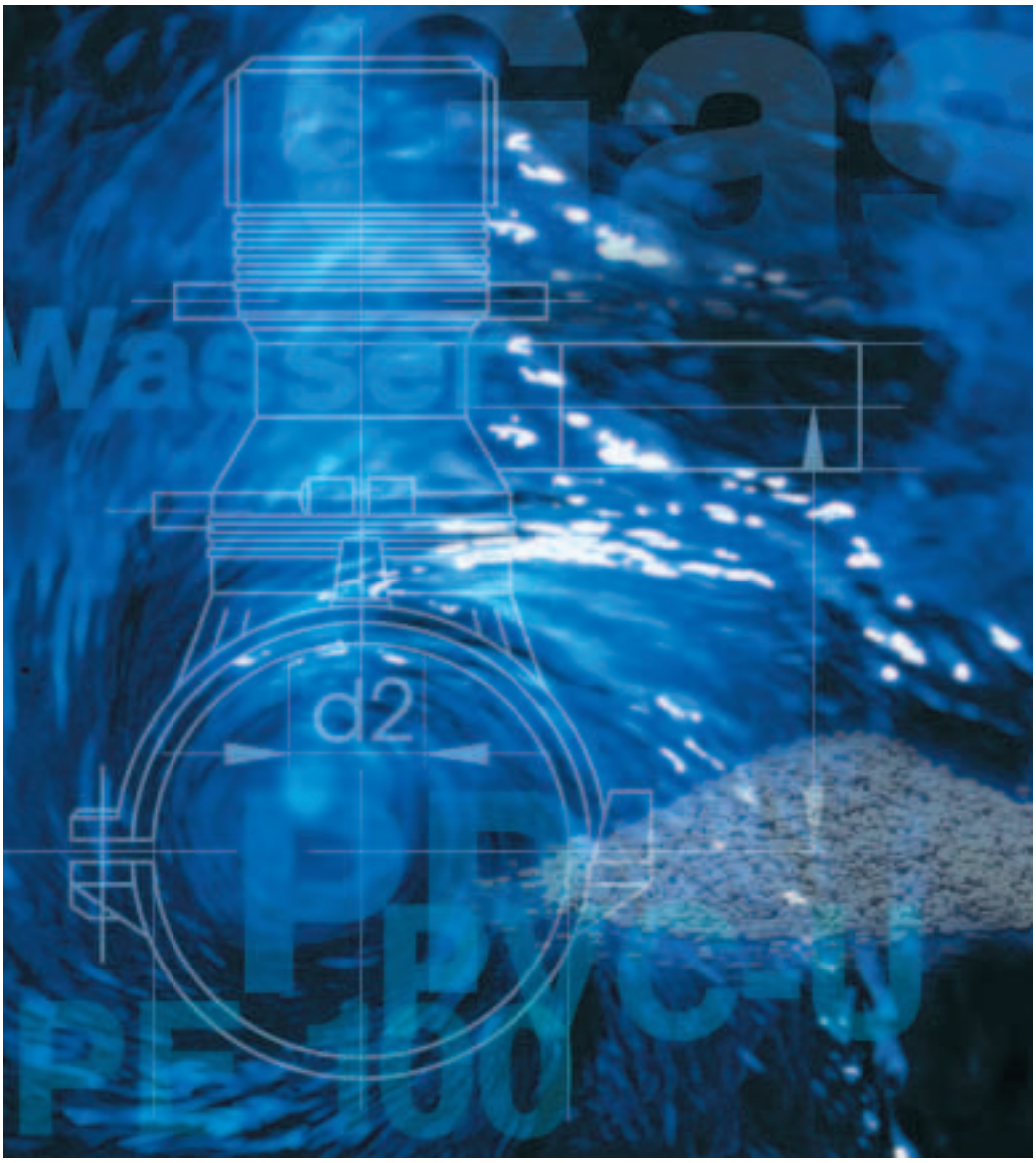
Distribution Piping Systems



Technical Handbook

GEORG FISCHER +GF+

Preface

This technical handbook contains all essential information on the Georg Fischer range of products for pressure pipelines in the distribution industry.
It covers the fields of buried gas and water supply, drainage and irrigation systems. The specifications also permit the use of these products in industrial applications.

In this handbook, you will find all the important data for planning, selecting products, processing, installation and commissioning.

The various ranges of products are listed in separate product catalogues.

Products for plastic sanitary installations in polybuthene (Instaflex) as well as PVC for cold and hot water are given in separate technical handbooks.

The catalogues for malleable cast iron fittings, Primofit, WAGA couplings provide information on metal piping systems.

For further information, especially about industrial product applications, please contact either your area or country representative or the Product Management Department for Distribution Systems directly.

Telephone: ++41/52/631 38 41
Telefax: ++41/52/631 28 14
E-Mail: info@piping.georgfischer.com
Internet: http://piping.georgfischer.com

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They contain no warranty of characteristics.
We reserve the right to alter any information.
Our general terms and conditions of sale are applicable.

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General

The distribution industry and Georg Fischer

The supply of energy and water is fundamental for sound infrastructure and development of civilisation. For more than 100 years Georg Fischer has had a large share in supplying the distribution services. The development and production of malleable iron pipeline components dates back to the second half of the 19th century. From the 1860's malleable iron fittings for gas and water distribution have been manufactured in industrial quantities by Georg Fischer.

Then and today the consequent conversion of customer oriented problem solutions into high-quality products was the maxim for Georg Fischer. Specialised consultants, worldwide closeness to customers through local presence and a qualified and motivated staff in development, production and distribution ensure a quick response to customer needs and the realisation of solutions offering high benefit for the user. Future orientation together with pioneer spirit are important elements of our engagement in the distribution supply industry.

At the end of the 1950's "plastics" were introduced at Georg Fischer. Since the beginning of the 1960's we have supplied PVC and polyethylene pipeline components to our customers. For example, solvent cement fittings and valves in PVC for water distribution and treatment or PE socket fusion fittings for installation in gas distribution pipelines.

The successful introduction of plastics in pressurised pipline construction motivated us towards further innovations which meet the increased needs and requirements of our partners in gas and water distribution.

The introduction of PE electrofusion saddles in the mid-70s and plastic gate valve systems at the beginning of the 1980's are two steps successfully accomplished.
At the beginning of the new century, new challenges are waiting to be solved. One of the prevailing topics of these times is the integrated and consistent quality assurance going from the manufacturer to the end user. Together with our partners in the gas and water distribution industry, we have created innovative solutions. The future in the area of PE jointing technology is called ELGEF Plus – a product that was developed **with our customers for our customers.**

Quality management

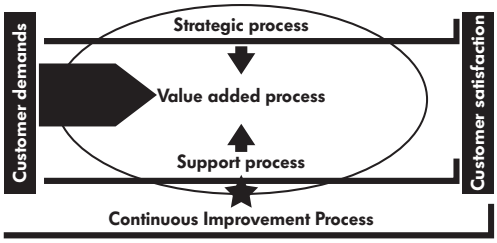
General

Georg Fischer products meet the requirements of the relevant international standards and the various conditions for approval; this applies to the dimensions and to the material properties. Consistent quality is ensured by the systematic production self-monitoring system implemented at our factories.
The volume and quality requirments of products correspond to the standards given in the data sheets.

Customer satisfaction

Our top goal "customer satisfaction" is achieved with the comprehensive provision of high-quality products and services as well as with a management system characterized by
– an optimum process organisation
– a certified quality management system in accordance with ISO 9001/9002
– established active continuous improvement processes (CIP), which bring in and utilize the knowledge and experience of our staff
– a continuous evaluation and improvement of our Management System.

Customer oriented proocess organisation



SQS Certification in accordance with ISO 9001

All audits concerning compliance of the company QA system with the ISO 9001 standards are carried out by external, independent bodies. Such an audit was initially conducted at Georg Fischer in 1993 by an internationally recognized institution, The Swiss Association for Quality and Management Systems (SQS). We constantly strive to enhance this QA system in order to further improve customer satisfaction.


SQS

The Swiss Association
for Quality and Management Systems

Georg Fischer
Piping Systems Ltd.
CH-8201 Schaffhausen

SQS Certificate ISO 9001 / ISO 14001

Accreditation by EN 45001
The Georg Fischer Test Laboratory is officially accredited by SN EN 45001. The training and specific experience of our staff, the technical level of our test systems as well as our organization correspond to the state of the art technologies.
This allows us to complete all test commissions competently, efficiently and free of errors.

We are an accredited Test Center for piping system components such as pipes, pipe joints, jointing elements, fittings, manual and automatic accessories and flowmeters.

International and European Standards

For years, Georg Fischer has played an active role in International and European Standard Committees. The company is interested in the development of advanced test standards and test guidelines for European certification, and supports the efforts made towards assured quality and reliability.

Environment Management ISO 14001

General

Today, the ecologically acceptable production of products and services is a matter of course and a permanent component of the company philosophy at Georg Fischer. That an environment friendly product design and production is possible, is demonstrated by the numerous stages in our work, from procurement to disposal. Looking ahead towards the development of products can reduce or even prevent many environmental impacts during the life of the product. We are convinced that services and products which are in accord with the environment are also an important factor for our customers.

Improving the environmental benefits

We have come to recognise that as a company we can contribute significantly to environmental protection, for example, by saving energy and water and reducing industrial effluents and wastes.
In order to procure effective information about the improvement of the environmental performance, we apply our "Company Environmental Information System" (BUIS). This helps us to establish relevant data. By applying these facts and figures we decide upon objectives and measures to constantly improve our endeavours in the area of environmental protection.

Implementing Environment Management Systems

The objective of the Georg Fischer Group is to secure environmental certifications and approvals for all its production and logistics companies by the year 2002.

Since the beginning of 2000, about 60% of our staff is already working in an environmental certified company.

Explanation of abbreviations

Materials

ABS	Acrylnitrile Butadiene Styrene
CR	Chloroprene rubber, e.g. Neoprene
EPDM	Ethylene Propylene rubber
FPM	Fluorine rubber, e.g. Viton®
Ms	Brass
NBR	Nitrile rubber
NR	Natural rubber
PB	Polybutylene
PE	Polyethylene
PE-X	Cross-linked polyethylene
PP	Polypropylene
PTFE	Polytetrafluorethylene, e.g. Teflon®
PVC	Polyvinylchloride
PVC-C	Rechlorinated polyvinylchloride (increased chloride content)
PVC-U	Unplasticised polyvinylchloride
PVDF	Polyvinylidene fluoride
TG	Malleable iron
UP-GF	Unsaturated polyester resin, glass fibre reinforced

Dimensions and Units

Dimensions are indicated in mm and/or inches and are specified as nominal or standard sizes.

We reserve the right to alter designs of fittings.

d, d1, d2, d3, d4	Diameter
DN	Nominal diameter
SC	Size of hexagonal bolts
AL	Number of screw holes
s	Witdth across flats of hexagonal bolts
g	Weight in grams
SP	Quantity per standard pack
GP	Quantity per large pack
e	Pipe wall thickness
PN	Nominal pressure
Rp	Parallel internal pipe thread to ISO 7-1
R	Conical external pipe thread to ISO 7-1
ppm	Parts per million
1 bar	= 0.1 N/mm^2 = 0.1 MPa (Megapascal) = 14.504 psi
C	Design factor
S	Pipe series
SDR	Standard Dimension Ratio
MFR	Melt Flow Rate according to ISO 4440

Product names

ELGEF® Plus	Electrofusion system
MSA®	Electrofusion devices
STEMU®	Plug-in fittings
POLYRAC®	Compression fittings
POLYFAST	Compression fittings
PVP®	Universal pipe joints
PRIMOFIT®	Compression fittings
WAGA®	Repair and Adaptor couplings
DRAW-LOCK®	Adaptor pipe fittings

Product identification

PE Fittings and Saddles	– Manufacturer (**+GF+**) – Dimension (pipe outer diameter) – Material (PE 100) – Wall thickness ratio (SDR 11) – Series identification
STEMU fittings Branch and tapping saddles Shutoff slide	– Manufacturer (**+GF+**) – Dimension (pipe outer diameter) – Nominal diameter (DN) – Material (PVC-U) – Series identification
PVP Pipe connections	– Manufacturer (**+GF+**) – Nominal size of fitting body in inches – Material (PVC-HI) – Outer diameter or nominal size of pipes to be connected – Series identification
Solvent cement and Adaptor pipe fittings	– Manufacturer (**+GF+**) – Pipe outer diameter or pipe thread diameter – Material (PVC-U) – Nominal pressure: M = PN 16 without specification = PN 10 S 6.3/PN 16 = PN 16 S 10/PN 10 = PN 10 – Series identification
Threaded pipe fittings	– Manufacturer (**+GF+**) – Pipe thread size – Material (PVC-U) – Series identification
WAGA MULTI/JOINT: Body	– Manufacturer – Dimension (108–130) – Material (GGG 42) – Nominal pressure (PN 16) – Series identification
Pressure ring	– Manufacturer – Dimension (108–130) – Material (GGG 42) – Series identification
CIRCOFLEX-Ring Type 2000/3000	– Manufacturer – Dimension (108–130) – Material (C/NBR) – Series identification
Polyrac	– Manufacturer (**+GF+**) – Dimension (32) – Material (PP) – Series identification
Polyfast	– Manufacturer – Dimension (32) – Material (PP)

Approvals

To be able to market the products worldwide, it is necessary to obtain national approvals in most countries. They are issued according to the product line and application area.
The most essential ones have been listed below.

Country	Approval issuing authoriiy
Argentina	Instituto del Gas Argentino
Belgium	ELECTRABEL
Denmark	DS (Danish Standards Association)
Germany	DVGW (Deutscher Verein des Gas- und Wasserfaches e.V.)
France	GDF (Gaz de France)
Italy	I.I.P. (Instituto Italiano dei Plastici)
Lithuania	Lithuanian technical supervision service
The Netherlands	GASTEC
Austria	ÖVGW (Österreichische Vereinigung für das Gas- und Wasserfach)
Poland	IGNIG (Instytut Gornictwa Naftowego i Gasownictwa)
Rumania	Conisia de agrement Tehnic in Constructi
Russia	Gosgortechnadzor
Switzerland	SVGW (Schweizerischer Verein des Gas- und Wasserfaches)
Slovakia	VUSAPL
Spain	Gaz Natural
Czech Republic	Institut pro testovani a certifikaci a.s.

Further details are given in the approvals catalogue.

Jointing techniques for plastic pipes

With respect to the manufacture of plastic piping, the following **jointing techniques** are applied:
– Fusion
– Solvent cementing
– Compression
– Plugging
– Flanging
– Thread jointings

When selecting the appropriate jointing method, it is necessary to take into consideration the
areas of application
– Domestic installation
– Distribution
– Industry
with their specific requirements. At the same time the selected material also needs to be considered.

Here, **part-crystalline thermoplastics**
– Polyethylene (PE)
– Polybutylene (PB)
– Polypropylene (PP)
– PVDF
are very good for fusion joints,

and **amorphous thermoplastics**
– PVC-U
– PVC-C
– ABS
are good for solvent cement joints.

On the basis of several decades of experience in plastic pipe construction, we are in a position to realize the best jointing technique with the optimum material and the respective area of application.

Fusion

As polyethylene is mainly used in gas and water distribution systems, we primarily apply the following two fusion procedures:
– Electrofusion (socket fusion with incorporated heating)
– Heating element butt fusion

ELGEF® Plus Electrofusion System in PE 100

Solvent cementing

The PVC-U solvent cementing connection is a homogeneous connection. It necessitates extreme care during jointing. Solvent cementing produces a force-connected and permanent joint. It is pressure-proof until bursting. Georg Fischer offers a wide range of PVC-U fittings and valves.

PVC solvent cementing

Compression jointing
Compression joints may be dismantled. It is used as a connection element in plastic piping systems and is distinguished by its low installation costs owing to simple and quick assembly. Compression jointing can be loaded immediately after assembly. It is sealed with elastomeric elements. Typical applications are domestic lines in drinking water supply, irrigation systems, telecommunication applications, water supply at construction sites and sprinkler systems.

POLYRAC® Compression fittings for PE pipes

Flange connection and shell coupling

Different pipe materials can be connected with each other using a flange connection. Flanged connections are longitudinal force-connected and detachable, and can be assembled using simple tools and methods.
A special feature of flange connections is the loose PVC-U flange and the unique Georg Fischer shell coupling for the Georg Fischer plastic gate valves with the accompanying PVC flanges.

Shell coupling has the above mentioned characteristics; moreover, this connection can be made without using bolts. It is quick and simple using individual component parts.

Water distribution with the plastic gate valve system

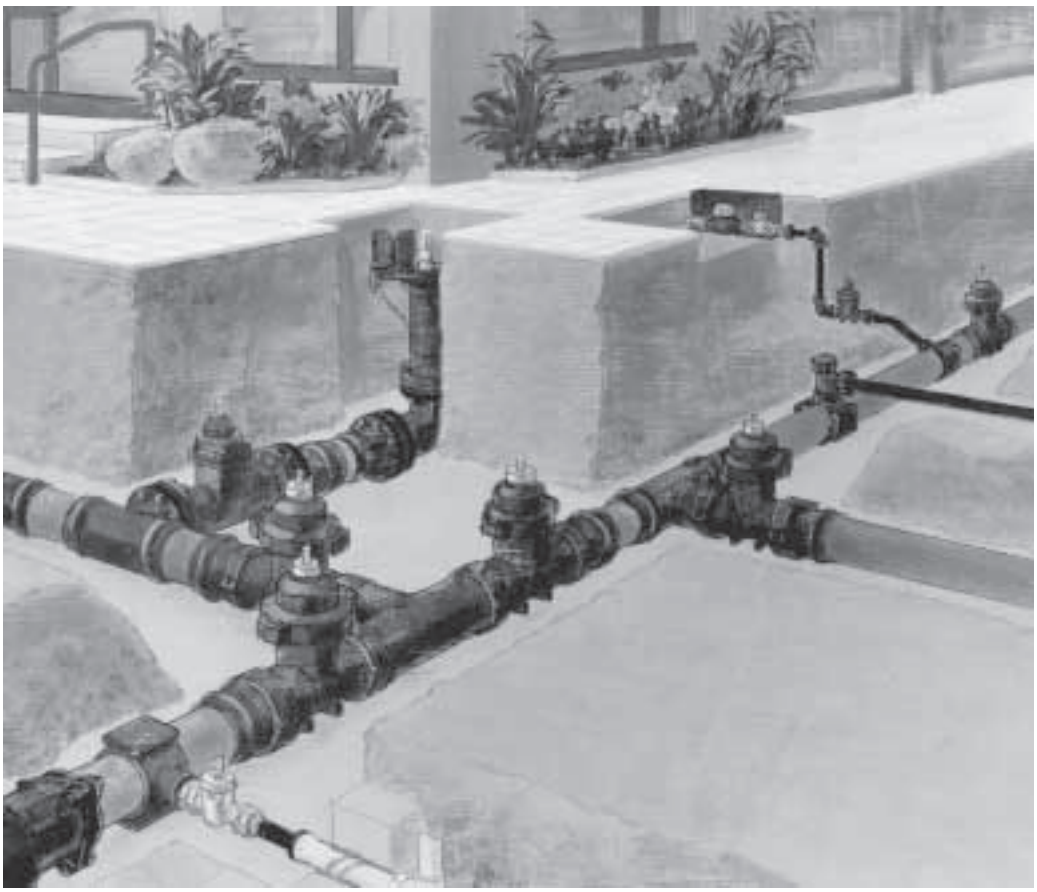
Push-fit connection

The push-fit connection for PVC piping systems is distinguished by its simple and quick installation and a long service life with unchanging properties.

The push-fit connection is not longitudinal force-connected. It enables connecting PVC pipes and fittings. Installation is above ground and only possible without pressure (up to 12.5 bar internal pressure). Buried pressure pipelines should be installed with abutment (for instance, according to DVGW GW 310) or with appropriate protection against longitudinal movement.

PVC push-fit connections are used in the following applications:

– Water distribution
– Service water systems
– Irrigation
– Pressure and vacuum
– Drainage



Handling Plastic Piping Systems

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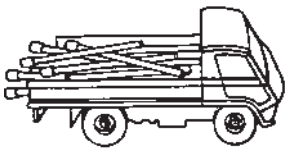
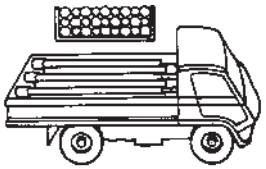
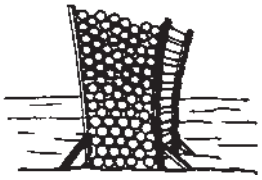
	 
	
	

Transport
Vehicles for transporting pipes should be selected in such a way that the pipes lie completely on the floor of the vehicle, without jutting out of the vehicle. Pipes should be supported so that they do not bend and get deformed. The area where the pipes are to be placed should be covered with sheeting or cardboard (including the side supports) in order to avoid damage caused by protruding rivets and nails. To protect the pipes and fittings from damage, they should not grind against the load area of the vehicle or against the floor of the vehicle during transportation.

