



FIRE[®]PRO

ADVANCED CPVC FIRE SPRINKLER SYSTEM

**INSTALLATION AND
DESIGN MANUAL**



Astral Limited Warranty Astral Limited. Fire Pro CPVC

Astral Limited., warrants that its FIRE PRO Products will be free from manufacturing defect and will conform to the applicable ASTM standard in effect at the time of "Product" production. Under normal installation, use, and service, the warranty period extends for ten (10) years from the date of shipment. Remedy for breach of this warranty is limited to replacement of, or credit for, the defective "Product", at the sole discretion of APL.

THIS WARRANTY EXCLUDES ANY EXPENSE FOR REMOVAL OR REINSTALLATION OF ANY DEFECTIVE "PRODUCT" AND ANY OTHER INCIDENTAL, CONSEQUENTIAL, OR PUNITIVE DAMAGES. THIS LIMITED WARRANTY IS THE ONLY WARRANTY MADE BY SELLER AND IS EXPRESSLY IN LIEU OF ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED, INCLUDING ANY WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

No statement, conduct, or description by Astral Limited. or its representative, in addition to or beyond this Limited Warranty, shall constitute a warranty. This Limited Warranty may only be modified in writing, and such modification must be signed by an officer of Astral Limited.

This Limited Warranty will not apply under the following circumstances:

- The "Products" are not installed in compliance with the instructions published by Astral Limited. and in accordance with industry-established engineering, installation, operating and maintenance specifications, recommendations, and instructions or is not installed in conformance with all applicable fire and building code requirements.
- The "Products" fail due to defect or deficiencies in design, engineering, installation, or operation of the water distribution system of which they are a part.
- The "Products" have been the subject of modification, misuse, misapplication, improper maintenance or repair, damage caused by the fault or negligence of anyone other than Astral Limited., or any other act or event beyond the control of Astral Limited. • The "Products" fail due to the freezing of water in the Products.
- The "Products" fail due to contact with chemical agents, fire stopping materials, thread sealants, plasticized vinyl products, cutting oils, or other aggressive chemical agents not compatible with CPVC compounds.
- The "Products" fail for any reason other than manufacturing defect, or the "Products" lack of conformity to the applicable ASTM standard.

All "Products" alleged to be defective *MUST* be made available to Astral Limited., at the following address, for verification, inspection and determination of cause.

The Limited Warranty will not apply to any "Products" for which a defect is claimed unless written NOTICE is mailed to Astral Limited., at the following address, within thirty (30) days after the date of discovery of any such alleged defect.

Astral Limited.

**Attention: Marketing Department 207/1,
Astral House, B/h. Rajpath Club, Off.
S.G. Highway, Ahmedabad-380 059 Gujarat,
India.**

Astral Limited. does not warrant and cannot accept responsibility for the performance, dimensional accuracy, or compatibility of pipe, solvent weld fittings, gasketed or threaded transitional fittings, or any system component not manufactured or sold by Astral Limited.

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Introduction

FIRE PRO CPVC Fire Sprinkler products produced by Astral Limited. (APL) are manufactured from high quality, Post-Chlorinated Poly Vinyl Chloride (CPVC), a specialty thermoplastic material tested and approved by certifying agencies for use in CPVC fire sprinkler systems. Astral manufactured FIRE PRO CPVC Fire Sprinkler products provide unique advantages over traditional metal fire sprinkler systems through superior hydraulics, ease of installation and handling and quick assembly using readily available, inexpensive tools. These products also are based on a technology with a continuous and proven service history of more than forty (40) years.

This design manual provides instructions for handling and installing a FIRE PRO fire sprinkler system with products manufactured by Astral as well as information regarding system design. It is intended as a supplement to basic, fundamental knowledge relating to the installation and/or repair of CPVC fire sprinkler systems. Before commencing installation, a user should fully understand and confirm applicable national, state and local codes, and installation requirements for CPVC fire sprinkler systems.

FIRE PRO CPVC pipes manufactured by Astral carry the UL and C-UL markings of Underwriters Laboratories Inc.

CPVC Fire Sprinkler Systems must be engineered, installed and maintained in accordance with national, state and local codes, standards and Astral Limited.'s Installation Instructions. Code requirements and field conditions may differ. It is the responsibility of the installing contractor to insure that the product is suitable for the intended use and that all requirements have been satisfied.

FIRE PRO CPVC Fire Sprinkler Products manufactured by Astral are approved for use in combination with other listed FIRE PRO manufacturers' products (see, "Use with Other Manufacturers' Pipes, Fittings, and Solvent Cements" section). However, specific application approvals may not be the same among manufacturers. It is the installer's responsibility to verify suitability of products used in combination according to each manufacturer's installation instructions.

Engineering data related to the installation and use of Listed FIRE PRO CPVC Fire Sprinkler Pipes provided in this manual is based on the data available at the time of printing. If products other than FIRE PRO are used, follow the appropriate manufacturer's installation instructions. **Contact Astral Limited. if there are questions on any matters or applications not specifically addressed in this manual.**

This manual is intended for use by specifiers, installers, and users in the selection, design, installation, and inspection of FIRE PRO pipe manufactured by Astral for fire protection service. **Due to the critical safety and loss prevention uses of such systems, all information contained herein is considered vital to proper system performance and must be carefully read and understood before starting the installation. This manual is not meant as a replacement for formal installer training and is intended for use only by a qualified installer and/or contractor. APL expressly disclaims any and all liability for product use or installation in any matter other than expressly stated herein.** If you need additional copies, or if you have any questions about the proper installation and use of these products, contact Astral Limited, 207/1, Astral House, B/h Rajpath Club, Off. S.G.Highway, Ahmedabad 380059 or Call +91-79-66212000. You may also contact APL through the website: www.astralpipes.com.

Hazards & Information

Definitions for identifying the various hazard levels are as follows:

- **WARNING** - The use of the word **WARNING** identifies the presence of hazards or unsafe practices that could result in severe personal injury and/or death if instructions, including recommended precautions, are not followed.
- **CAUTION** - The use of the word **CAUTION** identifies possible hazards or unsafe practices that could result in personal injury and/or death, product damage, and/or property damage if instructions, including precautions, are not followed.
- **NOTICE** - The use of the word **NOTICE** identifies special instructions that are highly important but not related to specific hazards.

Installer Training Available

Astral Limited. recommends that installers receive proper installation training and that this training is renewed every two (2) years. Training will be provided at no charge by contacting an authorized distributor of FIRE PRO CPVC Fire Sprinkler Products manufactured by Astral Limited.

Safety Guidelines for Installation

WARNING: USE ONLY RECOMMENDED TOOLS, ACCESSORIES AND COMPONENTS. USE OF IMPROPER TOOLS, ACCESSORIES OR UNAPPROVED SYSTEM COMPONENTS IN CONJUNCTION WITH FIRE PRO CPVC FIRE SPRINKLER PRODUCTS MANUFACTURED BY ASTRAL WILL VOID THE WARRANTY AND MAY RESULT IN PROPERTY DAMAGE, PRODUCT DAMAGE, SEVERE PERSONAL INJURY AND/OR DEATH.

WARNING: AVOID DANGEROUS ENVIRONMENTS. If utilizing electrically powered tools for installation, be sure that the area is free of moisture or wetness that could create an unsafe condition. Keep work area clean and well illuminated. Allow sufficient space for measuring and system preparation to accommodate proper installation.

WARNING: FOLLOW ALL WORKPLACE SAFETY REQUIREMENTS. WEAR SAFETY GLASSES, HARD HAT, AND SAFETY FOOTWEAR. ALWAYS PRACTICE SAFETY FIRST.

Prevent back injury. Always practice safe lifting and installation techniques.

Use only tools specifically designed for plastic pipe and fittings.

Inspect the products. Be sure that all parts are included and that you have all necessary tools available to properly install the system.

When solvent cementing, always work in a well-ventilated area. Avoid sources of heat or open flames. DO NOT smoke. Wear protective gloves. PVA-coated protective gloves are recommended for use while solvent cementing. If hands come in contact with solvent cement, immediately rinse with water and wash thoroughly with a waterless, abrasive soap.

Wear ear protection. Protect your hearing if you are exposed to long periods of very noisy jobsite operations.

Material Compatibility

FIRE PRO CPVC Fire Sprinkler Products manufactured by Astral resist attack from a large group of chemicals that are corrosive to metallic piping. However, care must be taken to avoid contact with chemicals that are harmful to CPVC. Specific chemicals or chemical vapors that contact CPVC can weaken or severely damage the system. Consult with the Astral before use.

NOTICE: DO NOT EXPOSE FIRE PRO CPVC FIRE SPRINKLER PRODUCTS MANUFACTURED BY ASTRAL TO EDIBLE OILS, ESTERS, KETONES, OR PETROLEUM-BASED PRODUCTS, SUCH AS CUTTING OILS, PACKING OILS, TRADITIONAL PIPE THREAD PASTE OR DOPES, AND SOME LUBRICANTS. CONSULT WITH THE CHEMICAL MANUFACTURER OR ASTRAL LIMITED. BEFORE USE. CONTACT WITH INCOMPATIBLE CHEMICALS COULD CAUSE PROPERTY DAMAGE AND PRODUCT DAMAGE.

Handling & Storage

Astral recommends that CPVC Fire Sprinkler Pipe be stored indoors. If storing outdoors, the products must be covered with a non-transparent material to prevent extended exposure to sunlight. Short term exposure to sunlight will not affect physical properties and can cause slight fading of color. Longer term exposure to sunlight will increase the amount of color fading and cause the pipe to be more brittle.

Reasonable care must be exercised in handling FIRE PRO pipe manufactured by Astral. DO NOT drop the products or drop anything on them. If improper handling results in scratches, splits, or gouges, the damaged fitting or section of pipe must be discarded.

WARNING: DO NOT INSTALL FIRE PRO PIPE MANUFACTURED BY ASTRAL THAT HAVE BEEN SCRATCHED, SPLIT, OR GOUGED. THE USE OF PIPE AND FITTINGS THAT HAVE BEEN DAMAGED DUE TO IMPROPER HANDLING COULD CAUSE PROPERTY DAMAGE, PRODUCT DAMAGE, SERIOUS PERSONAL INJURY AND/OR DEATH.

