		
Machine Oil	R	R
Magnesium Carbonate	R	R
Magnesium Chloride	R	R
Magnesium Citrate	R	R
Magnesium Hydroxide	R	R
Magnesium Nitrate	R	R
Magnesium Sulfate	R	R
Manganese Chloride	R	R
Manganese Sulfate (Sat.)	R	R
Manganese Sulfate (10%)	R	R
Manganese Sulfate (20%)	R	R
Maleic Acid	R	R
Malic Acid	R	R
Mercural Ointment, Blue (5%)	R	R
Mercuric Chloride	R	R
Mercuric Cyanide	R	R
Mercurous Nitrate	R	R
Mercury	R	R
Mercury Ointment (Ammoniated)	R	NR
Methoxyethyl Oleate	R	R
Methyl Alcohol	R	NR
Methyl Cellosolve	NR	NR
Methyl Chloride	NR	NR
Methyl Ethyl Ketone	NR	NR
Methyl Iso-Butyl Ketone	NR	NR
Methyl Methacrylate	R	NR
Methyl Salicylate	R	NR
Methyl Sulfate	R	R
Methyl Sulfuric Acid	R	R
Methylamine	NR	NR
Methylene Bromide	NR	NR
Methylene Chloride	NR	NR
Methylene Iodine	NR	NR
Milk	R	R
Mineral Oils	R	R
Mixed Acids	R	R
Molasses	R	R
Muriatic Acid	R	R
[N]		
Naphtha	R	R
Naphthalene	NR	NR
Natural Gas	R	R
Nickel Acetate	R	R
Nickel Chloride	R	R
Nickel Nitrate	R	R
Nickel Sulfate	R	R
Nicotine	R	R
Nicotine Acid	R	R
Nitric Acid, Anhydrous	NR	NR
Nitric Acid, 10%	R	R

REAGENT	TEMPERATURE	
	23°C (73°F)	45°C (113°F)
[N]		
Nitric Acid, 30%	R	R
Nitric Acid, 60%	R	R
Nitric Acid, 68%	R	NR
Nitrobenzene	NR	NR
Nitroglycerine	NR	NR
Nitrous Oxide	R	NR
Nitroglycol	NR	NR
[O]		
Ocenol, Type I	R	R
Oils and Fats	R	R
Oils, Sour Crude	R	R
Oleic Acid	R	R
Oleum	NR	NR
Oxalic Acid	R	R
Oxygen	R	R
Ozone	R	R
[P]		
Palmitic Acid, 10%	R	R
Palmitic Acid, 70%	R	NR
Paraffin	R	R
Peracetic Acid, 40%	R	NR
Perchloric Acid, 10%	R	R
Perchioric Acid, 15%	R	NR
Perchloric Acid, 70%	R	NR
Perphosphate	R	R
Petroleum Liquifier	R	R
Petroleum Oils (Sour)	R	NR
Phenol	NR	NR
Phenylhydrazine	NR	NR
Phenylhydrazine Hydrochloride	NR	NR
Phosgene, Liquid	NR	NR
Phosgene, Gas	R	R
Phosphoric Acid, 10%	R	R
Phosphoric Acid, 25%	R	R
Phosphoric Acid, 50%	R	R
Phosphoric Acid, 75%	R	R
Phosphoric Acid, 85%	R	R
Phosphorous (Yellow)	R	NR
Phosphorous Pentoxide	R	NR
Phosphorous Trichloride	NR	NR
Picric Acid	NR	NR
Potash (Sat. Aq.)	R	R
Potassium Alum	R	R
Potassium Amyl Xanthate	R	NR
Potassium Bicarbonate	R	R
Potassium Bisulfate	R	R
Potassium Borate	R	R
Potassium Bromate	R	R
Potassium Bromide	R	R
Potassium Carbonate	R	R

REAGENT	TEMPERATURE	
	23°C (73°F)	45°C (113°F)
[P]		
Potassium Chromate	R	R
Potassium Chlorate	R	R
Potassium Chloride	R	R
Potassium Cyanide	R	R
Potassium Dichromate	R	R
Potassium Ethyl Xanthate	R	NR
Potassium Ferricyanide	R	R
Potassium Ferrocyanide	R	R
Potassium Fluoride	R	R
Potassium Hydroxide	R	R
Potassium Nitrate	R	R
Potassium Perborate	R	R
Potassium Perchlorate	R	R
Potassium Permanganate, 10%	R	R
Potassium Persulfate	R	R
Potassium Sulfate	R	R
Propane	R	R
Propane Gas	R	R
Propargyl Alcohol	R	R
Propyl Alcohol	R	R
Propylene Dichloride	NR	NR
Plating Solutions:		
Brass	R	R
Cadmium	R	R
Copper	R	R
Gold	R	R
Indium	R	R
Lead	R	R
Nickel	R	R
Rhodium	R	R
Silver	R	R
Plating Solutions (continued):		
Tin	R	R
Zinc	R	R
Pyridine,	NR	NR
Pyrogallic Acid	R	NR
Propylene Oxide	NR	NR
[R]		
Rayon Coagulating Bath	R	R
Refinery Crudes	R	R
Rochelle Salts	R	R
[S]		
Salicylic Acid	R	R
Sea Water	R	R
Selenic Acid	R	R
Sewerage	R	R
Silicic Acid	R	R
Silver Cyanide	R	R
Silver Nitrate	R	R
Silver Plating Solution	R	R