Pipes and fittings should be loaded and unloaded with extreme caution and care. If hoists are used, then pipe components may not be thrown from the vehicle into the storage area.

Sudden impacts should be avoided under all circumstances. This is especially the case at ambient temperatures of < 0 °C, as here the impact resistance of some plastic materials is considerably reduced (such as PVC).

Pipes and fittings should be transported and stored in such a way that they do not get dirty as a result of earth, sludge, dirty water etc. To prevent dirt entering the pipes, the pipe ends must be covered with protective caps.

Georg Fischer PE fittings and valves are packed in PE plastic bags to protect them from ultraviolet radiation and dust.

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

Storage

Storage areas for pipes should be without gravel and plain. Storage and stack heights should be selected in such a way, as to avoid damages or permanent deformations. Pipes with large diameters and small wall thickenss should be equipped with circular stiffeners. Point and line supports for the pipes should be avoided.

The following table gives recommendations for the permitted stacking heights for pipes not stored on paletts. If the pipes are stacked on pallets and are secured against lateral movements, the stacking heights recommended in the table can be increased by 50%.

Material	Permitted stacking height
ABS	1.0 m
PE	1.0 m
PP	1.5 m
PVC-U	1.5 m
PVC-C	1.5 m
PVDF	1.5 m

The area where pipe components are stored should provide as much protection as possible. Pipes should be completely protected from the effects of oil, solvents and other chemical substances during the storage period.

The influence of weather on stored pipe components should be kept to a minimum, i.e. the pipe components should be kept in a warehouse. If the pipes are stored in the open (construction sites), then they should be covered with colored or black sheeting to protect them from the influence of weather (for example, UV rays).

Maximum permitted storage periods should be adhered to (for example, DVGW).

Moreover, one-sided heat exposure caused by sunshine can lead to deformations in the pipes.

The pipe components should be used in the order of their manufacture and delivery to ensure appropriate stock turnover.

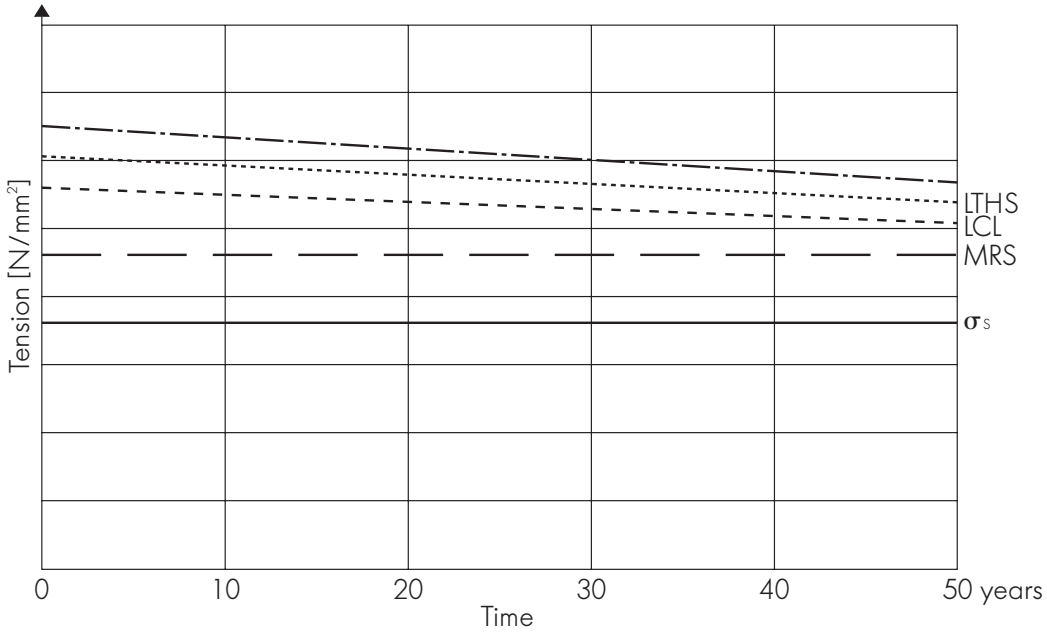
Materials for Gas and Water Distribution

Classification of plastics for piping systems

The development of plastics used in gas and water distribution is continuous and does not stand still. In recent years outstanding progress has been achieved. The creation of new material types with increased strength, higher property consistency and at the same time good or better processability are paramount. Moreover, European standardization already shows the first conceivable effects in as far as classification systems come into use today, with subsequent lasting influences on pipe construction with plastic (prEN1555 and prEN12201).

The starting point for the new classification system according to ISO 12162 and EN 32162 is the long-term behavior of the respective material under internal pressure. For this purpose, values are obtained with a pipe-type specimen filled with water at different temperatures and evaluated by means of the Standard Extrapolation Method in accordance with ISO/DIS 9080.

Procedure
At different temperatures, different internal pressures (= circumferential stress in the pipe wall) are applied to the specimens. The (load) duration until break is determined. The respective breaking stress is applied over the appropriate load time. This results in the load duration graph.



Long duration graph

The circumferential stress values for 20 °C are extrapolated to 50 years according to ISO/DIS 9080 and lead to
– **the LTHS anticipated value,** 50 years (Long Term Hydrostatic Strength),
– **the 97.5 % LCL** (Lower Confidence Limit).
This LCL value is categorized in accordance with the Renard series of numbers (R10 or R20 in accordance with ISO 3 and ISO 497). The calculated LCL value is reduced to the next lower Renard number. This results in
– **the required MRS** (Minimum Required Strength).

This MRS value in MPa is the basis for the classification. The MRS value multiplied by 10 results in the "classification" of the material. As example, let us look at common PE pipe materials. They have an MRS of 10 MPa. They are therefore called PE 100 in accordance with the new system.

Unlike the existing classification methods based upon the dimensional stress and the "safety coefficients" (sometimes different in each nation), the new system refers to a uniformly determined material parameter. This eliminates earlier misunderstandings due to the different starting points.

From classification to application

The MRS value represents the long-term circumferential stress in the pipe where the break may occur after 50 years at the earliest. The calculation stress σs is applied for dimensioning of the piping network. This is calculated from

$$\sigma_S = \frac{MRS}{C}$$

with C = total operating coefficient.

The total operating coefficient replaces the classical "safety coefficient" and considers the facts of application, the installation conditions etc.

Within the course of harmonization of standards in Europe, uniform guidelines were also created by defining the "minimum applied total operating coefficient". For PE and PVC materials primarily used in the distribution industry, the minimum values for C are as follows:

Material	Application	C min
PE	Water	1.25
PE	Gas	2
PVC-U	Water	2

The responsibility of selecting the C factor to be applied lies with the planning engineer, who can/must also apply higher values after taking into consideration all relevant operating and ambient conditions.

Standard Dimension Ratio SDR

In the relevant regulations for plastic pipes for distribution, specific pipe dimensions have been fixed based on the pipe outer diameter and the pipe wall thickness in accordance with the respective pipe series. At the same time, each pipe series is geometrically defined by the SDR code = Standard Dimension Ratio, whereby:

SDR = d/e

The essential pipe series used for gas and water distribution are described by the pipe outer diameter d and the pipe wall thickness e.

The relation between the SDR geometrical code and the maximum permitted internal pressure in the pipes important for the user is produced from the equations:

σ_u = p x (da–e)/(20 x e)

and

$\sigma_v = \sigma_u <= \sigma_{zul.}$

the following equation:

SDR = 20 x ($\sigma_{zul.}$/p) + 1

If one defines - based on the PE tensile properties for the life span of 50 years for example,

$\sigma_{zul.}$ = MRS/C

the following relation is produced:

SDR = (20/p) x (MRS/C)) + 1

Polyethylene PE

Polyethylene is the most widely known mass-produced plastic material. It is the classical member of the polyolefine family. The chemical formula is: -(CH_2-CH_2)n, so it is an environmentally compatible hydro-carbon product.

PE has become most widely used in pipelines systems for the assembly of buried gas and water piping. It has become the dominant piping material in this sphere of application in many countries. However, this material also offers many advantages in domestic installations and industrial piping systems. These include low weight, excellent flexibility, low pipe friction losses, ductile fracture properties, toughness even at very low temperatures, good chemical resistance, fusionable and low price. PE has predominantly good resistance against acids and caustic substances. It is insoluble in all organic and inorganic solvents at 20 °C. PE is destroyed by highly oxidized acids over the course of time.
Please refer to the Georg Fischer list of chemical resistances.

The polyethylene we use is stabilised against the effects of ultraviolet radiation by the addition of carbon black. The stabilisation also counteracts the heat fatigue and thus increases the operating life.

The PE types used by Georg Fischer are suitable for drinking water applications and for storing foodstuff. The fittings are odorless, tasteless and physiologically safe. They can therefore be used in all relevant applications.

PE is a covalent material. The material can neither swell nor dissolve. PE pipes cannot therefore be joined with fittings by means of solvent cement. The appropriate jointing method for the material is fusion jointing. We offer three jointing methods for pipeline systems in our range: electrofusion, heating element butt fusion and heating element socket fusion. The first of these jointing methods is favoured for pipelines carrying gas, water, compressed air or other less aggressive media.
In buried pipe construction, a high molecular type with average to high density is accepted. The shortform is: PE80 (PE second generation) or PE100 (PE third generation). There are hardly any representatives of the PE types from the first generation - in accordance with the present classification PE63 - in the market.

Material properties of polyethylene

	PE 80	PE 100 (ELTEX TUB 121)		
Properties	**Value**	**Value**	**Unit**	
Density	> 0.93	> 0.95	g/cm^3	
Melt flow index MFI 190 °C/50N	0.4–1.3	0.4–0.55	g/10 min	
Yield stress	22	25	N/mm^3	test rate 125 mm/min
Elongation at fracture	> 800	> 600	%	
Bend creep module (1 min. value)	800	840	N/mm^2	
Crystallite melting range	127–131	127–131	°C	
Coefficient of linear expansion	0.20	0.13	mm/m * K	
Heat conductivity at 20 °C	0.43	0.38	W/m * K	
Surface resistance	10^{13}	> 10^{14}	Ω	

Operating pressures in PE piping systems (bar)

The maximum permitted operating pressure (PN) for water at 20 °C and a planned operating duration of 50 years is:

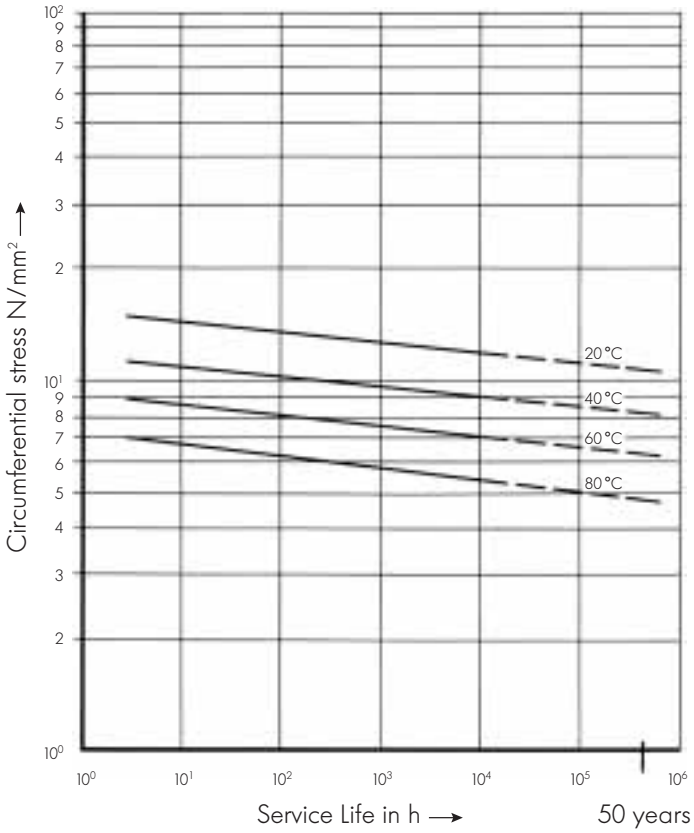
SDR	PE 80	PE 100	Wall thickness for d110
	(MRS = 8, C = 1,25) (PN)	(MRS = 10 C = 1.25) (PN)	
SDR 7.5	16 bar (20 bar)	24 bar	15.5 mm
SDR 9	16 bar	20 bar	12.5 mm
SDR 11	10 bar (12.5 bar)	16 bar	10 mm
SDR 17	6 bar (8 bar)	10 bar (9.6 bar with SDR 17.6)	6.5 mm
SDR 26	5 bar	6 bar	4.5 mm
SDR 33	4 bar	5 bar	3.5 mm

P = (20*MRS)/(C*(SDR-11)) [bar] = PN

In other liquids or at medium temperatures above 20 °C appropriate reduction factors should be taken into consideration for the maximum permitted operating pressure.
The maximum permitted operating pressure for gas should be in accordance with the corresponding national standards.

Durability graphs PE 100

Durability graph of PE 100 pipes



Calculating the effective safety factor and the permissible operating pressure
To calculate the safety factor and permissible operating pressure it is necessary to know the durability strength of the material.
Depending on the desired service life and the maximum operating pressure, the appropriate durability strength can be taken from this diagram.

PE-X
In recent years, pipes made from cross-linked polyethylene (PE-X) have been used for transporting gas and water in buried pipelines.
These pipes are deployed in particular as a consequence of their notch insensitivity and their good stress fracture behavior.

The basic material for PE-X pipes is a high density polyethylene. Through a process during applied or following the production of the pipes, a modified network structure develops. As a result of the cross-linking, the PE-X is no longer a thermoplastic material. It is no longer fusible.
The PE-X properties depend on the cross-linking density and on the cross-linking method.
There are different cross-linking methods:
Peroxide cross-linking = named **PE-Xa**
Silan cross-linking = named **PE-Xb**
Rays cross-linking = named **PE-Xc**
Azo cross-linking = named **PE-Xd**

Jointing method:
In addition to other jointing methods, it is also possible to join PE-X pipes using electrofusion.
However, partly through the cross-linking methods and the resulting properties, Georg Fischer cannot issue a general approval for electrofusion products for all PE-X pipe types.
For reasons of processing safety, we recommend using only the pipe types and material types tested and approved by Georg Fischer, in accordance with the applicable technical rules.

Polyvinylchloride PVC-U

Polyvinylchloride is more commonly known by its abbreviated name PVC. It is the oldest and most common plastic, being used in many branches of the industry as well as in daily life. Contrary to popular belief, this plastic that comes from the thermoplastic group is easily cementable, fusible, repeatedly reshapeable under heat, and highly recyclable. Scrap PVC may be recycled.

PVC is made by polymerising vinylchoride, a gas-like monomer.

Georg Fischer fittings and valves for buried pipelines and for installations of drinking water tanks are manufactured from PVC-U (PVC unplasticized) without softener and without fillers. For industrial applications, besides PVC-U, even PVC-C (PVC rechlorinated) is used. PVC-C is distinguished by a higher temperature resistance and is exclusively solvent cemented.

To enable working on extruding, calandering and injection molding machines, additives should be added to the PVC-U. They are lubricants and stabilizers; moreover, if the product should be dyed, then pigments should be added. The total of all additives is below 5 %.

Georg Fischer PVC-U fittings and valves are dark grey in color, in accordance with RAL 701.

Metal stabilizers are used for protection against thermal decomposition during treatment and against the effects of UV radiation. Georg Fischer uses tin stabilized PVC for manufacturing fittings and valves. This ensures that the products can be used worldwide in the food industry, for example, drinking water applications.

PVC-U is resistant against most acids and alkalis. As a result, it is also used for storage and transport of aggressive media. Please refer to the comprehensive list of resistances with regard to the Georg Fischer piping systems (Order No. Fi 1980/1c). That is why, PVC-U is preferred in pipe constructions like:
– Drinking water main lines
– Drinking water supply lines
– Discharge lines
– Irrigation lines
– Plant construction
– Piping systems for the industry

The most important properties of the versatile and economical material, PVC-U are listed in the table below.

Material properties of polyvinylchloride without softener (PVC-U, Standard values)

Properties	**Value**	**Unit**
Density	1.38	g/cm^3
Tensile strength	55	N/mm^2
Elongation at fracture	> 30	%
Elasticity coefficient	3000	N/mm^2
Coefficient of linear expansion	0.08	mm/m °C
Max. operating temperature	60	°C
Vicat fusing temperature	> 76	°C (VST/B 50)
Water absorption	< 4	mg/cm^3
Surface resistance	approx. 1013	Ω

Polypropylene PP

Polypropylene is a thermoplastic from the polyolefine group. It is a semi-crystalline material. The density is lower than that of other known thermoplastics. The mechanical properties, the chemical resistance and especially the heat non-deformability have made polypropylene an important material in the construction of pipes.

PP is developed from polymerization of propylene (C_3H_6) by using catalyzers. In the pipe construction industry, it is generally supplied in three forms: PP homopolymerisate (PP-H), PP block copolymerisate (PP-B) and PP random copolymerisate (PP-R).

PP-H is further differentiated into α and β nucleared homopolymers.

From these different PP types, Georg Fischer has always opted for the best material for the industrial areas of application:

Daplen Beta (ß)-PP

Fittings and valves in PP are highly heat stabilized. However, they have no special protection against the effects of UV rays. The same is true for PP pipes. PP piping systems that run the risk of UV light during operation, should be protected in the appropriate areas. This can be done by using a cover, for example, in the form of insulation or a UV light absorbing coat of paint.

Foodstuffs may be stored in the material used by Georg Fischer, and the material can therefore be used in associated areas.

PP is a covalent material whose surface does not swell and is insoluble. As a result, solvent cementing is not possible without special surface treatment and under special construction conditions.
On the other hand, PP is fusible. Heating element socket fusion, heating element butt fusion and the R-fusion technology are used for pressure pipes.

Standards and Regulations

General

Georg Fischer products meet the requirements of the relevant international and national standards and regulations with regard to dimensions, identification, materials and mechanical and physical properties.

The relevant standards
The relevant standards can primarily be divided into three main groups, as shown below:

Norms	Committees
ISO	International Organization for Standardization Organisation Internationale de Normalisation
EN	Europäisches Komitee für Normung Comité Européen de Normalisation European Committee for Standardization
SN, DS, UNI, DIN, BS, NF, Ö Norm, DVGW etc.	National Committees for Norms

The European Product Standards

The harmonization of European standards is one of the key achievements of the common European market. Technical regulations and national standards are no longer allowed to restrict the free exchange of goods and services.

In the CEN (Comité Européen de Normalisation) committees, users national associations/ organizations and manufacturers have come together to create uniform European standards. These CEN Standards will become imperative for all members of the European Community as well as for the EFTA States who voted in its favour. They may then not be overruled by a national standard.

All European product standards have a uniform structure. They consist of 7 parts with the following structure:

Part 1: General
Part 2: Pipes
Part 3: Fittings
Part 4: Valves
Part 5: Fitness for purpose
Part 6: Recommended practice for installation
Part 7: Assessment of conformity

Plastic products that are used for underground piping for gas and water distribution, are subject to the following standards:

prEN 1452:
PVC in water distribution

prEN 12201:
PE in water distribution

prEN 1555:
PE in gas distribution

The Georg Fischer range of products is designed in such a way that they comply with these standards. Our commitment to quality and the knowledge that standards only include the minimum requirements, have resulted in internal quality standards at Georg Fischer, which are more or less above the "Norm Level".