One-Step Solvent Cement

Weld On 550 Fire Sprinkler Solvent Cement must be stored out of direct sunlight in an ambient temperature between 40°F (4°C) and 110°F (43°C). The solvent cement may be used for a period of two years from the date stamped on the container. Expired solvent cement must be discarded in an environmentally friendly fashion, in accordance with national, state and local regulations. To prolong the life of the cement, the containers must be kept tightly closed when not in use and covered as much as possible when in use.

WARNING: WELD ON FIRE PRO ONE-STEP SOLVENT CEMENT IS HIGHLY FLAMMABLE. ELIMINATE ALL IGNITION SOURCES. NO SMOKING WHILE USING SUCH CEMENT. IGNITION OF THE CEMENT COULD CAUSE PROPERTY DAMAGE, PRODUCT DAMAGE, SERIOUS PERSONAL INJURY AND/OR DEATH.

Avoid breathing vapors. Use only with adequate ventilation. Explosion-proof, general mechanical ventilation or local exhaust is recommended to maintain vapor concentrations below recommended exposure limits. In confined or partially enclosed areas, a NIOSH approved organic vapor cartridge respirator with a full face-piece is recommended. Avoid frequent contact with skin. It is recommended that you wear PVA coated gloves and an impervious apron.

Avoid contact with eyes. Splash-proof chemical goggles should be worn at all times. Review the Material Safety Data Sheet (MSDS), and the important product information provided on the label for Weld On FIRE PRO One-Step Solvent Cement. FAILURE TO FOLLOW THE ABOVE RECOMMENDATIONS COULD CAUSE PROPERTY DAMAGE, PRODUCT DAMAGE, SERIOUS PERSONAL INJURY AND/OR DEATH.

Where to Use Astral Fire Pro Fire Sprinkler Systems

FIRE PRO CPVC Fire Sprinkler products manufactured by Astral are fully tested and approved by Underwriters Laboratories Inc. (UL) for use in wet pipe fire sprinkler systems.

NOTICE: All national, state or local codes must be referenced for design and installation requirements in conjunction with this manual.

NOTICE: FIRE PRO CPVC Fire Sprinkler products manufactured by Astral are NOT listed for outdoor applications.

NOTICE: FIRE PRO CPVC Fire Sprinkler products manufactured by Astral are to be used in wet pipe systems only. A wet pipe system is one that contains water and is connected to a water supply system so that the water will discharge immediately when the sprinkler is opened.

WARNING: FIRE PRO CPVC FIRE SPRINKLER PRODUCTS MANUFACTURED BY ASTRAL MUST NEVER BE USED OR TESTED IN A SYSTEM OF COMPRESSED AIR OR OTHER GASES. FAILURE TO FOLLOW THIS WARNING COULD RESULT IN PRODUCT DAMAGE, PROPERTY DAMAGE AND/OR SEVERE PERSONAL INJURY OR DEATH.

Light Hazard Occupancies

FIRE PRO CPVC Fire Sprinkler products manufactured by Astral are Listed by UL and C-UL for use in: Light Hazard Occupancies as defined in the National Fire Protection Association Standard for the Installation of Sprinkler Systems, NFPA 13. In accordance with NFPA 13 (2007 edition), paragraph 6.3.6.2, "Pipe or tube listed for light hazard occupancies shall be permitted to be installed in ordinary hazard rooms of otherwise light hazard occupancies where the room does not exceed 400 square feet."

NOTICE: Local jurisdictions must approve of this exception.

Residential Occupancies

FIRE PRO CPVC Fire Sprinkler products manufactured by Astral are Listed by UL and C-UL Listed for use in: Residential occupancies as defined in the National Fire Protection Association Standard for the Installation of Sprinkler Systems in Residential Occupancies Up to and Including Four Stories in Height, NFPA 13R, and residential occupancies as defined in the National Fire Protection Association Standard for the Installation of Sprinkler Systems in One and Two Family Dwellings and Manufactured Homes, NFPA 13D.

Concealed Installations

In concealed installations, the minimum protection shall be one layer of 3/8 inch (9.5 mm) gypsum wallboard, 1/2 inch (12.7 mm) plywood soffits, or a suspended membrane ceiling with lay-in panels or tiles having a minimum weight of not less than 0.35 lbs/ft² (1.7 kg/m²) when installed with metal support grids. The minimum protection for residential occupancies may consist of one layer of 1/2 inch (12.7 mm) plywood.

In accordance with the C-UL Listing, the effectiveness of this protection can be impaired if penetrated by large openings such as ventilation grills, except where exhaust fans are connected to metal ducts serving washrooms. Where such penetration is present, individual openings exceeding 0.03 m² but not exceeding 0.71 m² in area must be located so that the distance from the edge of the opening to the

nearest sprinkler does not exceed 300 mm. FIRE PRO products manufactured by Astral shall not be used where such openings exceed 0.71 m² in area. The presence of non-rated recessed lighting fixtures, public address speakers and other interruptions of the protective membrane has not been investigated and may cause damage to the products and may result in property damage, personal injury and/or death.

FIRE PRO pipe manufactured by Astral must be used in sprinkler systems employing sprinkler heads rated at 225°F (107°C) or lower when installed concealed (protected) in accordance with the Listing. The ambient temperature around the pipe must not exceed 120°F.

Combustible Concealed Installations

FIRE PRO pipe manufactured by Astral must not be installed in combustible concealed areas requiring sprinklers as required by NFPA 13. NFPA 13D and NFPA 13R permit the omission of sprinklers in combustible concealed spaces and FIRE PRO pipe manufactured by Astral may be installed in these areas when sprinkling residential occupancies in accordance with these standards.

Exception: In accordance with the UL Listing, specially Listed sprinklers exist that have been tested and are Listed for use with FIRE PRO pipe manufactured by Astral. in combustible concealed spaces requiring sprinklers. When using FIRE PRO products manufactured by Astral® in these applications always follow the sprinkler manufacturers' installation guidelines.

Similarly there are specially listed sprinkler heads that have been tested and are listed for use with FIRE PRO products in attics that require sprinklers. The sprinkler head manufacturers' installation guidelines must be followed when using FIRE PRO pipe and fittings with these sprinkler heads.

Return Air Plenum

FIRE PRO pipe manufactured by Astral meets the combustibility requirements for thermoplastic sprinkler pipe, as described in the Standard for Installation of Air Conditioning and Ventilating Systems, NFPA 90A. In accordance with the UL and C-UL Listing, FIRE PRO CPVC fire sprinkler pipe manufactured by Astral may be installed in the plenum adjacent to, but not over, openings in the ceiling such as ventilation grills and require the use of Schedule 80 fittings in the 1-1/2 inch (40 mm) and larger size.

Garage Installations

FIRE PRO CPVC Fire Sprinkler Products manufactured by Astral are UL Listed for installation by a qualified installer or contractor in garages requiring sprinklers, as defined in NFPA 13R, with the following requirements:

1. Minimum protection consisting of either one layer of 3/8 inch (9.5 mm) thick gypsum or 1/2 inch (12.7 mm) thick plywood shall be provided.
2. Listed pendent or sidewall sprinklers with a maximum temperature rating of 225°F (107°C) shall be used.
3. All sprinklers shall be installed per the manufacturer's published installation instructions.
4. The system must be installed per the requirements of NFPA 13R and these installation instructions.

Ambient Temperature Limitations

FIRE PRO CPVC Fire Sprinkler products manufactured by Astral are suitable for use in areas where ambient temperatures are within the range of 35°F (2°C) to 120°F (49°C).

High Temperature Areas

FIRE PRO CPVC Fire Sprinkler products manufactured by Astral can be installed in areas, such as an attic, where the ambient temperature exceeds 120°F (49°C) if ventilation is provided or if insulation is used around the product to maintain a cooler environment.

WARNING: DO NOT INSTALL FIRE PRO CPVC PIPE MANUFACTURED BY ASTRAL IN AREAS WHERE THE AMBIENT TEMPERATURE EXCEEDS 120°F (49°C) WITHOUT ADEQUATE VENTILATION OR INSULATION AROUND THE PRODUCT TO MAINTAIN A COOLER ENVIRONMENT. INSTALLATION IN AREAS WHERE THE AMBIENT TEMPERATURE EXCEEDS 120°F (49°C) CAN CAUSE DAMAGE TO THE CPVC SPRINKLER SYSTEM AND MAY RESULT IN PROPERTY DAMAGE.

Heat Sources & Open Ceiling Areas

Piping systems using FIRE PRO pipe manufactured by Astral must be laid out so that the piping is not closely exposed to heat producing sources, such as light fixtures, ballasts, and steam lines. Pipe shall not be positioned directly over open ventilation grills. During remodeling or ceiling repair, appropriate precautions shall be implemented to properly protect the piping.

Cold Temperature Areas

FIRE PRO pipe manufactured by Astral can be used in areas where the ambient temperature remains above 35° F (2° C). These products can also be used in an area subject to freezing temperatures if the sprinkler system installation is protected from freezing. Many standard cold weather piping design and installation practices can be used to protect the system from freezing, including, but not limited to, the use of glycerin, insulation installation techniques, and pipe insulation. Contact the manufacturers for compatibility of their products with FIRE PRO CPVC Fire Sprinkler products. **ATTENTION:** Attention must be given to local insulating techniques and codes that require a particular method. Since cold weather will make FIRE PRO pipe manufactured by Astral more susceptible to damage, extra care should be taken to avoid rough handling or impact to these products.

WARNING: DO NOT ALLOW A SPRINKLER SYSTEM TO FREEZE. A FROZEN SYSTEM WILL NOT OPERATE AND THE PRESSURES BUILT UP CAN CAUSE THE SPRINKLERS TO OPEN OR DAMAGE THE PIPE AND FITTINGS. ANTIFREEZE SOLUTIONS OF WATER AND USP OR CP GRADE GLYCERIN ARE ACCEPTABLE FOR USE WITH FIRE PRO CPVC FIRE SPRINKLER PRODUCTS MANUFACTURED BY ASTRAL. REFER TO NFPA 13, NFPA 13R, NFPA 13D AND CONSULT THE LOCAL AUTHORITY HAVING JURISDICTION BEFORE USING GLYCERIN SOLUTIONS IN FIRE SPRINKLER APPLICATIONS.

