GF Piping Systems

+GF+

Technical Guide

Aquasystem PP-R Pipes and Fittings

Contents

The best choice

Corrosion and chemical resistant products, systems and complete solutions from GF Piping Systems

Georg Fischer

Georg Fischer focuses on three core businesses: GF Piping Systems, GF Automotive and GF AgieCharmilles. The industrial corporation founded in 1802 headquarters in Switzerland and operates approximately 130 companies with more than 13 500 employees in 30 countries.
GF Piping Systems is a leading supplier of plastic and metal piping systems with global market presence. For the treatment and distribution of water and chemicals, as well as the safe transport of liquids and gases in industry, we have the corresponding jointing technologies, fittings, valves, automation products and pipes in our portfolio.

GF Piping Systems headquarters in Schaffhausen, Switzerland.

Our market segments

Being a strong implementation partner, GF Piping Systems supports its customers in every phase of the project. No matter which processes and applications are planned in the following market segments:

- Building Services
- Chemical Process Industry
- Energy
- Food & Beverage / Cooling
- Microelectronics
- Marine
- Water & Gas Utilities
- Water Treatment

Global presence

Our global presence ensures customer proximity worldwide. Sales companies in over 25 countries and representatives in another 80 countries provide customer service around the clock. With 50 production sites in Europe, Asia and the USA we are close to our customers and comply with local standards. A modern logistics concept with local distribution centers ensures highest product availability and short delivery times. GF Piping Systems specialists are always close by.

Complete solutions provider

Our extensive product range represents a unique form of product and competence bundling. With over 60 000 products, allied with a broad range of services, we offer individual and comprehensive system solutions for a variety of industrial applications. Our automation offering fits perfectly into our complete system approach and is thus an integral part of our portfolio. By having a focus on the profitability of projects, we optimize processes and applications that are integrated into the whole system.
Continually setting standards in the market, we provide our customers with cutting-edge technology. Thanks to our worldwide network, customers benefit directly from our 50+ years experience in plastics.

From start to finish, we support our customers as a competent, reliable and experienced partner, actively contributing the know-how of an industrial company that has been successful in the market for over 200 years.

GF Hakan Plastik Aquasystem PP-R pipes and fittings

GF Hakan Plastik PP-R pipes and fittings are ideal for hot and cold water distribution in buildings, heating systems, air ducts as well as other applications in industry. They have high temperature and pressure resistance and are suitable for drinking water..

- GF Hakan Aquasystem is manufactured in accordance with the standards of ISO 9001:2008, ISO 14001, DVGW W544, ISO 15874, ISO 1 5874-2, ISO 1 5874-3, DIN 8077, DIN 8078, TSEK 28, DIN 18836, with a minimum 50-year lifespan.
- GF Hakan Aquasystem is made of PP-R. Its characteristics such as elasticity, rigidity, leak tightness, compressive strength, special resistance to high temperatures and extraction make Aquasystem one of the most technologically advanced systems available.
- GF Hakan Aquasystem is produced in diameters between 20mm and 250mm with fittings and complementary accessories.

GF Hakan Aquasystem PP-R pipes are available in 4 different types depending on the application fields and customer expectations:
- Standard PP-R pipe systems
- Faser fiberglass reinforced PP-R pipe systems
- Climafaser fiberglass reinforced PP-R pipe systems
- Stabil aluminum PP-R pipe systems

- GF Hakan Aquasystem is manufactured in white, grey, green, blue and beige; different colors are available upon request.

+ Benefits

- **No water-hammer and less pressure loss**
  The internal surface of GF Hakan Aquasystem is smooth, homogeneous and non-porous. Due to the low flow resistance, there is less pressure loss and flow rates are higher. Customers benefit from a wide range of applications with exceptional impact resistance and reduced noise generation.
- **Long service life under aggressive working conditions**
  The quality of the raw material and the sophisticated manufacturing technology used to produce GF Hakan Aquasystem ensure long-lived, reliable products. System lifetime is over 50 years (under proper use)
- **Easy and low-cost installation**
  GF Hakan Aquasystem is extremely light and easy to handle on site. Making a connection is simple, quick and safe. Complete installations are practical and fast with a wide range of fittings.
  Fast and simple process, reliable connections, strong, resilient joints, visible quality control, no systematic weak points, less weight than with traditional materials, quick, easy and clean installation work with less noise.
- **Hygienic, non-toxic and environmentally friendly**
  All materials used in the production of GF Hakan Aquasystem are non-toxic in accordance with current international standards and are completely safe for use with liquid consumables.
  - No health risks, odor and taste neutral
  - Potable water and food-safe
  - Completely recyclable
  - Compliance with all health requirements
  - Chemically resistant
  - No corrosion and/or encrustation.

Worldwide quality assurance

GF Hakan Plastik is one of the world's largest plastic pipe manufacturers

+ System standards

ISO 9001:2008	Quality management system.
ISO 14001	Environmental management system
DVGW W544	General requirements & testing of plastic pipes.
ISO 15874	Plastic pipe system for hot and cold water installations: polypropylene.
ISO 15874-2	Plastic piping systems for hot and cold water installations - polypropylene (PP) - Part 2: Pipes.
ISO 15874-3	Plastic piping systems for hot and cold water installations - polypropylene (PP) - Part 3: Fittings.
DIN 8077	Polypropylene (PP) pipe dimensions.
DIN 8078	Polypropylene (PP) pipes; general quality requirements testing & chemical resistance of pipes and fittings.
TSEK 28	Multi-layer glass fiber pipes made of polypropylene (PP) - pressure pipes used for hot and cold water systems.
DIN 18836	Multilayer pipes-general requirement & testing.

+ Approvals & certificates

TURKEY
TURKISH STANDARTS INSTITUTE
[14.31.34/8741]

TURKEY
HIFZISSIHHA INSTITUTE [7241]

GERMANY
DVGW CERTIFICATE
[30.11.201 2/06-0236-WNE]

GERMANY
HYGIENE INSTITUTE

GERMANY
SKZ [72012/06]

SPAIN
AENOR [001/005882]

SOUTH AFRICA
SABS [9959/15744]

HUNGARY
EMI [A 738 / 2006]

UKRAINE UKR SEPRO
[05.0302-03/113734]

RUSSIA
GOST-R [0863206]

RUSSIA HYGIENE
[77.01.16.490.074908.10.07]

UKRAINE HYGIENE
[05.03.02-03/7168]

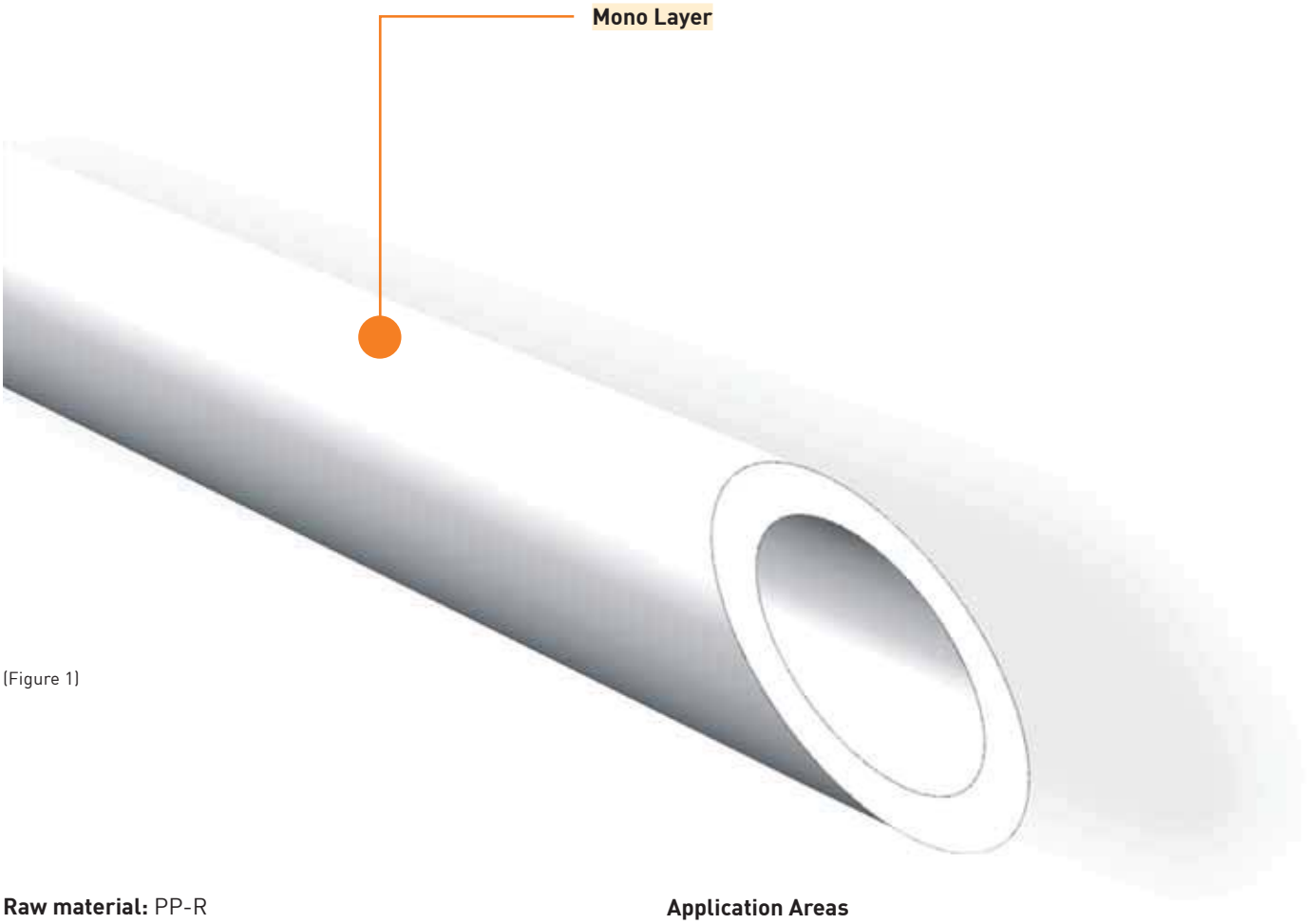
UNITED KINGDOM
WRAS [1401521]

Fields of application

	Standard PP-R Pipe Systems	Faser Fiberglass Reinforced Pipe Systems	Climafaser Fiberglass Reinforced Pipe Systems	Stable-Aluminum Foiled Pipe Systems
				
Plumbing Applications				
Plumbing installations	✓	✓	✗	✓
Mobile System Plumbing	✓	✓	✗	✓
Heating and Cooling Systems				
Boiler Replacement	✓	✓	✗	✓
Mobile System Heating	✓	✓	✗	✓
Underfloor Heating	✓	✗	✗	✗
Mobile System Clean Water	✓	✓	✓	✓
Clima System	✗	✗	✓	✗
Drinking Water Network Applications				
Drinking Water Network	✓	✓	✗	✓
*Exterior Application	✗	✗	✗	✓
Solar Collector	✓	✗	✗	✓
Swimming Pool System	✓	✓	✓	✓
Industrial Clean Water System	✓	✓	✓	✓

* Aquasystem can be used for exterior applications after insulation

Standard PP-R pipes



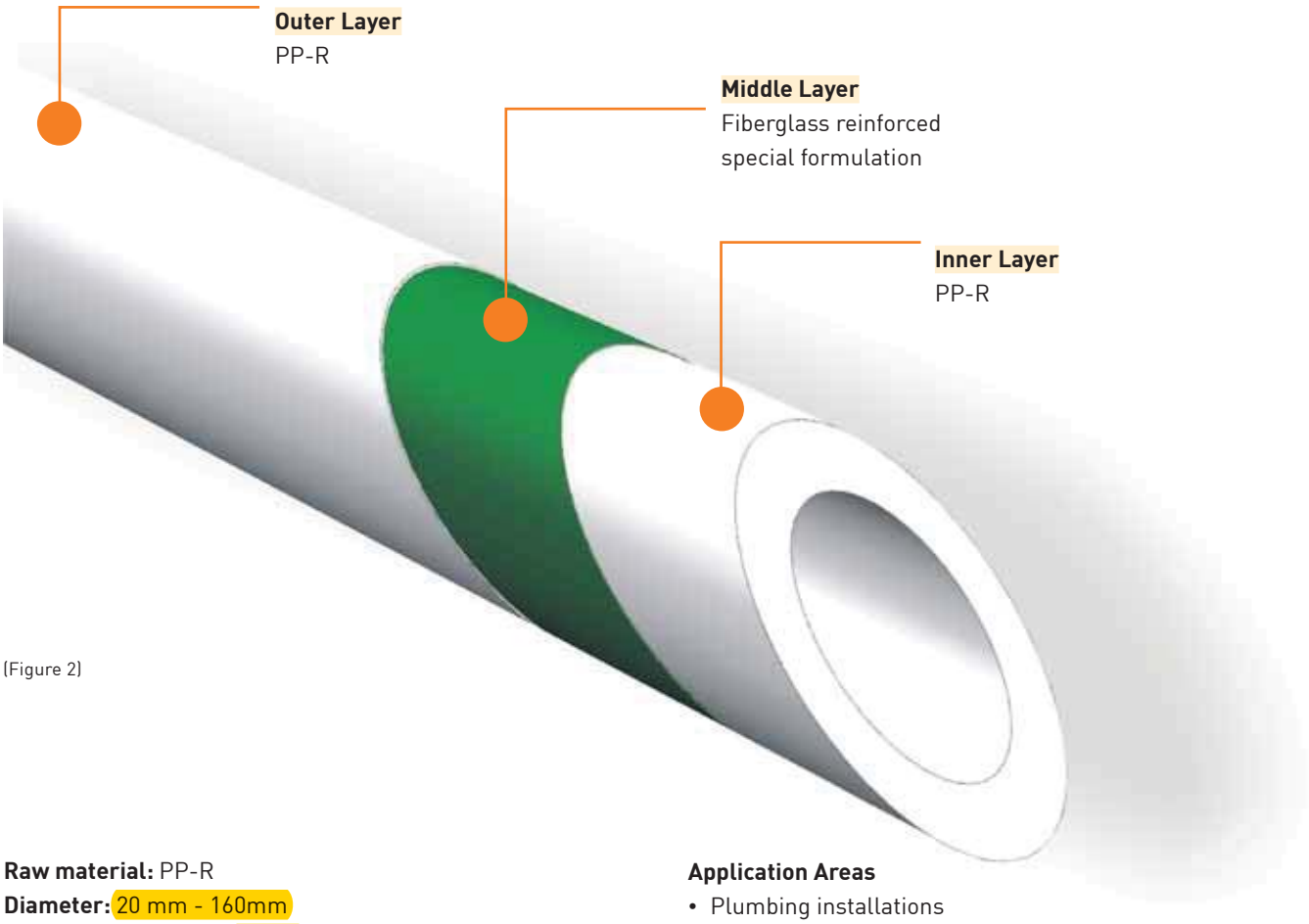
(Figure 1)

Raw material: PP-R
Diameter: 20 mm - 160 mm
Pressure rating (PN): PN 10, PN 16, **Standard Dimension Ratio (SDR):** SDR 6, SDR 7,4, SDR 11 **Standards:** D VGW W544, I SO 15874-1, I SO 15874-2, I SO 15874-3, DIN 8077, DIN 8078, DIN 18836
Service life: 50 years
Color: white, grey, green, beige, blue
Temperature of operating media: 5°C - 95°C
Operation & installation temperature: 5°C - 45°C
Pipe length: 4m
Connections: Fusion welding
Coefficient of thermal expansion: 0.15mm/mK
Coefficient of thermal conductivity: 0.24w/mK

Application Areas

- Plumbing installations
- Mobile System Plumbing
- Mobile System Heating
- Mobile System Clean Water
- Drinking water network
- Swimming pool systems
- Industrial clean water systems

Faser fiberglass reinforced PP-R pipes



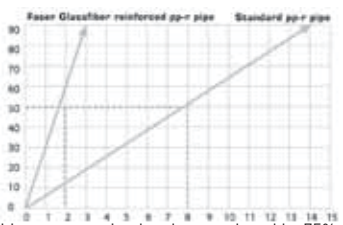
(Figure 2)

Raw material: PP-R
Diameter: 20 mm - 160mm
Pressure rating (PN): PN 20, PN 25
Standard Dimension Ratio (SDR): SDR 6, SDR 7,4
Standard: TS EK 28
Service life: 50 years
Color: white, grey, green, beige, blue
Temperature of operating media: 5°C - 95°C
Operation & installation temperature: 5°C - 45°C
Pipe length: 4m
Connections: Fusion welding
Coefficient of thermal expansion: 0.035mm/mK
Coefficient of thermal conductivity: 1.10w/mK

Application Areas

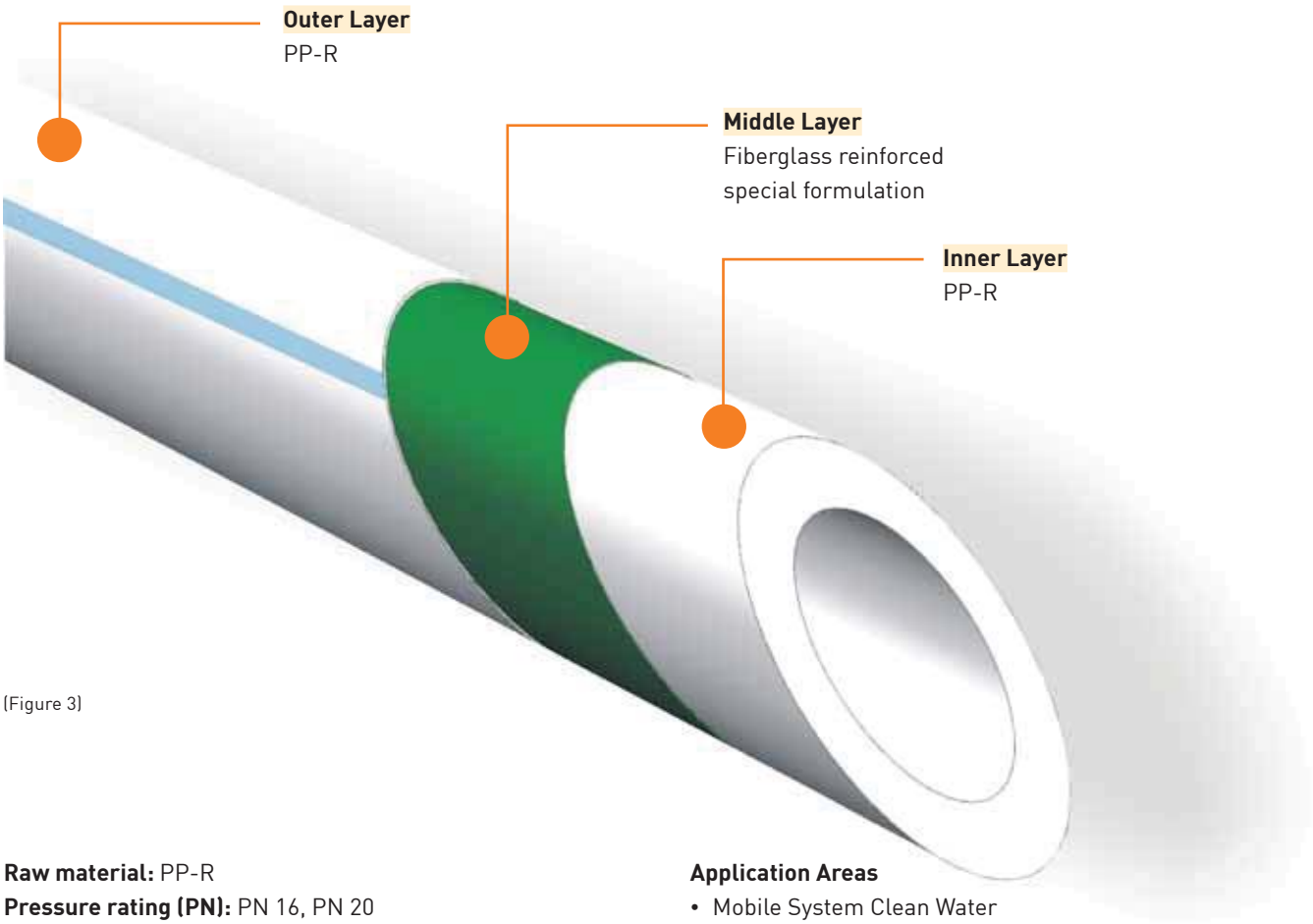
- Plumbing installations
- Mobile System Plumbing
- Boiler replacement
- Mobile System Heating
- Mobile System Clean Water
- Drinking water network
- Swimming pool systems
- Industrial clean water systems

Linear expansion comparison:



Linear expansion has been reduced by 75%

Climafaser fiberglass reinforced PP-R pipes



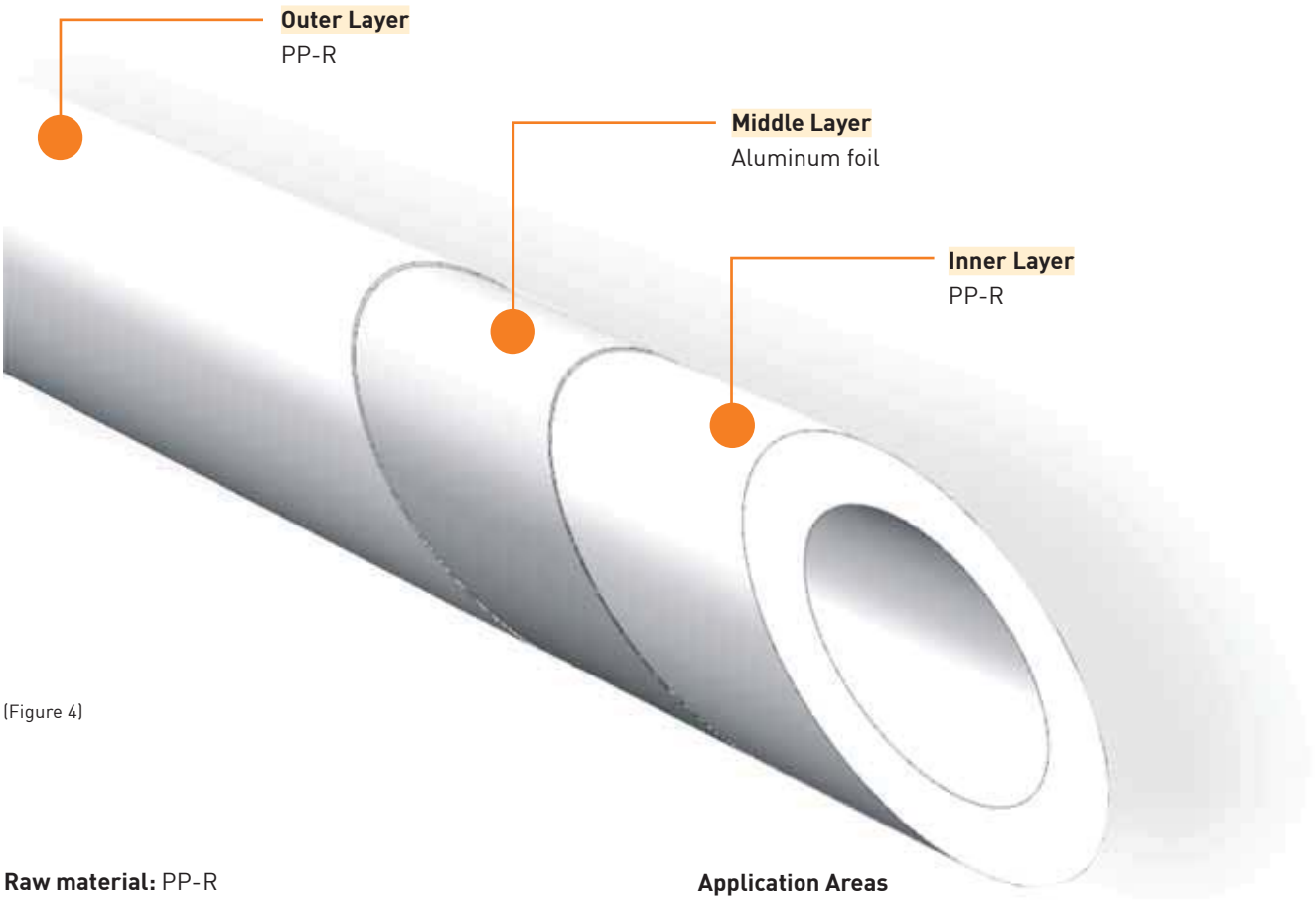
(Figure 3)