List of relevant standards

PE Piping Systems

ISO 161-1	Thermoplastic pipes for the transport of fluids
ISO 1183	Polyethylene – measurement of density
ISO 3607	PE pipes – tolerances on o. d. and wall thicknesses
ISO 3663	PE pressure pipes and fittings – dimensions of flange
ISO 4427	Buried PE pipes for the supply of potable water
ISO 4437	Buried PE pipes for the supply of gaseous fuels
ISO 4440	PE pipes and fittings – determination of melt flow rate
ISO 6447	Rubber seals-joint rings used for gas supply pipes and fittings
ISO 8085	PE fittings for the supply of gaseous fuels
prEN 1555	Plastic piping systems for gas supply – Polyethylene (PE)
prEN 12201	Plastic piping systems for water supply – Polyethylene
prEN 13244	Plastic pipe systems for buried and above-ground pressure systems for water for general purpose, drainage and sewerage
DIN 3535	Gaskets for gas supply
DIN 3543	Valves in PE HD for PE-HD-Mass pipes
DIN 3544	Valves in polyethylene of high density (PE-HD) Requirements and test of tapping valves
DIN 8074	Pipes in polyethylene of high density (PE-HD)-Mass
DIN 8075	Pipes in polyethylene of high density (PE-HD) General quality requirements – Test
DIN 16963	Pipe joints and piping components for pressure pipelines in high density polyethylene (PE-HD)
DIN 19533	Pipes in PE-HD and PE-MD for drinking water supply; pipes, pipe joints, piping components
DS 2131.2	Pipes, fittings and joints of PE type PEM and PEH for buried gas pipelines
UNI 8849	Raccordi di polietilene (PE50), saldabili per fusione mediante elementi riscaldanti, per condotte per convogliamento di gas combustibili. Tipi, dimensioni e requisiti
UNI 8850	Raccordi di polietilene (PE50), saldabili per elettrofusione per condotte interrate per convogliamento di gas combustibili. Tipi, dimensioni e requisiti
Ö Norm B 5192	Pipes, pipe joints and piping components in PE for buried gas pipelines
DSV 2207 Part 1 DVGW G 477	Fusion of thermoplastic plastics, (PE) pipes and Piping components for gas and water pipelines Manufacture, quality assurance and testing of pipes in rigid PVC and PE-HD for gas pipelines
DVGW VP 302	Butterfly valves in PE-HD
DVGW VP 304	Gas and tapping valves for PE-HD piping systems
DVGW VP 607	PE-HD fittings for gas and water pipelines
DVGW VP 608	Polyethylene pipes (PE80 and PE100) for gas and drinking water lines; requirements and tests
DVGW VP 609	Plastic clamp joints for connecting PE pipes in the water supply
DVGW VP 610	Temporary test basis for water tapping valve, requirements and tests
DVGW VP 302	PE-HD butterfly valves
DVGW VP 304	Gas butterful valves for PE-HD piping systems
DVGW VP 610	Temporary test basis for water tapping valve, requirements and tests
DVGW G 472	Laying gas lines
DVGW G 459	Laying gas domestic connections
DVGW G 477	Pipes and piping components for rigid PVC and HDPE gas lines
DVGW W 320	Rigid PVC, HDPE and LDPE water supply pipelines
Ö Norm B 5192	Pipes, pipe joints and piping components in PE for buried gas lines
prEN 681	Seals (water)
prEN 1555	Plastic piping systems for gas supply – Polyethylene (PE)
prEN 12201	Plastic piping systems for water supply – Polyethylene
UNI 8849	Raccordi di polietilene (PE50), saldabili per fusione mediante elementi riscaldanti, per condotte per convogliamento di gas combustibili. Tipi, dimensioni e requisiti
UNI 8850	Raccordi di polietilene (PE50), saldabili per elettrofusione per condotte interrate per convogliamento di gas combustibili. Tipi, dimensioni e requisiti

PVC Piping Systems

ISO 2045	Minimum insertion depth for push-fit sockets
ISO 2536	Flange dimensions
ISO 3460	PVC adaptor for backing flange
ISO 3603	Leak test under internal pressure
ISO/DIN 4422	PVC pipes and fittings for water supply
prEN 1452	Plastic pipelines for water supply (PVC-U)
prEN 1456	Buried pressure drainage and sewage pressure lines (PVC-U)
DIN 2501 Part 1	Flange, connection dimensions
DIN 3441 Part 1	PVC valves; requirements and testing
DIN 3543	PVC tapping valves, dimensions
DIN 4279 Part 7	Internal pressure test of PVC pressure pipelines for water
DIN 8061 Part 1	PVC pipes; general quality requirements
DIN 8062	PVC pipes; dimensions
DIN 8063 Part 4	Pipe joints and piping components for PVC pressure pipelines; adaptors, flanges, seals, dimensions
DIN 8063 Part 5	Pipe joints and piping components for PVC pressure pipes; general quality requirements, tests
DIN 16450	Fittings for PVC pressure pipes; designations, symbols
DIN 16929	Chemical resistance of PVC
DIN 19532	PVC pipelines for drinking water supply
KRV A 1.1.2	Push-fit joints on PVC pressure pipes and fittings, dimensions, requirements, test
KIWA BRL K 603	Plastic gate valves of nominal Sizes from 25 mm through 150 mm
KIWA Quality specification No. 53	Couplings and Fittings of unplasticized polyvinylchlorid for water pipes
KIWA Criteria Nr. 23	Doop Spuitgieten vervaardigde PVC-hulpstukken met flensaansluitigen
KIWA BRLK 2013	Rubberingen and flenspakkringen voor verbindungen in drinkwater en afvalwaterleidingen
prEN 681	Seals (water)
prEN 1452	PVC System
WIS 4-31-07	Specification for emplasticized PVC pressure fittings and assemblies for cold potable water (underground use)

PP Clamp Fittings for PE Pipes (POLYRAC)

ISO 3459	Internal/external pressure test on assembled connections between fittings and polyethylene (PE) pressure pipes
ISO 3458	Internal pressure test on assembled connections between fittings and polyethylene (PE) pressure pipes
ISO 3501	Test on assembled connections between fittings and polyethylene (PE) pressure pipes to verify resistance to pull out
ISO 3503	Internal pressure test on assembled connections between fittings and polyethylene (PE) pressure pipes when subjected to bending
DIN 8076	Part 3, Draft May 1984. Pressure pipelines in thermoplastic materials. Plastic screwed joints for PE pipes. General quality requirements. Tests.
UNIPLAST 403	Raccordi a compressione mediante serraggio meccanico a base di materiali termoplastici per condotte in polietilene per liquidi in pressione. Metodi di prova.
BS 5114 1975	Specification for performance requirements for joints and compression fittings for use with polyethylene pipes.
ISO 14236	Plastic pipes and fittings – Mechanical screwed joints for Polyethylene pressure pipes in water supply lines

General

Electrofusion

Using electrofusion to join PE pipes and valves enables a secure, systematic, economical and efficient installation of buried PE piping systems.

Prerequisites

ELGEF Plus electrofusion products are supplied with a magnet card, which contains all relevant product information (trace code) and fusion data.

Only similar material can be fused. In this case, the PE 63, PE 80 and PE 100 materials can be considered as similar and can therefore be fused with one another.

The melt flow range (MFR) of ELGEF Plus electrofusion products is in the range 0.4 to 1.4 g/10 min. They can be fused with PE pipes with a melt flow range between 0.2 and 1.4 g/10 min and are listed below:

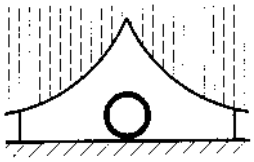
Manufacturer	Material Type	Material	Melt Flow Range MFR 190/5 (g/10 min)
Borealis AB	HE 2467	PE 63 (PE-HD)	0.5
	HE 2467 BL	PE 80 (PE-HD)	0.5
	ME 2418	PE 80 (PE-MD)	0.8
	ME 2421/2424	PE 80 (PE-MD)	0.9
	ME 0909	PE 80 (PE-MD)	0.6
	HE 2490/2492/2494	PE 100 (PE-HD)	0.4
	CE 4664	PE 80 (PE-HD)	0.45
	DE 3964	PE 80 (PE-MD)	0.75
BP	Rigidex PC001–55	PE 80 (PE-HD)	0.5
	Rigidex PC002–40/2040	PE 80 (PE-MD)	0.9
	Rigidex PC002–50	PE 80 (PE-MD)	0.85
	Rigidex PC3100F Blue	PE 100 (PE-HD)	0.22
	Rigidex PC4100F Black	PE 100 (PE-HD)	0.22
DSM Polyolefine GmbH	Vestolen A5041R	PE 80 (PE-HD)	0.5
	Vestolen A4042R	PE 80 (PE-HD)	0.8
	Vestolen A6060R	PE 100 (PE-HD)	0.3
Elenac GmbH	Lupolen 3822 D GB00350	PE 80 (PE-MD)	0.9
	Hostalen GM5010T3	PE 80 (PE-HD)	0.45
	Hostalen GM7040G	PE 80 (PE-HD)	0.45
	Hostalen GM5140	PE 80 (PE-MD)	0.85
	CRP100	PE 100 (PE-HD)	0.22
Repsol	Alcudia 3802	PE 80 (PE-MD)	0.8
	Alcudia 5300	PE 80 (PE-HD)	0.5
Solvay	Eltex TUB 71/72	PE 63 (PE-HD)	0.45
	Eltex TUB 101/102	PE 80 (PE-MD)	0.8
	Eltex TUB 131/132	PE 80 (PE-HD)	0.85
	Eltex TUB 131 N2010/N2012	PE 80 (PE-HD)	0.46
	Eltex TUB 171/172/174	PE 80 (PE-HD)	0.85
	Eltex TUB 121/124/125	PE 100 (PE-HD)	0.5
	Eltex TUB 121/124/125 N2025	PE 100 (PE-HD)	0.3
TotalFina	Finathene 3802	PE 80 (PE-MD)	0.9
	Finathene HP 401/5400	PE 80 (PE-HD)	0.45

This list does not claim to be comprehensive.
For clarifications, please contact the pipe and pipe material manufacturer.

Jointing tips
The quality of the joint depends to a considerable extent on the care with which the preparatory work is performed. Electrofusion jointing should be carried out only by trained personnel.

Protect the fusion zone against bad weather, such as rain, snow or wind. Admissible temperature range for electrofusion is –10 °C to +45 °C.

The national guidelines are to be observed. A more uniform temperature profile around the entire pipe circumference can be achieved by shielding the fusion zone against direct sunlight or inclement weather.



Especially check that the electrofusion automatic machine and the fusion zone are placed under the same climatic conditions.

Storage
ELGEF Plus electrofusion fittings are packed separately in a polythene bag. If the fittings are protected from direct sunlight in the original packing and not stored above 50 °C, they can be stored for almost 10 years.
The storage duration commences on the date that the fittings are produced.

Protection of fusion area
The pipe and fitting surfaces to be fused should be carefully protected from dust, grease, oil and lubricants. Use only cleaning agents that are suitable for PE.

Attention: There should be no grease (such as hand cream, oily dusters, silicon etc.) in the fusion zone!

Operating pressure and operating temperature
PE fittings and saddles come in sizes that correspond to the creep strength requirements of the associated ISO Series 4065.
Operating pressures for water (Total operating coefficient C min = 1.25):

Pipe class	Operating pressure PE 100	Operating pressure PE 80	Temperature
ISO S3.2 SDR 7.4	–	16 bar	20 °C
ISO S5 SDR 11	16 bar	12.5 bar	20 °C
ISO S8 SDR 17/17.6	10 bar/9.6 bar	8 bar/7.6 bar	20 °C
ISO S12.5 SDR 26	6.4 bar	5 bar	20 °C

Operating pressures for gas (Total operating coefficient C min = 2.0):

Pipe class	Operating pressure PE 100	Operating pressure PE 80	Temperature
ISO S5 SDR 11	10 bar	4 bar	20 °C
ISO S8 SDR 17/17.6	5 bar	1 bar	20 °C

Details about the dependence of operating pressures on the operating temperatures are available on request from Georg Fischer.

Product and fusion data
ELGEF Plus electrofusion products are normally supplied with a magnetic card containing all relevant product, processing and traceability data in the form of magnetic strips, barcode and data table.

The products can be joined using any kind of fusion units that comply with the current, international standards.

Fusion preparation
The pipe should be wiped clean, prepared and finally cleaned using a PE cleaner. Scraping tools can be used for uniform and time-saving pipe preparation.
Please comply with the assembly and operating instructions.

Adhere to the following scraping measurements:

d Pipe	Min. chip thickness	Max. chip thickness*
20–25 mm	0.20 mm	0.20 mm
32–63 mm	0.20 mm	0.25 mm
75–225 mm	0.20 mm	0.30 mm
> 225 mm	0.20 mm	0.35 mm

Tip: Maximum permitted pipe ovalness 1.5%

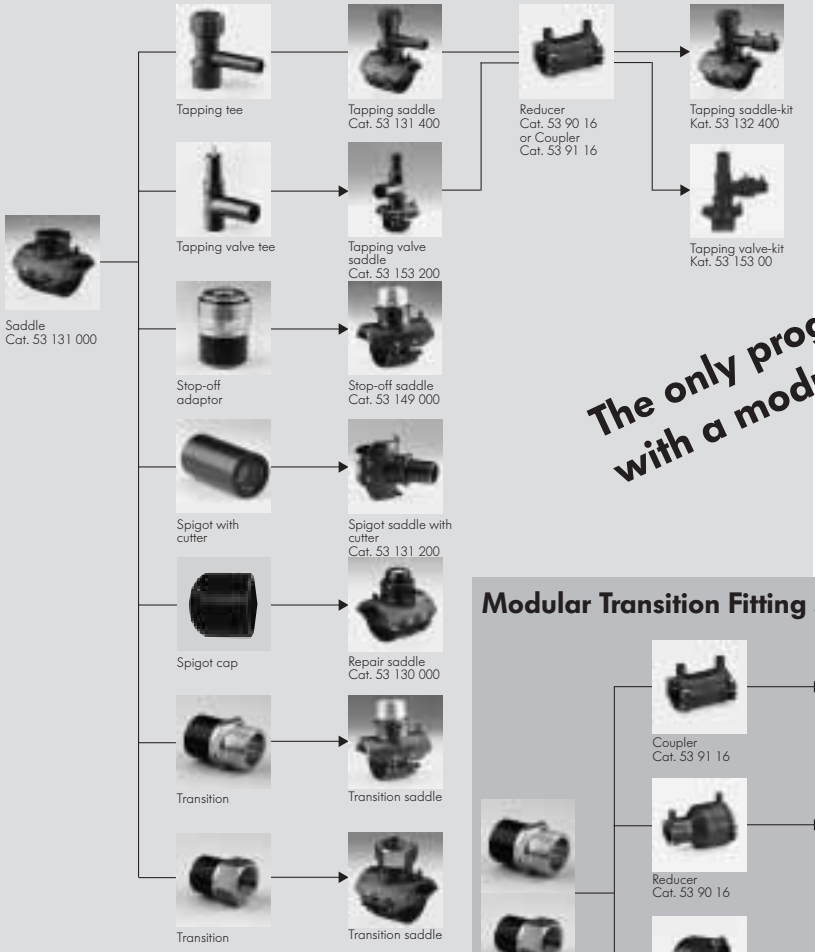
* The data refers to the pipe inner diameter without "+ tolerance"

Modular System ELGEF Plus – What is it?

We can help you to reduce storage costs and storage volumes to simplify planning, ordering and making tenders.
But how? With the ELGEF Plus saddles and adaptor fittings modular system. All you have to do is select a base part, for example, the saddle plus any additional part such as the tapping-T, and you have a tapping saddle. You need to establish inventories for every part.

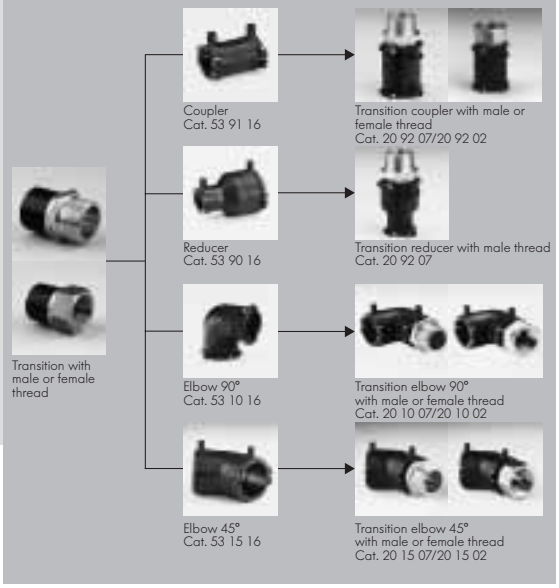
Less stock, higher flexibility, more variations – a contradiction?
Not with the ELGEF Plus Modular System.
It is that easy:

Modular System Saddles



The only programme with a modular system

Modular Transition Fitting System



Suitability of electrofusion fittings for different pipe classes

ELGEF Plus electrofusion sockets

Sockets (with integrated clamps of d 20–63 mm) are mounted on PE pipes and PE fusion supports. Both socket joints are simultaneously fused.

Suitability of ELGEF Plus sockets for PE pipes and PE fusion supports of different wall thickness:

Diameter Pipe	Wall thickness *1 **Pipe**	ISO S5 SDR 11		ISO S8 SDR 17/17,6		ISO S8 SDR 26	
	Wall thickness **Socket**	ISO S5 SDR 11	ISO S8 SDR 17/17.6	ISO S5 SDR 11	ISO S8 SDR 17/17.6	ISO S5 SDR 11	ISO S8 SDR17/17.6
	20	+		+ *2			
	25	+		+ *2			
	32	+		+ *2			
	40	+		+ *2			
	50	+		+			
	63	+		+			
	75	+		+			
	90	+		+			
	110	+		+			
	125	+		+		+ *3	
	140	+		+		+ *3	
	160	+	+	+	+	+ *3	+
	180	+	+	+	+	+ *3	+
	200	+	+	+	+	+ *3	+
	225	+	+	+	+	+ *3	+
	250	+	+	+	+	+ *3	+
	280	+	+	+	+	+ *3	+
	315	+	+	+	+	+ *3	+
	355	+	+	+	+	+ *3	+
	400	+	+	+	+	+ *3	+
	450		+		+		+
	500		+		+		+

*1 Other wall thickness are possible on request
*2 Use of spigot jackets possible
*3 Consultation required depending on operating conditions

ELGEF Plus electrofusion saddles
They are used for domestic and branch lines of PE pressure pipelines in gas and water distribution systems.

In addition, they are used when installing bypass lines, placing stop off bags in low pressure lines, connecting valves and plugging minor pipe defects.

A special feature of Georg Fischer tapping saddles and pressure tapping valves is the padding that can be positioned anywhere. They can be fused on PE lines in operation. The built-in drilling cutter enables tapping even below the maximum permissible operating pressure; the disc cut out of the pipe wall is permanently kept in the drilling cutter.

Pipe d (mm)	ISO S5 SDR 11	ISO S8 SDR 17/17.6	ISO S8 SDR 26
40	+		
50	+		
63	+	+	
75	+	+	
90	+	+	
110	+	+	*
125	+	+	*
140	+	+	*
160	+	+	*
180	+	+	*
200	+	+	*
225	+	+	*
250	+	+	*
280	+	+	*
315	+	+	*

* under preparation, consultation required

Operating pressure and operating temperature

PE Fittings
PE Fittings and saddles come in sizes that correspond to the requirements of the creep strength in accordance with the associated ISO pipe series (i.e. ISO S3.2, ISO S5 and ISO S8 in accordance with ISO 4065).

In accordance with ISO and national standards, for water as medium. This corresponds to the operating conditions given in the following table:
For further details about the dependency of operating pressures on the operating temperatures are available on request from Georg Fischer.

Pipe class	**Operating pressure PE 100**		**Operating pressure PE 80**		**Temperature**
	Water	**Gas**	**Water**	**Gas**	
ISO S3.2 SDR 7.4	–	–	16 bar	–	20 °C
ISO S5 SDR 11	16 bar	10 bar	12.5 bar	5 bar	20 °C
ISO S8 SDR 17/17.6	10 bar	5 bar	8 bar	1 bar	20 °C

Vacuum: up to 800 mbar below atmospheric pressure

PVC STEMU® and Gate valve

STEMU fittings, branch and tapping saddles as well as parts from the Georg Fischer plastic gate valve system in PVC come in sizes that correspond to the requirements of the creep strength in accordance with the associated ISO pipe series according to ISO 4422.

According to ISO and national norms, for water as medium it corresponds to the operating conditions given in the following table:

Operating temperatures

STEMU fittings in PVC
Maximum operating temperature 60 °C, depending on the internal pressure.

Plastic gate valve, branch and tapping saddles in PVC
Maximum operating temperature 45 °C, depending on the internal pressure.

Dimension	Pipe class	Operating pressure	Temperature
d 63–d 160	ISO S8 SDR 17	10 bar (12.5 for gate valve)	20 °C
d 200, d 225	ISO S10 SDR 21	10 bar	20 °C

Vacuum: STEMU fittings are suitable up to 800 mbar below atmospheric pressure.