WARNING: DO NOT USE GLYCOL-BASED ANTIFREEZE SOLUTIONS. GLYCOL SOLUTIONS ARE NOT CHEMICALLY COMPATIBLE WITH THE CPVC MATERIAL AND CAN CAUSE DAMAGE TO THE CPVC FIRE SPRINKLER SYSTEM AND MAY RESULT IN PROPERTY DAMAGE.

The following information can be used to determine the quantity of a glycerin based antifreeze solution needed to protect the piping system.

Nominal Size in Inches (Metric)	Gallons per Foot of Pipe	Liters per Meter of Pipe
3/4 (20 mm)	0.031	0.387
1 (25 mm)	0.049	0.614

1-1/4 (32 mm)	0.079	0.985
1-1/2 (40 mm)	0.104	1.294
2 (50 mm)	0.164	2.033
2-1/2 (65 mm)	0.240	2.975
3 (80 mm)	0.355	4.409

NOTICE: The gallons per foot column can be used for calculations when adding GLYCERIN to the piping system for freeze protection. All fire protection systems winterized with glycerin solutions must conform to local, state, and federal requirements, including NFPA regulations. Glycerin based solutions are the only antifreeze solutions recommended for use.

Sprinkler Head Temperature Ratings

FIRE PRO CPVC fire sprinkler pipe manufactured by Astral shall be used in sprinkler systems employing sprinkler heads rated at 225°F (107°C) or lower when installed protected (concealed).

Pressure Rating

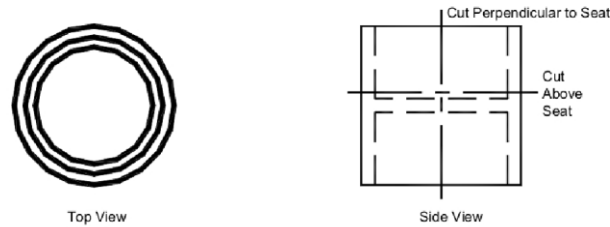
FIRE PRO CPVC pipe manufactured by Astral of nominal sizes 3/4" – 3" (20 – 80 mm), the rated pressure is 175 psi (12.3 Kg/Cm²) and the maximum temperature is 120°F (49°C). FIRE PRO pipe is produced in SDR 13.5 dimensions. SDR, or standard dimensional ratio, means the pipe wall thickness is directly proportional to the outside diameter. This results in all diameters carrying the same pressure capability. FIRE PRO pipe is produced to the specifications of ASTM F 442.

Fire Sprinkler System Risers

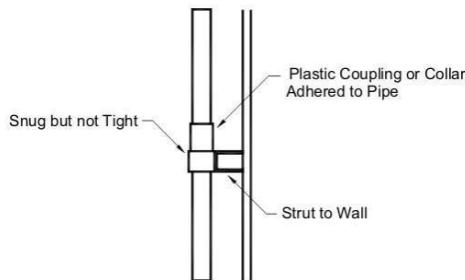
FIRE PRO pipe manufactured by Astral may be installed by qualified installer or contractor as system risers when subject to the following additional limitations:

1. FIRE PRO CPVC pipe manufactured by Astral may be used as system risers in accordance with NFPA 13 light hazard, NFPA 13D, and 13R when installed protected (concealed). The minimum protection shall consist of either one layer of 3/8 inch (9.5 mm) thick gypsum wallboard or 1/2 inch (12.7 mm) thick plywood.
2. The system shall be installed per the requirements of NFPA 13, Support of Risers.
3. FIRE PRO pipe manufactured by Astral shall be installed per the manufacturer's installation and design manual.

4. Risers shall be supported by pipe clamps or by hangers located on the horizontal connection close to the riser. Only Listed hangers and clamps shall be used.
5. Vertical lines must be supported at intervals, described in 7 & 8 below, to avoid placing excessive load on a fitting at the lower end. Use riser clamps or double bolt pipe clamps Listed for this service. The clamps shall not exert compressive stresses on the pipe. If possible, the clamps should be located just below a fitting so that the shoulder of the fitting rests against the clamp. If necessary, a coupling can be modified and adhered to the pipe as a bearing support such that the shoulder of the fitting rests on the clamp. Follow the manufacturer's recommended cure time.



Field Modification for Riser Collar for Vertical Use



Coupling Modification for Riser Collar

The above illustration shows the recommended method for securing FIRE PRO pipe vertically. Place clamp below shoulder of fitting.

WARNING: MODIFIED RISER COLLAR SHALL ONLY BE USED TO PROVIDE SUPPORT TO THE RISER AND SHALL NOT BE USED TO JOIN PIECES OF PIPE TOGETHER.

7. **CAUTION: DO NOT USE RISER CLAMPS THAT SQUEEZE THE PIPE AND DEPEND ON COMPRESSION OF THE PIPE TO SUPPORT THE WEIGHT.**
8. **CAUTION: HANGERS AND STRAPS SHALL NOT COMPRESS, DISTORT, CUT OR ABRASE THE PIPING AND SHALL ALLOW FOR FREE MOVEMENT OF THE PIPE TO ALLOW FOR THERMAL EXPANSION AND CONTRACTION.**
9. Maintain vertical piping in straight alignment with supports at each floor level, or at 10 feet (3.05 m) intervals, whichever is less.
10. CPVC risers in vertical shafts or in buildings with ceilings over 25 feet (7.62 m), shall be aligned straightly and supported at each floor level, or at 10 feet (3.05 m) intervals, whichever is less.

Penetrating Fire-Rated Walls & Partitions

Before beginning installation, consult the building codes and authorities having jurisdiction in your area. Several UL Classified, through-penetration firestop systems are approved for use with CPVC pipe. Consult the UL Building Materials Directory, the UL Fire Resistance Directory, and the system manufacturer for proper selection and application.

Use With Other Manufacturers' Pipes, Fittings, & Solvent Cements

Astral pipe and fittings as described herein are intended only for use in combination with Listed Astral CPVC pipe and fittings when assembled with Weld On 550 Fire Sprinkler Solvent Cement.

Joining CPVC Pipe and Fittings with One-Step Solvent Cement

NOTICE

Read and understand all instructions prior to assembly. Follow all instructions. Failure to follow instructions during joining and testing may result in pipe failure, clogged waterways, or leakage.

Cutting

CPVC pipe can be easily cut with a ratchet cutter, a wheel-type plastic tubing cutter, a power saw or a fine toothed saw. Tools used to cut CPVC must be designed for plastic use and must be in good condition in accordance with the tool manufacturer's recommendations. It is important to cut the pipe square. A square cut provides the surface of the pipe with maximum bonding area.

NOTICE

Avoid splitting the pipe when using ratchet cutters. Failure to do so may result in pipe failure or leakage.

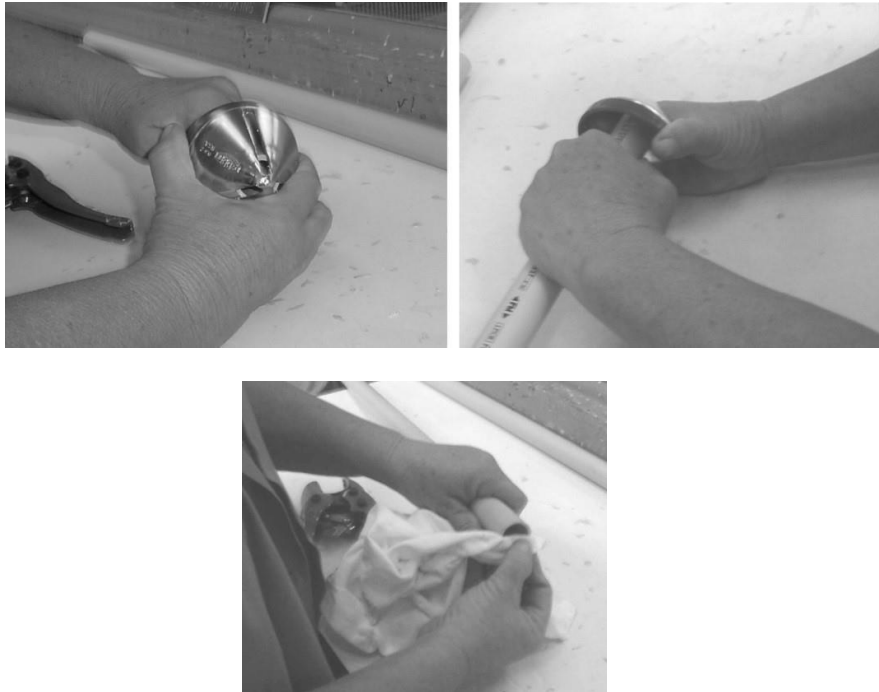
- *Only use ratchet cutters that contain a sharp blade (blades dull quickly).*
- *Only use ratchet cutters at temperatures of 50°F (10°C) or warmer.*
- *Only use well-maintained, good quality ratchet cutters capable of consistently cutting the pipe squarely.*

If any indication of damage or cracking is evident at the pipe end, cut off at least 2 inches (50 mm) beyond any visible crack.



Deburring & Beveling

Burrs and filings can prevent proper contact between pipe and fitting during assembly, and must be removed from the outside and the inside of the pipe. A chamfering/reaming tool or a file is suitable for this purpose. A slight bevel (approximately 10° to 15°) shall be placed at the end of the pipe to ease entry of the pipe into the socket. This will minimize the chance that the edges of the pipe will wipe solvent cement from the fitting socket during the insertion of the pipe.



Solvent Cement Application

CAUTION  Prior to using approved fire sprinkler CPVC solvent cements, review and follow all precautions found on the container labels, material safety data sheet, and Standard Practice for Safe Handling ASTM F 402. Failure to follow precautions may result in injury.

Using a clean, dry rag, wipe loose dirt and moisture from the fitting socket and pipe end. Moisture can slow the cure time and at this stage of assembly, excessive water can reduce joint strength.

The pipe should enter the fitting socket easily one-third to two-thirds of the way. Contact between the pipe and fitting is essential in making a good joint. This contact allows the solvent cement (which is applied in the next step) to effectively join the pipe and fitting.

Use a dauber that is properly sized for the pipe. For 3/4 inch (20 mm) and 1 inch (25 mm) pipe, use a dauber that is 1/2 inch (12.7 mm) in size. For 1-1/4 inch (32 mm) through 3 inch (80 mm) pipe, use a dauber that is 3/4 inch (19.1 mm) in size.