Raw material: PP-R
Pressure rating (PN): PN 16, PN 20
Diameter: 20 mm - 160mm
Standard Dimension Ratio (SDR): SDR 7,4, SDR 11
Standard: TS EK 28 color: green (blue striped)
Service life: 50 years
Temperature of operating media: 5°C - 95°C
Operation & installation temperature: 5°C - 45°C
Pipe length: 4m
Connections: Fusion welding
Coefficient of thermal expansion: 0.035mm/mK
Coefficient of thermal conductivity: 1.10w/mK

Application Areas

- Mobile System Clean Water
- Clima Systems
- Swimming pool systems
- Industrial clean water systems

Stable aluminum foiled PP-R pipe



(Figure 4)

Raw material: PP-R
Diameter: 20 mm - 160mm
Pressure rating (PN): PN 25
Standard Dimension Ratio (SDR): SDR 6
Standards: ISO 15874, ISO 15874-2, ISO 15874-3, DIN 8077, DIN 8078, DIN 18836
Service life: 50 years
Color: white, grey, green, beige, blue
Temperature of operating media: 5°C - 95°C
Operation & installation temperature: 5°C - 45°C
Pipe length: 4m
Connections: Peeling + Fusion welding
Coefficient of thermal expansion: 0.030mm/mK
Coefficient of thermal conductivity: 190w/mK

Application Areas

- Plumbing installations
- Mobile System Plumbing
- Boiler replacement
- Mobile System Heating
- Mobile System Clean Water
- Drinking water network
- Exterior application
- Solar collector
- Swimming pool systems
- Industrial clean water systems

Technical Properties

Aquasystem has 4 types of PP-R pipes

	Standard PP-R Pipe Systems	Faser Glassfiber Reinforced Pipe Systems	Climafaser Glassfiber Reinforced Pipe Systems	Stable-Aluminum Foiled Pipe Systems
				
Diameter	20 ∅ -160 ∅	20 ∅ -160 ∅	20 ∅ -160 ∅	20 ∅ -160 ∅
Pressure Nominal (PN)	PN10-PN16-PN20	PN20-PN25	PN16-PN20	PN25
Standard Dimension Ratio (SDR)	SDR 6 / SDR 7,4 / SDR 11	SDR 6 / SDR 7,4	SDR 7,4 / SDR 11	SDR 6
Standard	DVGW W544, ISO 15874-1, ISO 15874-2, ISO 15874-3, DIN 8077, DIN 8078, DIN 18836	TS EK 28	TS EK 28	ISO 15874, ISO 15874-2, ISO 15874-3, DIN 8077, DIN 8078, DIN 18836
Service Life (See Table 5)	50 Years	50 Years	50 Years	50 Years
Colour	White-Grey-Green Beige-Blue	White-Grey-Green Beige-Blue	White-Grey-Green Beige-Blue	White-Grey-Green Beige-Blue
Working Liquid Temperature	5°C - 95°C	5°C - 95°C	5°C - 95°C	5°C - 95°C
Operation & Installation Temperature	5°C - 45°C	5°C - 45°C	5°C - 45°C	5°C - 45°C
***Pipe Length**	4 m	4 m	4 m	4 m
Impact Strength	EN 15874	TS EK 28	TS EK 28	EN 15874
Application Class	A Class 1,2,5	A Class 1,2,5	A Class 1,2,5	A Class 1,2,5
Density	0,98 gr/cm^3	0,98 gr/cm^3	0,98 gr/cm^3	0,98 gr/cm^3
Connections	Fusion welding	Fusion welding	Fusion welding	Trimming (Peeling) + Fusion welding
Structure	1 Layer PP-R	3 Layer PP-R / GF** / PP-R **Glassfiber Reinforced Formula	3 Layer PP-R / GF** / PP-R **Glassfiber Reinforced Formula	3 Layer PP-R / AL*** / PP-R ***Aluminium Foiled
Coefficient of Thermal Expansion	0,15mm/mK	0,035mm/mK	0,035mm/mK	0,030mm/mK
Coefficient of Thermal Conductivity	0,24w/mK	1,10w/mK	1,10w/mK	190w/mK
Product Quality	Raw Material: (PP-R) (Authorised by German plastics testing institutes (DVGW) and TSE)			

Table 2

*Different lengths are available for special orders.

Chemical resistance

The table in this document summarizes the data given in a number of polypropylene chemical resistance tables currently in use in various countries, derived from both practical experience and test results.

Source: ISO/TR 10358

The table contains an evaluation of the chemical resistance to a number of fluids judged to be either aggressive or not towards polypropylene. This evaluation is based on values obtained by immersion of polypropylene test specimens in the fluid concerned at 20, 60 and 100°C and atmospheric pressure, followed in certain cases by the tensile characteristics.

Definitions, symbols and abbreviations

The criteria of classifications, definitions, symbols and abbreviations adopted in this document are as follows:

S = Satisfactory
The chemical resistance of polypropylene exposed to the action of a fluid is classified as "satisfactory" when the test results are acknowledged to be "satisfactory" by the majority of the countries participating in the evaluation.

L = Limited
The chemical resistance of polypropylene exposed to the action of a fluid is classified as **"limited"** when the test results are acknowledged to be **"limited"** by the majority of the countries participating in the evaluation.
Also classified as "limited" is the resistance to the action of chemical fluids for which judgements **"S"** and **"NS"** or **"L"** are pronounced to an equal extent.

NS = Not satisfactory
The chemical resistance of polypropylene exposed to the action of a fluid is classified as "not satisfactory" when the test results are acknowledged to be "not satisfactory" by the majority of the countries participating in the evaluation.

Also classified as "not satisfactory" are materials for which judgement **"L"** and **"NS"** are pronounced to an equal extent.

Sat.sol Saturated aqueous solution, prepared at 20°C

Sol Aqueous solution at a concentration higher than 10 % but not saturated

Dil.sol Dilute aqueous solution at a concentration equal to or lower than 10 %

Work.sol Aqueous solution having the usual concentration for industrial use

Solution concentrations reported in the text are expressed as a percentage by mass. The aqueous solutions of slightly soluble chemicals are considered, as far as chemical action towards polypropylene is concerned, as saturated solutions.

In general, common chemical names are used in this document

The table serves as a first guideline for users of polypropylene. If a chemical compound is not to be found or if there is an uncertainty regarding the chemical resistance in an application, please contact GF Hakan Plastik for advice and recommendations on testing.

Chemical resistance table for polypropylene

Chemical resistance of polypropylene, not subjected to mechanical stress, for various media at 20, 60 and 100 ° C

Chemical or Product	Concentration	Temperature ° C		
		20	60	100
Acetic acid	Up to 40 %	S	S	-
Acetic acid	50 %	S	S	L
Acetic acid, glacial	→ 96 %	S	L	NS
Acetic anhydride	100 %	S	-	-
Acetone	100 %	S	S	-
Aceptophenone	100 %	S	L	-
Acrylonitrile	100 %	S	-	-
Air		S	S	S
Allyl alcohol	100 %	S	S	-
Almond oil		S	-	-
Alum	Sol	S	S	-
Ammonia, aqueous	Sat. sol	S	S	-
Ammonia, dry gas	100 %	S	-	-
Ammonia, liquid	100 %	S	-	-
Ammonium acetate	Sat. sol	S	S	-
Ammonium chloride	Sat. sol	S	S	-
Ammonium fluoride	Up to 20 %	S	S	-
Ammonium hydrogen carbonate	Sat. sol	S	S	-
Ammonium metaphosphate	Sat. sol	S	S	S
Ammonium nitrate	Sat. sol	S	S	S
Ammonium persulphate	Sat. sol	S	S	-
Ammonium phosphate	Sat. sol	S	-	-
Ammonium sulphate	Sat. sol	S	S	S
Ammonium sulphide	Sat. sol	S	S	-
Amyl acetate	100 %	L	-	-
Amyl alcohol	100 %	S	S	S
Aniline	100 %	S	S	-
Apple juice		S	-	-
Aqua regia	HCl/HNO_3 = 3/1	NS	NS	NS
Barium bromide	Sat. sol	S	S	S
Barium carbonate	Sat. sol	S	S	S
Barium chloride	Sat. sol	S	S	S

Table 3.0

Chemical resistance table for polypropylene

Chemical or Product	Concentration	Temperature ° C		
		20	60	100
Barium hydroxide	Sat. sol	S	S	S
Barium sulphide	Sat. sol	S	S	S
Beer		S	S	-
Benzene	100 %	L	NS	NS
Benzoic acid	Sat. sol	S	S	-
Benzyl alcohol	100 %	S	L	-
Borax	Sol	S	S	-
Boric acid	Sat. sol	S	-	-
Boron trifluoride	Sat. sol	S	-	-
Bormine, gas		NS	NS	NS
Bromine, liquid	100 %	NS	NS	NS
Butane, gas	100 %	S	-	-
Butanol	100 %	S	L	L
Butyl acetate	100 %	L	NS	NS
Butyl glycol	100 %	S	-	-
Butyl phenols	Sat. sol	S	-	-
Butyl phthalate	100 %	S	L	L
Calcium carbonate	Sat. sol	S	S	S
Calcium chlorate	Sat. sol	S	S	-
Calcium chloride	Sat. sol	S	S	S
Calcium hydroxide	Sat. sol	S	S	S
Calcium hypochlorite	Sol	S	-	-
Camphor oil		NS	NS	NS
Carbon dioxide, dry gas		S	S	-
Carbon dioxide, wet gas		S	S	-
Carbon disulphide	100 %	S	NS	NS
Carbon monoxide, gas		S	S	-
Carbon tetrachloride	100 %	NS	NS	NS
Castor oil	100 %	S	S	-
Caustic soda	Up to 50 %	S	L	L
Chlorine, aqueous	Sat. sol	S	L	-
Chlorine, dry gas	100 %	NS	NS	NS
Chlorine, liquid	100 %	NS	NS	NS
Chloroacetic acid	Sol	S	-	-

Table 3.1

Chemical resistance table for polypropylene

Chemical or Product	Concentration	Temperature ° C		
		20	60	100
Chloroethanol	100 %	S	-	-
Chloroform	100 %	L	NS	NS
Chlorosulphonic acid	100 %	NS	NS	NS
Chrome alum	Sol	S	S	-
Chromic acid	Up to 40 %	S	L	NS
Citric acid	Sat. sol	S	S	S
Coconut oil		S	-	-
Copper (II) chloride	Sat. sol	S	S	-
Copper (II) nitrate	Sat. sol	S	S	S
Copper (II)	Sat. sol	S	S	-
Corn oil		S	L	-
Cottonseed oil		S	S	-
Cresol	Greater than 90 %	S	-	-
Cyclohexane	100 %	S	-	-
Cyclohexanol	100 %	S	L	-
Cyclohexanone	100 %	L	NS	NS
Decalin (decahydronaphthalene)	100 %	NS	NS	NS
Dextrin	Sol	S	S	-
Dextrose	Sol	S	S	S
Dibutyl phthalate	100 %	S	L	NS
Dichloroacetic acid	100 %	L	-	-
Dichioroethylene (A and B)	100 %	L	-	-
Diethanolamine	100 %	S	-	-
Diethyl ether	100 %	S	L	-
Diethylene glycol	100 %	S	S	-
Diglycolic acid	Sat. sol	S	-	-
Diisooctyl	100 %	S	L	-
Dimethyl amine, gas		S	-	-
Dimethyl formamide	100 %	S	S	-
Dioctyl phthalate	100 %	L	L	-
Dioxane	100 %	L	L	-
Distilled water	100 %	S	S	S
Ethanolamine	100 %	S	-	-
Ethyl acetate	100 %	L	NS	NS

Table 3.2

Chemical resistance table for polypropylene

Chemical or Product	Concentration	Temperature ° C		
		20	60	100
Ethyl alcohol	Up to 95 %	S	S	S
Ethyl chloride, gas		NS	NS	NS
Ethylene chloride (mono and di)		L	L	-
Ethyl ether	100 %	S	L	-
Ethylene glycol	100 %	S	S	S
Ferric chloride	Sat. sol	S	S	S
Formaldehyde	40 %	S	-	-
Formic add	10 %	S	S	L
Formic acid	85 %	S	NS	NS
Formic acid, anhydrous	100 %	S	L	L
Fructose	Sol	S	S	S
Fruit juice		S	S	S
Gasoline, petrol (aliphatic hydrocarbons)		NS	NS	NS
Gelatine		S	S	-
Glucose	20 %	S	S	S
Glycerine	100 %	S	S	S
Glycolic acid	30 %	S	-	-
Heptane	100 %	L	NS	NS
Hexane	100 %	S	L	-
Hydrobromic acid	Up to 48 %	S	L	NS
Hydrochloric acid	Up to 20 %	S	S	S
Hydrochloric acid	30 %	S	L	L
Hydrochloric acid	From 35 to 36 %	S	-	-
Hydrofluoric acid	Dil. sol	S	-	-
Hydrofluoric acid	40 %	S	-	-
Hydrogen	100 %	S	-	-
Hydrogen chloride, dry gas	100 %	S	S	-
Hydrogen peroxide	Up to 10 %	S	-	-
Hydrogen peroxide	Up to 30 %	S	L	-
Hydrogen sulphide, dry gas	100 %	S	S	-
				-
Iodine, in alcohol		S	-	-
Is octane	100 %	L	NS	NS

Table 3.3

Chemical resistance table for polypropylene

Chemical or Product	Concentration	Temperature ° C		
		20	60	100
Isopropyl alcohol	100 %	S	S	S
Isopropyl ether	100 %	L	-	-
Lactic acid	Up to 90 %	S	S	-
Lanoline		S	L	-
Linseed oil		S	S	S
Magnesium carbonate	Sat. sol	S	S	S
Magnesium chloride	Sat. sol	S	S	-
Magnesium hydroxide	Sat. sol	S	S	-
Magnesium sulphate	Sat. sol	S	S	-
Maleic acid	Sat. sol	S	S	-
Mercury (II) chloride	Sat. sol	S	S	-
Mercury (II) cyanide	Sat. sol	S	S	-
Mercury (I) nitrate	Sol	S	S	-
Mercury	100 %	S	S	-
Methyl acetate	100 %	S	S	-
Methyl alcohol	5 %	S	L	L
Methyl amine	Up to 32 %	S	-	-
Methyl bromide	100 %	NS	NS	NS
Methyl ethyl ketone	100 %	S	-	-
Methylene chloride	100 %	L	NS	NS
Milk		S	S	S
Monochloroacetic acid	→ 85 %	S	S	-
Naphtha		S	NS	NS
Nickel chloride	Sat. sol	S	S	-
Nickel nitrate	Sat. sol	S	S	-
Nickel sulphate	Sat. sol	S	S	-
Nitric acid	Up to 30 %	S	NS	NS
Nitric acid	From 40 to 50 %	L	NS	NS
Nitric acid, fujming (with nitrogen dioxide)		NS	NS	NS
Nitrobenzene	100 %	S	L	
Oleic acid	100 %	S	L	-
Oleum (sulphuric acid with 60 % of S03)		S	L	-

Table 3.4

Chemical resistance table for polypropylene

Chemical or Product	Concentration	Temperature ° C		
		20	60	100
Olive oil		S	S	L
Oxalic acid	Sat. sol	S	L	NS
Oxygen, gas		S	-	-
Paraffin oil (FL65)		S	L	NS
Peanut oil		S	S	-
Peppermint oil		S	-	-
Perchloric acid	(2 N) 20 %	S	-	-
Petroleum ether (ligroine)		L	L	-
Phenol	5 %	S	S	-
Phenol	90 %	S	-	-
Phosphine, gas		S	S	-
Phosphoric acid	Up. to 85 %	S	S	S
Phosphorus oxychloride	100 %	L	-	-
Picric acid	Sat. sol	S	-	-
Potassium bicarbonate	Sat. sol	S	S	S
Potassium borate	Sat. sol	S	S	-
Potassium bromate	Up to 10 %	S	S	-
Potassium bromide	Sat. sol	S	S	
Potassium carbonate	Sat. sol	S	S	
Potassium chlorate	Sat. sol	S	S	
Potassium chlorite	Sat. sol	S	S	
Potassium chromate	Sat. sol	S	S	
Potassium cyanide	Sol	S	-	
Potassium dichromate	Sat. sol	S	S	S
Potassium ferricyanide	Sat. sol	S	S	-
Potassium fluoride	Sat. sol	S	S	-
Potassium hydroxide	Up to 50 %	S	S	S
Potassium iodide	Sat. sol	S	-	-
Potassium nitrate	Sat. sol	S	S	-
Potassium perchlorate	10 %	S	S	-
Potassium permanganate	(2 N) 30 %	S	-	-
Potassium persulphate	Sat. sol	S	S	-
Potassium sulphate	Sat. sol	S	S	-
Propane, gas	100 %	S	-	-
Propionic acid	→ 50 %	S	-	-

Table 3.5

Chemical resistance table for polypropylene

Chemical or Product	Concentration	Temperature ° C		
		20	60	100
Pyridine	100 %	L	-	-
Seawater		S	S	S
Silicon oil		S	S	S
Silver nitrate	Sat. sol	S	S	L
Sodium acetate	Sat. sol	S	S	S
Sodium benzoate	35 %	S	L	-
Sodium bicarbonate	Sat. sol	S	S	S
Sodium carbonate	Up to 50 %	S	S	L
Sodium chlorate	Sat. sol	S	S	-
Sodium chloride	Sat. sol	S	S	-
Sodium chlorite	2 %	S	L	NS
Sodium chlorite	20 %	S	L	NS
Sodium dichromate	Sat. sol	S	S	S
Sodium hydrogen carbonate	Sat. sol	S	S	S
Sodium hydrogen sulphate	Sat. sol	S	S	-
Sodium hydrogen sulphite	Sat. sol	S	-	-
Sodium hydroxide	1 %	S	S	S
Sodium hydroxide	From 10 to 60 %	S	S	S
Sodium hypochlorite	5 %	S	S	-
Sodium hypochlorite	10 % - 15 %	S	-	-
Sodium hypochlorite	20 %	S	L	-
Sodium metaphosphate	Sol	S	-	-
Sodium nitrate	Sat. sol	S	S	-
Sodium perborate	Sat. sol	S	S	-
Sodium phosphate (neutral)		S	S	S
Sodium silicate	Sol	S	S	-
Sodium sulphate	Sat. sol	S	S	-
Sodium sulphide	Sat. sol	S	-	-
Sodium sulphite	40 %	S	S	S
Sodium thiosulphate (hypo)	Sat. sol	S	-	-
Soybean oil		S	L	-
Succinic acid	Sat. sol	S	S	-
Sulphuric acid	Up to 10 %	S	S	S
Sulphuric dioxide, dry or wet	100 %	S	S	-

Table 3.6

Chemical resistance table for polypropylene

Chemical or Product	Concentration	Temperature ° C		
		20	60	100
Sulphur acid	From 10 to 30 %	S	S	-
Sulphuric acid	50 %	S	L	L
Sulphuric acid	96 %	S	L	NS
Sulphuric acid	98 %	L	NS	NS
Sulphurous acid	Up to 30 %	S	-	-
Tartaric acid	Sat. sol	S	S	-
Tietrahydrofuran	100 %	L	NS	NS
Tetralin	100 %	NS	NS	NS
Thiophene	100 %	S	L	-
Tin (IV) chloride	Sol	S	S	-
Tin (II) chloride	Sat. sol	S	S	-
Toluene	100 %	L	NS	NS
Trichloroacetic acid	Up to 50 %	S	S	-
Trichloroethylene	100 %	NS	NS	NS
Triethanolamine	Sol	S	-	-
Turpentine		NS	NS	NS
Urea	Sat. sol	S	S	-
Vinegar		S	S	
Water brackish, mineral, potable		S	S	S
Whiskey		S	S	-
Wines		S	S	-
Xylene	100 %	NS	NS	NS
Yeast	Sol	S	S	S
Zinc chloride	Sat. sol	S	S	-
Zinc sulphate	Sat. sol	S	S	-

Table 3.7

This data is based on multiple sources. You are required to carry out the appropriate tests to ensure the suitability and safety of the products for the envisaged use in accordance with all applicable regulations.

Pressure loss

D s Di	20 mm 3,4 mm 13,2 mm			D s Di	25 mm 4,2 mm 16,6 mm			D s Di	32 mm 5,4 mm 21,2 mm		
V	Q		J	V	Q		J	V	Q		J
m/s	m^3/h	m^3/s	m/m	m/s	m^3/h	m^3/s	m/m	m/s	m^3/h	m^3/s	m/m
0.4	0.18	0.00005	0.01555	0.4	0.32	0.00009	0.01512	0.4	0.50	0.00014	0.01042
0.5	0.25	0.00007	0.02899	0.5	0.40	0.00011	0.02193	0.5	0.65	0.00018	0.01659
0.6	0.29	0.00008	0.03713	0.6	0.47	0.00013	0.02988	0.6	0.76	0.00021	0.02207
0.7	0.36	0.00010	0.05613	0.7	0.54	0.00015	0.03895	0.7	0.90	0.00025	0.03048
0.8	0.40	0.00011	0.06696	0.8	0.61	0.00017	0.04911	0.8	1.01	0.00028	0.03760
0.9	0.43	0.00012	0.07867	0.9	0.68	0.00019	0.06035	0.9	1.15	0.00032	0.04815
1.0	0.50	0.00014	0.10467	1.0	0.79	0.00022	0.07917	1.0	1.26	0.00035	0.05684
1.1	0.54	0.00015	0.11893	1.1	0.86	0.00024	0.09302	1.1	1.40	0.00039	0.06945
1.2	0.58	0.00016	0.13403	1.2	0.94	0.00026	0.10788	1.2	1.51	0.00042	0.07967
1.3	0.65	0.00018	0.16670	1.3	1.01	0.00028	0.12375	1.3	1.66	0.00046	0.09429
1.4	0.68	0.00019	0.18426	1.4	1.08	0.00030	0.14062	1.4	1.76	0.00049	0.10599
1.5	0.76	0.00021	0.22179	1.5	1.15	0.00032	0.15847	1.5	1.91	0.00053	0.12257
1.6	0.79	0.00022	0.24174	1.6	1.26	0.00035	0.18708	1.6	2.02	0.00056	0.13573
1.7	0.83	0.00023	0.26248	1.7	1.33	0.00037	0.20736	1.7	2.16	0.00060	0.15423
1.8	0.90	0.00025	0.30632	1.8	1.40	0.00039	0.22859	1.8	2.30	0.00064	0.17381
1.9	0.94	0.00026	0.32939	1.9	1.48	0.00041	0.25078	1.9	2.41	0.00067	0.18920
2.0	0.97	0.00027	0.35324	2.0	1.55	0.00043	0.27390	2.0	2.56	0.00071	0.21065
2.1	1.04	0.00029	0.40322	2.1	1.62	0.00045	0.29796	2.1	2.66	0.00074	0.22744
2.2	1.08	0.00030	0.42935	2.2	1.73	0.00048	0.33579	2.2	2.81	0.00078	0.25073
2.3	1.12	0.00031	0.45623	2.3	1.80	0.00050	0.36216	2.3	2.92	0.00081	0.26888
2.4	1.19	0.00033	0.51224	2.4	1.87	0.00052	0.38945	2.4	3.06	0.00085	0.29398
2.5	1.22	0.00034	0.54136	2.5	1.94	0.00054	0.41764	2.5	3.17	0.00088	0.31349
2.6	1.30	0.00036	0.60181	2.6	2.02	0.00056	0.44674	2.6	3.31	0.00092	0.34039
2.7	1.33	0.00037	0.63313	2.7	2.09	0.00058	0.47674	2.7	3 42	0.00095	0.36123
2.8	1.37	0.00038	0.66519	2.8	220	0.00061	0.52341	2.8	3.56	0.00099	0.38990
2.9	1.44	0.00040	0.73147	2.9	2.27	0.00063	0.55564	2.9	3.67	0.00102	0.41207
3.0	1.48	0.00041	0.76570	3.0	2.34	0.00065	0.58875	3.0	3.82	0.00106	0.44249
3.1	1.51	0.00042	0.80065	3.1	2.41	0.00067	0.62273	3.1	3.92	0.00109	0.46597
3.2	1.58	0.00044	0.87269	3.2	2.48	0.00069	0.65760	3.2	4.07	0.00113	0.49813
3.3	1.62	0.00045	0.90977	3.3	2.56	0.00071	0.69333	3.3	4.18	0.00116	0.52290
3.4	1 69	0.00047	0.96607	3.4	2.66	0.00074	0.74857	3.4	4.32	0.00120	0.55678
3.5	1.73	0.00048	1.02528	3.5	2.74	0.00076	0.78646	3.5	4.46	0.00124	0.59164
3.6	1.76	0.00049	1.06519	3.6	2.81	0.00078	0.82522	3.6	4.57	0.00127	0.61842
3.7	1.84	0.00051	1.14711	3.7	2.88	0.00080	0.86484	3.7	4.72	0.00131	0.65498
3.8	1.87	0.00052	1.18911	3.8	2.95	0.00082	0.90531	3.8	482	0.00134	0.68303
3.9	1.91	0.00053	1.23181	3.9	3.02	0.00084	0.94662	3.9	4.97	0.00138	0.72127
4.0	1.98	0.00055	1.31928	4.0	3.13	0.00087	1.01019	4.0	5.08	0.00141	0.75058
4.1	2.02	0.00056	1.36404	4.1	3.20	0.00089	1.05362	4.1	5.22	0.00145	0.79049
4.2	2.05	0.00057	1.40950	4.2	3.28	0.00091	1.09789	4.2	5.33	0.00148	0.82104
4.3	2.12	0.00059	1.50246	4.3	3.35	0.00093	1.14299	4.3	5.47	0.00152	0.86261
4.4	2.16	0.00060	1.54996	4.4	3.42	0.00095	1.18893	4.4	558	0.00155	0.89441
4.5	2.23	0.00062	1.64700	4.5	3.49	0.00097	1.23570	4.5	5.72	0.00159	0.93762
4.6	2.27	0.00063	1.69653	4.6	3.60	0.00100	1 30741	4.6	583	0.00162	0.97065
4.7	2.30	0.00064	1.74674	4.7	3.67	0.00102	1.35625	4.7	5.98	0.00166	1.01550
4.8	2.38	0.00066	1.84918	4.8	3.74	0.00104	1.40591	4.8	6.08	0.00169	1.04975