POLYRAC®

Application

POLYRAC® compression joints are suitable for connecting PE pipes. Areas of application include water supply, irrigation, cable protecting pipes.

POLYRAC® compression fittings come in sizes that correspond to the requirements of the creep strength in accordance with the associated ISO pipe series in compliance with the norms (for example, ISO S5). According to ISO and national norms, for water as medium it corresponds to the operating conditions given in the following table:

Dimension	Operating pressure	Temperature
d 16–d 63	16 bar	–20 °C to +20 °C
d 75–d 110	10 bar	–20 °C to +20 °C
d 16–d 63	9 bar	+40 °C
d 75–d 110	6 bar	+40 °C
d 16–d 63	4 bar	+60 °C
d 75–d 110	2 bar	+60 °C

PVP Pipe connection System

d 20–d 63	Operating pressure	Temperature (Medium)
	10 bar	20 °C (Water)
	6 bar	40 °C (Water)
	1 bar	20 °C (Gas)

Comply with the national standards with regard to application at a higher pressure.

PRIMOFIT

Operating pressure and temperature range (NBR seal)

Seal	Medium	Steel pipe		PE Pipe	
		Max. Temperature	Max. pressure	Max. Temperature	Max. pressure 20 °C
NBR	Gas Water Air Oil	70 °C 80 °C 80 °C 80 °C	10 bar 16 bar 10 bar 16 bar	40 °C 40 °C – –	5 bar 16 bar – –
EPDM*	Water	40 °C	16 bar	40 °C	16 bar
FPM	Please contact the manufacturer				

* Water applications require the WBS permissible material

DRAW LOCK System

Medium	PE Pipe	
	Max. Temperature	Max. pressure at 20 °C
Gas	40 °C	7 bar*
Water	40 °C	7 bar*

* Max. operating pressure, depends on PE pipe specification and national standards

WAGA® MULTI/JOINT

Pressure class	PN 16	max. temperature 70 °C

Georg Fischer Electrofusion Units

Overview of the MSA electrofusion units and their technical data

Following electrofusion units are available:
MSA 200; manual fusion unit
MSA 300; automatic fusion unit
MSA 350; recording fusion unit
MSA 400; retracing fusion unit

General		**MSA 200**	**MSA 300**	**MSA 350**	**MSA 400**
Fusion data: Barcode input (12/5, Code 128)		–	✔	✔	✔
Fusion data: Manual input (U,t)		(only t)	✔	✔	✔
Traceability data: Barcode input (Code 128-C)		–	–	–	✔
Traceability data: Manual input		–	–	–	✔
Collective recording		–	–	✔	✔
Individual recording		–	–	✔	✔
Info Text		–	–	✔	✔
Safety recording (backup memory)		–	–	✔	✔
Safety recording memory: configurable (Fix/Overflow)		–	–	–	✔ (750)
Safety recording memory: only overflow		–	–	✔ (750)	✔ (750)
Record memory: (Number of records)		–	–	–	400/800/1600
Record memory: Memory card as flexible data carrier		–	–	–	✔
Operator ID: configurable as compulsory entry		–	–	✔	✔
Order number: configurable as compulsory entry (Man. & BC)		–	–	✔	✔
Record printing from MSA		–	–	✔	✔
Sort according to order number		–	–	✔	✔
Sort according to fusion number		–	–	✔	✔
Audit: configurable		–	–	✔	✔
Interface		–	–	serial RS232	serial RS232
Languages for unit operation		–	max. 24	max. 24	max. 24
Display		LED 1 x 4 N	LCD graphical	LCD graphical	LCD graphical
Display size (B/H)		50/18 mm	132/39 mm	132/39 mm	132/39 mm
Display contrast configurable		–	✔	✔	✔
Background lighting		–	✔	✔	✔
Error messages as plain text		–	✔	✔	✔
Scope of delivery:		Operating instructions Packing	Fusion unit with barcode reader, 4-mm adapter, operating instructions and Packing		
Options					
Barcode scanner		–	x	x	x
Adaptor 4.7 mm		x	x	x	x
PC serial cable		–	–	x	x
Printer cable serial → parallel		–	–	x	x
Printer cable parallel		–	–	x	x
Transport case: solid Alu wooden case, uncovered		x	x	x	x
MSA WIN-WELD Software can be used		–	–	x	x
Technical Data					
Input					
Voltage	VAC	180-264			
Current	A	16			
Frequence	Hz	45-65			
Power factor controller		–	✔	✔	✔
Output					
Voltage	V	39.5	8–42 (48)	8–42 (48)	8–42 (48)
Current	A	2.5–100	0.5–90	0.5–90	0.5–90
Max. voltage	W	3200	3780	3780	3780
Voltage principle		Phase cut	Switching mains supply	Switching mains supply	Switching main supply
General					
Automatic temperature compensation		–	✔	✔	✔
Temperature range	°C	–10 to + 45 °C			
Type of protection	IP	65			
Protection class		1			
Length of power cable	m	3			
Length of fusion cable	m	3			
Active casing cooling (Patented)		–	✔	✔	✔
Generator positive List		not necessary			
Norms: Complies with		EN 60335-1, EN 60335-2-45, EN 50081-1, EN 50082-1, EN 55014, EN 61000-3-3			
Warranty	Mt	12	24		
Dimensions (B/H/D)	mm	230/340/160	284/364/195	284/364/195	284/364/195
Weight incl. cable approx.	kg	19	11.5	11.5	11.5

4

Integrated Quality Assurance

MSA electrofusion units with automatic recording

The auomatic recording feature in the MSA 350 and MSA 400 electrofusion automatic systems is an additional cornerstone. The MSA 400 offers a thorough Quality Assurance System from the pipe material to laying the pipe and fitting.

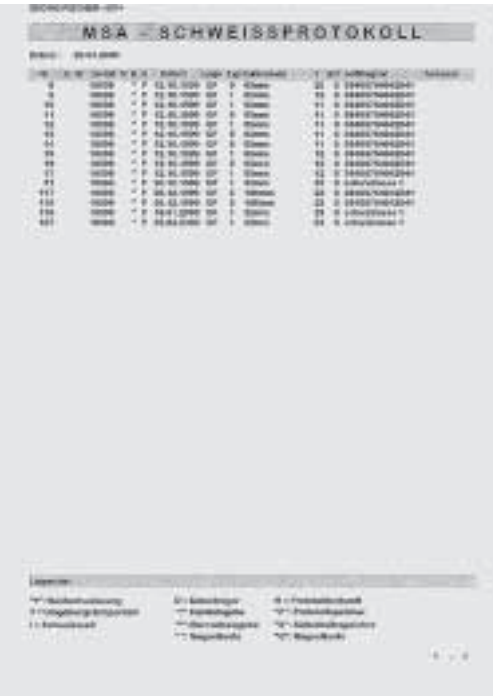


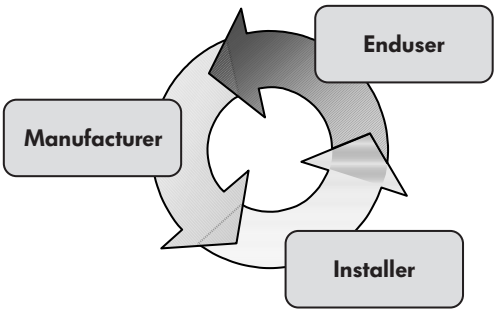
Illustration of MSA 350 and MSA 400 collective record

Illustration of MSA 400 individual record

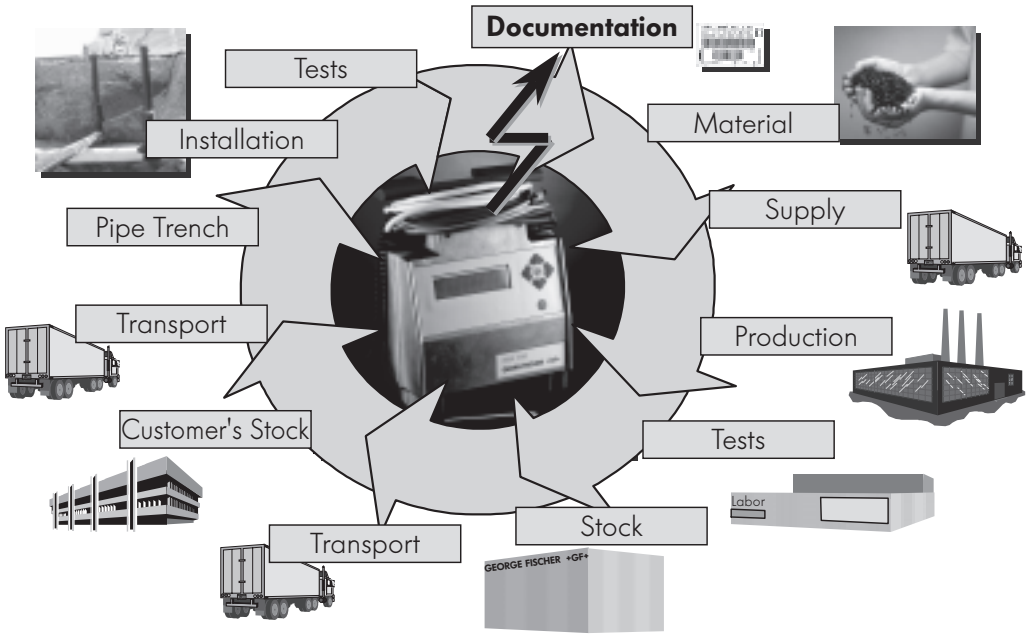
Product traceability in polyethylene pipeline systems

Today, everybody who is involved in the production of pipeline systems especially for gas and water distribution are confronted with the most varying demands. Keywords such as quality assurance, product liability, duty of the service provider, cost reduction, profitability of the participating companies etc. are on the other side of the perspective. If varying interests have to agree with varying demands, then it is necessary to create an electronic documentation of all relevant data for reasons of traceability. Based on the new traceability system, today all the prerequisites for a uniform and safe system with respect to standards, pipe and fitting manufacturers and manufacturers of fusion units are available.
Now the operators and network administrators only need to adequately install this economical and neatly structured resource in their companies to fulfil the requirements with regard to constant quality assurance.

Though diverse interests such as quality assurance, product liability, duty of the service provider, cost reduction, profitability of the participating companies etc. are in conflict while creating pipeline systems especially for gas and water distribution, it should be ideally possible to integrate them in a quality cycle as a whole.



As a result, it should be possible to close this cycle completely, which however was not entirely or not at all possible until today for various reasons.
In particular while using system components from different suppliers the necessary instruments for implementing the quality cycle was possible only partly or sometimes not at all.
The "key" to a documentation system represents a reliable documentation that cannot be manipulated. It should be possible to create such a system efficiently and without any significant additional costs. If one considers the QA cycle, then the fusion unit becomes the central documentation instrument.
The DVS worksheet 2207 Part 1 stipulates at least one manually written fusion record. In the DVGW Worksheet G 472 a mechanically created fusion record has been provided at an operating pressure of 4 bar.
If one is successful in bringing into line the varying interests with the market requirements, then a future system should be able to furnish a reliable electronic documentation.



This record should include the following data:
- Fusion data of the joint
- Data of the fittings used
- Data of the pipe used
- Installation data

This results in a comprehensive pipe log book and series book for the respective piping system operator.
Today several operators are maintaining pipe log books to be able to locate the position of the individual components later. This is done manually and naturally means extra cost and effort for the administration.
Electronic documentation offers an optimal, economical solution for data management.

Requirements
As part of quality assurance of the total system and traceability of the products from raw material to installation, it is important that the installed products can be located later any time.
As a result, the operator has to do more than merely document the fusion joints.
Other system components such as pipes, valves, fittings without incorporated heating, building installations etc. must also be documented. If this is possible, then an automated documentation system becomes more significant.

This means noting measurements such as lengths and distances onsite while laying the pipes, and maintaining an electronic log book with the following information:

- Length/distance
- Product name
- Product manufacturer
- Product data
- Material
- Production date/series
- Installation parameters
- Distributor
- Company

The above described process not only affects the manufacturer of the system components, but also the person laying the pipes in the trench.
If one looks at the real circumstances, it quickly becomes clear that installation tools such as electrofusion automatic systems and butt fusion machines available with sales support are necessary.

Several operators and sales persons already have sufficient practical experience in extensive documentation of fusion data serving as the initial point for the other products and data.
Product and assembly data must be harmonized, as the requirements for such system components can stem from various areas. It is only in this way that a manufacturer dependent compatibility can be ensured.

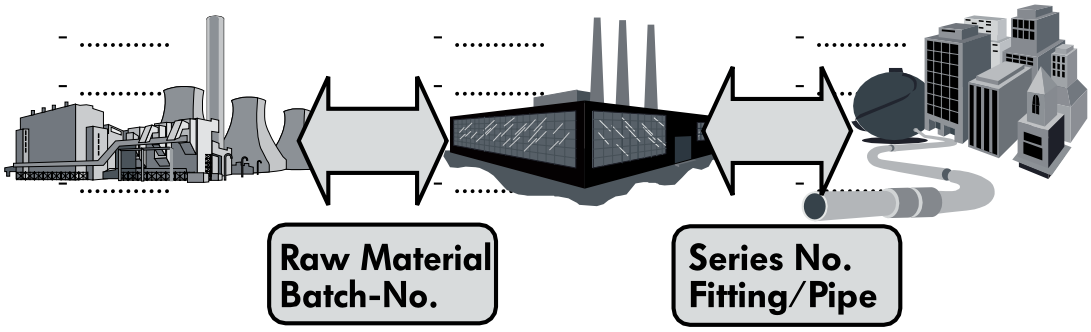
View of the operator/Fitter
Such a system offers distinct advantages for the operator. They can access a database at any time and get quick information on products with association to the installation site. The distribution system definitely becomes more transparent. For example, it must be possible to inquire about the installed product from different points of view.

It must be possible to store information in a universal format, to process and link data with different kinds of systems. As a result, it is not enough to have an original data format that cannot be linked with other systems.
From the point of view of the fitter, this means that he can make use of a tool in the pipe trench to process product data as well as the pertinent geometric data (lengths and dimensions).
Anyway, this requires more effort and reliability from the pipe fitter. The advantage being that the quality produced by the fitter is also documented.
This appliance holds special significance for product liability.

International standardization
As there are differing views and viewpoints at the national and international levels, it becomes necessary to take up such a development for economical reasons and to search for the largest common denominator. Operators, fitters and manufacturers have established their common interest.
The new traceability system is presently being formulated in the standards group ISO/TC 138/SC4-WG2, and the ISO 12176 standards Part 4 should result from it.

Implementation
With regard to the recording options that should preferably be integrated in the existing electro fusion and butt fusion units, manufacturers are expected to ensure compatibility of the various systems on the basis of the above mentioned standards.
To technically ensure traceability from raw material to the installed product, one must work with so-called batch or serial numbers. This produces the link between the main stations of each product.

Raw Material	Product	Installer
- Additives	- Raw Material Batch	- Series-No.
- Density	- Density	- Assembly
- MFI	- MFI	- MFI
- MRS	- MRS	- MRS
- Process Data	- Production Data	- Installation Data
-	-	- .....
-	-	- .....
-	-	- .....
-	-	- .....
-	-	- .....



All relevant information stipulated in the new ISO standard will be described again in a so-called product identification or a traceability code.

As seen in the examples in table 1 and 2, the product identification or traceability codes include the following.

Code relevant for electrofusion fittings and spigot fittings
Code 128 Typ C, 26 Digits (even numbered)

Sign	Description	Example
1	Name of manufacturer	GF = Georg Fischer
2	(additional dimension information)	
3	Use of a test digit No/Yes	Test digit active: = +3
4		
5	Component, for ex. socket, tapping saddle	03 = socket
6	Angle 45 etc.	
7	Diameter	
8		
9		
10	Batch number of component	983400 = 34th week 1998
11	6 digits can be defined for manufacturer	
12		
13		
14		
15		
16	Place of manufacture in addition to batch	00 = Factory Schaffhausen
17		
18	SDR of component, for ex. SDR 11	7 = SDR 11 / 8 = SDR 9
19	Raw material from which the component	F01 = Finathene 3802b
20	was manufactured	
21		
22		
23	Material status (new, recycled, mixed)	0 = new
24	Material MRS (PE 80/PE 100)	2 = PE 80 / 3 = PE 100
25	Material MFI	1 = > 10– < 13
26	Test digit	If sign 3 = Yes (+3): Code acc. to TR13950

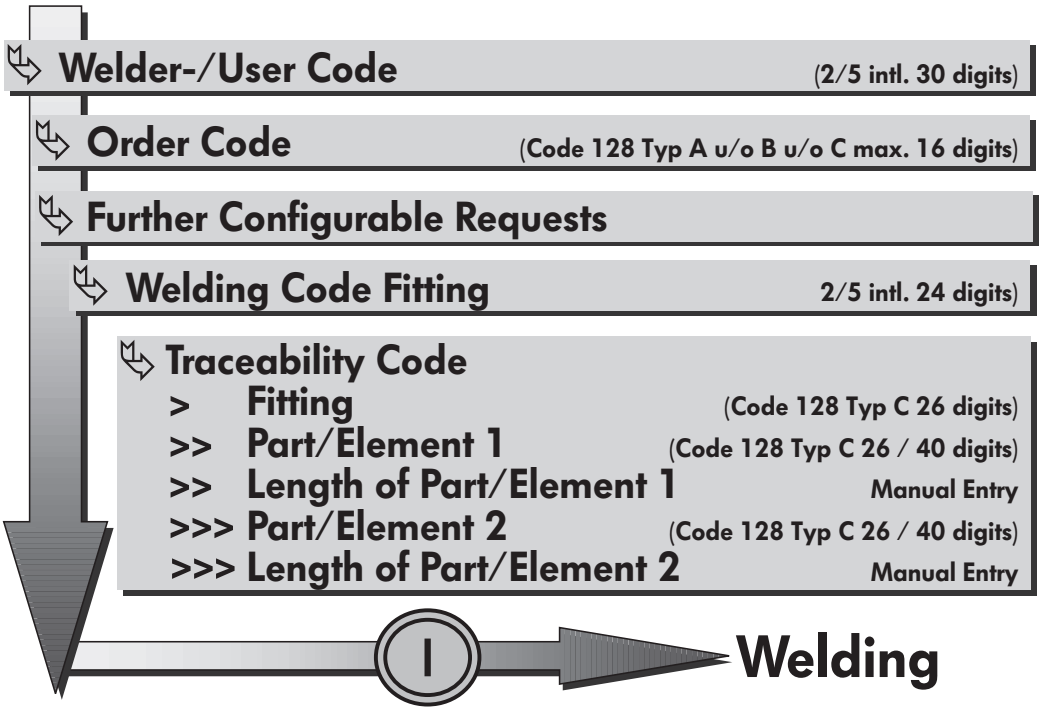
Table 1

Code 128 Typ C, 26 Digits (even numbered)

Sign	Description	Example
1	Name of manufacturer	GF = Georg Fischer
2	(additional dimension information)	
3	Use of test digit No/Yes	Test digit active: = +3
4		
5	Component, for ex. pipe, socket	02 = Pipe, rollers
6		03 = Socket
7	Diameter	063 = d 63
8		
9		
10	Batch number of component	981028 = (28th Oct. 1998)
11	6 digits can be defined for manufacturer	
12		
13		
14		
15		
16	Place of manufacturer in addition to batch	00 = Factory Schaffhausen
17		
18	SDR of component, for ex. SDR 11	7 = SDR 11 / 8 = SDR 9
19	Raw material from which the component	F01 = Finathene 3802b
20	was manufactured	
21		
22		
23	Material status (new, recycled, mixed)	0 = new
24	Material MRS (PE 80/PE 100)	2 = PE 80 / 3 = PE 100
25	Material MFI	1 = > 10– < 13
26	To be defined later	
27		
28		
29		
30		
31		
32		
33		
34		
35		
36		
37	Correction factor	
38	Extra Information for identification	for ex. pipe length
39		
40		

Table 2

Furthermore, owing to the complexity of such systems special attention should be given to user friendliness. To ensure the maximum compability of all unit manufacturers, the input sequence was kept uniform, as shown below. The input requests can vary slightly depending on the options used for the fusion units/ machines.



Implementation by the manufacturers

Several existing systems are being overtaxed to meet all the requirements and make the system user friendly.

The development of a new family of fusion units was therefore necessary. The "MSA 400" fulfils these requirements.

Early inclusion of market considerations as well as the active cooperation of international and national standardization committees meant that development could be carried out in parallel. The new fusion unit MSA 400 is already being used with the software since November 1999. Similarly, a universal data recording system "SUVI" suitable for butt fusion machines of different types is also in use.