Only use solvent cements that have been specifically formulated and listed/approved for use with CPVC fire sprinkler systems and approved by the pipe and fitting manufacturers.

Vigorously apply a heavy, even coat of cement to the outside pipe end. Apply a medium coat to the fitting socket. Pipe sizes 1-1/4 inch (32 mm) and above shall always receive a second cement application on the pipe end. **FIRST APPLY CEMENT ON THE PIPE END, THEN IN THE FITTING SOCKET, AND, FINALLY, ON THE PIPE END AGAIN.**

NOTICE

Too much solvent cement can cause clogged waterways or weaken the wall of the pipe or fitting and result in pipe failure or leakage.

- *Do not allow excess cement to puddle in the pipe and fitting assembly. To prevent this puddling, apply a lighter coating of solvent cement to the inside of the fitting socket than the outside of the pipe.*

- *Wipe off excess cement on the outside of the joint. The solvents will evaporate, but the solvent cement inside the fitting will stay there.*

Special care shall be exercised when assembling CPVC fire sprinkler systems in temperatures below 40°F (4°C). In colder temperatures extra time must be allowed for the solvent cement to set and cure. Extra care should be taken to prevent damaging the pipe during handling. When solvent welding pipe and fittings in colder temperatures, make certain that the cement has not become lumpy or has “gelled”. Gelled cement must be discarded.

At temperatures above 80°F (27°C) make sure both surfaces to be joined are still wet with cement during assembly. Higher temperatures and/or wind accelerate the evaporation of the volatile solvents in the cement. Pipe stored in direct sunlight may have surface temperatures 20°F to 30°F above the air temperature. If possible store the pipe and fittings, or, at least, the ends to be solvent welded, out of the direct sunlight prior to cementing. The solvents will penetrate hot surfaces more deeply. In conditions like this it is very important to avoid puddling the solvent cement inside the fitting socket.



Assembly

After applying cement, immediately insert the pipe into the fitting socket, while rotating the pipe onequarter turn until the pipe bottoms out at the fitting stop. Rotate the pipe as it is inserted into the fitting not after it has bottomed out in the fitting. Properly align the fitting for the installation at this time. Pipe must bottom to the stop. Hold the assembly for 30 seconds to ensure initial bonding. **A bead of solvent cement should be evident around the pipe and fitting juncture. If this bead is not continuous around the socket shoulder, it may indicate that insufficient cement was applied.** If insufficient cement is applied, the fitting must be cut out and discarded. Cement in excess of the bead should be wiped off with a rag.

NOTICE

Failure to allow sprinkler fitting joints to cure before installing sprinklers may result in cement in the sprinkler waterway.

- *Install sprinkler heads only after all the CPVC pipe and fittings, including the sprinkler adapters, are solvent welded and allowed to cure for a minimum of 30 minutes.*
- *Do not install sprinklers in the fittings prior to the fittings being cemented in place.*

Exercise care when installing sprinklers. Allow sprinkler head fittings and previously joined fittings to cure for a minimum of 30 minutes prior to installing the sprinkler. When installing sprinklers, be sure to anchor or hold the pipe drop securely to avoid rotating the pipe in previously cemented connections.

NOTICE

Too much solvent cement can cause clogged waterways.

- Visually inspect sprinkler fittings to ensure that the waterway and threads are clear of any excess cement.
- Once the installation is complete and cured per Table I, II or III, hydrostatically test the system.



Set and Cure Times

NOTICE

Inadequate curing of solvent cement joints may cause pipe failure or leakage.

Solvent cement set and cure times are a function of pipe size, temperature, relative humidity, and tightness of fit.

Cure times should be increased when moisture is present such as during cut-ins to live sprinkler lines. (NOTE: A specific procedure for modifications or repairs to existing CPVC fire sprinkler lines is included in this manual.) The assembly must be allowed to set, without any stress on the joint, for 1 to 5 minutes, depending on pipe size and temperature. Following the initial set period, the assembly can be handled carefully, **avoiding significant stresses to the joint.**

Refer to Tables 1, 2, and 3 for MINIMUM cure times prior to pressure testing.

Table 1: Ambient Temperature Cure Times for Test Pressures of 225 psi / 15.8 Kg/Cm² (maximum)

Nominal Pipe Size (Metric)	60°F to 120°F (16°C to 49°C)	40°F to 59°F (4.4°C to 16°C)	0°F to 39°F (-17.8°C to 4.4°C)
3/4" (20mm)	1 hour	4 hours	48 hours
1" (25mm)	1-1/2 hours	4 hours	48 hours
1-1/4" & 1-1/2" (32 & 40 mm)	3 hours	32 hours	10 days
2" (50mm)	8 hours	48 hours	Note 1
2-1/2" & 3" (65 & 80 mm)	24 hours	96 hours	Note 1

Table 2: Ambient Temperature Cure Times for Test Pressures of 200 psi / 14.1 Kg/Cm² (maximum)

Nominal Pipe Size (Metric)	60°F to 120°F (16°C to 49°C)	40°F to 59°F (4.4°C to 16°C)	0°F to 39°F (-17.8°C to 4.4°C)

3/4" (20 mm)	45 minutes	1 1/2 hours	24 hours
1" (25 mm)	45 minutes	1 1/2 hours	24 hours
1-1/4" & 1-1/2" (32 & 40 mm)	1-1/2 hours	16 hours	120 hours
2" (50 mm)	8 hours	36 hours	Note 1
2-1/2" & 3" (65 & 80 mm)	8 hours	72 hours	Note 1

Note 1: Solvent cement can be applied at temperatures below 40°F (4.4°C) in all sizes. However, for the 2 inch size & larger, the temperature must be raised to 40°F (4.4°C) or above and allowed to cure per the recommended times before the system is filled and pressurized.

Table 3: Ambient Temperature Cure Times for Test Pressures of 100 psi / 7.0 Kg/Cm² (maximum)

Nominal Pipe Size (Metric)	60°F to 120°F (16°C to 49°C)	40°F to 59°F (4.4°C to 16°C)	0°F to 39°F (-17.8°C to 4.4°C)
3/4" (20 mm)	15 minutes	15 minutes	30 minutes
1" (25 mm)	15 minutes	30 minutes	30 minutes
1-1/4" (32 mm)	15 minutes	30 minutes	2 hours

NOTICE: 1-1/2 inch (40 mm) and larger must be tested ONLY in accordance with Table 1 and Table 2.

System Acceptance Testing (Hydrostatic Pressure Test)

⚠ WARNING

Never use air or compressed gas for system acceptance testing (hydrostatic pressure test). System failure when using compressed air or gas for system acceptance testing may result in property damage, serious injury, or death.

Once an installation is completed and joints are properly cured per the above recommendations, the system should be pressure tested with water at 200 psi (14.1 Kg/Cm²) for 2 hours. See Table II for curing conditions at 200 psi (14.1 Kg/Cm²).

The system should be pressure tested with water at 50 psi (3.5 Kg/Cm²) in excess of maximum pressure when the maximum system pressure is to be maintained in excess of 150 psi (10.5 Kg/Cm²). See Table I for curing conditions at 225 psi (15.8 Kg/Cm²). This requirement is in accordance with the requirements established by NFPA Standard 13, Section 24.2.1 (2007 Edition).

Sprinkler systems in one- and two-family dwellings and mobile homes may be pressure tested with water at line pressure, after following Table III curing conditions, in accordance with the requirements established by NFPA 13D, Section 4.3 (2007 Edition).

When pressure testing, the sprinkler system shall be slowly filled with water and the air bled from the highest and farthest sprinkler heads before pressure testing is applied. Air must be removed from piping systems (plastic or metal) to prevent it from being locked in the system when pressure is applied. Entrapped air can generate excessive surge pressures that can result in bodily injury and/or property damage, regardless of the piping materials used.

If a leak is found, the fitting must be cut out and discarded. A new section can be installed using couplings or a union. Unions should be used in accessible areas only.

Solvent Cement Requirements

The following guidelines provide an estimate of the quantities of Weld On FIRE PRO One-Step Solvent Cement that you will need to complete the assembly.

Nominal Fitting Size (Metric)	Number of Joints Per Quart	Number of Joints Per Liter
3/4" (20 mm)	270	285
1" (25 mm)	180	190
1-1/4" (32 mm)	130	137
1-1/2" (40 mm)	100	106
2" (50 mm)	70	74
2-1/2" (65 mm)	50	53
3" (80 mm)	40	42

Threaded Connections

Astral Limited recommends the use of a quality Teflon® (PTFE) tape, having a thickness of .0025" or greater and meeting or exceeding military specification MIL-T-27730A for all threaded connections. The use of other thread sealants may result in damage to the FIRE PRO fire sprinkler pipe manufactured by Astral. Consult with the manufacturer of the thread sealant for compatibility with FIRE PRO CPVC or refer to the manufacturer for CPVC chemical compatibility.

NOTE: Starting with the first full thread and continuing over the entire threaded length, making sure that all the threads are covered, wrap Teflon® tape in the direction of the threads. Generally 3 to 4 wraps are sufficient.

WARNING: CARE MUST BE TAKEN TO AVOID OVERTORQUING – GENERALLY 1 TO 2 TURNS BEYOND FINGER TIGHT IS ALL THAT IS REQUIRED TO MAKE UP A THREADED CONNECTION. FACTORY TESTING HAS INDICATED 10-25 FT. LBS. (13.6 – 33.9 NM) OF TORQUE IS ADEQUATE TO OBTAIN A LEAK FREE SEAL. ASTRAL LIMITED. RECOMMENDS THE USE OF A STRAP WRENCH WHEN MAKING UP THREADED CONNECTIONS. OVER TIGHTENING MAY RESULT IN PROPERTY DAMAGE OR PRODUCT DAMAGE.

Sprinkler head adapters are manufactured with a brass threaded insert to provide a high strength, heavy duty fitting for threaded connections with male metal threads.

Sprinkler heads shall be installed only after all the fire sprinkler pipe fittings, including the sprinkler head adapters, are solvent welded to the piping **and have been allowed to cure as recommended in the cure chart**. Plastic threaded plugs are available for use in pressure testing. The sprinkler head fittings should be visually inspected or probed with a wooden dowel, to insure the waterway and threads are clear of any excess cement. **NOTICE:** It is an unacceptable practice to assemble sprinklers into the head adapter fittings and then solvent cement them to the drop.

