Technical Support and Warranty

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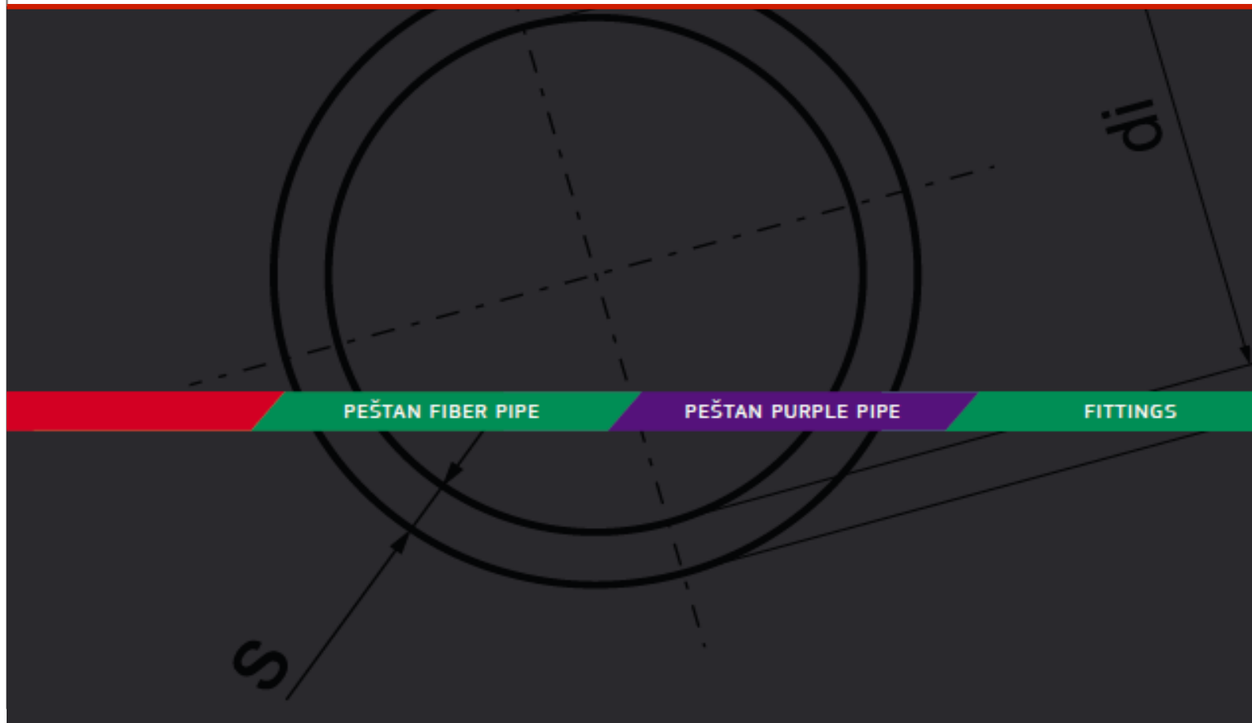
PP-R and PP-RCT
pressure piping systems

PESTAN
Reliability. Quality. Innovation



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Section 1

Introduction to PESTAN
North American

Founded in 1989, PESTAN is a privately held company that takes enormous pride in employing 750 people locally and an additional 200 employees worldwide. Utilizing an in-house logistics system and transportation fleet, our products are shipped to over 5,000 distribution centers in 50 countries around the world.

PESTAN consistently produces the most advanced plastic piping systems made from Polypropylene (PP-R and PP-RCT), Polyethylene (PE) and Polyvinyl Chloride (PVC).

Photo: Main offices in Europe

PESTAN's production facilities are located in Central Europe on the banks of the Pestan River. To preserve and protect this environment, we developed and implemented an environmental management system which is certified to ISO 14001. The guiding principles of this system are deeply rooted in all of PESTAN's operations.

Innovation is at the core of PESTAN's ideology and is apparent throughout every phase of the operation. In addition to the environmental management system, the PESTAN team utilizes technologically advanced compounding, extrusion, injection molding and testing equipment to produce piping systems that are used throughout the world. As the industry leader, PESTAN pipes set the standard for quality and performance.

Recognized throughout the world, PESTAN utilizes state of the art technology, quality control and environmental management systems. Synergies developed using extensive extrusion innovation and market expertise make PESTAN Polypropylene pipeand fittings the smart, sustainable and logical choice for your piping solutions!

Now, PESTAN products are available through North America with extensive inventory of PESTAN PP-R(CT) pipe and fittings at their US based Distribution Center ensuring prompt, on-time deliveries.

Furthermore, PESTAN North America Product Education, Fusion Training and Certification and Technical Support.

Section 2

PP-R and PP-RCT Properties and Approvals

Polypropylene Random Copolymer (PP-R) and Polypropylene Random Crystalline Temperature (PP-RCT)

With more than thirty years of proven performance, Polypropylene Random Copolymer (PP-R) pipe and fittings have been used throughout the world in plumbing, mechanical and industrial applications. Pipes made from PP-R are lightweight, do not corrode, rust, or scale and they are joined via heat fusion for permanent, leak-free joints.
These pipes may be used inside the building, outside the building with U.V. (ultra violet) Protection or Direct buried. (See section on UV Protection)

Applications include but are not limited to the following systems:

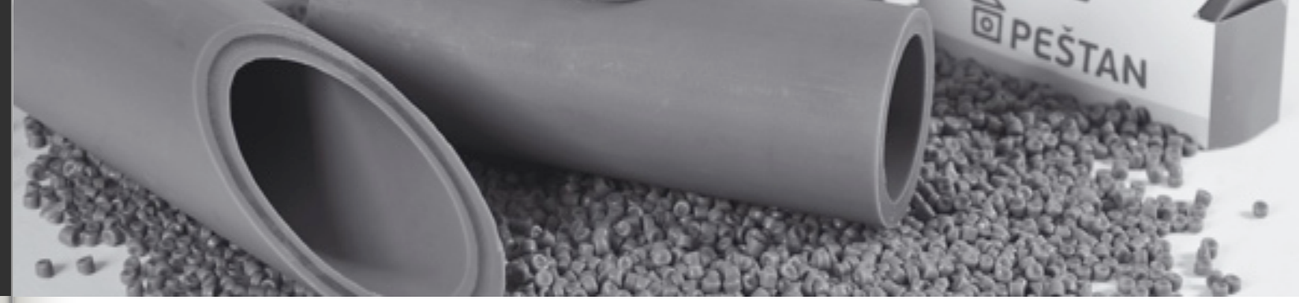
Hot and Cold Potable Water
Food Processing
Hydronics
Geothermal
Industrial
Compressed air and vacuum
Rainwater Collection,
Gray and Reclaimed Water

For more information on applications please contact our Technical Support at support@pestanpipes.com

Based on the success of PP-R, the next generation of Polypropylene-Random Copolymer was developed with a special crystalline structure that exhibits an improved pressure rating at elevated temperatures. It is called Polypropylene-**R**andom **C**rystalline **T**emperature (PP-**RCT**). Its enhanced crystalline structure is created through a special nucleation process that enables the pipe to operate at higher pressures at elevated temperatures. This advanced resin is used in PESTAN's Mechanical and Potable Water Pipes and Fittings.

In long-term pressure tests, the outstanding performance characteristics of PP-RCT vs. standard PP-R is apparent:
PP-RCT : 50 year strength at 70˚C (158˚F) = 5.00 MPa (725 psi)
PP-R : 50 year strength at 70˚C (158˚F) = 3.21 MPa (464 psi)

Offering more than 50% improved long-term strength, PP-RCT enables designers to achieve higher pressure ratings than with traditional PP-R pipes of the same wall thickness, or they can utilize PP-RCT's higher pressure rating and down-gauge to a thinner wall pipe offering higher hydraulic capacities and cost savings.



Material Stability

Integrity of the PP-R(CT) raw material is not affected during processing and fabrication. More importantly, the material is engineered to withstand long-term service life even at high temperatures.

Premium Quality

PESTAN's strict policy on quality control requires the use of premium PP-R(CT) resins produced by the world's premier resin manufacturers. Material formulations and processing parameters are continuously monitored for compliance and consistency, insuring a 50+ year service life when used in PESTAN approved applications.

UV Protection - Indoor vs. Outdoor

PP-R(CT) pipe and fittings are not stabilized for direct Ultraviolet (UV) exposure.
Over time, UV exposure causes degradation, resulting in decreases in the pipe's physical properties and chemical resistance as well as affecting the long-term performance.
If the pipes are going to be used outdoors, they should be encased in a protective wrap or insulation.

For more information on protective coatings, please visit: www.PestanPipes.com/UV-Protection/ or contact our Technical Department.

Hydrolysis

PESTAN PP-R(CT) pipes are completely resistant to hydrolysis meaning they will not react with water. The pipe will not break down and no chemicals will leach into the water throughout its lifecycle Additionally, these pipes do not impart any taste or odor into the fluids they convey. This makes them ideal for the transport of water and food grade liquids.

Corrosion Resistance

Unlike metal piping systems that have to be upsized due to corrosion, PP-R(CT) systems do not corrode, rust or scale. No corrosion means long-term consistent flow, no decrease in pipe inside diameter, lower pumping costs and a better quality of water

Chemical Resistance and Special Applications

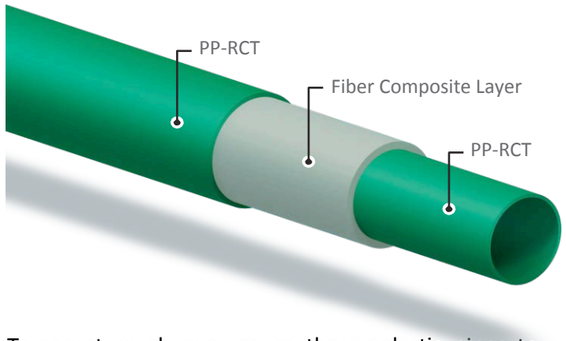
PP-R(CT) is safe for the transport of drinking water and any food-grade fluids. Because of the non-polar characteristics of polypropylene and a specially designed additive package, PP-R(CT) systems are also suitable for the distribution of most chemicals*. Although PP-R(CT) is resistant to a wide variety of chemicals, it is very important to select appropriate "transition" fittings (fittings with metal inserts).
To determine if PESTAN piping is suitable for your desired application, please contact our Technical Department.

Warning: Pestan does not recommend PP-R(CT) being used in installations where copper and highly aggressive water are present. The water attacks the copper and releases free ions that negatively affect water and any material it contacts in the system. Even inert materials such as polypropylene can be affected.
To avoid the erosion/corrosion of the copper piping systems, please follow recommended design instructions from The Copper Tube Handbook, by Copper Development Association (page 11).

Note: According to the ANSI/ASME B31.3 Process Piping Code, thermoplastic piping should not be used in flammable fluid service above ground, in nominal sizes above 1 inch (32 mm). With sizes 1 inch and below, secondary containment should be provided.

*for more information please contact our Technical Support at support@pestanpipes.com

Fiber Composite Pipes
Integrated Expansion and Contraction Control



Temperature changes cause thermoplastic pipes to expand and contract in the linear direction. With PESTAN's PP-R(CT) Fiber Composite pipes, expansion and contraction is controlled in the linear direction. This is achieved by the addition of a fiber layer co-extruded into the mid-wall of the pipe. The middle layer is comprised of oriented fibers encapsulated in PP-RCT, which does not expand when exposed to temperature changes. Therefore, overall expansion of the pipe is minimized. Not only does it reduce the need for additional expansion control, it also provides rigidity and stability.

PESTAN's Mechanical and Hot Drinking Water Pipes are with the Fiber Composite layer and are joined via heat fusion and use standard PESTAN PP-RCT fittings.

Heat Fusion Connections

PESTAN piping systems use the Heat Fusion process to create the homogeneous connections between the pipe and the fittings. The connections use no added solders, solvents, glues or similar products. When heat fusing PP-R(CT) components, extra material is collected at the joint which makes fusion joints the strongest points of the system. Properties of the material do not change when heat fused, so connections between pipes and fittings are strong and safe.

50+ Years of Savings

PESTAN has developed long-lasting, low maintenance piping systems. Our products are produced from proprietary resin formulations insuring long term performance. The pipes are resistant to scaling and corrosion; the walls of the pipes are extremely smooth and therefore have a low friction coefficient eliminating abrasion. Furthermore, mechanical joints, the weakest point of a traditional piping system, are eliminated by using heat fusion as the joining method. With heat fused joints, physical stresses will not damage the integrity of the joints.

Low Thermal Conductivity

The value of Thermal conductivity of PP-R(CT) material is 1.67 BTU(in/hr ft^2 °F). This low conductivity value, combined with the thickness of the pipe and fitting wall, acts as a natural insulator. Traditional metal piping systems have much higher Thermal Conductivity values. Under normal operating conditions, non-insulated PP-R(CT) pipes have less heat loss or gain and greater resistance to condensation as compared with metal and other types of plastic piping systems.

One of the objectives of Energy and Building codes is to improve operating efficiencies. They make recommendations for the required amount of insulation for piping systems. Because PESTAN piping systems have much lower heat losses and heat gains than traditional metal systems, our piping system is capable of operating at an equal or in most cases a more efficient level than other metal systems under the same code. If there is a need for insulation, both space and material can be saved using PP-R(CT) systems. Further details on this are given in Section 5.

Insulation and Energy Savings

The level of insulation required in a PP-R(CT) Piping system is relative to the thickness of the wall. A chart on the equivalent R values of PESTAN pipe can be found in Chapter 5. A 50% improvement in heat loss or heat gain can be realized when comparing non insulated metal pipe to non insulated PESTAN PP-R(CT) pipe. Before starting installation, always check code requirements to make sure that your installation complies. Both past and current ICC and ASHRAE energy codes support insulation savings when using PESTAN pipes (see Section 4).

Although PP-R(CT) is a better insulator than metal pipes, care should be taken in areas where there is a high dew point or where the ΔT between the fluid in the pipe and the ambient temperature is great. The pipe has the potential to condensate. In these situations, insulation is recommended.

Fittings Insulation Advantage

The socket fusion fittings vary from ½" to 4" (20 mm – 125 mm). When pipes are inserted into the socket of the fitting, thickness of the PP-R(CT) material is increased at the joint. When thickness of the over-engineered fittings and pipe are added in conjunction with natural thermal resistance of the material, need for fitting insulation may be eliminated in certain applications.

Natural Sound Insulation

Because of the integrated natural sound insulation, pressure billow and water flow noise are lessened by PP-R(CT) pipes, enhancing the quality of living for the occupants of the buildings.

Prevention of Biological Growth

Light transmission through PP-R(CT) pipe is less than 0.2%. Therefore, algae and other biofilm attachment is not supported. This benefit makes it an ideal piping system for health care facilities and food grade applications.

Flame and Smoke

PP-R(CT) pipes will burn, but are not classified as flammable. The NFPA classifies these products as a 1 (slow burning) on a scale of 0 to 4 with 4 being the quickest to burn. When burning, these pipes emit CO_2 and H_2O vapor. In an underdeveloped combustion situation, small amounts of CO can be emitted, just as it is from wood or wood-based products.
PP-R(CT) pipes require special wrapping when installed in plenums or other spaces where the Code requires the pipe to meet a Flame Spread Index (FSI) of 25 and a Smoke Development Index (SDI) of 50. You may use ASTM E84 OR CAN/ULC S-102.2 approved materials to comply with the code. Always be sure to review project and local code requirements before beginning an installation.
For more information visit our web site at http://www.pestanpipes.com/flame-and-smoke-rating/

Safe Handling and Installations

Installation of PP-R(CT) piping system is preferred over other piping systems because they weigh less and are joined using heat fusion, instead of solders or glues (eliminating VOC's during the process).
Installers should follow all safety recommendations established by PESTAN as well as all project, local, state and federal (OSHA) safety guidelines when working with PESTAN PP-R(CT) piping systems.

LISTINGS AND CODE APPROVALS

PESTAN products are listed for following Standards:

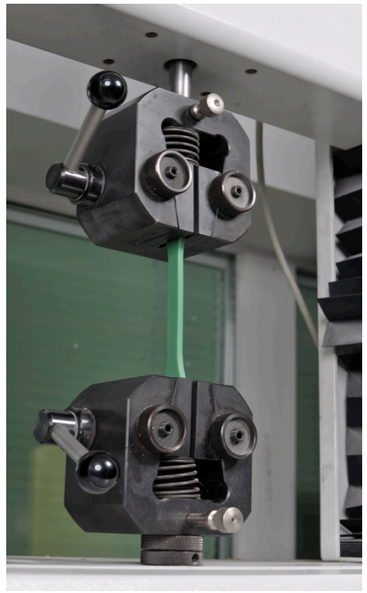
- ASTM F 2389 Standard Specification for Pressure Rated Polypropylene (PP) Piping System
- NSF/ANSI 14 Plastic Piping Systems Components and Related Materials
- NSF/ANSI 61 Drinking Water System Components-Health Effects
- NSF/ANSI 51 Food Equipment Materials
- NSF/ANSI 372 Drinking Water System Components - Lead Content
- CSA B137.11 Polypropylene (PP-R) Pipe and Fittings for Pressure Applications
- ICC-LC1004, PP, PEX, PEX-AL-PEX and PP-AL-PP Piping, Tube and Fittings used in Radiant Heating and Water Supply

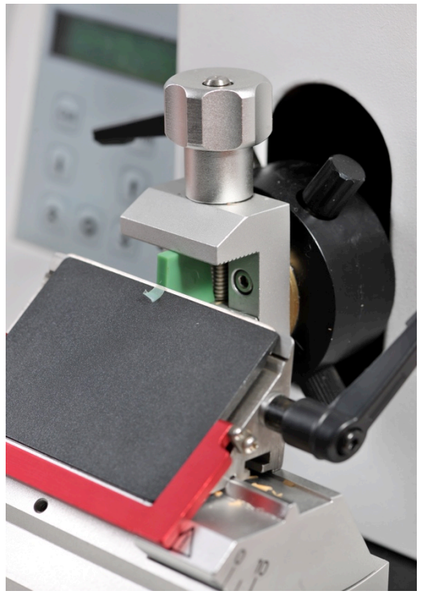
PESTAN products are listed for following Codes:

- 2015, 2012, 2009 and 2006 International Residence Code (IRC)
- 2015, 2012, 2009 and 2006 International Plumbing Code (IPC)
- 2015, 2012, 2009 and 2006 International Mechanical Code (IMC)
- 2015, 2012, 2009 and 2006 Uniform Plumbing Code (UPC)
- 2015, 2012, 2009 and 2006 Uniform Mechanical Code (UMC)
- 2013 and 2010 California Plumbing Code (CPC)
- 2013 and 2010 California Mechanical Code (CMC)
- 2010 National Plumbing Code of Canada

PESTAN manufacturing plant is listed for the following Standards:

- ISO 9001:2007 for Quality Management
- ISO 14001 for Environmental Management
- OHSA 18001:2007 for Occupational Health and Safety Management





ICC EVALUATION SERVICE

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ICC-ES Report

PMG-1106

Reissued 12/2018

This report is subject to renewal 12/2019

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EVALUATION SUBJECT:

PESTAN POLYPROPYLENE (PP-R) AND (PP-RCT) PIPE AND FITTING SYSTEM

DIVISION:
22 00 00—PLUMBING
SECTION:
22 11 00—FACILITY WATER DISTRIBUTION
22 11 16—DOMESTIC WATER PIPING

DIVISION:
23 00 00—HVAC
SECTION:
23 21 13—HYDRONIC PIPING

Report Holder:

PESTAN NORTH AMERICA

Look for the ICC-ES marks of Conformity!

IAPMO RESEARCH AND TESTING, INC.

5001 E. Philadelphia Street, Ontario, CA 91761-2816 • (909) 472-4100 • Fax (909) 472-4244 • www.iapmort.org

IAPMO R&T Product Listing

This IAPMO R&T Listing is current as of 9/30/2019

Product: Pressure Rated Polypropylene Piping Systems File No. 8358

Issued To: PESTAN NORTH AMERICA
461 ESTRELITA DR
VISTA, CA 92084

Identification: Pipe shall be marked at intervals of not more than 5 ft. with the manufacturer's name or trademark, nominal size, for metric series pipe - the term "metric" and the dimension ratio or both the outside diameter and wall thickness, IPS series pipe shall include "Schedule 80" or "SCH 80", type of material (PP-R or PP-RCT) and classification number (80 or 100), pressure rating and temperature for which pressure rating is valid, the designation "F2389", manufacturer's production code, and pipe intended for the transport of potable water shall bear the mark of the lab making such evaluation. Fittings shall be marked with the manufacturer's name or trademark, nominal size, dimension ratio or schedule for corresponding pipe and type of material (PP-R or PP-RCT). The fitting or packaging shall be marked with "Metric" or "NPT" for threaded fittings, and the designation "F2389". All products shall bear the UPC® and/or UMC® certification mark.

Characteristics: Pressure rated polypropylene pipe and fittings manufactured in accordance with ASTM F2389. To be installed per the manufacturer's instructions and the latest edition of the Uniform Plumbing Code and Uniform Mechanical Code.

Products listed on this certificate have been tested by an IAPMO R&T recognized laboratory. This recognition has been granted based upon the laboratory's compliance to the applicable requirements of ISO/IEC 17025.

Products are in compliance with the following code(s):

Uniform Plumbing Code (UPC®)
Uniform Mechanical Code (UMC®)

Products are in compliance with the following standard(s):

ASTM F2389-2017a
NSF/ANSI 14-2015

Section 3

Advantages of using PESTAN PP-R and PP-RCT Systems

OWNER BENEFITS

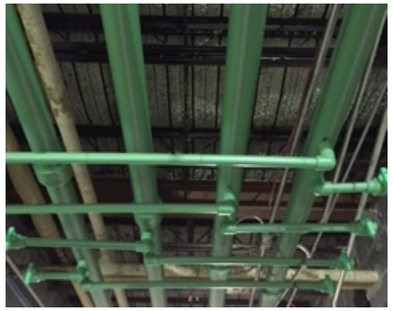
No Maintenance

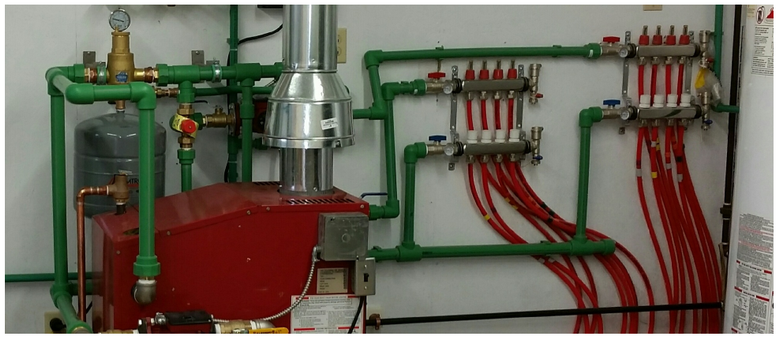
PESTAN PP-R(CT) piping systems are more cost effective to operate and maintain as compared to traditional metal piping systems. It is joined with heat fusion so there are no mechanical fittings or gaskets to fail. The absence of mechanical fittings substantially minimize the chance of damage related to leaks.
The pipe is resistant to corrosion and scaling so no additional chemical treatments are required. PP-R(CT) pipes have a better coefficient of friction than metal pipes resulting in lower pumping costs.

No Toxic Elements

PESTAN pipes and fittings do not contain toxic materials and do not emit VOC's or other dangerous compounds even when exposed to fire.

Photos of PESTAN pipes installed





Reduced Heat Transfer Values

PESTAN PP-R(CT) pipes have a lower thermal conductivity value than traditional metal pipes: 1.67 BTU(in/hr ft² °F), 0.139 BTU(ft hr °F), 0.241 watts/(m °K).

This provides several advantages:
➢Minimized loss or gain of heat improves energy savings
➢Less insulation is required
➢Less condensation when used for chilled water
➢Reduced chance of injury around exposed hot water piping

Freezing Conditions

Although not designed to be installed in applications that are repeatedly frozen and thawed, the ductility of PP-RCT makes it less likely to rupture than metal pipes during one of these events. If installed in areas with potential for freeze events, Pestan recommends the use of anti-freeze solutions such as glycols or at least keep the minimum constant flow through pipes to protect proper function and integrity of the system. Follow Pestan's guidelines if heat tapes are used.

Extended Service Life

PESTAN PP-R(CT) Pipes are both chemically and physically durable and offer advanced performance over other piping systems. They can provide building owners with a long, low maintenance service life of 50 + years, depending on the application.

Product Warranty

PESTAN offers a 10 year warranty that covers product replacement, incidental and property damages caused by product failure due to manufacturing defects. Systems must be installed and successfully tested by PESTAN Certified Installers and a properly recorded Pressure Test Form must be submitted.

For more information please visit www.PestanPipes.com/warranty/

INSTALLER BENEFITS

Compatible Piping Systems

PESTAN offers a full line of PP-RCT fittings keeping installation simple and providing an easy transition to other piping systems and equipment.

Lightweight Material

Weighing up to 80% less than traditional metal pipes PESTAN pipes are easy to handle and more cost-effective to transport. Their light weight makes them easier to assemble making for a safe and less tiring installation.

Non-Shattering

Under normal operating temperatures, the pipes will not shatter when impacted or crushed. When temperatures fall to or below freezing, the impact resistance of the pipes decreases so the installers must use caution when handling.

Heat Fusion

During installation, there are no solders, solvents or glues required. PP-R(CT) is joined via a process known as heat fusion. During the fusion process, the pipe and fittings are heated under controlled temperatures and then joined. The molecules of the polymer flow together creating a seamless, permanent leak-free bond. No open flames are required and no toxic Volatile Organic Compounds (VOC's) are emitted during the process. Heat fusion is a quick, safe joining method that can be utilized in occupied buildings.

Saddle Outlet Fusion Joints

Even after the mains are set, branch lines can be easily added using saddle outlet joints. With saddle outlets, the branch is fused directly on and into the wall of the main. Furthermore saddle outlets are a great solution for easy fabrication and modification of manifolds. It is a time saver and provides lower pressure drop as compared to traditional tee fittings.
Note: Saddle Outlets cannot be hot tapped, the line must be free of water before installing Saddle Outlet joints.

Prefabrication and Transport

PESTAN PP-R(CT) pipes and fittings cannot be dry fit, preventing the possibility of any missed connections. Because they joined with heat fusion, ideal for prefabrication and transport without the risk of the pre-fab joints failing. The unique properties of PP-R(CT) pipe combined with the permanent, leak-free bonds (created by joining with heat fusion), creates a monolithic system. These characteristics also help prevent damage from seismic activity or from exposure to vibrations, such as on cruise ships, trains and in manufacturing facilities.

Uniform and Rigid Appearance

Because of rigidity and strength, PESTAN PP-R(CT) piping systems maintain a uniform, professional appearance in all types of installations including wall mounted vertical and horizontal installations as well as when suspended from hangers.

Pressure Testing

Final pressure testing must be done on a completed installation and documented according to pre-set guidelines established by PESTAN. These steps enable the installer to identify potential leaks before the system becomes operational.

The installer may use water, air or a mixture of air and water as the pressure test medium. Strict adherence to safety and pressure testing procedures should be followed, especially when the test is performed using air.

Easy to Identify

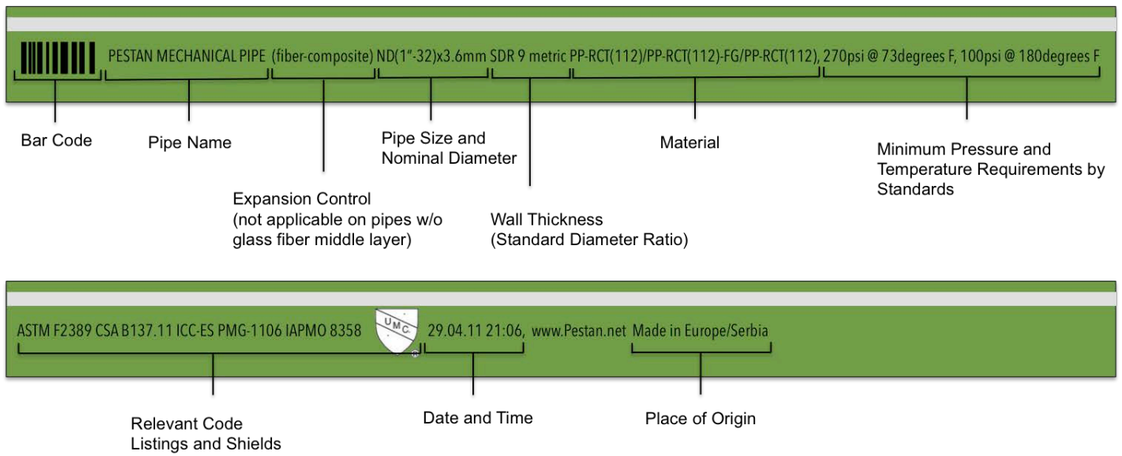
Coloring and Markers:

- Hot Potable Water Pipe - Green with Red Stripes
- Cold Potable Water Pipe - Green with Blue Stripes
- Mechanical Pipe Color Coding
  - SDR 7.4 - green with 4 gray stripes
  - SDR 9 - green with 4 gray stripes
  - SDR 11 - solid green
  - SDR 17.6 - solid green
- Reclaimed Water - solid Purple

PESTAN Pipes are available in the following lengths:

- 20mm to 63mm (1/2" to 2") comes in 13' sticks
- 75mm (2 ½") and larger come in 19' sticks

Mechanical Pipe (with fiber composite layer) – Green with Grey Stripes



The straight lengths of pipe are bundled by size and packaged in UV resistant bags. If pipe is temporarily stored outside, bags will protect pipe from UV exposure up to 6 months.

The content of the bundles is clearly identified with labels specifying the type of pipe, size, dimension and number of pipes per bundle.
Fittings are packaged in plastic bags. The bags are labeled with the product description, part number and total number of fittings per bag.
Both pipe bundles and fitting labels have barcodes for easy identification when shipping and receiving.

Integrated Expansion Control

Unlike other plastic piping systems, the integrated linear expansion control of PESTAN PP-RCT Fiber Composite Piping Systems do not require any additional expansion control when compared to metal piping systems.
Additionally thrust blocking is not required on buried PP-RCT piping system with fiber layer. The exception to this is if the PP-R(CT) is connected to another type of piping product. Thrust blocking is required at the transition point.

The Environmental Advantages

- Contain NO toxic substances (BPA's or dioxins)
- Contain NO heavy metals
- Has an extended service life (50+ years depending on application)
- 100% recyclable
- Non-corrosive with a low friction factor meaning less pumping energy is required
- Lightweight (8 times lighter than steel) facilitating easier transportation, handling and installation
- Heat fusible joints providing No-Leak systems
- No VOC's are released during production or fusion.

ENGINEER/DESIGNER BENEFITS

PESTAN PP-R(CT) piping systems provide multiple benefits for Engineers/Designers including:

➢Efficient System that will not corrode and will not reduce inner diameter
➢Minimal heat transfer values as compared to metal pipes
➢The natural sound insulation of water flow and pressure effects
➢Complete piping system components readily available
➢Easy to transition to and from existing piping systems
➢Cooler boiler rooms

PESTAN and LEED Credits

An important part of "Green" building involves designing "LEED" approved projects. Designing a "LEED" approved building not only helps insure energy efficiency and lower operating costs, it helps promote sustainability of our resources while balancing the environmental and economic impact of the project.

There are no established LEED credits for using a particular piping material. However, installations using PESTAN PP-R(CT) can still help qualify for many LEED points from various categories, such as innovation, sustainability, energy savings, etc.

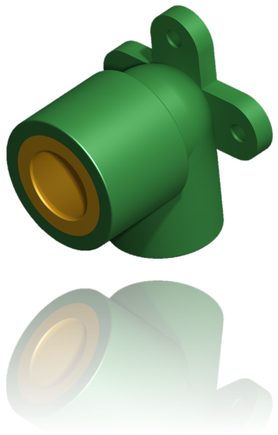
For more information, visit our website at www.pestanpipes.com

Because PESTAN PP-R(CT) pipes offer so many advantages for the engineers, project owners, the installers and the end users, it is no surprise this product has gained acceptance throughout the world.

Section 4

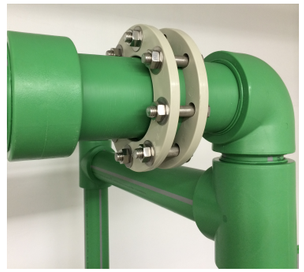
SYSTEM DESIGN

Ideal Pipe System for Desired Application



FITTINGS

Sizes: ½" - 12" (20mm - 315 mm)
Color: Molded – Green
Fabricated – Green with markers

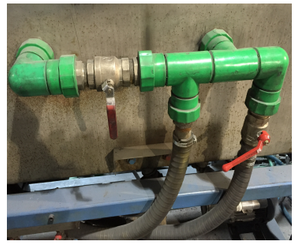


PESTAN piping systems are compatible and easily connected to other systems and equipment. To satisfy numerous application and system needs, PESTAN offers various fittings that are grouped in 3 major collections: Injection Molded, Transition and Fabricated Fittings.

Injected Molded Fittings

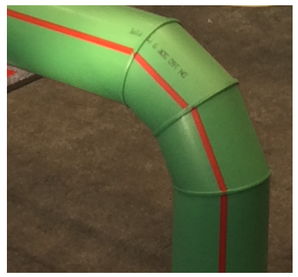
PESTAN injection molded fittings are made with a greater safety factor and are compatible with all PESTAN's PP-R and PP-RCT pipes*. Designed with a heavy wall, the fittings are the strongest part of the system and are pressure rated higher than the compatible pipe. The heat transfer of the fittings is reduced and the need to insulate them may be eliminated in certain applications.

Transition Fittings



Transition fittings are used for connections to unlike materials. Transition fittings are made of injection molded PP-RCT are available up to 2" with integrated brass inserts (threads, nipples, stubs). The brass inserts are available in both Leaded and Zero-Lead brass.
Flange adapters and back-up rings are also available in pipe sizes as small as 32mm (1").

Fabricated Fittings



Fabricated fittings are designed for 160 mm (6") pipe and larger. These fittings are specific to the application and type of pipe. The engineer and installer must match the fitting, end use application, pipe size and wall thickness of the fitting to the pipe in their application.

*Note: for compatibility of connection with PP-R systems manufactured by other companies, please contact our Technical Department.

PIPES

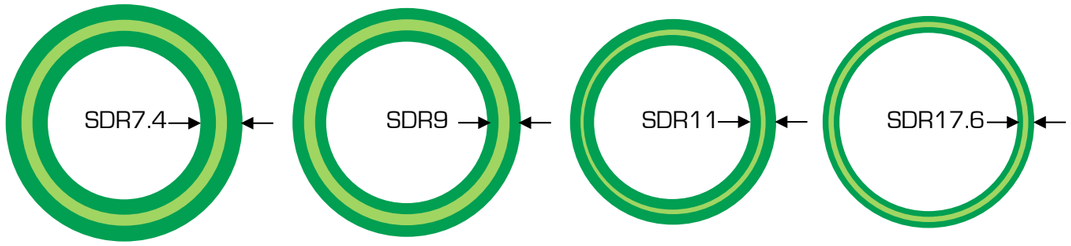
Sizes: ½" - 12" (20mm - 315 mm)
Color: Green with markers

Although all PESTAN PP-RCT Pipes are metric, PESTAN has assigned Imperial pipe size equivalents to make it reflective of the U.S. Market. When Designing PP-R(CT) systems, it is most important to understand Standard Diameter Ratio and keeping in mind that pipes are produced in metric sizes, but we have converted each of our metric pipe sizes to Imperial nominal diameters for the North American market.

Standard Dimension Ratio (SDR)
Standard Dimension Ratio is defined as the outside diameter of a pipe divided by the pipe's wall thickness.

SDR = d / s
Where d = pipe outside diameter, s = pipe wall thickness.

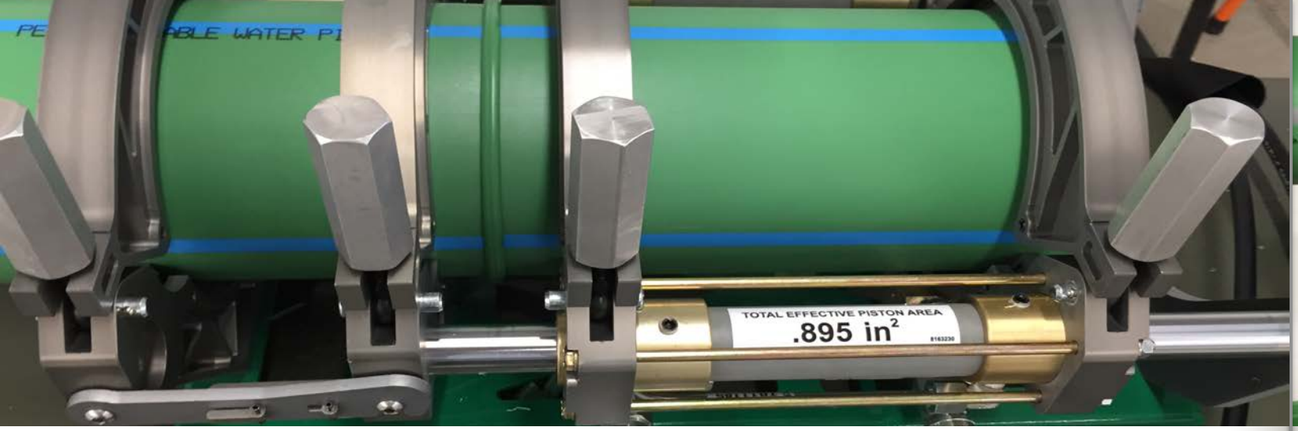
Manufactured Outside Diameter (metric)	Nominal Pipe Diameter (imperial)
20 mm	½"
25 mm	¾"
32 mm	1"
40 mm	1¼"
50 mm	1½"
63 mm	2"
75 mm	2½"
90 mm	3"
125 mm	4"
160 mm	6"
200 mm	8"
250 mm	10"
315 mm	12"



The SDR of the pipe is important as it is used as a design parameter of the pipe. The lower the SDR number, the thicker the pipe wall. A thicker wall increases the pipe's ability to hold pressure. A thinner pipe wall, increases the amount of flow through the pipe.

PESTAN pipes are made of the most advanced material known as PP-RCT and the unique middle fiber layer technology. PP-RCT (Polypropylene **R**andom **C**rystalline **T**emperature) is the newest generation of High Performance Polypropylene resins. Its enhanced crystalline structure is achieved by a special nucleation process giving the material improved temperature resistance for long term, superior performance. PESTAN pipe remains ductile throughout its service life.

The middle layer of PESTAN Composite Pipes are made of oriented fibers encapsulated in PP-RCT resin. When this special fiber composite layer is co-extruded, the outer and inner layers of PP-RCT remain unaltered. When exposed to heat, the fibers prevent the PP-RCT material from expanding in a linear direction. Therefore, the overall expansion and contraction of the pipe is reduced by 75% to 80% compared with non-fiber plastic pipes. The fiber layer improves properties of the pipe when exposed to higher heat and as a result, less support is required in comparison with other plastics.
PESTAN's Composite Pipes do not require any additional expansion control when compared to traditional metal piping systems. Furthermore, the pipe absorbs its own stresses and does not require thrust blocking.



DRINKING WATER PIPE

In addition to the fact that the pipe does not scale, and provides maintenance and leak free solutions, there are numerous other benefits to using PESTAN's Drinking Water Pipes. Pestan Pipes are made of hydrophobic material, meaning that it will not react with water and most other fluids**. Furthermore , the pipe is stabilized to resist the effects of chlorine in the potable water. PESTAN Pipes have been tested in the most prestigious laboratories and certified by the world's elite third party compliance agencies as having Class 5 Chlorine Resistance, the highest in the industry. PESTAN'S Drinking Water Pipe is also tested and certified to NSF/ANSI 61 and NSF/ANSI 51, confirming its suitability for use in drinking water and food grade applications.

From extrusion to installation and throughout the entire service life, PESTAN Pipes are Energy Savers. It takes less energy to extrude PP-RCT than to make metal pipes, the low coefficient of friction and resistance to scaling means lower pumping costs and the natural insulating features of the pipe mean less heat loss or gain (Table 55).

HOT DRINKING WATER PIPE

Nominal ID Sizes: ½" – ¾" (20 – 25mm) SDR7.4 and 1" – 12" (32 – 315mm) SDR9 (packaged in white bags)
Identification: SDR7.4 and SDR9 Green with four Red Stripes
Material: PP-RCT/Fiber Composite/PP-RCT

For the hot water applications, PESTAN's pipes are reinforced with the middle layer that prevents pipe from excessive expansion and contraction eliminating the need of additional expansion loops when compared to metal systems. Middle layer also makes pipe sturdy, which allows for greater hanger spacing (Table 46).

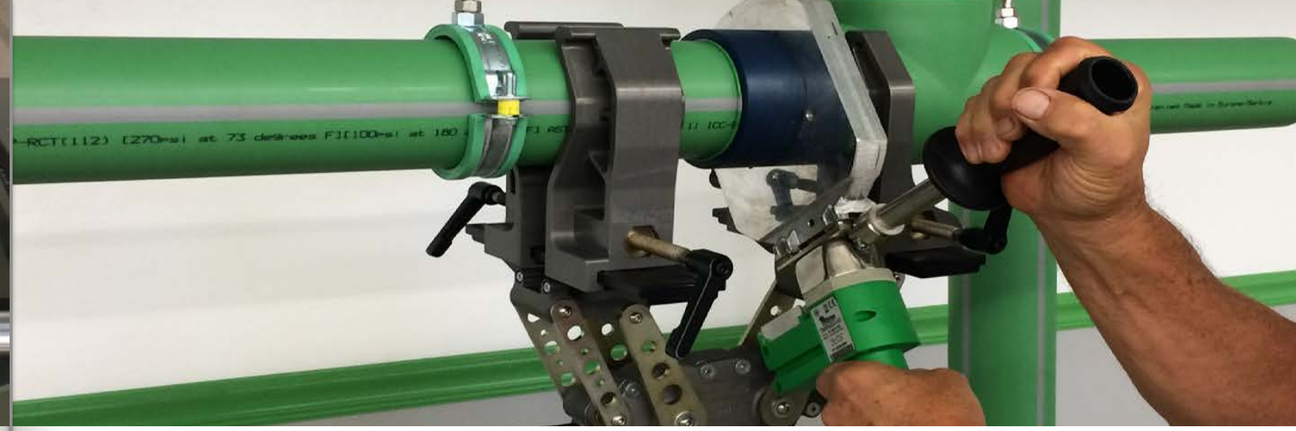
Applications: The pipe is designed for Potable Hot Water and Food Processing Applications, but, because it has composite middle layer, it may also be used for heating and cooling systems, compressed air and vacuum, direct burial, industrial, geothermal and chemical** applications.
Note: If the color-coded PESTAN pipe is used for an application other than what the color coding suggests, PESTAN recommends labeling the pipe clearly reflect the end use application.