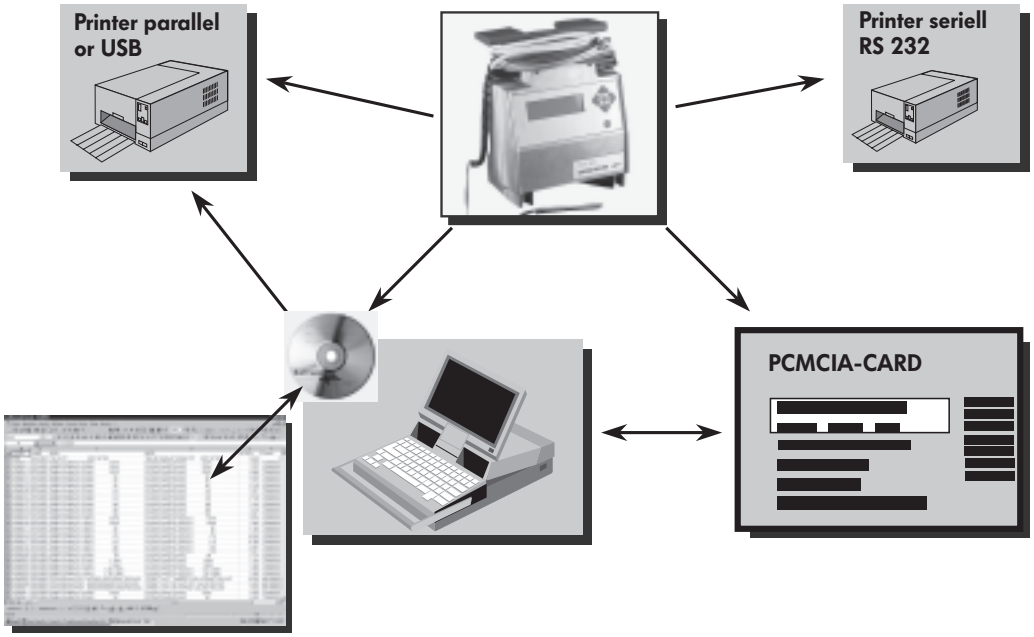
Implementation by the operators

Introduction to such an extensive system must be consistent and tuned to the data system, so that the concerned persons can access data fast and easy anytime.

With the help of PC software the system can be configured customer-specific to meet the requirements of every customer/ user. It is only in this way that optimum use on the part of the unit manufacturer is ensured.

Moreover, the recording options that the operator uses as basis for such a system is of considerable importance. The respective configurations should be determined before introducing the system especially in view of the pipe series book and documentation method.

Finally, easy data handling is also important. A universal, sophisticated system for data transfer from the units to the PC using standard data carriers would be the best solution. In addition, one must note that the units are provided with a so-called backup memory inside the unit. This would prevent data loss in case something goes wrong when transferring data from the unit to the PC using a data carrier. In such a situation, the data can be read directly on the PC via the appropriate interface.



Based on the new retraceability system, today all the prerequisites for a uniform and safe system with respect to standards, pipe and fitting manufacturers and manufacturers of fusion units are available.

Now the operators and network administrators only need to adequately install this economical and neatly structured resource in their companies to fulfil the requirements with regard to constant quality assurance.

Assembly and operating instructions

ELGEF Plus electrofusion fittings

Fundamental tips
Electrofusion for PE pipes and PE fittings enables safe, efficient and economical installation of piping systems.
Owing to the high quality standards of our products, tools and resources, the joints are easy to make.

However, careful preparation of the fusion surface is the absolute prerequisite and should not be neglected!

General tips for preparation and assembly of Georg Fischer fittings:
Fusion zones should be well protected from moisture during inclement weather (rain, snowfall etc.).

Georg Fischer Fittings are supplied with the appropriate magnet card in a polythene bag. Fittings that arrive at the place of installation in their original packing, must neither be machined nor cleaned with the PE cleaner. If the products (spigots) are nevertheless machined, then it will not reduce the quality if it is done professionally. However, it is not necessary.
Exception: If the fusion zones are touched by hand during assembly, the fittings must be cleaned with the PE cleaner.

The pipe should be wiped, scraped and finally cleaned with the PE cleaner. Scraping tools should be used for even and time-saving pipe preparation.

The following scraping measurements should be maintained:

d Pipe	Min. chip thickness	Max. chip thickness*
20–25 mm	0.20 mm	0.20 mm*
32–63 mm	0.20 mm	0.25 mm*
75–225 mm	0.20 mm	0.30 mm*
> 225 mm	0.20 mm	0.35 mm*

Tip: Maximum permissible pipe ovalness 1.5%
* the specifications refer to the pipe inner diameter without "+ tolerance"
As a result: If the average pipe outer diameter is equal to the upper tolerance limit, the pipe can be cut out by scraping until the permissible pipe outer diameter. In this case, the chip thickness can be greater than 0.3 mm.

Permissible minimum pipe outer diameter

d Pipe	Min. chip thickness	Per. minimum pipe outer diameter
20 mm	0.20 mm	19.6 mm
25 mm	0.20 mm	24.6 mm
32 mm	0.20 mm	31.5 mm
40 mm	0.20 mm	39.5 mm
50 mm	0.20 mm	49.5 mm
63 mm	0.20 mm	62.5 mm
75 mm	0.20 mm	74.4 mm
90 mm	0.20 mm	89.4 mm
110 mm	0.20 mm	109.4 mm
125 mm	0.20 mm	124.4 mm
140 mm	0.20 mm	139.4 mm
160 mm	0.20 mm	159.4 mm
180 mm	0.20 mm	179.4 mm
200 mm	0.20 mm	199.4 mm
225 mm	0.20 mm	224.4 mm
250 mm	0.20 mm	249.3 mm
280 mm	0.20 mm	279.3 mm
315 mm	0.20 mm	314.3 mm
355 mm	0.20 mm	354.3 mm
400 mm	0.20 mm	399.3 mm
450 mm	0.20 mm	449.3 mm
500 mm	0.20 mm	499.3 mm

The stability and surface hardness of PE 100 is greater than that of PE 80. This is especially noticeable when the scraping tools become blunt. Therefore regular testing and maintenance of wear parts is required. We recommend servicing the units at least once a year.

Use only PE cleaner with soft, absorbent paper to clean the fusion zones. Dusters soaked in PE cleaner are allowed.

Clean only the scraped fusion surface. Otherwise, there is danger of tranferring dirt to the already cleaned surface.

When using markers, check that no ink reaches the fusion zone. Even when cleaning marker ink, take care that no ink touches the fusion zone.

Ink in the fusion zone **cannot** be removed completely despite repeated cleaning. The pipe piece should be remachined or replaced.

Pipes that are oval or not round should be rounded using rounding clamps in the connection zone.

Use brackets or suitable devices to fix the pipes and fittings. In particular when working with roller pipes, ensure that no force is applied between the pipe and fusion zone during the fusion and cooling phase.

To transfer the fusion data to the fusion unit, you must always use the magnet card and the barcode supplied in the original bag.

Wait until minimum cooling times before removing brackets, tapping and conducting the pressure test.

Observe the assembly instructions.

Refusion
If there is power failure caused by external influences (for ex. generator failure) and if

the electrofusion is subsequently interrupted, you can refuse the joint. The following points should be kept in mind during refusion:

- Check and correct the cause of the fault. Appropriate error messages on the fusion unit might provide tips on the possible cause.
- Do not remove the brackets.
- Cool the fitting completely again, i. e. cool to the ambient temperature. Do not use other resources to cool the fitting (cold water etc.).
- Protect the joint from dirt and moisture during the cooling phase.
- Carry out the fusion again in accordance with the assembly instructions and the specifications on the data carrier.
- Test the fusion for leaks, conduct a pressure test.

If the fusion joint fails in the pressure test, refusion is no longer possible.

Assembly instructions for sockets, fittings and adaptors

Sequence of tasks

1 Clean pipe(s), cut at right angles and trim

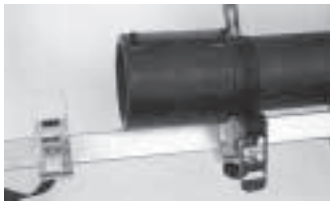
2 Remove oxide film of pipe(s) using scraper (adhere to max. permissible wall thickness reduction)

3 Clean pipe(s) in fusion zone with duster and PE cleaner

4 Mark the insertion depth on the pipe

5 Remove the fitting(s) from the packaging without touching the fusion surface.

6 Screw or unscrew transition adaptor



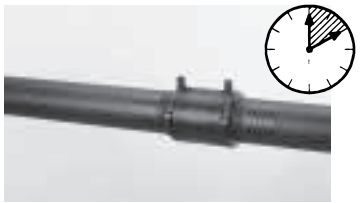
7 Push in the PE pipe until the center stop or marking
8 Firmly fasten integrated clamp
9 Mount and fix assembly attachment

10 Slide in second pipe up to center stop or marking
11 Firmly fasten integrated clamp
12 Mount and fix assembly attachment

13 Follow operating instructions for fusion

14 After fusion: Check fusion indicator on fitting and fusion unit display, then remove cable
15 Wait for cooling, finally remove assembly attachment. Refer to magnet card imprint and fusion unit display for cooling time

16 Screw or unscrew transition adaptor with loose clamping nut (if required)



17 Wait minimum waiting time until pressure test, then conduct pressure test

ELGEF Plus assembly instructions for sockets, fittings and transition adaptors

Sequence of tasks	Socket Fittings d 20–d 63	Socket Fittings d 75–d 500	Terminal caps d 20–d 63	Terminal caps kit d 75–d 225	Transition adaptor d 20–d 63	Transition adaptor with loose cl nut d 20–d 63
						
1 Clean pipe(s), cut at right angles and trim	■	■	■	■	■	■
2 Remove oxide film of pipe(s) using scraper	■	■	■	■	■	■
3 Clean pipe(s) in fusion zone with duster and PE cleaner	■	■	■	■	■	■
4 Mark the insertion depth on the pipe *1	▒	▒	▒	▒		
5 Remove fitting(s) from the packaging without touching the fusion surface	■	■	■	■	■	■
6 Screw or unscrew transfer adaptor					■	▒
7 Push in the PE pipe up to center stop or marking	■	■	■	■		
8 Firmly fasten integrated bracket	■		■			
9 Mount and fix assembly attachment		■		■		
10 Slide in second pipe up to center stop or marking	■	■			■	■
11 Firmly fasten integrated bracket	■				■	■
12 Mount and fix assembly attachment		■		■		
13 Fusion in accordance with operating instructions of the unit	■	■	■	■	■	■
14 After fusion: Check fusion indicator on fitting and fusion unit display, then remove cable	■	■	■	■	■	■
15 Wait for cooling, finally remove assembly attachment *2		■		■		
16 Screw or unscrew transition adaptor with loose clamping nut (if required)						▒
17 Wait minimum waiting time until pressure test, then conduct pressure test *2	■	■	■	■	■	■

■ = compulsory ▒ = if required

4

*1 Insertion depth L1 in mm

d		(mm)	20	25	32	40	50	63	75	90	110	125	140	160	180	200	225	250	280	315	355	400	450	500
L1	SDR 11	(mm)	34	34	36	40	44	48	55	62	72	79	84	90	97	104	112	112	112	112	122	122	–	–
L1	SDR 17	(mm)	–	–	–	–	–	–	–	–	–	–	–	95	100	105	110	123	135	123	123	123	145	145

*2 Minimum cooling time for sockets and fittings in minutes

d	SDR	Remove bracket	Pressure test p<= 6 bar	p<= 24 bar
(mm)		(min)	(min)	(min)
20– 63	11	6	10	30
75–110	11	10	20	60
125–160	11	15	30	75
180–225	11	20	45	90
250–400	11	30	60	150
450–500	–	–	–	–

SDR	Remove bracket	Pressure test p<= 6 bar	p<= 24 bar
	(min)	(min)	(min)
–	–	–	–
–	–	–	–
17	15	30	75
17	20	45	90
17	30	60	150
17	40	60	150

p = test pressure

Assembly instructions for saddles and tapping valves

Sequence of work

1 Clean pipe in fusion zone, remove oxide film of pipe using scraper, (machine it, adhere to max. permissible wall thickness reduction)

2 Clean pipe in fusion zone with duster and PE cleaner

3 Remove saddle from packaging without touching the fusion surface; hang lower part on its hinge; check if stop cams sit correctly in the recesses of the saddle upper part

4 Place saddle on pipe and tighten with pre-mounted screws (stress clamp for strengthening saddle)

5 Remove modular system component from the packaging and assemble (without touching fusion surfaces)

6 Place saddle on pipe and assemble with top-Load tool (detailed assembly instructions)

7 Align rotatable outlet and firmly fasten integrated clamp of saddle outlet

8 Fusion in accordance with operating instructions of unit

9 After fusion: Check fusion indicator of saddle; check fusion unit display, then remove cable 10 Wait for minimum time until pressure test, then conduct pressure test

11 Remove screw and fusion cap 12 Tap clockwise, withdraw drilling cutter up to the top stop; follow detailed assembly instructions!

13 Fasten screw and fusion cap by hand

14 Fusion in accordance with operating instructions of unit

ELGEF Plus Assembly Instructions for Saddles and Tapping Valves

Sequence of work	Tapping saddle Monoblock d 40–d 63	Tapping saddle with rotatable outlet d 63–d 315	Pressure tapping valve d 63–d 315	Spigot saddle d 63–d 315	Stopoff saddle d 63–d 315	Repair saddle d 63–d 315	Strengthening saddle (24 V) d 40–d 250
							
1 Clean pipe in fusion area, remove oxide film of pipe using scraper (machine it)							
2 Clean pipe in fusion area using duster and PE cleaner							
3 Remove saddle from packaging without touching; hang lower part on its hinge							
4 Place saddle on pipe and tighten with pre-mounted screws (stress clamp for strengthening saddle)		**<= 250**	**<= 250**	**<= 250**	**<= 250**	**<= 250**	
5 Remove modular system component from the packaging and assemble (without touching fusion surface)							
6 Place saddle on pipe and assemble with top-Load tool (detailed assembly instructions)		**>= 250**	**>= 250**	**>= 250**	**>= 250**	**>= 250**	
7 Align rotatable outlet and firmly fasten integrated bracket of saddle outlet							
8 Fusion in accordance with operating instructions of unit							
9 After fusion: Check fusion indicator; check fusion unit display, then remove cable							
10 Wait for minimum time until pressure test, then conduct pressure test *1							
11 Remove screw and fusion cap							
12 Tap clockwise, withdraw cutter up to top stop; (detailed assembly instructions) *1							
13 Fasten screw and fusion cap by hand							
14 Fusion in accordance with operating instructions of unit							

= compulsory **= if required**

***1 Minimum cooling time for saddles in minutes**

d	Pressure test/Tapping p<= 6 bar	p<= 24 bar
(mm)	(min)	(min)
40	10	30
63–315	20	60

p = test pressure

Tapping saddle with rotatable outlet

General, preparatory work
Assembly is done according to our general assembly instructions.
Use 2 screws to fasten saddle bottom part for d 63 to d 160 mm.
The bottom part indicator bar must be in the region of the saddle attachment bar.

Use 4 screws to fasten saddle bottom part for d 180 till d 250 mm. Fasten the screws until the stop on the bottom part.

Mount tapping-T and saddle compactly. Align rotatable outlet and fix integrated bracket with screws.

Recommended tapping tool
- Hexagonal tapping key s = 17 mm, Code-Nr. 799 198 079

or
- Tapping attachment for gas-free tapping under pressure
  Type S54 outlet ⌀ 20, 25, 32, 40 mm, Code No. 799 100 061
  Type S67 outlet ⌀ 50, 63 mm, Code No. 799 100 062

or
- Assembly and tapping key, Code No. 799 198 047

- **Do not use electrical tools for tapping!**

Tapping sequence

Wait minimum cooling time before tapping following the fusion process; turn clockwise using hexagon spanner until the pipe is tapped (note marking of cutter position on the tapping tool), as far as Georg Fischer tapping key.
Withdraw cutter anticlockwise until the top stop. The cutter is completely sealed in this position.

Tapping sequence with tapping tool type S54/S67
(Tapping without gas loss under pressure)

Wait minimum time before tapping.
Fix tapping attachment on the tapping saddle.
In attachment type S54, set the stop for the operating rod in the top nut. Place the operating rod in the cutter, if required twist the rod until the hexagon snaps shut.
With the Philips screwdriver lock the jointing element in the drill operating rod. Apply slight pressure on the Philips screwdriver when twisting, the jointing element is pushed into the cutter through the slot. After twisting further by 90° in clockwise, the jointing element pin is engaged deep in the cutter.
Check: The operating rod must no longer be pulled out by hand. Using a suitable tool, turn the cutter downwards over the operating rod until the stop (plug spring).
Now the pipe is tapped. Turn back the operating rod completely until the cutter stops in the top position.
For reasons of safety, the lock between the tapping attachment and the cutter must be released now.
Unscrew tapping attachment.
Always keep the tapping attachment clean, slightly oil the moving parts.

!Warning!
If the above instructions are not observed when tapping pipelines under pressure the operating rod can be pushed out suddenly.
!Danger of injury!

Pressure tapping valve

General, preparatory work
Assembly is done according to our general assembly instructions.
Use 2 screws to fasten saddle bottom part for d 63 to d 160 mm.
The bottom part indicator bar must be in the region of the saddle attachment bar.

Use 4 screws to fasten saddle bottom part for d 180 to d 250 mm. Fasten the screws until the stop on the bottom part.

Mount valve-T and saddle part compactly. Align rotatable outlet and fix integrated clamp with screws.

Recommended tapping tool
Operating key and operating rod with outer square, width over flats of hexagonal nut SW 14.
Do not use electrical tools for tapping.
Initiate tapping sequence, valve

After the fusion process, wait minimum cooling time before tapping.
With tee key turn clockwise until the bottom stop. The pipe is tapped, the valve is shut.
Torque moment 100 Nm.
Open the valve in anticlockwise until the top stop.

Spigot saddle with drilling cutter

General, preparatory work
Only suitable for tapping pressureless pipelines.
Assembly is done according to our general assembly instructions.
Use 2 screws to fasten saddle bottom part for d 63 to d 160 mm.
The bottom part indicator bar must be in the region of the saddle attachment bar.

Use 4 screws to fasten saddle bottom part for d 180 to d 250 mm. Fasten the screws till the stop on the bottom part.
Assemble spigots with integrated cutter and fix the integrated bracket with screws.

Recommended tapping tool
Hexagonal recess, width over flats of hexagonal nut SW 12,7, outlet ø 32 mm
Hexagonal recess, width over flats of hexagonal nut SW 17, outlet ø 63 mm

Tapping sequence
After the fusion process, wait minimum cooling time before tapping.

With hexagonal recess tap clockwise.
Withdraw cutter and remove anticlockwise.

Stop off saddle for bladder setting units

Stop off saddles with brass adaptors are designed for assembly bladder setting units.

General, preparatory work
Assembly is done according to our general assembly instructions.
Remove protective cap and plugs.
Use 2 screws to fasten saddle bottom part for d 63 to d 160 mm.
The bottom part indicator bar must be in the region of the saddle attachment bar.

Use 4 screws to fasten saddle bottom part for d 180 to d 250 mm. Fasten the screws until the stop on the bottom part.
Assemble stop off adaptors and fix integrated clamp with screws.

Recommended tapping tool
Tap and set bladder with standard setting units. Observe the appropriate assembly instructions of the manufacturer.
While turning the setting unit, check stop off adaptor using a suitable tool.

Tapping sequence
After the fusion process, wait minimum cooling time before tapping.
Tap and set bladder in accordance with the specifications of the manufacturer.

Repair saddle ELGEF Plus

General, preparatory work
Minor damage in PE pipes can be removed using the repair saddle and the tapping tool *(see Chapter Tools)*.
Saddles are assembled according to our general assembly instructions.

Require repair tools
Tapping unit with securing strap (Code 799 150 015)

Attachment prism (Code 799 150 352)

Ratchet (Code 799 150 032)

Cutter (Code 799 198 013 and 012)

PE repair plugs d 30 to d 39 mm (Code 799 199 033 and 089)

Repair sequence
Clean the pipe around the damaged area and fusion surface.

Fasten tapping tool on the pipe.

Drill out damaged part of pipe.
Pipe to d 63 mm, drill ⌀ 30 mm
Pipe from d 75 mm, drill ⌀ 39 mm
Remove tapping tool.

Push the PE repair plugs into the hole using a hammer until the top flange is adjacent to the pipe.