REAGENT	TEMPERATURE	
	23°C (73°F)	45°C (113°F)
[S]		
Silver Sulfate	R	R
Soaps	R	R
Sodium Acetate	R	R
Sodium Alum	R	R
Sodium Benzoate	R	R
Sodium Bicarbonate	R	R
Sodium Bichromate	R	R
Sodium Bisulfate	R	R
Sodium Bisulfite	R	R
Sodium Bromide	R	R
Sodium Carbonate	R	R
Sodium Chlorate	R	NR
Sodium Chloride	R	R
Sodium Chlorite	NR	NR
Sodium Cyanide	R	R
Sodium Dichromate	R	R
Sodium Ferricyanide	R	R
Sodium Ferrocyanide	R	R
Sodium Fluoride	R	R
Sodium Hydroxide, 10%	R	R
Sodium Hydroxide, 30%	R	R
Sodium Hydroxide, 50%	R	R
Sodium Hypochlorite	R	R
Sodium Nitrate	R	R
Sodium Nitrite	R	R
Sodium Peroxide, 8750	R	R
Sodium Perchlorate	R	R
Sodium Sulfate	R	R
Sodium Sulfide	R	R
Sodium Sulfite	R	R
Sodium Thiosulfate	R	R
Sour Crude Oil (West Texas)	R	R
Stannic Chloride	R	R
Stannous Chloride	R	R
Starch	R	R
Stearic Acid	R	R
Stoddards Solvent	NR	NR
Succinic Acid	R	R
Sulfite Liquor	R	R
Sulfur	R	R
Sulfur Dioxide, (Dry)	R	R
Sulfur Dioxide, (Wet)	R	NR
Sulfur Trioxide	R	R
Sulfuric Acid, 3%	R	R
Sulfuric Acid, 10%	R	R
Sulfuric Acid, 20%	R	R
Sulfuric Acid, 33%	R	R
Sulfuric Acid, 50%	R	R
Sulfuric Acid, 70%	R	NR
Sulfuric Acid, 80%	R	NR

REAGENT	TEMPERATURE	
	23°C (73°F)	45°C (113°F)
[S]		
Sulfuric Acid, 85%	R	R
Sulfuric Acid, 90%	R	NR
Sulfuric Acid, 95%	R	NR
Sulfuric Acid Pickling	R	R
Sulfuric/Nitric (50/50)	NR	NR
Sulfurous Acid	R	R
[T]		
Tall Oil	R	R
Tannic Acid	R	R
Tanning Liquors	R	R
Tartaric Acid	R	R
Tetra Sodium Pyrophosphate	R	R
Tetraethyl Lead	R	NR
Tetrahydrodurane	NR	NR
Thionyl Chloride	NR	NR
Thread Cutting Oil	R	R
Tirpineol	R	NR
Titanium Tetrachloride	R	NR
Toluol or Toluene	NR	NR
Transformer Oil	R	R
Tributyl Phosphate	NR	NR
Tributyl Citrate	R	NR
Trichloroacetic Acid	R	NR
Trichloroethylene	NR	NR
Triethanolamine	R	NR
Trilones	NR	NR
Trimethyl Propane	R	R
Trisodium Phosphate	R	R
Turpentine	R	R
Trimethylamine	R	R

REAGENT	TEMPERATURE	
	23°C (73°F)	45°C (113°F)
[U]		
Urea	R	R
Urine	R	R
[V]		
Vaseline	NR	NR
Vegetable Oil	R	R
Vinegar	R	R
Vinyl Acetate	NR	NR
[W]		
Water Acid Mine	R	R
Water Deionized	R	R
Water Demineralized	R	R
Water Distilled, Water Fresh	R	R
Water Salt	R	R
Whiskey	R	R
White Liquor	R	R
Wines	R	R
[X]		
Xylene or Xylol	NR	NR
[Z]		
Zinc Chloride	R	R
Zinc Nitrate	R	R
Zinc Sulfate	R	R

R - Recommended
NR - Not Recommended

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