COLD DRINKING WATER PIPE

Nominal ID Sizes: ½" – ¾" (20 – 25mm) SDR7.4 and 1" – 12" (32 – 315mm) SDR11 (packaged in white bags)
Material: PP-RCT
Identification: SDR7.4 and SDR9 Green with four Blue Stripes

Applications: The pipe is designed for Cold Potable Water and Food Processing applications. But it may also be used for other lower pressure and lower temperature applications.

**Note: for information on chemical resistance properties of PESTAN PP-R and PP-RCT product, please contact our Technical Department.



PESTAN MECHANICAL PIPE

Material: PP-RCT/Fiber Composite/PP-RCT

For the non-drinking applications, PESTAN's pipes are reinforced with the middle layer that prevents pipe from excessive expansion and contraction eliminating the need of additional expansion loops when compared to metal systems. Middle layer also makes pipe sturdy, which allows for greater hanger spacing (Table 46).

Identification and sizes available in different wall thicknesses for following Nominal ID Sizes:

- ½" – ¾" (20 – 25mm) SDR7.4 Green with Four Gray Stripes (packaged in blue bags)
- 1" – 12" (32 – 315mm) SDR9 Green with Four Gray Stripes (packaged in blue bags)
- 1" – 12" (32 – 315mm) SDR11 Solid Green (packaged in blue bags)
- 4" – 12" (125 – 315mm) SDR17.6 Solid Green (packaged in gray bags)

Applications: Designed for use in pressure applications with temperatures up to 180° F. Heating and cooling systems, compressed air and vacuum, industrial, geothermal and transportation of variety of chemicals**.

Note: PESTAN MECHANICAL pipe is not rated for transporting drinking water nor for use in food processing applications .

PESTAN PURPLE PIPE

Material: PP-R(100)
Color: Purple
Nominal ID Sizes: ½" – ¾" (20 – 25mm) SDR7.4 and 1" – 12" (32 – 315mm) SDR11

PESTAN PURPLE is designed for pressure applications at lower temperatures.
Applications: Collection and transportation of recycled, gray, reclaimed and rain water systems, irrigation and direct burial.

Note: PESTAN PURPLE pipe is not rated for transportation of drinking water or food grade fluids.

Conservation of water is becoming a major focus throughout North America. Rainwater collection systems, recycled, gray and reclaimed water systems are being installed in both new construction and in retrofits. PESTAN PURPLE is rapidly becoming the pipe of choice for these applications. With leak free joints, corrosion and scaling resistance and outstanding chemical resistance, this pipe provides energy savings and pumping efficiencies throughout it's service life. This is also beneficial for the project owner as the efficiencies gained by installing PESTAN PURPLE can help the project achieve or increase LEED credits.

PERMISSIBLE OPERATING PRESSURES

Determine the permissible system pressures for water based on the constant operating temperatures and the desired service life.

The following values are derived from an extrapolation method and are based on the conveyance of water at a constant temperature and pressure. Shown are the permissible operating pressures for each of the pipes based on temperature and the desired service life.

The permissible operating pressures of the pipes are shown with designed factors of 1.50 (per ASTM F2389) and 1.25 (typically used when designing systems for lower temperatures).

In the case of short-term increases in temperature and/or pressure, PESTAN assumes no responsibility.
The following tables are designed for water. When transporting chemicals, you must consider the effects that pressure and temperature have on the pipe. For conveyance of chemicals or compressed air, please contact Technical Support for additional information.

PESTAN MECHANICAL AND DRINKING WATER PIPE
Allowed Pressure (psi) for Service Life of 50+ years

Wall Thickness	SDR7.4		SDR9		SDR11		SDR17.6
Safety Factor	1.25	1.5	1.25	1.5	1.25	1.5	1.25[1]
50° F	487	406	387	322	308	257	160
68° F	423	352	335	280	266	222	135
73° F	400	335	324	270	252	210	133
86° F	364	303	289	241	230	192	121
104° F	312	260	248	206	197	164	103
122° F	265	221	211	176	167	140	88
140° F	223	186	177	148	141	118	70
160° F	187	155	147	123	117	97	62
180° F	100* (149)	100* (120)	100* (120)	100	100	85	50

PESTAN PURPLE PIPE
Allowed Pressure (psi) for Service Life of 50+ years

Wall Thickenss	SDR7.4		SDR11	
Safety Factor	1.25	1.5	1.25	1.5
50° F	419	349	264	220
68° F	355	296	223	186
73° F	348	290	216	180
86° F	300	250	189	157
104° F	252	210	160	133
122° F	213	178	133	111
140° F	178	149	112	93
158° F	118	98	74	62

*ASTM F2389 X1.1.4 requires the pressure rating at 180°F to be calculated based on an application class 5 from ISO 15874-2, but if the calculated pressure exceeds 100 psi, it has been arbitrarily lowered to 100 psi to conform with U.S. plumbing codes.
[1]Recommended Safety Factor by ISO 15874 & DIN 8077-8078.

NOTE: PESTAN PURPLE is primarily designed for cold water applications. If the operating temperature will exceed 140° F, please contact our technical support.

Allowed Pressure (psi) for COMPRESSED AIR APPLICATIONS
(Service Life of 50+ years)

Wall Thickness	SDR7.4	SDR9	SDR11	SDR17.6
up to 104°F	220	200	135	60

Note: For temperatures and conditions other than those noted in the chart, submit a Special Application Inquiry to PESTAN Technical Team. When synthetic oils are used in the compressor, install filters to prevent leakages of oil into the system.

SELECTION OF THE PIPE SIZE (Based on Flow Rate and Head Loss)

Determining Pipe Size by Flow Rate

As mentioned earlier, PESTAN piping systems are highly resistant to abrasion and leaks because it is made of PP-R and PPRCT, a low friction material. Consequently, most PESTAN pipes are designed to run at 8 ft/s. The pipe diameter and wall thickness determine the flow rate (GPM). The approximate flow rates based on 8 ft/s are shown in the table below.

Flow rate (GPM) based on the flow velocity of 8ft/s

Dimension		SDR 7.4	SDR 9	SDR 11	SDR 17.6
N.D. (in)	O.D. (mm)				
½"	20 mm	6.20			
¾"	25 mm	9.68			
1"	32 mm		18.38	20.51	
1¼"	40 mm		28.71	31.76	
1½"	50 mm		44.98	49.74	
2"	63 mm		71.16	78.94	
2½"	75 mm		101.21	112.65	
3"	90 mm		145.58	161.86	
4"	125 mm		281.14	312.09	366.83
6"	160 mm		460.90	512.00	600.80
8"	200 mm		719.73	801.70	938.23
10"	250 mm		1126.90	1248.40	1467.32
12"	315 mm		1793.56	1982.80	2329.24

Determining Pipe Size by Head Loss

After your required pipe sizes have been determined, the engineer will need to calculate the pressure drop of the system and size up the pump. When calculating for pressure loss, the recommended safety factor is 20%, taking into account the age of the pipe and quality of workmanship.
The Hazen-Williams formula is designed for water systems and may be used to calculate pressure loss, the conversion of pressure loss to head loss and the calculation of flow velocity. Consult PESTAN if you are designing a system using fluids other than water.

$$P_L = \frac{452}{di^{4.87}} \cdot \left(\frac{Q}{C}\right)^{1.85}$$

Where:
P_L = pressure loss, psi / 100ft of pipe
Q = flow rate, GPM
di = inside diameter of pipe, inches
C = flow coefficient = 150 for PP-R and PP-RCT piping

Conversion from Pressure Loss to Head Loss (ft. of head loss per 100 ft. of pipe)

$$H_L = 2.31 \cdot P_L$$

Where: H_L = head loss, ft. / 100 ft of pipe

Calculation of flow velocity:
Where: v = flow velocity, ft/sec

$$V = 0.4084 \cdot \left(\frac{Q}{di^2}\right)$$

PESTAN SDR7.4 PIPE

The following table provides head loss and flow rate for PESTAN pipes according to size and specified GPM.

Q = Flow rate(US gpm) R = Head Loss (ft_{H2O}/100ft) V = Flow Velocity, (ft/sec)

Q (GPM)	Dimension	½" -- 20 mm	¾" -- 25 mm
	d_i (in)	0.567	0.709
0.1	R	0	0
	v	0.1	0.1
0.2	R	0.1	0
	v	0.3	0.2
0.3	R	0.2	0.1
	v	0.4	0.2
0.4	R	0.3	0.1
	v	0.5	0.3
0.5	R	0.4	0.1
	v	0.6	0.4
0.6	R	0.6	0.2
	v	0.8	0.5
0.7	R	0.8	0.3
	v	0.9	0.6
0.8	R	1	0.3
	v	1	0.6
0.9	R	1.3	0.4
	v	1.1	0.7
1	R	1.6	0.5
	v	1.3	0.8
2	R	5.6	1.9
	v	2.5	1.6
3	R	11.9	4
	v	3.8	2.4
4	R	20.3	6.8
	v	5.1	3.2
5	R	30.7	10.2
	v	6.4	4
6	R	43	14.3
	v	7.6	4.9
7	R	57.2	19
	v	8.9	5.7
8	R	73.2	24.4
	v	10.2	6.5
9	R	91.1	30.3
	v	11.4	7.3
10	R		36.8
	v		8.1
11	R		43.9
	v		8.9
12	R		51.6
	v		9.7
13	R		59.9
	v		10.5
14	R		68.6
	v		11.3
15	R		78
	v		12.1
16	R		87.9
	v		13
17	R		98.3
	v		13.8
18	R		
	v		
19	R		
	v		
20	R		
	v		
22	R		
	v		
24	R		
	v		
26	R		
	v		
28	R		
	v		
30	R		
	v		
32	R		
	v		
34	R		
	v		
36	R		
	v		
38	R		
	v		
40	R		
	v		
45	R		
	v		

The recommended sizing based on flow rate (approx 8ft/s)

The recommended size of the critical leg of the system based on the head loss (avg. 3ft/100ft or less)

PESTAN SDR9 PIPE

The following table provides head loss and flow rate for PESTAN pipes according to size and specified GPM.

Q = Flow rate(US gpm) R = Head Loss (ft_{H2O}/100ft) V = Flow Velocity, (ft/sec)

Q (GPM)	Dimension	1" -- 32 mm	1 ¼" -- 40 mm	1 ½" -- 50 mm	2" -- 63 mm	2 ½" -- 75 mm	3" -- 90 mm	4" -- 125 mm	6" -- 160 mm	8" -- 200 mm	10" -- 250 mm	12" -- 315 mm
	di (in)	0.98	1.22	1.53	1.92	2.30	2.75	3.82	4.90	6.12	7.65	9.63
0.1	R											
	v											
0.2	R	0.0	0.0									
	v	0.1	0.1									
0.3	R	0.0	0.0	0.0								
	v	0.1	0.1	0.1								
0.4	R	0.0	0.0	0.0								
	v	0.2	0.1	0.1								
0.5	R	0.0	0.0	0.0	0.0							
	v	0.2	0.1	0.1	0.1							
0.6	R	0.0	0.0	0.0	0.0							
	v	0.3	0.2	0.1	0.1							
0.7	R	0.1	0.0	0.0	0.0	0.0						
	v	0.3	0.2	0.1	0.1	0.1						
0.8	R	0.1	0.0	0.0	0.0	0.0						
	v	0.3	0.2	0.1	0.1	0.1						
0.9	R	0.1	0.0	0.0	0.0	0.0						
	v	0.4	0.2	0.2	0.1	0.1						
1	R	0.1	0.0	0.0	0.0	0.0	0.0					
	v	0.4	0.3	0.2	0.1	0.1	0.1					
2	R	0.4	0.1	0.0	0.0	0.0	0.0	0.0				
	v	0.9	0.6	0.4	0.2	0.2	0.1	0.1				
3	R	0.9	0.3	0.1	0.0	0.0	0.0	0.0	0.0			
	v	1.3	0.8	0.5	0.3	0.2	0.2	0.1	0.1			
4	R	1.5	0.5	0.2	0.1	0.0	0.0	0.0	0.0			
	v	1.7	1.1	0.7	0.4	0.3	0.2	0.1	0.1			
5	R	2.2	0.7	0.2	0.1	0.0	0.0	0.0	0.0	0.0		
	v	2.2	1.4	0.9	0.6	0.4	0.3	0.1	0.1	0.1		
6	R	3.1	1.0	0.3	0.1	0.0	0.0	0.0	0.0	0.0		
	v	2.6	1.7	1.1	0.7	0.5	0.3	0.2	0.1	0.1		
7	R	4.1	1.4	0.5	0.1	0.1	0.0	0.0	0.0	0.0		
	v	3.0	1.9	1.2	0.8	0.5	0.4	0.2	0.1	0.1		
8	R	5.3	1.8	0.6	0.2	0.1	0.0	0.0	0.0	0.0	0.0	
	v	3.5	2.2	1.4	0.9	0.6	0.4	0.2	0.1	0.1	0.1	
9	R	6.6	2.2	0.7	0.2	0.1	0.0	0.0	0.0	0.0	0.0	
	v	3.9	2.5	1.6	1.0	0.7	0.5	0.3	0.2	0.1	0.1	
10	R	8.0	2.7	0.9	0.3	0.1	0.1	0.0	0.0	0.0	0.0	
	v	4.3	2.8	1.8	1.1	0.8	0.5	0.3	0.2	0.1	0.1	
11	R	9.5	3.2	1.1	0.3	0.1	0.1	0.0	0.0	0.0	0.0	
	v	4.8	3.0	1.9	1.2	0.9	0.6	0.3	0.2	0.1	0.1	

The recommended sizing based on flow rate (approx 8ft/s)

The recommended size of the critical leg of the system based on the head loss (avg. 3ft/100ft or less)

PESTAN SDR9 PIPE

The following table provides head loss and flow rate for PESTAN pipes according to size and specified GPM.
Q = Flow rate(US gpm) R = Head Loss (ft_{H2O}/100ft) V = Flow Velocity, (ft/sec)

Q (GPM)	Dimension	1" -- 32 mm	1 ¼" -- 40 mm	1 ½ " -- 50 mm	2" -- 63 mm	2 ½" -- 75 mm	3" -- 90 mm	4" -- 125 mm	6" -- 160 mm	8" -- 200 mm	10" -- 250 mm	12" -- 315 mm
	di (in)	0.98	1.22	1.53	1.92	2.30	2.75	3.82	4.90	6.12	7.65	9.63
12	R	11.2	3.8	1.3	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0
	v	5.2	3.3	2.1	1.3	0.9	0.6	0.3	0.2	0.1	0.1	0.1
13	R	13.0	4.3	1.5	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0
	v	5.6	3.6	2.3	1.4	1.0	0.7	0.4	0.2	0.1	0.1	0.1
14	R	14.9	5.0	1.7	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0
	v	6.1	3.9	2.5	1.5	1.1	0.8	0.4	0.2	0.2	0.1	0.1
15	R	16.9	5.7	1.9	0.6	0.3	0.1	0.0	0.0	0.0	0.0	0.0
	v	6.5	4.1	2.6	1.7	1.2	0.8	0.4	0.3	0.2	0.1	0.1
16	R	19.1	6.4	2.1	0.7	0.3	0.1	0.0	0.0	0.0	0.0	0.0
	v	6.9	4.4	2.8	1.8	1.2	0.9	0.4	0.3	0.2	0.1	0.1
17	R	21.3	7.1	2.4	0.8	0.3	0.1	0.0	0.0	0.0	0.0	0.0
	v	7.4	4.7	3.0	1.9	1.3	0.9	0.5	0.3	0.2	0.1	0.1
18	R	23.7	7.9	2.7	0.9	0.4	0.2	0.0	0.0	0.0	0.0	0.0
	v	7.8	5.0	3.2	2.0	1.4	1.0	0.5	0.3	0.2	0.1	0.1
19	R	26.2	8.8	2.9	0.9	0.4	0.2	0.0	0.0	0.0	0.0	0.0
	v	8.2	5.2	3.3	2.1	1.5	1.0	0.5	0.3	0.2	0.1	0.1
20	R	28.8	9.7	3.2	1.0	0.4	0.2	0.0	0.0	0.0	0.0	0.0
	v	8.6	5.5	3.5	2.2	1.6	1.1	0.6	0.3	0.2	0.1	0.1
22	R	34.4	11.5	3.9	1.2	0.5	0.2	0.0	0.0	0.0	0.0	0.0
	v	9.5	6.1	3.9	2.4	1.7	1.2	0.6	0.4	0.2	0.2	0.1
24	R	40.4	13.5	4.5	1.5	0.6	0.3	0.1	0.0	0.0	0.0	0.0
	v	10.4	6.6	4.2	2.7	1.9	1.3	0.7	0.4	0.3	0.2	0.1
26	R	46.9	15.7	5.3	1.7	0.7	0.3	0.1	0.0	0.0	0.0	0.0
	v	11.2	7.2	4.6	2.9	2.0	1.4	0.7	0.4	0.3	0.2	0.1
28	R	53.7	18.0	6.0	1.9	0.8	0.3	0.1	0.0	0.0	0.0	0.0
	v	12.1	7.7	4.9	3.1	2.2	1.5	0.8	0.5	0.3	0.2	0.1
30	R	61.1	20.4	6.8	2.2	0.9	0.4	0.1	0.0	0.0	0.0	0.0
	v	13.0	8.3	5.3	3.3	2.3	1.6	0.8	0.5	0.3	0.2	0.1
32	R	68.8	23.0	7.7	2.5	1.1	0.4	0.1	0.0	0.0	0.0	0.0
	v	13.8	8.8	5.6	3.5	2.5	1.7	0.9	0.5	0.4	0.2	0.1
34	R	77.0	25.8	8.6	2.8	1.2	0.5	0.1	0.0	0.0	0.0	0.0
	v	14.7	9.4	6.0	3.8	2.7	1.8	1.0	0.6	0.4	0.2	0.1
36	R	85.5	28.6	9.6	3.1	1.3	0.5	0.1	0.0	0.0	0.0	0.0
	v	15.6	9.9	6.3	4.0	2.8	1.9	1.0	0.6	0.4	0.3	0.2
38	R		31.6	10.6	3.4	1.5	0.6	0.1	0.0	0.0	0.0	0.0
	v		10.5	6.7	4.2	3.0	2.1	1.1	0.6	0.4	0.3	0.2
40	R		34.8	11.7	3.8	1.6	0.7	0.1	0.0	0.0	0.0	0.0
	v		11.0	7.0	4.4	3.1	2.2	1.1	0.7	0.4	0.3	0.2
45	R		43.3	14.5	4.7	2.0	0.8	0.2	0.0	0.0	0.0	0.0
	v		12.4	7.9	5.0	3.5	2.4	1.3	0.8	0.5	0.3	0.2

The recommended sizing based on flow rate (approx 8ft/s)

The recommended size of the critical leg of the system based on the head loss (avg. 3ft/100ft or less)

PESTAN SDR9 PIPE

The following table provides head loss and flow rate for PESTAN pipes according to size and specified GPM.
Q = Flow rate(US gpm) R = Head Loss (ft_{H2O}/100ft) V = Flow Velocity, (ft/sec)

Q (GPM)	Dimension	1" -- 32 mm	1 ¼" -- 40 mm	1 ½ " -- 50 mm	2" -- 63 mm	2 ½" -- 75 mm	3" -- 90 mm	4" -- 125 mm	6" -- 160 mm	8" -- 200 mm	10" -- 250 mm	12" -- 315 mm
	di (in)	0.98	1.22	1.53	1.92	2.30	2.75	3.82	4.90	6.12	7.65	9.63
50	R		52.6	17.6	5.7	2.4	1.0	0.2	0.1	0.0	0.0	0.0
	v		13.8	8.8	5.5	3.9	2.7	1.4	0.9	0.5	0.3	0.2
55	R		62.7	21.0	6.8	2.9	1.2	0.2	0.1	0.0	0.0	0.0
	v		15.2	9.7	6.1	4.3	3.0	1.5	0.9	0.6	0.4	0.2
60	R			24.7	8.0	3.4	1.4	0.3	0.1	0.0	0.0	0.0
	v			10.6	6.6	4.7	3.2	1.7	1.0	0.7	0.4	0.3
65	R			28.6	9.2	3.9	1.6	0.3	0.1	0.0	0.0	0.0
	v			11.4	7.2	5.1	3.5	1.8	1.1	0.7	0.5	0.3
70	R			32.8	10.6	4.5	1.9	0.4	0.1	0.0	0.0	0.0
	v			12.3	7.7	5.5	3.8	2.0	1.2	0.8	0.5	0.3
75	R			37.3	12.0	5.1	2.1	0.4	0.1	0.0	0.0	0.0
	v			13.2	8.3	5.8	4.1	2.1	1.3	0.8	0.5	0.3
80	R			42.0	13.6	5.8	2.4	0.5	0.1	0.0	0.0	0.0
	v			14.1	8.9	6.2	4.3	2.2	1.4	0.9	0.6	0.4
85	R			47.0	15.2	6.5	2.7	0.5	0.2	0.1	0.0	0.0
	v			15.0	9.4	6.6	4.6	2.4	1.5	0.9	0.6	0.4
90	R			52.3	16.9	7.2	3.0	0.6	0.2	0.1	0.0	0.0
	v			15.8	10.0	7.0	4.9	2.5	1.5	1.0	0.6	0.4
95	R				18.7	8.0	3.3	0.7	0.2	0.1	0.0	0.0
	v				10.5	7.4	5.1	2.7	1.6	1.0	0.7	0.4
100	R				20.5	8.7	3.6	0.7	0.2	0.1	0.0	0.0
	v				11.1	7.8	5.4	2.8	1.7	1.1	0.7	0.4
110	R				24.5	10.4	4.3	0.9	0.3	0.1	0.0	0.0
	v				12.2	8.6	6.0	3.1	1.9	1.2	0.8	0.5
120	R				28.7	12.3	5.0	1.0	0.3	0.1	0.0	0.0
	v				13.3	9.4	6.5	3.4	2.1	1.3	0.8	0.5
130	R				33.3	14.2	5.8	1.2	0.4	0.1	0.0	0.0
	v				14.4	10.1	7.0	3.6	2.2	1.4	0.9	0.6
140	R				38.2	16.3	6.7	1.3	0.4	0.1	0.0	0.0
	v				15.5	10.9	7.6	3.9	2.4	1.5	1.0	0.6
150	R					18.5	7.6	1.5	0.5	0.2	0.1	0.0
	v					11.7	8.1	4.2	2.6	1.6	1.0	0.7
160	R					20.9	8.6	1.7	0.5	0.2	0.1	0.0
	v					12.5	8.7	4.5	2.7	1.8	1.1	0.7
170	R					23.3	9.6	1.9	0.6	0.2	0.1	0.0
	v					13.3	9.2	4.8	2.9	1.9	1.2	0.7
180	R					25.9	10.6	2.1	0.6	0.2	0.1	0.0
	v					14.0	9.7	5.0	3.1	2.0	1.3	0.8
190	R					28.7	11.8	2.4	0.7	0.2	0.1	0.0
	v					14.8	10.3	5.3	3.2	2.1	1.3	0.8

The recommended sizing based on flow rate (approx 8ft/s)

The recommended size of the critical leg of the system based on the head loss (avg. 3ft/100ft or less)

PESTAN SDR9 PIPE

The following table provides head loss and flow rate for PESTAN pipes according to size and specified GPM.
Q = Flow rate(US gpm) R = Head Loss (ft_{H2O}/100ft) V = Flow Velocity, (ft/sec)

Q (GPM)	Dimension	1" -- 32 mm	1 ¼" -- 40 mm	1 ½ " -- 50 mm	2" -- 63 mm	2 ½" -- 75 mm	3" -- 90 mm	4" -- 125 mm	6" -- 160 mm	8" -- 200 mm	10" -- 250 mm	12" -- 315 mm
	di (in)	0.98	1.22	1.53	1.92	2.30	2.75	3.82	4.90	6.12	7.65	9.63
200	R					31.5	12.9	2.6	0.8	0.3	0.1	0.0
	v					15.6	10.8	5.6	3.4	2.2	1.4	0.9
220	R						15.4	3.1	0.9	0.3	0.1	0.0
	v						11.9	6.2	3.8	2.4	1.5	1.0
240	R						18.1	3.6	1.1	0.4	0.1	0.0
	v						13.0	6.7	4.1	2.6	1.7	1.1
260	R						21.0	4.2	1.3	0.4	0.1	0.0
	v						14.1	7.3	4.4	2.8	1.8	1.1
280	R						24.1	4.8	1.5	0.5	0.2	0.1
	v						15.1	7.8	4.8	3.1	2.0	1.2
300	R							5.5	1.7	0.6	0.2	0.1
	v							8.4	5.1	3.3	2.1	1.3
320	R							6.2	1.9	0.6	0.2	0.1
	v							9.0	5.5	3.5	2.2	1.4
340	R							6.9	2.1	0.7	0.2	0.1
	v							9.5	5.8	3.7	2.4	1.5
360	R							7.7	2.3	0.8	0.3	0.1
	v							10.1	6.2	3.9	2.5	1.6
380	R							8.5	2.6	0.9	0.3	0.1
	v							10.6	6.5	4.2	2.7	1.7
400	R							9.4	2.8	1.0	0.3	0.1
	v							11.2	6.8	4.4	2.8	1.8
450	R							11.7	3.5	1.2	0.4	0.1
	v							12.6	7.7	4.9	3.1	2.0
500	R							14.2	4.3	1.4	0.5	0.2
	v							14.0	8.5	5.5	3.5	2.2
550	R							16.9	5.1	1.7	0.6	0.2
	v							15.4	9.4	6.0	3.8	2.4
600	R								6.0	2.0	0.7	0.2
	v								10.3	6.6	4.2	2.6
650	R								6.9	2.3	0.8	0.3
	v								11.1	7.1	4.5	2.9
700	R								7.9	2.7	0.9	0.3
	v								12.0	7.7	4.9	3.1
750	R								9.0	3.0	1.0	0.3
	v								12.8	8.2	5.2	3.3
800	R								10.2	3.4	1.2	0.4
	v								13.7	8.8	5.6	3.5

The recommended sizing based on flow rate (approx 8ft/s)

The recommended size of the critical leg of the system based on the head loss (avg. 3ft/100ft or less)

PESTAN SDR9 PIPE

The following table provides head loss and flow rate for PESTAN pipes according to size and specified GPM.
Q = Flow rate(US gpm) R = Head Loss (ft_{H2O}/100ft) V = Flow Velocity, (ft/sec)

Q (GPM)	Dimension	1" -- 32 mm	1 ¼" -- 40 mm	1 ½ " -- 50 mm	2" -- 63 mm	2 ½" -- 75 mm	3" -- 90 mm	4" -- 125 mm	6" -- 160 mm	8" -- 200 mm	10" -- 250 mm	12" -- 315 mm
	di (in)	0.98	1.22	1.53	1.92	2.30	2.75	3.82	4.90	6.12	7.65	9.63
850	R								11.4	3.8	1.3	0.4
	v								14.5	9.3	5.9	3.7
900	R								12.6	4.3	1.4	0.5
	v								15.4	9.8	6.3	4.0
950	R									4.7	1.6	0.5
	v									10.4	6.6	4.2
1000	R									5.2	1.7	0.6
	v									10.9	7.0	4.4
1100	R									6.2	2.1	0.7
	v									12.0	7.7	4.8
1200	R									7.3	2.4	0.8
	v									13.1	8.4	5.3
1300	R									8.4	2.8	0.9
	v									14.2	9.1	5.7
1400	R									9.7	3.2	1.0
	v									15.3	9.8	6.1
1500	R										3.7	1.2
	v										10.5	6.6
1600	R										4.2	1.3
	v										11.2	7.0
1700	R										4.6	1.5
	v										11.9	7.5
1800	R										5.2	1.7
	v										12.6	7.9
1900	R										5.7	1.8
	v										13.3	8.3
2000	R										6.3	2.0
	v										14.0	8.8
2200	R										7.5	2.4
	v										15.4	9.7
2400	R											2.8
	v											10.5
2600	R											3.3
	v											11.4
2800	R											3.8
	v											12.3
3000	R											4.3
	v											13.2

The recommended sizing based on flow rate (approx 8ft/s)

The recommended size of the critical leg of the system based on the head loss (avg. 3ft/100ft or less)

PESTAN SDR11 PIPE

The following table provides head loss and flow rate for PESTAN pipes according to size and specified GPM.
Q = Flow rate(US gpm) R = Head Loss (ft_{H2O}/100ft) V = Flow Velocity, (ft/sec.)

Q (GPM)	Dimension	1" -- 32 mm	1 ¼" -- 40 mm	1 ½ " -- 50 mm	2" -- 63 mm	2 ½" -- 75 mm	3" -- 90 mm	4" -- 125 mm	6" -- 160 mm	8" -- 200 mm	10" -- 250 mm	12" -- 315 mm
	di (in)	1.03	1.28	1.61	2.02	2.42	2.90	4.02	5.15	6.43	8.06	10.15
0.1	R											
	v											
0.2	R	0.0										
	v	0.1										
0.3	R	0.0	0.0									
	v	0.1	0.1									
0.4	R	0.0	0.0	0.0								
	v	0.2	0.1	0.1								
0.5	R	0.0	0.0	0.0								
	v	0.2	0.1	0.1								
0.6	R	0.0	0.0	0.0	0.0							
	v	0.2	0.1	0.1	0.1							
0.7	R	0.0	0.0	0.0	0.0							
	v	0.3	0.2	0.1	0.1							
0.8	R	0.1	0.0	0.0	0.0	0.0						
	v	0.3	0.2	0.1	0.1	0.1						
0.9	R	0.1	0.0	0.0	0.0	0.0						
	v	0.4	0.2	0.1	0.1	0.1						
1	R	0.1	0.0	0.0	0.0	0.0						
	v	0.4	0.2	0.2	0.1	0.1						
2	R	0.3	0.1	0.0	0.0	0.0	0.0	0.0				
	v	0.8	0.5	0.3	0.2	0.1	0.1	0.1				
3	R	0.7	0.2	0.1	0.0	0.0	0.0	0.0				
	v	1.2	0.7	0.5	0.3	0.2	0.1	0.1				
4	R	1.1	0.4	0.1	0.0	0.0	0.0	0.0	0.0			
	v	1.6	1.0	0.6	0.4	0.3	0.2	0.1	0.1			
5	R	1.7	0.6	0.2	0.1	0.0	0.0	0.0	0.0			
	v	2.0	1.2	0.8	0.5	0.4	0.2	0.1	0.1			
6	R	2.4	0.8	0.3	0.1	0.0	0.0	0.0	0.0	0.0		
	v	2.3	1.5	1.0	0.6	0.4	0.3	0.2	0.1	0.1		
7	R	3.2	1.1	0.4	0.1	0.0	0.0	0.0	0.0	0.0		
	v	2.7	1.7	1.1	0.7	0.5	0.3	0.2	0.1	0.1		
8	R	4.1	1.4	0.5	0.1	0.1	0.0	0.0	0.0	0.0	0.0	
	v	3.1	2.0	1.3	0.8	0.6	0.4	0.2	0.1	0.1	0.1	
9	R	5.1	1.7	0.6	0.2	0.1	0.0	0.0	0.0	0.0	0.0	
	v	3.5	2.2	1.4	0.9	0.6	0.4	0.2	0.1	0.1	0.1	
10	R	6.2	2.1	0.7	0.2	0.1	0.0	0.0	0.0	0.0	0.0	
	v	3.9	2.5	1.6	1.0	0.7	0.5	0.3	0.2	0.1	0.1	
11	R	7.4	2.5	0.8	0.3	0.1	0.0	0.0	0.0	0.0	0.0	
	v	4.3	2.7	1.7	1.1	0.8	0.5	0.3	0.2	0.1	0.1	

The recommended sizing based on flow rate (approx 8ft/s)

The recommended size of the critical leg of the system based on the head loss (avg. 3ft/100ft or less)

PESTAN SDR11 PIPE

The following table provides head loss and flow rate for PESTAN pipes according to size and specified GPM.
Q = Flow rate(US gpm) R = Head Loss (ft_{H2O}/100ft) V = Flow Velocity, (ft/sec)

Q (GPM)	Dimension	1" -- 32 mm	1 ¼" -- 40 mm	1 ½ " -- 50 mm	2" -- 63 mm	2 ½" -- 75 mm	3" -- 90 mm	4" -- 125 mm	6" -- 160 mm	8" -- 200 mm	10" -- 250 mm	12" -- 315 mm
	di (in)	1.03	1.28	1.61	2.02	2.42	2.90	4.02	5.15	6.43	8.06	10.15
12	R	8.7	2.9	1.0	0.3	0.1	0.1	0.0	0.0	0.0	0.0	
	v	4.7	3.0	1.9	1.2	0.8	0.6	0.3	0.2	0.1	0.1	
13	R	10.1	3.4	1.1	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0
	v	5.1	3.2	2.1	1.3	0.9	0.6	0.3	0.2	0.1	0.1	0.1
14	R	11.6	3.9	1.3	0.4	0.2	0.1	0.0	0.0	0.0	0.0	0.0
	v	5.5	3.5	2.2	1.4	1.0	0.7	0.4	0.2	0.1	0.1	0.1
15	R	13.2	4.4	1.5	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0
	v	5.9	3.7	2.4	1.5	1.1	0.7	0.4	0.2	0.1	0.1	0.1
16	R	14.9	5.0	1.7	0.5	0.2	0.1	0.0	0.0	0.0	0.0	0.0
	v	6.2	4.0	2.5	1.6	1.1	0.8	0.4	0.2	0.2	0.1	0.1
17	R	16.6	5.6	1.9	0.6	0.3	0.1	0.0	0.0	0.0	0.0	0.0
	v	6.6	4.2	2.7	1.7	1.2	0.8	0.4	0.3	0.2	0.1	0.1
18	R	18.5	6.2	2.1	0.7	0.3	0.1	0.0	0.0	0.0	0.0	0.0
	v	7.0	4.5	2.9	1.8	1.3	0.9	0.5	0.3	0.2	0.1	0.1
19	R	20.5	6.8	2.3	0.7	0.3	0.1	0.0	0.0	0.0	0.0	0.0
	v	7.4	4.7	3.0	1.9	1.3	0.9	0.5	0.3	0.2	0.1	0.1
20	R	22.5	7.5	2.5	0.8	0.3	0.1	0.0	0.0	0.0	0.0	0.0
	v	7.8	5.0	3.2	2.0	1.4	1.0	0.5	0.3	0.2	0.1	0.1
22	R	26.8	9.0	3.0	1.0	0.4	0.2	0.0	0.0	0.0	0.0	0.0
	v	8.6	5.5	3.5	2.2	1.6	1.1	0.6	0.3	0.2	0.1	0.1
24	R	31.5	10.6	3.5	1.1	0.5	0.2	0.0	0.0	0.0	0.0	0.0
	v	9.4	6.0	3.8	2.4	1.7	1.2	0.6	0.4	0.2	0.2	0.1
26	R	36.5	12.2	4.1	1.3	0.6	0.2	0.0	0.0	0.0	0.0	0.0
	v	10.2	6.5	4.1	2.6	1.8	1.3	0.7	0.4	0.3	0.2	0.1
28	R	41.9	14.0	4.7	1.5	0.6	0.3	0.1	0.0	0.0	0.0	0.0
	v	10.9	7.0	4.5	2.8	2.0	1.4	0.7	0.4	0.3	0.2	0.1
30	R	47.6	15.9	5.3	1.7	0.7	0.3	0.1	0.0	0.0	0.0	0.0
	v	11.7	7.5	4.8	3.0	2.1	1.5	0.8	0.5	0.3	0.2	0.1
32	R	53.7	18.0	6.0	1.9	0.8	0.3	0.1	0.0	0.0	0.0	0.0
	v	12.5	8.0	5.1	3.2	2.3	1.6	0.8	0.5	0.3	0.2	0.1
34	R	60.0	20.1	6.7	2.2	0.9	0.4	0.1	0.0	0.0	0.0	0.0
	v	13.3	8.5	5.4	3.4	2.4	1.7	0.9	0.5	0.3	0.2	0.1
36	R	66.7	22.3	7.5	2.4	1.0	0.4	0.1	0.0	0.0	0.0	0.0
	v	14.1	9.0	5.7	3.6	2.5	1.8	0.9	0.6	0.4	0.2	0.1
38	R	73.7	24.7	8.3	2.7	1.1	0.5	0.1	0.0	0.0	0.0	0.0
	v	14.8	9.5	6.0	3.8	2.7	1.9	1.0	0.6	0.4	0.2	0.2
40	R	81.1	27.1	9.1	2.9	1.3	0.5	0.1	0.0	0.0	0.0	0.0
	v	15.6	10.0	6.4	4.0	2.8	2.0	1.0	0.6	0.4	0.3	0.2
45	R		33.8	11.3	3.7	1.6	0.6	0.1	0.0	0.0	0.0	0.0
	v		11.2	7.2	4.5	3.2	2.2	1.1	0.7	0.4	0.3	0.2

The recommended sizing based on flow rate (approx 8ft/s)

The recommended size of the critical leg of the system based on the head loss (avg. 3ft/100ft or less)

PESTAN SDR11 PIPE

The following table provides head loss and flow rate for PESTAN pipes according to size and specified GPM.
Q = Flow rate(US gpm) R = Head Loss (ft_{H2O}/100ft) V = Flow Velocity, (ft/sec.)

Q (GPM)	Dimension	1" -- 32 mm	1 ¼" -- 40 mm	1 ½ " -- 50 mm	2" -- 63 mm	2 ½" -- 75 mm	3" -- 90 mm	4" -- 125 mm	6" -- 160 mm	8" -- 200 mm	10" -- 250 mm	12" -- 315 mm
	di (in)	1.03	1.28	1.61	2.02	2.42	2.90	4.02	5.15	6.43	8.06	10.15
50	R		41.0	13.8	4.4	1.9	0.8	0.2	0.0	0.0	0.0	0.0
	v		12.5	8.0	5.0	3.5	2.4	1.3	0.8	0.5	0.3	0.2
55	R		48.9	16.4	5.3	2.3	0.9	0.2	0.1	0.0	0.0	0.0
	v		13.7	8.7	5.5	3.9	2.7	1.4	0.8	0.5	0.3	0.2
60	R		57.5	19.3	6.2	2.7	1.1	0.2	0.1	0.0	0.0	0.0
	v		14.9	9.5	6.0	4.2	2.9	1.5	0.9	0.6	0.4	0.2
65	R			22.3	7.2	3.1	1.3	0.3	0.1	0.0	0.0	0.0
	v			10.3	6.5	4.6	3.2	1.6	1.0	0.6	0.4	0.3
70	R			25.6	8.3	3.5	1.4	0.3	0.1	0.0	0.0	0.0
	v			11.1	7.0	4.9	3.4	1.8	1.1	0.7	0.4	0.3
75	R			29.1	9.4	4.0	1.6	0.3	0.1	0.0	0.0	0.0
	v			11.9	7.5	5.3	3.7	1.9	1.2	0.7	0.5	0.3
80	R			32.8	10.6	4.5	1.9	0.4	0.1	0.0	0.0	0.0
	v			12.7	8.0	5.6	3.9	2.0	1.2	0.8	0.5	0.3
85	R			36.7	11.9	5.1	2.1	0.4	0.1	0.0	0.0	0.0
	v			13.5	8.5	6.0	4.2	2.2	1.3	0.8	0.5	0.3
90	R			40.8	13.2	5.6	2.3	0.5	0.1	0.0	0.0	0.0
	v			14.3	9.0	6.3	4.4	2.3	1.4	0.9	0.6	0.4
95	R			45.1	14.6	6.2	2.5	0.5	0.2	0.1	0.0	0.0
	v			15.1	9.5	6.7	4.6	2.4	1.5	0.9	0.6	0.4
100	R			49.6	16.0	6.8	2.8	0.6	0.2	0.1	0.0	0.0
	v			15.9	10.0	7.0	4.9	2.5	1.5	1.0	0.6	0.4
110	R				19.1	8.1	3.3	0.7	0.2	0.1	0.0	0.0
	v				11.0	7.8	5.4	2.8	1.7	1.1	0.7	0.4
120	R				22.4	9.6	3.9	0.8	0.2	0.1	0.0	0.0
	v				12.0	8.5	5.9	3.0	1.8	1.2	0.8	0.5
130	R				26.0	11.1	4.6	0.9	0.3	0.1	0.0	0.0
	v				13.0	9.2	6.4	3.3	2.0	1.3	0.8	0.5
140	R				29.8	12.7	5.2	1.1	0.3	0.1	0.0	0.0
	v				14.0	9.9	6.8	3.5	2.2	1.4	0.9	0.6
150	R				33.9	14.5	5.9	1.2	0.4	0.1	0.0	0.0
	v				15.0	10.6	7.3	3.8	2.3	1.5	0.9	0.6
160	R					16.3	6.7	1.3	0.4	0.1	0.0	0.0
	v					11.3	7.8	4.0	2.5	1.6	1.0	0.6
170	R					18.2	7.5	1.5	0.4	0.2	0.1	0.0
	v					12.0	8.3	4.3	2.6	1.7	1.1	0.7
180	R					20.3	8.3	1.7	0.5	0.2	0.1	0.0
	v					12.7	8.8	4.6	2.8	1.8	1.1	0.7
190	R					22.4	9.2	1.8	0.6	0.2	0.1	0.0
	v					13.4	9.3	4.8	2.9	1.9	1.2	0.8

The recommended sizing based on flow rate (approx 8ft/s)

The recommended size of the critical leg of the system based on the head loss (avg. 3ft/100ft or less)

PESTAN SDR11 PIPE

The following table provides head loss and flow rate for PESTAN pipes according to size and specified GPM.
Q = Flow rate(US gpm) R = Head Loss (ft_{H2O}/100ft) V = Flow Velocity, (ft/sec)

Q (GPM)	Dimension	1" -- 32 mm	1 ¼" -- 40 mm	1 ½ " -- 50 mm	2" -- 63 mm	2 ½" -- 75 mm	3" -- 90 mm	4" -- 125 mm	6" -- 160 mm	8" -- 200 mm	10" -- 250 mm	12" -- 315 mm
	di (in)	1.03	1.28	1.61	2.02	2.42	2.90	4.02	5.15	6.43	8.06	10.15
200	R					24.6	10.1	2.0	0.6	0.2	0.1	0.0
	v					14.1	9.8	5.1	3.1	2.0	1.3	0.8
220	R					29.4	12.1	2.4	0.7	0.2	0.1	0.0
	v					15.5	10.8	5.6	3.4	2.2	1.4	0.9
240	R						14.2	2.8	0.8	0.3	0.1	0.0
	v						11.7	6.1	3.7	2.4	1.5	1.0
260	R						16.4	3.3	1.0	0.3	0.1	0.0
	v						12.7	6.6	4.0	2.6	1.6	1.0
280	R						18.8	3.8	1.1	0.4	0.1	0.0
	v						13.7	7.1	4.3	2.8	1.8	1.1
300	R						21.4	4.3	1.3	0.4	0.1	0.0
	v						14.7	7.6	4.6	2.9	1.9	1.2
320	R						24.1	4.8	1.4	0.5	0.2	0.1
	v						15.6	8.1	4.9	3.1	2.0	1.3
340	R							5.4	1.6	0.5	0.2	0.1
	v							8.6	5.2	3.3	2.1	1.4
360	R							6.0	1.8	0.6	0.2	0.1
	v							9.1	5.5	3.5	2.3	1.4
380	R							6.7	2.0	0.7	0.2	0.1
	v							9.6	5.8	3.7	2.4	1.5
400	R							7.3	2.2	0.7	0.2	0.1
	v							10.1	6.2	3.9	2.5	1.6
450	R							9.1	2.7	0.9	0.3	0.1
	v							11.4	6.9	4.4	2.8	1.8
500	R							11.1	3.3	1.1	0.4	0.1
	v							12.6	7.7	4.9	3.2	2.0
550	R							13.2	3.9	1.3	0.4	0.1
	v							13.9	8.5	5.4	3.5	2.2
600	R							15.5	4.6	1.6	0.5	0.2
	v							15.2	9.2	5.9	3.8	2.4
650	R								5.4	1.8	0.6	0.2
	v								10.0	6.4	4.1	2.6
700	R								6.1	2.1	0.7	0.2
	v								10.8	6.9	4.4	2.8
750	R								7.0	2.3	0.8	0.3
	v								11.5	7.4	4.7	3.0
800	R								7.9	2.6	0.9	0.3
	v								12.3	7.9	5.0	3.2

The recommended sizing based on flow rate (approx 8ft/s)

The recommended size of the critical leg of the system based on the head loss (avg. 3ft/100ft or less)

PESTAN SDR11 PIPE

The following table provides head loss and flow rate for PESTAN pipes according to size and specified GPM.
Q = Flow rate(US gpm) R = Head Loss (ft_{H2O}/100ft) V = Flow Velocity, (ft/sec.)