WARNING: CUTTING OILS AND SOME THREAD SEALANTS USED IN METAL PIPE THREADING CAN CAUSE STRESS CRACKING IN CPVC MATERIALS. ALL CUTTING OILS MUST BE REMOVED AND THE METAL PIPE THOROUGHLY FLUSHED AND DEGREASED PRIOR TO ASSEMBLY WITH CPVC SYSTEMS. VIOLATION OF THIS WARNING MAY CAUSE SYSTEM FAILURE AND/OR PRODUCT DAMAGE, PROPERTY DAMAGE.

Cut- In Procedures for System Modification or Repairs

At times it may become necessary to make modifications to existing CPVC fire sprinkler systems. This can be done safely by a qualified installer or contractor when the proper procedures are followed. The following procedure has been developed to assure that the modifications are done successfully.

PRIOR TO MAKING SYSTEM CUT-INS ON EXISTING SYSTEMS, CARE SHOULD BE USED TO REVIEW PROPER JOINING PROCEDURES AND TO FOLLOW CUT-IN CURE SCHEDULES TO ENSURE THE HIGHEST SYSTEM INTEGRITY. Several methods can be utilized to tie into an existing system using a socket style tee fitting in combination with the use of socket unions, grooved coupling adapters, and flanges. Regardless of the method used, the following procedure must be followed to ensure the highest integrity:

1. Existing lines must be drained adequately prior to solvent cementing. Use a Drain Vac unit to be sure all water is removed from the system (moisture can slow the cure time and reduce joint strength).
2. The cut-in connection to the existing system should be made first, prior to proceeding with additional work.
3. Carefully review and follow manufacturers solvent cementing procedures for proper joining techniques prior to commencing with cut-in (pipe must be cut square to proper length, deburred, beveled and dry to ensure proper insertion depth and highest integrity).
4. Carefully measure and cut pipe to proper length to ensure complete insertion during assembly (check the dry fit of the components being joined).
5. Using proper tools, the cut-in should be made on the smallest diameter pipe section (that is capable of adequately supplying the system changes) in close proximity to the modification being made. This approach will expedite cure times prior to pressure testing.
6. During assembly of the cut-in tee (and other components) it is important to make a 1/4 turn when inserting the pipe into the fitting per the manufacturers assembly instructions, particularly on 1 1/2" (40 mm) pipe sizes and larger. This may require the use of several components assembled in combination with the cut-in tee to create as short spool piece assembly. This can be accomplished by using socket unions, flanges, or grooved coupling adapters that will ensure that a 1/4 turn can be obtained on all pipe connections being joined.

7. Prior to applying the solvent cement use a clean *dry* rag to wipe moisture and dirt from the fitting socket and the pipe end (the presence of moisture on the joining surfaces will reduce joint integrity).
8. Use a new can of cement when making cut-in connections (verify expiration dates stamped on can prior to use).
9. After all work is completed, the cut-in joints must be allowed to cure properly prior to pressure testing as follows:

Cut- Ins (Minimum Cure Prior To Pressure Testing)

Nominal Pipe Size (Metric)	Ambient Temperature During Cure		
	60°F to 120°F (16°C to 49°C)	40°F to 59°F (4.4°C to 16°C)	0°F to 39°F (-17.8°C to 4.4°C)
3/4" (20 mm)	1 hour	4 hour	48 hour
1" (25 mm)	1-1/2 hour	4 hour	48 hour
1-1/4" & 1 1/2" (32 mm & 40 mm)	3 hour	32 hour	10 days
2" (50 mm)	8 hour	48 hour	*
2-1/2" & 3" (65 mm & 80 mm)	24 hour	96 hour	*

***CAUTION:** Solvent cement can be applied at temperatures below 40°F (4.4° C) for 2" (50 mm) sizes and larger, however the temperature of the system must be raised to 40°F (4.4° C) or higher and allowed to cure per the above recommendations prior to pressure testing. When bringing cement, pipe or fittings in from the outside, be sure they are brought up to room temperature before using the 60°F (16° C) to 120°F (49° C) cure schedule. (Also reference Note 1.)

10. *After work is completed and cut-in cure times are met*, inspect work for proper alignment and hanger placement prior to pressure testing.
11. *After cut-in cure times are met*, the system must be slowly filled with water and the air bled from the furthest and highest sprinkler heads before test pressure is applied (refer to manufacturers installation instructions regarding Hydrostatic Testing).
12. *After cut-in cure times are met and the air is bled from the system*, it is recommended that portion of the sprinkler system containing the cut-in tee be pressure tested. Prior to pressure testing, the system must be sectioned off to its smallest area using floor valves, etc., to isolate the cut-in area. It is further recommended that the test pressure applied should not exceed 50 psi (3.5 Kg/Cm²) over the system pressure. This approach will minimize the potential for water damage should a leak occur.

WARNING: AIR OR COMPRESSED GAS MUST NEVER BE USED FOR PRESSURE TESTING. VIOLATION OF THIS WARNING MAY CAUSE SYSTEM FAILURE AND/OR PRODUCT DAMAGE, AND MAY RESULT IN PROPERTY DAMAGE, SEVERE PERSONAL INJURY AND/OR DEATH.

Painting Pipe & Fittings

Water-based acrylic latex paint is the preferred and recommended paint to use on FIRE PRO CPVC pipe and fittings.

WARNING: THE UL AND C-UL LISTING DOES NOT COVER PAINTED CPVC FIRE SPRINKLER PIPING PRODUCTS. USE OF OIL BASED PAINTS CAN DAMAGE CPVC FIRE SPRINKLER PIPING PRODUCTS. BEFORE PAINTING ANY CPVC FIRE SPRINKLER PIPING PRODUCTS, CONSULT WITH THE LOCAL AUTHORITY HAVING JURISDICTION FOR RESTRICTIONS, OR CONTACT ASTRAL LIMITED. FOR PAINTING RECOMMENDATIONS. VIOLATION OF THIS WARNING MAY CAUSE SYSTEM FAILURE, PRODUCT DAMAGE, AND MAY RESULT IN PROPERTY DAMAGE.

Transitions to Other Materials

Specifically designed threaded adapters, grooved coupling adapters, and flanges are Listed for connecting systems incorporating FIRE PRO pipe manufactured by Astral to other materials, valves, and accessories.

Engineering Data - Product Specifications

FIRE PRO pipe manufactured by Astral is produced in SDR 13.5 dimensions, as specified in ASTM F442. Engineering data on Material Properties and Expansion & Contraction for CPVC pipe in this manual are provided for FIRE PRO CPVC Fire Sprinkler Pipe. Consult other pipe manufacturers for applicable variations.

FIRE PRO Pipe Dimensions & Weights SDR 13.5 (ASTM F-442)				
Nominal Size Inches/(mm)	Average OD Inches/(mm)	Average ID Inches/(mm)	Empty lbs/ft (Kg/m)	H2O Filled lbs/ft (Kg/m)
3/4 (20.0)	1.050 (26.7)	0.874 (22.2)	0.168 (0.250)	0.428 (0.637)
1 (25.0)	1.315 (33.4)	1.101 (28.0)	0.262 (0.390)	0.675 (1.005)
1-1/4 (32.0)	1.660 (42.2)	1.394 (35.4)	0.418 (0.622)	1.079 (1.606)
1-1/2 (40.0)	1.900 (48.3)	1.598 (40.6)	0.548 (0.816)	1.417 (2.109)
2 (50.0)	2.375 (60.3)	2.003 (50.9)	0.859 (1.278)	2.224 (3.310)

2-1/2 (65.0)	2.875 (73.0)	2.423 (61.5)	1.257 (1.871)	3.255 (4.844)
3 (80.0)	3.500 (88.9)	2.950 (75.0)	1.867 (2.778)	4.829 (7.186)

Note: The above average OD and average ID information is per ASTM F-442.
Check with individual manufacturers for actual OD and ID information.

Hydraulic Design

Hydraulic calculations for the sizing of systems incorporating FIRE PRO pipe manufactured by Astral must be calculated using a Hazen-Williams C value of 150. Pipe friction loss calculations must be made according to NFPA Standard 13. The following table shows the allowance for friction loss for fittings, expressed as equivalent length of pipe. For additional information regarding friction loss, contact Astral Limited.

Allowance for Friction Loss in Fittings (SDR 13.5 Equivalent Pipe)							
	3/4" (20 mm)	1" (25mm)	1-1/4" (32mm)	1-1/2" (40 mm)	2" (50 mm)	2-1/2" (65mm)	3" (80 mm)
Tee Branch	7' (2.13 m)	7' (2.13 m)	11' (3.35 m)	13' (3.96 m)	13' (3.96 m)	12' (3.66 m)	15' (4.57 m)
Elbow 90	7' (2.13 m)	6' (1.83 m)	10' (3.05 m)	11' (3.35 m)	11' (3.35 m)	12' (3.66 m)	13' (3.96 m)
Elbow 45	3' (0.91 m)	4' (1.22 m)	7' (2.13 m)	6' (1.83 m)	8' (2.44 m)	3' (0.91 m)	4' (1.22 m)
Coupling	3' (0.91 m)	1' (0.31 m)	4' (1.22 m)	3' (0.91 m)	1' (0.31 m)	2' (0.61 m)	2' (0.61 m)
Tee Run	1' (0.31 m)	3' (0.91 m)	5' (1.52 m)	5' (1.52 m)	3' (0.91 m)	2' (0.61 m)	2' (0.61 m)

Hangers & Supports

Since CPVC fire sprinkler pipe is rigid, it requires fewer supports than flexible, plastic systems. Astral Limited. recommends use of hangers that are designed and listed for supporting the CPVC Fire Sprinkler pipe. However, some hangers designed for steel pipe may be used if their suitability is clearly established. **NOTICE:** These hangers must have a minimum 1/2 inch (13 mm), load-bearing surface, and they must be selected to accommodate the specific pipe size. In addition, they cannot contain rough or sharp edges that contact the pipe, and they must not bind the pipe from axial movement. Vertical runs must be supported so that the weight of the run is not on a fitting or a joint.