Table 4.0

Pressure loss

D s Di	40 mm 6,7 mm 26,6 mm			D s Di	50 mm 8,4 mm 33,2 mm			D s Di	63 mm 10,5 mm 42,0 mm		
V	Q		J	V	Q		J	V	Q		J
m/s	m^3/h	m^3/s	m/m	m/s	m^3/h	m^3/s	m/m	m/s	m^3/h	m^3/s	m/m
0.4	0.79	0.00022	0.00797	0.4	1.26	0.00035	0.00640	0.4	1.98	0.00055	0.00470
0.5	1.01	0.00028	0.01245	0.5	1.55	0.00043	0.00936	0.5	2.48	0.00069	0.00715
0.6	1.19	0.00033	0.01688	0.6	1.87	0.00052	0.01331	0.6	2.99	0.00083	0.01007
0.7	1.40	0.00039	0.02300	0.7	2.20	0.00061	0.01789	0.7	3.49	0.00097	0.01344
0.8	1.58	0.00044	0.02876	0.8	2.48	0.00069	0.02248	0.8	4.00	0.00111	0.01725
0.9	1.80	0.00050	0.03644	0.9	2.81	0.00078	0.02821	0.9	4.50	0.00125	0.02150
1.0	2.02	0.00056	0.04495	1.0	3.13	0.00087	0.03454	1.0	5.00	0.00139	0.02617
1.1	2.20	0.00061	0.05266	1.1	3.42	0.00095	0.04065	1.1	5.47	0.00152	0.03088
1.2	2.41	0.00067	0.06266	1.2	3.74	0.00104	0.04806	1.2	5.98	0.00166	0.03636
1.3	2.59	0.00072	0.07159	1.3	4.07	0.00113	0.05605	1.3	6.48	0.00180	0.04224
1.4	2.81	0.00078	0.08303	1.4	4.36	0.00121	0.06362	1.4	6.98	0.00194	0.04852
1.5	2.99	0.00083	0.09316	1.5	4.68	0.00130	0.07266	1.5	7.49	0.00208	0.05521
1.6	3.20	0.00089	0.10601	1.6	5.00	0.00139	0.08225	1.6	7.99	0.00222	0.06229
1.7	3.38	0.00094	0.11730	1.7	5.29	0.00147	0.09123	1.7	8.50	0.00236	0.06976
1.8	3.60	0.00100	0.13155	1.8	5.62	0.00156	0.10185	1.8	8.96	0.00249	0.07704
1.9	3.82	0.00106	0.14654	1.9	5.90	0.00164	0.11173	1.9	9.47	0.00263	0.08525
2.0	4.00	0.00111	0.15960	2.0	6.23	0.00173	0.12335	2.0	9.97	0.00277	0.09385
2.1	4.21	0.00117	0.17594	2.1	6.55	0.00182	0.13550	2.1	10.48	0.00291	0.10282
2.2	4.39	0.00122	0.19012	2.2	6.84	0.00190	0.14673	2.2	10.98	0 00305	0.11217
2.3	4.61	0.00128	0.20780	2.3	7.16	0.00199	0.15986	2.3	11.48	0.00319	0.12189
2.4	4.79	0.00133	0.22308	2.4	7.49	0.00208	0.17351	2.4	11.99	0.00333	0.13198
2.5	5.00	0.00139	0.24207	2.5	7.78	0.00216	0.18607	2.5	12.46	0.00346	0.14168
2.6	5.18	0.00144	0.25845	2.6	8.10	0.00225	0.20069	2.6	12.96	0.00360	0.15248
2.7	5.40	0.00150	0.27874	2.7	8.42	0.00234	0.21581	2.7	13.46	0.00374	0.16365
2.8	5.62	0.00156	0.29974	2.8	8.71	0.00242	0.22967	2.8	13.97	0.00388	0.17517
2.9	5.80	0.00161	0.31778	2.9	9.04	0.00251	0.24574	2.9	14.47	0.00402	0.18706
3.0	6.01	0.00167	0.34006	3.0	9.36	0.00260	0.26231	3.0	14.98	0.00416	0.19930
3.1	6.19	0.00172	0.35916	3.1	9.65	0.00268	0.27745	3.1	15.44	0.00429	0.21099
3.2	6.41	0.00178	0.38270	3.2	9.97	0.00277	0.29495	3.2	15 95	0.00443	0.22392
3.3	6.59	0.00183	0.40285	3.3	10.30	0.00286	0.31294	3.3	16.45	0.00457	0.23720
3.4	6.80	0.00189	0.42765	3.4	10.58	0.00294	0.32935	3.4	16.96	0.00471	0.25084
3.5	7.02	0.00195	0.45313	3.5	10.91	0.00303	0.34826	3.5	17.46	0.00485	0.26482
3.6	7.20	0.00200	0.47489	3.6	11.23	0.00312	0.36766	3.6	17 96	0.00499	0.27915
3.7	7.42	0.00206	0.50161	3.7	11.52	0.00320	0.38531	3.7	18.47	0.00513	0.29383
3.8	7.60	0.00211	0.52439	3.8	11.84	0.00329	0.40562	3.8	18 94	0.00526	0.30776
3.9	7.81	0.00217	0.55234	3.9	12.17	0.00338	0.42641	3.9	19.44	0.00540	0.32311
4.0	7.99	0.00222	0.57614	4.0	12.46	0.00346	0.44529	4.0	19 94	0.00554	0.33879
4.1	8.21	0.00228	0.60531	4.1	12.78	0.00355	0.46698	4.1	20.45	0.00568	0.35482
4.2	8.39	0.00233	0.63012	4.2	13.10	0.00364	0.48914	4.2	20.95	0.00582	0.37119
4.3	8.60	0.00239	0.66051	4.3	13.39	0.00372	0.50924	4.3	21.46	0.00596	0.38789
4.4	8.82	0.00245	0.69154	4.4	13.72	0.00381	0.53229	4.4	21 96	0.00610	0.40493
4.5	9.00	0.00250	0.71791	4.5	14.04	0.00390	0.55581	4.5	22.43	0.00623	0.42106
4.6	9.22	0.00256	0.75014	4.6	14.33	0.00398	0.57711	4.6	22 93	0.00637	0.43875
4.7	9.40	0.00261	0.77750	4.7	14.65	0.00407	0.60151	4.7	23.44	0.00651	0.45678
4.8	9.61	0.00267	0.81093	4.8	14.98	0.00416	0.62638	4.8	23 94	0.00665	0.47514

Table 4.1

Pressure loss

D s Di	75 mm 12,5 mm 50,0 mm			D s Di	90 mm 15,0 mm 60,0 mm			D s Di	110 mm 18,4 mm 73,2 mm		
V	Q		J	V	Q		J	V	Q		J
m/s	m³/h	m³/s	m/m	m/s	m³/h	m³/s	m/m	m/s	m³/h	m³/s	m/m
0.4	2.84	0.00079	0.00393	0.4	4.07	0.00113	0.00314	0.4	6.05	0.00168	0.00248
0.5	3.53	0.00098	0.00586	0.5	5.08	0.00141	0.00473	0.5	7.56	0.00210	0.00376
0.6	4.25	0.00118	0.00827	0.6	6.12	0.00170	0.00669	0.6	9.11	0.00253	0.00530
0.7	4.93	0.00137	0.01090	0.7	7.13	0.00198	0.00887	0.7	10.62	0.00295	0.00705
0.8	5.65	0.00157	0.01403	0.8	8.14	0.00226	0.01133	0.8	12.13	0.00337	0.00902
0.9	6.37	0.00177	0.01751	0.9	9.14	0.00254	0.01407	0.9	13.64	0.00379	0.01121
1.0	7.06	0.00196	0.02116	1.0	10.19	0.00283	0.01719	1.0	15.16	0.00421	0.01362
1.1	7.78	0.00216	0.02533	1.1	11.20	0.00311	0.02047	1.1	16.67	0.00463	0.01624
1.2	8.50	0.00236	0.02984	1.2	12.20	0.00339	0.02401	1.2	18.18	0.00505	0.01907
1.3	9.18	0.00255	0.03444	1.3	13.25	0.00368	0.02796	1.3	19.69	0.00547	0.02211
1.4	9.90	0.00275	0.03961	1.4	14.26	0.00396	0.03202	1.4	21.20	0.00589	0.02536
1.5	10.62	0.00295	0.04511	1.5	15.26	0.00424	0.03634	1.5	22.72	0.00631	0.02881
1.6	11.30	0.00314	0.05064	1.6	16.27	0.00452	0.04091	1.6	24.23	0.00673	0.03246
1.7	12.02	0.00334	0.05677	1.7	17.32	0.00481	0.04590	1.7	25.74	0.00715	0.03632
1.8	12.71	0.00353	0.06290	1.8	18.32	0.00509	0.05098	1.8	27.29	0.00758	0.04046
1.9	13.43	0.00373	0.06966	1.9	19.33	0.00537	0.05629	1.9	28.80	0.00800	0.04471
2.0	14.15	0.00393	0.07673	2.0	20 34	0.00565	0.06185	2.0	30.31	0.00842	0.04916
2.1	14.83	0.00412	0.08374	2.1	21.38	0.00594	0.06785	2.1	31.82	0.00884	0.05379
2.2	15.55	0.00432	0.09143	2.2	22.39	0.00622	0.07390	2.2	33.34	0.00926	0.05862
2.3	16.27	0.00452	0.09942	2.3	23.40	0.00650	0.08017	2.3	34.85	0.00968	0.06364
2.4	16 96	0.00471	0.10730	2.4	24.44	0.00679	0.08692	2.4	36.36	0.01010	0.06885
2.5	17.68	0.00491	0.11589	2.5	25.45	0.00707	0.09368	2.5	37.87	0.01052	0.07425
2.6	18.40	0.00511	0.12478	2.6	26.46	0.00735	0.10067	2.6	39.38	0.01094	0.07983
2.7	19.08	0.00530	0.13351	2.7	27.47	0.00763	0.10788	2.7	40.90	0.01136	0.08560
2.8	19.80	0.00550	0.14299	2.8	28.51	0.00792	0.11560	2.8	42.41	0.01178	0.09155
2.9	20.48	0.00569	0.15228	2.9	29.52	0.00820	0.12328	2.9	43.92	0.01220	0.09769
3.0	21.20	0.00589	0.16234	3.0	30.53	0.00848	0.13119	3.0	45.47	0.01263	0.10416
3.1	21.92	0.00609	0.17269	3.1	31.57	0.00877	0.13962	3.1	46.98	0.01305	0.11067
3.2	22.61	0.00628	0.18280	3.2	32.58	0.00905	0.14799	3.2	48.49	0.01347	0.11735
3.3	23.33	0.00648	0.19373	3.3	33.59	0.00933	0.15658	3.3	50.00	0.01389	0.12422
3.4	24.05	0.00668	0.20495	3.4	34.60	0.00961	0.16540	3.4	51.52	0.01431	0.13127
3.5	24.73	0.00687	0.21588	3.5	35.64	0.00990	0.17476	3.5	53.03	0.01473	0.13849
3.6	25.45	0.00707	0.22766	3.6	36.65	0.01018	0.18402	3.6	54.54	0.01515	0.14589
3.7	26.14	0.00726	0.23912	3.7	37.66	0.01046	0.19350	3.7	56.05	0.01557	0.15347
3.8	26.86	0.00746	0.25146	3.8	38.66	0.01074	0.20321	3.8	57.56	0.01599	0.16123
3.9	27.58	0.00766	0.26409	3.9	39.71	0.01103	0.21349	3.9	59.08	0.01641	0.16916
4.0	28.26	0.00785	0.27635	4.0	40.72	0.01131	0.22363	4.0	60.59	0.01683	0.17726
4.1	28.98	0.00805	0.28953	4.1	41.72	0.01159	0.23399	4.1	62.10	0.01725	0.18554
4.2	29.70	0.00825	0.30300	4.2	42.77	0.01188	0.24495	4.2	63.65	0.01768	0.19420
4.3	30.38	0.00844	0.31605	4.3	43.78	0.01216	0.25575	4.3	65.16	0.01810	0.20283
4.4	31.10	0.00864	0.33006	4.4	44 78	0.01244	0 26676	4.4	66.67	0.01852	0.21163
4.5	31.82	0.00884	0.34434	4.5	45.79	0.01272	0.27799	4.5	68.18	0.01894	0.22061
4.6	32.51	0.00903	0.35818	4.6	46.84	0.01301	0.28984	4.6	69.70	0.01936	0.22975
4.7	33.23	0.00923	0.37301	4.7	47.84	0.01329	0.30150	4.7	71.21	0.01978	0.23907
4.8	33.91	0.00942	0.38735	4.8	48.85	0.01357	0.31337	4.8	72.72	0.02020	0.24856

Table 4.2

Chemical resistance and pressure loss

D s Di	125 mm 20,9 mm 83,2 mm			D s Di	140 mm 23,4 mm 93,2 mm			D s Di	160 mm 26,7 mm 106,6 mm		
V	Q		J	V	Q		J	V	Q		J
m/s	m^3/h	m^3/s	m/m	m/s	m^3/h	m^3/s	m/m	m/s	m^3/h	m^3/s	m/m
0.4	7.81	0.00217	0.00214	0.4	9.83	0.00273	0.00188	0.4	12.85	0.00357	0.00161
0.5	9.79	0.00272	0.00325	0.5	12.28	0.00341	0.00284	0.5	16.06	0.00446	0.00243
0.6	11.74	0.00326	0.00455	0.6	14.72	0.00409	0.00398	0.6	19.26	0.00535	0.00340
0.7	13.72	0.00381	0.00607	0.7	17.21	0.00478	0.00531	0.7	22.50	0.00625	0.00454
0.8	15.66	0.00435	0.00775	0.8	19.66	0.00546	0.00680	0.8	25.70	0.00714	0.00581
0.9	17.60	0.00489	0.00963	0.9	22.10	0.00614	0.00845	0.9	28.91	0.00803	0.00722
1.0	19.58	0.00544	0.01173	1.0	24.55	0.00682	0.01026	1.0	32.11	0.00692	0.00677
1.1	21.53	0.00598	0.01398	1.1	27.00	0.00750	0.01223	1.1	35.35	0.00962	0.01048
1.2	23.47	0.00652	0.01641	1.2	29.48	0.00619	0.01440	1.2	38.56	0.01071	0.01230
1.3	25.45	0.00707	0.01906	1.3	31.93	0.00687	0.01669	1.3	41.76	0.01160	0.01426
1.4	27.40	0.00761	0.02185	1.4	34.38	0.00955	0.01914	1.4	44.96	0.01249	0.01636
1.5	29.38	0.00816	0.02486	1.5	36.83	0.01023	0.02174	1.5	48.20	0.01339	0.01861
1.6	31.32	0.00870	0.02799	1.6	39.31	0.01092	0.02453	1.6	51.41	0.01428	0.02096
1.7	33.26	0.00924	0.03130	1.7	41.76	0.01160	0.02744	1.7	54.61	0.01517	0.02344
1.8	35.24	0.00979	0.03483	1.8	44.21	0.01228	0.03049	1.8	57.82	0.01606	0.02605
1.9	37.19	0.01033	0.03847	1.9	46.66	0.01296	0.03369	1.9	61.06	0.01696	0.02882
2.0	39.13	0.01087	0.04228	2.0	49.10	0.01364	0.03704	2.0	64.26	0.01785	0.03169
2.1	41.11	0.01142	0.04633	2.1	51.59	0.01433	0.04058	2.1	67.46	0.01874	0.03467
2.2	43.06	0.01196	0.05047	2.2	54.04	0.01501	0.04422	2.2	70.67	0.01963	0.03779
2.3	45.00	0.01250	0.05477	2.3	56.48	0.01569	0.04800	2.3	73.91	0.02053	0.04106
2.4	46.98	0.01305	0.05932	2.4	58.93	0.01637	0.05193	2.4	77.11	0.02142	0.04441
2.5	48.92	0.01359	0.06394	2.5	61.42	0.01706	0.05605	2.5	80.32	0.02231	0.04789
2.6	50.90	0.01414	0.06882	2.6	63.86	0.01774	0.06026	2.6	83.52	0.02320	0.05149
2.7	52.85	0.01468	0.07376	2.7	66.31	0.01842	0.06461	2.7	86.76	0.02410	0.05525
2.8	54.79	0.01522	0.07887	2.8	68.76	0.01910	0.06910	2.8	89.96	0.02499	0.05909
2.9	56.77	0.01577	0.08423	2.9	71.21	0.01978	0.07372	2.9	93.17	0.02568	0.06304
3.0	58.72	0.01631	0.06964	3.0	73.69	0.02047	0.07856	3.0	96.37	0.02677	0.06712
3.1	60.66	0.01685	0.09522	3.1	76.14	0.02115	0.06346	3.1	99.61	0.02767	0.07136
3.2	62.64	0.01740	0.10105	3.2	78.59	0.02183	0.08649	3.2	102.82	0.02856	0.07567
3.3	64.58	0.01794	0.10694	3.3	81.04	0.02251	0.09367	3.3	106.02	0.02945	0.06009
3.4	66.53	0.01848	0.11298	3.4	83.52	0.02320	0.09905	3.4	109.22	0.03034	0.08463
3.5	68.51	0.01903	0.11928	3.5	85.97	0.02388	0.10450	3.5	112.46	0.03124	0.06934
3.6	70.45	0.01957	0.12563	3.6	88.42	0.02456	0.11007	3.6	115.67	0.03213	0.09411
3.7	72.43	0.02012	0.13224	3.7	90.86	0.02524	0.11579	3.7	118.87	0.03302	0.09900
3.8	74.38	0.02066	0.13889	3.8	93.31	0.02592	0.12163	3.8	122.08	0.03391	0.10399
3.9	76.32	0.02120	0.14569	3.9	95.80	0.02661	0.12769	3.9	125.32	0.03481	0.10916
4.0	78.30	0.02175	0.15277	4.0	98.24	0.02729	0.13380	4.0	128.52	0.03570	0.11439
4.1	80.24	0.02229	0.15987	4.1	100.69	0.02797	0.14004	4.1	131.72	0.03659	0.11973
4.2	82.19	0.02283	0.16711	4.2	103.14	0.02865	0.14641	4.2	134.93	0.03748	0.12517
4.3	84.17	0.02338	0.17465	4.3	105.62	0.02934	0.15301	4.3	138.17	0.03838	0.13080
4.4	86.11	0.02392	0.18219	4.4	108.07	0.03002	0.15964	4.4	141.37	0.03927	0.13647
4.5	88.09	0.02447	0.19002	4.5	110.52	0.03070	0.16640	4.5	144.58	0.04016	0.14225
4.6	90.04	0.02501	0.19786	4.6	112.97	0.03138	0.17329	4.6	147.78	0.04105	0.14815
4.7	91.98	0.02555	0.20585	4.7	115.42	0.03206	0.18031	4.7	151.02	0.04195	0.15422
4.8	93.96	0.02610	0.21413	4.8	117.90	0.03275	0.18757	4.8	154.22	0.04284	0.16033

Table 4.3

Testing of Aquasystem PP-R pipes and fittings

Testing of Aquasystem PP-R pipes and fittings

a. **Density Test:** According to ISO 1183 standard, the density is determined by weighing the material. This value is 0.9 g/cm3 for PP-R material.

b. **Melt Flow Index (MFI):** a measure of the ease of flow of the melt of a thermoplastic polymer. It is defined as the mass of polymer, in grams, flowing in ten minutes through a capillary of a specific diameter and length by a pressure applied via prescribed alternative gravimetric weights for alternative prescribed temperatures. The method is described in ISO 1133. The value for PP-R is 0.3 gr/10 min.

c. **Charpy Impact Test:** also known as the Charpy V-notch test, is a standardized high strainrate test which determines the amount of energy absorbed by a material during fracture. This absorbed energy is a measure of a given material's notch toughness and acts as a tool to study temperature-dependent ductile-brittle transition. EN ISO 179 specifies a method for determining the Charpy impact strength of the product.

d. **Longitudinal Reversion:** This test is standardized in EN ISO 2505:2005, which specifies a method for determining the longitudinal reversion of thermoplastics pipes, to be carried out in either a liquid or in air. The pipe is left in the oven for a certain period of time and then removed. The height and diameter variation is calculated after cooling. According to the standards EN 15874 and DIN 8078, this value must not be greater than 3% in length and 2% in diameter.

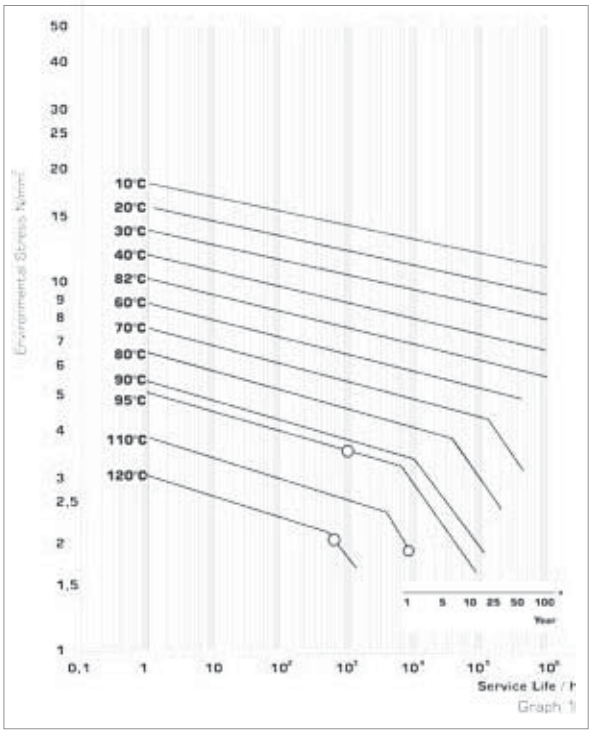
e. **Pressure Test:** The internal pressure test is standardized in ISO 1167 and EN 921 "Thermoplastic pipes for the conveyance of fluids - Resistance to internal pressure - Test method". The test specifies a method for determination of the resistance to constant internal pressure at constant temperature. Hydrostatic internal pressure tests are carried out in different pressure values at 20 °C for 1 hour, 95 °C for 1 hour, 22 hours, 165 hours and 1000 hours intervals. During this time, the pipes should not burst. In addition to raw materials used in the pressure specified in the standard temperature of 110 °C 8760 hours (one year) are tested. This test can guarantee the material life of 50 years.

f. **Homogeneity Test:** This test is standardized in EN ISO 13949 which is the method for the assessment of the degree of pigment dispersion in polyolefin pipes, fittings and compounds. The pipe cross-section taken from the surface microns is examined under the microscope to determine whether or not structural deterioration or gaps of non-homogeneous structure exist.