Q (GPM)	Dimension	1" -- 32 mm	1 ¼" -- 40 mm	1 ½ " -- 50 mm	2" -- 63 mm	2 ½" -- 75 mm	3" -- 90 mm	4" -- 125 mm	6" -- 160 mm	8" -- 200 mm	10" -- 250 mm	12" -- 315 mm
	di (in)	1.03	1.28	1.61	2.02	2.42	2.90	4.02	5.15	6.43	8.06	10.15
850	R								8.8	3.0	1.0	0.3
	v								13.1	8.4	5.4	3.4
900	R								9.8	3.3	1.1	0.4
	v								13.8	8.8	5.7	3.6
950	R								10.8	3.6	1.2	0.4
	v								14.6	9.3	6.0	3.8
1000	R								11.9	4.0	1.4	0.4
	v								15.4	9.8	6.3	4.0
1100	R									4.8	1.6	0.5
	v									10.8	6.9	4.4
1200	R									5.6	1.9	0.6
	v									11.8	7.6	4.8
1300	R									6.5	2.2	0.7
	v									12.8	8.2	5.2
1400	R									7.4	2.5	0.8
	v									13.8	8.8	5.6
1500	R									8.4	2.9	0.9
	v									14.7	9.5	6.0
1600	R									9.5	3.2	1.0
	v									15.7	10.1	6.4
1700	R										3.6	1.2
	v										10.7	6.8
1800	R										4.0	1.3
	v										11.4	7.1
1900	R										4.4	1.4
	v										12.0	7.5
2000	R										4.9	1.6
	v										12.6	7.9
2200	R										5.8	1.9
	v										13.9	8.7
2400	R										6.9	2.2
	v										15.1	9.5
2600	R											2.6
	v											10.3
2800	R											3.0
	v											11.1
3000	R											3.4
	v											11.9

The recommended sizing based on flow rate (approx 8ft/s)

The recommended size of the critical leg of the system based on the head loss (avg. 3ft/100ft or less)

PESTAN SDR17.6 PIPE

The following table provides head loss and flow rate for PESTAN pipes according to size and specified GPM.
Q = Flow rate(US gpm) R = Head Loss (ft_{H2O}/100ft) V = Flow Velocity, (ft/sec)

Q (GPM)	Dimension	4" -- 125 mm	6" -- 160 mm	8" -- 200 mm	10" -- 250 mm	12" -- 315 mm
	di (in)	4.36	5.58	6.98	8.72	10.99
2	R					
	v					
3	R	0.0				
	v	0.1				
4	R	0.0	0.0			
	v	0.1	0.1			
5	R	0.0	0.0			
	v	0.1	0.1			
6	R	0.0	0.0	0.0		
	v	0.1	0.1	0.1		
7	R	0.0	0.0	0.0		
	v	0.2	0.1	0.1		
8	R	0.0	0.0	0.0		
	v	0.2	0.1	0.1		
9	R	0.0	0.0	0.0		
	v	0.2	0.1	0.1		
10	R	0.0	0.0	0.0	0.0	
	v	0.2	0.1	0.1	0.1	
11	R	0.0	0.0	0.0	0.0	
	v	0.2	0.1	0.1	0.1	
12	R	0.0	0.0	0.0	0.0	
	v	0.3	0.2	0.1	0.1	
13	R	0.0	0.0	0.0	0.0	
	v	0.3	0.2	0.1	0.1	
14	R	0.0	0.0	0.0	0.0	
	v	0.3	0.2	0.1	0.1	
15	R	0.0	0.0	0.0	0.0	0.0
	v	0.3	0.2	0.1	0.1	0.1
16	R	0.0	0.0	0.0	0.0	0.0
	v	0.3	0.2	0.1	0.1	0.1
17	R	0.0	0.0	0.0	0.0	0.0
	v	0.4	0.2	0.1	0.1	0.1
18	R	0.0	0.0	0.0	0.0	0.0
	v	0.4	0.2	0.2	0.1	0.1
19	R	0.0	0.0	0.0	0.0	0.0
	v	0.4	0.2	0.2	0.1	0.1
20	R	0.0	0.0	0.0	0.0	0.0
	v	0.4	0.3	0.2	0.1	0.1

Q (GPM)	Dimension	4" -- 125 mm	6" -- 160 mm	8" -- 200 mm	10" -- 250 mm	12" -- 315 mm
	di (in)	4.36	5.58	6.98	8.72	10.99
22	R	0.0	0.0	0.0	0.0	0.0
	v	0.5	0.3	0.2	0.1	0.1
24	R	0.0	0.0	0.0	0.0	0.0
	v	0.5	0.3	0.2	0.1	0.1
26	R	0.0	0.0	0.0	0.0	0.0
	v	0.6	0.3	0.2	0.1	0.1
28	R	0.0	0.0	0.0	0.0	0.0
	v	0.6	0.4	0.2	0.2	0.1
30	R	0.0	0.0	0.0	0.0	0.0
	v	0.6	0.4	0.3	0.2	0.1
32	R	0.0	0.0	0.0	0.0	0.0
	v	0.7	0.4	0.3	0.2	0.1
34	R	0.1	0.0	0.0	0.0	0.0
	v	0.7	0.4	0.3	0.2	0.1
36	R	0.1	0.0	0.0	0.0	0.0
	v	0.8	0.5	0.3	0.2	0.1
38	R	0.1	0.0	0.0	0.0	0.0
	v	0.8	0.5	0.3	0.2	0.1
40	R	0.1	0.0	0.0	0.0	0.0
	v	0.9	0.5	0.3	0.2	0.1
45	R	0.1	0.0	0.0	0.0	0.0
	v	1.0	0.6	0.4	0.2	0.2
50	R	0.1	0.0	0.0	0.0	0.0
	v	1.1	0.7	0.4	0.3	0.2
55	R	0.1	0.0	0.0	0.0	0.0
	v	1.2	0.7	0.5	0.3	0.2
60	R	0.1	0.0	0.0	0.0	0.0
	v	1.3	0.8	0.5	0.3	0.2
65	R	0.2	0.1	0.0	0.0	0.0
	v	1.4	0.9	0.5	0.3	0.2
70	R	0.2	0.1	0.0	0.0	0.0
	v	1.5	0.9	0.6	0.4	0.2
75	R	0.2	0.1	0.0	0.0	0.0
	v	1.6	1.0	0.6	0.4	0.3
80	R	0.3	0.1	0.0	0.0	0.0
	v	1.7	1.0	0.7	0.4	0.3
85	R	0.3	0.1	0.0	0.0	0.0
	v	1.8	1.1	0.7	0.5	0.3

The recommended sizing based on flow rate (approx 8ft/s)

The recommended size of the critical leg of the system based on the head loss (avg. 3ft/100ft or less)

PESTAN SDR17.6 PIPE

The following table provides head loss and flow rate for PESTAN pipes according to size and specified GPM.
Q = Flow rate(US gpm) R = Head Loss (ft_{H2O}/100ft) V = Flow Velocity, (ft/sec.)

Q (GPM)	Dimension	4" -- 125 mm	6" -- 160 mm	8" -- 200 mm	10" -- 250 mm	12" -- 315 mm
	di (in)	4.36	5.58	6.98	8.72	10.99
90	R	0.3	0.1	0.0	0.0	0.0
	v	1.9	1.2	0.8	0.5	0.3
95	R	0.3	0.1	0.0	0.0	0.0
	v	2.0	1.2	0.8	0.5	0.3
100	R	0.4	0.1	0.0	0.0	0.0
	v	2.1	1.3	0.8	0.5	0.3
110	R	0.5	0.1	0.0	0.0	0.0
	v	2.4	1.4	0.9	0.6	0.4
120	R	0.5	0.2	0.1	0.0	0.0
	v	2.6	1.6	1.0	0.6	0.4
130	R	0.6	0.2	0.1	0.0	0.0
	v	2.8	1.7	1.1	0.7	0.4
140	R	0.7	0.2	0.1	0.0	0.0
	v	3.0	1.8	1.2	0.8	0.5
150	R	0.8	0.2	0.1	0.0	0.0
	v	3.2	2.0	1.3	0.8	0.5
160	R	0.9	0.3	0.1	0.0	0.0
	v	3.4	2.1	1.3	0.9	0.5
170	R	1.0	0.3	0.1	0.0	0.0
	v	3.6	2.2	1.4	0.9	0.6
180	R	1.1	0.3	0.1	0.0	0.0
	v	3.9	2.4	1.5	1.0	0.6
190	R	1.2	0.4	0.1	0.0	0.0
	v	4.1	2.5	1.6	1.0	0.6
200	R	1.4	0.4	0.1	0.0	0.0
	v	4.3	2.6	1.7	1.1	0.7
220	R	1.6	0.5	0.2	0.1	0.0
	v	4.7	2.9	1.8	1.2	0.7
240	R	1.9	0.6	0.2	0.1	0.0
	v	5.2	3.1	2.0	1.3	0.8
260	R	2.2	0.7	0.2	0.1	0.0
	v	5.6	3.4	2.2	1.4	0.9
280	R	2.5	0.8	0.3	0.1	0.0
	v	6.0	3.7	2.4	1.5	0.9
300	R	2.9	0.9	0.3	0.1	0.0
	v	6.4	3.9	2.5	1.6	1.0
320	R	3.3	1.0	0.3	0.1	0.0
	v	6.9	4.2	2.7	1.7	1.1
340	R	3.6	1.1	0.4	0.1	0.0
	v	7.3	4.5	2.9	1.8	1.1
360	R	4.0	1.2	0.4	0.1	0.0
	v	7.7	4.7	3.0	1.9	1.2
380	R	4.5	1.3	0.5	0.2	0.0
	v	8.2	5.0	3.2	2.0	1.3
400	R	4.9	1.5	0.5	0.2	0.1
	v	8.6	5.2	3.4	2.1	1.4
450	R	6.1	1.8	0.6	0.2	0.1
	v	9.7	5.9	3.8	2.4	1.5
500	R	7.4	2.2	0.8	0.3	0.1
	v	10.7	6.6	4.2	2.7	1.7
550	R	8.9	2.7	0.9	0.3	0.1
	v	11.8	7.2	4.6	3.0	1.9
600	R	10.4	3.1	1.1	0.4	0.1
	v	12.9	7.9	5.0	3.2	2.0
650	R	12.1	3.6	1.2	0.4	0.1
	v	14.0	8.5	5.5	3.5	2.2
700	R	13.8	4.2	1.4	0.5	0.2
	v	15.0	9.2	5.9	3.8	2.4
750	R		4.7	1.6	0.5	0.2
	v		9.8	6.3	4.0	2.5
800	R		5.3	1.8	0.6	0.2
	v		10.5	6.7	4.3	2.7
850	R		6.0	2.0	0.7	0.2
	v		11.1	7.1	4.6	2.9
900	R		6.6	2.2	0.8	0.2
	v		11.8	7.6	4.8	3.0
950	R		7.3	2.5	0.8	0.3
	v		12.5	8.0	5.1	3.2
1000	R		8.1	2.7	0.9	0.3
	v		13.1	8.4	5.4	3.4
1100	R		9.6	3.2	1.1	0.4
	v		14.4	9.2	5.9	3.7
1200	R		11.3	3.8	1.3	0.4
	v		15.7	10.1	6.4	4.1
1300	R			4.4	1.5	0.5
	v			10.9	7.0	4.4

The recommended sizing based on flow rate (approx 8ft/s)

The recommended size of the critical leg of the system based on the head loss (avg. 3ft/100ft or less)

PESTAN SDR17.6 PIPE

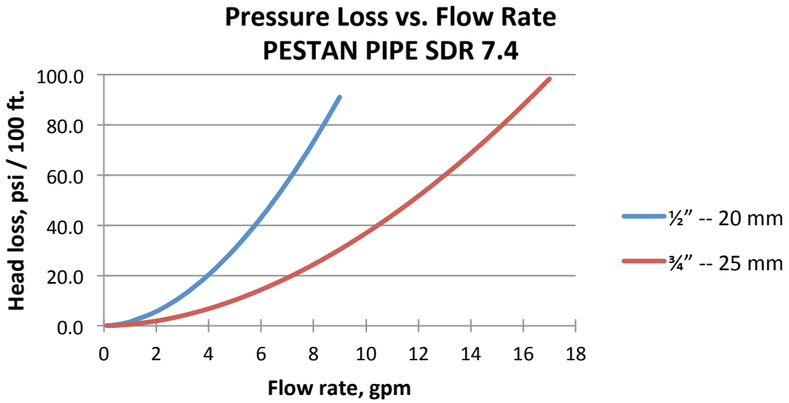
The following table provides head loss and flow rate for PESTAN pipes according to size and specified GPM.
Q = Flow rate(US gpm) R = Head Loss (ft_{H2O}/100ft) V = Flow Velocity, (ft/sec)

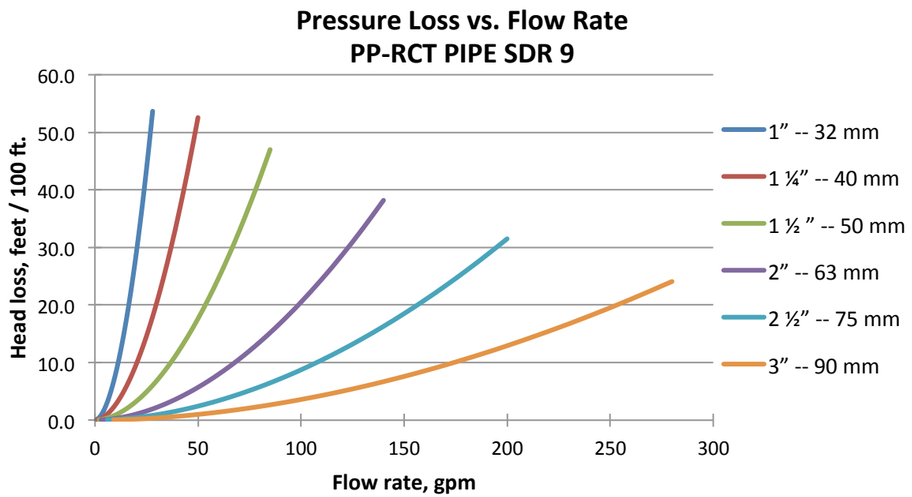
Q (GPM)	Dimension	4" -- 125 mm	6" -- 160 mm	8" -- 200 mm	10" -- 250 mm	12" -- 315 mm
	di (in)	4.36	5.58	6.98	8.72	10.99
1400	R			5.1	1.7	0.6
	v			11.8	7.5	4.7
1500	R			5.8	1.9	0.6
	v			12.6	8.1	5.1
1600	R			6.5	2.2	0.7
	v			13.4	8.6	5.4
1700	R			7.3	2.4	0.8
	v			14.3	9.1	5.7
1800	R			8.1	2.7	0.9
	v			15.1	9.7	6.1
1900	R				3.0	1.0
	v				10.2	6.4
2000	R				3.3	1.1
	v				10.7	6.8
2200	R				3.9	1.3
	v				11.8	7.4
2400	R				4.6	1.5
	v				12.9	8.1
2600	R				5.4	1.7
	v				14.0	8.8
2800	R				6.1	2.0
	v				15.0	9.5
3000	R					2.3
	v					10.1
3200	R					2.6
	v					10.8
3400	R					2.9
	v					11.5
3600	R					3.2
	v					12.2
3800	R					3.5
	v					12.8
4000	R					3.9
	v					13.5
4200	R					4.2
	v					14.2

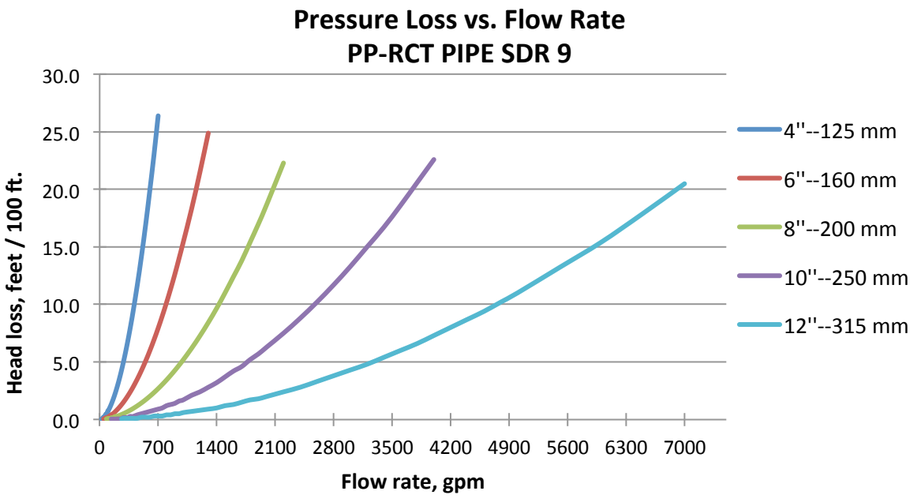
The recommended sizing based on flow rate (approx 8ft/s)

The recommended size of the critical leg of the system based on the head loss (avg. 3ft/100ft or less)

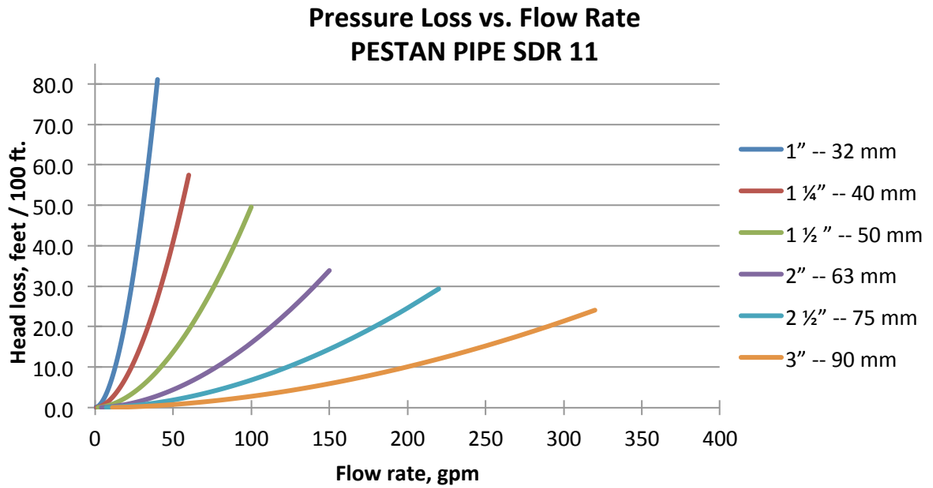
Graphs below represent pressure loss in PESTAN pipes based on the Hazen-Williams principle.

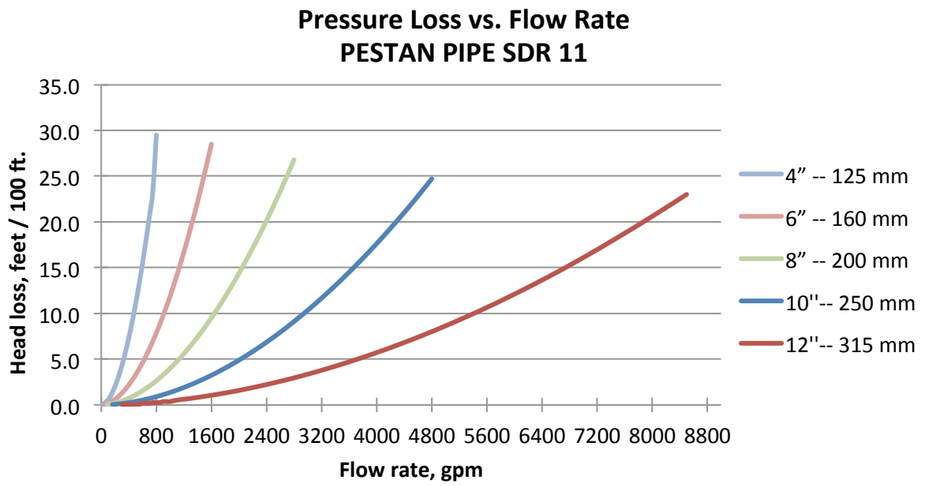


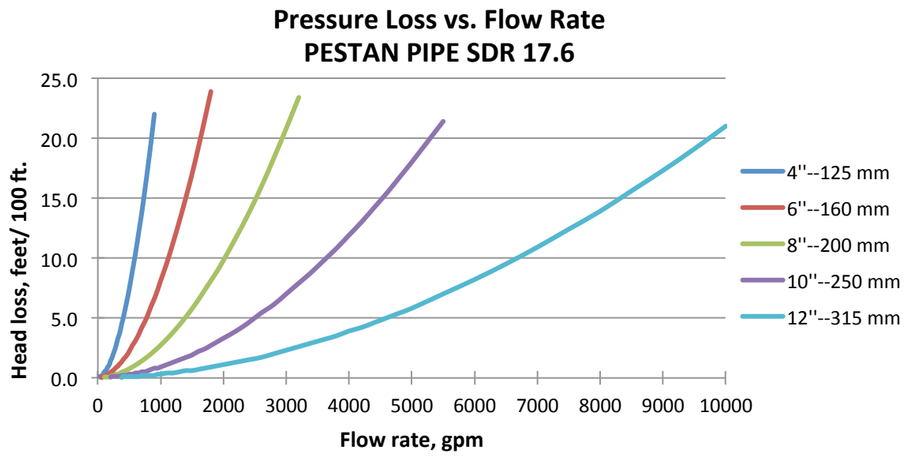




Graphs below represent pressure loss in PESTAN pipes based on the Hazen-Williams principle.







Pressure Loss Through Fittings (ft)

The following tables may be used to calculate pressure drop across fittings. The amount of pressure drop is equivalent to the length of pipe that will have the same pressure loss under the same flow conditions. These equivalents are added to your total piping footage for use when calculating pressure loss of your system.

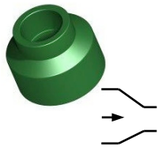
Coupling

Socket Fusion	Dimension N.D. - O.D.								
	½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm	2½" 75 mm	3" 90 mm	4" 125 mm
	0.5	0.7	0.9	1.1	1.4	1.7	2.1	2.5	4.2

Butt Fusion Bead

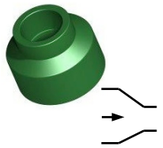
Butt Fusion	Dimension N.D. - O.D.								
	6" 160 mm	8" 200 mm	10" 250 mm	12" 315 mm					
SDR 9	2.0	1.5	1.9	2.4					
SDR 11	2.2	1.7	2.1	2.7					
SDR 17.6	3.0	1.9	2.3	2.9					

Reducer (by 1 dimension)



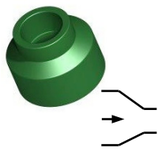
Socket Fusion	Dimension N.D. - O.D.								
	½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm	2½" 75 mm	3" 90 mm	4" 125 mm
	0.9	1.1	1.4	1.7	2.2	2.8	3.3	3.9	6.7
Butt Fusion	6" 160 mm	8" 200 mm	10" 250 mm	12" 315 mm					
SDR 9	7.6	10	12.7	16					
SDR 11	8.6	10.7	13.4	16.9					
SDR 17.6	9.3	11.6	14.5	18.3					

Reducer (by 2 dimensions)



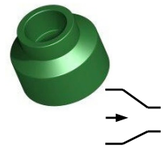
Socket Fusion	Dimension N.D. - O.D.								
	½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm	2½" 75 mm	3" 90 mm	4" 125 mm
	-	1.4	1.7	2.2	2.7	3.4	4.1	4.9	8.4
Butt Fusion	6" 160 mm	8" 200 mm	10" 250 mm	12" 315 mm					
SDR 9	9.5	12.7	15.9	20.1					
SDR 11	10.7	13.4	16.8	21.1					
SDR 17.6	11.6	14.5	18.2	22.9					

Reducer (by 3 dimensions)



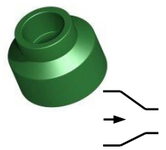
Socket Fusion	Dimension N.D. - O.D.								
	½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm	2½" 75 mm	3" 90 mm	4" 125 mm
	-	-	2.1	2.6	3.3	4.1	4.9	5.9	10.1
Butt Fusion	6" 160 mm	8" 200 mm	10" 250 mm	12" 315 mm					
SDR 9	11.5	15.0	18.6	23.5					
SDR 11	12.9	16.1	20.1	25.4					
SDR 17.6	14	17.4	21.8	27.5					

Reducer (by 4 dimensions)



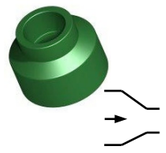
Socket Fusion	Dimension N.D. - O.D.								
	½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm	2½" 75 mm	3" 90 mm	4" 125 mm
	-	-	-	3.1	3.8	4.8	5.7	6.9	11.7
Butt Fusion	6" 160 mm	8" 200 mm	10" 250 mm	12" 315 mm					
SDR 9	13.7	17.5	21.8	27.3					
SDR 11	15.0	18.8	23.5	29.6					
SDR 17.6	16.3	20.3	25.4	32.1					

Reducer (by 5 dimensions)



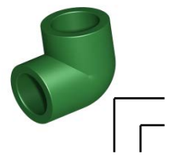
Socket Fusion	Dimension N.D. - O.D.								
	½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm	2½" 75 mm	3" 90 mm	4" 125 mm
	-	-	-	-	4.4	5.5	6.6	7.9	13.4
Butt Fusion	6" 160 mm	8" 200 mm	10" 250 mm	12" 315 mm					
SDR 9	15.2	19.1	23.8	30					
SDR 11	17.2	21.5	26.8	33.8					
SDR 17.6	18.6	23.3	29.1	36.6					

Reducer (by 6 dimensions)



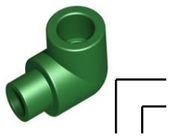
Socket Fusion	Dimension N.D. - O.D.								
	½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm	2½" 75 mm	3" 90 mm	4" 125 mm
	-	-	-	-	-	6.2	7.4	8.9	15.1
Butt Fusion	6" 160 mm	8" 200 mm	10" 250 mm	12" 315 mm					
SDR 9	17.2	21.4	26.8	33.8					
SDR 11	19.3	24.2	30.2	38.1					
SDR 17.6	20.9	26.2	32.7	41.3					

Elbow 90°



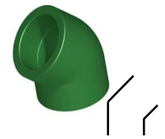
Socket Fusion	Dimension N.D. - O.D.								
	½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm	2½" 75 mm	3" 90 mm	4" 125 mm
	1.6	2	2.6	3.3	4.1	5.2	6.2	7.4	12.6
Butt Fusion	6" 160 mm	8" 200 mm	10" 250 mm	12" 315 mm					
SDR 9	18	21.5	25.5	32.2					
SDR 11	17.2	20.4	26.8	33.8					
SDR 17.6	19.8	23.3	29.1	36.6					

Elbow 90° (street)



Socket Fusion	Dimension N.D. - O.D.								
	½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm	2½" 75 mm	3" 90 mm	4" 125 mm
	1.6	2	2.6	-	-	-	-	-	-

Elbow 45°

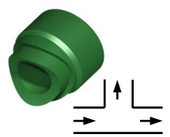


	Dimension N.D. - O.D.								
Socket Fusion	½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm	2½" 75 mm	3" 90 mm	4" 125 mm
	0.9	1.1	1.4	1.7	2.2	2.8	3.3	3.9	6.7
Butt Fusion	6" 160 mm	8" 200 mm	10" 250 mm	12" 315 mm					
SDR 9	6.0	7.6	9.6	12.0					
SDR 11	6.4	8.1	10.1	12.7					
SDR 17.6	7.0	8.7	10.9	13.7					

Elbow 45° (street)

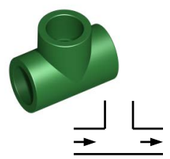
	Dimension N.D. - O.D.								
Socket Fusion	½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm	2½" 75 mm	3" 90 mm	4" 125 mm
	0.9	1.1	1.4	-	-	-	-	-	-

SADDLE OUTLET



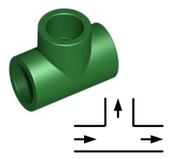
	Dimension N.D. - O.D.									
Outlet Fusion	½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm	2½" 75 mm	3" 90 mm	4" 125 mm	6" 160 mm
	0.6	0.8	1	1.3	1.7	2.1	2.5	3	5	5.8

TEE (thru-flow)



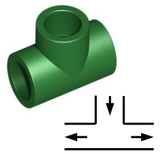
	Dimension N.D. - O.D.								
Socket Fusion	½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm	2½" 75 mm	3" 90 mm	4" 125 mm
	0.5	0.7	0.9	1.1	1.4	1.7	2.1	2.5	4.2
Butt Fusion	6" 160 mm	8" 200 mm	10" 250 mm	12" 315 mm					
SDR 9	5	6.2	7.7	9.1					
SDR 11	5.4	6.7	8.4	10.6					
SDR 17.6	5.8	7.3	9.1	11.5					

TEE (separation of flow)



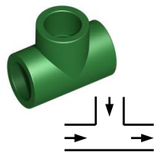
	Dimension N.D. - O.D.								
Socket Fusion	½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm	2½" 75 mm	3" 90 mm	4" 125 mm
	2.6	3.3	4.2	5.2	6.6	8.3	9.8	11.8	20.1
Butt Fusion	6" 160 mm	8" 200 mm	10" 250 mm	12" 315 mm					
SDR 9	23.9	30.6	38.2	48.2					
SDR 11	25.8	32.2	40.3	50.7					
SDR 17.6	27.9	34.9	43.6	55					

TEE (separation of flow - counter current)



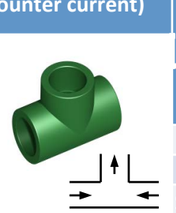
	Dimension N.D. - O.D.								
Socket Fusion	½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm	2½" 75 mm	3" 90 mm	4" 125 mm
	3.9	4.9	6.3	7.9	9.9	12.4	14.8	17.7	30.2
Butt Fusion	6" 160 mm	8" 200 mm	10" 250 mm	12" 315 mm					
SDR 9	34.4	42.9	53.6	67.5					
SDR 11	38.7	48.3	60.4	76.1					
SDR 17.6	41.9	52.3	65.4	82.4					

TEE (conjunction of flow)



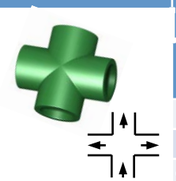
	Dimension N.D. - O.D.								
Socket Fusion	½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm	2½" 75 mm	3" 90 mm	4" 125 mm
	1.7	2.2	2.8	3.5	4.4	5.5	6.6	7.9	13.4
Butt Fusion	6" 160 mm	8" 200 mm	10" 250 mm	12" 315 mm					
SDR 9	15.2	19.1	23.8	30					
SDR 11	17.2	21.5	26.8	33.8					
SDR 17.6	18.6	23.3	29.1	36.6					

TEE (conjunction of flow - counter current)



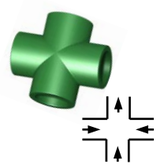
	Dimension N.D. - O.D.								
Socket Fusion	½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm	2½" 75 mm	3" 90 mm	4" 125 mm
	5.2	6.5	8.2	10.4	13.1	16.4	24.6	29.5	50.3
Butt Fusion	6" 160 mm	8" 200 mm	10" 250 mm	12" 315 mm					
SDR 9	57.2	76.5	95.6	120.6					
SDR 11	64.4	80.5	100.7	126.9					
SDR 17.6	69.8	87.2	109.1	137.4					

CROSS (separation of flow)

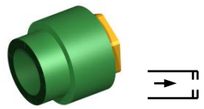


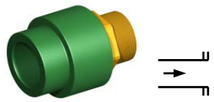
	Dimension N.D. - O.D.								
Socket Fusion	½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm	2½" 75 mm	3" 90 mm	4" 125 mm
	4.5	5.7	-	-	-	-	-	-	-
Butt Fusion	6" 160 mm	8" 200 mm	10" 250 mm	12" 315 mm					
SDR 9	40	50	62.5	-					
SDR 11	45.1	56.4	70.5	-					
SDR 17.6	48.8	61	76.3	-					

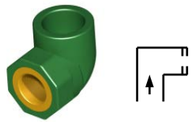
CROSS (conjunction of flow)

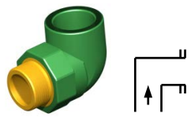


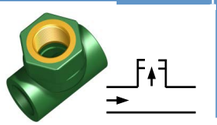
	Dimension N.D. - O.D.								
Socket Fusion	½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm	2½" 75 mm	3" 90 mm	4" 125 mm
	8	10.1	-	-	-	-	-	-	-
Butt Fusion	6" 160 mm	8" 200 mm	10" 250 mm	12" 315 mm					
SDR 9	70.5	88.1	110.2	-					
SDR 11	79.5	99.3	124.1	-					
SDR 17.6	86.1	107.6	134.5	-					

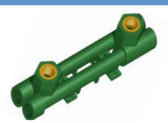
TRANSITIION w/ Female Threads	Socket Fusion	Dimension N.D. - O.D.					
		½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm
		1.1	1.4	1.7	2.2	2.7	3.4

TRANSITIION w/ Male Threads	Socket Fusion	Dimension N.D. - O.D.					
		½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm
		1.5	1.9	2.4	3.1	3.8	4.8

TRANSITIION ELBOW w/ Female Thread	Socket Fusion	Dimension N.D. - O.D.					
		½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm
		1.9	2.4	3	-	-	-

TRANSITIION ELBOW w/ Male Thread	Socket Fusion	Dimension N.D. - O.D.					
		½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm
		2.2	2.7	3.5	-	-	-

TRANSITIION TEE w/ Female Thread	Socket Fusion	Dimension N.D. - O.D.					
		½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm
		3.5	4.4	-	-	-	-

TRANSITIION ASSMBLY	Socket Fusion	Dimension N.D. - O.D.					
		½" 20 mm	¾" 25 mm	1" 32 mm	1¼" 40 mm	1½" 50 mm	2" 63 mm
		0.5	-	-	-	-	-

Section 5

Installation and Testing of the System

PIPE SUPPORT

There are two types of pipe supports: Continual and Point Support. The support is continual if the pipe is installed in the wall or in a duct or channel. The pipe is point-supported when hangers and clamps are used.

When selecting pipe support for your system, it is important to choose products which have been proven safe for use in your given installation. PESTAN recommends using non-metal hangers and clamps. If they are metal, then the portion that contacts the pipe should be lined to protect the pipe from damage. Be aware that condensation might appear if the metal clamps are used directly on cold pipes. All clamps should be lined with felt or rubber to prevent condensation from happening.

Installer Tip: Prior to finalizing the hanger spacing, run hot water through the pipes to simulate an active system.

Clamp and Hanger Sizing

The following table provides size recommendations for pipe supports. These are based on the pipe's outside diameter only. If insulating the pipe, total diameter (pipe diameter + insulation thickness) must be taken into consideration.

Recommendations of IPS or CTS clamp and hanger sizes suited for equivalent PESTAN pipe size

Recommended Size of Clamps	
Pipe Dimension N.D. - O.D.	**Clamp Size Best Fit (other solution)**
½" - 20 mm	½" IPS
¾" - 25 mm	¾" IPS
1" - 32 mm	1" IPS
1¼" - 40 mm	1½" CTS (1¼" IPS)
1½" - 50 mm	1½" IPS
2" - 63 mm	2" IPS
2½" - 75 mm	2 ½" IPS
3" - 90 mm	3" CTS (3" IPS)
4" - 125 mm	5" CTS (5" IPS)
6" - 160 mm	6" IPS
8" - 200 mm	8" CTS (8" IPS)
10" - 250 mm	10" CTS (10" IPS)
12" - 315 mm	12" IPS

Note: PESTAN's Warranty does not cover damage caused by hangers or clamps.

Support Spacing

General rules apply to the positioning of pipe support for both fixed or sliding points. Maximum support spacing depends on the type of pipe (fiber vs. non-fiber), the pipe's outside diameter and anticipated temperature difference between ambient and operating temperature of the fluid. Maximum recommended support spacing for PESTAN pipes are shown in the following tables.

Support Interval for the SDR7.4, SDR9 and SDR11 PESTAN pipe with fiber middle layer

	Outside Pipe Diameter N.D. and O.D.											
ΔT Difference in Temp.	½" 20mm	¾" 25mm	1" 32mm	1¼" 40mm	1½" 50mm	2" 63mm	2½" 75mm	3" 90mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm	12" 315mm
	Maximum and [Recommended] Support Spacing (Distance in Feet)												
0° F	4.0	4.5 [4.0]	5.0 [4.0]	6.0 [4.5]	6.5 [5.0]	7.5 [6.0]	8.0 [6.5]	8.5 [6.5]	10 [7.5]	11 [8.0]	11 [8.0]	11.5 [8.0]	12 [8.0]
36° F	4.0	4.0	4.0	4.5 [4.0]	5.0 [4.0]	5.5 [4.5]	6.0 [5.0]	6.5 [5.0]	8.0 [6.0]	9.0 [6.5]	9.0 [6.5]	9.0 [6.5]	10 [7.5]
54° F	4.0	4.0	4.0	4.5 [4.0]	5.0 [4.0]	5.5 [4.5]	6.0 [5.0]	6.5 [5.0]	7.5 [5.5]	8.0 [6.0]	8.0 [6.0]	8.5 [6.5]	9.0 [6.5]
72° F	4.0	4.0	4.0	4.0	5.0 [4.0]	5.5 [4.5]	5.5 [4.5]	6.0 [5.0]	7.0 [5.0]	7.5 [5.5]	8.0 [5.5]	8.0 [5.5]	8.5 [6.5]
90° F	4.0	4.0	4.0	4.0	4.5 [4.0]	5.5 [4.5]	5.5 [4.5]	6.0 [5.0]	6.5 [5.0]	6.5 [5.0]	7.5 [5.0]	7.0 [5.0]	8.0 [5.5]
108° F	4.0	4.0	4.0	4.0	4.5 [4.0]	5.0 [4.0]	5.5 [4.5]	5.7 [4.5]	6.0 [5.0]	6.5 [5.0]	6.5 [5.0]	6.5 [5.0]	7.0 [5.5]
126° F	4.0	4.0	4.0	4.0	4.0	4.5 [4.0]	5.0 [4.0]	5.5 [4.5]	5.5 [4.5]	6.0 [5.0]	6.5 [5.0]	6.5 [5.0]	6.5 [5.0]

Support Interval for the SDR17.6 PESTAN pipe with fiber middle layer

	Outside Pipe Diameter N.D. and O.D.				
ΔT Difference in Temp.	4" 125mm	6" 160mm	8" 200mm	10" 250mm	12" 315mm
	Maximum and [Recommended] Support Spacing (Distance in Feet)				
0° F	8.0 [6.0]	8.5 [6.5]	8.5 [6.5]	9.0 [7.0]	9.0 [7.0]
36° F	6.0 [5.0]	6.0 [5.0]	6.5 [5.5]	6.5 [5.5]	7.0 [6.0]
54° F	5.5 [4.5]	6.0 [5.0]	6.0 [5.0]	6.5 [5.5]	6.5 [5.5]
72° F	5.5 [4.5]	5.5 [4.5]	6.0 [5.0]	6.0 [5.0]	6.0 [5.0]
90° F	5.0 [4.0]	5.5 [4.5]	5.5 [4.5]	6.0 [5.0]	6.0 [5.0]
108° F	5.0 [4.0]	5.0 [4.0]	5.5 [4.5]	5.5 [4.5]	6.0 [5.0]
126° F	4.5 [4.0]	4.5 [4.0]	5.0 [4.0]	5.0 [4.0]	5.5 [4.5]

Support Interval for the SDR11 PESTAN pipe without fiber middle layer
(Cold water applications with the ambient temperature below 85°F)

Outside Pipe Diameter N.D. and O.D.												
½" 20mm	¾" 25mm	1" 32mm	1¼" 40mm	1½" 50mm	2" 63mm	2½" 75mm	3" 90mm	4" 125mm	6" 160mm	8" 200mm	10" 250mm	12" 315mm
Maximum Support Spacing – Distance in Feet												
4	4	4	4	4	4.5	5	5	6.5	7	7.5	8	8.5

LINEAR EXPANSION AND CONTRACTION

Linear Expansion and Contraction is an important factor when designing a piping system. Pipe expansion and contraction is based on the difference between the ambient temperature and the maximum temperature of the fluid in the pipe.

$$\Delta T = T_{\text{operating temperature}} - T_{\text{installation temperature}}$$

When transporting cold fluids, the ΔT value is minimal and the contraction of the pipe caused by the cold fluid will have no impact on the fused connections.