Horizontal runs must be braced so that the stress loads (caused by bending or snaking pipe) will not be placed on a fitting or a joint. Support spacing is shown in the following table. See "Pipe Deflection" in this manual for information regarding bending or snaking CPVC Fire Sprinkler Pipe.

NFPA 13D permits “support methods comparable to those required by local plumbing codes.” These hanger support requirements must also be followed on NFPA 13D systems.

Table A - Standard Support Spacing

Nominal Size, Inches/(mm)	Max. Support Spacing, Feet/(Meters)
3/4 (20.0)	5-1/2 (1.67)
1 (25.0)	6 (1.83)
1-1/4 (32.0)	6-1/2 (1.98)
1-1/2 (40.0)	7 (2.13)
2 (50.0)	8 (2.43)
2-1/2 (65.0)	9 (2.74)
3 (80.0)	10 (3.05)

CAUTION: DO NOT use hanger items such as plumber’s tape or “nail-on” devices. Pipe hanger must comply with the requirements in NFPA 13, 13D and 13R.

CAUTION: When a sprinkler head activates, a significant reactive force can be exerted on the pipe. With a pendent head, this reactive force can cause the pipe to lift vertically if it is not secured properly, especially if the sprinkler drop is from small diameter pipe. The pipe must be braced against the vertical lift-up with the closest hanger. Refer to the following illustration and Table B & C.

**Table B - Maximum Support Spacing Distance In Line
Sprinkler Head Drop Tee**

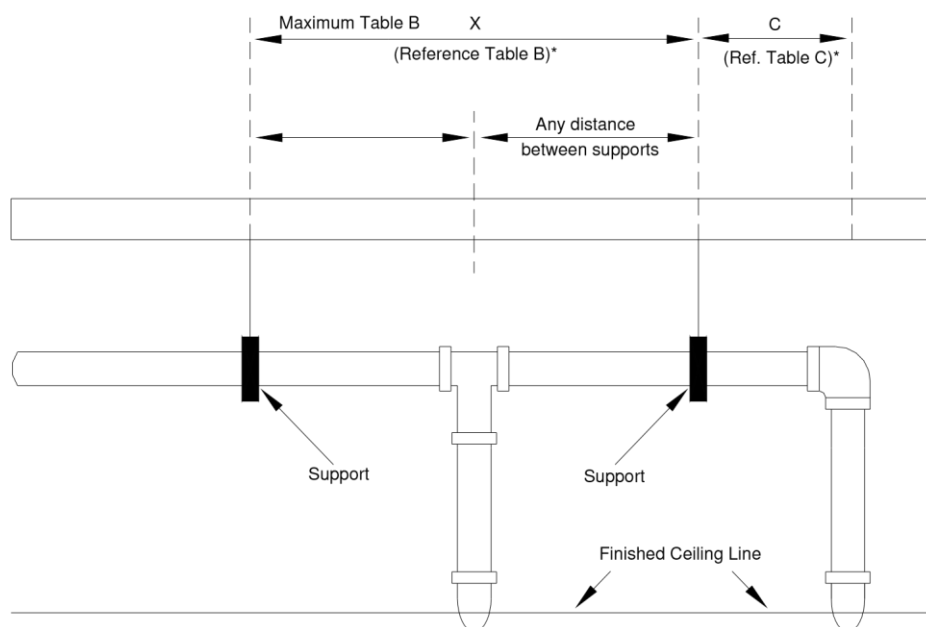
Nominal Pipe Size (inches/mm)	Less than 100 psi (7.0 Kg/Cm ²)	More than 100 psi (7.0 Kg/Cm ²)
3/4" (20 mm)	4' (1.22 m)	3' (0.91 m)
1" (25 mm)	5' (1.52 m)	4' (1.22 m)

1-1/4" (32 mm)	6' (1.83 m)	5' (1.52 m)
1-1/2" – 3" (40 - 80 mm)	7' (2.13 m)	7' (2.13 m)

Table C – Maximum Support Spacing Distance

End Sprinkler Head Drop Elbow

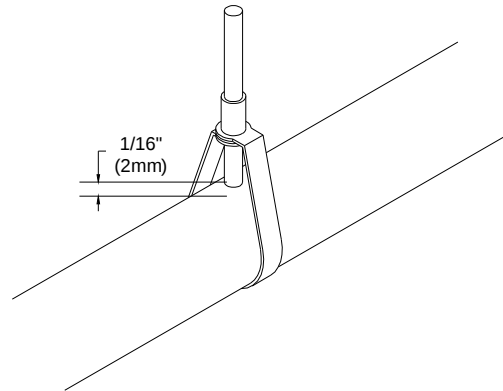
Nominal Pipe Size (inches/mm)	Less than 100 psi (7.0 Kg/Cm²)	More than 100 psi (7.0 Kg/Cm²)
3/4" (20 mm)	9" (228.6 mm)	6" (152.4 mm)
1" (25 mm)	12" (304.8 mm)	9" (228.6 mm)
1-1/4" (32 mm)	16" (406.4 mm)	12" (304.8 mm)
1-1/2" – 3" (40 – 80 mm)	24" (609.6 mm)	12" (304.8 mm)



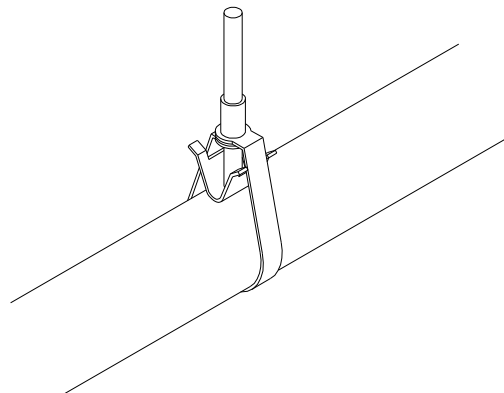
Support Spacing Drop Elbow and Drop Tee

Numerous common methods are used to brace Fire Sprinkler Pipe. Acceptable methods include, but not limited to, the following: use of a standard band hanger by positioning the threaded support rod to 1/16 inch (2 mm) above the pipe (however, it is important that the rod does not contact the pipe); a wrap around U-hanger; a special escutcheon which prevents upward movement of the sprinkler through the ceiling or band hangers with surge restraints to provide surge protection for the system. Pipe hangers are available that are tested and UL Listed for fire sprinkler service. These hangers comply with NFPA 13 requirements for use with CPVC Fire Sprinkler Piping Systems. The following descriptions are examples of these.

Band Hanger - designed to support CPVC piping systems when used in conjunction with a hanging steel threaded rod that is suspended from a ceiling or other flat, horizontal surface. The threaded rod must be leveled properly before installing the hanger and restraint. Threaded rod shall not come in contact with CPVC when installed. It is advisable to use lift restraints devices that prevent the threaded rod from coming in contact with the Fire Pro CPVC pipe.

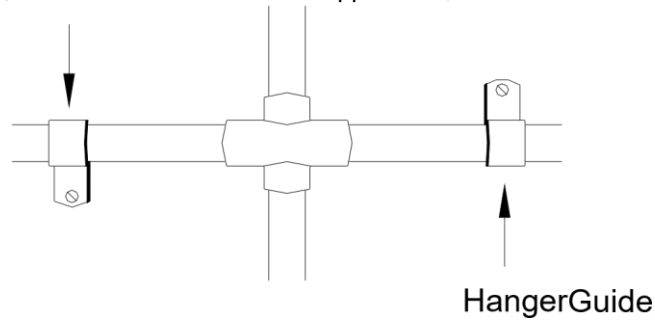


Surge Restraint - when installed with the band hanger, as shown below, provides surge protection for the system.

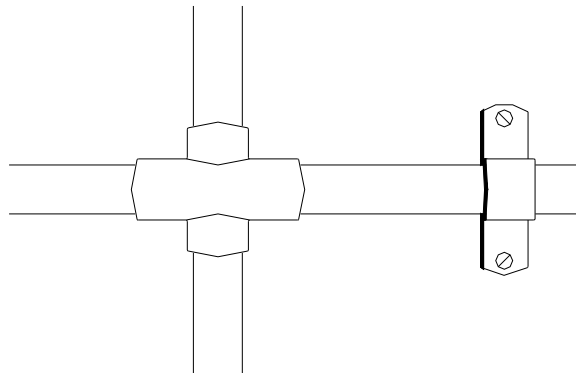


One Hole Wrap-Around Strap - designed to support CPVC piping systems only when the hanger tab is in the vertical position, and the screw-type fastener is in the horizontal position. The one-hole strap can be used as a pipe restrainer when the hanger tab is in the downward position, but it cannot be used as a hanger to hold any weight of the system. In addition, the one-hole strap can be used as a piping system guide when the system lies on top of the beam, and the beam supports the system's

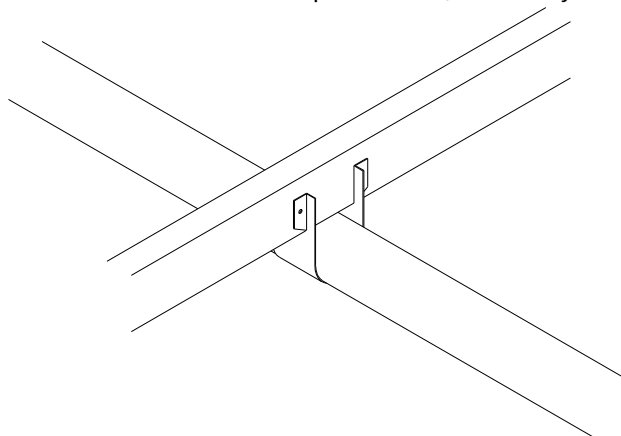
weight. **CAUTION:** The one-hole strap is not intended to support the CPVC piping system from under a ceiling or any other flat, horizontal surface. For this application, install two-hole strap.



Two-Hole Strap - designed to support CPVC piping systems when attached to a flat, horizontal surface with the screw-type fasteners in the vertical position. In addition, the two-hole strap is designed to support CPVC piping systems when attached to a flat, vertical surface with one mounting tab in the vertical position and the screw-type fasteners in the horizontal position. The two-hole strap can be used as a piping system guide when the system lies on top of a beam, and the beam supports the system's weight.