Service life

The expected service life of Aquasystem is more than 50 years

Using GF Hakan Aquasystem for heating applications within the pressure and temperature conditions given in the "Working pressure" tables will yield at least the projected service life.



Graph 1

Head °C		Service life (year)	Safety Factor: 1,5 Nominal Pressure Working pressure (bar) PN10	PN16	PN20	PN25
10°C	Cold Water	1	17,6	28,2	35,2	44
		5	16,5	26,5	33,1	41,3
		10	16,1	25,8	32,3	40,2
		25	15,6	25,0	31,2	39
		50	15.2	24,3	30,4	38
		100	14,8	23,7	29,6	37
20°C		1	14,9	23,9	29,9	37,3
		5	14,1	22,6	28,3	35,3
		10	13,7	22,0	27,5	34,3
		25	13,3	21,3	28,7	35,8
		50	12,9	20,7	25,9	32,3
		100	12,5	19,5	25,1	31,3
30°C		1	12,8	20,5	25,6	32
		5	12,0	19,2	24,0	30
		10	11,6	18,6	23,2	29
		25	11,2	17,9	22,4	28
		50	10,9	17,5	21,9	27,3
40°C		1	10,8	17,3	21,6	27
		5	10,1	16,2	20,3	25,3
		10	9,9	15,8	19,7	24,6
		25	9,5	15,2	18,9	23,6
		50	9,2	14,7	18,4	23
50°C		1	9,1	14,6	18,3	22,8
		5	8,5	13,7	17,1	21,3
		10	8,3	13,2	18,5	23,1
		25	8,0	12,8	18,0	22,5
		50	7,7	12,4	15,5	19,3
60°C		1	7,7	12,4	15,5	19,3
		5	7,2	11,5	14,4	18
		10	6,9	11,1	13,9	17,3
		25	6,7	10,7	13,3	16,6
		50	6,5	10,4	12,9	16,1
65°C			1	11,8	14,9	18,6
			5	10,8	13,5	16,8
			10	10,0	12,6	15,7
			25	8,5	10,7	13,3
			50	7,2	10,2	12,7
70°C			1	10,5	13,1	16,3
			5	9,6	12,0	15
			10	9,3	11,6	14,5
			25	7,9	9,9	12,3
			50	6,6	8,5	10,6
80°C			1	8,8	10,9	13,6
			5	7,7	9,6	12
			10	6,4	8,0	10
			25	5,1	6,4	8
95°C			1	9,3	9,5	9,6
			5	6,2	6,4	6,5
			10	5,1	5,2	5,3

Table 5

During the jointing process of PP-R pipes and fittings, a welding machine is required.

Welding machines

During the jointing process of PP-R pipes and fittings, a welding machine is required. Aquasystem offers two different types of welding machines:

a Welding machine for smaller diameters

Welding Threader

Diameter (mm)			
20	25	32	40

b Welding machine for bigger diameters

Welding Threader

Welding Threader

Diameter (mm)				
50	63	75	90	110

The various types of welding machines consist of complete devices including power sources, monitors and controls.

Application

1. Make sure the working area is safe before starting the machine.
2. Welding heads should be placed on the welding machine so that the parts do not move or are not turned.
3. Plug the welding machine in a 220 volt standard outlet.
4. Adjust the temperature to 260 °C (500° F). GF Hakan Plastik welding machine contains a fast-indicating surface thermometer.
5. Switch on the power button. Heating takes 1-3 minutes. (Switching two buttons will reduce heating time.)
6. Thermostat light will dim down automatically as the temperature reaches 260 °C (500° F).
7. Insert the pipes and fittings to their respective die heads.

Figure 5

8. If UV or Stabil pipe is used, completely peel off the exterior layer first. Blunt peeling blades must be replaced by Aquasystem - approved blades, (see page 58) It will be necessary to make trial peelings to ensure the correct setting of the new blade. Push the end of the pipe into the guide of the peeling tool. Peel off the outer layer up to the stop of the peeling tool. It is not necessary to mark the welding depth as the stop of the peeling tool indicates the correct welding depth. Before starting the fusion, check to ensure the exterior layer has been completely removed.

9. Pipes and fittings should be heated at the same time. Heating times vary depending on the diameter of the pipe. Heating for too short a time can result in improper bonding. Heating for too long can result in ID restriction.

Diameter (mm)	Welding Depth (mm)	Heating Time (mm)	Welding Time (sec)	Cooling Time (sec
20 MM	14	5	4	2
25 MM	15	7	4	2
32 MM	16.5	8	5	3
40 MM	18	12	6	4
50 MM	20	18	7	4
63 MM	24	24	8	6
75 MM	28	30	8	6
90 MM	29	40	8	8
110 MM	32.5	50	10	8
125 MM	40	70	10	8

10. After the heating time, quickly remove the pipe and the fitting from the welding tools.

Figure 6

11. Join them immediately, by inserting the pipe straight into the fitting without turning. The result of the fusion is an inseparable material joining of pipe and fitting.

Figure 7

12. After jointing, wait until the cooling period has elapsed.

13. After the cooling period, the fused joint is ready for use.

14. After use, switch off and unplug the welding device. Let it cool down. Never use water to cool the welding device, as this will destroy the tempered metal. Always keep the welding heads dry.

15. After completion of the welding process, clean the lay-outs with a clean cloth or absorbent paper.

Important: If the air around the pipe is below 5°C (40°F), the heating times will be increased by 50%. Remember to take greater care with the pipe as it can become brittle in cold temperatures. Using power cutters on cold pipe can cause cracking and is not recommended. Use standard ratchet or wheel cutters instead. Never pre-heat the pipe beyond 38°C (100°F)

Safety precautions

- The surface temperature of the welding iron and heads will normally be between 240°C (400°F) and 260°C (500°F) during operation, and they can remain at these temperatures for as long as 30 minutes after being un-plugged.
- When working with the welding irons, always wear the appropriate hand and arm protection to avoid the risk of burns. Protective eyewear is also recommended. Dur-ing operation, always be aware of the location of the iron. Do not leave the iron hanging loosely or allow it to brush up against flammable materials. Make sure to keep the iron clear of other people. Inform those work-ing nearby that the iron is hot and could pose a safety risk to them. Do not leave the iron unattended while it is plugged in. After unplugging the iron, protect it with a heat-resistant covering or place the iron back in its con-tainer. Do not allow the cord to contact the welding surfaces.
- All welding tools must be free from impurities. Make sure they are clean and dry before assembling. If neces-sary, clean the welding tools with a coarse, non-fibrous tissue and with rubbing alcohol.
- Pipes must be cut perpendicular to the axis with suita-ble cutting tools. Always ensure that cutters are sharp. Cutting pipes with dull or damaged ratchet cutters can cause the pipe to crack. Only use the cutters to cut PP-R material. It is also acceptable to use power saws with plastic- appropriate blades. Take care that the pipe sur-face is free from burrs or cutting debris and remove where necessary.
- For perfect fusion, damaged or dirty welding heads must be replaced, as only impeccable heads guarantee a perfect connection.

If the device has been unplugged (e.g. during longer breaks) the heating process must be restarted.

The linear expansion of pipes bases on the difference between the operating temperature and the installation temperature.

The linear expansion of pipes is based on the difference between the operating temperature and the installation temperature:

T = T operating temperature - T installation temperature

For this reason cold water pipes have practically no linear expansion.

Due to the heat-dependent expansion of the material, the linear expansion must be given special consideration for hot water and heating installations. There is a difference between the installation types:

- Open installation
- Installation in ducts
- Concealed installations with piping insulated

In the case of exposed installation pipes (e.g. in the basement), perfect visual characteristics and dimensional stability are significant. Aquasystem PP-R pipes for hot water and heating systems facilitate this. The coefficient (a) of linear expansion of Aquasystem PP-R pipes is comparable to the linear expansion of metal pipes:

The coefficient of linear expansion of Aquasystem PP-R standard piping systems without stabilizing components is α Aquasystem Standard PP-R Pipe:
0.150 mm/mK

The coefficient (a) of linear expansion of Aquasystem Faser Fiberglass Reinforced & Climafaser Fiberglass Reinforced PP-R pipes is α Aquasystem Faser Fiber glass Reinforced & Climafaser Reinforced PP-R Pipe:
0.035 mm/mK

The coefficient of linear expansion of Aquasystem Stabil Aluminum Foil PP-R pipes is α Aquasystem Stabil Aluminum Foil PP-R Pipe: **0.030 mm/mK**

The Aquasystem Faser Fiberglass Reinforced PP-R pipes require enough space to expand (see page 7). An expansion control is necessary for straight and long fiberglass pipes (over 120 ft). The Aquasystem PP-R pipes without the stabilizing compound should have expansion control on every 30 ft of straight runs.
Risers made of Faser composite pipes may be installed tightly without expansion compensation. The following formula, data tables, calculation examples and diagrams help to determine the linear expansion. The difference between working temperature and maximum or minimum installation temperature is fundamental to calculate the linear expansion.

$\Delta L = L \Delta t^* \alpha$
ΔL=Linear Expansion (mm)
L =Pipe Length (m)
ΔT=Temperature Difference between Working and Installation temperature (° K, °C or °F)
α = Coefficient of Linear Expansion (mm/mK)

Example; if a 2m long Aquasystem Faser fiberglass reinforced PP-R pipe operates in 65 °C and is installed in 25° C, the linear expansion will be calculated as follows;
$\Delta L = L^* \Delta t^* \alpha$
$\Delta L = 2^* 40^* 0{,}035$
ΔL=2,8 mm

Linear expansion

Pipe Length (mt)	Difference in temperatures (°C) ΔT = T operating temperature - T installation temperature								Difference in temperatures (°C) ΔT = T operating temperature - T installation temperature								Difference in temperatures (°C) ΔT = T operating temperature - T installation temperature							
	10°C	**20°C**	**30°C**	**40°C**	**50°C**	**60°C**	**70°C**	**80°C**	**10°C**	**20°C**	**30°C**	**40°C**	**50°C**	**60°C**	**70°C**	**80°C**	**10°C**	**20°C**	**30°C**	**40°C**	**50°C**	**60°C**	**70°C**	**70°C**
1,0	1.50	3.00	4.50	6.00	7.50	9.00	10.50	12.00	0.40	0.70	1.10	1.40	1.80	2.10	2.50	2.80	0.30	0.60	0.90	1.20	1.50	1.80	2.10	2.40
2,0	3.00	6.00	9.00	12.00	15.00	18.00	21.00	24.00	0.70	1.40	2.10	2.80	3.50	4.20	4.90	5.60	0.60	1.20	1.80	2.40	3.00	3.60	4.20	4.80
3,0	4.50	9.00	13.50	18.00	22.50	27.00	21.50	36.00	1.10	2.10	3.20	4.20	5.30	6.30	7.40	8.40	0.90	1.80	2.70	3.60	4.50	5.40	6.30	7.20
4,0	6.00	12.00	18.00	24.00	30.00	36.00	42.00	48.00	1.40	2.80	4.20	5.60	7.00	8.40	9.80	11.20	1.20	2.40	3.60	4.80	6.00	7.20	8.40	9.60
5,0	7.00	15.00	22.50	30.00	37.50	45.00	52.50	60.00	1.80	3.50	5.30	7.00	8.80	10.50	12.30	14.00	1.50	3.00	4.50	6.00	7.50	9.00	10.50	12.00
6,0	9.00	18.00	27.00	36.00	45.00	54.00	63.00	72.00	2.10	4.20	6.30	8.40	10.50	12.60	14.70	16.80	1.80	3.60	5.40	7.20	9.00	10.80	12.60	14.40
7,0	10.50	21.00	31.50	42.00	52.50	63.00	73.50	84.00	2.50	4.90	7.40	9.80	12.30	14.70	17.20	19.60	2.10	4.20	6.30	8.40	10.50	12.60	14.70	16.80
8,0	12.50	24.00	36.00	48.00	60.00	72.00	84.00	96.00	2.80	5.60	8.40	11.20	14.00	16.80	19.60	22.40	2.40	4.80	7.20	9.60	12.00	14.40	16.80	19.20
9,0	13.50	27.00	40.50	54.00	67.50	81.00	94.50	108.00	3.20	6.30	9.50	12.60	15.80	18.90	22.10	25.20	2.70	5.40	8.10	10.80	13.50	16.20	18.90	21.60
10,0	13.50	27.00	40.50	54.00	67.50	81.00	94.50	108.00	3.20	7.00	10.50	14.00	17.50	21.00	24.50	28.00	3.00	6.00	9.00	12.00	15.50	18.00	21.00	24.00

Linear expansion of Aquasystem Standard PP-R pipes

Linear expansion ΔL (in):

Aquasystem
Standard PP-R Pipe = α -
0.150 mm/mK

Linear expansion of Aquasystem Faser fiberglass reinforced and Climafaser fiberglass reinforced PP-R pipes

Linear expansion ΔL (in):

Aquasystem
Faser Fiberglass Reinforced and
Climafaser Reinforced
PP-R Pipe = α -
0.035 mm/mK

Linear expansion of Aquasystem Stabil aluminum foil PP-R pipes

Linear expansion ΔL (in):

Aquasystem
Stabil Aluminum PP-R Pipe = α -
0.030 mm/mK

The linear expansion is calculated according to the following formula:

ΔL = Lo x α x ΔT

ΔL : Amount of elongation
α : Linear expansion coefficient
Lo : First length
ΔT : Difference in temperatures

Free Expansion

Fixed supports prevent undesirable movements of the pipe. Stabilizing abilities of the fixed supports must be better than on the sliding supports.

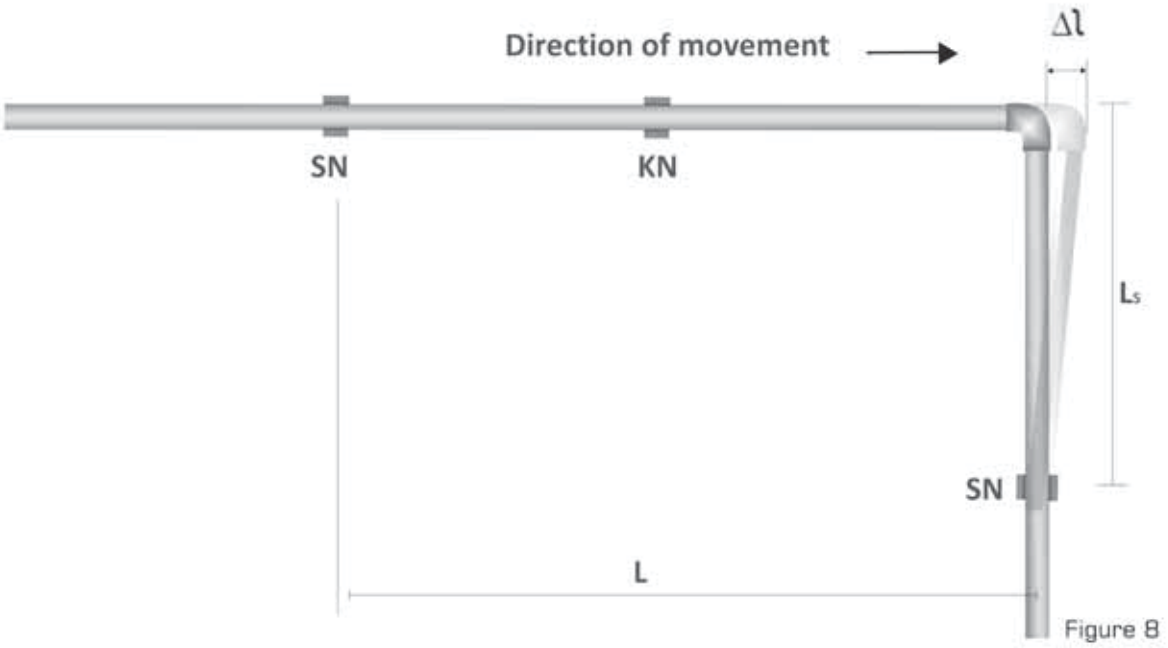


Figure 8

Lenght of free bending part

The expansion adjustments are made mostly unidirectionally in polypropylene pipes. The pipe should move freely in the axial direction.
Freely moving expansion parts are created in order to prevent the installation from linear expansion which may arise in the pipes due to temperature fluctuation.

Length of freely moving part is calculated by the following formula:

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

SN: Fixed point
KN: Varying point
Ls: Length of freely moving part (mm)
D: Pipe outer diameter
Δl: Amount of elongation (mm)
L: Pipe length (m)
K: Specific constant of material (K=30)

Expansion Loop

Bending parts should be used in installations where the expansion will be bidirectional and in runs exceeding 5 meters in length.
Expansion loops cannot be removed for direction change, an expansion chamber must be designed. Shape of this expansion loop is given below.

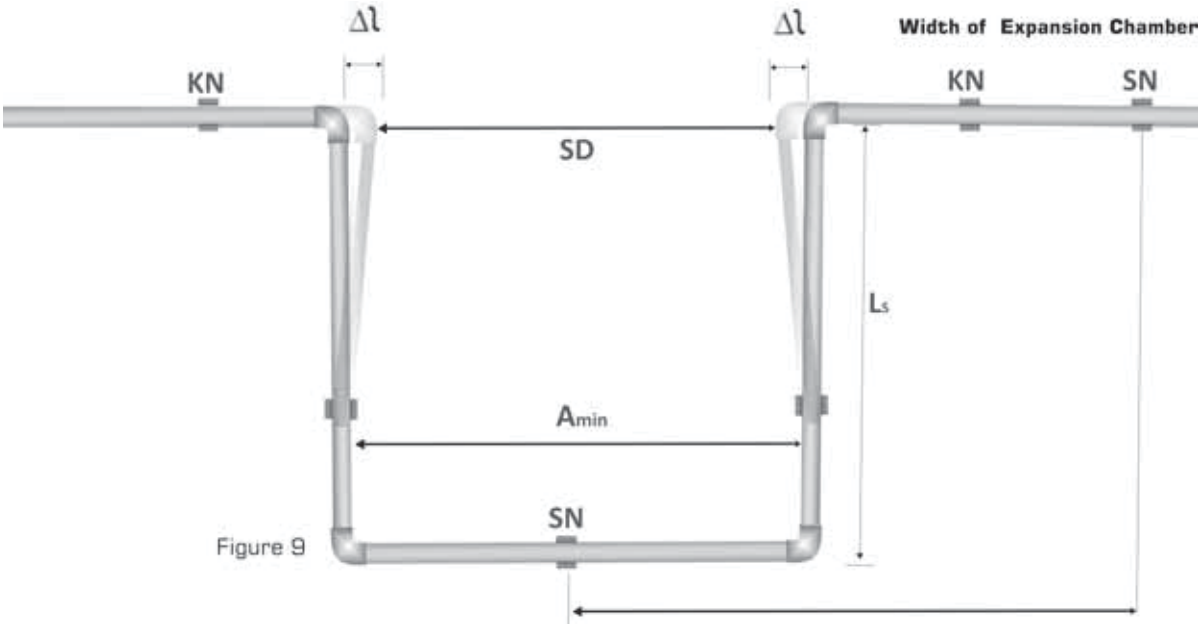


Figure 9

Calculation of minimum width of expansion chamber:
If the linear expansion cannot be compensated for by a change in direction, it may be necessary to install an expansion loop.

The pipe bend A_{min} is calculated according to the following formula:

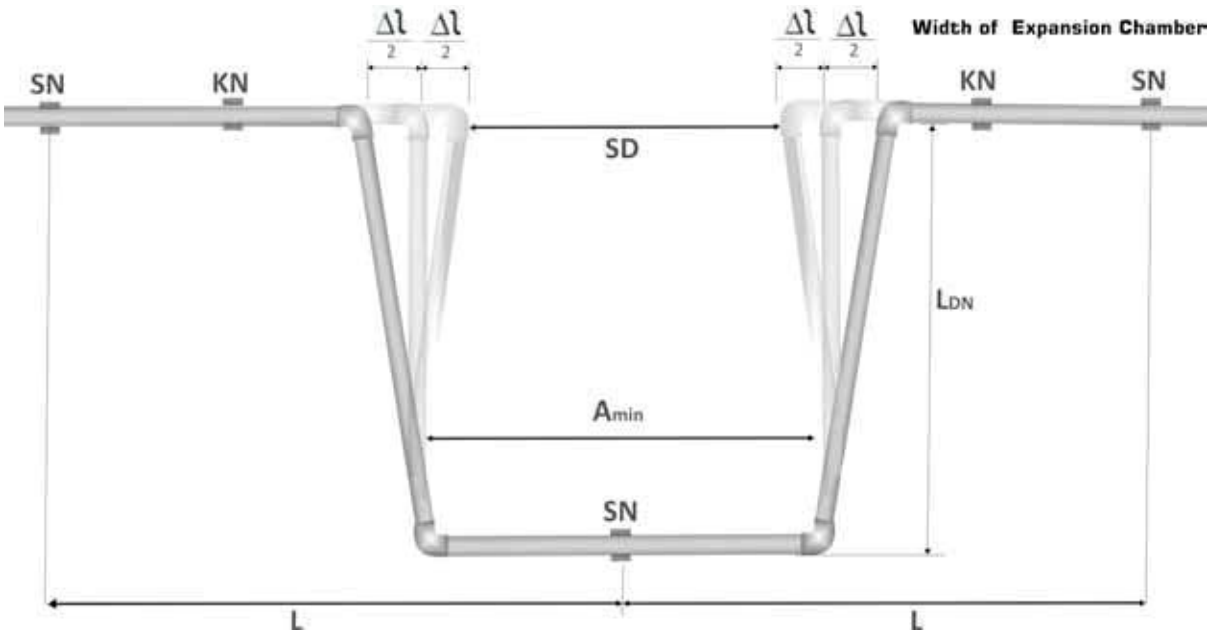
Safety margin of 150mm is provided considering that elongation amount may increase under temperature fluctuation.

Length of freely moving part is calculated by the following formula:

$$A_{min} = 2 \times \Delta l \times SD$$

A_{min}: Minimum width of expansion loop
SD: Safety margin (150mm)
Ls: Length of freely moving part (mm)
Δl Pipe outer diameter
: Amount of elongation (mm)
L: Pipe length (m)
K: Specific constant of material (K=30)

Stress Status



Stress status during installation, if planned and carried out properly, offers a visually perfect installation, as the linear expansion is not noticeable in the operating system.

The side length LDN is calculated according to the following calculation example:

$$L_{DN} = K \times \sqrt{D \times \frac{\Delta l}{2}}$$

A_{min}: Minimum width of expansion loop
SD: Safety margin (150mm)
LDN: Length of stress status (mm)
D: Pipe outer diameter
Δl Amount of elongation (mm)
L: Pipe length (m)
K: Specific constant of material (K=30)

Distance between clamps in PP-R pipe installation

Standard PP-R Pipes

Temperature Difference AT [°C]	Pipe Diameter [mm]								
	∅20	∅25	∅32	∅40	∅50	∅63	∅∅75	∅90	∅110
0°C	85	105	125	140	165	190	205	220	250
20°C	60	75	90	100	120	140	150	160	180
30°C	60	75	90	100	120	140	150	160	180
40°C	60	70	80	90	110	130	140	150	170
50°C	60	70	80	90	110	130	140	150	170
60°C	55	65	75	85	100	115	125	140	160
70°C	50	60	75	80	95	105	115	125	140

Distance between Clamps (cm)

Faser Fiberglass Reinforced PP-R Pipes and Climafaser Fiberglass Reinforced PP-R Pipes

Temperature Difference AT [°C]	Pipe Diameter [mm]								
	∅20	∅25	∅32	∅40	∅50	∅63	∅∅75	∅90	∅110
0°C	115	130	150	165	185	215	240	260	280
20°C	90	100	115	130	145	165	185	200	215
30°C	90	100	115	130	145	165	185	200	210
40°C	80	90	105	120	135	155	175	190	200
50°C	80	90	105	120	135	155	175	190	180
60°C	70	80	100	115	130	145	165	180	175
70°C	65	75	90	105	120	135	155	175	175

Distance between Clamps (cm)

Stabil-Aluminum Foil PP-R Pipes

Temperature Difference AT [°C]	Pipe Diameter [mm]								
	∅20	∅25	∅32	∅40	∅50	∅63	∅∅75	∅90	∅110
0°C	155	170	195	220	245	270	285	300	325
20°C	120	130	150	170	190	210	220	230	250
30°C	120	130	150	170	190	210	220	230	240
40°C	110	120	140	160	180	200	210	220	210
50°C	110	120	140	160	180	200	210	220	210
60°C	100	110	130	150	170	190	200	210	200
70°C	90	100	120	140	160	180	190	200	200

Distance between Clamps (cm)

Installation in shaft

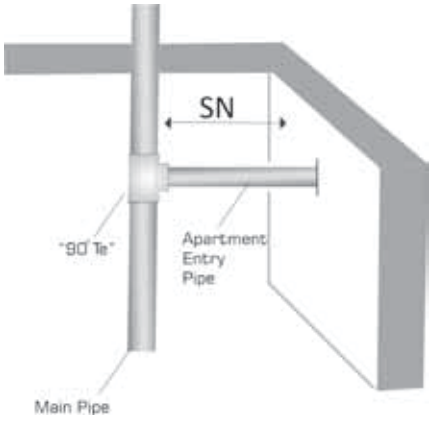


Figure 11.0

During the installation of the pipes from the main line to the apartments in a building, one of the following techniques is used to allow the pipes to expand linearly.