Heat, on the other hand, causes pipes to expand. Typically you will see a greater ΔT value when transporting hot fluids and therefore the system may require compensating additions such as expansion loops and sliding elbows to prevent pipe deformation. PESTAN MECHANICAL pipe with fiber composite helps minimize linear expansion.

The Linear Expansion of the pipe can be calculated using the following formulas:

The linear thermal expansion can be estimated as it follows:

$$\Delta L = \alpha \times L \times \Delta T$$

Where
ΔL is linear thermal expansion inches
α is the coefficient of thermal expansion in/ft °F
L is the pipe length ft.
ΔT is the change in temperature °F.

For PESTAN PP-R PURPLE pipe made of PP-R:

$$\alpha = 1.008 \times 10^{-3} \text{ in/ft°F}$$

For PESTAN MECHANICAL pipe with fiber composite layer:

$$\alpha = 2.367 \times 10^{-4} \text{ in/ ft°F}$$

The change in temperature can be estimated as follows:

$$\Delta T = T_1 - T_2$$

Where

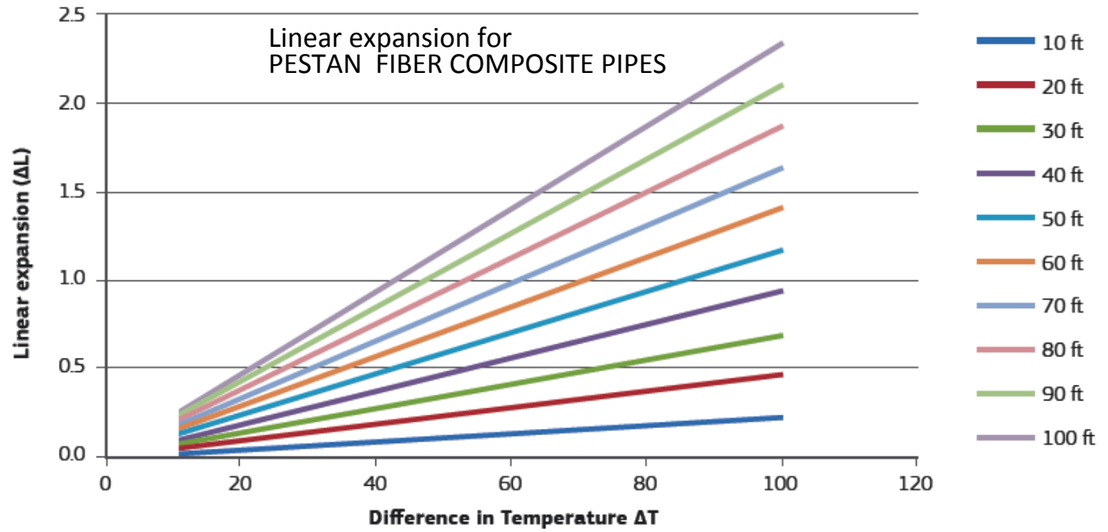
T_1 stands for the temperature before the change has occurred °F
T_2 stands for the temperature after the change has occurred °F

The tables on pages 48 and 49 express the linear expansion of PESTAN pipes with composite middle layer and pipes without composite layer.

Linear expansion of PESTAN MECHANICAL Pipes (with Fiber Composite Layer)

PESTAN Pipe with fiber composite has a high level of stability. The linear expansion is decreased to almost 1/5 the value of the standard PP-R and PP-RCT non fiber composite pipes.
Linear expansion ΔL (inches)
Pestan pipes with fiber - α= 0.035 mm/mK = 2.367 x 10-4"/ft°F

Difference in Temperature ΔT								
Pipe Length (ft)	10	20	30	40	50	60	80	100
	Linear Expansion ΔL (in)							
10	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2
20	0.0	0.1	0.1	0.2	0.2	0.3	0.4	0.5
30	0.1	0.1	0.2	0.3	0.3	0.4	0.6	0.7
40	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.9
50	0.1	0.2	0.3	0.5	0.6	0.7	0.9	1.2
60	0.1	0.3	0.4	0.6	0.7	0.8	1.1	1.4
70	0.2	0.3	0.5	0.7	0.8	1.0	1.3	1.6
80	0.2	0.4	0.6	0.7	0.9	1.1	1.5	1.9
90	0.2	0.4	0.6	0.8	1.0	1.3	1.7	2.1
100	0.2	0.5	0.7	0.9	1.2	1.4	1.9	2.3
150	0.3	0.7	1.0	1.4	1.7	2.1	2.8	3.5
200	0.5	0.9	1.4	1.9	2.3	2.8	3.7	4.7

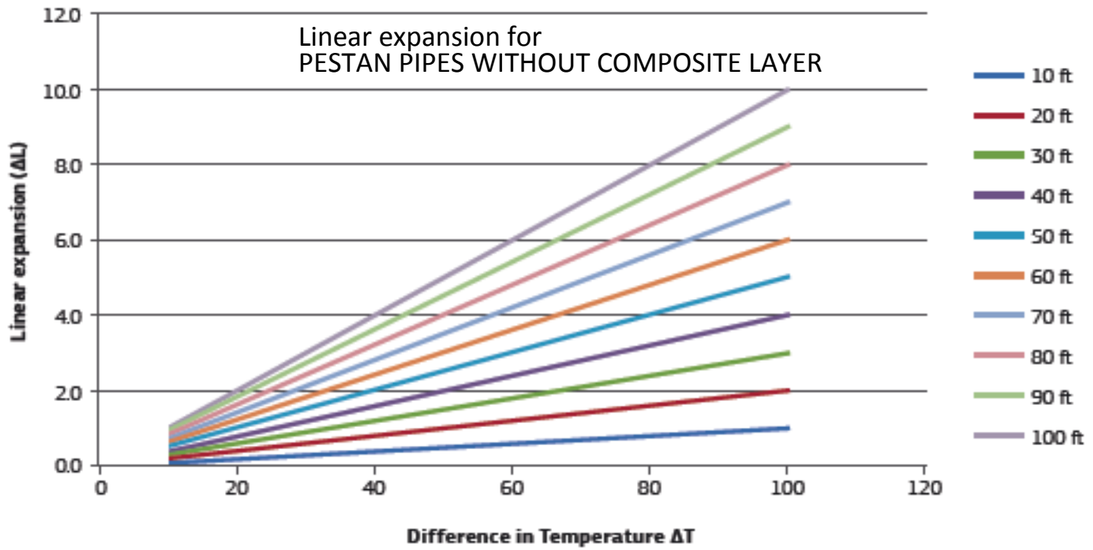


Linear Expansion of PESTAN PURPLE Pipes

The linear expansion of Pestan PP-R pipe without fiber composite layer are given below.

Linear expansion ΔL (inches)
α = 0.150 mm/mK = 1.008x 10-3 in/ft°F

Pipe Length (ft)	Difference in Temperature ΔT							
	10	20	30	40	50	60	80	100
	Linear Expansion ΔL (in)							
10	0.1	0.2	0.3	0.4	0.5	0.6	0.8	1.0
20	0.2	0.4	0.6	0.8	1.0	1.2	1.6	2.0
30	0.3	0.6	0.9	1.2	1.5	1.8	2.4	3.0
40	0.4	0.8	1.2	1.6	2.0	2.4	3.2	4.0
50	0.5	1.0	1.5	2.0	2.5	3.0	4.0	5.0
60	0.6	1.2	1.8	2.4	3.0	3.6	4.3	6.0
70	0.7	1.4	2.1	2.8	3.5	4.2	5.6	7.0
80	0.8	1.6	2.4	3.2	4.0	4.8	6.4	8.0
90	0.9	1.8	2.7	3.6	4.5	5.4	7.2	9.0
100	1.0	2.0	3.0	4.0	5.0	6.0	8.0	10.0
150	1.5	3.0	4.5	6.0	7.5	9.0	12.0	14.9
200	2.0	4.0	6.0	8.0	10.0	12.0	15.9	19.9



Pipe Movement

Based on the application and environment, calculate the expansion or contraction the system will experience. Select the proper pipe supports that will compensate for the movement of the pipe.
In concealed installations, installers typically allow enough additional pipe length to compensate for the expansion and contraction. In open installations, it is important that the visual uniformity of the system is maintained. Therefore, expansion loops or sliding elbows are used.

Open Pipe Installation

(including transition through pipe duct)

Both open pipe installation and installation through pipe duct use point support for supporting the pipe. There are two kinds of point supports: fixed and sliding. Fixed points make pipe expansion move to or from the fixed point where sliding points allow pipe movement and expansion through the support without damaging the pipe. Linear expansion has to be neutralized at one point by branch lines or expansion loops.

Transition Through the Wall

Use only suitable fusion transition fittings. Recommendations are as follows:
Female threaded transition – install outside of the wall board
Male threaded transitions – flush or outside the wall

Use PESTAN transition elbow 90° for gypsum wall mounting.

Accommodating Pipe Expansion with Branch Lines

Branch lines at 90˚ angles are used for accommodating pipe expansion. The length of any part of the pipe which is installed perpendicular to the branch and accommodates pipe expansion can be estimated using the following formula:

$$L_s = K \times \sqrt{d \times \Delta l}$$

Where
Ls is the length of compensating branch.
K is material-specific dimensionless constant (constant of PESTAN pipes is 2.98 if using Imperial sizing. When using metric sizing the constant of PESTAN Pipes is 15)
d is outside pipe diameter in millimeters or inches
Δl is previously estimated longitudinal pipe expansion expressed in millimeters or inches.

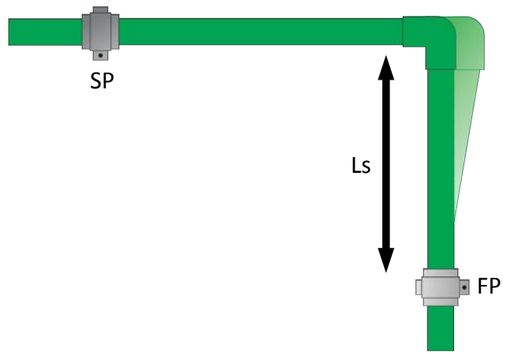
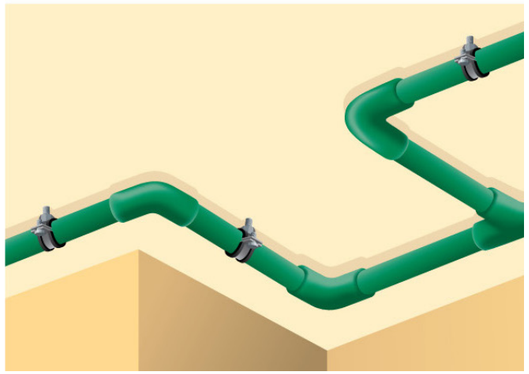


Figure above shows correct accommodation of longitudinal expansion with branch line (SP stands for sliding point, FP for fixed point and L_S is necessary length of compensating branch line)

Note: Branch line has to be installed at 90˚ angles as shown in the picture.

Accommodating Pipe Expansion and Contraction with Expansion Loops



An expansion loop has to be installed if longitudinal expansion with branch lines is not available. For the installation of an expansion loop, four 90 °elbows will be required. Aside from the length of the branch line L_S, the width of the expansion loop should be included in the formula. The necessary expansion loop parameters will be analyzed in the following formula.

$$L_s = K \times \sqrt{d \times \Delta l}$$

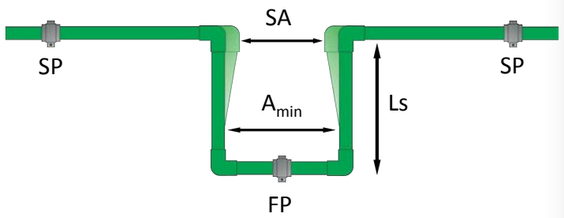
Where
Ls is the length of the compensating branch.
K is material-specific dimensionless constant (constant of PESTAN pipes is 2.98 or when using metric sizing the constant of PESTAN Pipes is 15)
d is outside pipe diameter in millimeters or inches
Δl is previously estimated longitudinal pipe expansion in millimeters or inches

It is also important to estimate the width of expansion loop (A_{min}) using following equation:

$$A_{min} = 2 \times \Delta l + SA$$

Where
A_{min} is the width of expansion loop
Δl is previously estimated longitudinal pipe expansion in inches or millimeters
SA is a safety distance of 6" (152.44 mm)

Note: A compensating branch line has to be installed at 90˚ angles as shown in the picture

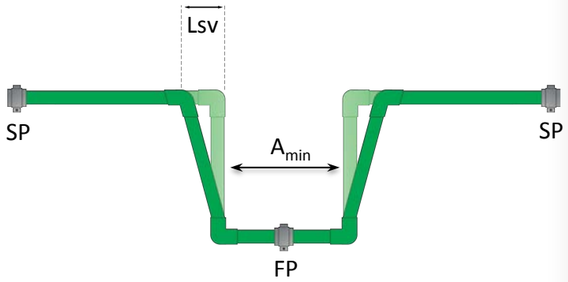


Correct accommodation of longitudinal expansions with expansion loops (SP stands for sliding point, FP for fixed point, Ls is necessary length of branch line, Amin is the width of the pipe bow and SA is safety distance).

In order to install compensation elements such as branch lines or expansion loops in limited spaces, the length L_s and therefore the A_{min}, can be reduced by pre-stressing the expansion loop. Length of pre-stressed elements are calculated as follows:

$$L_{SV} = K \times \sqrt{d \times \frac{\Delta l}{2}}$$

Where
Lsv is necessary pre-stressing length.
K is material-specific dimensionless constant (constant of PESTAN pipes is 2.98 or when using metric sizing the constant of PESTAN Pipes is 15)
d is outside pipe diameter in millimeters or inches
Δl is previously estimated longitudinal pipe expansion expressed in inches



Pre-stressed expansion loop with marked pre-stressing length Lsv

Note: It is important to follow the fusion order of pre-stressed expansion loops or branch lines. First create an expansion loop, fuse the other pipeline elements and then install the expansion loop. Pre-stress and secure using fixed points then continue the pipeline connection. Following this procedure prevents joint strain.

Recommended Length of Bending Side in Expansion Loop

Pipe Dimension N.D. - O.D.		Linear expansion in inches											
		1	2	3	4	5	6	7	8	9	10	11	12
		Length if Bending side in inches											
½"	20 mm	13	19	23	27	30	33	35	38	40	42	44	46
¾"	25 mm	15	21	26	30	34	37	40	42	45	47	50	52
1"	32 mm	17	24	29	34	38	42	45	48	51	54	56	59
1¼"	40 mm	19	27	33	38	42	46	50	54	57	60	63	66
1½"	50 mm	21	30	37	42	47	52	56	60	64	67	70	73
2"	63 mm	24	34	41	48	53	58	63	67	71	75	79	82
2½"	75 mm	26	37	45	52	58	64	69	73	78	82	86	90
3"	90 mm	28	40	49	57	64	70	75	80	85	90	94	99
4"	125 mm	34	47	58	67	70	82	89	95	101	106	111	116
6"	160 mm	38	54	66	76	85	93	100	107	114	120	126	131
8"	200 mm	42	60	73	85	95	104	112	120	127	134	141	147
10"	250 mm	47	67	82	95	106	116	125	134	142	150	157	164
12"	315 mm	53	75	92	106	119	130	141	151	160	168	177	184

Recommended Length of Bending Side with Pre-stressed Elements in Expansion Loop

Pipe Dimension N.D - O.D.		Linear expansion in inches											
		1	2	3	4	5	6	7	8	9	10	11	12
		Length if Bending side in inches											
½"	20 mm	9	13	16	19	21	23	25	27	28	30	31	33
¾"	25 mm	11	15	18	21	24	26	28	30	32	34	35	37
1"	32 mm	12	17	21	24	27	29	32	34	36	38	40	42
1¼"	40 mm	13	19	23	27	30	33	35	38	40	42	44	46
1½"	50 mm	15	21	26	30	34	37	40	42	45	47	50	52
2"	63 mm	17	24	29	34	38	41	45	48	51	53	56	58
2½"	75 mm	18	26	32	37	41	45	49	52	55	58	61	64
3"	90 mm	20	28	35	40	45	49	53	57	60	64	67	70
4"	125 mm	24	34	41	47	53	58	63	67	71	75	79	82
6"	160 mm	27	38	46	54	60	66	71	76	80	85	89	93
8"	200 mm	30	42	52	60	67	73	79	85	90	95	99	104
10"	250 mm	34	47	58	67	75	82	89	95	101	106	111	116
12"	315 mm	38	53	65	75	84	92	100	106	113	119	125	130

Vertical installation

As fiber and non-fiber pipes have various linear expansion coefficients, the pipe branches are to be installed on risers according to the selected type of pipe.

With fiber pipe:
When installing risers with PESTAN Fiber Composite pipe, fixed points are positioned next to a branch. The expansion will be distributed between the fixed points, thus, the linear expansion of PESTAN fiber composite pipes in vertical risers can be ignored. Generally, risers are installed without expansion joints. For pipe sizes 2" and below, the space between two fixed points must be a minimum of 10ft, and mid-story guides are recommended.

With non-fiber pipe:
When installing risers with PESTAN pipes without a fiber layer, it is necessary to install branch lines so linear expansion of the vertical riser can be accommodated. An adequate expansion control must be installed as described in this section. Because non-fiber pipes have no integrated expansion control, PESTAN recommends installing fixed points in heated applications before or after each branch line, inhibiting any movement due to expansion.
Besides the above mentioned methods, pipe sleeves or swing joints can also be used.

INSULATION

Pipes are insulated to prevent condensation and heat loss. One of the benefits of using PESTAN PP-R(CT) is the relatively low thermal transmission coefficient. It significantly improves energy savings as compared to traditional metal piping by reducing the amount of insulation that is required and minimizing condensation. Recommendations on minimum required pipe insulation are made in both ASHRE 189.1-2010 C-11 and in IECC 2012-403.2.8.

ASHRAE 189.1-2010 C-11

	Fluid Design Operating Temp. Range (°F)	Conductivity Btu in/(h ft² °F)	Nominal Pipe or Tube Size (in)	Minimum Pipe Insulation (in)
HOT WATER	140 - 200	0.25 - 0.29	½ - 4	1.5
CHILLED WATER	40 - 60	0.22 - 0.28	½ - 1¼	1
			1½ - 4	1.5

IECC 2012 403.2.8

	Fluid Design Operating Temp. Range (°F)	Conductivity Btu in/(h ft² °F)	Nominal Pipe or Tube Size (in)	Minimum Pipe Insulation (in)
HOT WATER	105 - 200	0.25 - 0.29	½ - 4	1.5
CHILLED WATER	40 - 60	0.22 - 0.28	½ - 1¼	1
			1½ - 4	1.5

Heat Gain and Loss Calculations

PESTAN's PP-R(CT) pipe have low thermal conductivity (k)* value, especially when compared to metal piping. Metals are considered to be conductors of heat, which results in the loss of energy, lower system efficiencies and increased costs. The following are comparisons of the thermal conductivity (K factors) expressed in BTU/hr-ft-F:

k_{PESTAN} = 0.139 @ 68°F k_{copper} = 227 @ 75°F k_{steel} = 31 @ 75°F

*The thermal conductivity (K Factor) of a material is based on the number of BTUs per hour which passes through a one inch thick by one square foot section of material, with a 1°F temperature difference between the two surfaces. Materials with a lower K-Factor are better insulators.

The R-Value is the capacity of an insulating material to resist heat flow. The higher the R-value, the greater the insulating power.

Heat loss or gain characteristics can also be expressed through R-value, which has direct relationship with the K-values, as shown in the following equations:

$$R - value = \frac{Equivalent\ Thickness\ (inches)}{k - factor\left(\frac{BTU\ inch}{hr\ ft^2\ F}\right)}$$

Where r_1 = Inner Radius and r_2 = Outer Radius

$$Equivalent\ Thickness = r_2\ x\ ln\left(\frac{r_2}{r_1}\right)$$

Insulation Thickness Calculations

For applications not covered by the tables published by ASHRAE and IECC, the following information is useful when calculating thermal resistance values and heat loss/gain:

k_{ins} = 0.0208333 (for typical .25" up to 1" closed cell foam insulation)
k_{ins} = 0.02375 (for typical 1.50 up to 2" closed cell foam insulation)

ΔT = 50°F (typical temperature difference between hot water and room temperature)

Heat Transfer Coefficients (BTU/hr-ft²-°F/in)

The heat transfer coefficients are affected by factors including average temperature, pipe wall temperature and wind speed. It is calculated by using the Zukauskas Equation and typically falls in the range of 0.5 to 4 (BTU/hr-ft2-°F). To calculate, determine the Nusselt number for the set of conditions then calculate the outdoor heat transfer coefficient.

Example:
Air heat transfer coefficient = 2 @ avg. temperature = 100° F, pipe wall temp = 80° F and wind speed at 5 mph.
For this given set of conditions, the heat transfer coefficient: h_O = 1.6

Calculated Thermal Resistance Values (hr ft F/BTU)

R_{pipe} =Thermal resistance of pipe wall

$$R_{pipe} = \frac{ln\left(\frac{r_{pipe,o}}{r_{pipe,i}}\right)}{2\pi k_{ins}}$$

R_{ins} = Thermal resistance of pipe insulation

$$R_{ins} = \frac{ln\left(\frac{r_{ins,o}}{r_{pipe,o}}\right)}{2\pi k_{ins}}$$

R_O = Thermal resistance of outer air

$$R_o = \frac{1}{2\pi r_o h_o L}$$

Where r_o = layer radius and L = length of pipe/insulation

Thermal Resistance cont.

R_{total} = Total thermal resistance of pipe and pipe insulation

$$R_{total} = R_{pipe} + R_{ins} + R_o$$

Calculated Heat Loss (BTU/hr-ft)

q_{pipe} = Heat loss through a non-insulated pipe,

$$q_{pipe} = \frac{\Delta T}{R_{pipe}}$$

q_{total} = Total heat loss through an insulated pipe,

$$q_{total} = \frac{\Delta T}{R_{total}}$$

Where ΔT is the temperature difference between ambient temperature and liquid in the pipe

Note: It is common practice among contractors to install the entire PESTAN piping system first, then to insulate it with specified material.

R-Values (hr ft² F/BTU)
Based on the outside diameter and wall thickness of the pipe

Pipe Wall Thickness	Nominal Pipe Size	Wall Thickness	R - Value
SDR	(in)	(mm)	(hr*ft² F) /BTU
SDR 7.4	½"	2.8	0.08
	¾"	3.5	0.10
SDR 9	1"	3.6	0.10
	1¼"	4.5	0.12
	1½"	5.6	0.15
	2"	7.1	0.19
	2½"	8.4	0.23
	3"	10.1	0.27
	4"	14	0.38
	6"	17.9	0.48
	8"	22.4	0.60
	10"	27.9	0.75
	12"	35.2	0.94
SDR 11	1"	2.9	0.08
	1¼"	3.7	0.10
	1½"	4.6	0.12
	2"	5.8	0.15
	2½"	6.8	0.18
	3"	8.2	0.21
	4"	11.4	0.30
	6"	14.55	0.38
	8"	18.3	0.48
	10"	22.7	0.59
	12"	28.6	0.75
SDR 17.6	4"	7.1	0.18
	6"	9.1	0.23
	8"	11.4	0.29
	10"	14.2	0.36
	12"	17.9	0.45

Recommended Size of Pre-formed Insulation	
Pipe Dimension N.D. - O.D.	Insulation Size Best Fit (other solution)
½" - 20 mm	½" IPS
¾" - 25 mm	¾" IPS
1" - 32 mm	1" IPS
1¼" - 40 mm	1½" CTS (1¼" IPS)
1½" - 50 mm	1½" IPS
2" - 63 mm	2" IPS
2½" - 75 mm	2½" IPS
3" - 90 mm	3" CTS (3" IPS)
4" - 125 mm	5" CTS (5" IPS)
6" - 160 mm	6" IPS
8" - 200 mm	8" CTS (8" IPS)
10" - 250 mm	10" CTS (10" IPS)
12" - 315 mm	12" IPS

PRE-FORMED INSULATION

The outstanding natural insulating properties of PESTAN pipes helps reduce the amount of insulation required to control heat loss/gain, heat gain and condensation as compared to metal piping systems. Consult code requirements for your particular project to insure that reductions in insulation thickness are allowed.
PESTAN recommends using metric size pre-formed insulation for the pipes. If not available, the chart to the right makes recommendations on which IPS or CTS sizes of pre-formed insulation are best suited for equivalent size.

SYSTEM CARE

Flushing the Pipeline

The piping system should be flushed after installation. It is also highly recommended to disinfect the pipeline as both mineral and organic particles can contaminate the piping system and affect transported fluid. The flushing medium should be safe for PP-R(CT) material and should be specified under local codes, engineering specifications and/or by the needs of the mechanical equipment used. If no flushing methods are specified then water, air or a mixture of both can be used.

CERTIFICATE OF COMPLIANCE

Pressure test

Pressure testing is critical to a successful pipe installation and should be performed while the system is fully accessible, allowing access to the segments of the system in need of attention. The unique property of PP-R(CT) allows the pipe to be tested with water, air, or with a mixture of both.
Warning: When pressure testing with air, the contractor must exercise extreme caution. Accidents can occur due to a sudden release of energy such as unrestrained sections of pipe whipping about or piping system components blowing off. PESTAN recommends hydrostatic or hydrostatic/pneumatic testing over pneumatic.
During pressure testing, the pipe, fittings and connections must be able to sustain 15O% of the Operating Pressure (OP) or 150 psi, whichever is greater.
Warning: Isolate components of the system with the ratings lower than 150psi when pressure testing PP-R(CT) systems.

150% of OP or 150 psi, whichever is greater = Test Parameter (**TP**).

The pressurization of the system can affect the physical characteristics of the pipe. The ΔT (system fluid temperature minus ambient temperature) can cause expansion or contraction. Subsequently, the test results will be influenced by these factors.

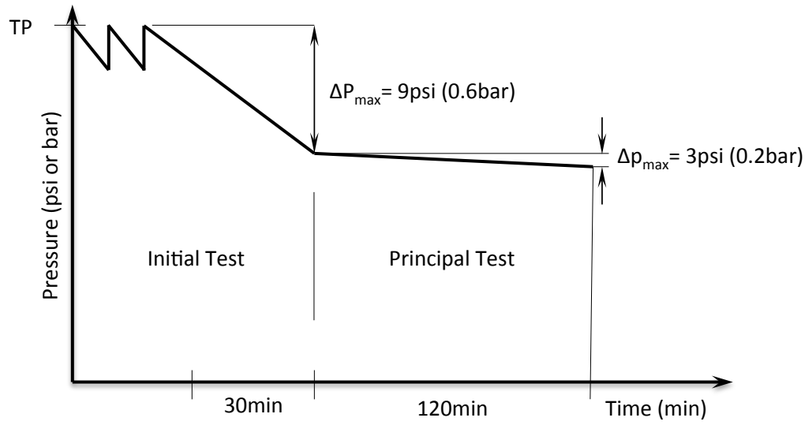
Various temperatures of the pipe and the test medium will lead to changes in system pressure. Temperature fluctuations of 18° lead to changes in test pressure from 7.25 to 14.5 psi (0.5 to 1 bar). During the pressure test, the highest possible constant temperature of the test medium must be measured. If feasible, let the temperature between the pipes and the test medium reach equilibrium before reading the meter to get the most accurate results.
The pressure test consists of three phases: Initial, Principal and Final test. Please see page 57 for instructions.
Note: During the testing of large installations, small leaks may take longer to manifest as a pressure loss.

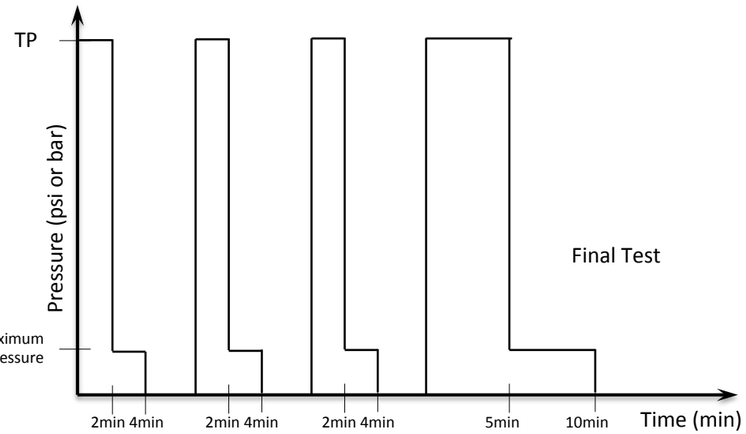
How to Measure Pressure Test

The pressure test must be performed with a pressure gauge that measures in 0.5 psi increments. When testing a multi-story installation, the pressure test should be conducted at the lowest point of the piping system that can be accessed.

Test Record

All PESTAN installations must be pressure tested and documented on the official PESTAN Pressure Test Form. The Pressure Test is required in order to identify any potential issues including manufacturing defects and installation errors. It is acceptable to pressure test the system in phases providing that every heat fused connection is tested and that each phase is properly documented on Pressure Test Form. The entire form must be completed and signed by the PESTAN trained installer. Both the client and contractor should keep a copy of the pressure test record. Completion and submittal of the Pressure Test form is required by PESTAN in order for the warranty to be valid. It does not replace any local legal requirements or supersede them. PESTAN requires this test to be performed, documented and submitted before the system becomes operational.





Initial and Principal Test:

1. Initial Test: Bring pressure in system up to 150% of the operating pressure (OP) or 150 psi, whichever is greater (Test Parameter = **TP**).
2. Wait 10 minutes then read pressure. When system pressure decreases due to pipe expansion, pressure it back to **TP**.
3. Repeat step 2 until the system has stabilized.
4. When stable, begin 30 minute test period, then read pressure. Pressure must not lose more than 9 psi (0.6 bars). If it passes, begin the Principal Test.
5. Principal Test: Begin the 120 minutes (2 hours) test period. Pressure must not drop more than 3 psi (0.2 bars) during the two hour period.
6. Once the system has met the requirements of steps 4 and 5 the final test can be performed.
7. If the system pressure fails to stabilize or fails to meet the requirements of steps 4 and 5, inspect the system for possible leaks. Make any necessary repairs and restart the testing process.

Final Test:

1. Bring the system up to 150% of the operating pressure (OP) or 150 psi, whichever is greater. (Test Parameter = **TP**) and wait 2 minutes.
2. After 2 minutes with no pressure loss, reduce pressure to 15% of OP and wait 2 minutes.
3. After 2 minutes with no pressure loss, drop pressure to 0 psi.
4. Immediately bring system pressure back up to **TP** and repeat steps #2, #3 and #4, four more times.
5. When testing for the fourth time, drop pressure to 15% OP and wait 5 minutes. After 5 minutes with no pressure loss, drop pressure to 0 psi.
6. Immediately bring system pressure back up to **TP** and wait for 5 minutes.
7. Drop pressure to 15% OP and wait for another 5 minutes. Drop pressure to 0 psi.
8. No leakage is allowed to occur at any point of the tested installation. This test is designed to expose any possible cracks and to detect bad pipe connections.

PRESSURE TEST FORM

PESTAN

V2 5-20-15

Pressure Test Form

Project Name		
Project Owner		
Project Address		
City, State Zip		
Type of System Installed		
Units	feet or meters	psi or bar

Length of pipe used on the project	.50" 20mm	.75" 25mm	1" 32mm	1.25" 40mm	1.50" 50mm	2" 63mm	2.50" 75mm	3" 90mm	4" 125mm
Maximum Operating Pressure									

TEST PARAMETER* = 150% of operating pressure or 150psi whichever is GREATER

Initial Test	Test Parameter*		Pressure Drop (ΔP) after 30 Minute	
Principal Test	Principal Test Parameter*		Time Elapsed	Test Pressure Drop (ΔP) (after minimum of 120 minutes)
Final Test (Depressurize the pipe between each cycle)	1	Test Parameter* (2 minute minimum)	Then	15% of Operating Pressure (2 min)
	2	Test Parameter* (2 minute minimum)	Then	15% of Operating Pressure (2 min)
	3	Test Parameter* (2 minute minimum)	Then	15% of Operating Pressure (2 min)
	4	Test Parameter* (5 minute minimum)	Then	15% of Operating Pressure (5 min)
Timing (minutes)	Date	Start Time	Time Elapsed	Test Duration

What liquid/gas was used for the Pressure Test? ◯ Water ◯ Air ◯ Mixture of Water and Air ◯ Other (specify)

What Manufacturer of Fusion Equipment was used? ☐ McElroy ☐ Ritmo ☐ Widos ☐ Other (specify)

What Socket Fusion Heads were used? (specify Type)

Was flushing of the system performed before or after the Pressure Test?	◯ before ◯ after
What chemicals were used for flushing of the piping system?	

Certified Installer Responsible for Testing First Name, Last Name, Company	
Phone and Email	

Certified Installer Signature	Pestan Certification ID Number	Date
Signature		

Additional Information (optional)

Other Material Pipe Sizes, Elements and materials used on project

Was Manufacturers Rep present on job Site? ◯ Yes ◯ No

PRESSURE TEST FORM MUST BE SUBMITTED TO Pestan North America Warranty Department WITHIN 3 DAYS OF SUCCESSFUL TEST COMPLETION via email Warranty@PestanPipes.com, Fax (888) 213-4342 or mail to P.O. Box 26 Titusville, PA 16354

Office Use Only: Date Received	Reviewed By

Always use latest edition of Pressure Test Form, available at www.pestanpipes.com/technical-information/

Section 6

Connections, Fusion Tools and Instructions

TRAINING FOR INSTALLERS

PESTAN offers training to installers via local representatives or through their affiliates. Trained and registered installers are critical for a successful system to be covered under the warranty. When installation is not properly conducted, documented and submitted, the warranty will not be valid. For more information, contact PESTAN N.A.

If you have previous experience installing PP-R(CT) piping systems, please contact Pestan North America.

Installation Concept: PP-R(CT) = Savings

PESTAN PP-R(CT) piping systems provide the installer with innovative installation advantages that provide real time savings:

- Ability to prefabricate and transport complex assemblies
- Ability to pre-assemble components on the jobsite
- Lightweight PP-R(CT) provides easier handling, installation and transportation
- Heat Fusion connections are permanent and leak-free.
- Ability to install sidewall outlet connections (used for branching lines, manifolds, repairs, gauge outlets, etc.)

Prefabrication

The ability to prefabricate and transport connections is one of the great advantages of PESTAN piping systems. Instead of having to make all of the complex assemblies on the job site, the installer can prefabricate them at his convenience, in a clean, controlled environment which improves the overall integrity of the system and saves him both time and labor dollars on the jobsite. Because PP-R(CT) piping systems are joined with heat fusion, the prefabricated pieces can be safely transported to the jobsite without having to worry about negatively affecting the integrity of the joints.

Note: Creating a Fabrication Work Space on the job site is another important time saver. It provides a space for the installer to measure, cut and pre-assemble system components. The space needs to be equipped with ample light and adequate power.

Effective Planning

To best utilize the advantages of a PP-R(CT) piping system the installer needs to plan ahead. This will help him to save time and prevent waste. A few tips include:

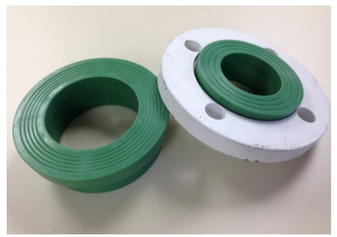
- Insure you have the required system components on hand.
- Create a convenient space for a work station where pipe can be cut and fabrications can be pre-assembled.
- Plan your connections in advance so you have enough space and flexibility for placement of the fusion machine and for fusing the last connection in a series. Remember to include the additional length of pipe used by heat fusion in your calculation.
- Utilize prefabrication and pre-assembly of components and connections whenever possible.

CONNECTIONS AVAILABLE

PP-R(CT) pipes are joined via Heat Fusion which provides permanent, leak-free joints.
Depending on pipe size, there are three different types of heat fusion processes that are recommended:
- .50" to 4" - Socket Fusion
- >4 - Butt Fusion
- Saddle Outlet Fusion for branching off mains, manifold fabrication, gauge outlets, etc.

PESTAN offers a complete line of fusion fittings for connecting your system . When you need to transition from your fused piping system to a non PP-R(CT) system or to equipment, metal fittings or valves, PESTAN offers two options:
- Transition Fittings are made from injection molded PP-RCT with brass or lead-free brass threads.
- Flange Connections are made using PESTAN's PP-RCT Flange adapter and a steel back-up ring. PESTAN recommends using full face rubber gaskets. Ring gaskets are acceptable for lower pressure systems.

Transition fittings



Flange adapters

Flange Back-Up Ring Bolt Requirements

Pipe Dimension N.D. - O.D.	Number of Bolts	Bolt Size	Washer Requirements	Torque (ft-lb)	Torque (N-m)
½" - 20mm	4	½"	Yes	7	9
¾" - 25mm	4	½"	Yes	10	14
1" - 32mm	4	½"	Yes	15	20
1¼" - 40mm	4	½"	Yes	15	20
1½" - 50mm	4	½"	Yes	25	34
2" - 63mm	4	⅝"	Yes	30	41
2½" - 75mm	4	⅝"	Yes	40	54
3" - 90mm	8	⅝"	Yes	40	54
4" - 125mm**	8	⅝"	Yes	40	54
6" - 160mm	8	¾"	Yes	55	75
8" - 200mm	8	¾"	Yes	75	102
10" - 250mm	12	⅞"	Yes	90	122
12" - 315mm	12	⅞"	Yes	105	142

**Flange adapter can be butt fused, or socket fused if used in conjunction with coupling (part number 18000010)

FUSION

Fusion of the joint has to be performed according to the guidelines in this manual. More information is available in ASTM D2657 - Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
There are several styles of fusion tools to choose from based on the pipe size, type of fusion and the location of the installation. Tools can be categorized as following: Hand-Held Irons, Table Top models and Portable Fusion Machines. The quality of the fusion equipment will affect the quality of the fusions. When fusing PESTAN pipe, we recommend using fusion equipment by recommended manufacturers that are strictly designed to follow the DVS 2208 standard.
Note: PESTAN assumes no responsibility when connections are made using faulty and/or non-standard equipment. For recommended fusion equipment please visit our web site at
www.pestanpipes.com/tools-and-accessories/
Preparation for fusion utilizes the same basic steps regardless of which fusion tool is used. It includes the following basic steps: Safety, Power Supply, Tool Preparation, Marking and Pipe Preparation.

Safety Measures

When conducting heat fusion, you are handling tools, pipe and fittings that are heated to temperatures up to 500°F. It is extremely important that safety guidelines be followed.

- Only persons certified in heat fusion should conduct fusions.
- Always wear the applicable safety clothing which may include: safety glasses, long sleeves, gloves, safety shoes and a hard hat.
- Be aware of your environment and verify that it is a safe space to operate fusion equipment.
- Understand proper operation and safety procedures for the fusion equipment you are using.
- Insure all fusion tools are in good working order.
- Never leave heated fusion tools unattended.
- When unplugged, fusion tools should be properly stored.
- When using electric fusion tools, follow recommended electrical safety practices.
- Never start the fusion process without posting a warning sign.

Power Supply

The power supply needs to be compatible with the fusion iron. Insufficient power supply can cause cold fusions that will fail. If using extension cords, insure that cord is capable of delivering the required power and that you are within a reasonable distance from the power supply.

Tool Preparation

1. Assemble the required socket fusion tools.
2. Verify that the fusion heads and cold ring (if used) are compatible with the pipe size.
3. Make sure that the iron and socket heads are clean and free from any contaminants. If dirty, clean with a soft cloth and alcohol, taking care not to scratch the teflon coating.
4. Attach the fusion heads to the fusion iron insuring full surface contact between the head and the iron.
5. Connect the heating tool to the power supply.
6. Pre-heat the iron to 480-500°F (248-260°C).
7. Verify that the temperature on the fusion head has reached 480-500°F (248-260°C). Use of Tempilstiks, or any other thermal detection devices are recommended in addition to the tool indicator light or gauge on the fusion tool.

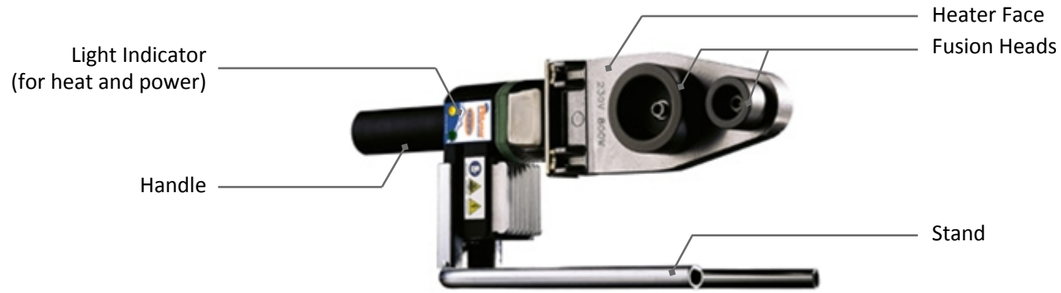
Pipe Preparation

Follow these steps to prepare the pipe for fusion:

1. Make sure that the pipe length has not been damaged. Double check the pipe ends which are more susceptible to damage. If damage is noted, remove the damaged section of the pipe.
3. Measure and mark the length of pipe.
4. Use pipe supports when cutting to prevent pipe movement.
5. Wear eye protection when cutting the pipe.
6. Use ratchet cutters with a sharp blade. A dull blade can affect the ovality of the pipe.
7. Use hand wheel cutters for larger diameter pipe
8. If using a handsaw, the teeth should be safe for plastic.
9. Band saws and reciprocating saws may be used. Thinner blades produce a better cut with fewer shavings.
10. When using electric saws, use a circular hardwood blade with carbide teeth (60 -100T).