Two-Hole 90°Side Mount Strap - designed to support CPVC piping systems when attached to a horizontal beam with the screw-type fasteners in the horizontal position and the pipe hanging below the beam. The fastener's mounting edges are designed to allow the screws to be installed horizontally. This is a benefit when overhead clearance is limited. In addition, the 90° side mount strap can be used in a restrainer fashion when it is attached to the top of a beam, and the system lies on top of the beam.



Riser Supports

Risers must be supported by pipe clamps or by hangers located on the horizontal connection close to the riser. Only Listed hangers and clamps can be used. Vertical lines must be supported at intervals to avoid placing excessive load on a fitting at the lower end. This can be done by using riser clamps or double-bolt pipe clamps listed for this service.

NOTICE: Hangers and supports must not compress, distort, cut, or abrade the piping, and they must allow free movement of the pipe for thermal expansion and contraction. DO NOT use riser clamps that squeeze the pipe and depend on compression of the pipe to support the weight.

Maintain vertical piping in straight alignment with supports at each floor level or 10-foot (3.05 m) intervals, whichever is less. CPVC risers in vertical shafts or buildings with ceilings over 25 feet (7.62 m) must be aligned straight and supported at each floor level or 10-foot (3.05 m) intervals, whichever is less.

Clamps must not exert compressive stresses on the pipe. If possible, the clamps should be located directly below a coupling so that the shoulder of the coupling rests against the clamp. A coupling can be modified to achieve this by cutting a CPVC coupling just above the stop at the socket bottom. Then, cut this piece in half lengthwise to provide two halves that do not contain the stop. Follow the "Solvent Cement Welding Instructions" to cement the two halves to the pipe at the required location, and make sure that the shoulder of the modified coupling rests on the clamp. Allow the assembly to cure before placing any stress on the joint.

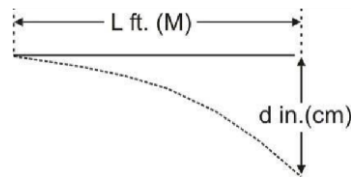
WARNING: CPVC PIPE AND/OR SYSTEM COMPONENTS MUST NOT BE USED TO PROVIDE STRUCTURAL SUPPORT FOR THE SYSTEM. CARE SHOULD BE USED WHEN INSTALLING, HANGING, OR BRACING TO PREVENT UNNECESSARY STRESS LOADS ON THE CPVC PIPING SYSTEM. FAILURE TO FOLLOW THIS WARNING CAN CAUSE PRODUCT FAILURE AND MAY RESULT IN PROPERTY DAMAGE.

Earthquake Bracing

Since CPVC fire sprinkler plastic piping is more ductile than metallic sprinkler pipe, it has a greater capacity to withstand earthquake damage. In areas subject to earthquakes, CPVC fire sprinkler systems should be designed and braced in accordance with national, state and local codes including NFPA Standard 13.

Pipe Deflection

FIRE PRO Fire Sprinkler Piping is inherently ductile allowing it to be deflected, within permissible limits, around or away from objects during installation, which can reduce installation time. This ductility allows for greater freedom of design and lower installed cost. The maximum installed deflections for FIRE PRO piping are as follows:



Maximum Installed Deflections (One End Restrained)

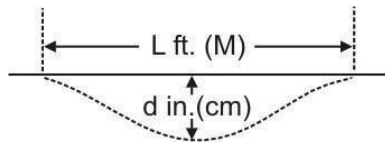
Pipe Length in Feet															
Pipe Size	2	5	7	10			12	15	20	25	30	35	40	45	50
	Permissible Bending Deflections SDR 13.5 (73°F) in Inches														
3/4"	1.3	7.1	15.4	31.3	45.1	70.5	90.6	125.4	195.9	282.1	383.9				
1"	1.0	6.1	12.3	25.0	36.0	56.3	72.3	100.1	156.4	225.2	306.6	400.4			
1-1/4"	0.8	5.0	9.7	19.8	28.5	44.6	57.3	79.3	123.9	178.4	242.8	317.2	401.4		
1-1/2"	0.7	4.1	8.5	17.3	24.9	39.0	50.1	69.3	108.2	155.9	212.2	277.1	350.7	433.0	
2"	0.6	3.1	6.3	13.9	20.0	31.2	40.0	55.4	86.6	124.7	169.7	221.7	280.6	346.4	
2-1/2"	0.5	2.1	5.5	11.4	16.5	25.8	33.1	45.8	71.5	103.0	140.2	183.1	231.8	286.2	
3"	0.4	2.1	4.5	9.4	13.5	21.2	27.2	37.6	58.8	84.6	115.2	150.4	190.4	235.1	

Note: Allowable Bending Deflections Based on Fire Pro 88738 Orange 734 CPVC compound.

Pipe Length in Meters														
Pipe Size	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Permissible Bending Deflections SDR 13.5 (23°C) in cm														
20 mm	8.6	34.3	77.1	137.1	214.2	308.4	419.8	548.3	694.0	856.7	1,036.7			
25 mm	6.8	27.4	61.6	109.5	171.0	246.3	335.2	437.8	554.1	684.1	827.8	985.1		
32 mm	5.4	21.7	48.8	86.7	135.5	195.1	265.5	346.8	439.0	541.9	655.7	780.4	915.8	
40 mm	4.7	18.9	42.6	75.8	118.4	170.4	232.0	303.0	383.5	473.5	572.9	681.8	800.2	928.0
50 mm	3.8	15.2	34.1	60.6	94.7	136.4	185.6	242.4	306.8	378.8	458.3	545.4	640.1	742.4
65 mm	3.1	12.5	28.2	50.1	78.2	112.6	153.3	200.3	253.4	312.9	378.6	450.6	528.8	613.3
80 mm	2.6	10.3	23.1	41.1	64.3	92.5	125.9	164.5	208.2	257.0	311.0	370.1	434.4	503.8

Note: Allowable Bending Deflections Based on Fire Pro 88738 Orange 734 CPVC compound.

THIS SPACE INTENTIONALLY LEFT BLANK



Maximum Installed Deflections (Both Ends Restrained)

Pipe Size	Pipe Length in Feet													
	2	5	7	10	12	15	17	20	25	30	35	40	45	50
Permissible Bending Deflections SDR 13.5 (73°F) in Inches														
3/4"	0.3	2.0	3.8	7.8	11.3	17.6	22.6	31.1	49.0	70.5	96.0	125.4	158.7	195.9
1"	0.3	1.6	3.1	6.3	9.0	14.1	18.1	25.0	39.1	56.3	76.6	100.1	126.7	156.4
1-1/4"	0.2	1.2	2.4	5.0	7.1	11.2	14.3	19.8	31.0	44.6	60.7	79.3	100.4	123.9
1-1/2"	0.2	1.1	2.1	4.3	6.2	9.7	12.5	17.3	27.1	39.0	53.0	69.3	87.7	108.2
2"	0.1	0.9	1.7	3.5	5.0	7.8	10.0	13.9	21.6	31.2	42.4	55.4	70.1	86.6
2-1/2"	0.1	0.7	1.4	2.9	4.1	6.4	8.3	11.4	17.9	25.8	35.1	45.8	57.9	71.5
3"	0.1	0.6	1.2	2.4	3.4	5.3	6.8	9.4	14.7	21.2	28.8	37.6	47.6	58.8

Note: Allowable Bending Deflections Based on Fire Pro compound.

Pipe Size	Pipe Length in Meters
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	1	2	3	4	5	6	7	8	9	10	11	12	13	14
	°C) in cm Permissible Bending Deflections SDR 13.5 (23													
20 mm	2.1	8.6	19.3	34.2	53.5	77.1	104.9	137.0	173.4	214.1	259.0	308.2	361.8	419.5
25 mm	1.7	6.8	15.4	27.4	42.8	61.6	83.8	109.5	138.6	171.1	207.1	246.4	289.2	335.4
32 mm	1.4	5.4	12.2	21.7	33.9	48.8	66.4	86.7	109.7	135.4	163.9	195.0	228.9	265.4
40 mm	1.2	4.7	10.6	18.9	29.6	42.6	58.0	75.7	95.8	118.3	143.2	170.4	200.0	231.9
50 mm	0.9	3.8	8.5	15.2	23.7	34.1	46.4	60.7	76.8	94.8	114.7	136.5	166.2	185.8
65 mm	0.8	3.1	7.0	12.5	19.6	28.2	38.4	50.1	63.4	78.3	94.7	112.7	132.3	153.5
80 mm	0.6	2.6	5.8	10.3	16.1	23.1	31.5	41.1	52.1	64.3	77.8	92.6	108.6	126.0

Note: Allowable Bending Deflections Based on Fire Pro CPVC compound.

Material Properties

Table I
Modulus of Elasticity & Stress vs. Temperature
For FIRE PRO CPVC Fire Sprinkler Pipe

Property	Temperature °F							
	73	80	90	100	110	120	140	150
	4.23	4.14	3.99	3.85	3.70	3.55	3.23	3.08
Modulus of Elasticity 5 "E" x 10 ⁵ psi	4.23	4.14	3.99	3.85	3.70	3.55	3.23	3.08
Working Stress "S" psi	2,000	1,875	1,715	1,560	1,415	1,275	1,000	875

Note: Material properties based on Fire Pro CPVC compound.

Table II
Physical & Thermal Properties of FIRE PRO

Property	CPVC	ASTM
Specific Gravity	1.51	D 792
IZOD Impact Strength (ft. lbs./inch, notched)	4.8	D 256A
Modulus of Elasticity, @ 73°F, psi	4.23 x 10 ⁵	D 638
Ultimate Tensile Strength, psi	8,000	D 638

Hazen-Williams C Factor	150	-
Coefficient of Linear expansion in./in./°F	3.2×10^{-5}	D 696
Thermal Conductivity BTU/hr./ft. ² /°F/in.	0.95	C 177
Limiting Oxygen Index	60%	D 2863
Electrical Conductivity	Non Conductor	

NOTE: Material Properties based on Fire Pro CPVC compound.

Expansion and Contraction

FIRE PRO CPVC Fire Sprinkler Products, like all piping materials, expand and contract with changes in temperature. If the coefficient of linear expansion is 3.4×10^{-5} inch /inch-°F, a 25° F (4° C) change in temperature will cause an expansion of 1 inch (25 mm) for a 100-foot (30 m) straight length. For most operating and installation conditions, expansion and contraction can be accommodated at changes of direction.