1) When a branch is embedded in concrete, as shown as in Figure 11.0, the SN distance between the tee and wall opening should be ensured to allow for expansion of the pipe during change of temperature.

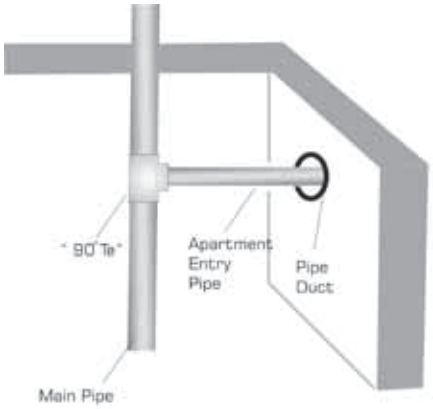


Figure 11.1

2) The hole diameter inside the wall should be bigger than the pipe diameter which passes through the wall as shown in Figure 11.1. The diameter of the hole must be specified in such a manner that the branch is able to move during expansion of the main pipe.

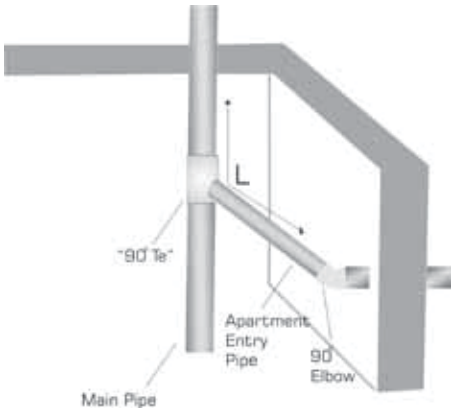


Figure 11.2

3) The L-shaped pipe segment in Figure 11.2 is used to compensate for length variations due to thermal expansion.

* The horizontal spacing of fixed clamps depends on the size and type of pipe (see page 34).

Assembly

Figure 12.0

For screw-type joints, threaded fittings must be used. Cutting thread directly to plastic components is not permitted. Threads are sealed with a special teflon tape or sealing compounds.

Figure 12.1

Polyfusion welding or electric and butt welding techniques are used to join plastic parts. The result is a high- quality homogeneous joint. A correct working process and appropriate tools must be used in joining procedures. Welding GF Hakan Plastik components together with other brands is not suggested (because of warranty issues).

Figure 12.2

Pipeline crossings are made by using components which are specially designed for this purpose.

Figure 12.3

To cap off a pipe, e.g. if elbows for wall mounting or wall assemblies are to be closed before mounting outlet fittings, an end cap is used (for example during pressure tests, etc.)

Figure 12.4

Components must not be subjected to open fire.

Figure 12.5

If the pipeline continues with metal piping beyond a combined pipe fitting, then no welding or brazing is allowed near this point due to possible hazard of heat transfer to the fitting.

Figure 12.6

Components of plastic piping systems must be protected against falling, impact, blows or another mechanical damage during transport and installation.

Figure 12.7

Pipe bending should be done at +15°C. Minimum bending radius for pipes of diameter range 16 - 32 mm is eight diameters.

Storage and Transport

- Pipes and fittings should be loaded and unloaded with extreme caution and care.

- Maximum outdoor storage time is 6 months.

Figure 13.0

- Pipes without UV-resistance should not be exposed to UV rays for any length of time.

- Pipes must not be subjected to heavy blows.

Do not bend

Figure 13.1

Do not hit

Figure 13.2

Do not throw

Figure 13.3

- At temperatures below 0°C (32°F), pipes may become dam aged by strong impact. In spite of its high impact resistance, the material must be treated with care at low temperatures.

- Providing a solid, flat, and level base for the pipe is very important to avoid a deformation of the pipes while in transport and storage. Improper storage of pipe can cause bowing.

Figure 13.4

Figure 13.5

- Do not drop pipes or slide them over the ground. Unloading pipes, packed as a block, should be done using plastic straps or forklifts equipped with flat prongs or extensions.

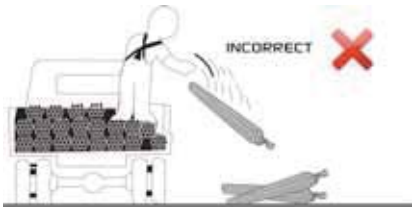


Figure 13.6

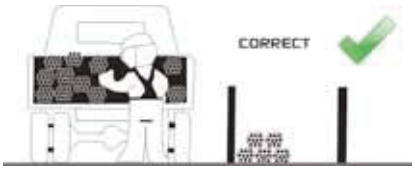


Figure 13.7

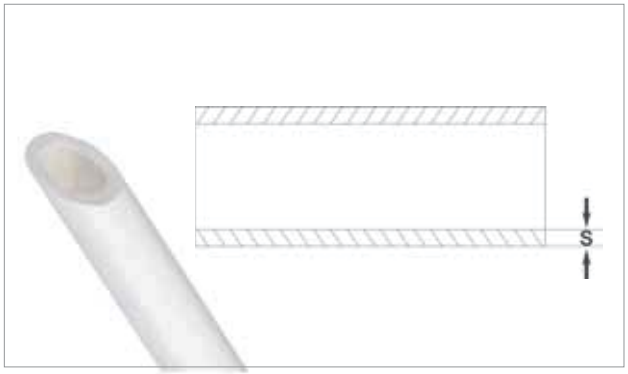
- Avoid contact with metal straps, hooks or chains. Further more, make sure that the pipes are not pulled over sharp edges (e.g. tailgate).

- We recommend removing the pipes from the packing only shortly before installation.

- Carton-packed pipes and fitting must be protected against moisture.

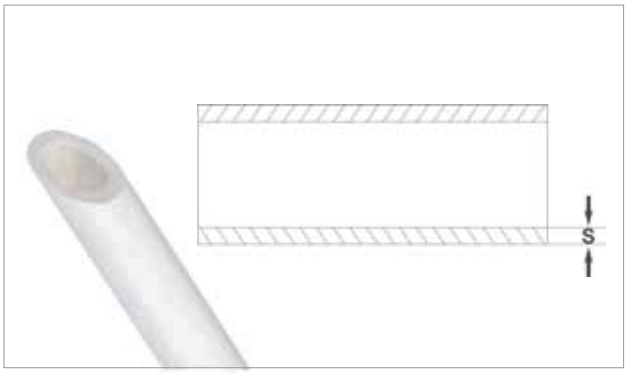
Figure 13.8

Standard PP-R Pipe [PN10]



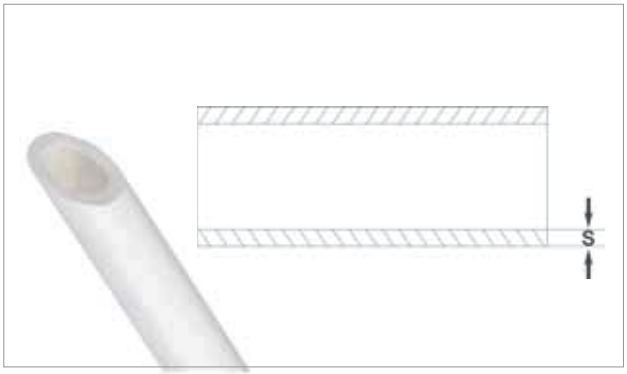
Codes				Diameter ∅ (mm)	S (Thick) (mm)	Packing (m)
White	Green	Blue	Grey			
4000002002021	4002002002021	*	4001002002021	20	1,9	100
4000002502121	4002002502121	*	4001002502121	25	2,3	80
4000003202221	4002003202221	*	4001003202221	32	2,9	60
4000004002321	4002004002321	*	4001004002321	40	3,7	40
4000005002421	4002005002421	*	4001005002421	50	4,6	20
4000006302521	4002006302521	*	4001006302521	63	5,8	16
4000007502621	4002007502621	*	4001007502621	75	6,8	12
4000009002721	4002009002721	*	*	90	8,2	8
4000011002821	4002011002821	*	4001011002821	110	10,0	4
4000012502921	*	*	*	125	11,4	4
*	*	*	*	140	12,7	4
*	*	*	*	160	14,6	4

Standard PP-R Pipe [PN16]



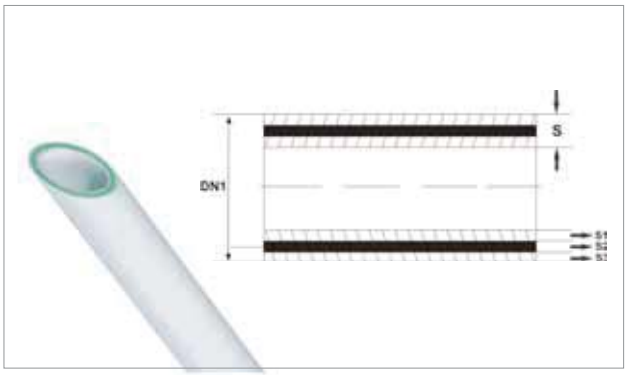
Codes				Diameter ∅ (mm)	S (Thick) (mm)	Packing (m)
White	Green	Blue	Grey			
4000002004021	4002002004029	*	4001002004021	20	2,8	100
4000002504121	4002002504129	*	4001002504121	25	3,5	80
4000003204221	4002003204229	4004003204221	4001003204221	32	4,4	60
4000004004321	4002004004329	*	4001004004321	40	5,5	40
4000005004421	4002005004429	*	4001005004421	50	6,9	20
4000006304521	4002006304529	*	4001006304521	63	8,6	16
4000007504621	4002007504629	*	4001007504621	75	10,3	12
4000009004721	4002009001029	*	4001009004721	90	12,3	8
4000011004821	4002011001029	*	4001011004821	110	15,1	4
4000012504821	4002012500929	*	*	125	20.8	4
*	*	*	*	140	23.4	4
*	*	*	*	160	26.7	4
*	4002020001129	*	*	200		*

Standard PP-R Pipe [PN20]



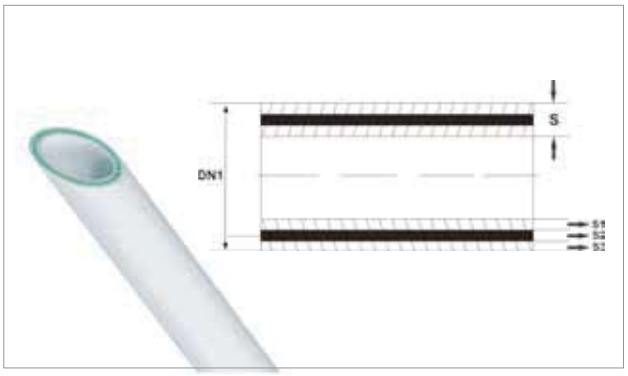
Codes				Diameter ∅ (mm)	S (Thick) (mm)	Packing (m)
White	Green	Blue	Grey			
4000002000121	4002002000121	4004002000121	4001002000121	20	3.4	100
4000002500221	4002002500221	4004002500221	4001002500221	25	4.2	80
4000003200321	4002003200321	4004003200321	4001003200321	32	5.4	60
4000004000421	4002004000421	4004004000421	4001004000421	40	6.7	40
4000005000521	4002005000521	4004005000521	4001005000521	50	8.3	20
4000006300621	4002006300621	4004006300621	4001006300621	63	10.5	16
4000007500721	4002007500721	4004007500721	4001007500721	75	12.5	12
4000009000821	4002009000821	*	4001009000821	90	15.0	8
4000011000921	4002011000921	*	4001011000921	110	18.3	4
4000012501021	4002012501021	*	*	125	20.8	4
4000014011121	*	*	*	140	23.4	4
4000016001221	4002016001121	*	*	160	26.7	4

Faser Fiberglass Reinforced PP-R Pipe [PN20]



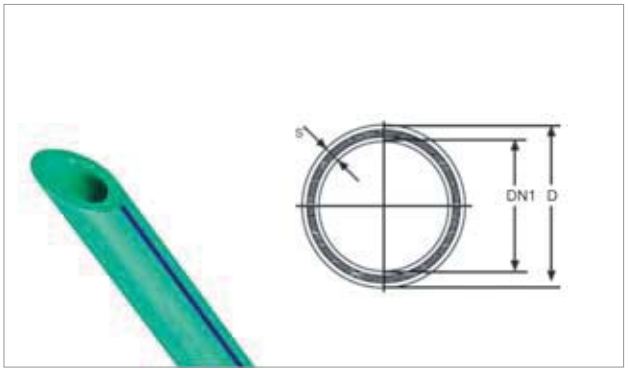
Codes				Diameter ∅ (mm)	S (mm)	S1 (mm)	S2 (mm)	S3 (mm)	Packing (m)
White	Green	Blue	Grey						
4200002000121	4202002000121	*	4201002000121	20	3,2	1,1	1,0	1,1	100
4200002500221	4202002500221	*	4201002500221	25	4,0	1,3	1,4	1,3	80
4200003200321	4202003200321	*	4200003200321	32	4,7	1,6	1,5	1,6	60
4200004000421	4202004000421	*	4201004000421	40	5,8	1,9	2,0	1,9	40
4200005000521	4202005000521	*	4201005000521	50	7,0	2,3	2,4	2,3	20
4200006300621	4202006300621	*	4201006300621	63	8,6	2,8	3,0	2,8	16
4200007500721	4202007500721	*	4201007500721	75	10,3	3,4	3,5	3,4	12
4200009000821	4202009000821	*	4201009000821	90	12,3	4,1	4,1	4,1	8
4200011000921	4202011000921	*	4201011000921	110	15,1	5,0	5,1	5,0	4
4200012500121	4202012500121	*	4201012500121	125	17,1	5,7	5,6	5,7	4
4200014000121	*	*	4201014000121	140	19,2	6,3	6,4	6,3	4
4200016000121	4202016000321	*	4201016000121	160	*	*	*	*	4

Faser Fiberglass Reinforced PP-R Pipe [PN25]



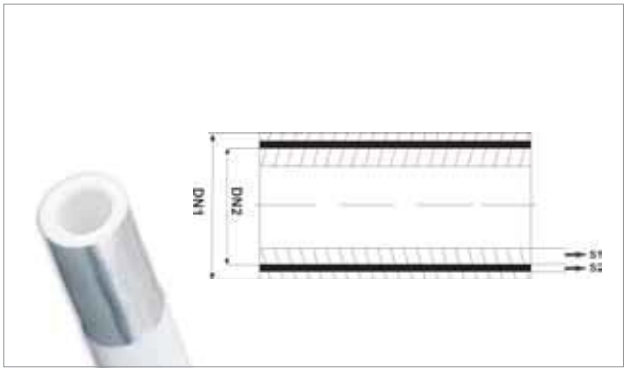
Codes				Diameter ∅	S	S1	S2	S3	Packing
White	Green	Blue	Grey	(mm)	(mm)	(mm)	(mm)	(mm)	(m)
4200002002021	4202002001021	*	4201002002021	20	3,4	1,1	1,2	1,1	100
4200002502121	4202002501121	*	4201002502121	25	4,2	1,4	1,4	1,4	80
4200003202221	4202003201221	*	4201003202221	32	5,4	1,8	1,8	1,8	60
4200004002321	*	*	4201004002321	40	6,8	2,2	2,3	2,2	40
4200005002421	*	*	*	50	8,3	2,8	2,8	2,8	20
4200006302521	*	*	*	63	10,5	3,5	3,5	3,5	16
4200007506521	*	*	*	75	12,5	4,2	4,1	4,2	12
4200009006621	*	*	*	90	15,0	5,0	5,0	5,0	8
4200011006421	*	*	*	110	18,3	6,1	6,1	6,1	4
4200012500221	*	*	4201012500221	125	20,8	8,0	6,8	8,0	4
4200014000221	*	*	4201014000221	140	23,4	7,8	8,8	8,8	4
4200016000221	*	*	4201016000221	160	*	*	*	*	4

Climafaser Fiberglass Reinforced PP-R Pipe [PN10]



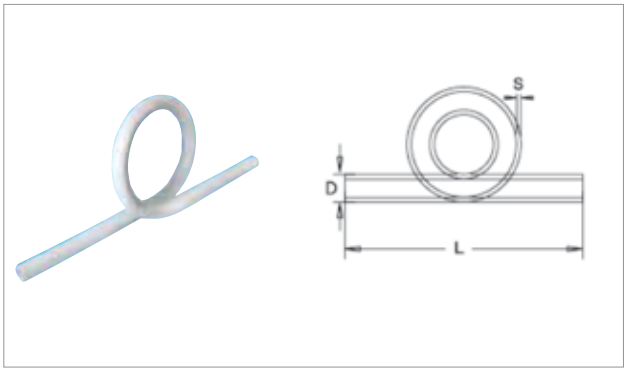
Codes	Diameter ∅	SDR	S (Thick)	Packing
Green	(mm)		(mm)	(m)
4202002030021	20	7,4	2,8	100
4202002530021	25	7,4	3,5	80
4202003230021	32	7,4	4,4	60
4202003230121	32	11	2,9	60
4202004030021	40	11	3,7	40
4202005030021	50	11	4,6	20
4202006330121	63	11	5,8	16
4202007530021	75	11	6,8	12
4202009030021	90	11	8,2	8
4202011030021	110	11	10	4
4202012530021	125	11		4

Stable-Aluminum Foiled PP-R Pipe [PN25]



Codes				Diameter ∅ (mm)	DN1 (mm)	S1 (mm)	S2 (mm)	Packing (m)
White	Green	Blue	Grey					
4100002000121	4102002000121	*	4101002000121	20	21	3,4	0,15	100
4100002500221	4102002500221	*	4101002500221	25	26	4,2	0,15	80
4100003200321	4102003200321	*	4101003200321	32	33	5,4	0,15	60
4100004000421	4102004000421	*	4101004000421	40	41	6,7	0,15	40
4100005000521	4102005000521	*	4101005000521	50	51	8,3	0,15	20
4100006300621	4102006300621	*	4101006300621	63	64	10,5	0,15	16
4100007500721	4102007500721	*	4101007500721	75	76	12,5	0,15	12
4100009000821	4102009000821	*	4101009000821	90	91	15,0	0,15	8
4100011000921	4102011007421	*	4101011000921	110	111	18,3	0,15	4

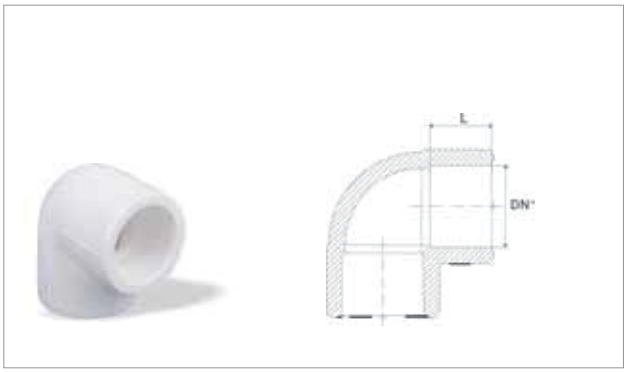
Omega [PN25]



Codes				Diameter ∅ (mm)	DN1 (mm)	S1 (mm)	S2 (mm)	Packing (Pcs)
White	Green	Blue	Grey					
4300902007022	*	*	4301902007022	20	3,4	20,3	350	15
4300902507122	*	*	4301902507122	25	4,2	25,3	350	10
4300903207222	*	*	4301903207222	32	5,4	32,3	350	7
4300904007322	*	*	4301904007322	40	6,7	40,4	350	5

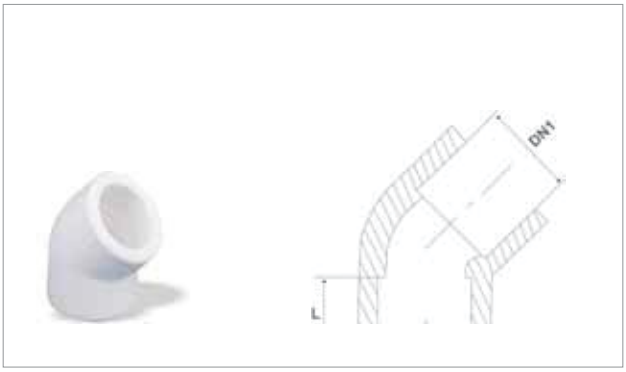
Technical drawings & dimensions

Elbow (90°) [PN25]



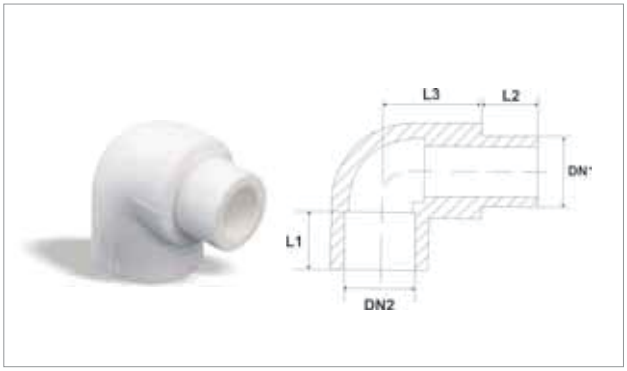
Codes				Diameter ∅ (mm)	DN1 (mm)	L (mm)	Packing (Pcs)
White	Green	Blue	Grey				
4300102000721	4302102000721	4304102000721	4301102000721	20	19,1	16	400
4300102500821	4302102500821	4304102500821	4301102500821	25	24,1	16	250
4300103200921	4302103200921	4304103200921	4301103200921	32	31,1	20	125
4300104001021	4302104001021	4304104001021	4301104001021	40	39	21	75
4300105001121	4302105001121	4304105001121	4301105001121	50	49	23,8	40
4300106301221	4302106301221	4304106301221	4301106301221	63	62	27,5	20
4300107501321	4302107501321	*	4301107501321	75	73,5	31	15
4300109001421	4302109001421	*	4301109001421	90	91,2	36	8
4300111001521	4302111001521	*	4301111001521	110	109,5	41,5	3
4300112501622	4302112501622	*	*	125	*	*	*
4300116001422	4302116001422	*	*	160	*	*	*
*	4302120001522	*	*	200			*

Elbow (45°) [PN25]



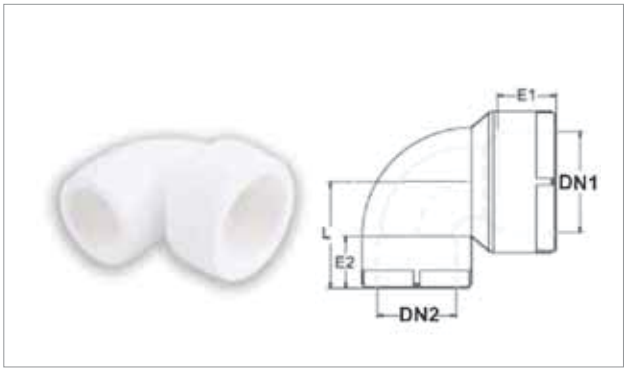
Codes				Diameter ∅ (mm)	DN1 (mm)	L (mm)	Packing (Pcs)
White	Green	Blue	Grey				
4300102000121	4302102000121	4304102000121	4301102000121	20	19,1	16	400
4300102500221	4302102500221	4304102500221	4301102500221	25	24,1	16	300
4300103200321	4302103200321	4304103200321	4301103200321	32	31,1	20	175
4300104000422	4302104000422	*	4301104000422	40	39	21	80
4300105000522	4302105000522	*	4301105000522	50	49	23,8	40
4300106300622	4302106300622	*	4301106300622	63	62	27,5	20
4300107501222	4302107501222	*	*	75	*	*	*
4300109001322	4302109001322	*	*	90	*	*	*
4300111001422	4302111001422	*	*	110	*	*	*
4300112501522	4302112501522	*	*	125	*	*	*
4300116001622	4302116001622	*	*	160	*	*	*