Note: Do not use circular saws if the ambient temperature is less than 40°F

SOCKET FUSION (using Hand-Held Irons)



Socket Fusion - Marking

When performing socket fusion, there are two methods to determine how far the pipe should be pushed onto the fusion iron. You may use a recommended marking guide or use the chart below to reference the appropriate stab depth and then use a measuring tape to mark it on the pipe. Mark required depth on several places around the pipe for insertion depth guidance.

Marking pipe using measuring tape

Marking pipe using Marking Guide

Pipe O.D.	.50" 20 mm	.75" 25 mm	1.00" 32 mm	1.25" 40 mm	1.50" 50 mm	2.00" 63 mm	2.50" 75 mm	3.00" 90 mm	4.00" 125mm
Stab Depth (inches)	.51	.63	.71	.81	.93	1.08	1.18	1.30	1.56

Socket Fusion – Heating Pipe and Fittings

When the heating iron has reached 480-500°F (248-260°C), you may begin the heating process. When socket fusing, you will be heating the outside of the pipe and the inside of the fitting.

- The pipe and fitting are simultaneously pushed (no twisting) on to the fusion head which is attached to the heating iron.
- As the pipe and fitting soften, you will be able to push them further on the fusion head.
- When you reach the point on the pipe that you marked, stop pushing.
- Continue to push the fitting until it reaches the base of the fusion head.
- The heating time starts when both the pipe and fitting have reached their maximum insertion points.

Socket Fusion – Heating Time

The following heating times are recommendations based on ambient temperatures above 40°F (for requirements and instruction of installations in environments under 40°F, please contact us). Actual required heating times may vary based on ambient conditions, continuity of power supply, etc. PESTAN recommends that you perform a test fusion in order to identify optimum heating times.

Socket Fusion – Joining the Pipe and the Fitting

Once the Heating Times have been met, remove the pipe and fitting from the fusion head. Do not twist them off, pull them straight away. Quickly inspect the melt on both. Align the pipe with the fitting and insert the end of the pipe into the fitting until the bead on the pipe touches the edge of the fitting. Do not twist the pipe or fitting. This can displace the molten material and affect the integrity of the joint.

Pipe O.D.	.50" 20 mm	.75" 25 mm	1.00" 32 mm	1.25" 40 mm	1.50" 50 mm	2.00" 63 mm	2.50" 75 mm	3.00" 90 mm	4.00" 125mm
Heating Time (sec.) >40 F	5	7	8	12	18	24	30	40	60

Socket Fusion - Correction Time

Once the pipe has been inserted into the fitting, you have a few seconds during the Fusion Time to adjust the angle of the pipe up to 10° in order to properly align it with the fitting.

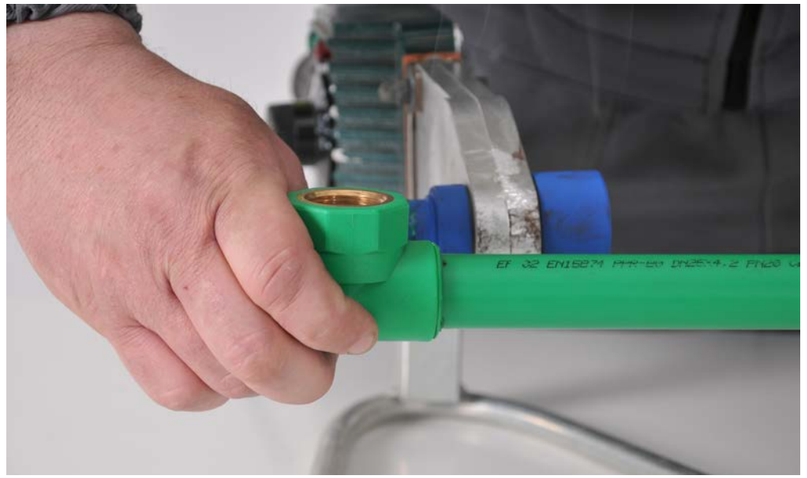
Socket Fusion – Fusion Times

Once the pipe has been inserted into the fitting and any required corrections have been made, the connection must be held in place until the joint cools and the fusion is set. Recommended Fusion Times are given in the table below, based on pipe size and may vary based on ambient temperatures.

Pipe O.D.	.50" 20 mm	.75" 25 mm	1.00" 32 mm	1.25" 40 mm	1.50" 50 mm	2.00" 63 mm	2.50" 75 mm	3.00" 90 mm	4.00" 125mm
Fusion Time (sec.)	4	4	6	6	6	8	8	8	10

Socket Fusion - Cooling Times

After the Hold Time has been met, the joint should be allowed to rest for a few more minutes before use. The following are Cooling Time recommendations. Do not try to accelerate the cooling times by using water.



Pipe O.D.	.50" 20 mm	.75" 25 mm	1.00" 32 mm	1.25" 40 mm	1.50" 50 mm	2.00" 63 mm	2.50" 75 mm	3.00" 90 mm	4.00" 125 mm
Cooling Time (min.)	2	2	4	4	4	6	8	8	9

After the cooling times have been met, the joint is ready for use. Socket fusion results in a perfect bond of the pipe and fitting.

Recommendation

For the socket fusion under 2" the use of a chamfer tool with depth gauge along with cold rings is recommended. Chamfer tool already has set Stab Depth, so cold ring should be set right next to it after chamfering has been done. Using cold rings, it makes socket fusion square and keeps installer hands away from the iron, preventing the burning.

Note:
Metric cold rings and chamfering tools are available exclusively through CT Piping.

SADDLE OUTLET FUSION (using Hand-Held Irons)

With Socket or Butt Fusion, the end of the pipe is being heated and fused. With Saddle Outlet Fusion, the fusion welds are in the wall of the pipe as well as on the curved surface of the pipe and fitting. This makes it ideal for installing branch lines off the main, manifolds, insertion of the gauges, etc. These connections can even be made after the main lines have been installed. Using saddle connections when building manifolds saves fabrication time and money. Also, saddle connections have lower pressure loss than a reducing tee.

The following table shows whether a regular and threaded saddle is available for a particular branch size:

Pipe Size	Sizes From - To
1¼"	½" – ¾"
1½"	½" – ¾"
2"	½" – 1"
2½"	½" – 1¼"
3"	½" – 1¼"
4"	½" – 2"
6"	½" – 3"
8"	½" – 4"
10"	½" – 4"
12"	2" – 6"

Pipe Size	Thread Size		
	½"	¾"	1"
1½"	M/F	M/F	-
2"	M/F	M/F	-
2½"	M/F	M/F	F
3"	M/F	M/F	F
4"	M/F	M/F	F
6"	M/F	M/F	F
8"	F	F	F
10"	F	F	F

M - Male Thread
F - Female Thread

Saddle Outlet Fusion – Preparation

Before you begin the Saddle Outlet Fusion process, follow the Basic Preparation Steps outlined on page 61.

Mark the location of the bore on the wall of the pipe. When drilling the outlet bore, Pestan recommends using a a special bit that is designed to take out the cuttings created during the boring process. PESTAN offers drill bits for making precise bores in the pipe wall. If the drill bits are larger than 2", a drill press is required. When using bits supplied by companies other than PESTAN, make sure they are between 1 mm to 3 mm smaller than the branch size.
It is important to drill at a precise 90° angle. The fusion heads must fit flush against the pipe. Double-check to ensure that no extra material or burrs are left inside the pipe once you have drilled the hole. Make sure to remove any pipe shavings that are still attached.

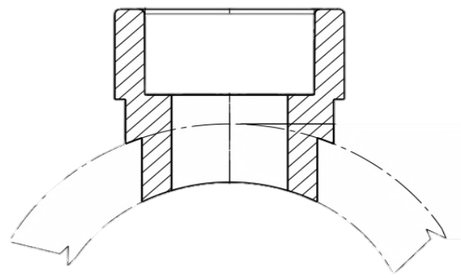
Saddle Outlet Fusion - Heating Process

Verify that the temperature on the fusion head has reached 480-500°F (248-260°C). Insert the heating tool into the borehole of the pipe.
Use a wooden dowel or other heat resistant device to push down on the heating tool, melting it into the borehole.
When the fusion head is completely inserted into the borehole, place the saddle fitting on the fusion head and apply pressure. Be careful not to move or twist the heating tool.
When the saddle fitting is completely on the fusion head, until you can see an even melt all the way around (approx. 30 seconds).

When the heating time is met, pull the heating tool straight out of the borehole and the saddle fitting straight off the fusion head. Do not twist off.

Saddle Outlet Fusion - Connecting the Fitting to the Pipe

As soon as you remove the saddle fitting from the fusion head, insert it vertically into the borehole. Do not twist the fitting into the borehole. Twisting the fitting can displace the molten material and affect the integrity of the fitting. Immediately check the placement of the fitting on the pipe and use a level to insure it is placed properly. The installer has only a couple of seconds to correct the position of the saddle.



Cross-section of the Saddle Outlet Fusion connection

Saddle Outlet Fusion – Fusion Times and Cooling Period

Once the fitting has been installed on the pipe and any required corrections have been made, the connection must be held in place until the joint cools and the fusion is set. After 10 minutes, the connection is ready to operate under pressure.

PIPE REPAIR TECHNIQUES

If PP-R(CT) pipe is punctured by a nail or screw, the pipe can be repaired. For holes that are 3/8" or less in diameter, you may use a repair pin. For larger punctures, repair with saddles.

Repair Pin

1. First assemble the tools required for making the repair. Attach the fusion repair head onto the fusion iron.

2. Connect the fusion iron to the power supply.

3. Remove the penetrating object from the pipe and clear the hole.

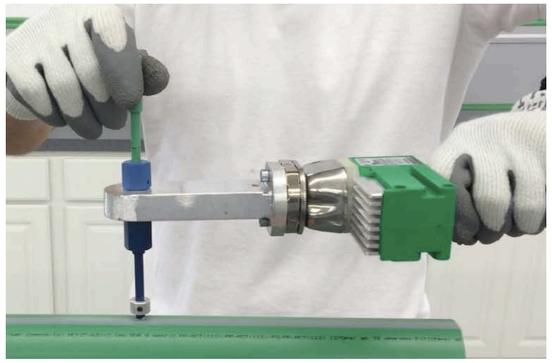
4. The repair head comes in two sizes: ¼" and 7/16". If the hole is too small then the installer should drill it out with a 3/16" bit for the ¼" repair tool or a 3/8" bit for the 7/16" repair tool. If the hole is larger than the 7/16" repair tool, then a saddle repair should be done.

5. Wipe away any dirt or debris and insure that the pipe is completely dry.

6. Mark the repair pin to the appropriate depth of insertion, which is equal to the thickness of the pipe wall. If you are unsure of what this thickness is, refer to the pipe dimension table on pages 79 to 82. You may also compare it to a piece of uninstalled pipe of the same diameter and DR.

7. When the fusion repair head has reached 480-500°F (248-260°C), insert the repair pin into the repair head and insert the repair head into the hole in the pipe.

8. Heat both the hole and the pin for 5 seconds.



9. Remove the fusion repair head and insert the repair pin into the hole to the pre-marked depth of insertion. Do not twist.

10. Hold the pin in place.

11. Once the pin has set, remove the unused portion of the Repair Pin by carefully holding the end of the pin in place while cutting it with pipe cutters or construction knife. Use caution when doing this and be sure that your fingers are clear of the cutter blade.

12. Pressure test the system following the repair.

Saddle Repairs

A Saddle Repair is used for holes too large to be fixed using the repair pin. The procedure for Saddle Repairs is made of following four steps:

1. Drill out the hole with a drill bit that is just slightly larger than the damage in the pipe.
2. Use appropriate saddle for the size of the hole and the repair pipe size.
3. Follow the instructions for Saddle Outlet Fusion found on page 65 and 66.
4. Cap a short length of pipe and then fuse it into the saddle fitting using socket fusion method.

SOCKET FUSION ASSISTED BY FUSION MACHINE

For the socket fusion connections of 2" and above, it is recommended to use the assistance of Fusion Machines. Using fusion machines will help installers with faster and more precise connections. There are three major types of fusion machines: Jig, Portable and Bench machines, all using same principles and procedures of fusion.

Jig and Portable Fusion Machine

Portable fusion machines and Jigs are mobile and are designed for jobsite fusion connections of 2" and above. They can be freestanding or fastened to available surfaces and used in a pre-fab station. These units consist of a sliding carriage with a light metal body, a built-in or removable heating plate, clamping jaws and mounting clamp. These types of fusion machines are ideal for vertical, overhead and tight space installations.

Bench Fusion Machine

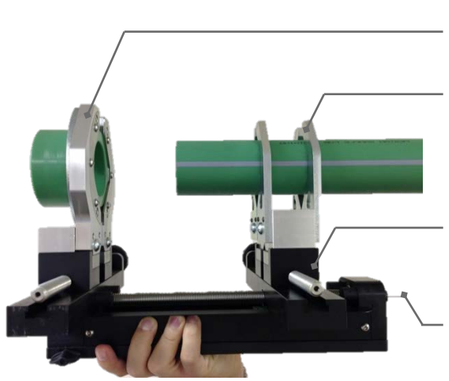
Bench fusion machines are designed for socket fusion connections of 2" and above. These machines assist the installer by holding the pipes in place making for precise and consistent fusion joints. They are available in both tabletop and portable models.

When using either a stationary or portable Socket Fusion Machine, it is important that you follow all safety, maintenance and operational guidelines set forth by the equipment manufacturer.
Fusions done with Socket Fusion Machines follow the same basic fusion preparation steps as those done with hand-held machines. PESTAN recommends that prior to making a system connection, the operator conducts a test fusion to verify that the machine is in proper working order.

Pipe Diameter		Fusion Depth	Heating Time (sec)	Fusion Time (sec)	Cooling Time (min)
N.D. (inches)	O.D. (mm)	Inch (mm)	Above 40°F (5°C)		
½"	20	½" (13mm)	5	4	2
¾"	25	⅝" (16mm)	7	4	2
1"	32	$^{11}/_{16}$" (18mm)	8	6	4
1¼"	40	$^{13}/_{16}$" (20.5mm)	12	6	4
1½"	50	$^{15}/_{16}$" (23.5mm)	18	6	4
2"	63	1 $^{1}/_{16}$" (27.5mm)	24	8	6
2½"	5	1 $^{3}/_{16}$" (30mm)	30	8	8
3"	90	1 $^{5}/_{16}$" (33mm)	40	8	8
4"	125	1 $^{9}/_{16}$" (40mm)	60	10	9

Attention: The fusion plate and heads are extremely hot. Do not forget to use appropriate safety measures.
If fusing in the ambient temperature lower then 40F, please contact our Technical Department for the special instruction.

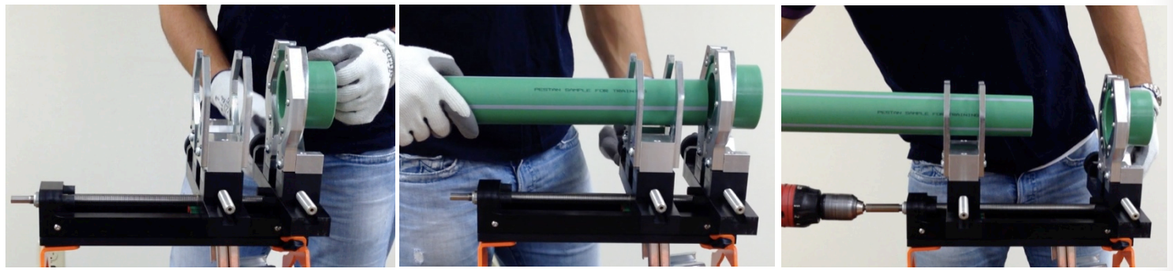
Jig-Assisted Socket Fusion



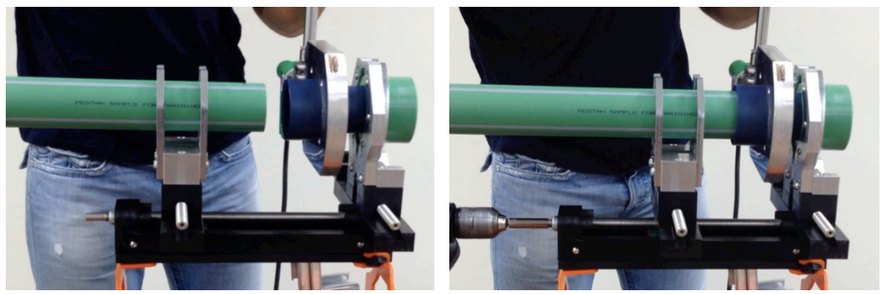
Jig's light and compact design, allows installers to accomplish connections in tight spaces or while working on overhead installations. Furthermore, jigs can be used on the ground as the prefabrication station for uniform and consistent connections.
When performing jig-assisted socket fusion, follow all safety measures and recommendations on page 61.
Verify the fusion heads are compatible with the pipe and fitting size. Install the fusion heads on the heater face.

Plug the fusion tool into the power source and verify the temperature of 480 - 500˚F (248 - 260˚C) has been reached. Cut the pipe to the desired length.
Measure and mark the insertion depth (page 68) on the pipe in multiple points around the pipe O.D.

Place the end of the pipe to be fused in the smaller set of clamping jaws. Make sure that the measured insertion mark is ½" to 1" beyond the edge of the clamping jaws. Place the fitting in the larger jaw flush with the integrated stop rim. Make sure that pipe and fitting are tight enough to prevent movement. Use a drill to move the carriage forward and backward.
NOTE: Do not leave the drill hanging from the jig after use.
In order to check for alignment and proper spacing, advance the carriage forward so that the pipe and fitting are in the proper position for fusion.

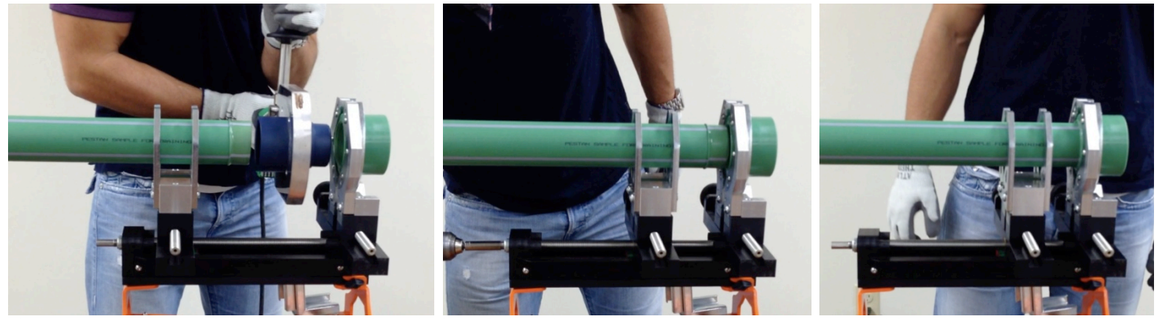


Reverse the carriage, backing the pipe and fitting apart, so that the fusion iron can be inserted between them.
Insert the fusion iron. Advance the carriage forward moving the pipe and fitting into the fusion head. Continue advance until the marked insertion depth is reached. When fusing larger pipe diameters, it is recommended advance the carriage in short bursts, allowing the fusion heads to melt the pipe and the fitting.



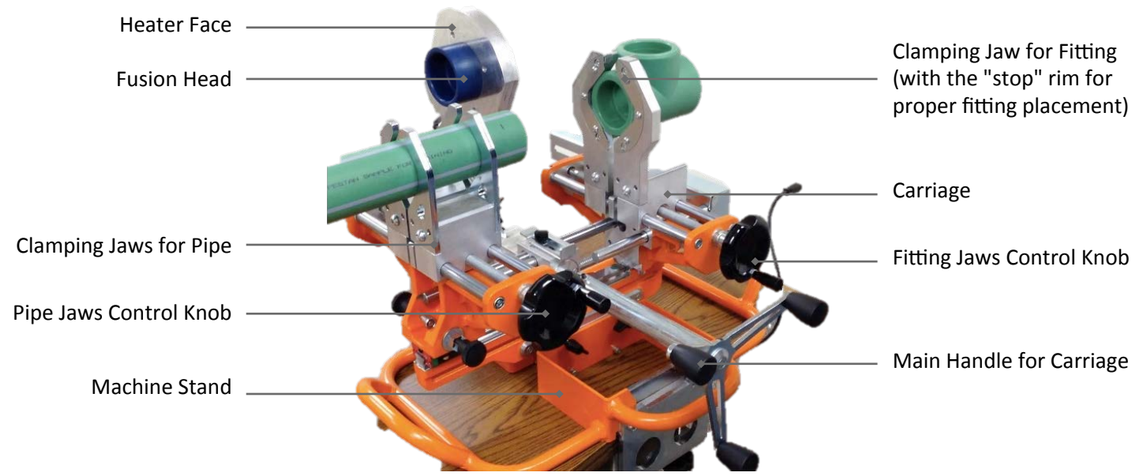
Refer to the table for fusion heating times on page 63. The heating time starts when the pipe and fitting completely inserted in the fusion head.

When the heating time is met, reverse the carriage moving the pipe and fitting away from the fusion iron. When removing the iron, do not twist but pull the iron straight away from the pipe and fitting, being careful not to damage the fusion bead or disturb the melt.
Set the fusion iron back on its stand.
Immediately advance the carriage forward, moving the pipe and fitting together until the pipe is inserted into the fitting. Do not over-insert (stop when the melted beads meet).



The pipe remains in this position until cooled. Refer to the recommended cooling time table on page 64.

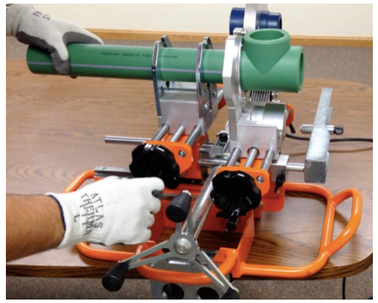
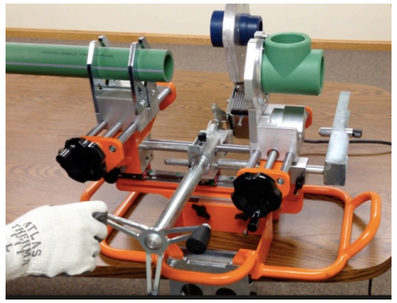
Bench and Portable Fusion Machines



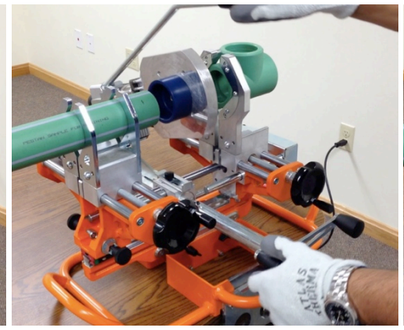
Clear the surrounding area where the fusion machine will be placed and secure the machine to the work surface to assure no movement during fusion.
Verify that the fusion heads match the size of the pipe and fittings. Install the fusion heads on the heater face.
Plug in the fusion tool into the power source and verify the temperature of the fusion heads after it indicates that the desired temperature of 480 - 500˚F (248 - 260˚C) has been reached.

Cut the pipe to the desired length.
Measure and mark the insertion depth (page 68) on the pipe in multiple points around the pipe O.D.. Some types of machines have preset stab depth for each pipe size, reassuring precision and uniformity of each fusion.
Install the clamping jaw inserts on the carriage insuring that you have the proper size for the pipe and fittings to be fused.

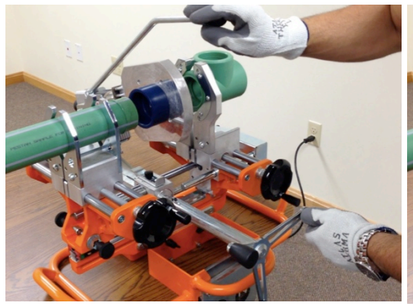
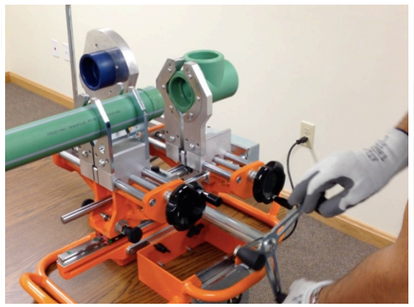
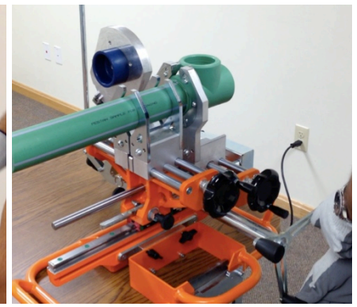
Place the fitting in the clamping jaws and adjust the "stop" to hold the fitting.
Place the pipe in the other clamping jaws but do not tighten.
Turn the main handle to advance the carriage forward so that the pipe and fitting are in the proper position for fusion. Check for alignment and spacing of the pipe and fitting. Once aligned, secure the pipe and fitting in the clamping jaws and use jaw knobs to tighten them enough to prevent slipping.

Using the main handle, reverse the carriage, backing the pipe and fitting apart, making appropriate space for the fusion iron to be inserted between them. Lower the fusion iron to align fusion heads with pipe and fitting.
Advance the carriage forward moving the pipe and fitting to the fusion heads. Continue to advance until the marked insertion depth is reached.
Refer to the table for fusion heating times on page 68. The heating time starts when the pipe and fitting are completely inserted in the fusion head.


When the heating time is met, reverse the carriage moving the pipe and fitting away from the fusion iron. Be careful not to damage the fusion bead or disturb the melt when removing the fusion iron.
Move the fusion iron back to its "resting" position, away from the pipe and fitting.
Immediately advance the carriage forward, moving the pipe and fitting together until the pipe is inserted into the fitting. Be careful not to over-insert. Stop when the melted beads meet. The insertion mark should still be visible. Machines with calibration knobs will prevent over-insertion of the pipe into the fitting.

The pipe remains in this position until cooled. Refer to the recommended cooling time table on page 68.

BUTT FUSION

Butt fusion is used to accomplish connections of 4” or larger pipes and/or fittings. There are many models of butt fusion machines, each designed for specific pipe size range. Some are light weight for use in overhead installations, other are designed to be used on the ground as part of a pre-fabrication station. To insure you have the proper equipment for the job, please consult with PESTAN support or with an approved PESTAN equipment manufacturer.

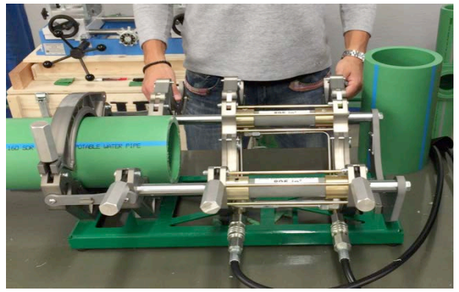
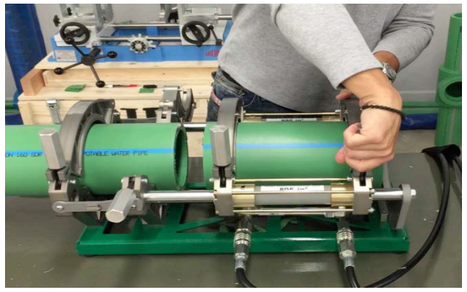
There are two main types of butt fusion machines, Manual and Hydraulic (shown in the photo above). The difference in the two is pressure regulation: one uses manual force, the other uses a hydraulic power unit. The basic principles of fusion is the same for both types of fusion machines.
Before performing butt fusion, read the fusion machine manual. Familiarize yourself with the operation of the fusion machine and follow all safety measures and recommendations.

Verify the sizes of the inserts are compatible with the pipe and/or fitting size. Secure the inserts into the machine clamps. Clean the heating plate with lint free, non-synthetic cloth or paper towel.

Plug the fusion machine and heating plate into the power source and verify the temperature of heating plate reached 410°F (210°C), with maximum variance of +/-15°F. Make sure power supply is sufficient for the machine used. Insufficient power supply can cause cold fusions that will fail. If using extension cords, insure that cord is capable of delivering the required power and that you are within a reasonable distance from the power supply.

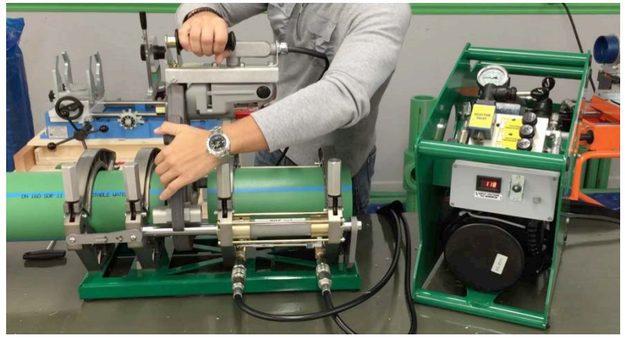
Cut the pipe to the desired length. Make sure to cut as squarely as possible.

Place pipes and/or fitting into the clamps of the fusion machine, leaving approximately 1” from the edge of the pipe to the clamp. Adjust second clamp of the fusion machine to accommodate length of the pipe/fitting. If there is ovality in the pipe/fitting, place the long side vertically, so the clamps help re-round the pipe.

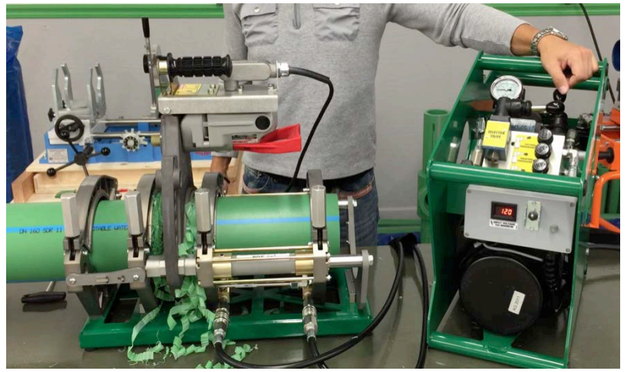



Note: if two pipes are being fused, line up the print lines on both pipes. If print line is not available, line up the stripes on the pipe.

Insert Facer. Make sure facer is not touching the pipe and/or fitting, turn it on and let it reach full speed.



Slowly increase the pressure control valve until carriage with pipes and/or fittings move towards each other and trim until the jaws come in contact with the facer stops.



Note: if facer motor stalls, decrease the pressure.

When trimming is achieved, drive the carriage away from the facer and then turn the facer off.
Remove facer and place it in the holder.

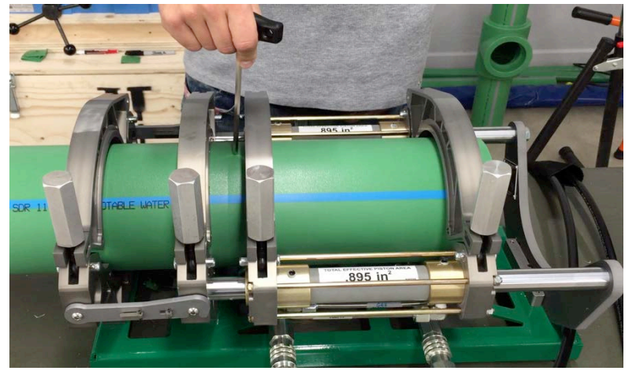
Clear shavings from the pipes and the fusion space. Clean faced ends of the pipe and/or fitting with the lint free non-synthetic cloth or paper towel.

Inspect shavings ribbons for at least one complete ribbon from both ends. This ensures that the pipe faces are clean and parallel.

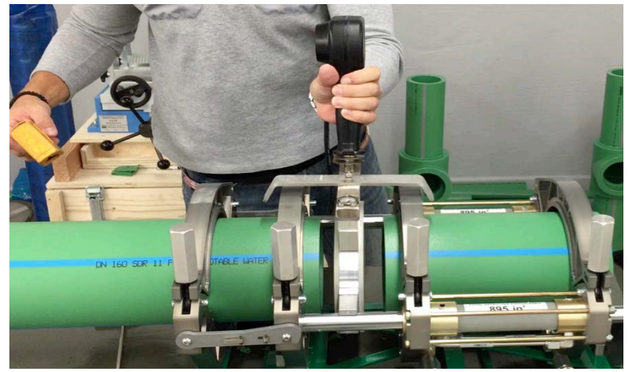
Slowly increase the pressure until the carriage starts moving, then back the pressure down until the carriage is barely moving. This is your Drag Pressure.

Close the carriage, visually check for the vertical alignment of the faced ends. If needed, tighten the inside clamp on the high side to bring ends into the alignment and re-face the pipe.

Note: Pen or other slim flat edged instrument can also be used to check if the ends are vertically aligned.



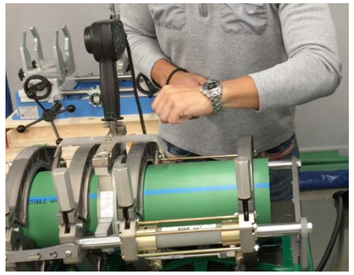
Once facing is completed and both faced ends are aligned, set the Fusion Pressure to recommended pressures depending on the pipe size, wall thickness and machine model. Fusion Pressures can be found in the tables on pages 75-77 or online at www.pestanpipes.com. Bring pipe ends together to insure that pipe doesn't slip in clamps. Open carriage with the space between faced ends with 2-3" gap and insert the heating plate. Bring the faced ends onto the heating plate using the Fusion Pressure.

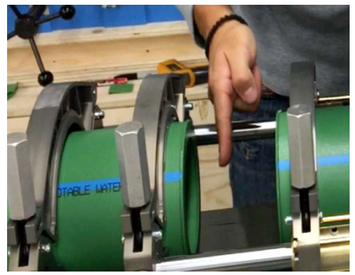


Watch closely for the formation of the beads where the pipe/fitting touches the heating plate. When a thin line of melt appears all the way around the pipe, drop the pressure down to 0 if the machine has locking carriage, otherwise drop the pressure to Drag pressure and start measuring the required Heating Time.

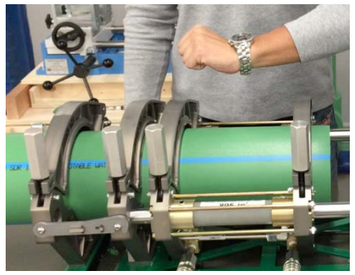
Wait for the entire Heating Time to elapse (Table on pg. 75).
Shift the fusion machine into fusion pressure.
After reaching the proper Heating Time, Open the carriage and carefully remove the heating plate. Quickly (within 3 seconds) inspect heated ends for contamination, concave pipe/fitting face and a consistent melt bead.

After the inspection, use the Fusion Pressure to close the carriage and start the Cooling Time (table below).





Leave the fusion machine running for the entire Cooling Time. Depending on the type of fusion machine you may need to periodically check the pressure gauge, and adjust to keep the required Fusion Pressure.



Note: Do not pour water onto the connecting to shorten the Cooling Time. If both ends of the pipes and/or fittings continues to be supported, then Cooling Times can be reduced by 50%.

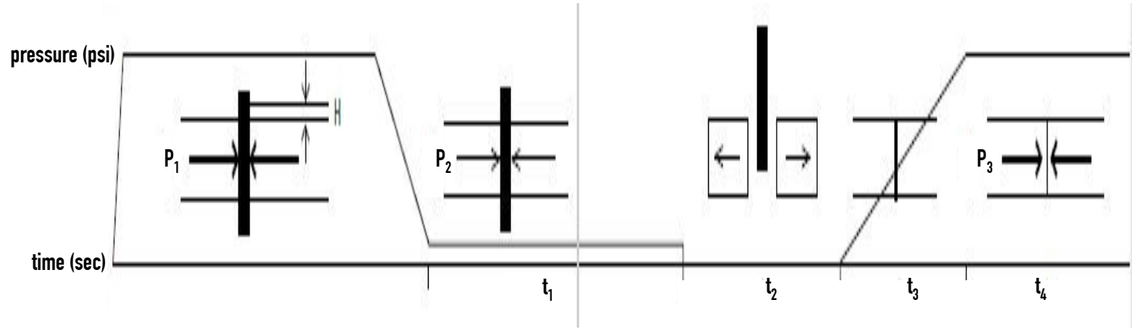
After reaching Cooling Time, bring pressure to 0 and release pipes and or fittings from the clamps.
Inspect the joint for any contamination, uniform bead size, no double-bead formation.

The following table gives the times for the heating phase, fusion phase and cooling phase of a butt fusion. The heating, Fusion and cooling times are based on the size and SDR of the pipe. These values do not change from one fusion machine to the next.

Butt Fusion Heating and Cooling Times

Dimension		Heating Time	Fusion Time		Cooling Time
SDR	ND (OD)	Heating Time (sec) t_1	Max. Transition Time (sec) t_2	Time of Pressure Build-up (sec) t_3	Cooling Time (min) t_4
9	6"(160mm)	315	9	16	28
11	6"(160mm)	277	8	13	24
17.6	6"(160mm)	204	6	9	15
9	8"(200mm)	364	10	19	35
11	8"(200mm)	320	9	16	29
17.6	8"(200mm)	237	7	11	19
9	10"(250mm)	415	12	24	43
11	10"(250mm)	367	10	20	35
17.6	10"(250mm)	272	8	13	23
9	12"(315mm)	471	14	30	53
11	12"(315mm)	412	12	24	44
17.6	12"(315mm)	317	9	16	28

The second table includes that value from some of the commonly available machines in Pestan's systems for quick reference. This data is based on information from the respective manufacturers of these tools. These pressures also depends on the size and SDR of the pipe. When using other fusion machines, the pressures P_1, P_2 and P_3 must be adjusted. Following diagram shows physical meaning of parameters (times and pressures), which are used in first and second table in this section.



Butt Fusion Adjustment and Heating Pressures (psi)
Ritmo machines

Dimension		Adjustment pressure P_1 (psi)		Heating pressure P_2 (psi)	
SDR	ND (OD)	Ritmo Delta Dragon 315B	Ritmo Delta Dragon 355B	Ritmo Delta Dragon 315B	Ritmo Delta Dragon 355B
9	6"(160mm)	189	87	15	15
11	6"(160mm)	160	73	15	0
17.6	6"(160mm)	102	44	15	0
9	8"(200mm)	308	131	29	15
11	8"(200mm)	261	102	29	15
17.6	8"(200mm)	160	73	15	0
9	10"(250mm)	479	203	49	15
11	10"(250mm)	406	160	44	15
17.6	10"(250mm)	261	102	29	15
9	12"(315mm)	753	319	75	29
11	12"(315mm)	638	261	64	29
17.6	12"(315mm)	406	174	44	15

Butt Fusion Adjustment and Heating Pressures (psi)
Widos Machines

Dimension		Adjustment pressure P_1 (psi)					Heating pressure P_2 (psi)				
SDR	ND (OD)	WI 4400	WI 4600	WI 4900	WI 5100& 5500	WI 6100	WI 4400	WI 4600	WI 4900	WI 5100& 5500	WI 6100
9	6” (160mm)	463	222	205			46	22	20		
11	6” (160mm)	392	188	174			40	19	20		
17.6	6” (160mm)	261	131	116			27	15	15		
9	8” (200mm)		342	308	137			35	30	15	
11	8” (200mm)		290	261	116			29	27	15	
17.6	8” (200mm)		188	174	73			20	17	0	
9	10” (250mm)		547	479	205			55	48	20	
11	10” (250mm)		464	406	174			47	40	17	
17.6	10” (250mm)		305	261	116			30	26	15	
9	12” (315mm)			755	326	257			75	33	26
11	12” (315mm)			640	276	218			64	28	22
17.6	12” (315mm)			421	174	145			42	18	15

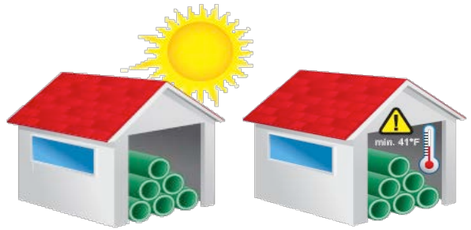
Butt Fusion Adjustment and Heating Pressures (psi)
McElroy Machines

Dimension		Adjustment pressure P_1 (psi)					Heating pressure P_2 (psi)				
SDR	ND (OD)	28 Low Force	Acrobat 160	DM 250 EP	412& 618 Low Force	824& 1236 Low Force	28 Low force	Acrobat 160	DM 250 EP	412& 618 Low Force	824& 1236 Low Force
9	6” (160mm)	110	196	110	58		15	20	15	0	
11	6” (160mm)	93	167	93	49		15	15	15	0	
17.6	6” (160mm)	60	108	60	32		0	15	0	0	
9	8” (200mm)	171		171	91	31	15		15	15	0
11	8” (200mm)	145		145	77	26	15		15	0	0
17.6	8” (200mm)	94		94	50	17	0		15	0	0
9	10” (250mm)			257	141	47			25	15	0
11	10” (250mm)			218	120	40			25	15	0
17.6	10” (250mm)			142	78	26			15	0	0
9	12” (315mm)				225	74				25	0
11	12” (315mm)				191	63				25	0
17.6	12” (315mm)				124	41				15	0

SHIPPING, STORAGE AND HANDLING

Shipping

It is the customer’s responsibility to verify the product against the packing slip and visually inspect it for damage. Variations in the shipment or any damaged product should be documented and reported to the Distributor.



Storage

PP-R(CT) pipe is shipped in 13’ and 19’ straight lengths which are packaged in plastic bags that help protect it from UV exposure and keep it clean. We recommend that the pipes remain in their protective packaging until ready for use.

The pipe should be stored on a flat surface. If storing the pipe on racks, it should have a minimum of four evenly spaced supports. We recommend you place plywood or a similar form of backing across the supports to prevent the pipe from deforming. Maximum stacking height for the pipe is 3ft.

Indoor storage of PP-R(CT) pipe is recommended. Avoid storage in areas where solvents, paints, glue or similar products are kept.

If stored outside for an extended period, keep the pipes in their UV Resistant bags and place them in a shaded area. If you are storing the pipe outside but covering them, use a light colored tarp. Black tarp is not recommended as it can cause heat damage. The warranty will be voided if the pipes are exposed to UV radiation for more than 6 months.

Handling

Proper handling of the pipe is necessary to prevent damage. By following a few precautions, you can insure the integrity of your system.