Table III Thermal Expansion

Temp Change ΔT °F	Length of Run in Feet													
	5	10	15	20	25	30	35	40	45	50	70	90	120	160
	Thermal Expansion ΔL (in.)													
20	0.04	0.08	0.12	0.16	0.20	0.24	0.29	0.33	0.37	0.41	0.57	0.73	0.98	1.31
30	0.06	0.12	0.18	0.24	0.31	0.37	0.43	0.49	0.55	0.61	0.86	1.10	1.47	1.96
40	0.08	0.16	0.24	0.33	0.41	0.49	0.57	0.65	0.73	0.82	1.14	1.47	1.96	2.61
50	0.10	0.20	0.31	0.41	0.51	0.61	0.71	0.82	0.92	1.02	1.43	1.84	2.45	3.26
60	0.12	0.24	0.37	0.49	0.61	0.73	0.86	0.98	1.10	1.22	1.71	2.20	2.94	3.92
70	0.14	0.29	0.43	0.57	0.71	0.86	1.00	1.14	1.29	1.43	2.00	2.57	3.43	4.57
80	0.16	0.33	0.49	0.65	0.82	0.98	1.14	1.31	1.47	1.63	2.28	2.94	3.92	5.22
90	0.18	0.37	0.55	0.73	0.92	1.10	1.29	1.47	1.65	1.84	2.57	3.30	4.41	5.88
100	0.20	0.41	0.61	0.82	1.02	1.22	1.43	1.63	1.84	2.04	2.86	3.67	4.90	6.53

Thermal Expansion based on Fire Pro CPVC compound.

Temp Change ΔT °C	Length of Run in Meters													
	1	2	4	6	8	10	12	14	16	18	20	30	40	50
	Thermal Expansion ΔL (cm)													
10	0.06	0.12	0.24	0.37	0.49	0.61	0.73	0.86	0.98	1.10	1.22	1.84	2.45	3.06
15	0.09	0.18	0.37	0.55	0.73	0.92	1.10	1.29	1.47	1.65	1.84	2.75	3.67	4.59
20	0.12	0.24	0.49	0.73	0.98	1.22	1.47	1.71	1.96	2.20	2.45	3.67	4.90	6.12
25	0.15	0.31	0.61	0.92	1.22	1.53	1.84	2.14	2.45	2.75	3.06	4.59	6.12	7.65
30	0.18	0.37	0.73	1.10	1.47	1.84	2.20	2.57	2.94	3.30	3.67	5.51	7.34	9.18
35	0.21	0.43	0.86	1.29	1.71	2.14	2.57	3.00	3.43	3.86	4.28	6.43	8.57	10.71
40	0.24	0.49	0.98	1.47	1.96	2.45	2.94	3.43	3.92	4.41	4.90	7.34	9.79	12.24
45	0.28	0.55	1.10	1.65	2.20	2.75	3.30	3.86	4.41	4.96	5.51	8.26	11.02	13.77
50	0.31	0.61	1.22	1.84	2.45	3.06	3.67	4.28	4.90	5.51	6.12	9.18	12.24	15.30

Thermal Expansion based on Fire Pro CPVC compound.

$$\Delta L = 12eL(\Delta T)$$

$e = 3.4 \times 10^{-5}$ in./in. °F (Coefficient of Linear Expansion for
FIRE PRO CPVC Fire Sprinkler Pipe)

L = Length of Run in Feet

ΔT = Temperature Change in °F

Example:

How much will a 40 ft. run of 2" FIRE PRO CPVC Fire Sprinkler Pipe expand if the expected ambient temperature will range from 45° F to 85° F?

$$\Delta L = 12eL(\Delta T)$$

$$\Delta L = 12 (.000034) \times 40 \times 40 \Delta L$$

$$= .65"$$

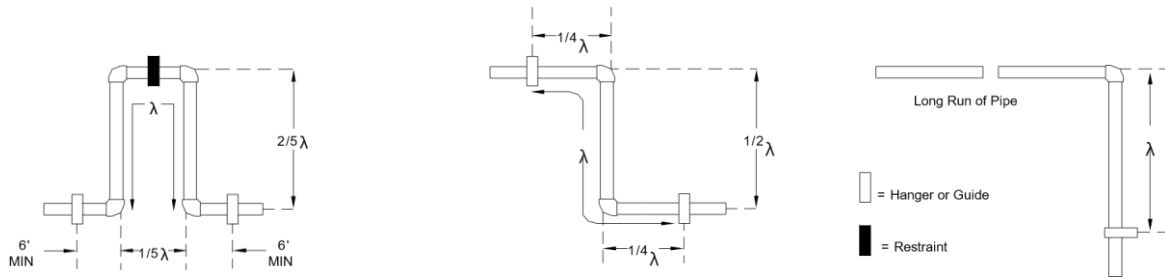
Expansion Loop & Offset Configurations

Hangers or guides should only be placed in the loop, offset or change of direction as indicated below. Piping supports should restrict lateral movement and should direct axial movement into the expansion loop.

Loop

Offset

Change of Direction



Expansion Loop and Offset Configuration

Table IV Expansion Loop Length in Inches For FIRE PRO CPVC Fire Sprinkler Pipe

Nominal Pipe Size	Avg. O.D.	Length of Run in Feet													
		5	10	15	20	25	30	35	40	45	50	70	90	120	160
		Length of Loop (in)													
		Temperature = 100°F-30°F, ΔT = 70°F													
3/4"	1.050	7	11	13	15	17	18	20	21	22	24	28	32	37	42
1"	1.315	8	12	14	17	19	20	22	24	25	26	31	35	41	47
1-1/4"	1.660	9	13	16	19	21	23	25	26	28	30	35	40	46	53
1-1/2"	1.900	10	14	18	22	22	25	27	28	30	32	38	43	49	57
2"	2.375	11	16	20	22	25	27	30	32	34	35	42	48	55	63
2-1/2"	2.875	12	18	21	25	27	30	33	35	37	39	46	52	60	70
3"	3.500	13	19	24	27	30	33	36	38	41	43	51	58	67	77

Note: Table IV is based on Stress & Elasticity at 100°F.

$$\lambda = \sqrt{\frac{3ED(\Delta L)}{25}}$$

25λ = Length of Expansion Loop in
Inches

E = Modulus of Elasticity at 100° F

D = Average O.D. of Pipe

ΔL = Change in Length of Pipe Due to Change in Temperature
(Table III)

S = Working Stress at 100° F (Table I)

Example: How much expansion can be expected in a 200 ft. run of 2" FIRE PRO CPVC Fire Sprinkler Pipe and how long should the expansion loop be to compensate for this expansion? (The expected temperature range will be from 40° F to 110° F).

First Find:

ΔT = (Change in Temperature)

$\Delta T = T_2 - T_1$

$\Delta T = 110^\circ\text{F} - 40^\circ\text{F}$

$\Delta T = 70^\circ\text{F}$

To Find:

ΔL = (Amount of Expansion in inches from Table III)

$\Delta L = \Delta L \text{ of } 160 \text{ ft. with a } \Delta T \text{ of } 70^\circ\text{F} + \Delta L \text{ of } 40 \text{ ft. with a } \Delta T \text{ of } 70^\circ\text{F}$

$\Delta L = 4.57" + 1.14"$

$\Delta L = 5.71"$

OR

$\Delta L = 12eL(\Delta T) e = 3.4 \times 10^{-5}$

5 (from Table II)

L = Length of Run in Feet

ΔT = Change in Temperature in °F ΔL

$= 12 \times .000034 \times 200 \times 70$

$\Delta L = 5.71"$

To find the length of the expansion loop or offset in inches:

$$\lambda = \sqrt{\frac{3ED(\Delta L)}{2S}}$$

λ = Length of Expansion Loop in Inches E = Modulus of Elasticity at 110° F (Table I)

D = Average O.D. of Pipe

ΔL = Change in Length of Pipe Due to Change in Temperature (Table III)

S = Working Stress at 110° F (Table I)

$$\lambda = \sqrt{\frac{3ED - 2S(\Delta L)}{2}}$$

$$= \sqrt{\frac{3 \times 370000 \times 2.375 \times 5.71}{2 \times 1415}}$$

= 5319

$\lambda = 72.93''$

λ

λ

Review – Do's & Don'ts

Do's

- Installation should be made only by a qualified installer or contractor in accordance with all applicable codes and requirements.
- Read and follow the installation instructions.
- Follow recommended safe work practices.
- Make certain that thread sealants, gasket lubricants, and firestop materials are compatible with CPVC.
- Keep pipe and fittings in original packaging until needed.
- Cover pipe and fittings with an opaque tarp if stored outdoors.
- Follow proper handling procedures.
- Use tools specifically designed for use with plastic pipe and fittings.
- Use the proper solvent cement and follow application instructions.
- Use a drop cloth to protect interior finishes.
- Cut the pipe ends square.
- Deburr and bevel the pipe end with a chamfering tool.
- Rotate the pipe 1/4 turn when bottoming pipe in fitting socket.
- Make certain no solvent cement is on sprinkler head and adapter threads.
- Make certain that solvent cement does not run and plug the sprinkler head orifice.
- Follow the manufacturer's recommended cure times prior to pressure testing. Fill lines slowly and only at a proper pressure.
- Bleed the air from the system prior to pressure testing.
- Support sprinkler head properly to prevent lift up of the head through the ceiling when activated.
- Keep threaded rod within 1/16" of the pipe or use a surge arrestor.
- Install FIRE PRO CPVC fire sprinkler pipe manufactured by Astral in wet systems only.
- Use only insulation and/or glycerin and water solutions for freeze protection.
- Allow for movement due to expansion and contraction.
- Renew your FIRE PROCPVC fire sprinkler products installation training every two years.

Don'ts

- Do not use edible oils such as Crisco as a gasket lubricant.
- Do not use petroleum or solvent-based sealants, lubricants, or fire stop materials.
- Do not use any glycol-based solutions as an anti-freeze.
- Do not mix glycerin and water solutions in contaminated containers.
- Do not use solvent cement that exceeds its shelf life or has become discolored or jellied.
- Do not allow solvent cement to plug the sprinkler head orifice.
- Do not connect rigid metal couplers to CPVC grooved adapters.
- Do not thread, groove, or drill CPVC pipe.

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