Tailed Elbow (90°) [PN25]



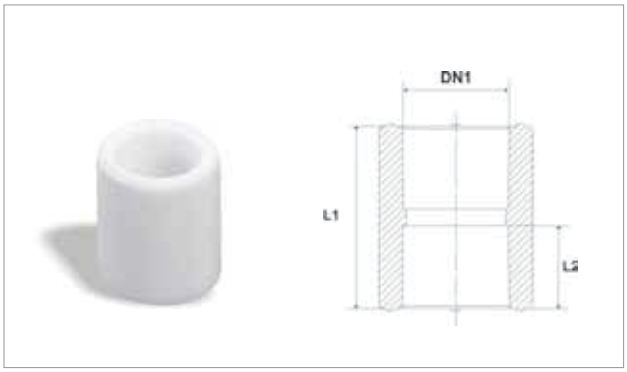
Codes				Diameter ∅ (mm)	DN1 (mm)	DN2 (mm)	L1 (mm)	L2 (mm)	L3 (mm)	Packing (Pcs)
White	Green	Blue	Grey							
4300102000721	4202002000121	4304102005021	4201002000121	20x90	20,5	19,1	16	16	28	350
4300102500821	4202002500221	4304102505121	4201002500221	25x90	25,5	24,1	16	16	28	200

Reducing Elbow [PN25]



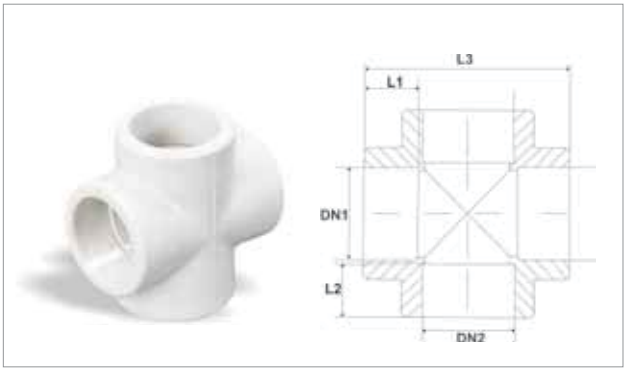
Codes				Diameter ∅ (mm)	DN1 (mm)	DN2 (mm)	E1 (mm)	E2 (mm)	L (mm)	Packing (Pcs)
White	Green	Blue	Grey							
4300402011022	4302402010022	*	4301402011022	20x90	24,5	19,5	16	14,5	29	200
4300402511122	4302402510122	*	4301402511122	25x90	31,5	24,5	18	16	33	150

Socket [PN25]



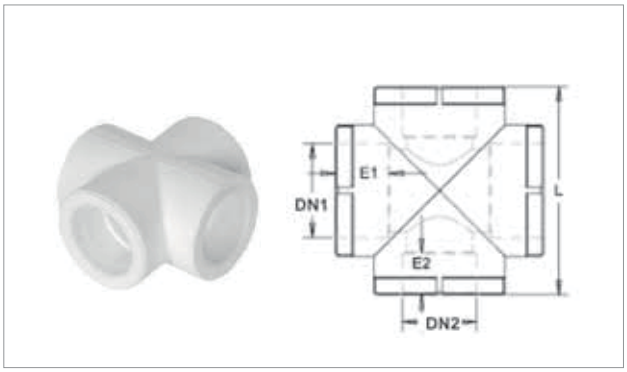
Codes				Diameter ∅ (mm)	DN1 (mm)	L1 (mm)	L2 (mm)	Packing (Pcs)
White	Green	Blue	Grey					
4300502020021	4302502020021	4304502020021	4301502020021	20	19,1	16	34	500
4300502520121	4302502520121	4304502520121	4301502520121	25	24,1	16	34	350
4300503220221	4302503220221	4304503220221	4301503220221	32	31,1	20	45	200
4300504020321	4302504020321	4304504020321	4301504020321	40	39	21	48	125
4300505020421	4302505020421	4304505020421	4301505020421	50	49	23,8	52	70
4300506320521	4302506320521	4304506320521	4301506320521	63	62	27,5	58	45
4300507520621	4302507520621	4304507520621	4301507520621	75	73,5	31	65	30
4300509020721	4302509020721	*	4301509020721	90	91,2	36	75	20
4300511020821	4302511020821	*	4301511020821	110	109,5	41,5	85	10
4300512520921	4302512520921	*	*	125	*	*	*	*

Cross Tee [PN25]



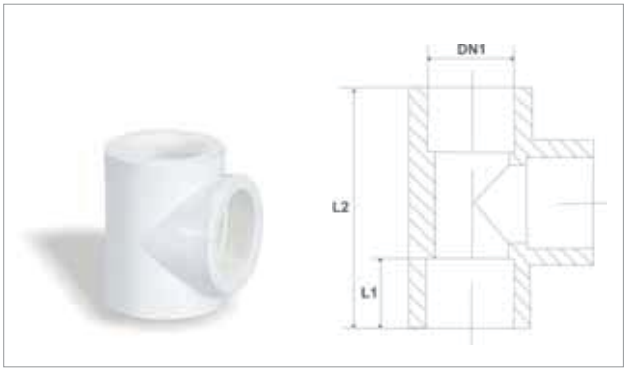
Codes				Diameter ∅ (mm)	DN1 (mm)	DN2 (mm)	L1 (mm)	L2 (mm)	L3 (mm)	Packing (Pcs)
White	Green	Blue	Grey							
4300902060022	4302902060022	*	4301902060022	20	24,1	19,1	16	16	56	150
4300902560122	4302902560122	*	4301902560122	25	31,1	24,1	20	16	70	75
4300903260222	4302903260222	*	43019032472222	32	39	31,1	20	20	80	50
4300904060322	4302904060322	*	4301904060322	40	*	*	*	*	*	*

Reducing Cross [PN25]



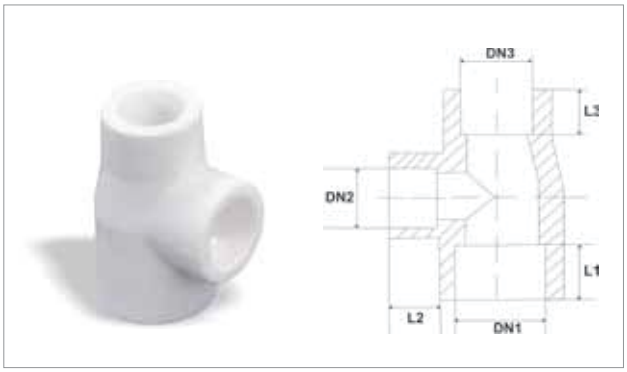
Codes				Diameter ∅ (mm)	DN1 (mm)	DN2 (mm)	E1 (mm)	E2 (mm)	L (mm)	Packing (Pcs)
White	Green	Blue	Grey							
4300902560222	*	*	4301902560222	25/20	24,5	19,5	16,5	14,5	56	100
4300903260322	*	*	4301903260322	32/25	31,5	24,5	18,1	16,5	70	75
4300904060422	*	*	4301904060422	40/32	39	39,4	31,5	20,5	18,1	*

Tee [PN25]



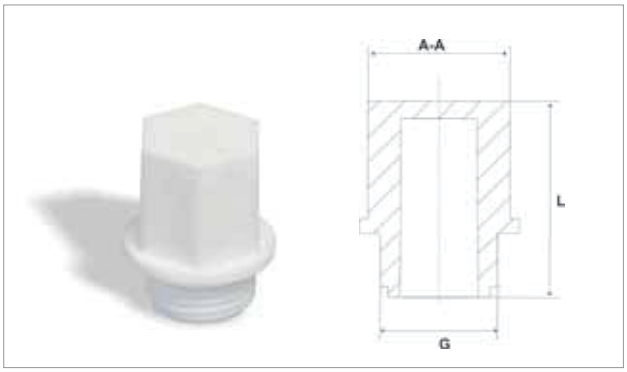
Codes				Diameter ∅ (mm)	DN1 (mm)	L1 (mm)	L2 (mm)	Packing (Pcs)
White	Green	Blue	Grey					
4300902008021	4302902008021	4304902008021	4301902008021	20	19,1	16	52	250
4300902508121	4302902508121	4304902508121	4301902508121	25	24,1	16	60	150
4300903208221	4302903208221	4304903208321	4301903208221	32	31,1	20	70	100
4300904008321	4302904008321	4304904008421	4301904008321	40	39	21	82	50
4300905008421	4302905008421	4304905008521	4301905008421	50	49	33,8	100	30
4300906308521	4302906308521	4304906308621	4301906308521	63	62	27,5	120	20
4300907508621	4302907508621	4304907508721	4301907508621	75	73,5	31	137	10
4300909008721	4302909008721	*	4301909008721	90	91,2	36	160	7
4300911008821	4302911008821	*	4301911008821	110	109,5	41,5	190	3
4300912508922	4302912508922	*	*	125	*	*	*	*
4300916009022	4302916009022	*	*	160	*	*	*	*

Reducing Tee [PN25]



Codes				Diameter ∅ (mm)	DN1 (mm)	DN2 (mm)	DN3 (mm)	L1 (mm)	L2 (mm)	L3 (mm)	Packing (Pcs)
White	Green	Blue	Grey								
4300902520021	4302902520021	4304902520021	4301902520021	25 - 20 - 20	24,1	19,1	19,1	16	16	16	200
4300902520121	4302902520121	4304902520121	4301902520121	25 - 20 - 25	24,1	19,1	24,1	16	16	16	175
4300903220221	4302903220221	4304903220221	4301903220221	32 - 20 - 20	31,1	19,1	31,1	20	16	16	125
4300903220421	4302903220421	4304903220421	4301903220421	32 - 20 - 32	31,1	19,1	31,1	20	16	20	100
4300903220521	4302903220521	4304903220521	4301903220521	32 - 25 - 20	31,1	24,1	19,1	20	16	20	125
4300903220621	4302903220621	4304903220621	4301903220621	32 - 25 - 32	31,1	24,1	31,1	20	16	20	100
4300903220321	4302903220321	4304903220321	4301903220321	32 - 20 - 25	31,1	19,1	24,1	20	16	16	125
4300904020721	4302904020721	4304904020721	4301904020721	40 -20 - 40	39	19,1	39	21	16	21	50
4300904020821	4302904020821	4304904020821	4301904020821	40 - 25 - 40	39	24,1	39	21	16	21	50
4300904020921	4302904020921	4304904020921	4301904020921	40 - 32 - 40	39	31,1	39	21	20	25	50
4300905021021	4302905021021	*	4301905021021	50 - 20 - 50	49	19,1	49	26	16	26	40
4300905021221	4302905021221	*	4301905021221	50 - 25 - 50	49	24,1	49	26	16	26	30
4300905021321	4302905021321	*	4301905021321	50 - 32 - 50	49	31,1	49	26	20	26	30
4300905021421	4302905021421	*	4301905021421	50 - 40 - 50	49	39	49	26	21	26	30
4300906321322	4302906321322	*	4301906321322	63 - 20 - 63							16
4300906321422	4302906321422	*	4301906321422	63 - 25 - 63							16
4300906321522	4302906321522	*	4301906321522	63 - 32 - 63	62	31,1	62	28	20	28	16
4300906321622	4302906321622	*	4301906321622	63 - 40 - 63	62	39	62	28	21	28	16
4300906321722	4302906321722	*	4301906321722	63 - 50 - 63	62	49	62	28	26	28	16
4300907521722	4302907521722	*	*	75 - 63 - 75	*	*	*	*	*	*	*
4300909021722	4302909021722	*	*	90 - 75 - 90	*	*	*	*	*	*	*
4300911021622	*	*	*	110 - 75 - 110	*	*	*	*	*	*	*
4300911021722	4302911021722	*	*	110 - 90 - 110	*	*	*	*	*	*	*
4300912521822	4302912521822	*	*	125 - 110 - 125	*	*	*	*	*	*	*
4300916021922	4302916021922	*	*	160 - 110 - 160	*	*	*	*	*	*	*
*	4302920021722	*	*	200 - 160 - 200							*

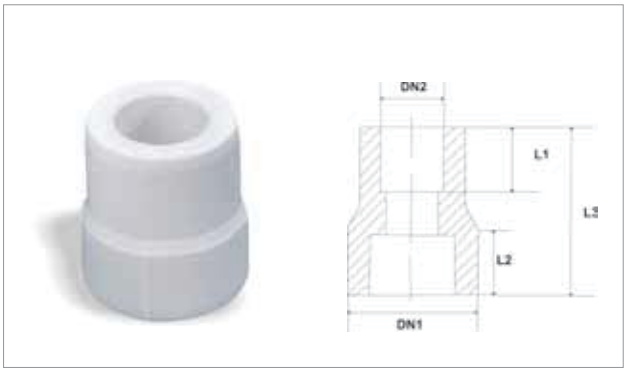
Blind Cap



Codes				Diameter ∅ (mm)	G (Inch)	A-A (mm)	L (mm)	Packing (Pcs)
White	Green	Blue	Grey					
4300902014021	4302902014021	4304902014021	4301902014021	20	1/2"	22	35	700
4300902514121	4302902514121	4304902514121	4301902514121	25	3/4"	22	35	500

Technical drawings & dimensions

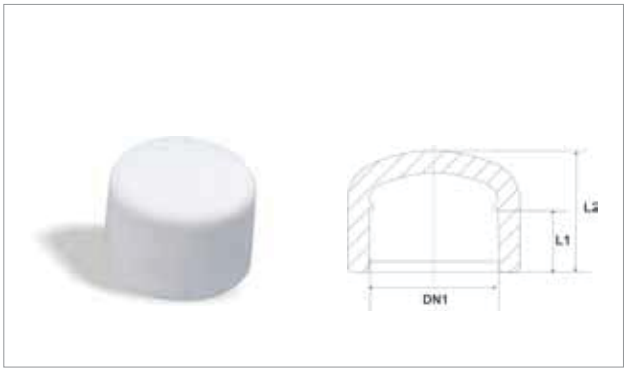
Reducer [PN25]



Codes				Diameter ∅ (mm)	DN1 (mm)	DN2 (mm)	L1 (mm)	L2 (mm)	L3 (mm)	Packing (Pcs)
White	Green	Blue	Grey							
4300402510021	4302402510021	4304402510021	4301402510021	25 - 20	25	19,1	16	18	36	500
4300403210121	4302403210121	4304403210121	4301403210121	32 - 20	32	19,1	16	21	41	400
4300403210221	4302403210221	4304403210221	4301403210221	32 - 25	32	24,1	16	25	39	350
4300404010321	4302404010321	43044040103211	4301404010321	40 - 20	40	19,1	15	27	46	250
4300404010421	4302404010421	4304404010421	4301404010421	40 - 25	40	24,1	19	25	47	250
4300404010521	4302404010521	4304404010521	4301404010521	40 - 32	40	31,1	18,5	25	48	175
4300405010621	4302405010621	4304405010621	4301405010621	50 - 20	50	19,1	15,5	32	47	150
4300405010721	4302405010721	4304405010721	4301405010721	50 - 25	50	24,1	16,5	32	48	150
4300405010821	4302405010821	4302405010821	4301405010821	50 - 32	50	31,1	18,5	28	50	150
4300405010921	4302405010921	4304405010921	4301405010921	50 - 40	50	39	21	28	53	100
4300406311021	4302406311021	4304406311021	4301406311021	63 - 25	63	25,1	16,2	26,4	57	75
4300406311121	4302406311121	4304406311121	4301406311121	63 - 32	63	31,1	19	36	57	75
4300406311221	4302406311221	4304406311221	4301406311221	63 - 40	63	39	22	36	63	75
4300406311321	4302406311321	4304406311321	4301406311321	63 - 50	63	49	25	25	63	50
4300407511421	4302407511421	4304407511421	4301407511421	75 - 50	75	49	25	25	67	40
4300407511521	4300407511521	4304407511521	4301407511521	75 - 63	75	62	28	28	67	40
4300409011622	4302409011622	*	4301409011622	90 - 63	90	62	28	34	83	20
4300409011722	4302409011722	*	4301409011722	90 - 75	90	74	31	34	83	16
4300411011822	4302411011822	*	4301411011822	110 - 75	110	74	31	38	92	12
4300411011922	4302411011922	*	4301411011922	110 - 90	110	89	34	42	94	12
4300412512022	4302412512022	*	*	125 - 75	*	*	*	*	*	*
4300412512122	4302412512122	*	*	125 - 90	*	*	*	*	*	*
4300412512222	4302412512222	*	*	125 - 110	*	*	*	*	*	*
4300416012322	4302416012322	*	*	160 - 125	*	*	*	*	*	*
*	4302420011922	*	*	200 - 160						*

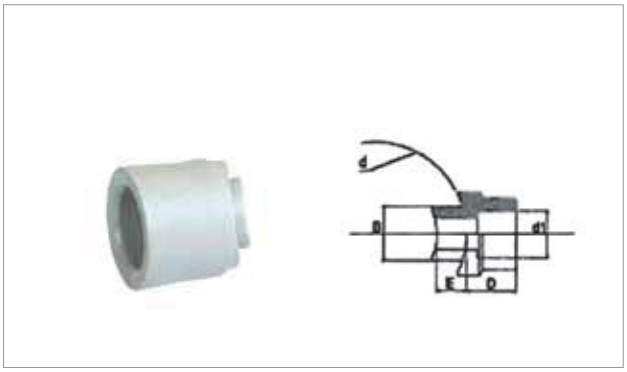
Technical drawings & dimensions

End Cap [PN25]



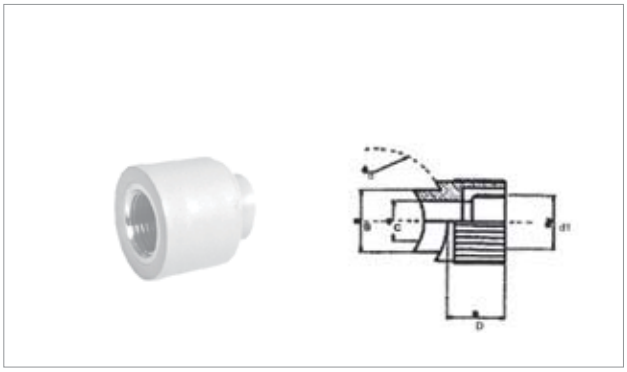
Codes				Diameter ∅ (mm)	DN1 (mm)	L1 (mm)	L2 (mm)	Packing (Pcs)
White	Green	Blue	Grey					
4300902006021	4302902006021	4304902006021	4301902006021	20	19,1	16	26,5	1.000
4300902506121	4302902506121	4304902506121	4301902506121	25	24,1	16	29,5	600
4300903206221	4302903206221	4304903206221	4301903206221	32	31,1	20	35,5	300
4300904006321	4302904006321	4304904006321	4301904006321	40	39	21	37	175
4300905006421	4302905006421	4304905006421	4301905006421	50	49	23,8	40	100
4300906306522	4302906306522	4304906306521	4301906306522	63	62	27,5	47	50
4300907506622	4302907506622	4304907506621	4301907506622	75	73,5	31	52	25
4300909006822	4302909032022	*	*	90	87,9	32,2	65,4	18
4300911006722	4302911006722	*	4301911006722	110	107,1	36,8	77,9	50
*	4302912506722	*	*	125				*
*	4302916006722	*	*	160				*
*	4302920006722	*	*	200				*

Saddle With Spigot



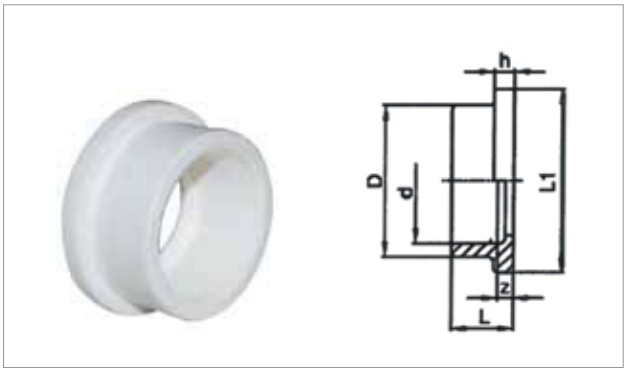
Codes				Diameter ∅ d-d1(mm)	B (mm)	D (mm)	E (mm)	Packing (Pcs)
White	Green	Blue	Grey					
*	4302904090022	*	*	40 - 20	22	20	7	*
*	4302904090122	*	*	40 - 25	22	27	7	*
*	4302905090022	*	*	50 - 20	22	20	8	*
*	4302905090122	*	*	50 - 25	22	27	8	*
*	4302906390022	*	*	63 - 20	22	20	10	*
*	4302906390122	*	*	63 - 25	22	27	10	*
*	4302906390222	*	*	63 - 32	32	30	10	*
*	4302907590022	*	*	75 - 20	22	20	10	*
*	4302907590122	*	*	75 - 25	22	27	10	*
*	4302907590222	*	*	75 - 32	32	30	10	*
*	4302907590322	*	*	75 - 40	32	30	15	*
*	4302909090022	*	*	90 - 20	22	20	15	*
*	4302909090122	*	*	90 - 25	22	27	15	*
*	4302909090222	*	*	90 - 32	32	30	15	*
*	4302909090322	*	*	90 - 40	32	30	15	*
*	4302911090022	*	*	110 - 20	22	20	15	*
*	4302911090122	*	*	110 - 25	22	27	15	*
*	4302911090222	*	*	110 - 32	32	30	15	*
*	4302911090322	*	*	110 - 40	32	30	15	*
*	4302912590022	*	*	125 - 20	22	27	15	*
*	4302912590122	*	*	125 - 25	22	30	15	*
*	4302912590222	*	*	125 - 32	32	30	15	*
*	4302912590322	*	*	125 - 40	32	30	15	*

Threaded Female Saddle With Spigot



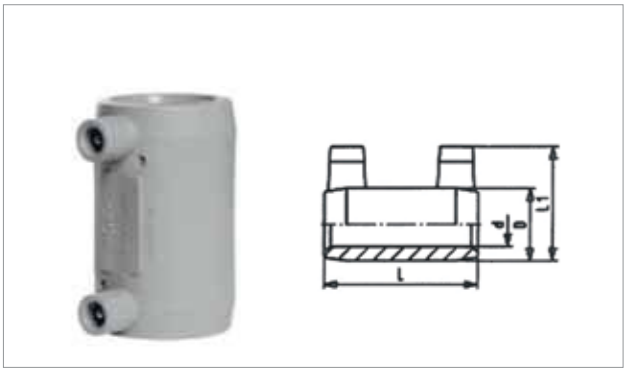
Codes				Diameter ∅ d-d1(mm)	B (mm)	C (mm)	C (mm)	Packing (Pcs)
White	Green	Blue	Grey					
*	4302904091122	*	*	40 - 1/2"	22	13	27	*
*	4302905091122	*	*	50 - 1/2"	22	13	27	*
*	4302905091022	*	*	50 - 3/4"	32	21	30	*
*	4302906391122	*	*	63 - 1/2"	22	13	27	*
*	4302906391022	*	*	63 - 3/3"	32	21	30	*
*	4302907591122	*	*	75 - 1/2"	22	13	27	*
*	4302907591022	*	*	75 - 3/4"	32	21	30	*
*	4302907591222	*	*	75 - 1"	32	22	34	*
*	4302909091122	*	*	90 - 1/2"	22	13	27	*
*	4302909091022	*	*	90 - 3/4"	32	21	30	*
*	4302909091222	*	*	90 - 1"	32	22	34	*
*	4302911091122	*	*	110 - 1/2"	22	13	27	*
*	4302911091O22	*	*	110 - 3/4"	32	21	30	*
*	4302911091222	*	*	110 - 1"	32	22	34	*
*	4302912591122	*	*	125 - 1/2"	22	14	27	*
*	4302912591022	*	*	125 - 3/4"	32	22	30	*
*	4302912591222	*	*	125 - 1"	32	22	34	*