1. Protect the ends of the pipe. Dropping them on a hard surface or stepping on them can cause micro-fractures in the pipe wall.
2. If the pipe is dropped or crushed, check it for damage. Damages should be identified, marked and eliminated.
3. Cold weather makes the pipe less flexible and more susceptible to impact damage. Use caution when handling in cold temperature. Handling of PP-R(CT) products is not recommended in temperatures below -5°F.
4. Use caution when using a forklift to move the pipe. Do not drape the pipe over the fork. Instead, place the pipe on a pallet for support and then transport. When handling larger diameter pipes, do not insert the forks into the end of the pipe.
5. When shipping, load on a flat or supported surface and only strap in supported areas to prevent pipe deformation.
6. Keep the fittings in their original bags for ease of identification.

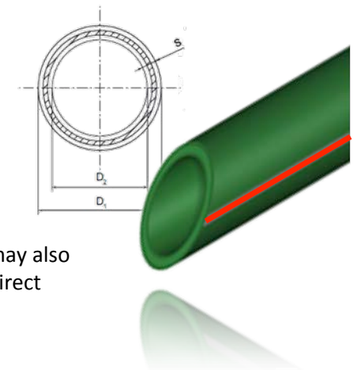
Section 7

DOMESTIC PIPE
MECHANICAL PIPE
PURPLE PIPE
FITTINGS
FLANGES
VALVES
CLAMPS

PESTAN Product List

HOT DRINKING WATER PIPE

Material: PP-RCT with Fiber Composite Layer



Identification: SDR7.4 and SDR9 Green with 4 red stripes.

Applications: The pipe is designed for Potable Hot Water and Food Processing Applications, but, because it has composite middle layer, it may also be used for heating and cooling systems, compressed air and vacuum, direct burial, industrial, geothermal and chemical** applications.

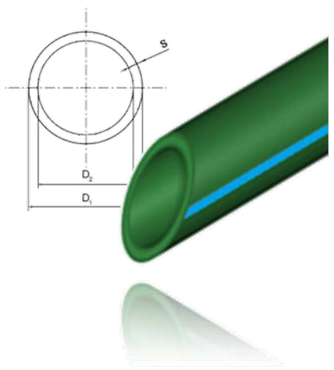
In compliance to: NSF/ANSI -61, NSF/ANSI -51, NSF/ANSI -14, CSA-B137.11, ASTM F 2389, ISO 15874, DIN 8077-8078, UPC, CPC, IPC®, IRC®, NPC; ICC-ES PMG – 1106, IAMPO 3538

	Part Number [CODE]	Dimension N.D. - O.D. [in -mm]	Outer Diameter, D_1 [mm]	[in]	Inner Diameter, D_2 [mm]	[in]	Wall Thickness, s [mm]	[in]	Pipe Length [ft]	Weight [lb/ft]	Number of Items in the Bag
SDR 7.4	18002300	½" - 20	20	0.79	14.4	0.57	2.8	0.11	13	0.12	25
	18002301	¾" - 25	25	0.98	18.0	0.71	3.5	0.14	13	0.17	20
SDR 9	18002302	1" - 32	32	1.26	24.8	0.98	3.6	0.14	13	0.22	14
	18002303	1¼" - 40	40	1.58	31.0	1.22	4.5	0.18	13	0.34	10
	18002304	1½" - 50	50	1.97	38.8	1.53	5.6	0.22	13	0.53	8
	18002305	2" - 63	63	2.48	48.8	1.92	7.1	0.28	13	0.85	5
	18002306	2½" - 75	75	2.95	58.2	2.29	8.4	0.33	19	1.19	3
	18002307	3" - 90	90	3.54	69.8	2.75	10.1	0.40	19	1.72	2
	18002308	4" - 125	125	4.92	97.0	3.82	14	0.55	19	3.28	1
	18002309	6" - 160	160	6.30	124.2	4.90	17.9	0.71	19	5.37	1
	18002310	8" - 200	200	7.87	155.2	6.11	22.4	0.88	19	8.39	1
	18002311	10" - 250	250	9.84	194.2	7.65	27.9	1.10	19	13.05	1
	18002312	12" - 315	315	12.40	244.6	9.63	35.2	1.39	19	20.75	1

**Note: for information on chemical resistance properties of PESTAN PP-R and PP-RCT product, please contact our Technical Department.

COLD DRINKING WATER PIPE

Material: PP-RCT



Identification: SDR7.4 and SDR11 Green with 4 blue stripes.

Applications: The pipe is designed for Cold Potable Water and Food Processing applications. But it may also be used for other lower pressure and lower temperature applications.

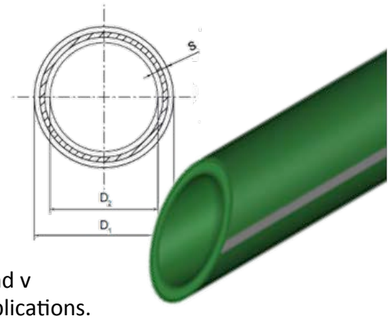
In accordance to: NSF/ANSI -61, NSF/ANSI -51, NSF/ANSI -14, CSA-B137.11, ASTM F 2389, ISO 15874, DIN 8077-8078, UPC, CPC, IPC®, IRC®, NPC; ICC-ES PMG – 1106, IAMPO 3538

	Part Number [CODE]	Dimension N.D. - O.D. [in -mm]	Outer Diameter, D_1 [mm]	[in]	Inner Diameter, D_2 [mm]	[in]	Wall Thickness, s [mm]	[in]	Pipe Length [ft]	Weight [lb/ft]	Number of Items in the Bag
SDR 7.4	18002400	½" - 20	20	0.79	14.4	0.57	2.8	0.11	13	0.10	25
	18002401	¾" - 25	25	0.98	18.0	0.71	3.5	0.14	13	0.16	20
SDR 11	18002402	1" - 32	32	1.26	26.2	1.03	2.9	0.11	13	0.18	14
	18002403	1¼" - 40	40	1.58	32.6	1.28	3.7	0.15	13	0.28	10
	18002404	1½" - 50	50	1.97	40.8	1.61	4.6	0.18	13	0.43	8
	18002405	2" - 63	63	2.48	51.4	2.02	5.8	0.23	13	0.68	5
	18002406	2½" - 75	75	2.95	61.4	2.42	6.8	0.27	19	0.95	3
	18002407	3" - 90	90	3.54	73.6	2.90	8.2	0.32	19	1.36	2
	18002408	4" - 125	125	4.92	102.2	4.02	11.4	0.45	19	2.63	1
	18002409	6" - 160	160	6.30	130.9	5.15	14.6	0.58	19	4.30	1
	18002410	8" - 200	200	7.87	163.6	6.43	18.2	0.72	19	6.71	1
	18002411	10" - 250	250	9.84	204.6	8.06	22.7	0.89	19	10.44	1
	18002412	12" - 315	315	12.40	257.8	10.15	28.6	1.13	19	16.56	1

**Note: for information on chemical resistance properties of PESTAN PP-R and PP-RCT product, please contact our Technical Department.

MECHANICAL PIPE

Material: PP-RCT with Fiber Composite Layer



Identification: SDR7.4 and SDR9 Green with 4 grey stripes.
SDR11 & SDR17.6 Solid Green

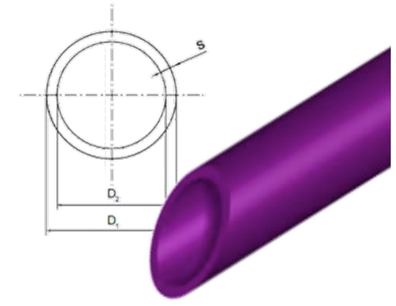
Applications: Heating and cooling systems, compressed air and v acuum, direct burial, industrial, geothermal and chemical applications.

In accordance with following standards: NSF/ANSI -14, CSA-B137.11, ASTM F 2389, ISO 15874, DIN 8077-8078, UMC, CMC, IMC®; ICC-ES PMG – 1106, IAMPO 3538

	Part Number [CODE]	Dimension N.D. - O.D. [in -mm]	Outer Diameter, D_1 [mm]	[in]	Inner Diameter, D_2 [mm]	[in]	Wall Thickness, s [mm]	[in]	Pipe Length [ft]	Weight [lb/ft]	# of Items in the Bag
SDR 7.4	18002150	½" - 20	20	0.79	14.4	0.57	2.8	0.11	13	0.11	25
	18002151	¾" - 25	25	0.98	18	0.71	3.5	0.14	13	0.17	20
SDR 9	18002170	1" - 32	32	1.26	24.8	0.98	3.6	0.14	13	0.22	14
	18002171	1¼" - 40	40	1.58	31	1.22	4.5	0.18	13	0.34	10
	18002172	1½" - 50	50	1.97	38.8	1.53	5.6	0.22	13	0.53	8
	18002173	2" - 63	63	2.48	48.8	1.92	7.1	0.28	13	0.85	5
	18002174	2½" - 75	75	2.95	58.2	2.29	8.4	0.33	13	1.19	3
	18002175	3” - 90	90	3.54	69.8	2.75	10.1	0.40	13	1.72	2
	18002177	4" - 125	125	4.92	97	3.82	14	0.55	13	3.28	1
	18002180	6" - 160	160	6.30	124.2	4.90	17.9	0.71	13	5.37	1
	18002182	6" - 160	160	6.30	124.2	4.90	17.9	0.71	19	5.37	1
	18002181	8" - 200	200	7.87	155.2	6.11	22.4	0.88	19	8.39	1
	18002183	10" - 250	250	9.84	194.2	7.65	27.9	1.10	19	13.05	1
	18002184	12" - 315	315	12.40	244.6	9.63	35.2	1.39	19	20.75	1
SDR 11	18002190	1" - 32	32	1.26	26.2	1.03	2.9	0.11	13	0.19	14
	18002191	1 ¼" - 40	40	1.58	32.6	1.28	3.7	0.15	13	0.29	10
	18002192	1½" - 50	50	1.97	40.8	1.61	4.6	0.18	13	0.45	8
	18002193	2" - 63	63	2.48	51.4	2.02	5.8	0.23	13	0.72	5
	18002194	2½" - 75	75	2.95	61.4	2.42	6.8	0.27	13	1.00	3
	18002195	3" - 90	90	3.54	73.6	2.90	8.2	0.32	13	1.44	2
	18002197	4" - 125	125	4.92	102.2	4.02	11.4	0.45	13	2.77	1
	18002198	6" - 160	160	6.30	130.9	5.15	14.6	0.58	13	4.52	1
	18002200	6" - 160	160	6.30	130.9	5.15	14.6	0.58	19	4.52	1
	18002199	8" - 200	200	7.87	163.4	6.43	18.3	0.72	19	7.04	1
	18002185	10" - 250	250	9.84	204.6	8.06	22.7	0.89	19	10.95	1
	18002186	12" - 315	315	12.40	257.8	10.15	28.6	1.13	19	17.26	1
SDR 17.6	18002160	4" - 125	125	4.92	110.8	4.36	7.1	0.28	19	1.80	1
	18002161	6" - 160	160	4.92	141.8	5.58	9.1	0.36	19	2.93	1
	18002162	8" - 200	200	7.87	177.2	6.98	11.4	0.45	19	4.57	1
	18002163	10" - 250	250	9.84	221.6	8.72	14.2	0.56	19	7.11	1
	18002164	12" - 315	315	12.40	279.2	10.99	17.9	0.71	19	11.25	1

PURPLE PIPE

Material: PP-R(100)



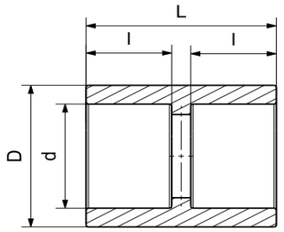
Identification: Purple.

Applications: For collection and transportation of rain, gray, recycled and reclaimed water systems, irrigation and direct buri al.

In accordance with following standards: NSF/ANSI -14, CSA - B137.11, ASTM F 2389, ISO 15874, DIN 8077-8078, UPC, CPC, IPC®, IRC®, NPC; ICC-ES PMG – 1106, IAMPO 3538

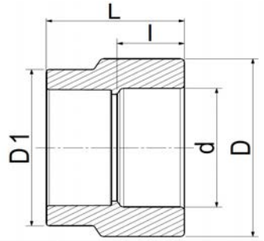
	Part Number [CODE]	Dimension N.D. - O.D. [in -mm]	Outer Diameter, D_1 [mm]	[in]	Inner Diameter, D_2 [mm]	[in]	Wall Thickness, s [mm]	[in]	Pipe Length [ft]	Weight [lb/pc]	# of Items in the Bag
SDR 7.4	18002202	½" - 20	20	0.79	14.4	0.57	2.8	0.11	13	0.10	25
	18002201	¾" - 25	25	0.98	18	0.71	3.5	0.14	13	0.16	20
SDR 11	18002250	1" - 32	32	1.26	26.2	1.03	2.9	0.11	13	0.18	14
	18002251	1¼" - 40	40	1.58	32.6	1.28	3.7	0.15	13	0.28	10
	18002252	1½" - 50	50	1.97	40.8	1.61	4.6	0.18	13	0.43	8
	18002253	2" - 63	63	2.48	51.4	2.02	5.8	0.23	13	0.68	5
	18002254	2½" - 75	75	2.95	61.4	2.42	6.8	0.27	19	0.95	3
	18002255	3" - 90	90	3.54	73.6	2.90	8.2	0.32	19	1.36	2
	18002257	4" - 125	125	4.92	102.2	4.02	11.4	0.45	19	2.63	1
	18002260	6" - 160	160	6.30	130.9	5.15	14.6	0.58	19	4.29	1
	18002261	8" - 200	200	7.87	163.6	6.43	18.2	0.72	19	6.71	1
	18002262	10" - 250	250	9.84	204.6	8.06	22.7	0.89	19	10.42	1

COUPLING
(socket fusion)



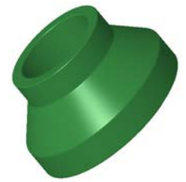
Part Number	ND - OD	d (in)	D (in)	l (in)	L (in)	Weight (lb)
18000001	½" - 20 mm	0.79	1.10	0.63	1.42	0.03
18000002	¾" - 25 mm	0.99	1.34	0.71	1.56	0.04
18000003	1" - 32 mm	1.26	1.77	0.79	1.57	0.07
18000004	1¼" - 40 mm	1.58	2.24	0.85	1.81	0.13
18000005	1½" - 50 mm	1.97	2.74	0.99	2.07	0.20
18000006	2" - 63 mm	2.48	3.43	1.14	2.52	0.38
18000007	2½" - 75 mm	2.96	3.94	1.22	2.62	0.45
18000008	3" - 90 mm	3.55	4.76	1.32	2.95	0.86
18000010	4" - 125 mm	4.93	6.54	1.65	3.39	1.83

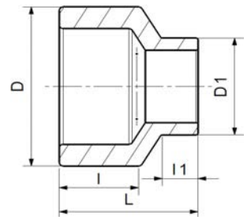
BUSHING / REDUCER
(socket fusion)



Part Number	ND - OD	D1 (in)	d (in)	D (in)	l (in)	L (in)	Weight (lb)
18000030	¾" to ½" - 25 to 20 mm	0.99	0.79	1.02	0.57	1.54	0.02
18000031	1" to ½" - 32 to 20 mm	1.26	0.79	1.34	0.69	1.63	0.05
18000032	1" to ¾" - 32 to 25 mm	1.26	0.99	1.34	0.69	1.63	0.04
18000033	1¼" to ½" - 40 to 20 mm	1.58	0.79	1.05	0.57	1.50	0.04
18000034	1¼" to ¾" - 40 to 25 mm	1.58	0.99	1.29	0.63	1.52	0.04
18000035	1¼" to 1" - 40 to 32 mm	1.58	1.26	1.73	0.75	1.88	0.08
18000037	1½" to ¾" - 50 to 25 mm	1.97	0.99	1.29	0.63	1.57	0.08
18000038	1½" to 1" - 50 to 32 mm	1.97	1.26	1.65	0.71	1.58	0.08
18000039	1½" to 1¼" - 50 to 40 mm	1.97	1.58	2.19	0.85	1.85	0.12
18000041	2" to ¾" - 63 to 25 mm	2.48	0.99	1.36	0.65	2.56	0.19
18000042	2" to 1" - 63 to 32 mm	2.48	1.26	1.71	0.73	2.44	0.19
18000043	2" to 1¼" - 63 to 40 mm	2.48	1.58	0.00	0.86	2.56	0.19
18000044	2" to 1½" - 63 to 50 mm	2.48	1.97	2.72	0.94	2.18	0.22
18000045	2½" to 1¼" - 75 to 40 mm	2.96	1.58	2.05	0.81	1.94	0.22
18000046	2½" to 1½" - 75 to 50 mm	2.96	1.97	2.59	0.93	1.96	0.23
18000047	2½" to 2" - 75 to 63 mm	2.96	2.48	3.43	1.08	2.62	0.40
18000048	2½" to ½" - 75 to 20 mm	2.96	0.79	1.02	0.57	1.77	0.21
18000049	2½" to ¾" - 75 to 25 mm	2.96	0.99	1.29	0.63	1.94	0.22
18000050	2½" to 1" - 75 to 32 mm	2.96	1.26	1.65	0.71	1.93	0.22
18000051	3" to 1½" - 90 to 50 mm	3.55	1.97	2.59	0.93	2.13	0.35
18000052	3" to 2" - 90 to 63 mm	3.55	2.48	3.26	1.08	2.17	0.36
18000053	3" to 2½" - 90 to 75 mm	3.55	2.96	4.13	1.22	3.03	0.70
18000056	4" to 2½" - 125 to 75 mm	4.93	2.96	3.91	1.18	2.55	0.82
18000057	4" to 3" - 125 to 90 mm	4.93	3.55	4.70	1.30	2.76	0.89
18000058	6" to 4" - 160 to 125 mm SDR9	6.30	4.88	6.53	1.58	3.35	1.60
18000059	6" to 4" - 160 to 125 mm SDR11	6.30	5.15	6.53	1.58	3.35	1.49
18000054	6" to 4" - 160 to 125 mm SDR17.6	6.30	5.58	6.53	1.58	3.35	1.39

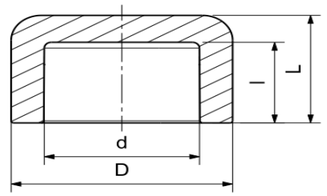
BUSHING / REDUCER
(butt welded)





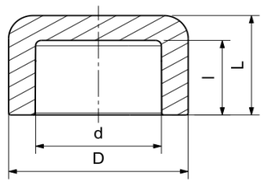
Part Number	ND - OD	D (in)	l (in)	D1 (in)	l1 (in)	L (in)	Weight (lb)
18000060	8" to 4" - 200 to 125 mm (SDR9)	7.87	1.54	4.92	1.54	4.98	2.50
18000061	8" to 4" - 200 to 125 mm (SDR11)	7.87	1.54	4.92	1.54	4.98	2.21
18000065	8" to 4" - 200 to 125 mm (SDR17.6)	7.87	1.54	4.92	1.54	4.98	1.52
18000062	8" to 6" - 200 to 160 mm (SDR9)	7.87	1.54	6.30	1.46	4.07	2.44
18000063	8" to 6" - 200 to 160 mm (SDR11)	7.87	1.54	6.30	1.46	4.07	2.11
18000064	8" to 6" - 200 to 160 mm (SDR17.6)	7.87	1.54	6.30	1.46	4.07	1.39
18000087	10" to 6" - 250 to 160 mm (SDR9)	9.84	1.65	6.30	1.46	5.37	4.48
18000066	10" to 6" - 250 to 160 mm (SDR11)	9.84	1.65	6.30	1.46	5.37	4.03
18000067	10" to 6" - 250 to 160 mm (SDR17.6)	9.84	1.65	6.30	1.46	5.37	2.67
18000068	10" to 8" - 250 to 200 mm (SDR9)	9.84	1.65	7.87	1.46	4.43	4.15
18000069	10" to 8" - 250 to 200 mm (SDR11)	9.84	1.65	7.87	1.46	4.43	3.64
18000080	10" to 8" - 250 to 200 mm (SDR17.6)	9.84	1.65	7.87	1.46	4.43	2.39
18000081	12" to 10" - 315 to 200 mm (SDR9)	12.40	1.81	7.87	1.54	6.19	8.24
18000082	12" to 8" - 315 to 200 mm (SDR11)	12.40	1.81	7.87	1.54	6.19	7.46
18000083	12" to 8" - 315 to 200 mm (SDR17.6)	12.40	1.81	7.87	1.54	6.19	4.95
18000084	12" to 10" - 315 to 250 mm (SDR9)	12.40	1.81	9.84	1.54	5.02	7.49
18000085	12" to 10" - 315 to 250 mm (SDR11)	12.40	1.81	9.84	1.54	5.02	6.59
18000086	12" to 10" - 315 to 250 mm (SDR17.6)	12.40	1.81	9.84	1.54	5.02	4.34

END CAP
(socket fusion)



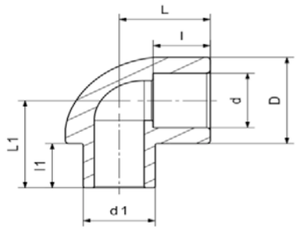
Part Number	ND - OD	d (in)	D (in)	l (in)	L (in)	Weight (lb)
18000250	½" - 20 mm	0.79	1.08	0.61	0.75	0.01
18000251	¾" - 25 mm	0.99	1.35	0.67	0.85	0.03
18000252	1" - 32 mm	1.26	1.74	0.77	1.04	0.05
18000253	1¼" - 40 mm	1.58	2.24	0.83	1.36	0.12
18000254	1½" - 50 mm	1.97	2.74	0.94	1.35	0.18
18000255	2" - 63 mm	2.48	3.43	1.13	1.65	0.33
18000256	2½" - 75 mm	2.96	3.91	1.18	1.99	0.49
18000257	3" - 90 mm	3.55	4.70	1.30	2.28	0.80
18000259	4"-125 mm	4.93	6.54	1.58	3.01	2.04

END CAP
(butt fusion)



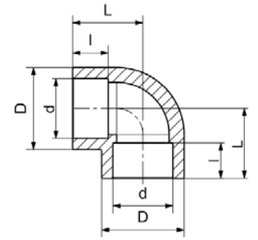
Part Number	ND - OD	D (in)	d (in)	L (in)	l (in)	Weight (lb)
18000260	6"-160 mm SDR9	6.30	4.90	2.92	1.69	1.67
18000261	6"-160 mm SDR11	6.30	5.15	2.92	1.65	1.58
18002520	6"-160 mm SDR17.6	6.30	5.58	2.92	1.65	1.36
18000262	8"-200 mm SDR9	7.87	6.09	4.35	3.20	3.65
18000263	8"-200 mm SDR11	7.87	6.42	4.35	3.20	3.30
18000264	8"-200 mm SDR17.6	7.87	6.95	4.35	3.10	2.70
18000265	10"-250 mm SDR9	9.84	7.65	4.48	3.03	6.05
18000266	10"-250 mm SDR11	9.84	8.06	4.48	3.00	5.56
18000267	10"-250 mm SDR17.6	9.84	8.72	4.48	2.91	4.68
18000268	12"-315 mm SDR9	12.40	9.63	4.68	2.81	10.40
18000269	12"-315 mm SDR11	12.40	10.15	4.68	2.75	9.67
18000092	12"-315 mm SDR17.6	12.40	10.99	4.68	2.65	8.37

STREET 90°
(socket fusion)



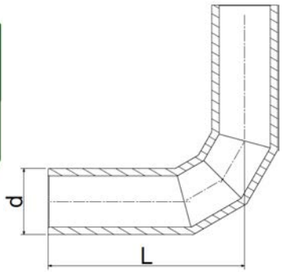
Part Number	ND - OD	d (in)	D (in)	d1 (in)	l (in)	L (in)	l1 (in)	L1 (in)	Weight (lb)
18000100	½" - 20 mm	0.79	1.19	0.79	0.62	1.04	0.62	1.34	0.05
18000101	¾" - 25 mm	0.99	1.28	0.99	0.65	1.00	0.49	1.13	0.05
18000102	1" - 32 mm	1.26	1.65	1.26	0.73	1.21	0.58	1.40	0.10

ELBOW 90°
(socket fusion)



Part Number	ND - OD	d (in)	D (in)	l (in)	L (in)	Weight (lb)
18000070	½" - 20 mm	0.79	1.10	0.62	1.02	0.03
18000071	¾" - 25 mm	0.99	1.35	0.68	1.24	0.07
18000072	1" - 32 mm	1.26	1.77	0.75	1.42	0.13
18000073	1¼" - 40 mm	1.58	2.09	0.81	1.61	0.17
18000074	1½" - 50 mm	1.97	2.68	0.95	2.61	0.40
18000075	2" - 63 mm	2.48	3.35	1.12	2.50	0.77
18000076	2½" - 75 mm	2.96	3.96	1.22	2.72	1.03
18000077	3" - 90 mm	3.55	4.77	1.38	3.23	1.84
18000079	4" - 125 mm	4.93	6.54	1.58	4.07	4.25

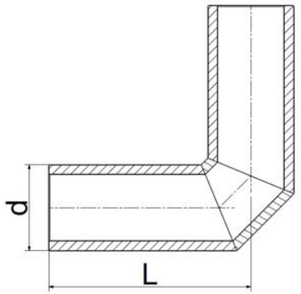
ELBOW 90°
Fabricated
(butt fusion)



Part Number	ND - OD	d (in)	L (in)	Weight (lb)
18000116	6"-160 mm (POTABLE COLD SDR11)	6.30	19.24	12.58
18000114	6"-160 mm (POTABLE HOT SDR9)	6.30	19.24	15.15
18000110	6"-160 mm (MECHANICAL SDR9)	6.30	19.24	15.15
18000112	6"-160 mm (MECHANICAL SDR11)	6.30	19.24	12.58
18000078	6"-160 mm (MECHANICAL SDR17.6)	6.30	19.24	8.47
18000117	8"-200 mm (POTABLE COLD SDR11)	7.88	20.00	20.14
18000115	8"-200 mm (POTABLE HOT SDR9)	7.88	20.00	23.90
18000111	8"-200 mm (MECHANICAL SDR9)	7.88	20.00	23.90
18000113	8"-200 mm (MECHANICAL SDR11)	7.88	20.00	20.14
18000118	8"-200 mm (MECHANICAL SDR17.6)	7.88	20.00	13.34
18000108	10"-250 mm (POTABLE COLD SDR11)	9.85	22.00	35.50
18000109	10"-250 mm (POTABLE HOT SDR9)	9.85	22.00	42.10
18000105	10"-250 mm (MECHANICAL SDR9)	9.85	22.00	42.10
18000106	10"-250 mm (MECHANICAL SDR11)	9.85	22.00	35.50
18000107	10"-250 mm (MECHANICAL SDR17.6)	9.85	22.00	23.50
18000090	12"-315 mm (POTABLE COLD SDR11)	12.40	25.00	64.22
18000091	12"-315 mm (POTABLE HOT SDR9)	12.40	25.00	76.59
18000088	12"-315 mm (MECHANICAL SDR9)	12.40	25.00	76.59
18000119	12"-315 mm (MECHANICAL SDR11)	12.40	25.00	64.22
18000089	12"-315 mm (MECHANICAL SDR17.6)	12.40	25.00	42.04

ELBOW 90°

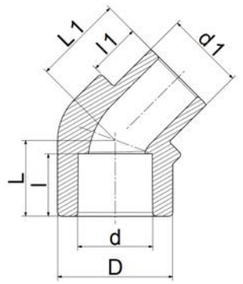
SHORT RADIUS
Fabricated
(butt fusion)



Part Number	ND - OD	d (in)	L (in)	Weight (lb)
18000126	6"-160 mm (POTABLE COLD SDR11)	6.30	11.04	6.98
18000124	6"-160 mm (POTABLE HOT SDR9)	6.30	11.04	8.40
18000120	6"-160 mm (MECHANICAL SDR9)	6.30	11.04	8.40
18000122	6"-160 mm (MECHANICAL SDR11)	6.30	11.04	6.98
18002450	6"-160 mm (MECHANICAL SDR17.6)	6.30	11.04	4.70
18000127	8"-200 mm (POTABLE COLD SDR11)	7.88	16.00	16.45
18000125	8"-200 mm (POTABLE HOT SDR9)	7.88	16.00	19.51
18000121	8"-200 mm (MECHANICAL SDR9)	7.88	16.00	19.51
18000123	8"-200 mm (MECHANICAL SDR11)	7.88	16.00	16.45
18000128	8"-200 mm (MECHANICAL SDR17.6)	7.88	16.00	10.89
18000129	10"-250 mm (POTABLE COLD SDR11)	9.85	19.00	30.96
18000140	10"-250 mm (POTABLE HOT SDR9)	9.85	19.00	36.72
18000141	10"-250 mm (MECHANICAL SDR9)	9.85	19.00	36.72
18000142	10"-250 mm (MECHANICAL SDR11)	9.85	19.00	30.96
18000143	10"-250 mm (MECHANICAL SDR17.6)	9.85	19.00	20.50
18000144	12"-315 mm (POTABLE COLD SDR11)	12.40	22.00	56.90
18000145	12"-315 mm (POTABLE HOT SDR9)	12.40	22.00	67.85
18000146	12"-315 mm (MECHANICAL SDR9)	12.40	22.00	67.85
18000147	12"-315 mm (MECHANICAL SDR11)	12.40	22.00	56.90
18000148	12"-315 mm (MECHANICAL SDR17.6)	12.40	22.00	37.24

STREET 45°

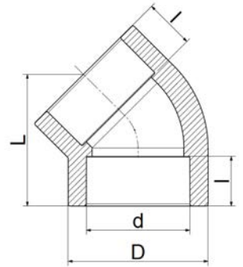
(socket fusion)



Part Number	ND - OD	d (in)	D (in)	d1 (in)	l (in)	L (in)	l1 (in)	L1 (in)	Weight (lb)
18000150	½" - 20 mm	0.79	1.03	0.79	0.57	0.72	0.43	0.76	0.02
18000151	¾" - 25 mm	0.99	1.28	0.99	0.67	0.81	0.49	0.89	0.04
18000152	1" - 32 mm	1.26	1.65	1.26	0.72	0.93	0.58	1.10	0.08

ELBOW 45°

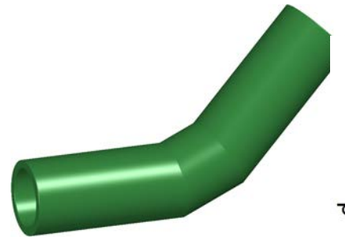
(socket fusion)

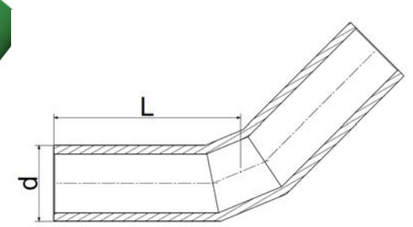


Part Number	ND - OD	d (in)	D (in)	l (in)	L (in)	Weight (lb)
18000130	½" - 20 mm	0.79	1.10	0.61	1.43	0.03
18000131	¾" - 25 mm	0.99	1.33	0.67	1.58	0.04
18000132	1" - 32 mm	1.26	1.69	0.79	1.87	0.08
18000133	1¼" - 40 mm	1.58	2.24	0.87	2.13	0.18
18000134	1½" - 50 mm	1.97	2.59	0.93	2.45	0.26
18000135	2" - 63 mm	2.48	3.26	1.08	2.81	0.45
18000136	2½" - 75 mm	2.96	3.91	1.18	3.17	0.74
18000137	3" - 90 mm	3.55	4.70	1.30	3.61	1.22
18000139	4" - 125 mm	4.93	6.54	1.58	4.63	3.05

ELBOW 45°

Fabricated
(butt fusion)

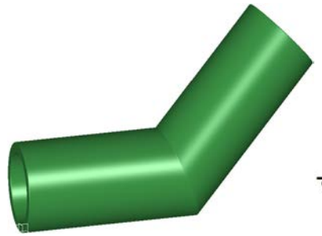


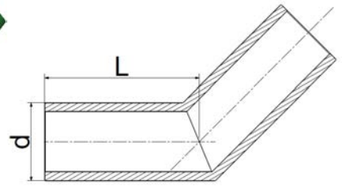


Part Number	ND - OD	d (in)	L (in)	Weight (lb)
18000166	6"-160 mm (POTABLE COLD SDR11)	6.30	9.95	7.01
18000164	6"-160 mm (POTABLE HOT SDR9)	6.30	9.95	8.43
18000160	6"-160 mm (MECHANICAL SDR9)	6.30	9.95	8.43
18000162	6"-160 mm (MECHANICAL SDR11)	6.30	9.95	7.01
18002460	6"-160 mm (MECHANICAL SDR17.6)	6.30	9.95	4.72
18000167	8"-200 mm (POTABLE COLD SDR11)	7.88	17.50	19.72
18000165	8"-200 mm (POTABLE HOT SDR9)	7.88	17.50	23.38
18000161	8"-200 mm (MECHANICAL SDR9)	7.88	17.50	23.38
18000163	8"-200 mm (MECHANICAL SDR11)	7.88	17.50	19.72
18000168	8"-200 mm (MECHANICAL SDR17.6)	7.88	17.50	13.06
18000180	10"-250 mm (POTABLE COLD SDR11)	9.85	15.00	26.56
18000181	10"-250 mm (POTABLE HOT SDR9)	9.85	15.10	31.50
18000182	10"-250 mm (MECHANICAL SDR9)	9.85	15.10	31.50
18000183	10"-250 mm (MECHANICAL SDR11)	9.85	15.10	26.56
18000184	10"-250 mm (MECHANICAL SDR17.6)	9.85	15.10	17.59
18000185	12"-315 mm (POTABLE COLD SDR11)	12.40	17.60	48.98
18000186	12"-315 mm (POTABLE HOT SDR9)	12.40	17.60	58.42
18000187	12"-315 mm (MECHANICAL SDR9)	12.40	17.60	58.42
18000188	12"-315 mm (MECHANICAL SDR11)	12.40	17.60	48.98
18000189	12"-315 mm (MECHANICAL SDR17.6)	12.40	17.60	32.06

ELBOW 45°

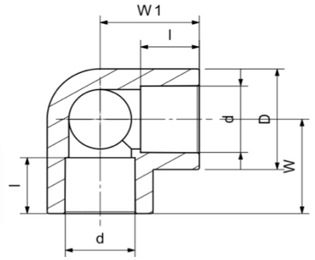
SHORT RADIUS
Fabricated
(butt fusion)





Part Number	ND - OD	d (in)	L (in)	Weight (lb)
18000196	6"-160 mm (POTABLE COLD SDR11)	6.30	7.52	5.39
18000194	6"-160 mm (POTABLE HOT SDR9)	6.30	7.52	6.48
18000190	6"-160 mm (MECHANICAL SDR9)	6.30	7.52	6.48
18000192	6"-160 mm (MECHANICAL SDR11)	6.30	7.52	5.39
18002470	6"-160 mm (MECHANICAL SDR17.6)	6.30	7.52	3.63
18000197	8"-200 mm (POTABLE COLD SDR11)	7.88	12.10	13.98
18000195	8"-200 mm (POTABLE HOT SDR9)	7.88	12.10	16.58
18000191	8"-200 mm (MECHANICAL SDR9)	7.88	12.10	16.58
18000193	8"-200 mm (MECHANICAL SDR11)	7.88	12.10	13.98
18000198	8"-200 mm (MECHANICAL SDR17.6)	7.88	12.10	9.26
18000235	10"-250 mm (POTABLE COLD SDR11)	9.85	9.75	17.57
18000236	10"-250 mm (POTABLE HOT SDR9)	9.85	9.75	20.84
18000237	10"-250 mm (MECHANICAL SDR9)	9.85	9.75	20.84
18000238	10"-250 mm (MECHANICAL SDR11)	9.85	9.75	17.57
18000239	10"-250 mm (MECHANICAL SDR17.6)	9.85	9.75	11.64
18000244	12"-315 mm (POTABLE COLD SDR11)	12.40	11.20	31.89
18000245	12"-315 mm (POTABLE HOT SDR9)	12.40	11.20	38.03
18000246	12"-315 mm (MECHANICAL SDR9)	12.40	11.20	38.03
18000247	12"-315 mm (MECHANICAL SDR11)	12.40	11.20	31.89
18000248	12"-315 mm (MECHANICAL SDR17.6)	12.40	11.20	19.82

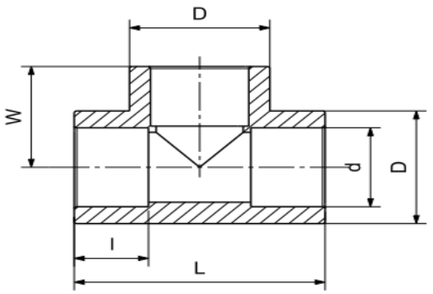
3 WAY ELBOW



Part Number	ND - OD	d (in)	D (in)	l (in)	W (in)	W1 (in)	Weight (lb)
18000950	(½" - 20 mm) x (½" - 20 mm) x (½" - 20 mm)	0.79	1.05	0.62	1.08	1.08	0.05
18000951	(¾" - 25 mm) x (¾" - 25 mm) x (¾" - 25 mm)	0.99	1.05	0.68	1.26	1.26	0.08

TEE

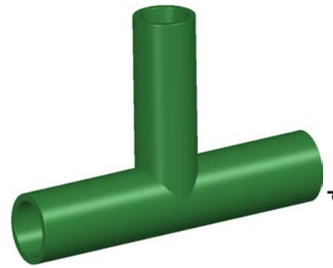
(socket fusion)

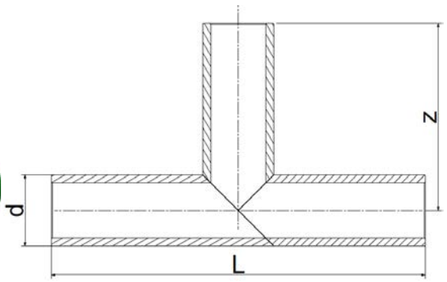


Part Number	ND - OD	d (in)	D (in)	l (in)	L (in)	w (in)	Weight (lb)
18000170	½" - 20 mm	0.79	1.10	0.63	2.09	1.04	0.05
18000171	¾" - 25 mm	0.99	1.18	0.71	2.44	1.22	0.07
18000172	1" - 32 mm	1.26	1.77	0.73	2.87	1.40	0.16
18000173	1¼" - 40 mm	1.58	2.06	0.83	3.43	1.75	0.27
18000174	1½" - 50 mm	1.97	2.68	0.95	4.13	2.05	0.49
18000175	2" - 63 mm	2.48	3.35	1.11	5.00	2.46	0.92
18000176	2½" - 75 mm	2.96	3.94	1.22	5.51	2.76	1.33
18000177	3" - 90 mm	3.55	4.76	1.42	6.46	3.27	2.29
18000179	4" - 125 mm	4.93	6.54	1.58	8.13	4.06	5.04

TEE

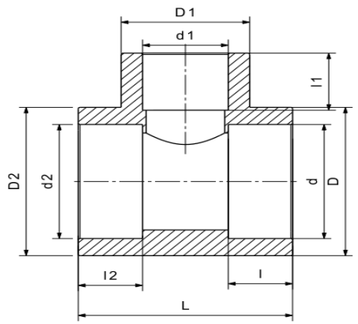
Fabricated
(butt fusion)





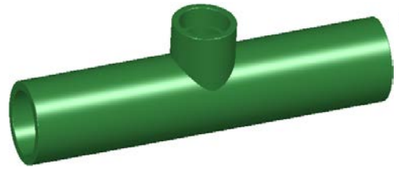
Part Number	ND - OD	d (in)	L (in)	z (in)	Weight (lb)
18001206	6"-160 mm (POTABLE COLD SDR11)	6.30	23.62	11.81	11.39
18001204	6"-160 mm (POTABLE HOT SDR9)	6.30	23.62	11.81	13.76
18001200	6"-160 mm (MECHANICAL SDR9)	6.30	23.62	11.81	13.76
18001202	6"-160 mm (MECHANICAL SDR11)	6.30	23.62	11.81	11.39
18002480	6"-160 mm (MECHANICAL SDR17.6)	6.30	23.62	11.81	7.64
18001207	8"-200 mm (POTABLE COLD SDR11)	7.88	27.50	13.75	21.15
18001205	8"-200 mm (POTABLE HOT SDR9)	7.88	27.50	13.75	25.15
18001201	8"-200 mm (MECHANICAL SDR9)	7.88	27.50	13.75	25.15
18001203	8"-200 mm (MECHANICAL SDR11)	7.88	27.50	13.75	21.15
18001208	8"-200 mm (MECHANICAL SDR17.6)	7.88	27.50	13.75	13.95
18001218	10"-250 mm (POTABLE COLD SDR11)	9.85	35.40	17.70	42.65
18001209	10"-250 mm (POTABLE HOT SDR9)	9.85	35.40	17.70	50.70
18001210	10"-250 mm (MECHANICAL SDR9)	9.85	35.40	17.70	50.70
18001211	10"-250 mm (MECHANICAL SDR11)	9.85	35.40	17.70	42.65
18001212	10"-250 mm (MECHANICAL SDR17.6)	9.85	35.40	17.70	28.10
18001213	12"-315 mm (POTABLE COLD SDR11)	12.40	39.40	19.70	73.80
18001214	12"-315 mm (POTABLE HOT SDR9)	12.40	39.40	19.70	88.25
18001215	12"-315 mm (MECHANICAL SDR9)	12.40	39.40	19.70	88.25
18001216	12"-315 mm (MECHANICAL SDR11)	12.40	39.40	19.70	73.80
18001217	12"-315 mm (MECHANICAL SDR17.6)	12.40	39.40	19.70	48.00

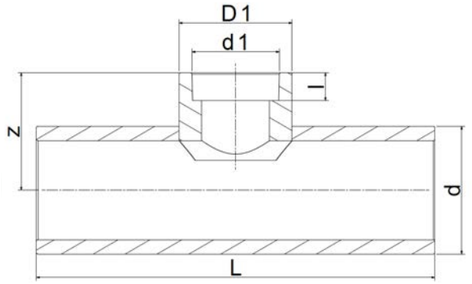
REDUCING TEE
(socket fusion)