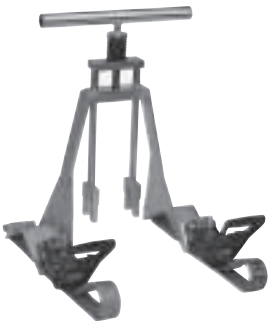
Use a file to machine the PE plugs, so that it is flush with the pipe surface.
Prepare fusion surface and saddle assembly according to our general assembly instructions.

Tapping saddles

Top-Load-assembly d 280 mm – d 315 mm

General, preparatory work
All branch and tapping saddles d 280 to d 315 mm are assembled in the top-Load System.
Fusion surface preparation and saddle assembly (remove oxide film, clean etc.) is done according to the general assembly instructions.
Assembly of saddles in accordance with the detailed instructions *(see below).*
Fusion is done according to the general assembly instructions.
Tapping sequence is done analogous to the general assembly instructions.

Required assembly tool
Top-Load tool (Code 799 350 368)

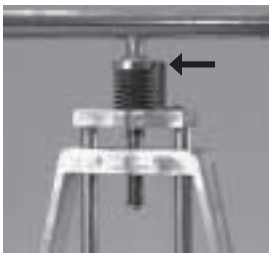


Assembly sequence Top-Load
Preparations for the saddle assembly (remove oxide film, clean etc.) is done according to the general assembly instructions.

Assembly Top-Load tool with securing straps.

Mount the saddle.

Press the saddle until it is in line with the pipe outer diameter.



Indicator bar should be flush with the top part of the spring plate.

Fusion according to the general assembly instructions.
After successful fusion, wait cooling time and finally remove the Top-Load tool.
Pressure test and tapping according to the general assembly instructions.

Strengthening saddle 24 Volt

General, preparatory work
Small damages or weak points in the PE pipes can be repaired using the strengthening saddle and the tapping tool *(see Chapter Tools)* and strengthened later.
Preparation for saddle assembly (remove oxide film, clean) is done according to the general assembly instructions.
The strengthening saddle can be fused only by fusion units that can produce 24 Volt fusion voltage (MSA 300, MSA 350, MSA 400).

Required assembly tool
Tension clamp (Code 799 150 090)

Required repair tool
Tapping unit with securing strap (Code 799 150 015)

Attachment prism (Code 799 150 352)

Ratchet (Code 799 150 032)

Cutter (Code 799 198 013 and 012)

PE repair plugs d 30 to d 39 mm (Code 799 199 033 and 089)

Repair sequence
Clean the pipe around the damaged area and the fusion surface.

Fasten tapping tool on the pipe.

Drill out damaged part of pipe.
Pipe to d 63 mm, drill ⌀ 30 mm
Pipe from d 75 mm, drill ⌀ 39 mm
Remove tapping tool.

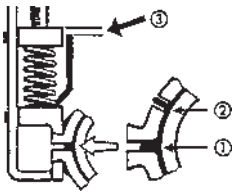
Push the PE repair plugs into the hole using a hammer until the top flange is adjacent to the pipe.

Use a file to machine the PE plugs, so that it is flush with the pipe surface.

Saddle assembly
Fusion surface preparation and saddle assembly is done according to the general assembly instructions.
Fasten saddle on the pipe using the tension clamp, check that the fusion mat is properly centered.

Clamp screws should be tightened until the red indicator plate is flush with the top edge of the tension clamp pressure bar.

Fusion sequence in accordance with the general assembly instructions.



The completed fusion is discernible on the joint area between top and bottom halves and on the fusion indicator by fused PE. In addition, the top edge of the red display plate is no longer flushed with the top edge of the pressure bar.

Tools and assembly accessories

Peeling tools for fusion preparation

General

The fusion surface should be prepared with extreme care. Insufficiently machined or dirty surfaces can affect the fusion joint. Georg Fischer offers various tools for reliable preparation. While designing the tools, special attention was paid to enable a maintenance-free, tough and safe function. Still, it is absolutely necessary that the user is careful and capable while working with the tools.
We recommend attending the training courses offered by Georg Fischer.

Requirements

Following scraping dimensions should be maintained:

d Pipe	Min. chip thickness	Max. chip thickness*
20–25 mm	0.20 mm	0.20 mm*
32–63 mm	0.20 mm	0.25 mm*
75–225 mm	0.20 mm	0.30 mm*
> 225 mm	0.20 mm	0.35 mm*

Tip: maximum permissible pipe ovalness 1.5%

* The data refers to the pipe outer diameter without "+ tolerance"
This results in: If the average pipe outer diameter is at the upper tolerance limit, the pipe can be cutoff until the permissible outer diameter by peeling. In this case, the chip thickness can be greater than 0.3 mm.

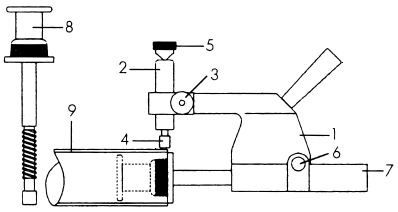
Preservation and Care

It is recommended to handle tools carefully and to put them back in a suitable case after use. Lightly oil the guides and threaded spindles every month. Regularly check the scraping depth (see table above) and the scraping quality, they are an essential factor for a good fusion quality.

Operating Instructions

Peeler PT 1E

The required applications are set in the basic unit for each pipe dimension and pipe wall thickness. Clean pipes well before and cut to length at right angles.

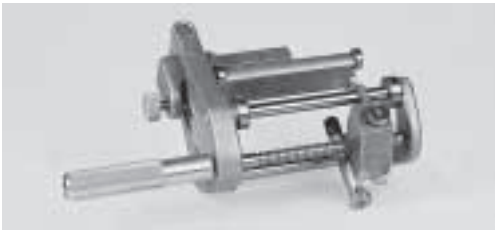


1. Hand pistol tool
2. Cutter connecting pin
3. Thumb screw
4. Cutter head
5. Pressure thumb screw
6. Quick release head for the thrust nut
7. Cavity
8. Pipe insertion adaptor
9. Pipe

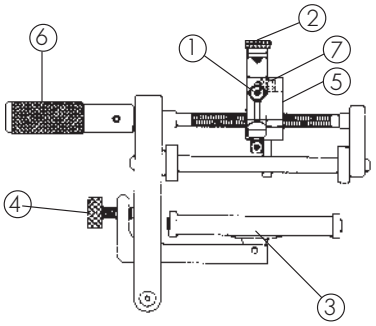
- Select the correct pipe spindle and insert it inside the pipe.
- Release the cutter connecting pin (2), where you loosen the thumb screw sufficiently, so that it is possible to move up and down. Take back the cutter connecting pin to its top position and tighten the entire thing with the thumb screw.
- Maintain pressure on the cutter head by turning the thumb screw (5), until the V marking in the base is loosened and is located at an angle of 90° to the V marking above on the cutter connecting pin.
- While you hold the quick release head for the thrust nut (6), according to the diagram, position the hand pistol tool on the threaded shaft of the spindle at the start of the pipe (9). Now, you can loosen the quick release head again.
- Position the cutter head (4) about 1mm before the pipe outer wall, where you loosen the thumb screw (3), lower the cutter connecting pin and again fasten.
- Apply pressure on the cutter head by fastening the pressure thumb screw by one quarter turn until the V marking is located in the slot.
- Rotate the hand pistol tool around the pipe until the cutter head has obtained the required length of the peeled pipe. This completes the preparation.
- The tool is removed by maintaining the spring pressure by turning the pressure thumb screw by one quarter turn. Then the quick release head is actuated and the hand pistol tool is released. Do not touch the prepared surface while taking it out of the pipe insertion adaptor.

Changing the tool blade PT 1E
Use 3-mm-Inbus-spanner and keep clean.

Peeler PT 2



Preparation of PE pipe
Clean roughly and cut to length at right angles.



1 Clamp screw
2 Prestress screw
3 Arm brackets
4 Clamp screw
5 Knife holder
6 Handle
7 Tension screw

– Take knife to top position (loosen clamp screw 1, this withdraws the tool holder). Again fasten clamp screw 1. Remove protective cap on tool.
– Turn spring loaded screw 2 in such a way that pre-tension is produced (the wedge is on the plane surface).
– Open arm bracket 3 (screw 4), slide tool on the pipe end and take the arm bracket to the top position; fasten with screw 4. Tool can move in the pipe periphery.
– Open tension screw 7 until the knife holder 5 can be moved up to the marked peeling length.
– Loosen clamp screw 1 and move tool blade to the pipe surface. Fasten clamp screw again.
– Turn spring loaded screw 2 in such a way that pre-tension is produced (the wedge moves into the prism).
– Hold tool on the handle 6 and turn clockwise evenly until the pipe surface to be scraped is machined.

Disassembly of tool
– Turn spring loaded screw 2 in such a way that pre-tension is produced (the wedge moves is on the plane surface).
– Loosen clamp screw 1 and withdraw tool blade. Fasten clamp screw again.
– Attach protective cap on the tool blade, keep tool clean.

Changing the tool blade PT 2
Use 3-mm-Inbus-spanner and keep clean.

Peeler PT 3

The units consists of a top and bottom part, joined by a threaded spindle and two column sleeves.
The blade depth is defined by two lateral guide pads on the cutter. The knife is evenly pressed on the pipe due to the spring deflection of the blade holder.

Preparation of PE pipe
Clean pipe.

Round the pipe end
- By rotating the spindle open the top and bottom part until the unit can be mounted on the pipe end.
- When mounting, position the blade on the pipe end.
- Fasten the spindle by hand.
- The rollers hold the tool on the pipe and give the thrust.

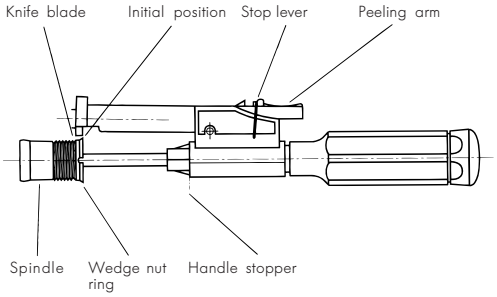
Round the pipe periphery for saddle fusion
- Tighten the unit as described above on the pipe until the knife is on the marked starting position.
- Now the unit is moved on the pipe until the marked surface is shaved off without gaps.
- The thrust is provided by the position of the guide rollers and must not be altered.

Disassembly of peeler
The peeler can be dismantled from the pipe by loosening the spindle.

Changing the tool blade PT 3
Use 3-mm-Inbus-spanner and keep clean.

Peeler PT 4

Preparation of PE Pipe
Clean pipe and cut to length at right angles.



- Bring spindle to initial position, i.e. knife disc and wedge nut ring behind the spindle should be at same height.
- Release stop lever. Then depress spring loaded peeling arm with cams and push the spindle firmly into the pipe cut vertical before until the pipe sits on the wedge nut ring behind spindle. Now loosen spring loaded peeling arm.
- Rotate the handle clockwise and the surface is shaved. Rotate until the desired peeled length is obtained, i.e. until the stopper on the handle.
- Depress peeling arm and pull out spindle from the pipe.
  Remove shavings without touching the peeled surface.

Changing the tool blade PT 4
Use size 6 Phillips screwdriver and keep clean.

PVC assembly and operating instructions

General
Avoid contact of PVC parts with solvents, especially with chlorinated hydrocarbons or adhesives (chemical resistance of PVC in accordance with DIN 16929), exception: special Tangit PVC cleaner and solvent cement. The same is true for lubricants and oils, which we have not released for these applications.

Operating pressure and temperature
STEMU fittings in PVC
Maximum operating temperature 60 °C, depending on the internal pressure.

Plastic gate valve, branch and tapping and saddles in PVC.
Maximum operating temperature 45 °C, depending on the internal pressure.

Dimension	Pipe class	Operating pressure	Temperature
d 63–d 160	ISO S8 SDR 17	10 bar (12.5 for gate valve)	20 °C
d 200, d 225	ISO S10 SDR 21	10 bar	20 °C

Vacuum application: STEMU fittings can be used 800 mbar below atmospheric pressure.

KS gate valve system

Application options
The KS (plastic) gate valve system in PVC is especially designed for buried application in water distribution. Moreover, these KS valves can also be used for installing drinking water containers. With the option of using PVC valve ends (smooth) and connecting flange adaptors in PE, these valves can be installed with all popular KS systems. On request, the KS gate valve system can also be used for other media.

Operating temperatures:

STEMU fittings, plastic gate valve, branch and tapping saddles in PVC
Maximum operating temperature 45 °C, depending on the internal pressure.

Installation
Please observe the KRV installation guidelines for PVC pipelines and valves. It is recommended to replace the gate valve marking where "S" stands for gate valve by "KS". This helps to identify the location of the KS valves.

Pressure test
Prior to commissioning, the pipe should be subjected to a pressure test in accordance with DIN 4279 Part 7. Remove air carefully from the line before the pressure test. Pressure increase should be maximum 2 bar/min.

Operating tips
The KS valve should be opened and closed using a standard Tee key or KS handwheel. Extension of the Tee key is not recommended. Ensure valve is opened in a smooth and continuous movement without jerks.

Maximum operating torques in accordance with KIWA BRL K603/02) are:

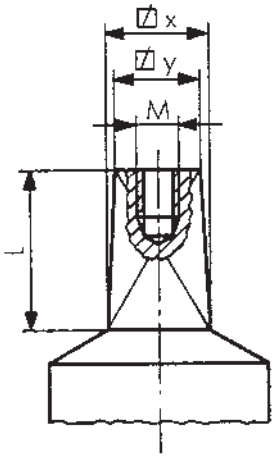
< d63 mm max. 128 Nm
> d63 mm max. 168 Nm

It is advisable to open and close the KS gate valve at least once a year.

Disinfection of pipelines
After completion of disinfection, disinfection fluid must be flushed by opening and closing the gate valve several times.

Dimensions
A detailed list of KS gate valve system dimensions is given in the special price list.

Dimensions of the connecting piece for accepting the extension spindle (coupling socket with actuating rod) are as follows:



Dim. (d1)	y	x	L	M
63–75	14.0	17.0	29.0	M6 x 12
90	17.3	20.7	34.0	M8 x 12
110	19.3	22.0	38.0	M8 x 12
160	19.3	22.0	38.0	M8 x 12

When opening the gate valve, we recommend to turn back the gate valve by a half turn after reaching the upper stop.

Materials

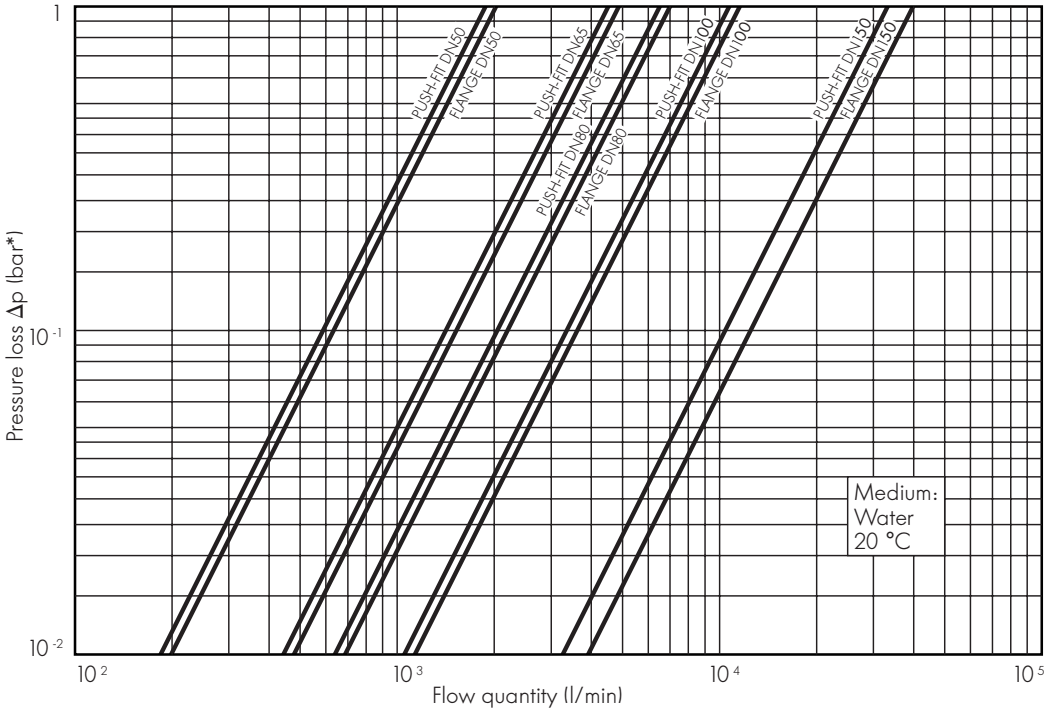
KS gate valve system and shell coupling

Lip seal	SBR (Styrol-Butadene-rubber
Gate valve seal	NBR (Nitrile rubber) according to ISO 6447
Shell coupling seal	EPDM (Ethylene-Propylene-Rubber
Collar lip seal	NBR (Nitrile rubber according to ISO 6447
Connecting piece	X6CrNiMoTi 17/12/2 rustproof
Spindle	X6CrNiMoTi 17/12/2 rustproof
Cylindrical pin	X6CrNiMoTi 17/12/2 rustproof
Nut	Red brass

Extension spindles

Coupling socket and square protector	GTW 40
Rigid rods	Litaminiate steel
Telescope rods	Hot galvanized steel
Jacket pipe and bell	PE

Pressure loss diagram of gate valve

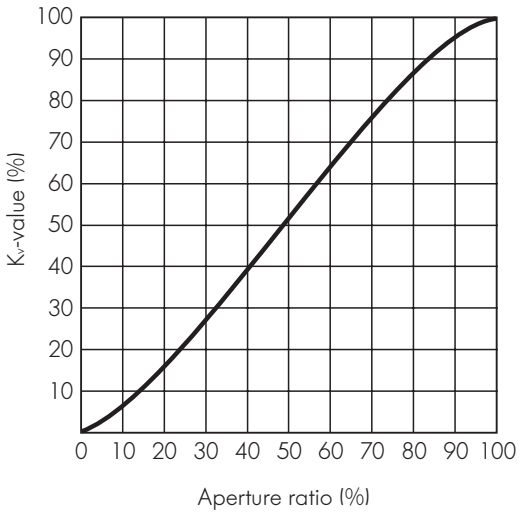


Pressure loss values of gate valve

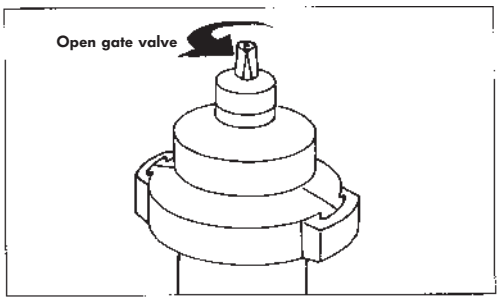
d	Type	DN mm	Kv 100 value[1] l/min	Kv m^3/h	Cv BS-Gall./min	Cv US-Gall./min	Zetta value
63	Gate valve	50	2000	120	117	146	0.69
	Push-fit gate valve	50	1900	114	111	139	0.77
75	Gate valve	65	4842	291	283	353	0.34
	Plug-in valve	65	4600	276	269	336	0.37
90	Gate valve	80	6970	418	408	509	0.37
	Plug-in valve	80	6630	398	388	484	0.41
110	Gate valve	100	11230	674	657	820	0.35
	Plug-in valve	100	10800	648	632	788	0.38
160	Gate valve	150	40090	2405	2345	2927	0.14
	Plug-in valve	150	32733	1964	1915	2390	0.21

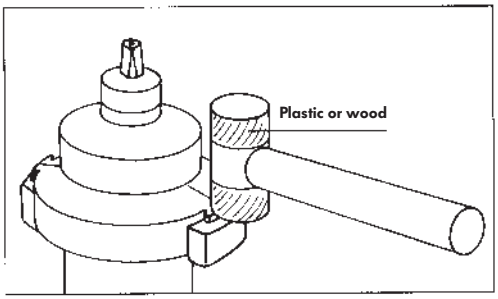
5

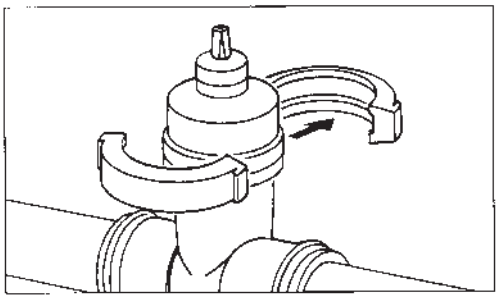
Pressure loss characteristics of gate valve