Flange Adaptor



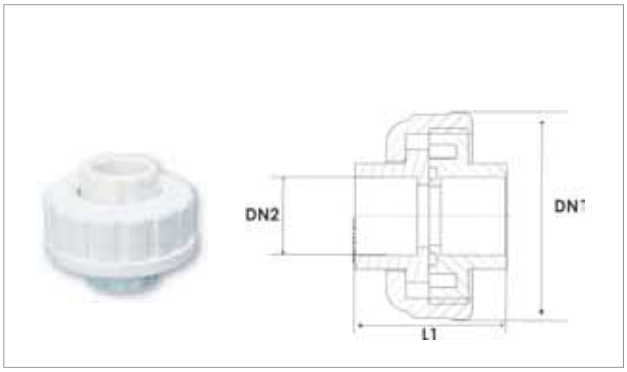
Codes				Diameter ∅ d-d1(mm)	D (mm)	L (mm)	L1 (mm)	Packing (Pcs)
White	Green	Blue	Grey					
*	4302902533022	*	*	25	33	13	27	*
*	4302903233022	*	*	32	41	13	27	*
*	4302904033022	*	*	40	50	21	30	*
*	4302905033022	*	*	50	61	13	27	*
*	4302906333022	*	*	63	76	21	30	*
*	4302907533022	*	*	75	90	13	27	*
*	4302909033022	*	*	90	106	21	30	*
*	4302911033022	*	*	110	131	22	34	*
*	4302912533022	*	*	125	146	13	27	*
*	4302916033022	*	*	160	*	*	*	*
*	4302920033022	*	*	200				*

Electrofusion Coupler



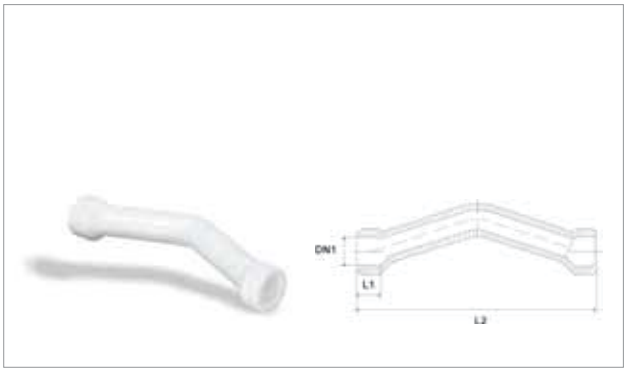
Codes				Diameter ∅ d-d1(mm)	D (mm)	L (mm)	L1 (mm)	Packing (Pcs)
White	Green	Blue	Grey					
*	4302902091522	*	*	20	33	70	50	*
*	4302902591522	*	*	25	38	70	57	*
*	4302903291522	*	*	32	46	79	62	*
*	4302904091522	*	*	40	55	90	71	*
*	4302905091522	*	*	50	67	100	82	*
*	4302906391522	*	*	63	86	106	101	*
*	4302907591522	*	*	75	103	121	115	*
*	4302909091522	*	*	90	121	131	134	*
*	4302911091522	*	*	110	142	142	156	*
*	4302912591522	*	*	125	163	151	175	*
*	4302916091522	*	*	160	*	*	*	*

Union [PN16] (Cold Water Application)



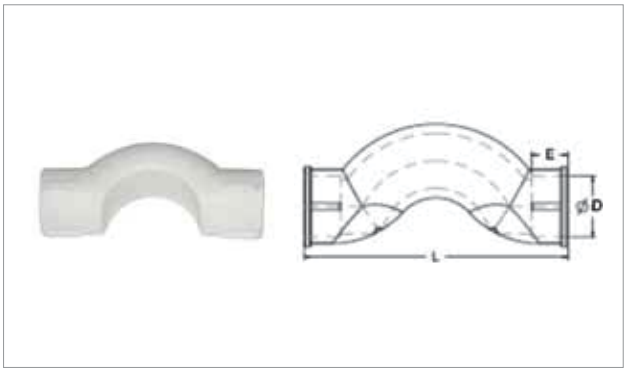
Codes				Diameter ∅ (mm)	DN1 (mm)	DN2 (mm)	L1 (mm)	Packing (Pcs)
White	Green	Blue	Grey					
4300902028022	4302902028022	4304902028022	4301902028022	20	54	15	40	30
4300902528122	4302902528122	*	4301902528122	25	60	20	46	24
4300903228222	4302903228222	*	4301903228222	32	68	25	52	24
4300904028322	4302904028322	*	4301904028322	40	83	32	60	12
4300905028422	4302905028422	*	4301905028422	50	97	40	72	24
4300906328522	4302906328522	*	4301906328522	63	118	50	87	12
4300907528622	4302907528622	*	4301907528622	75	143	65	100	10
4300909032522	4302909028722	*	*	90	178	80	117	6

Crossover With Socket [PN25]



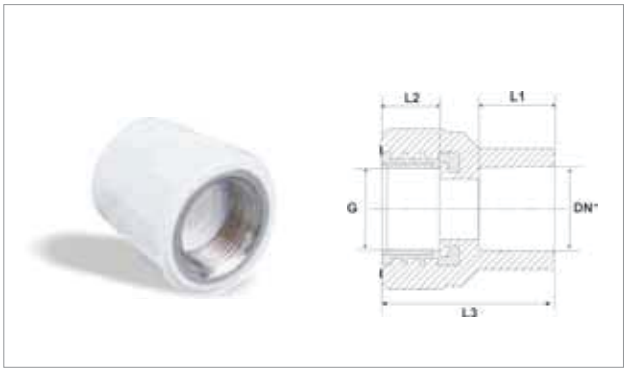
Codes				Diameter ∅ (mm)	DN1 (mm)	L1 (mm)	L2 (mm)	Packing (Pcs)
White	Green	Blue	Grey					
4300902000121	4302902000121	4304902000121	4301902000121	20	19,1	16	160	130
4300902500221	4302902500221	4304902500221	4301902500221	25	24,1	16	20,3	80
4300903200321	4302903200321	4304903200321	4301903200321	32	31,1	20	27,3	30

Crossover With Socket (Short) [PN25]



Codes				Diameter ∅ (mm)	DN1 (mm)	E (mm)	L (mm)	Packing (Pcs)
White	Green	Blue	Grey					
4300902000122	4302902000122	*	4301902000122	20	19,5	14,5	86	500
4300902500222	*	*	4301902500222	25	24,5	16	95	500

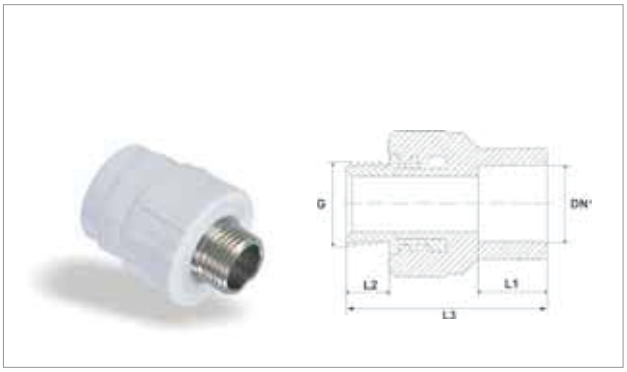
Female Socket (round) [PN25]



Codes				Diameter ∅ (mm)	G (Inch)	DN1 (mm)	L1 (mm)	L2 (mm)	L3 (mm)	Packing (Pcs)
White	Green	Blue	Grey							
4300702030021	4302702030021	4304702030021	4301702030021	20	1/2"	19,1	16	12	40	200
4300702030121	4302702030121	4304702030121	4301702030121	20	3/4"	19,1	16	13	40	175
4300702530221	4302702530221	4304702530221	4301702530221	25	1/2"	24,1	16	12	40	125
4300702530321	4302702530321	4304702530321	4301702530321	25	3/4"	24,1	16	13	40	100
4300703230421	4302703230421	4304703230421	4301703230421	32	1"	31,1	20	13	44	125
4300703225321	4302703225322	*	4301703225322	32	3/4"	31,1	20	13	44	125

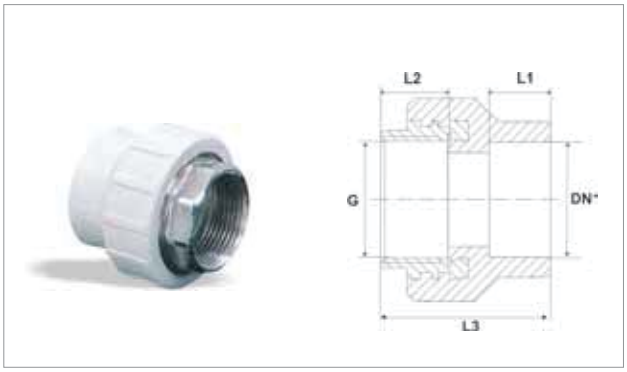
Technical drawings & dimensions

Male Socket (round) [PN25]



Codes				Diameter ∅ (mm)	G (Inch)	DN1 (mm)	L1 (mm)	L2 (mm)	L3 (mm)	Packing (Pcs)
White	Green	Blue	Grey							
4300702032021	4302702032021	4304702032021	4301702032021	20	1/2"	19,1	16	11	51	250
4300702032121	4302702032121	4304702032121	4301702032121	20	3/4"	19,1	16	12	52	250
4300702532221	4302702532221	4304702532221	4301702532221	25	1/2"	24,1	16	11	51	200
4300702532321	4302702532321	4304702532321	4301702532321	25	3/4"	24,1	16	12	52	200
4300703232421	4302703232421	4304703232421	4301703232421	32	1"	31,1	20	12	56	100
4300703227321	4302703227421	*	*	32	3/4"	31,1	20	12	56	100

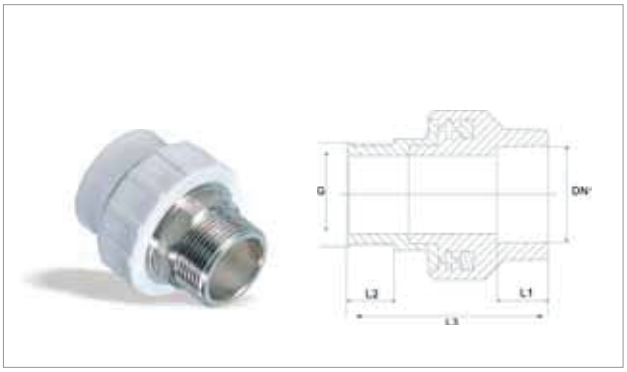
Female Socket (Hexagon) [PN25]



Codes				Diameter ∅ (mm)	G (Inch)	DN1 (mm)	L1 (mm)	L2 (mm)	L3 (mm)	Packing (Pcs)
White	Green	Blue	Grey							
4300703225021	4302703227021	*	4301703227021	32	1"	31,1	18	18	55	80
4300704025121	4302704027121	4304704025121	4301704025121	40	1.1/4"	39	21	20	65	50
4300705025221	4302705027221	4304705025221	4301705025221	50	1.1/2"	49	24	22	70	40
4300706325321	4302706327321	4304706325321	4301706325321	63	2"	62	28	22	75	20
4300707525422	4302707527422	4304707525421	4301707525422	75	2.1/2"	73,5	31	25	80	12
4300709025622	4302709028422	*	4301709025622	90	3"	91,2	36	28	105	3
4300711025522	4302711025522	*	4301711025522	110	4"	110	41,5	34	110	2

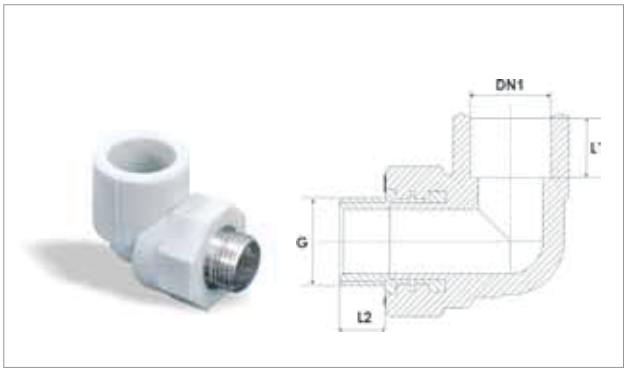
Technical drawings & dimensions

Male Socket (Hexagon) [PN25]



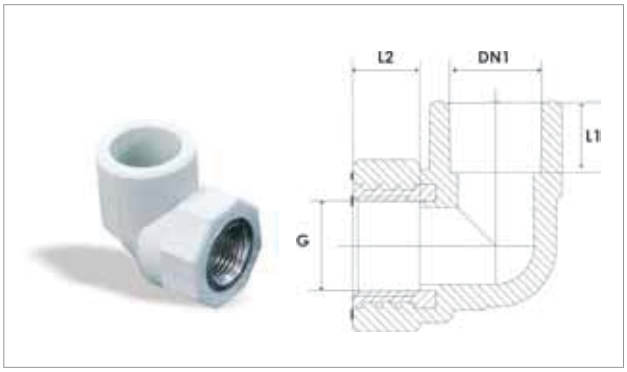
Codes				Diameter ∅ (mm)	G (Inch)	DN1 (mm)	L1 (mm)	L2 (mm)	L3 (mm)	Packing (Pcs)
White	Green	Blue	Grey							
4300703227021	4302703227121	*	4301703227121	32	1"	31,1	18	15	60	80
4300704027121	4302704027121	4304704027121	4301704027221	40	1.1/4"	39	21	20	80	50
4300705027221	4302705027221	4304705027221	4301705027321	50	1.1/2"	49	24	22	90	40
4300706327321	4302706327321	4304706327321	4301706327421	63	2"	62	28	22	95	20
4300707527422	4302707527422	4304707527421	4301707527522	75	2.1/2"	73,5	31	25	105	12
4300709027522	4302709029422	*	4301709027722	90	3"	91,2	36	28	120	3
4300711027622	4302711027622	*	4301711027622	110	4"	110	41,5	32	140	2

Male Elbow [PN25]



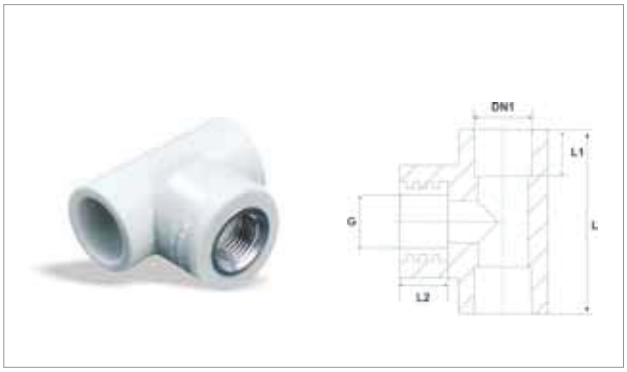
Codes				Diameter ∅ (mm)	G (Inch)	DN1 (mm)	L1 (mm)	L2 (mm)	Packing (Pcs)
White	Green	Blue	Grey						
4300102007021	4302102007021	4304102006021	4301102007021	20	1/2"	19,1	16	14	200
4300102007121	4302102007121	4304102006121	4301102007121	20	3/4"	19,1	16	13,5	180
4300102507221	4302102507221	4304102506221	4301102507221	25	1/2"	24,1	18,5	14	180
4300102507321	4302102507321	4304102506321	4301102507321	25	3/4"	24,1	18,5	13,5	100
4300103207421	4302103207421	4304103206421	4301103207421	32	3/4"	31,1	18,5	13,5	75
4300103207521	4302103207521	4304103206521	4301103207521	32	1"	31,1	18,5	17	80

Female Elbow [PN25]



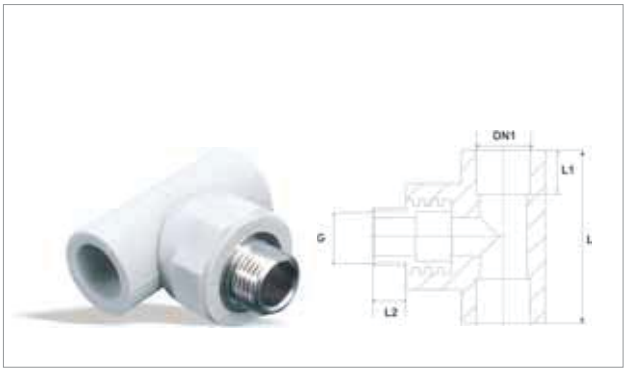
Codes				Diameter ∅ (mm)	G (Inch)	DN1 (mm)	L1 (mm)	L2 (mm)	Packing (Pcs)
White	Green	Blue	Grey						
4300102006021	4302102006021	4304102006021	4301102006021	20	1/2"	19,1	16	15	200
4300102006121	4302102006121	4304102006121	4301102006121	20	3/4"	19,1	16	15	200
4300102506221	4302102506221	4304102506221	4301102506221	25	1/2"	24,1	18,5	15	175
4300102506321	4302102506321	4304102506321	4301102506321	25	3/4"	24,1	18,5	15	140
4300103206421	4302103206421	4304103206421	4301103206421	32	3/4"	31,1	18,5	15	75
4300103206521	4302103206521	4304103206521	4301103206521	32	1"	31,1	18,5	18	75
4300103206822	*	*	*	32	1/2"				30

Transition Tee Female [PN25]



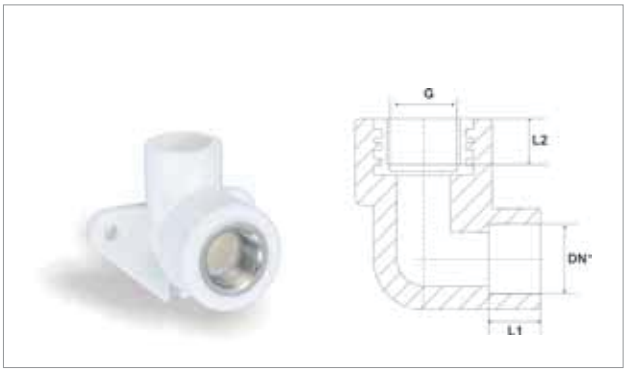
Codes				Diameter ∅ (mm)	G (Inch)	DN1 (mm)	L1 (mm)	L2 (mm)	L (mm)	Packing (Pcs)
White	Green	Blue	Grey							
4300902010021	4302902010021	4304902010021	4301902010021	20	1/2"	19,1	16	15	52	160
4300902010121	4302902010121	4304902010121	4301902010121	20	3/4"	19,1	16	15	52	160
4300902510221	4302902510221	4304902510221	4301902510221	25	1/2"	24,1	16	15	60	120
4300902510321	4302902510321	4304902510321	4301902510321	25	3/4"	24,1	16	15	60	120
4300903210421	4302903210421	4304903210421	4301903210421	32	3/4"	31,1	20	15	70	75
4300903210521	4302903210521	4304903210521	4301903210521	32	1"	31,1	20	18	70	70
4300903210322	*	*	*	32	1/2"					*

Transiton Tee Male [PN25]



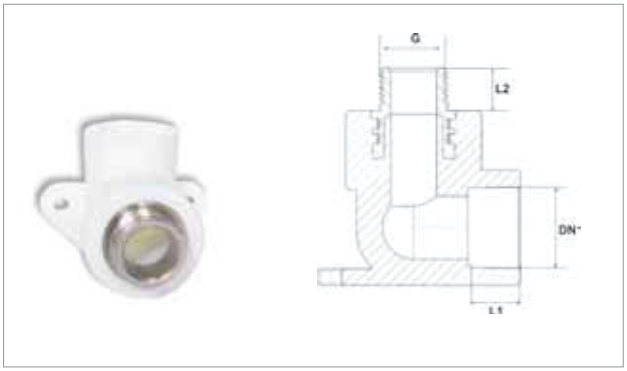
Codes				Diameter ∅ (mm)	G (Inch)	DN1 (mm)	L1 (mm)	L2 (mm)	L (mm)	Packing (Pcs)
White	Green	Blue	Grey							
4302902012021	4302902012021	4304902012021	4301902012021	20	1/2"	19,1	16	11	52	150

Backplate Elbow (Female) [PN25]



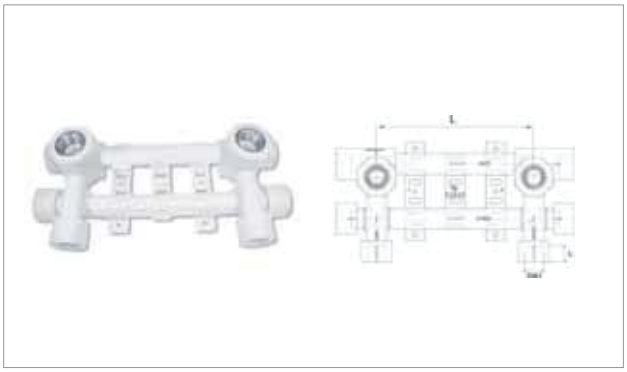
Codes				Diameter ∅ (mm)	G (Inch)	DN1 (mm)	L1 (mm)	L2 (mm)	Packing (Pcs)
White	Green	Blue	Grey						
4300102008021	4302102008021	*	4301102008021	20	1/2"	19,1	16	12	100
4300102508221	4302102508221	4304902508221	4301102508221	25	1/2"	24,1	16	12	100
4300102008121	4302102008121	*	4301102008121	20	3/4"	19,1	16	13	100
4300102508321	4302102508321	*	4301102508321	25	3/4"	24,1	16	13	100

Backplate Elbow (Male) [PN25]



Codes				Diameter ∅ (mm)	G (Inch)	DN1 (mm)	L1 (mm)	L2 (mm)	Packing (Pcs)
White	Green	Blue	Grey						
4300102009021	4302102009021	*	4301102009021	20	1/2"	19,1	16	11	100
4300102509122	4302102509122	*	*	25	1/2"	24,1	16	11	100
4300102509221	4302102509221	*	4301102509221	25	3/4"	24,1	16	13	100

Distribution Manifold [PN25]

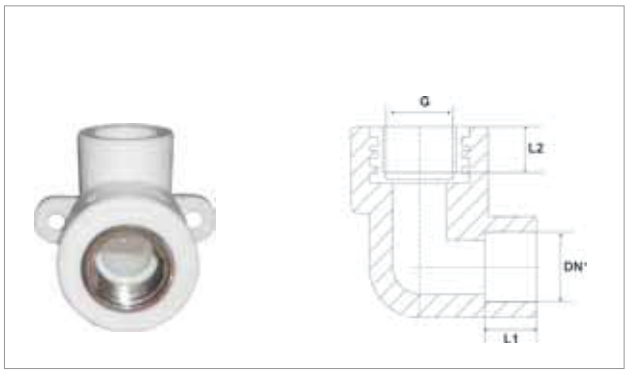


Codes				Diameter ∅ (mm)	G (Inch)	DN1 (mm)	L1 (mm)	L (mm)	Packing (Pcs)
White	Green	Blue	Grey						
4300902002321	4302902002321	4304902002321	4301902002321	25	1/2"	19,1	16	150	15

Backplate Elbow (Double) [PN25]

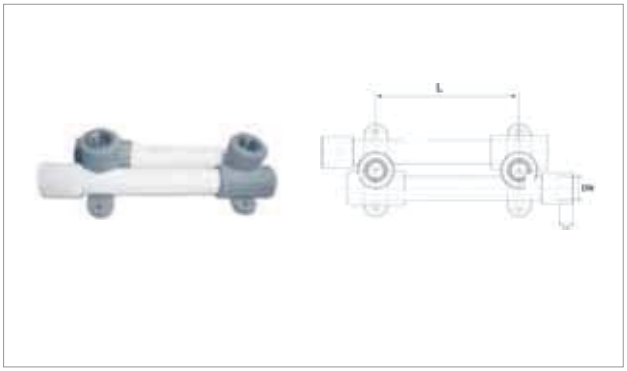
Codes				Diameter ∅ (mm)	G (Inch)	DN1 (mm)	L1 (mm)	L (mm)	Packing (Pcs)
White	Green	Blue	Grey						
4300902502121	4302902502121	4304902502121	4301902502121	25	1/2"	19,1	16	83,5	80

Backplate Elbow [PN25]