Part Number	ND - OD	d (in)	D (in)	l (in)	d1 (in)	D1 (in)	l1 (in)	d2 (in)	D2 (in)	l2 (in)	L (in)	Weight (lb)
18000200	½" x ½" x ¾" - 20 x 20 x 25mm	0.79	1.10	0.62	0.99	1.38	0.68	0.79	1.10	0.62	2.17	0.06
18000202	¾" x ¾" x ½" - 25 x 25 x 20mm	0.99	1.38	0.68	0.99	1.11	0.62	0.79	1.38	0.68	2.19	0.07
18000203	1" x ½" x ½" - 32 x 20 x 20mm	0.79	1.65	0.62	0.79	1.02	0.62	1.26	1.65	0.76	2.24	0.10
18000204	1" x 1" x ½" - 32 x 32 x 20mm	1.26	1.77	0.76	0.79	1.11	0.62	1.26	1.77	0.76	2.42	0.12
18000205	1" x ¾" x ¾" - 32 x 25 x 25mm	1.26	1.65	0.76	0.99	1.29	0.68	0.99	1.65	0.68	2.40	0.11
18000206	1" x 1" x ¾" - 32 x 32 x 25mm	1.26	1.77	0.76	0.99	1.38	0.68	1.26	1.77	0.76	2.60	0.13
18000207	1¼" x 1¼" x ½" - 40 x 40 x 20mm	1.57	2.24	0.86	0.79	1.11	0.62	1.57	2.24	0.86	2.55	0.19
18000208	1¼" x 1¼" x ¾" - 40 x 40 x 25mm	1.57	2.24	0.86	0.99	1.40	0.68	1.57	2.24	0.86	2.80	0.21
18000209	1¼" x 1¼" x 1" - 40 x 40 x 32mm	1.57	2.24	0.86	1.26	1.77	0.76	1.57	2.24	0.86	3.03	0.24
18000211	1½" x 1½" x ¾" - 50 x 50 x 25mm	1.97	2.59	0.98	0.99	1.29	0.68	1.97	2.59	0.98	2.91	0.26
18000212	1½" x 1½" x 1" - 50 x 50 x 32mm	1.97	2.59	0.98	1.26	1.65	0.76	1.97	2.59	0.98	3.23	0.30
18000213	1½" x 1½" x 1¼" - 50 x 50 x 40mm	1.97	2.59	0.98	1.58	2.05	0.86	1.97	2.59	0.98	3.54	0.34
18000215	2" x 2" x ¾" - 63 x 63 x 25mm	2.48	3.26	1.13	0.99	1.29	0.68	2.48	3.26	1.13	3.31	0.46
18000216	2" x 2" x 1" - 63 x 63 x 32mm	2.48	3.26	1.13	1.26	1.65	0.76	2.48	3.26	1.13	3.54	0.50
18000217	2" x 2" x 1¼" - 63 x 63 x 40mm	2.48	3.26	1.13	1.58	2.05	0.86	2.48	3.26	1.13	3.86	0.55
18000218	2" x 2" x 1½" - 63 x 63 x 50mm	2.48	3.26	1.25	1.97	2.59	0.98	2.96	3.26	1.25	4.25	0.63
18000220	2½" x 2½" x ¾" - 75 x 75 x 25mm	2.96	3.91	1.25	0.99	1.66	0.68	2.96	3.91	1.25	3.54	0.75
18000221	2½" x 2½" x 1" - 75 x 75 x 32mm	2.96	3.91	1.25	1.26	1.66	0.76	2.96	3.91	1.25	3.78	0.76
18000222	2½" x 2½" x 1¼" - 75 x 75 x 40mm	2.96	3.91	1.25	1.58	3.26	0.86	2.96	3.91	1.25	4.10	0.84
18000223	2½" x 2½" x 1½" - 75 x 75 x 50mm	2.96	3.91	1.25	1.97	3.26	0.98	2.96	3.91	1.25	4.41	0.91
18000224	2½" x 2½" x 2" - 75 x 75 x 63mm	2.96	3.91	1.25	2.48	3.26	1.13	2.96	3.91	1.25	4.92	1.07
18000225	3" x 3" x 1" - 90 x 90 x 32mm	3.55	4.71	1.40	1.26	2.59	0.76	3.55	4.71	1.40	4.10	1.20
18000226	3" x 3" x 1¼" - 90 x 90 x 40mm	3.55	4.71	1.40	1.58	2.59	0.86	3.55	4.71	1.40	4.33	1.27
18000227	3" x 3" x 1½" - 90 x 90 x 50mm	3.55	4.71	1.40	1.97	2.59	0.98	3.55	4.71	1.40	4.73	1.41
18000228	3" x 3" x 2" - 90 x 90 x 63mm	3.55	4.71	1.40	1.97	3.92	0.98	3.55	4.71	1.40	5.20	1.56
18000229	3" x 3" x 2½" - 90 x 90 x 75mm	3.55	4.71	1.40	2.96	3.92	1.25	3.55	4.71	1.40	5.67	1.78
18000233	4" x 4" x 2½" - 125 x 125 x 75mm	4.93	6.56	1.71	2.96	4.70	1.25	4.93	6.56	1.71	6.30	3.62
18000234	4" x 4" x 3" - 125 x 125 x 90mm	4.93	6.56	1.71	3.55	4.71	1.40	4.93	6.56	1.71	6.78	3.94

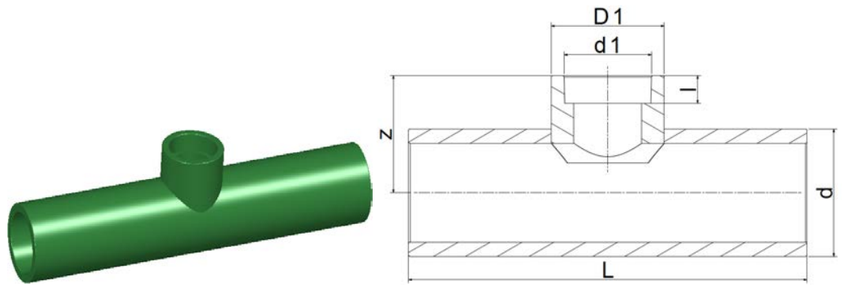
REDUCING TEE
Fabricated
(butt and socket fusion)





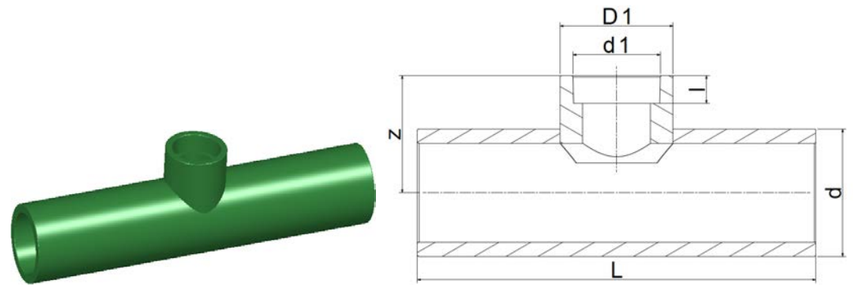
Part Number	ND - OD	d (in)	d1 (in)	D1 (in)	l (in)	L (in)	z (in)	Weight (lb)
18000476	6" x 6" x 2½"-160 x 160 x 75 mm (POTABLE COLD SDR11)	6.30	2.95	3.91	1.22	15.75	4.82	5.99
18000474	6" x 6" x 2½"-160 x 160 x 75 mm (POTABLE HOT SDR9)	6.30	2.95	3.91	1.22	15.75	4.82	6.71
18000470	6" x 6" x 2½"-160 x 160 x 75 mm (MECHANICAL SDR9)	6.30	2.95	3.91	1.22	15.75	4.82	6.71
18000472	6" x 6" x 2½"-160 x 160 x 75 mm (MECHANICAL SDR11)	6.30	2.95	3.91	1.22	15.75	4.82	5.99
18002490	6" x 6" x 2½"-160 x 160 x 75 mm (MECHANICAL SDR17.6)	6.30	2.95	3.91	1.22	15.75	4.82	4.19
18000477	6" x 6" x 3"-160 x 160 x 90 mm (POTABLE COLD SDR11)	6.30	3.54	4.70	1.37	15.75	4.92	6.18
18000475	6" x 6" x 3"-160 x 160 x 90 mm (POTABLE HOT SDR9)	6.30	3.54	4.70	1.37	15.75	4.92	7.28
18000471	6" x 6" x 3"-160 x 160 x 90 mm (MECHANICAL SDR9)	6.30	3.54	4.70	1.37	15.75	4.92	7.28
18000473	6" x 6" x 3"-160 x 160 x 90 mm (MECHANICAL SDR11)	6.30	3.54	4.70	1.37	15.75	4.92	6.18
18002491	6" x 6" x 3"-160 x 160 x 90 mm (MECHANICAL SDR17.6)	6.30	3.54	4.70	1.37	15.75	4.92	4.41
18000482	8" x 8" x 2½"-200 x 200 x 75 mm (POTABLE COLD SDR11)	7.88	2.96	3.94	1.22	27.50	5.60	16.05
18000481	8" x 8" x 2½"-200 x 200 x 75 mm (POTABLE HOT SDR9)	7.88	2.96	3.94	1.22	27.50	5.60	18.96
18000478	8" x 8" x 2½"-200 x 200 x 75 mm (MECHANICAL SDR9)	7.88	2.96	3.94	1.22	27.50	5.60	18.96
18000479	8" x 8" x 2½"-200 x 200 x 75 mm (MECHANICAL SDR11)	7.88	2.96	3.94	1.22	27.50	5.60	16.05
18000480	8" x 8" x 2½"-200 x 200 x 75 mm (MECHANICAL SDR17.6)	7.88	2.96	3.94	1.22	27.50	5.60	10.76
18000487	8" x 8" x 3" – 200 x 200 x 90 mm (POTABLE COLD SDR11)	7.88	3.54	4.77	1.37	27.50	5.76	16.19
18000486	8" x 8" x 3" – 200 x 200 x 90 mm (POTABLE HOT SDR9)	7.88	3.54	4.77	1.37	27.50	5.76	19.08
18000483	8" x 8" x 3" – 200 x 200 x 90 mm (MECHANICAL SDR9)	7.88	3.54	4.77	1.37	27.50	5.76	19.08
18000484	8" x 8" x 3" – 200 x 200 x 90 mm (MECHANICAL SDR11)	7.88	3.54	4.77	1.37	27.50	5.76	16.19
18000485	8" x 8" x 3" – 200 x 200 x 90 mm (MECHANICAL SDR17.6)	7.88	3.54	4.77	1.37	27.50	5.76	10.93

REDUCING TEE Cont'd
Fabricated
(butt and socket fusion)



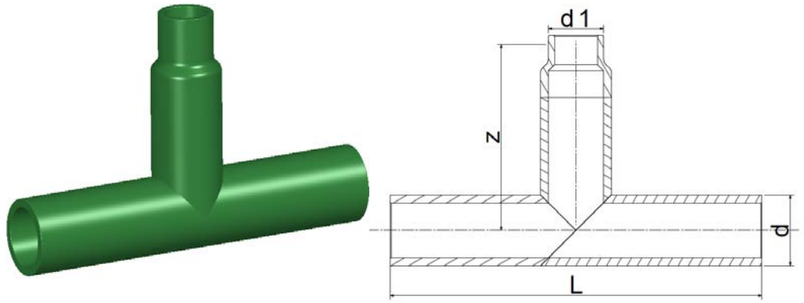
Part Number	ND - OD	d (in)	d1 (in)	D1 (in)	l (in)	L (in)	z (in)	Weight (lb)
18000492	8" x 8" x 4" – 200 x 200 x 125 mm (POTABLE COLD SDR11)	7.88	4.93	6.54	1.58	27.50	6.20	16.80
18000491	8" x 8" x 4" – 200 x 200 x 125 mm (POTABLE HOT SDR9)	7.88	4.93	6.54	1.58	27.50	6.20	19.63
18000488	8" x 8" x 4" – 200 x 200 x 125 mm (MECHANICAL SDR9)	7.88	4.93	6.54	1.58	27.50	6.20	19.63
18000489	8" x 8" x 4" – 200 x 200 x 125 mm (MECHANICAL SDR11)	7.88	4.93	6.54	1.58	27.50	6.20	16.80
18000490	8" x 8" x 4" – 200 x 200 x 125 mm (MECHANICAL SDR17.6)	7.88	4.93	6.54	1.58	27.50	6.20	11.63
18000493	10" x 10" x 2½"-250 x 250 x 75 mm (POTABLE COLD SDR11)	9.85	2.96	3.94	1.22	35.40	6.60	32.02
18000494	10" x 10" x 2½"-250 x 250 x 75 mm (POTABLE HOT SDR9)	9.85	2.96	3.94	1.22	35.40	6.60	37.90
18000495	10" x 10" x 2½"-250 x 250 x 75 mm (MECHANICAL SDR9)	9.85	2.96	3.94	1.22	35.40	6.60	37.90
18000496	10" x 10" x 2½"-250 x 250 x 75 mm (MECHANICAL SDR11)	9.85	2.96	3.94	1.22	35.40	6.60	32.02
18000497	10" x 10" x 2½"-250 x 250 x 75 mm (MECHANICAL SDR17.6)	9.85	2.96	3.94	1.22	35.40	6.60	21.34
18000498	10" x 10" x 3" – 250 x 250 x 90 mm (POTABLE COLD SDR11)	9.85	3.54	4.70	1.37	35.40	6.75	32.10
18000499	10" x 10" x 3" – 250 x 250 x 90 mm (POTABLE HOT SDR9)	9.85	3.54	4.70	1.37	35.40	6.75	38.40
18000097	10" x 10" x 3" – 250 x 250 x 90 mm (MECHANICAL SDR9)	9.85	3.54	4.70	1.37	35.40	6.75	38.40
18000098	10" x 10" x 3" – 250 x 250 x 90 mm (MECHANICAL SDR11)	9.85	3.54	4.70	1.37	35.40	6.75	32.10
18000099	10" x 10" x 3" – 250 x 250 x 90 mm (MECHANICAL SDR17.6)	9.85	3.54	4.70	1.37	35.40	6.75	21.50
18000103	10" x 10" x 4" – 250 x 250 x 125 mm (POTABLE COLD SDR11)	9.85	4.93	6.54	1.58	35.40	7.18	32.66
18000104	10" x 10" x 4" – 250 x 250 x 125 mm (POTABLE HOT SDR9)	9.85	4.93	6.54	1.58	35.40	7.18	38.44
18000149	10" x 10" x 4" – 250 x 250 x 125 mm (MECHANICAL SDR9)	9.85	4.93	6.54	1.58	35.40	7.18	38.44
18000153	10" x 10" x 4" – 250 x 250 x 125 mm (MECHANICAL SDR11)	9.85	4.93	6.54	1.58	35.40	7.18	32.66
18000154	10" x 10" x 4" – 250 x 250 x 125 mm (MECHANICAL SDR17.6)	9.85	4.93	6.54	1.58	35.40	7.18	22.14

REDUCING TEE Cont'd
Fabricated
(butt and socket fusion)



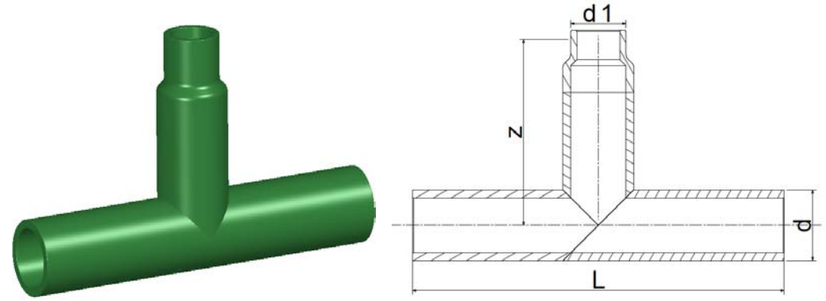
Part Number	ND - OD	d (in)	d1 (in)	D1 (in)	l (in)	L (in)	z (in)	Weight (lb)
18000155	12" x 12" x 3"-315 x 315 x 90 mm (POTABLE COLD SDR11)	12.40	3.54	4.70	1.37	39.40	8.03	56.24
18000156	12" x 12" x 3"-315 x 315 x 90 mm (POTABLE HOT SDR9)	12.40	3.54	4.70	1.37	39.40	8.03	66.93
18000157	12" x 12" x 3"-315 x 315 x 90 mm (MECHANICAL SDR9)	12.40	3.54	4.70	1.37	39.40	8.03	66.93
18000158	12" x 12" x 3"-315 x 315 x 90 mm (MECHANICAL SDR11)	12.40	3.54	4.70	1.37	39.40	8.03	56.24
18000159	12" x 12" x 3"-315 x 315 x 90 mm (MECHANICAL SDR17.6)	12.40	3.54	4.70	1.37	39.40	8.03	37.05
18000169	12" x 12" x 4"-315 x 315 x 125 mm (POTABLE COLD SDR11)	12.40	4.93	6.54	1.58	39.40	8.46	56.68
18000199	12" x 12" x 4"-315 x 315 x 125 mm (POTABLE HOT SDR9)	12.40	4.93	6.54	1.58	39.40	8.46	67.30
18000201	12" x 12" x 4"-315 x 315 x 125 mm (MECHANICAL SDR9)	12.40	4.93	6.54	1.58	39.40	8.46	67.30
18000210	12" x 12" x 4"-315 x 315 x 125 mm (MECHANICAL SDR11)	12.40	4.93	6.54	1.58	39.40	8.46	56.68
18000214	12" x 12" x 4"-315 x 315 x 125 mm (MECHANICAL SDR17.6)	12.40	4.93	6.54	1.58	39.40	8.46	36.63
18000219	12" x 12" x 6"-315 x 315 x 160 mm (POTABLE COLD SDR11)	12.40	-	6.30	3.54	39.40	10.05	58.13
18000240	12" x 12" x 6"-315 x 315 x 160 mm (POTABLE HOT SDR9)	12.40	-	6.30	3.54	39.40	10.05	68.62
18000241	12" x 12" x 6"-315 x 315 x 160 mm (MECHANICAL SDR9)	12.40	-	6.30	3.54	39.40	10.05	68.62
18000242	12" x 12" x 6"-315 x 315 x 160 mm (MECHANICAL SDR11)	12.40	-	6.30	3.54	39.40	10.05	58.13
18000243	12" x 12" x 6"-315 x 315 x 160 mm (MECHANICAL SDR17.6)	12.40	-	6.30	3.54	39.40	10.05	39.27

REDUCING TEE
Fabricated
(butt fusion)



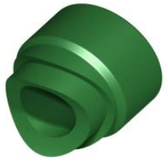
Part Number	ND - OD	d (in)	d1 (in)	L (in)	z (in)	Weight (lb)
18000379	6" x 6" x 4"-160 x 160 x 125 mm (POTABLE COLD SDR11)	6.30	4.93	23.62	15.75	12.71
18000376	6" x 6" x 4"-160 x 160 x 125 mm (POTABLE HOT SDR9)	6.30	4.93	23.62	15.75	15.31
18000370	6" x 6" x 4"-160 x 160 x 125 mm (MECHANICAL SDR9)	6.30	4.93	23.62	15.75	15.31
18000373	6" x 6" x 4"-160 x 160 x 125 mm (MECHANICAL SDR11)	6.30	4.93	23.62	15.75	12.71
18002500	6" x 6" x 4"-160 x 160 x 125 mm (MECHANICAL 17.6)	6.30	4.93	23.62	15.75	8.50
18000380	8” x 8” x 4” – 200 x 200 x 125 mm (POTABLE COLD SDR11)	7.88	4.93	27.50	33.74	24.18
18000377	8” x 8” x 4” – 200 x 200 x 125 mm (POTABLE HOT SDR9)	7.88	4.93	27.50	33.74	28.74
18000371	8” x 8” x 4” – 200 x 200 x 125 mm (MECHANICAL SDR9)	7.88	4.93	27.50	33.74	28.74
18000374	8” x 8” x 4” – 200 x 200 x 125 mm (MECHANICAL SDR11)	7.88	4.93	27.50	33.74	24.18
18000382	8” x 8” x 4” – 200 x 200 x 125 mm (MECHANICAL SDR17.6)	7.88	4.93	27.50	33.74	16.08
18000381	8” x 8” x 6” – 200 x 200 x 160 mm (POTABLE COLD SDR11)	7.88	6.30	27.50	35.43	24.96
18000378	8” x 8” x 6” – 200 x 200 x 160 mm (POTABLE HOT SDR9)	7.88	6.30	27.50	35.43	29.73
18000372	8” x 8” x 6” – 200 x 200 x 160 mm (MECHANICAL SDR9)	7.88	6.30	27.50	35.43	29.73
18000375	8” x 8” x 6” – 200 x 200 x 160 mm (MECHANICAL SDR11)	7.88	6.30	27.50	35.43	24.96
18000383	8” x 8” x 6” – 200 x 200 x 160 mm (MECHANICAL SDR17.6)	7.88	6.30	27.50	35.43	16.55
18000360	10” x 10” x 6” – 250 x 250 x 160 mm (POTABLE COLD SDR11)	9.85	6.30	35.40	43.75	48.38
18000361	10” x 10” x 6” – 250 x 250 x 160 mm (POTABLE HOT SDR9)	9.85	6.30	35.40	43.75	57.43
18000384	10” x 10” x 6” – 250 x 250 x 160 mm (MECHANICAL SDR9)	9.85	6.30	35.40	43.75	57.43

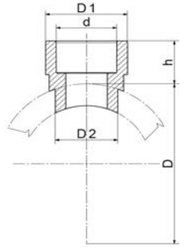
REDUCING TEE Cont’d
Fabricated
(butt fusion)



Part Number	ND - OD	d (in)	d1 (in)	L (in)	z (in)	Weight (lb)
18000385	10” x 10” x 6” – 250 x 250 x 160 mm (MECHANICAL SDR11)	9.85	6.30	35.40	43.75	48.38
18000386	10” x 10” x 6” – 250 x 250 x 160 mm (MECHANICAL SDR17.6)	9.85	6.30	35.40	43.75	32.22
18000387	10” x 10” x 8” – 250 x 250 x 200 mm (POTABLE COLD SDR11)	9.85	7.88	35.40	43.27	48.65
18000388	10” x 10” x 8” – 250 x 250 x 200 mm (POTABLE HOT SDR9)	9.85	7.88	35.40	43.27	57.80
18000389	10” x 10” x 8” – 250 x 250 x 200 mm (MECHANICAL SDR9)	9.85	7.88	35.40	43.27	57.80
18000390	10” x 10” x 8” – 250 x 250 x 200 mm (MECHANICAL SDR11)	9.85	7.88	35.40	43.27	48.65
18000391	10” x 10” x 8” – 250 x 250 x 200 mm (MECHANICAL SDR17.6)	9.85	7.88	35.40	43.27	32.20
18000392	12” x 12” x 8” – 315 x 315 x 200 mm (POTABLE COLD SDR11)	12.40	7.88	39.40	48.00	83.40
18000393	12” x 12” x 8” – 315 x 315 x 200 mm (POTABLE HOT SDR9)	12.40	7.88	39.40	48.00	99.35
18000394	12” x 12” x 8” – 315 x 315 x 200 mm (MECHANICAL SDR9)	12.40	7.88	39.40	48.00	99.35
18000395	12” x 12” x 8” – 315 x 315 x 200 mm (MECHANICAL SDR11)	12.40	7.88	39.40	48.00	83.40
18000396	12” x 12” x 8” – 315 x 315 x 200 mm (MECHANICAL SDR17.6)	12.40	7.88	39.40	48.00	55.50
18000397	12” x 12” x 10” – 315 x 315 x 250 mm (POTABLE COLD SDR11)	12.40	9.85	39.40	47.45	83.60
18000398	12” x 12” x 10” – 315 x 315 x 250 mm (POTABLE HOT SDR9)	12.40	9.85	39.40	47.45	99.75
18000399	12” x 12” x 10” – 315 x 315 x 250 mm (MECHANICAL SDR9)	12.40	9.85	39.40	47.45	99.75
18000095	12” x 12” x 10” – 315 x 315 x 250 mm (MECHANICAL SDR11)	12.40	9.85	39.40	47.45	83.60
18000096	12” x 12” x 10” – 315 x 315 x 250 mm (MECHANICAL SDR17.6)	12.40	9.85	39.40	47.45	54.73

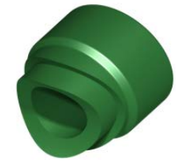
SADDLE
(outlet and socket fusion)

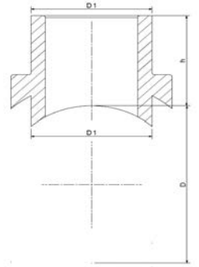




Part Number	ND – OD (D x d)	d (in)	D (in)	D1 (in)	D2 (in)	h (in)	Weight (lb)
18000270	1¼" x ½" - 40 x 20 mm	0.79	1.58	1.05	0.99	0.73	0.03
18000271	1¼" x ¾" - 40 x 25 mm	0.99	1.58	1.29	0.99	0.80	0.03
18000272	1½" x ½" - 50 x 20 mm	0.79	1.97	1.05	0.99	0.73	0.03
18000273	1½" x ¾" - 50 x 25 mm	0.99	1.97	1.29	0.99	0.80	0.03
18000274	2" x ½" - 63 x 20 mm	0.79	2.48	1.05	0.99	0.73	0.03
18000275	2" x ¾" - 63 x 25 mm	0.99	2.48	1.29	0.99	0.80	0.03
18000276	2" x 1" - 63 x 32 mm	1.26	2.48	1.65	1.26	0.95	0.05
18000277	2½" x ½" - 75 x 20 mm	0.79	2.95	1.05	0.99	0.73	0.03
18000278	2½" x ¾" - 75 x 25 mm	0.99	2.95	1.29	0.99	0.80	0.03
18000279	2½" x 1" - 75 x 32 mm	1.26	2.95	1.65	1.26	0.95	0.05
18000280	2½" x 1¼" - 75 x 40 mm	1.58	2.95	2.05	1.58	1.07	0.09
18000281	3" x ½" - 90 x 20 mm	0.79	3.54	1.05	0.99	0.73	0.03
18000282	3" x ¾" - 90 x 25 mm	0.99	3.54	1.29	0.99	0.80	0.03
18000283	3" x 1" - 90 x 32 mm	1.26	3.54	1.65	1.26	0.95	0.05
18000284	3" x 1¼" - 90 x 40 mm	1.58	3.54	2.05	1.58	1.07	0.09
18000290	4" x ½" - 125 x 20 mm	0.79	4.93	1.05	0.99	0.73	0.03
18000291	4" x ¾" - 125 x 25 mm	0.99	4.93	1.29	0.99	0.80	0.03
18000292	4" x 1" - 125 x 32 mm	1.26	4.93	1.65	1.26	0.95	0.05
18000293	4" x 1¼" - 125 x 40 mm	1.58	4.93	2.05	1.58	1.07	0.09
18000294	4" x 1½" - 125 x 50 mm	1.97	4.93	2.59	1.97	1.26	0.18
18000295	4" x 2" - 125 x 63 mm	2.48	4.93	3.26	2.48	1.49	0.33
18000296	6" x ½" - 160 x 20 mm	0.79	6.30	1.05	0.99	0.73	0.03
18000297	6" x ¾" - 160 x 25 mm	0.99	6.30	1.29	0.99	0.80	0.03
18000298	6" x 1" - 160 x 32 mm	1.26	6.30	1.65	1.26	0.95	0.05
18000299	6" x 1¼" - 160 x 40 mm	1.58	6.30	2.05	1.58	1.07	0.08
18000300	6" x 1½" - 160 x 50 mm	1.97	6.30	2.59	1.97	1.26	0.16
18000301	6" x 2" - 160 x 63 mm	2.48	6.30	3.26	2.48	1.49	0.30
18000302	6" x 2½" - 160 x 75 mm	2.95	6.30	3.91	2.95	1.67	0.49
18000303	6" x 3" - 160 x 90 mm	3.55	6.30	4.70	3.54	1.77	0.75
18000304	8" x ½" - 200 x 20 mm	0.79	7.87	1.07	0.79	0.79	0.02
18000305	8" x ¾" - 200 x 25 mm	0.99	7.87	1.31	0.99	0.91	0.03
18000306	8" x 1" - 200 x 32 mm	1.26	7.87	1.70	1.26	1.02	0.06
18000307	8" x 1¼" - 200 x 40 mm	1.58	7.87	2.13	1.58	1.18	0.11
18000308	8" x 1½" - 200 x 50 mm	1.97	7.87	2.72	1.97	1.30	0.20
18000309	8" x 2" - 200 x 63 mm	2.48	7.87	3.32	2.48	1.48	0.32
18000310	8" x 2½" - 200 x 75 mm	2.95	7.87	4.35	2.95	1.65	0.68
18000311	8" x 3" - 200 x 90 mm	3.55	7.87	4.87	3.55	1.81	0.88
18000312	8" x 4" - 200 x 125 mm	4.92	7.87	6.76	4.92	2.24	2.18
18000313	10" x ½" - 250 x 20 mm	0.79	7.87	1.07	0.79	0.79	0.02
18000314	10" x ¾" - 250 x 25 mm	0.99	7.87	1.31	0.99	0.91	0.03
18000315	10" x 1" - 250 x 32 mm	1.26	7.87	1.70	1.26	1.02	0.06
18000316	10" x 1¼" - 250 x 40 mm	1.58	9.84	2.13	1.58	1.18	0.11
18000317	10" x 1½" - 250 x 50 mm	1.97	9.84	2.72	1.97	1.30	0.20
18000318	10" x 2" - 250 x 63 mm	2.48	9.84	3.32	2.48	1.48	0.32
18000319	10" x 2½" - 250 x 75 mm	2.95	9.84	4.35	2.95	1.65	0.67
18000327	10" x 3" - 250 x 90 mm	3.55	9.84	4.87	3.55	1.81	0.87
18000321	10" x 4" - 250 x 125 mm	4.92	9.84	6.76	4.92	2.24	2.12
18000322	12" x 2" - 315 x 63 mm	2.48	12.40	3.32	2.48	1.48	0.34
18000323	12" x 2½" - 315 x 75 mm	2.95	12.40	4.35	2.95	1.65	0.69
18000324	12" x 3" - 315 x 90 mm	3.55	12.40	4.87	3.55	1.81	0.89
18000325	12" x 4" - 315 x 125 mm	4.92	12.40	6.76	4.92	2.24	2.11

SADDLE
(outlet and butt fusion)

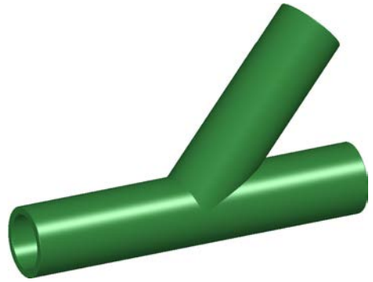


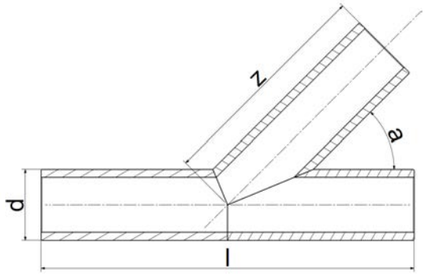


Part Number	ND - OD	D (in)	D1 (in)	h (in)	Weight (lb)
18000326	12" x 6" - 315 x 160 mm	12.40	6.30	3.94	3.47

TEE WYE

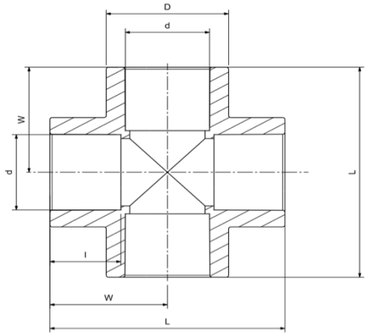
Fabricated
(butt fusion)





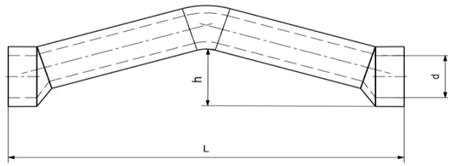
Part Number	ND - OD	d (in)	L (in)	z (in)	a (°)	Weight (lb)
18001189	4"-125 mm (POTABLE COLD SDR11)	4.93	29.15	21.65	45.0	10.30
18001186	4"-125 mm (POTABLE HOT SDR9)	4.93	29.15	21.65	45.0	22.30
18001180	4"-125 mm (MECHANICAL SDR9)	4.93	29.15	21.65	45.0	22.30
18001183	4"-125 mm (MECHANICAL SDR11)	4.93	29.15	21.65	45.0	10.30
18002511	4"-125 mm (MECHANICAL SDR17.6)	4.93	29.15	21.65	45.0	6.93
18001190	6"-160 mm (POTABLE COLD SDR11)	6.30	33.00	23.60	45.0	18.47
18001187	6"-160 mm (POTABLE HOT SDR9)	6.30	33.00	23.60	45.0	22.28
18001181	6"-160 mm (MECHANICAL SDR9)	6.30	33.00	23.60	45.0	22.28
18001184	6"-160 mm (MECHANICAL SDR11)	6.30	33.00	23.60	45.0	18.47
18002510	6"-160 mm (MECHANICAL SDR17.6)	6.30	33.00	23.60	45.0	12.39
18001191	8"-200 mm (POTABLE COLD SDR11)	7.88	39.40	27.50	45.0	35.24
18001188	8"-200 mm (POTABLE HOT SDR9)	7.88	39.40	27.50	45.0	41.80
18001182	8"-200 mm (MECHANICAL SDR9)	7.88	39.40	27.50	45.0	41.80
18001185	8"-200 mm (MECHANICAL SDR11)	7.88	39.40	27.50	45.0	35.24
18001192	8"-200 mm (MECHANICAL SDR17.6)	7.88	39.40	27.50	45.0	22.95
18001179	10"-250 mm (POTABLE COLD SDR11)	9.85	45.30	33.50	45.0	63.50
18001193	10"-250 mm (POTABLE HOT SDR9)	9.85	45.30	33.50	45.0	75.50
18001194	10"-250 mm (MECHANICAL SDR9)	9.85	45.30	33.50	45.0	75.50
18001195	10"-250 mm (MECHANICAL SDR11)	9.85	45.30	33.50	45.0	63.50
18001196	10"-250 mm (MECHANICAL SDR17.6)	9.85	45.30	33.50	45.0	41.90
18001197	12"-315 mm (POTABLE COLD SDR11)	12.40	51.20	39.40	45.0	114.34
18001198	12"-315 mm (POTABLE HOT SDR9)	12.40	51.20	39.40	45.0	136.70
18001199	12"-315 mm (MECHANICAL SDR9)	12.40	51.20	39.40	45.0	136.70
18000093	12"-315 mm (MECHANICAL SDR11)	12.40	51.20	39.40	45.0	114.34
18000094	12"-315 mm (MECHANICAL SDR17.6)	12.40	51.20	39.40	45.0	74.50

CROSS



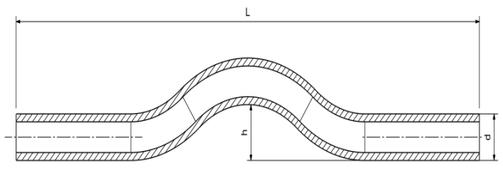
Part Number	ND - OD	d (in)	D (in)	l (in)	L (in)	W (in)	Weight (lb)
18000930	(½" - 20 mm) x (½" - 20 mm) x (½" - 20 mm) x (½" - 20 mm)	0.79	1.09	0.63	2.09	1.04	0.05
18000931	(¾" - 25 mm) x (¾" - 25 mm) x (¾" - 25 mm) x (¾" - 25 mm)	0.99	1.38	0.73	2.56	1.28	0.10

CROSS OVER
(MOLDED)



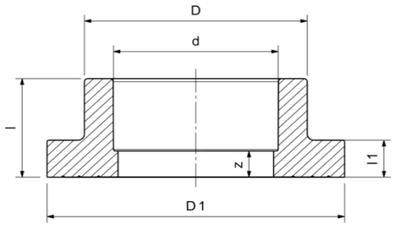
Part Number	ND - OD	d (in)	L (in)	h (in)	Weight (lb)
18001070	(½" - 20 mm) x (½" - 20 mm)	0.79	6.30	0.95	0.07
18001071	(¾" - 25 mm) x (¾" - 25 mm)	0.99	7.87	1.25	0.13
18001072	(1" - 32 mm) x (1" - 32 mm)	1.26	9.84	1.58	0.26

CROSS OVER



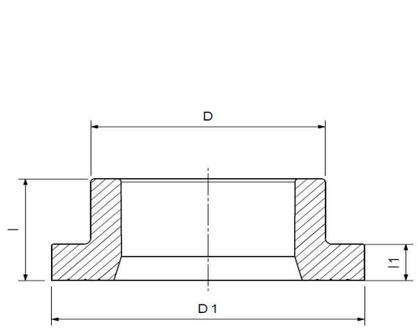
Part Number	ND - OD	d (in)	L (in)	h (in)	Weight (lb)
18000850	½" - 20 mm	0.79	11.81	0.82	0.12
18000851	¾" - 25 mm	0.99	12.21	0.99	0.20
18000852	1" - 32 mm	1.26	11.02	1.26	0.26

FLANGE ADAPTER
(socket fusion)



Part Number	ND - OD	d (in)	D (in)	l (in)	D1 (in)	l1 (in)	z (in)	Weight (lb)
18000330	1" - 32 mm	1.26	1.65	0.93	2.68	0.39	0.21	0.08
18000331	1¼" - 40 mm	1.58	2.06	1.07	3.07	0.43	0.26	0.12
18000332	1½" - 50 mm	1.97	2.37	1.26	3.15	0.47	0.34	0.16
18000333	2" - 63 mm	2.48	2.95	1.50	3.94	0.55	0.42	0.22
18000334	2½" - 75 mm	2.96	3.52	1.67	4.65	0.63	0.49	0.35
18000335	3" - 90 mm	3.55	4.23	1.89	5.12	0.67	0.59	0.46

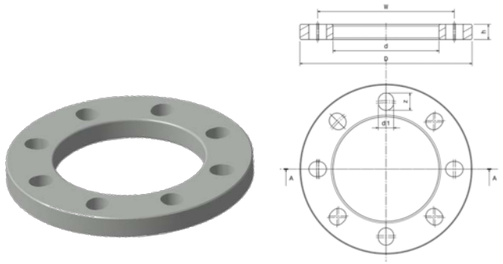
FLANGE ADAPTER
(butt fusion)



Part Number	ND - OD	D (in)	l (in)	D1 (in)	l1 (in)	Weight (lb)
18000337**	4" - 125 mm SDR9	4.96	7.70	6.21	0.73	2.77
18002530**	4" - 125 mm SDR11	4.96	7.70	6.21	0.73	2.03
18002531**	4" - 125 mm SDR17.6	4.96	7.70	6.21	0.73	1.43
18000340	6" - 160 mm SDR9	6.30	7.70	8.50	0.98	4.30
18000341	6" - 160 mm SDR11	6.30	7.70	8.50	0.98	3.99
18002540	6" - 160 mm SDR17.6	6.30	7.70	8.50	0.98	2.85
18000342	8" - 200 mm SDR9	7.87	5.32	10.43	1.38	5.47
18000343	8" - 200 mm SDR11	7.87	5.32	10.43	1.38	4.85
18000344	8" - 200 mm SDR17.6	7.87	5.32	10.43	1.38	3.75
18000345	10" - 250 mm SDR9	9.84	5.32	12.60	1.38	8.12
18000346	10" - 250 mm SDR11	9.84	5.32	12.60	1.38	7.16
18000347	10" - 250 mm SDR17.6	9.84	5.32	12.60	1.38	5.46
18000348	12" - 315 mm SDR9	12.40	5.32	14.57	1.38	11.41
18000349	12" - 315 mm SDR11	12.40	5.32	14.57	1.38	9.87
18000320	12" - 315 mm SDR17.6	12.40	5.32	14.57	1.38	7.17

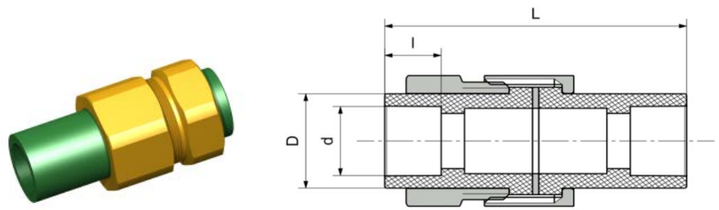
**Flange adapter can be butt fused, or socket fused if used in conjunction with coupling (part number 18000010)

FLANGE RING



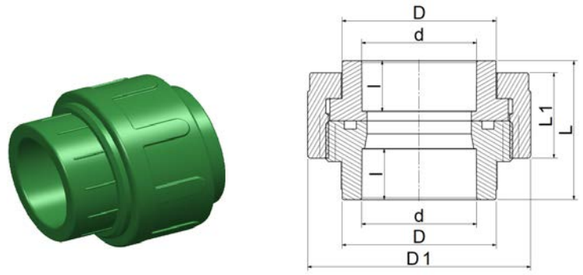
Part Number	ND - OD	d (in)	D (in)	d1 (in)	W (in)	h (in)	z (in)	Weight (lb)
20501050	Steel flange ring to 1½" - 50 mm							
20501063	Steel flange ring to 2" - 63 mm							
20501075	Steel flange ring to 2½" - 75 mm							
20501090	Steel flange ring to 3" - 90 mm							
20501125	Steel flange ring to 4" - 125 mm							
20501160	Steel flange ring to 6" - 160 mm							
20501200	Steel flange ring to 8" - 200 mm							
20501250	Steel flange ring to 10" - 250 mm							
20501315	Steel flange ring to 12" - 315 mm							

PLASTIC - PLASTIC NUT CONNECTOR
(socket fusion)



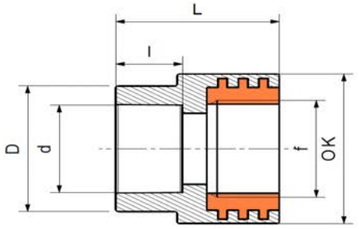
Part Number	ND - OD	d (in)	D (in)	l (in)	L (in)	Weight (lb)
18000790	½" - 20 mm	0.79	1.05	0.62	3.03	0.36

PPR-CT NUT
(socket fusion)