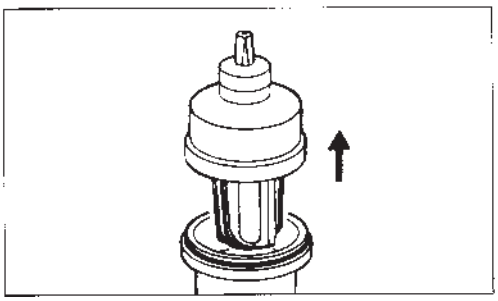


Dismantling

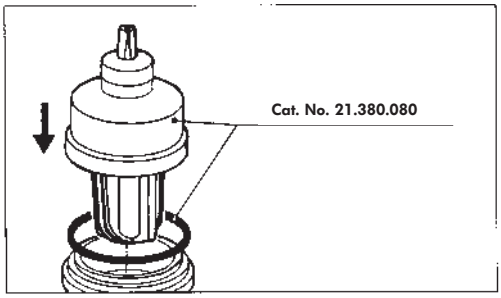


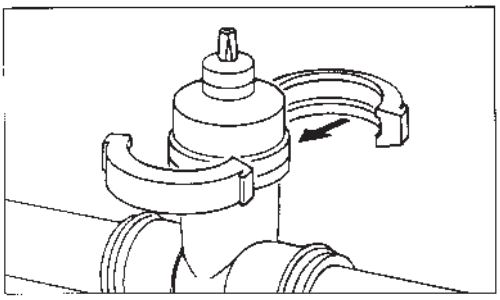


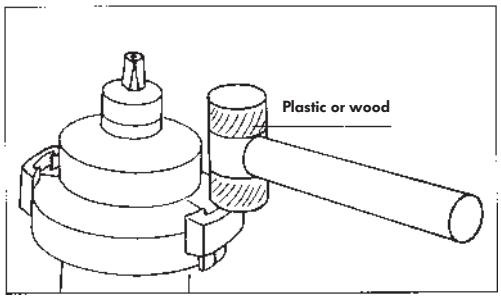




Assembly



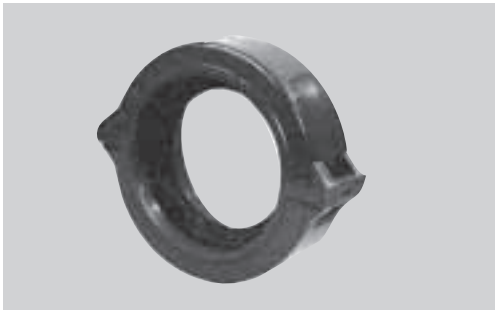




STEMU Fittings

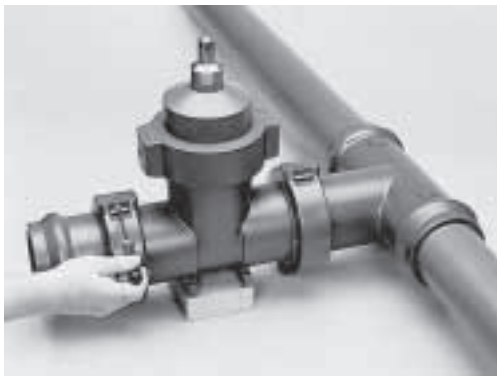
Shell coupling

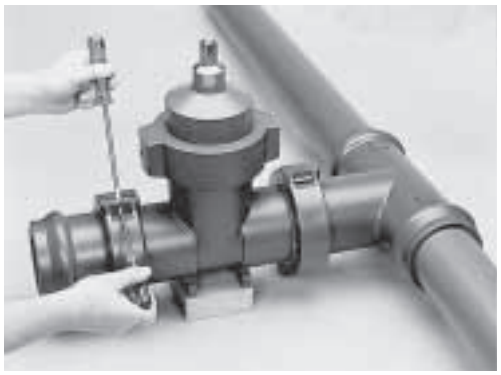
Assembly

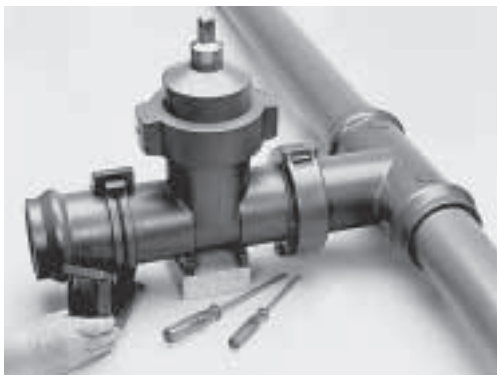


Tip: The gap between the shell coupling halves should be positioned horizontally after assembly to avoid pressing of the latches when back-filling the trench.

Disassembly







PVC Loose Flange

General

Flange connections with PVC loose flanges or PVC shell couplings are tension-proof/ longitudinal force-joint connections.

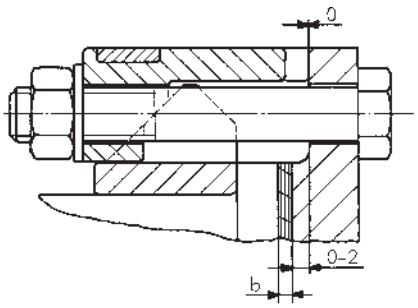
Assembly

Installation

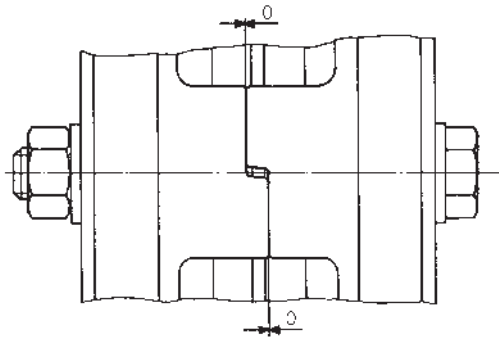
Flange assemblies with PVC loose flanges or PVC shell couplings are tension-proof/ longitudinal force-joined connections.

Installation

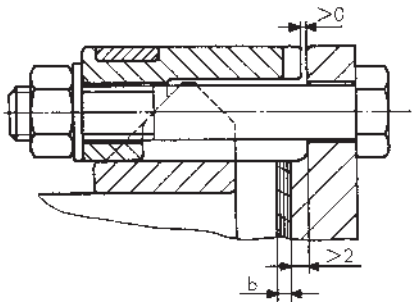
1. Insert the PVC loose flange with a metallic backing flange:
With a gasket thickness of 0-2 mm: normal, firm tightening of the bolts until the stop lugs at least contact the backing flange (1).



With a gasket thickness of more than 2 mm: normal, firm tightening of the bolts, but not necessarily until the stop lugs contact the backing flange (2).



2. Insert two PVC loose flanges with one another:
When using two PVC loose flanges with one another, the maximum tightening torque is achieved if both stop lugs contact against each another (3) at a maximum seal height s (values from the following table).



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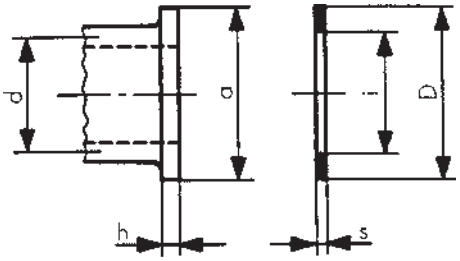
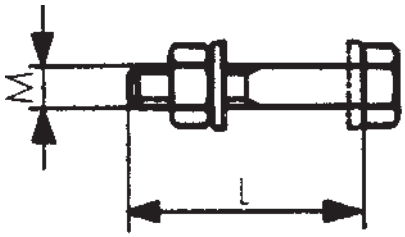
Data for flange dimensions, bolts and gaskets





Place gaskets on loose flange side.

Nominal value		Flange		Fabric-reinforced gasket commercially available to the following specifications				Bolts commercially available to the following specifications		
d	DN	a	h	i mm	D mm	S	Material	M	L mm	Material
63	50	90	9	63	88	3	Natural or	M16	90	Optional,
75	65	106	10	75	104	3	synthetic	M16	100	in accordance
90	80	125	11	90	123	3	rubber in accordance	M16	100	with corrosion
110	100	130	12	110	148	4	with toxicological	M16	100	resistance
160	150	213	16	160	211	4	specifications Hardness approx. 65 Shore A	M20	120	required

Tip
For the conventional pipes adaptor, such as cast iron on PVC, E-KS and F-KS fittings with loose flanges or the Georg Fischer WAGA Multi-Joint adaptor fittings are recommended.

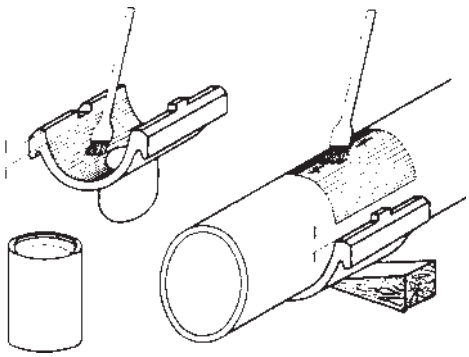
PVC branch and tapping saddles

Mounting the saddle on the pipe

a) Top saddle with rubber seal
Cat. No.: 21 111, 21 114 400, 21 111 500
The contact surfaces of the PVC pipe, the saddle halves, the seal groove and the wedges must be clean and dry. There must be no grooving or scratches within the sealing area of the pipe. Insert the lip seal and place the saddle halves on the PVC pipe without moving it. Locate the wedges and alternately hammer them flush.

b) Top saddles solvent cemented (21 110)
Cat. No.: 21 110, 21 147 800
The contact surfaces of the PVC pipe, the saddle halves and the wedges must be clean and dry. Determine the position of the top saddle. Clean the surfaces of the top part and PVC pipe to be joined using PVC Tangit cleaner. Fix the lower part without cement to the pipe considering cams and recesses. Apply Tangit cement in sufficient quantity with a 50 x 5 mm brush lengthwise to the pipe and top saddle. Place top saddle immediately on the PVC pipe in the right position. Check that there is no solvent cement on the cams and recesses of the top saddle. Slide over wedges and alternately hammer them flush. Remove excessive solvent cement with absorbent paper.

Tip: The drying time for the solvent cement and other details concerning cementing PVC are given in the chapter "Manufacture of solvent cement joints with PVC fittings".

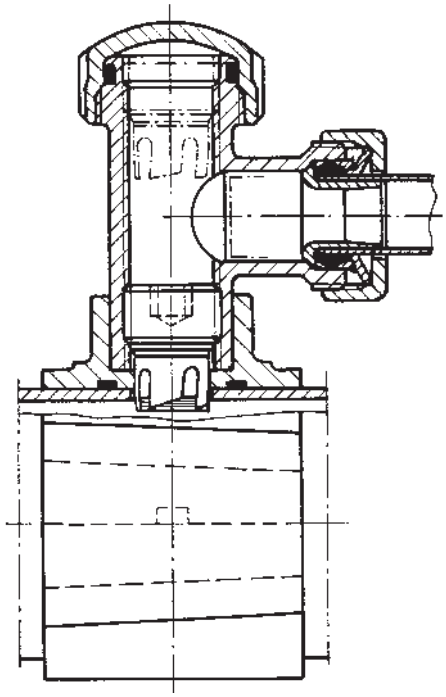


c) Top saddle with metallic inside thread, rubber sealed
Cat. No.: 21 111 550
This PVC top saddle is suitable for installing a metallic outside thread, for example, metallic angle valve/ gate valve or as thermometer/ manometer connection.
It is assembled as described above under 1. a).

Assembly for domestic lines

General
Metal pipes and metal valves must not be connected directly to Georg Fischer PVC branch and tapping saddles. Exceptions: Cat. No.: 21 111 550.

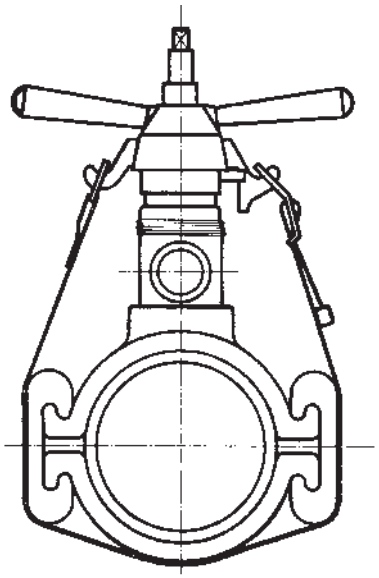
PVC branch saddle with threaded outlet for PVP system fittings:
Please refer chapter "PVP pipelines" for preparing the delivery connection (domestic line) and for other information.
Tip: Install the distribution line, branch saddle and domestic line in accordance with the KRV-PVC installation guidelines.



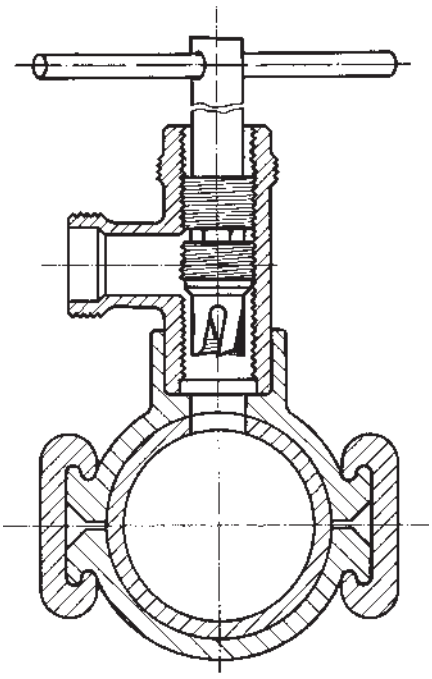
Pressure test
Before tapping, check that the tapping saddle and the connecting pipe are leak-proof. A pressure test should be conducted in accordance with DIN 4279 for domestic lines. Pressure is best applied from the end of the branch pipe.

Tapping

Tapping saddle
Use tapping tool Cat. No. 9 150 351 for tapping. The tapping tool is suitable only for pressureless lines.

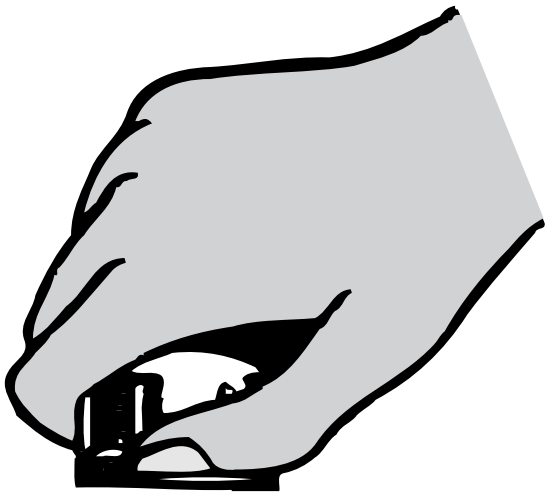


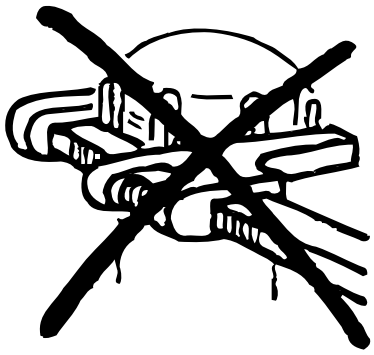
Tapping saddle with integral cutter
- Tapping lines under pressure with hexagon key.
  Take Cat. No. 9 150 012.
- Screw down integral cutter with hexagon key.
- Tap pipe.
- Unscrew cutter until it is level with the top edge of the tapping saddle. **The hexagon key prevents the pipeline medium from overflowing as the outlet is passed.**
- If necessary, an emergency shut-off can be made with the cutter at its lowest point.
- The cutter is intended to be used once only. It must not be removed. The disc cut out of the pipe and the shavings are retained securely in the cutter.



Sealing the branch saddle
Coat the rubber ring on the tapping tee with water, soap or vaseline (**do not use** grease, oil, thread sealing paste, etc.).

Tighten screw cap **by hand** as far as the stop. Do not use tools that can cause notches.





Materials

PVC branch and tapping saddles

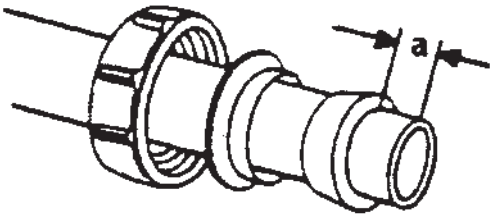
Threaded element	Red brass
Cutter	Brass
Seal	Rubber

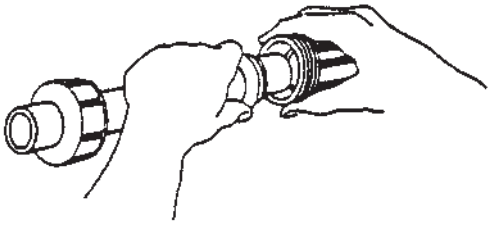
PVP Pipe connections

1. Detach pipe in perpendicular direction. Chamfer inside wall edge to about half wall thickness (a).

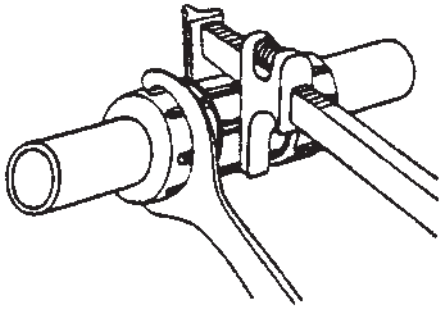
Remove solvent cement strips and slide connection parts over the pipe end. Distance "a" seal ring to pipe end:
up tol pipe diameter ≤32 mm:
a = 10 mm
above pipe diameter 32 mm
a = 15 mm

Slide tightening disc on seal ring. Apply lubricant on the seal ring edge, socket insertion and thread of the fitting for PVC pipes to enable them to slide smoothly. Do not use grease, oil, thread paste or similar material under any circumstances!



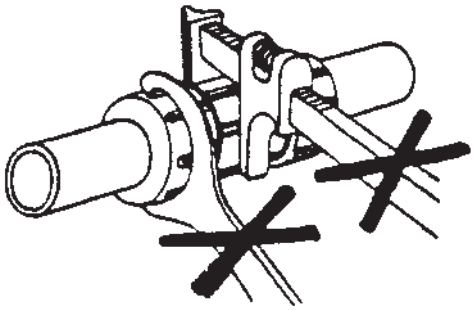


2. Hold the pipe just behind the tightening disc and insert the fitting.
If the pipe and fitting sit well, apply lubricant meant for PVC pipes on the pipe below the seal ring. Drive in the seal ring by using a piece of wood and hammer it lightly.
Tighten the clamping nut **by hand.**



3. No more than 2 thread pitches of the fitting body should be visible on the mounted connection. Otherwise, use a spanner to tighten it further.
For 1"–2" (32–36 mm) Georg Fischer offers special spanners. **Do not use any sharp-edged tools.**

Connection with O-Ring-Seal
1. Remove solvent cement strips and slide nut over the pipe end.
2. Moisten O-Ring, put together the connection and tighten **by hand**.
Do not use spanner.



Preparing PVC-U solvent cement joints

General

Solvent cement jointing calls for adequate technical knowledge that can be acquired from appropriate training courses. We will gladly provide information about our training sessions.

The dimensions of Georg Fischer fittings and pipes generally correspond to the most diverse national standards as well as to the ISO 727. These fittings can be connected with all PVC-U pipes whose outer diameter tolerances conform to ISO 11922-1.

Tools and acccessories

Cutting the pipe to length

Pipe chamfering tool (recommended) or coarse file.

Chamfering the pipe

Code Numbers:

PVC-U cleaner
799 298 010 (1 litre tin)

PVC-U solvent cement
799 298 001 (0.25 kg can)
799 298 002 (0.50 kg can)
799 298 003 (1.00 kg can)

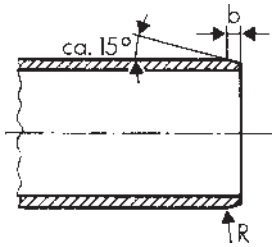
Scraper, brushes, white absorbent paper roll.

Additional material for solvent cementing

Brush sizes

Pipe outer ø mm	Brush	Code Numbers
6–10	Round brush ø 4 mm	799 299 001
12–32	Round brush ø 8 mm	799 299 002
40–63	Flat brush 25 x 3 mm	799 299 003
75 <=	Flat brush 50 x 5 mm	799 299 004

Preparations
Pipe must be cut off at right angles. Deburr the inside edges and chamfer the outside as illustrated in the sketch.