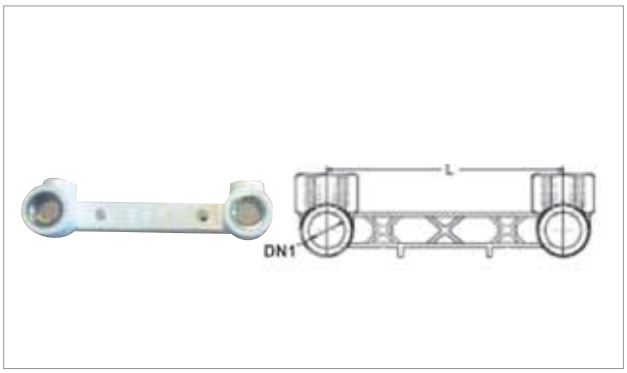
Codes				Diameter ∅ (mm)	G (Inch)	DN1 (mm)	L1 (mm)	L2 (mm)	Packing (Pcs)
White	Green	Blue	Grey						
4300902002021	4302902002021	4304902002021	4301902002021	20	1/2"	19,1	16	12	100

Backplate Elbow Assembly Set [PN25]



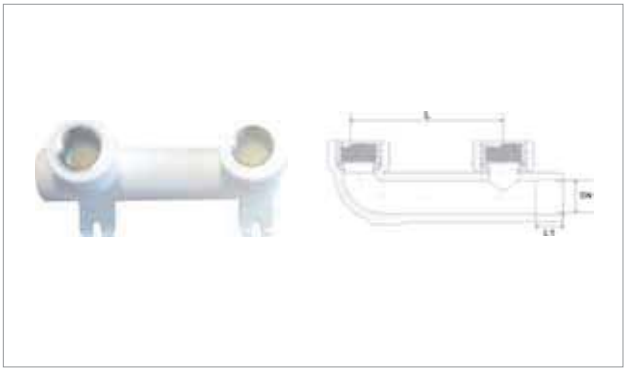
Codes				Diameter ∅ (mm)	G (Inch)	DN1 (mm)	L1 (mm)	L (mm)	Packing (Pcs)
White	Green	Blue	Grey						
4300902527021	*	*	4301902527021	25	1/2"	19,1	16	150	5

Backplate Elbow Assembly Set [PN25]



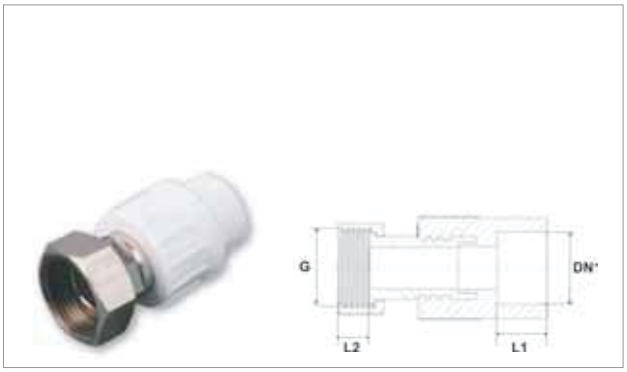
Codes				Diameter ∅ (mm)	G (Inch)	DN1 (mm)	L1 (mm)	L (mm)	Packing (Pcs)
White	Green	Blue	Grey						
4300902010022	4302902010022	*	4301902010022	20	1/2"	19,1	16	150	60
4300902502122	*	*	*	25	1/2"				*

Backplate Elbow (Double) [PN25]



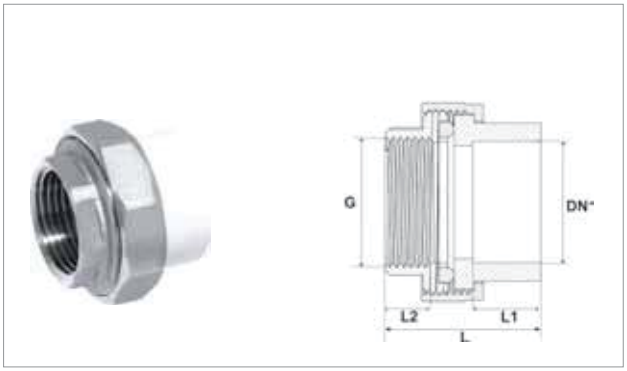
Codes				Diameter ∅ (mm)	G (Inch)	DN1 (mm)	L1 (mm)	Packing (Pcs)
White	Green	Blue	Grey					
4300902002022	4302902002022	*	4301902002022	20	1/2"	19,1	15	50

Transition with Loose Nut [PN25]



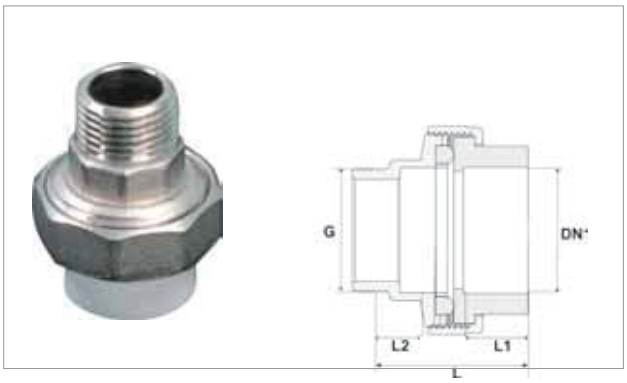
Codes				Diameter ∅ (mm)	G (Inch)	DN1 (mm)	L1 (mm)	L2 (mm)	Packing (Pcs)
White	Green	Blue	Grey						
4300902013021	4302902013021	*	4301902013021	20	1/2"	19,1	16	12	300
4300902513321	4302902513321	4304802513321	4301902513321	25	1"	31,1	20	13	150
4300902513121	*	*	4301902513121	25	1/2"	19,1	16	12	100
4300902513221	4302902513221	4304902513221	4301902513221	25	3/4"	24,1	16	13	200

Female Transiton Joint (Hexagon) [PN25]



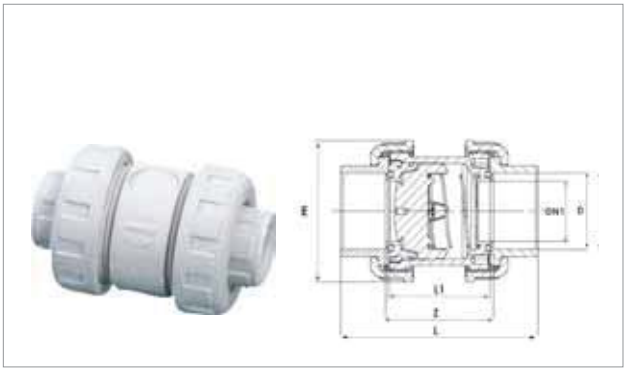
Codes				Diameter ∅ (mm)	G (Inch)	DN1 (mm)	L1 (mm)	L2 (mm)	L (mm)	Packing (Pcs)
White	Green	Blue	Grey							
4300902003021	4302702003021	4304902003021	4301902003021	20	1/2"	19,1	16	16	50	300
4300902003121	4302902003121	4304902003121	4301902003121	20	3/4"	19,1	16	16	50	150
4300902503321	4302702503121	4304902503321	4301902503321	25	3/4"	24,1	16	17	55	150
4300903203521	4302703203521	4304903203521	4301903203521	32	1"	31,1	20	18	57	150
4300904005022	4302904005022	*	4301904005022	40	1.1/4"	39	21	20	60	30
4300905005122	4302905005122	*	4301905005122	50	1.1/2"	49	24	25	62	25
4300906305222	4302906305222	*	4301906305222	63	2"	6 2	28	28	65	10

Male Transition Joint (Hexagon) [PN25]



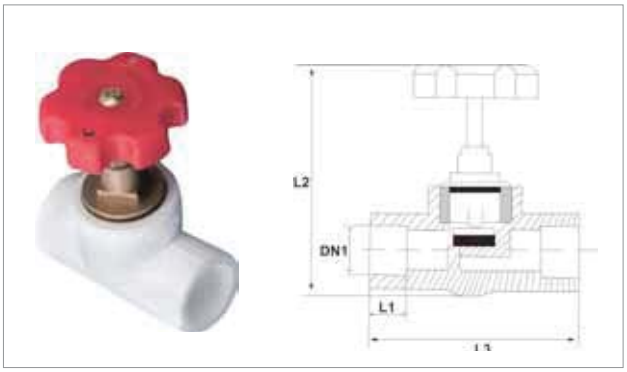
Codes				Diameter ∅ (mm)	G (Inch)	DN1 (mm)	L1 (mm)	L2 (mm)	L (mm)	Packing (Pcs)
White	Green	Blue	Grey							
4300902004021	4302702003021	4304902004021	4301902004021	20	1/2"	19,1	16	13	60	300
4300902004121	4302902003121	4304902004121	4301902004121	20	3/4"	19,1	16	15	60	150
4300902504321	4302702503121	4304902504321	4301902504321	25	3/4"	24,1	16	15	65	150
4300903204521	4302703203521	4304903204521	4301903204521	32	1"	31,1	20	16	67	125
4300904005322	4302904005322	*	4301904005322	40	1.1/4"	39	21	18	69	25
4300905005422	4302905005422	*	4301905005422	50	1.1/2"	49	24	20	73	25
4300906305522	4302906305522	*	4301906305522	63	2"	62	28	20	75	10

Check Valve [PN20]



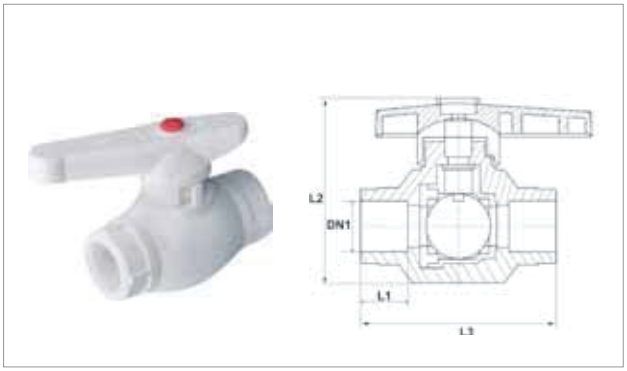
Codes				Diameter ∅ (mm)	DN1 (Inch)	E (mm)	L1 (mm)	Z (mm)	F (mm)	L (mm)	Packing (Pcs)
White	Green	Blue	Grey								
4300902031022	4302902031022	4304902031021	4301902031022	20	15	54	45	80	16	83	12
4300902531122	4302902531122	4304902531121	4301902531122	25	20	60	51	57	19	95	12
4300903231222	4300903231222	4304903231221	4301903231222	32	25	68	55	61	22	105	12
4300904031322	4302904031322	4304904031321	4301904031322	40	32	83	64	70	26	122	12
4300905031422	4302905031422	4304905031421	4301905031422	50	40	97	75	81	31	143	12
4300906331522	4302906331522	4304906331521	4301906331522	63	50	118	85	91	38	167	12
4300907531622	4302907531622	4304907531621	4301907531622	75	65	143	108	114	44	202	4
4300909031722	4302909031722	*	*	90	80	178	134	144	51	246	4

Gate Valve [PN20]



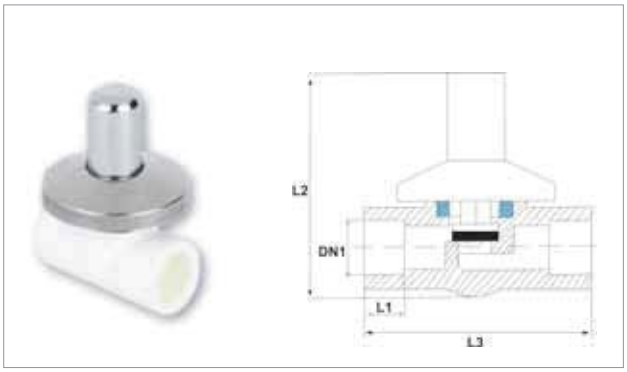
Codes				Diameter ∅ (mm)	G (Inch)	DN1 (mm)	L1 (mm)	L2 (mm)	Packing (Pcs)
White	Green	Blue	Grey						
4300802035021	4302802035021	4304802035021	4301802035021	20 1/2"	19,1	16	97	68	75
4300802535121	4302802535121	4304802535121	4301802535121	25 3/4"	24,1	19	102	78	60
4300803235221	4302803235221	4304803235221	4301803235221	32 1"	31,1	20	114	88	40

Special Ball Valve [PN20]



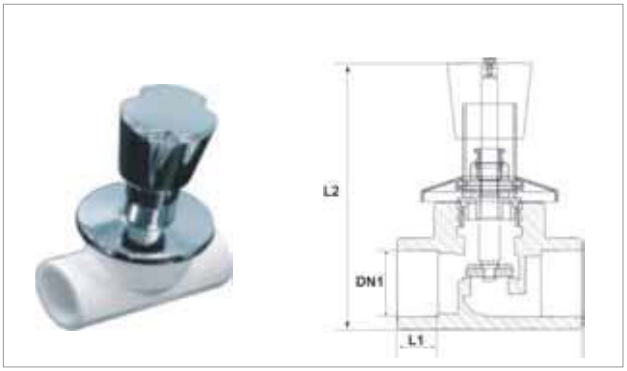
Codes				Diameter ∅ (mm)	G (Inch)	DN1 (mm)	L1 (mm)	L2 (mm)	Packing (Pcs)
White	Green	Blue	Grey						
4300802042822	4302802042822	4304902031721	4301802042822	20	19,1	16	72	88	60
4300802542922	4302802542922	4304902531821	4301802542922	25	24,1	19	82	76	50
4300803243022	4302803243022	*	4301803243022	32	31,1	20	92	68	25
4300804043622	4302804043622	*	4301804060422	40	49,0	36,1	121,4	109,1	25
4300805043722	4302805043722	*	4301805060522	50	62,9	36,5	140,0	125,2	25
4300806343822	4302806343822	*	4301806343822	63	49,3	35,9	121,1	119,3	25
4300807543322	4302807543922	*	4301807543522	75	74,4	42,6	159,5	144,9	25

Chromium Valve (Short) [PN20]



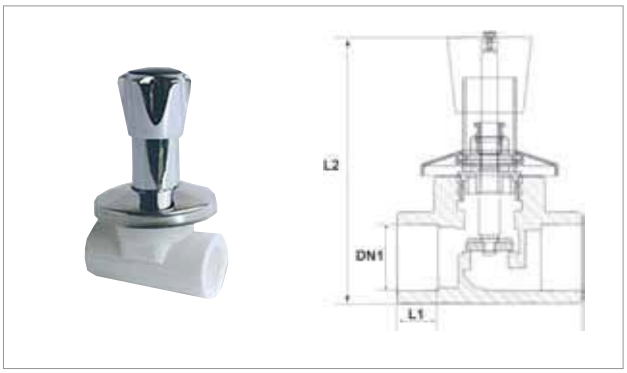
Codes				Diameter ∅ (mm)	DN1 (mm)	L1 (mm)	L2 (mm)	L3 (mm)	Packing (Pcs)
White	Green	Blue	Grey						
4300802040021	4302802040021	4304802040021	4301802040021	20 1/2"	19,1	16	97	68	50
4300802540221	4302802540221	4304802540221	4301802540221	25 3/4"	24,1	19	102	78	40
4300803240421	4302803240421	4304803240421	4301803240421	32 1"	31,1	20	114	88	40

Chromium Valve (Long) [PN20]



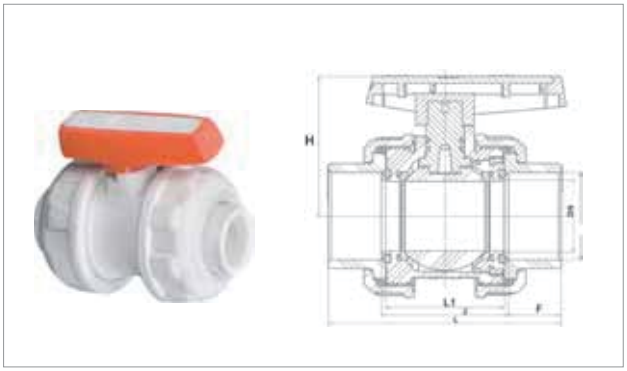
Codes				Diameter ∅ (mm)	DN1 (mm)	L1 (mm)	L2 (mm)	L3 (mm)	Packing (Pcs)
White	Green	Blue	Grey						
4300802040121	4302802040121	4304802040121	4301802040121	20 1/2"	19,1	16	115	68	50
4300802540321	4302802540321	4304802540321	4301802540321	25 3/4"	24,1	19	125	78	40
4300803240521	4302802540321	4304803240521	4301803240521	32 1"	31,1	20	135	88	40

Special Chromium Valve (Long) [PN20]



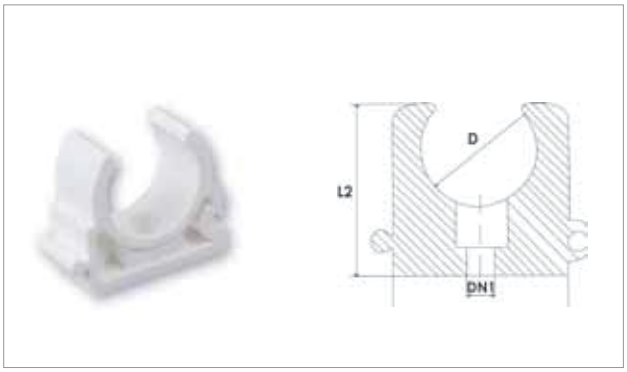
Codes				Diameter ∅ (mm)	DN1 (mm)	L1 (mm)	L2 (mm)	L3 (mm)	Packing (Pcs)
White	Green	Blue	Grey						
4300802060722	4302802040221	4304802040721	4301802040621	20 1/2"	19,1	16	115	68	50
4300802560822	4302802540421	4304802540821	4301802540721	25 3/4"	24,1	19	125	78	40
4300803260922	4302803240621	4304803240921	*	32 1"	31,1	20	135	88	40

Ball Valve [PN16] (Cold Water Application)



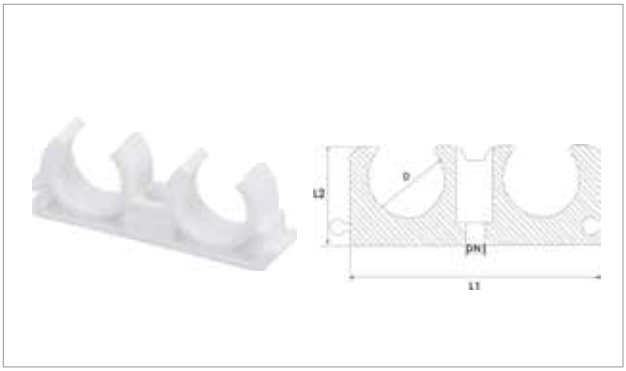
Codes				Diameter ∅ (mm)	DN (mm)	H (mm)	L1 (mm)	Z (mm)	F (mm)	L (mm)	Packing (Pcs)
White	Green	Blue	Grey								
4300802042522	4302802042522	*	4301802042522	20	15	48	45	51	16	83	12
4300802542622	4302802542622	*	4301802542622	25	20	55	51	57	19	95	12
4300803242722	4302803242722	*	4301803242722	32	25	65	55	61	22	105	12
4300804043122	4302804043122	*	4301804043122	40	32	76	64	70	26	122	12
4300805043222	4302805043222	*	4301805043222	50	40	87	75	81	31	143	12
4300806343322	4302806343322	*	4301806343322	63	50	101	85	91	38	167	12
4300807543422	4302807543422	*	4301807543422	75	65	113	108	114	44	202	4
4300809043522	4302809043522	*	4301809043522	90	80	144	134	144	51	246	4

Single Clamp



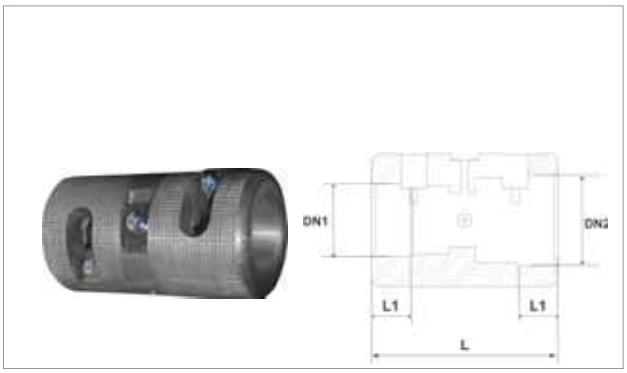
Codes				Diameter ∅ (mm)	DN1 (mm)	L1 (mm)	L2 (mm)	Packing (Pcs)
White	Green	Blue	Grey					
4300902025021	4302902025021	4304902025021	4301902025021	20	5,5	33	32,5	1.000
4300902525121	4302902525121	4304902525121	4301902525121	25	5,5	37	37,5	700
4300903225221	4302903225221	4304903225221	4301903225221	32	5,5	43	47,5	500
4300904025322	4302904025322	*	4301904025322	40	5,5	48	55	500
4300905025422	4302905025422	*	4301905025422	50	5,5	64	56	500
4300906331622	4302906331622	*	*	63	7,5	82	79	100
4300907532022	4302907532022	*	*	75	7,5	93	93	100
4300909032022	4302909032022	*	*	90	7,5	115	120	100
4300911009022	4302911007022	*	*	110	7,5	134	124	100

Double Clamp



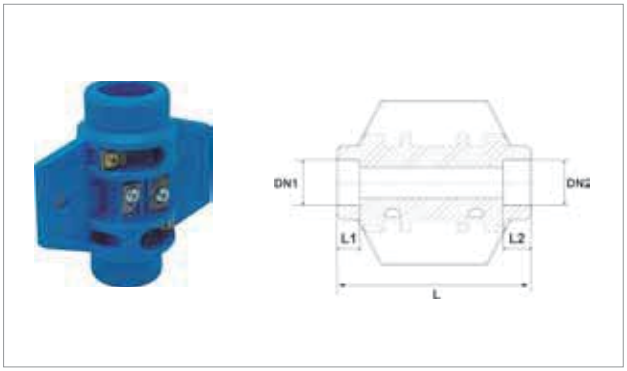
Codes				Diameter ∅ (mm)	DN1 (mm)	L1 (mm)	L2 (mm)	Packing (Pcs)
White	Green	Blue	Grey					
4300902025521	4302902025521	4304902025521	4301902025521	20	6	70	28	400
4300902525621	4302902525621	4304902525621	4301902525621	25	6	83	33	250
4300903225722	4302903225722	4304903225722	4301903225722	32	6	90	36	250

Sharpener (Metal)



Codes	Diameter ∅ (mm)	DN1 (mm)	DN2 (mm)	L1 (mm)	L2 (mm)	L (mm)	Packing (Pcs)
4301902040082	20-25	22,3	27,4	17,5	17,5	88	70
4301903240182	32-40	34,2	42,6	20	20	88	50
4301905040282	50-63	53,4	66,2	27	27	113	1
4301907540382	75-90	77,5	94,2	32	32	120	8
4301911042482	110						8

Sharpener (Plastic)



Codes	Diameter ∅ (mm)	DN1 (mm)	DN2 (mm)	L1 (mm)	L2 (mm)	L (mm)	Packing (Pcs)
4300902041022	20-25	22,3	27,4	17,5	17,5	88	70
4300903241122	32-40	34,2	42,6	20	20	88	50

Heater Bush

Codes	Diameter ∅ (mm)	Quantity
4301902045082	20	300
4301902545182	25	200
4301903245282	32	200
4301904045382	40	40
4301905045482	50	70
4301906345582	63	45
4301907545682	75	30
4301909045782	90	5
4301911045882	110	5
4301916046082	160	*

Pipe Cutter

Codes	Packing (Pcs)
4301900043082	1

Boiler Set (Straight and Angled)

Codes	Type
4300900050122	Straight
4300900050022	Angled

Includes (Straight Type)	Quantity
25 mm Filter	1
20 mm Filter	1
20 mm Special Ball Valve	1
25 mm Special Ball Valve	1
20 1/2" Socket With Cap Nut	2
25 3/4" Socket With Cap Nut	2

Fusion Welding Set (Diameter: 20-40)

Codes	Packing (Pcs)
4301900044282	1

Special Welding Set (Diameter: 50-110)

Codes	Packing (Pcs)
4301900044382	1

Welding Set (Diameter: 20-40)

Codes	Packing (Pcs)
4301900044082	1

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