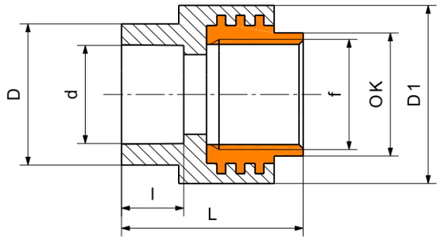
Part Number	ND - OD	d (in)	D (in)	l (in)	L (in)	L1 (in)	D1 (in)	Weight (lb)
18000350	½" - 20 mm	0.79	1.07	0.62	1.83	0.98	1.83	0.08
18000351	¾" - 25 mm	0.99	1.30	0.68	1.93	0.99	2.17	0.12
18000352	1" - 32 mm	1.26	1.67	0.76	2.09	1.12	2.64	0.17
18000353	1¼" - 40 mm	1.58	2.13	0.86	2.40	1.26	2.86	0.23
18000354	1½" - 50 mm	1.97	2.62	0.97	2.66	1.50	3.98	0.51
18000355	2" - 63 mm	2.48	3.30	1.10	2.99	1.74	4.89	0.95

TRANSITION PIECE
FEMALE THREADS
(socket fusion)



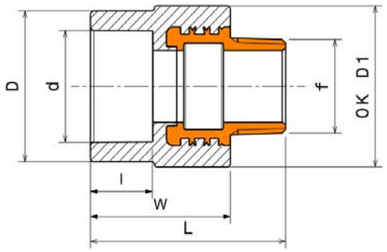
Part Number	ND - OD	d (in)	D (in)	l (in)	f (in)	OK	L (in)	Weight (lb)
18000450	(½" - 20 mm) x ½"F	0.79	1.08	0.63	1/2	1.41	1.42	0.15
18000451	(½" - 20 mm) x ¾"F	0.79	1.32	0.63	3/4	1.69	1.61	0.18
18000452	(¾" - 25 mm) x ½"F	0.99	1.34	0.67	1/2	1.37	1.46	0.14
18000453	(¾" - 25 mm) x ¾"F	0.99	1.34	0.67	3/4	1.61	1.46	0.16
18000454	(1" - 32 mm) x ¾"F	1.26	1.65	0.76	3/4	1.76	1.59	0.19
18000520	(½" - 20 mm) x ½"F (lead-free)	0.79	1.08	0.63	1/2	1.41	1.42	0.15
18000521	(½" - 20 mm) x ¾"F (lead-free)	0.79	1.32	0.63	3/4	1.69	1.61	0.18
18000522	(¾" - 25 mm) x ½"F (lead-free)	0.99	1.34	0.67	1/2	1.37	1.46	0.14
18000523	(¾" - 25 mm) x ¾"F (lead-free)	0.99	1.34	0.67	3/4	1.61	1.46	0.16
18000524	(1" - 32 mm) x ¾"F (lead-free)	1.26	1.65	0.76	3/4	2.13	1.59	0.19
18000525	(1" - 32 mm) x 1"F (lead-free)	1.26	1.73	0.72	1	2.13	1.69	0.33
18000526	(1¼" - 40 mm) x 1"F (lead-free)	1.58	2.17	0.86	1	2.64	1.81	0.40
18000527	(1¼" - 40 mm) x 1¼"F (lead-free)	1.58	2.17	0.86	1 1/4	2.64	1.81	0.55
18000528	(1½" - 50 mm) x 1½"F (lead-free)	1.97	2.76	0.97	1 1/2	3.07	2.08	0.80
18000529	(2" - 63 mm) x 2"F (lead-free)	2.48	3.43	1.10	2	3.48	2.24	1.07

TRANSITION PIECE
HEX FEMALE THREADS
(socket fusion)



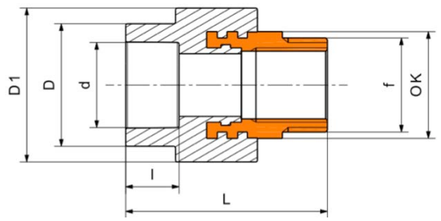
Part Number	ND - OD	d (in)	D (in)	l (in)	L (in)	f (in)	D1 (in)	OK (in)	Weight (lb)
18000500	(½" - 20 mm) x ½"F HEX	0.79	1.08	0.63	1.71	½	1.51	0.94	0.15
18000501	(¾" - 25 mm) x ½"F HEX	0.99	1.34	0.67	1.75	½	1.48	0.94	0.15
18000502	(¾" - 25 mm) x ¾"F HEX	0.99	1.34	0.67	1.81	¾	1.73	1.18	0.20
18000503	(1" - 32 mm) x ¾"F HEX	1.26	1.65	0.72	1.95	¾	1.89	1.18	0.22
18000504	(1" - 32 mm) x 1" F HEX	1.26	1.73	0.72	2.34	1	2.23	1.50	0.42
18000505	(1¼" - 40 mm) x 1"F HEX	1.58	2.17	0.86	2.21	1	2.84	1.50	0.53
18000506	(1¼" - 40 mm) x 1¼"F HEX	1.58	2.17	0.86	2.26	1¼	2.84	1.89	0.65
18000507	(1½" - 50 mm) x 1½"F HEX	1.97	2.76	0.97	2.56	1½	3.17	2.17	0.91
18000508	(2" - 63 mm) x 2" F HEX	2.48	3.43	1.10	2.82	2	3.64	2.68	1.17

TRANSITION PIECE
MALE THREADS
(socket fusion)



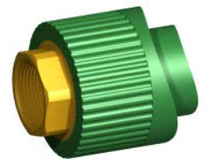
Part Number	ND - OD	d (in)	D (in)	l (in)	W (in)	f (in)	L (in)	OK (in)	Weight (lb)
18000530	(½" - 20 mm) x ½" M	0.79	1.08	0.63	1.34	½	1.95	1.40	0.14
18000531	(¾" - 25 mm) x ½" M	0.99	1.32	0.67	1.65	½	2.26	1.69	0.19
18000532	(¾" - 25 mm) x ¾" M	0.99	1.34	0.67	1.42	¾	2.05	1.61	0.23
18000533	(1" - 32 mm) x ¾" M	1.26	1.65	0.72	1.59	¾	2.22	1.76	0.26
18000540	(½" - 20mm) x ½"M (lead-free)	0.79	1.08	0.63	1.34	½	1.95	1.40	0.14
18000541	(¾" - 25mm) x ½"M (lead-free)	0.99	1.32	0.67	1.65	½	2.26	1.69	0.19
18000542	(¾" - 25mm) x ¾"M (lead-free)	0.99	1.34	0.67	1.42	¾	2.05	1.61	0.23
18000543	(1" - 32mm) x ¾"M (lead-free)	1.26	1.65	0.72	1.59	¾	2.22	1.76	0.26
18000544	(1"-32mm) x 1"M (lead-free)	0.79	1.08	0.63	1.34	½	1.95	1.40	0.14
18000545	(1¼"- 40mm) x 1¼"M (lead-free)	0.99	1.32	0.67	1.65	½	2.26	1.69	0.19
18000546	(1½"- 50mm) x 1½"M (lead-free)	0.99	1.34	0.67	1.42	¾	2.05	1.61	0.23
18000547	(2" - 63mm) x 2"M (lead-free)	1.26	1.65	0.72	1.59	¾	2.22	1.76	0.26

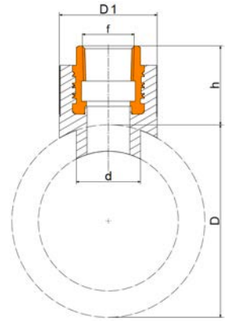
TRANSITION PIECE
HEX MALE THREADS
(socket fusion)



Part Number	ND - OD	d (in)	D (in)	l (in)	L (in)	D1 (in)	f (in)	OK (in)	Weight (lb)
18000550	(½" - 20 mm) x ½" M HEX	0.79	1.05	0.62	2.62	1.52	½	0.83	0.16
18000551	(¾" - 25 mm) x ¾" M HEX	0.99	1.29	0.68	2.62	1.52	¾	1.06	0.24
18000552	(1" - 32 mm) x 1" M HEX	1.26	1.66	0.76	3.09	2.09	1	1.26	0.44
18000554	(1¼" - 40 mm) x 1¼" M HEX	1.58	2.06	0.86	3.33	2.68	1 ¼	1.62	0.74
18000555	(1½" - 50 mm) x 1½" M HEX	1.97	2.61	0.98	3.47	2.92	1 ½	1.81	0.90
18000556	(2" - 63 mm) x 2" M HEX	2.48	3.28	1.13	4.04	2.88	2	2.25	1.42

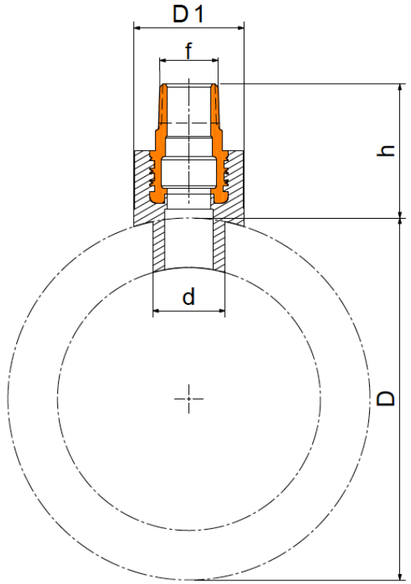
TRANSITION SADDLE
HEX FEMALE THREADS
(saddle outlet fusion)





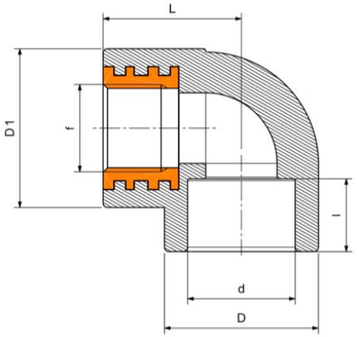
Part Number	ND - OD	d (in)	f (in)	D(in)	h (in)	D1 (in)	Weight (lb)
18000650	(1½" / ¾" - 50 / 25 mm) x ½"F HEX	0.99	½	1.97	1.21	1.50	0.15
18000651	(2" / ¾" - 63 / 25 mm) x ½"F HEX	0.99	½	2.48	1.21	1.50	0.15
18000652	(2½" / ¾" - 75 / 25 mm) x ½"F HEX	0.99	½	2.95	1.21	1.50	0.15
18000653	(3" / ¾" - 90 / 25 mm) x ½"F HEX	0.99	½	3.54	1.21	1.50	0.15
18000654	(4" / ¾" - 125 / 25 mm) x ½"F HEX	0.99	½	4.92	1.21	1.50	0.15
18000663	(6" / ¾" - 160 / 25 mm) x ½"F HEX	0.99	½	6.30	1.21	1.50	0.15
18000680	(8" / ¾" - 200 / 25 mm) x ½"F HEX	0.99	1	7.87	1.28	1.61	0.16
18000683	(10" / ¾" - 250 / 25 mm) x ½"F HEX	0.99	1	9.84	1.32	1.61	0.17
18000655	(1½" / ¾" - 50 / 25 mm) x ¾"F HEX	0.99	¾	1.97	1.29	1.71	0.19
18000656	(2" / ¾" - 63 / 25 mm) x ¾"F HEX	0.99	¾	2.48	1.37	1.71	0.19
18000657	(2½" / ¾" - 75 / 25 mm) x ¾"F HEX	0.99	¾	2.95	1.37	1.71	0.19
18000658	(3" / ¾" - 90 / 25 mm) x ¾"F HEX	0.99	¾	3.54	1.37	1.71	0.19
18000659	(4" / ¾" - 125 / 25 mm) x ¾"F HEX	0.99	¾	4.92	1.37	1.71	0.20
18000664	(6" / ¾" - 160 / 25 mm) x ¾"F HEX	0.99	¾	6.30	1.37	1.71	0.20
18000681	(8" / ¾" - 200 / 25 mm) x ¾"F HEX	0.99	1	7.87	1.36	1.81	0.20
18000684	(10" / ¾" - 250 / 25 mm) x ¾"F HEX	0.99	1	9.84	1.40	1.81	0.21
18000660	(2½" / 1" - 75 / 32 mm) x 1"F HEX	1.26	1	2.95	1.50	2.36	0.42
18000661	(3" / 1" - 90 / 32 mm) x 1"F HEX	1.26	1	3.54	1.50	2.36	0.43
18000662	(4" / 1" - 125 / 32 mm) x 1"F HEX	1.26	1	4.92	1.50	2.36	0.43
18000665	(6" / 1" - 160 / 32 mm) x 1"F HEX	1.26	1	6.30	1.50	2.36	0.42
18000682	(8" / 1" - 200 / 32 mm) x 1"F HEX	1.26	1	7.87	1.50	2.36	0.44
18000685	(10" / 1" - 250 / 32 mm) x 1"F HEX	1.26	1	9.84	1.50	2.36	0.44
18001350	(1½" / ¾" - 50/25mm) x ½"F HEX (lead-free)	0.99	½	1.97	1.21	1.50	0.15
18001453	(2" / ¾" - 63/25mm) x ½"F HEX (lead-free)	0.99	½	2.48	1.21	1.50	0.15
18001450	(2½" / ¾" - 75/25mm) x ½"F HEX (lead-free)	0.99	½	2.95	1.21	1.50	0.15
18001451	(3" / ¾" - 90/25mm) x ½"F HEX (lead-free)	0.99	½	3.54	1.21	1.50	0.15
18001452	(4" / ¾" - 125/25mm) x ½"F HEX (lead-free)	0.99	½	4.92	1.21	1.50	0.15
18001355	(6" / ¾" - 160/25mm) x ½"F HEX (lead-free)	0.99	½	6.30	1.21	1.50	0.15
18001455	(8" / ¾" - 200/25mm) x ½"F HEX (lead-free)	0.99	1	7.87	1.28	1.61	0.16
18001458	(10" / ¾" - 250/25mm) x ½"F HEX (lead-free)	0.99	1	9.84	1.32	1.61	0.17
18001356	(1½" / ¾" - 50/25mm) x ¾"F HEX (lead-free)	0.99	¾	1.97	1.29	1.71	0.19
18001357	(2" / ¾" - 63/25mm) x ¾"F HEX (lead-free)	0.99	¾	2.48	1.37	1.71	0.19
18001358	(2½" / ¾" - 75/25mm) x ¾"F HEX (lead-free)	0.99	¾	2.95	1.37	1.71	0.19
18001359	(3" / ¾" - 90/25mm) x ¾"F HEX (lead-free)	0.99	¾	3.54	1.37	1.71	0.19
18001360	(4" / ¾" - 125/25mm) x ¾"F HEX (lead-free)	0.99	¾	4.92	1.37	1.71	0.20
18001361	(6" / ¾" - 160/25mm) x ¾"F HEX (lead-free)	0.99	¾	6.30	1.37	1.71	0.20
18001456	(8" / ¾" - 200/25mm) x ¾"F HEX (lead-free)	0.99	1	7.87	1.36	1.81	0.20
18001459	(10" / ¾" - 250/25mm) x ¾"F HEX (lead-free)	0.99	1	9.84	1.40	1.81	0.21
18001362	(2½" / 1" - 75/32mm) x 1"F HEX (lead-free)	1.26	1	2.95	1.50	2.36	0.42
18001363	(3" / 1" - 90/32mm) x 1"F HEX (lead-free)	1.26	1	3.54	1.50	2.36	0.43
18001364	(4" / 1" - 125/32mm) x 1"F HEX (lead-free)	1.26	1	4.92	1.50	2.36	0.43
18001365	(6" / 1" - 160/32mm) x 1"F HEX (lead-free)	1.26	1	6.30	1.50	2.36	0.42
18001457	(8" / 1" - 200/32mm) x 1"F HEX (lead-free)	1.26	1	7.87	1.50	2.36	0.44
18001460	(10" / 1" - 250/32mm) x 1"F HEX (lead-free)	1.26	1	9.84	1.50	2.36	0.44

TRANSITION SADDLE
HEX MALE THREADS
(outlet fusion)



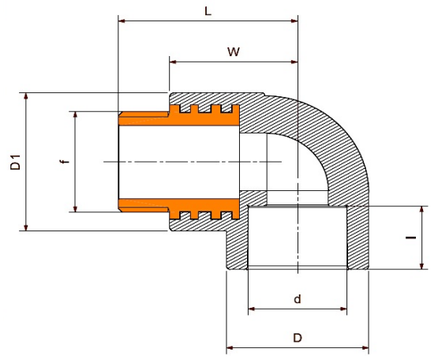
Part Number	ND - OD	d (in)	f (in)	D (in)	h (in)	D1 (in)	Weight (lb)
18000690	(1½" / ¾" - 50 / 25 mm) x ½"M HEX	0.99	½	1.97	1.82	1.50	0.18
18000691	(2" / ¾" - 63 / 25 mm) x ½"M HEX	0.99	½	2.48	1.82	1.50	0.18
18000692	(2½" / ¾" - 75 / 25 mm) x ½"M HEX	0.99	½	2.95	1.82	1.50	0.18
18000693	(3" / ¾" - 90 / 25 mm) x ½"M HEX	0.99	½	3.54	1.82	1.50	0.18
18000694	(4" / ¾" - 125 / 25 mm) x ½"M HEX	0.99	½	4.92	1.82	1.50	0.19
18000700	(6" / ¾" - 160 / 25 mm) x ½"M HEX	0.99	½	6.30	1.82	1.50	0.18
18000695	(1½" / ¾" - 50 / 25 mm) x ¾"M HEX	0.99	¾	1.97	1.92	1.71	0.26
18000696	(2" / ¾" - 63 / 25 mm) x ¾"M HEX	0.99	¾	2.48	1.92	1.71	0.26
18000697	(2½" / ¾" - 75 / 25 mm) x ¾"M HEX	0.99	¾	2.95	1.92	1.71	0.26
18000698	(3" / ¾" - 90 / 25 mm) x ¾"M HEX	0.99	¾	3.54	1.92	1.71	0.26
18000699	(4" / ¾" - 125 / 25 mm) x ¾"M HEX	0.99	¾	4.92	1.92	1.71	0.27
18000701	(6" / ¾" - 160 / 25 mm) x ¾"M HEX	0.99	¾	6.30	1.92	1.71	0.26
18001402	(1½" / ¾" - 50/25mm) x ½"M HEX (lead-free)	0.99	½	1.97	1.82	1.50	0.18
18001400	(2" / ¾" - 63/25mm) x ½"M HEX (lead-free)	0.99	½	2.48	1.82	1.50	0.18
18001404	(2½" / ¾" - 75/25mm) x ½"M HEX (lead-free)	0.99	½	2.95	1.82	1.50	0.18
18001408	(3" / ¾" - 90/25mm) x ½"M HEX (lead-free)	0.99	½	3.54	1.82	1.50	0.18
18001411	(4" / ¾" - 125/25mm) x ½"M HEX (lead-free)	0.99	½	4.92	1.82	1.50	0.19
18001409	(6" / ¾" - 160/25mm) x ½"M HEX (lead-free)	0.99	½	6.30	1.82	1.50	0.18
18001403	(1½" / ¾" - 50/25mm) x ¾"M HEX (lead-free)	0.99	¾	1.97	1.92	1.71	0.26
18001401	(2" / ¾" - 63/25mm) x ¾"M HEX (lead-free)	0.99	¾	2.48	1.92	1.71	0.26
18001405	(2½" / ¾" - 75/25mm) x ¾"M HEX (lead-free)	0.99	¾	2.95	1.92	1.71	0.26
18001407	(3" / ¾" - 90/25mm) x ¾"M HEX (lead-free)	0.99	¾	3.54	1.92	1.71	0.26
18001406	(4" / ¾" - 125/25mm) x ¾"M HEX (lead-free)	0.99	¾	4.92	1.92	1.71	0.27
18001410	(6" / ¾" - 160/25mm) x ¾"M HEX (lead-free)	0.99	¾	6.30	1.92	1.71	0.26

TRANSITION ELBOW 90°
(FEMALE THREADS)



Part Number	ND - OD	d (in)	D (in)	f (in)	l (in)	L (in)	D1 (in)	Weight (lb)
18000570	(½" - 20 mm) x ½" F	0.79	1.10	½	0.62	1.26	1.50	0.15
18000571	(¾" - 25 mm) x ¾" F	0.99	1.34	¾	0.68	1.30	1.70	0.19
18000572	(¾" - 25 mm) x ½" F	0.99	1.34	½	0.68	1.30	1.70	0.18
18000574	(1" - 32 mm) x 1" F	1.26	1.65	1	0.71	1.64	2.36	0.43
18001250	(½" - 20mm) x ½"F (lead-free)	0.79	1.10	½	0.62	1.26	1.50	0.15
18001251	(¾" - 25mm) x ¾"F (lead-free)	0.99	1.34	¾	0.68	1.30	1.70	0.19
18001252	(¾" - 25mm) x ½"F (lead-free)	0.99	1.34	½	0.68	1.30	1.70	0.18
18001253	(1" - 32mm) x 1"F (lead-free)	1.26	1.65	1	0.71	1.64	2.36	0.43

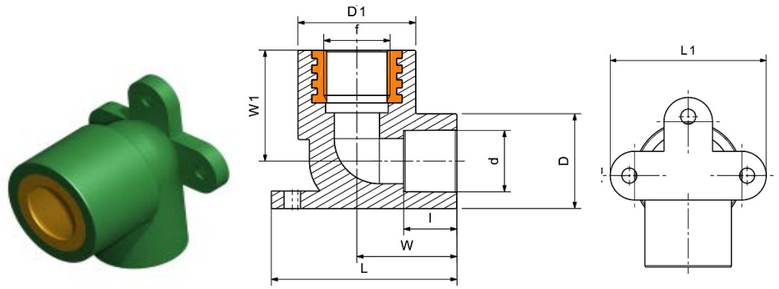
TRANSITION ELBOW 90°
MALE THREADS
(socket fusion)



Part Number	ND - OD	d (in)	D (in)	D1 (in)	l (in)	f (in)	L (in)	W (in)	Weight (lb)
18000590	(½" - 20 mm) x ½" M	0.79	1.10	1.52	0.62	½	1.83	1.22	0.17
18000591	(¾" - 25 mm) x ¾" M	0.99	1.36	1.74	0.68	¾	1.85	1.22	0.26
18000592	(1" - 32 mm) x 1" M	1.26	1.65	2.13	0.82	1	2.38	1.59	0.44
18001270	(½" - 20mm) x ½"M (lead-free)	0.79	1.10	1.52	0.62	½	1.83	1.22	0.17
18001271	(¾" - 25mm) x ¾"M (lead-free)	0.99	1.36	1.74	0.68	¾	1.85	1.22	0.26
18001272	(1" - 32mm) x 1"M (lead-free)	1.26	1.65	2.13	0.82	1	2.38	1.59	0.44

TRANSITION ELBOW 90°

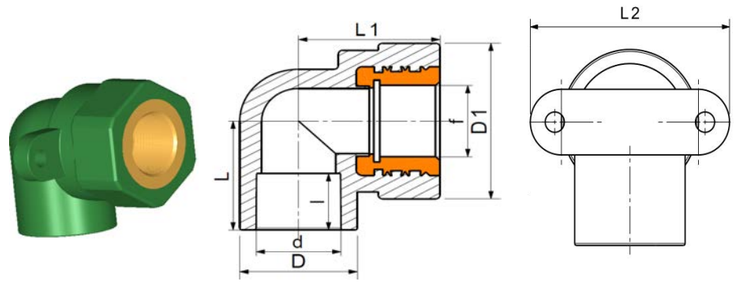
WITH 3 POINT BACK PLATE
FEMALE THREADS
(socket fusion)



Part Number	ND - OD	d (in)	D (in)	l (in)	W (in)	W1 (in)	L (in)	L1 (in)	f (in)	D1 (in)	Weight (lb)
18000400	(½" - 20 mm) x ½" F	0.79	1.10	0.63	1.22	1.26	2.28	2.13	½	1.50	0.16
18000401	(¾" - 25 mm) x ¾" F	0.99	1.28	0.68	1.30	1.30	2.46	2.32	¾	1.68	0.20
18000402	(¾" - 25 mm) x ½" F	0.99	1.28	0.68	1.30	1.30	2.46	2.32	¾	1.47	0.17
18000410	(½" - 20mm) x ½"F (lead-free)	0.79	1.10	0.63	1.22	1.26	2.28	2.13	½	1.50	0.16
18000411	(¾" - 25mm) x ¾"F (lead-free)	0.99	1.28	0.68	1.30	1.30	2.46	2.32	¾	1.68	0.20
18000412	(¾" - 25mm) x ½"F (lead-free)	0.99	1.28	0.68	1.30	1.30	2.46	2.32	¾	1.47	0.17

TRANSITION ELBOW 90°

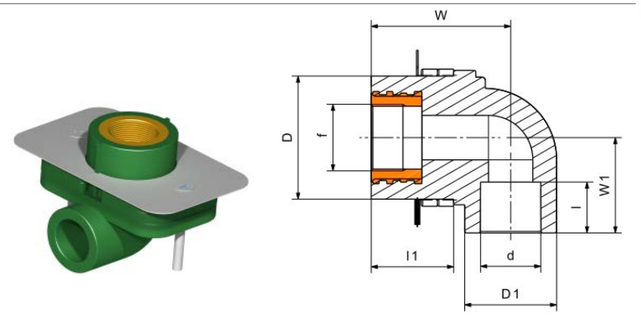
WITH SIDE PLATE
(FEMALE THREADS)



Part Number	ND - OD	d (in)	D (in)	D1 (in)	l (in)	f (in)	L (in)	L1 (in)	Weight (lb)
18000430	(¾" - 25 mm) x ¾" F	0.99	1.30	1.68	0.68	¾	1.30	1.30	0.19
18000440	(¾" - 25mm) x ¾"F (lead-free)	0.99	1.30	1.68	0.68	¾	1.30	1.30	0.19

TRANSITION ELBOW 90°

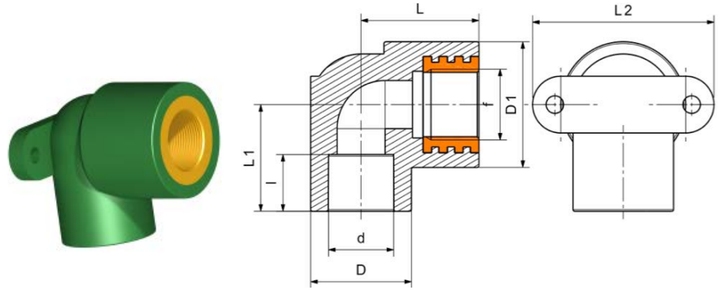
FOR GYPSUM WALL MOUNTING



Part Number	ND - OD	d (in)	D (in)	D1 (in)	W (in)	W1 (in)	l (in)	l1 (in)	f (in)	Weight (lb)
18000890	(½" - 20 mm) x ½" F	0.79	1.05	1.05	1.73	1.06	0.59	0.99	½	0.20

TRANSITION ELBOW 90°

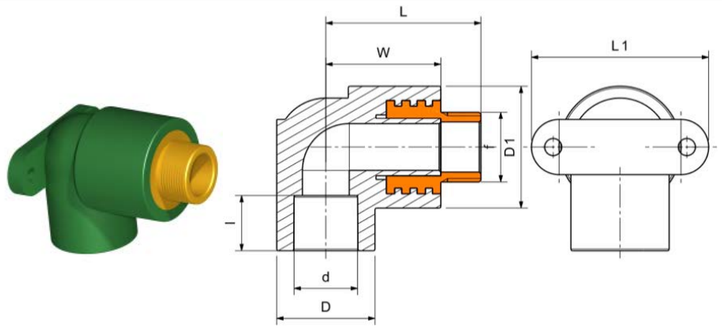
WITH BACK PLATE
FEMALE THREADS
(socket fusion)



Part Number	ND - OD	d (in)	D (in)	D1 (in)	l (in)	f (in)	L (in)	L1 (in)	L2 (in)	Weight (lb)
18000970	(½" - 20 mm) x ½" F	0.79	1.13	1.61	0.62	½	1.20	1.22	2.09	0.16
18000971	(½" - 20 mm) x ¾" F	0.79	1.14	1.68	0.62	¾	1.38	1.22	2.09	0.21
18000980	(½" - 20mm) x ½"F (lead-free)	0.79	1.13	1.61	0.62	½	1.20	1.22	2.09	0.16
18000981	(½" - 20mm) x ¾"F (lead-free)	0.79	1.14	1.68	0.62	¾	1.38	1.22	2.09	0.21

TRANSITION ELBOW 90°

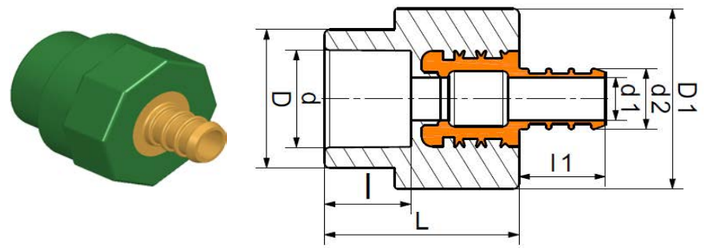
WITH BACK PLATE
(MALE THREADS
(socket fusion)



Part Number	ND - OD	d (in)	D (in)	l (in)	W (in)	f (in)	L (in)	L1 (in)	D1 (in)	Weight (lb)
18000990	(½" - 20 mm) x ½" M	0.79	1.13	0.62	1.20	½	1.81	2.09	1.61	0.19
18000991	(½" - 20 mm) x ¾" M	0.79	1.14	0.62	1.38	¾	2.01	2.09	1.46	0.26
18001420	(½" - 20mm) x ½"M (lead-free)	0.79	1.13	0.62	1.20	½	1.81	2.09	1.61	0.19
18001421	(½" - 20mm) x ¾"M (lead-free)	0.79	1.14	0.62	1.38	¾	2.01	2.09	1.46	0.26

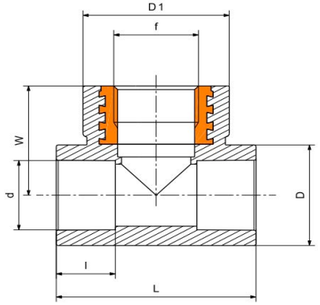
PEX ADAPTER

CRIMP / ASTM F1807
(socket fusion)



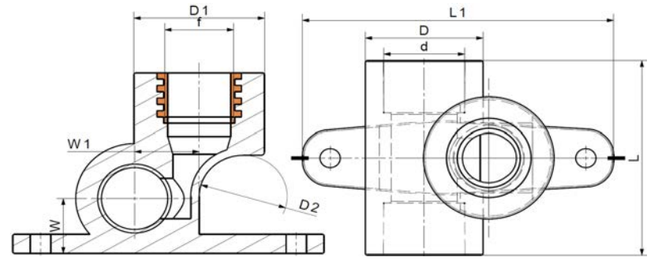
Part Number	ND - OD	D (in)	d (in)	D1 (in)	l (in)	L (in)	l1 (in)	d1 (in)	d2 (in)	Weight (lb)
18001020	(½" - 20mm) x ½" (lead-free)	1.08	0.79	1.51	0.63	1.42	0.63	0.34	0.47	0.10
18001021	(¾" - 25mm) x ¾" (lead-free)	1.34	0.98	1.73	0.67	1.42	0.63	0.53	0.67	0.14

TRANSITION TEE
FEMALE THREADS
(socket fusion)



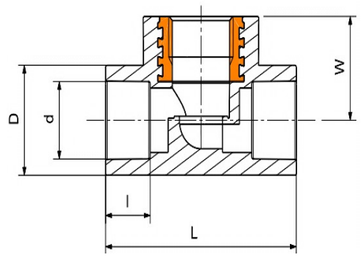
Part Number	ND - OD	d (in)	D (in)	f (in)	l (in)	L (in)	D1(in)	W (in)	Weight (lb)
18000630	(½" - 20 mm) x (½" - 20 mm) x ½"F	0.79	1.10	½	0.62	2.03	1.50	1.26	0.15
18000631	(¾" - 25 mm) x (¾" - 25 mm) x ½"F	0.99	1.37	½	0.68	2.09	1.54	1.31	0.17
18000632	(¾" - 25 mm) x (¾" - 25 mm) x ¾"F	1.26	1.37	¾	0.68	2.24	1.73	1.38	0.20
18001290	(½" - 20mm)x(½" - 20mm) x ½"F (lead-free)	0.79	1.10	½	0.62	2.03	1.50	1.26	0.15
18001291	(¾" - 25mm)x(¾" - 25mm) x ½"F (lead-free)	0.99	1.37	½	0.68	2.09	1.54	1.31	0.17
18001292	(¾" - 25mm)x(¾" - 25mm) x ¾"F (lead-free)	1.26	1.37	¾	0.68	2.24	1.73	1.38	0.20

TRANSITION TEE
BACK PLATE
FEMALE THREADS
(socket fusion)



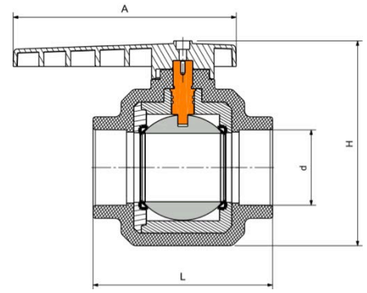
Part Number	ND - OD	d (in)	l (in)	D (in)	D1 (in)	D2 (in)	L (in)	L1 (in)	f (in)	W (in)	W1 (in)	Weight (lb)
18000830	(½" - 20 mm) x (½" - 20 mm) x ½"F	0.79	0.62	1.10	1.52	0.79	2.32	3.19	½	0.61	0.60	0.19
18000831	(¾" - 25 mm) x (¾" - 25 mm) x ½"F	0.99	0.68	1.37	1.52	1.02	2.42	3.62	½	0.69	0.75	0.24
18000840	(½"-20mm)x(½"-20mm) x ½"F (lead-free)	0.79	0.62	1.10	1.52	0.79	2.32	3.19	½	0.61	0.60	0.19
18000841	(¾"-25mm)x(¾"-25mm) x ½"F (lead-free)	0.99	0.68	1.37	1.52	1.02	2.42	3.62	½	0.69	0.75	0.24

STOP VALVE BODY
(socket fusion)



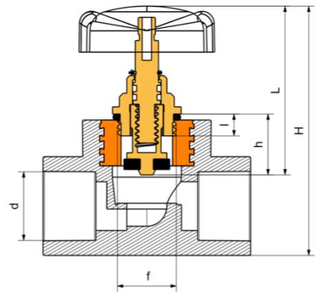
Part Number	ND - OD	d (in)	D (in)	l (in)	W (in)	L (in)	f (in)	Weight (lb)
18001030	(½" - 20 mm) x ½"	0.79	1.05	0.63	1.02	2.44	½	0.06
18001031	(¾" - 25 mm) x ¾"	0.99	1.29	0.71	1.02	2.64	¾	0.10
18001032	(1" - 32 mm) x 1"	1.26	1.66	0.74	1.65	3.88	1	0.20

BALL VALVE
(socket fusion)



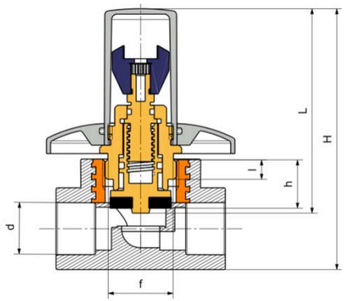
Part Number	ND - OD	d (in)	L (in)	A (in)	H (in)	Weight (lb)
18000730	½" - 20 mm	0.79	2.90	3.33	2.92	0.16
18000731	¾" - 25 mm	0.99	3.05	3.33	2.92	0.21
18000732	1" - 32 mm	1.26	3.51	4.26	3.62	0.32
18000733	1¼" - 40 mm	1.58	3.84	4.26	4.14	1.23
18000734	1½" - 50 mm	1.97	4.41	4.26	4.49	2.09
18000735	2" - 63 mm	2.48	5.18	5.91	5.91	4.85

GLOBE STOP VALVE
(socket fusion)



Part Number	ND - OD	d (in)	l (in)	L (in)	h (in)	H (in)	f (in)	Weight (lb)
18001100	½" - 20 mm	0.79	0.35	2.92	1.10	3.15	½	0.27
18001101	¾" - 25 mm	0.99	0.35	2.92	1.10	3.35	¾	0.39
18001102	1" - 32 mm	1.26	0.43	3.07	1.26	4.41	1	0.70

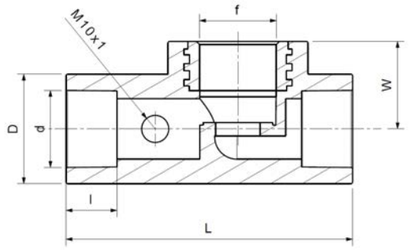
CONCEALED VALVE
CHROMIUM PLATED CAP
(socket fusion)



Part Number	ND - OD	d (in)	f (in)	L (in)	h (in)	H (in)	l (in)	Weight (lb)
18001090	½" - 20 mm	0.79	½	2.92	0.87	3.70	0.35	0.34
18001091	¾" - 25 mm	0.99	¾	2.92	0.99	3.74	0.35	0.43
18001092	1" - 32 mm	1.26	1	3.07	1.26	4.26	0.43	0.68

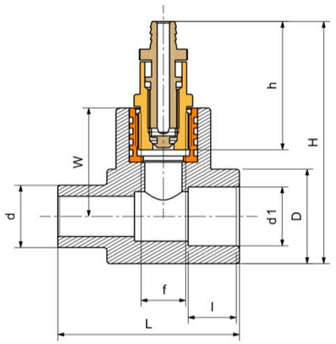
VALVE BODY W/ DRAINING BRANCH

REVERSABLE SIDES OF OUTPUTS
(socket fusion)



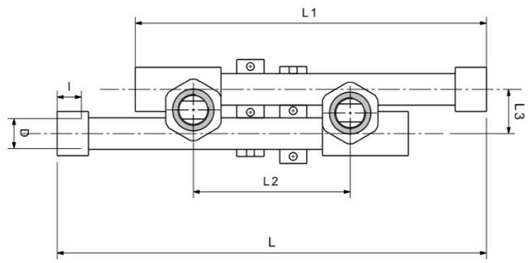
Part Number	ND - OD	d (in)	D (in)	l (in)	L (in)	W (in)	f (in)	Weight (lb)
18002550	½" - 20 mm	0.79	1.06	0.62	3.23	0.91	½	0.18
18002551	¾" - 25 mm	0.98	1.29	0.68	3.43	0.91	½	0.21

DRAINING BRANCH



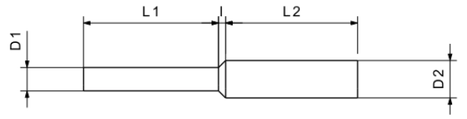
Part Number	ND - OD	d (in)	f (in)	L (in)	D (in)	d1 (in)	l (in)	W (in)	h (in)	H (in)	Weight (lb)
18001120	½" - 20 mm	0.79	0.38	2.30	1.20	0.75	0.65	1.38	1.64	3.07	0.24
18001121	¾" - 25 mm	0.99	0.38	2.30	1.36	0.95	0.65	1.43	1.64	2.50	0.26

TRANSITION ASSEMBLY



Part Number	ND - OD	D (in)	l (in)	L (in)	L1 (in)	L2 (in)	L3 (in)	Weight (lb)
18000770	½" - 20 mm F	0.75	0.61	10.84	8.87	3.96	1.10	0.50

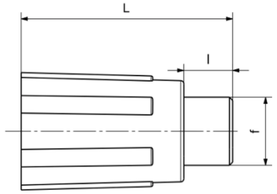
REPAIR PLUG



Part Number	ND - OD	D1 (in)	D2 (in)	l (in)	L1 (in)	L2 (in)	Weight (lb)
18001150	(¼" - 7 mm) x (7/16" - 11mm)	0.28	0.39	0.39	1.18	0.79	0.02

LONG PLUG

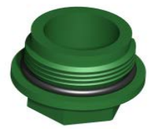
FOR PRESSURE TEST

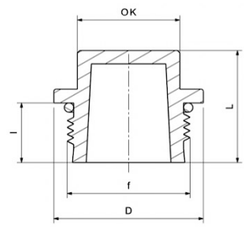


Part Number	ND - OD	l (in)	f (in)	L (in)	Weight (lb)
18000750	½" - 20 mm	0.59	½	2.52	0.04
18000751	¾" - 25 mm	0.59	¾	2.52	0.05

SHORT PLUG

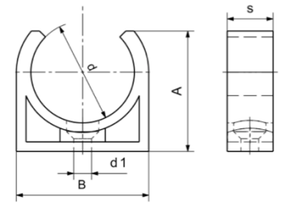
FOR PRESSURE TEST





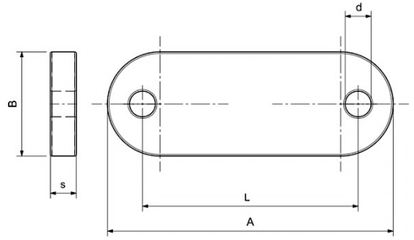
Part Number	ND - OD	d (in)	D (in)	f (in)	L (in)	OK (in)	Weight (lb)
18001050	½" - 20 mm	0.79	1.08	½	0.93	0.79	0.01
18001051	¾" - 25 mm	0.99	1.25	¾	0.95	0.43	0.02

CLAMPS



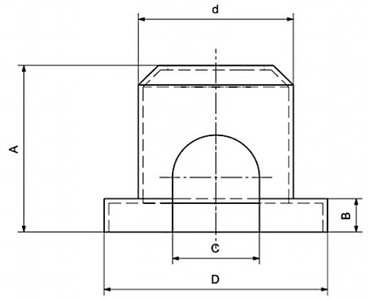
Part Number	ND - OD	A (in)	B (in)	d (in)	d1 (in)	s (in)	Weight (lb)
18000870	½" - 20 mm	1.04	1.11	0.79	0.22	0.53	0.01
18000871	¾" - 25 mm	1.26	1.38	0.99	0.22	0.53	0.02
18000872	1" - 32 mm	1.50	0.99	1.26	0.22	0.56	0.02
18000873	1¼" - 40 mm	1.81	1.18	1.58	0.22	0.60	0.04

PAD



Part Number	d (in)	A (in)	B (in)	L (in)	s (in)	Weight (lb)
18001000	0.19	2.08	0.77	1.54	0.20	0.01

ELBOW MASK



Part Number	A (in)	B (in)	C (in)	D (in)	d (in)	Weight (lb)
18001010	2.17	0.43	1.10	2.84	1.97	0.03

MARKING GUIDE

Part Number	
18001160	

DRILL BITS
(for saddle outlet)

Part Number	ND - OD	Weight (lb)
20620025	½" - 20 mm and ¾" - 25 mm	
20620032	1" - 32 mm	
20620040	1¼" - 40 mm	
20620050	1½" - 50 mm	
20620063	2" - 63 mm	