Pipe outer diameter mm	**b**
6–16 mm	1–2 mm
20–50 mm	2–4 mm
63 mm <=	4–6 mm

Important: Well-chamfered and rounded pipe ends prevent the layer of solvent cement from being removed as the pipe is inserted into the fitting.

Note: If necessary, mark the desired position of the fitting on both the pipe and fitting before cementing. Marking the jointing length on the pipe end makes it possible to check whether the pipe has been inserted to the full extent of the socket.

If the pipe outer diameter and the socket inner diameter are at opposite extremes of their tolerance, then the pipe cannot be inserted dry into the socket. This will only become possible once the cement has been applied.

Solvent cement is supplied ready for use. Shake well before use!
Solvent cement of the correct consistency will run down evenly from a wooden spatula held at a slant. Solvent cement which no longer runs smoothly is unusable. The cement must not be thinned. Cement and cleaner should be stored in a clean and dry place!

Checking the consistency of solvent cement

Cementing

Wipe the pipe end and the socket with a clean cloth.

Clean the outside of the pipe end and the inside of the socket **thoroughly** with PVC-U cleaner and absorbent paper. Use a fresh piece of paper each time. Cleaned areas must be dry before the cement is applied. Remove any condensation which may have formed on the parts.


Cleaning the pipe and socket

Note: Pipe end and fitting socket must be dry and free from grease and dirt.

The cleaner should dissolve the pipe surface. Check if the PVC-U is actually dissolved. If not, then roughen the surface using abrasive cloth k 80 and clean again.

Special protective measures must be taken at temperatures below + 5 °C.

At temperatures near freezing point pipe ends and fittings should be warmed to bring them to hand temperature. Next, remove any condensation or ice. Solvent cement and cleaner should be stored at room temperature prior to cementing. Completed joints must be held at 20-30 °C for approx. 10 minutes.

Avoid overheating when cementing at summer temperatures by protecting the jointing area from direct sunlight. If necessary, cool the pipe end with water before cementing.

As the solvent cement sets quickly, the parts should be slid together within one minute starting from the application of solvent cement. The time until when the PVC-U solvent cement is kept open depends on the ambient temperature and/or the thickness of the film of solvent cement.

Begin by applying a normal layer of cement to the fitting socket and then a thicker one to the pipe end with firm brush pressure. **Work in well.** The brush strokes should always be in an axial direction.

To ensure that both jointing surfaces are completely covered with a smooth, even layer of cement, the brush should be generously coated with solvent cement.

Clean the brush with dry absorbent paper after use. Brushes must be dry before being re-used.

Replace the lid of the solvent cement tin after use to prevent the solvent from evaporating. The special conical lid available from Henkel makes it possible to leave the brush in the cement tin during pauses.

Close the tin of solvent cement during work intervals

The joints can be made single handed for pipes with diameters up to 90 mm. For 110 mm and larger pipes, two people are need to apply the solvent cement on the fitting socket and pipe end simultaneously in order to avoid exceeding the maximum handling time.

Solvent cement coat at d =< 90 mm

Solvent cement coat at d ≥110 mm

Push the pipe and the fitting together immediately without twisting and bring them to correct alignment. Hold them in this position for a short while, until initial bonding has taken place.

Note: Insert the pipe to the full depth of the socket and ensure that the outlet of the fitting is in the correct position.

Remove any surplus cement immediately using absorbent paper.

Note: Both solvent cement and cleaner dissolve PVC-U. Pipes and fittings must not therefore be laid on or allowed to come into contact with spilled solvent cement or paper containing cement residues.

The pipe pit should not be used as a garbage dump

Drying time and pressure test

The drying time before the joint may be subjected to testing or operating pressures depends on the ambient temperature and the tolerances.

As a general rule, allow at least:
1 hour waiting time per bar operating pressure

Nominal pressure	Test pressure*	Waiting time
PN 10	15 bar	15 h
PN 16	21 bar	24 h

* 1.5 x PN, max. (PN + 5) bar

Safety precautions
Tangit solvent cement and cleaner contain highly volatile solvents. This makes good ventilation or adequate fume extraction essential in closed spaces. Since the solvent fumes are heavier than air, extraction must occur at floor level, or at least below the working level. Dispose of paper which has been used for cleaning or for the removal of surplus cement in closed containers to minimise the amount of solvent fumes in the air.

Adequate ventilation of the workplace

Solvent cement and cleaner are inflammable. Extinguish open fires before commencing work. Switch off unprotected electrical apparatus, electric heaters, etc. Smoking is prohibited! Furthermore, observe all instructions issued by the solvent cement manufacturers (for example, on the tin label and in any supplementary documentation).

No naked flames when cementing
No smoking

Protect pipes and fittings from spilled solvent cement, cleaner and absorbent paper which has been used to wipe off solvent cement. Do not dispose of surplus solvent cement or cleaner in drainage systems.

Use hand gloves for protection to avoid the skin from coming into contact with the solvent cement and cleaner. Rub protective cream on the hands before commencing work. Use a skin protective cream after cleaning and after completion of work.

Wash eyes with water thoroughly if the solvent cement comes in contact with the eye. Visit the doctor! Immediately change clothes soiled with solvent cement.

Do not close the cement pipelines during the drying process. This is particularly important at temperatures below + 5 °C, where there is a danger of damaging the material.

Because of the danger of explosion, do not perform any welding near pipes which have been cemented but are not yet filled. Danger of explosion!

Always obey the safety regulations issued by the authorities responsible.

Application limits
For the chemical resistance of solvent cement joints and other technical tips, please refer the appropriate specifications of the solvent cement manufacturer.

POLYRAC-/POLYFAST compression fittings for PE pipes

General

Programme description

In all areas of water usage, increasing water scarcity sets high requirements for water distribution. Stress on all system components due to temperature, corrosion, UV radiation, mechanical and hydraulic loads in conjunction with long service life must be taken into consideration.

POLYRAC-/POLYFAST compression fittings used in PE piping systems ideally fulfil all the requirements, i.e. reduced installation costs through trouble-free quick assembly and their suitability for re-use are some outstanding features.

POLYRAC-/POLYFAST compression fittings are supplied in different pipe diameters ranging from 16 to 110 mm and are suitable as connection components for PE pipes with varying wall thicknesses.

POLYRAC-/POLYFAST fittings are manufactured from specially selected thermoplastic materials and are subject to stringent quality inspection during production and in the laboratory.

POLYRAC-/POLYFAST compression fittings were especially designed for extreme ambient conditions and a temperature range from –20 °C to +60 °C.

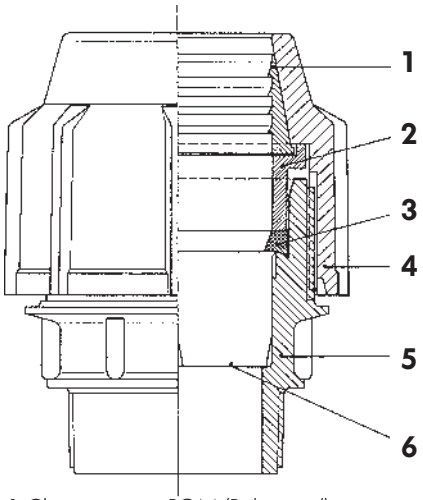
POLYRAC-/POLYFAST compression fittings are simple to use and ensure fast and safe connections of PE pipes.

POLYRAC is approved for up to 0.8 bar negative pressure.

Permissible operating pressure

Dimension	Operating pressure	Temperature
d 16–d 63	16 bar	–20 °C to +20 °C
d 75–d 110	10 bar	–20 °C to +20 °C
d 16–d 63	9 bar	+40 °C
d 75–d 110	6 bar	+40 °C
d 16–d 63	4 bar	+60 °C
d 75–d 110	2 bar	+60 °C

Fitting structure (Materials)



1 Clamping ring POM (Polyacetal)
2 Thrust ring PP Copolymer
3 Lip seal NBR
4 Nut PP Copolymer
5 Body PP Copolymer
6 Pipe stop

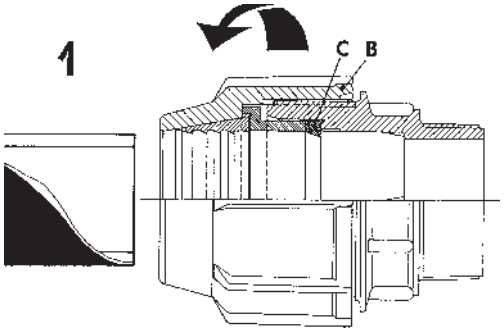
Chemical properties
POLYRAC-/POLYFAST compression fittings are corrosion resistant. With regard to the chemical resistance against individual media, please refer to our list of chemical resistances. The taste and smell of drinking water and foodstuffs are not affected.

Features of POLYRAC-/POLYFAST compression fittings
– Wide range of application
– Extensive product range
– For PE pipes in accordance with DIN 8072 and DIN 8074 in the diameter range d 16 to d 110 mm
– Fast and easy assembly
– Suitable for immediate service
– Patented double lip seal
– Reusability
– No pipe liners required
– No influence on potable water
– Proven design
– No corrosion problems
– UV resistant

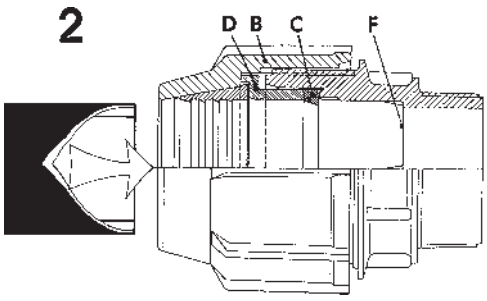
Typical applications
– Domestic services for potable water
– Distribution lines up to d 110 mm
– Temporary water lines for building sites
– Emergency water systems in calamity and crisis areas
– Sprinkler systems
– Drip irrigation
– Heating systems for greenhouses
– Earth collectors for solar heating
– Golf links and sports fields
– Laying cables (for example, telecommunication) as connection elements for protective pipes in PE

Assembly and operating instructions

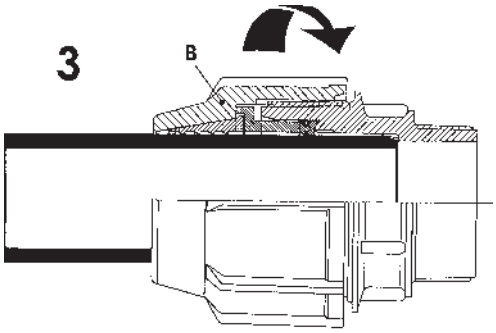
Assembly



1. Cut the pipe square and ensure that the pipe ends are clean. Lubricate pipe.



2. Unscrew the nuts.
   Then insert the pipe in the compression joint as follows to make sure it goes all the way past the seal.
   – Push the pipe through the thrust ring up to the first stop.
   The seal ring is now reached.
   – Now, slide the pipe further up to the stop through the seal ring.
   – Alternately, it is also possible to mark the entire insertion length on the pipe where by the marking should end with the upper edge of the nut as soon as the pipe has been inserted correctly.



3. Now tighten the nut firmly.
   Tighten by hand up to d 32 mm
   From d 40 mm use key (Code No. 799 198 081)

PP branch saddles for PE and PVC pipes
Branch saddles can be used for PE and PVC pipes from d 20 mm to d 315 mm.

Operating pressure

d x Rp	½″	¾″	1″	1¼″	1½″	2″	3″	4″
d 20	10 bar							
d 25	10 bar							
d 32	10 bar	10 bar	10 bar					
d 40	10 bar	10 bar	10 bar					
d 50	10 bar	10 bar	10 bar	10 bar				
d 63	10 bar	10 bar	10 bar	10 bar	10 bar			
d 75	10 bar	10 bar	10 bar	10 bar	10 bar	10 bar		
d 90	10 bar	10 bar	10 bar	10 bar	10 bar	10 bar		
d 110	10 bar	10 bar	10 bar	10 bar	10 bar	10 bar	6 bar	6 bar
d 125	10 bar	10 bar	10 bar	10 bar	10 bar	10 bar	6 bar	6 bar
d 140	6 bar	6 bar	6 bar	6 bar	6 bar	6 bar	6 bar	6 bar
d 160	6 bar	6 bar	6 bar	6 bar	6 bar	6 bar	6 bar	6 bar
d 200					5 bar	5 bar	5 bar	5 bar
d 225					5 bar	5 bar	5 bar	5 bar
d 250						5 bar	5 bar	5 bar
d 280						10 bar	5 bar	5 bar
d 315						10 bar	5 bar	5 bar

Branch saddle features
– Wide range of application
– Wide range of products
– Fast and easy assembly
– Suitable for immediate service
– Reusability
– UV resistant

Typical applications
– Sprinkler systems
– Drip irrigation
– Golf links and sports fields
– Supply lines

Miscellaneous

Setting and realizing goals
Our goal is to offer you comprehensive and competent advice and service.
Always and in everything. All around the world. With our extensive range of products, we bring you complete system solutions for every area. And a technology that matches the highest demands.
On the Internet you can find the Georg Fischer Distribution Systems under:
http://www.piping.georgfischer.com

Organization
The Georg Fischer Piping Systems Management Group is fully dedicated to the development, acquistion, production and international marketing of its piping systems. It has a strength of about 2700 staff around the world.

Georg Fischer components and systems are used in the industry for gas and water supply as well as for domestic use. They are used for controlling, measuring and regulating liquids and gases. The wide range of products consists of pipes, fittings, manual and automatic valves, measurement, control and regulation engineering products as well as tools and machines for the pipe jointing technology.

Services

Training and consultancy
Our elaborate training services offer you extensive training and advise in all areas of piping systems. Either at our Training Center in Schaffhausen. Or by our sales companies and distribution partners all over the world.
Please ask for our complete Training Program.

At the product training center at our Head Office in Schaffhausen we lay the foundation for further training sessions in the regions. Our staff from the regional sales offices worldwide are trained in Switzerland by our experts from the R&D, Product Management and Marketing departments. Then each of these trained representatives in turn pass on their knowledge to the colleagues and customers in their countries.

Today, the training sessions for our staff go much beyond just conveying the technical characteristics of the products. They also include understanding the areas of application, system knowledge, various processing options as well as identification of customer needs. Moreover, the sales aspect is gaining in significance. That is why the product training has been extended to sales training. This is because in addition to pure technical product knowledge, there are increasing arguments about customer handling, who ultimately make the decision on any sale.

Distribution Center, Schaffhausen

The Georg Fischer Distribution Center offers custom-made logistics solutions. Through distinctly regulated processing cycles right from receiving the order until the delivery (Standard of Performance), our customers know exactly what performance to expect from the Distribution Center. The customer can choose from different types of shipment and in this way can control the processing and shipment time to suit his requirements. Shipments are made several times a day to different regions and ensure continuous delivery to all our customers.

The main business is developing customers for Georg Fischer Piping Systems. However, the Distribution Center is also open to other companies from industry and trade. The extent of outsourcing is determined by the customer and ranges from storage, commissioning, packaging, shipments to purchase, decontrol and order processing.

Accredited test center for components from plastic piping systems

Our test laboratory is SN EN ISO 9001 certified and SN EN 45001 and ISO Guide 25 accredited. We are an accredited test center for piping systems components like pipes, pipe connections, connection elements, fittings, manual and automatic values and flowmeters.

Worldwide Presence

Georg Fischer Piping Systems is represented worldwide by sales companies in 25 countries and production locations in America, Asia and Europe. In this way, from planning to implementation we ensure the support of our specialists who are close to our customers. This proximity facilitates consistent conversion of customer oriented problem solutions.

GEORG FISCHER +GF+

A Georg Fischer Rohrleitungssysteme GmbH, Sandgasse 16, 3130 Herzogenburg, Tel. +43(0)2782/856 43-0, Fax +43(0)2782/856 64, e-mail: office@georgfischer.at
AUS George Fischer Pty Ltd, 186–190 Kingsgrove Road, Kingsgrove NSW 2008, Tel. +61(0)2/95 54 39 77, Fax +61(0)2/95 02 25 61
B/L Georg Fischer NV/SA, Digue du Canal 109-111 – Vaartdijk 109-111, 1070 Bruxelles/Brüssel, Tél. +32(0)2/556 40 20, Fax +32(0)2/524 34 26
e-mail: info.be@be.piping.georgfischer.com
BR George Fischer Ltda, Av. das Nações Unidas 21689, 04795-100 São Paulo, Brasil, Tel. +55(0)11/5687 1311, Fax +55(0)11/5687 6009
CH Georg Fischer Rohrleitungssysteme (Schweiz) AG, Amsler-Laffon-Strasse 1, Postfach, 8201 Schaffhausen, Tel. +41(0)52 631 30 26, Fax +41(0)52 631 28 97
e-mail: info@rohrleitungssysteme.georgfischer.ch
Georg Fischer Wavin AG, Ebnatstrasse 111, Postfach, CH-8201 Schaffhausen, Tel. +41(0)52 631 38 41, Fax +41(0)52 631 28 14
e-mail: info@piping.georgfischer.com, Internet: http://www.piping.georgfischer.com
CHINA Georg Fischer Piping Systems Ltd Shanghai, No. 218 Kang Qiao Dong Rd., Shanghai 201319, Tel. +86(0)21/58 13 33 33, Fax +86(0)21/58 13 33 66
e-mail: gfsro@public.shanghai.cngb.com
D Georg Fischer GmbH, Daimlerstraße 6, 73095 Albershausen, Tel. +49(0)7161/302-0, Fax +49(0)7161/302 111
e-mail: info@georgfischer.de, Internet: http://www.rls.georgfischer.de
DK/IS Georg Fischer A/S, Rugvænget 30, 2630 Taastrup, Tel. +45 70 22 19 75, Fax +45 70 22 19 76
e-mail: info@dk.piping.georgfischer.com, Internet: http://www.georgfischer.dk
E Georg Fischer S.A., Alcalá, 85, 2º, 28009 Madrid, Tel. +34(0)91/781 98 90, Fax +34(0)91/426 08 23
e-mail: info@georgfischer.es
F George Fischer S.A., 105–113, rue Charles Michels, 93208 Saint-Denis Cedex 1, Tél. +33(0)1/49 22 13 41, Fax +33(0)1/49 22 13 00, e-mail: info@georgefischer.fr
GB George Fischer Sales Limited, Paradise Way, Coventry, CV2 2ST, Tel. +44(0)2476/535 535, Fax +44(0)2476/530 450
e-mail: info@georgefischer.co.uk, Internet: http://www.georgefischer.co.uk
George Fischer Castings Ltd, Norse Road, Bedford MK41 7QN, Tel. +44(0)1234/355 291, Fax +44(0)1234/328 570
GR Georg Fischer S.p.A., Athens Branch, 101, 3rd September Str., 10434 Athen, Tel. +30(0)1/882 0491, Fax +30(0)1/881 0291, e-mail: dderv_piping_gf@oneway.gr
I Georg Fischer S.p.A., Via Sondrio 1, 20063 Cernusco S/N (MI), Tel. +3902/921 86 20 1, Fax +3902/921 86 24 7, e-mail: office@piping.georgfischer.it
ALPRENE S.r.l., Via Bonazzi, 32, Castel Maggiore, 40013 Bologna, Tel. +39051/63 24 211, Fax +39051/63 24 213, e-mail: info@alprene.georgfischer.it
N Georg Fischer AS, Rudsletta 97, 1351 Rud, Tel. +47(0)67 18 29 00, Fax +47(0)67 13 92 92, Internet: http://www.georgfischer.no
NL Georg Fischer N.V., Postbus 35-8160, 8161 PA Epe, Tel. +31(0)578/678222, Fax +31(0)578/621768
e-mail: info.vgnl@nl.piping.georgfischer.com, Internet: http://www.georgfischer.nl
Georg Fischer WAGA N.V., Lange Veenteweg 19, Postbus 290, 8160 AG Epe, Tel. +31(0)578/678378, Fax +31(0)578/620848
e-mail: info@waga.georgfischer.com, Internet: http://www.waga.georgfischer.com
PL Georg Fischer Sp. z o.o., ul. Radiowa 1A, 01-485 Warszawa, Tel. +48(0)22/638 91 39, Fax +48(0)22/638 00 94
S/FIN Georg Fischer AB, Box 113, 12523 Älvsjö-Stockholm, Tel. +46(0)8/506 77 500, Fax +46(0)8/749 23 70, e-mail: info@georgfischer.se, Internet: http://www.georgfischer.se
SGP George Fischer Pte Ltd, 15 Kaki Bukit Road 2, KB Warehouse Complex, 417 845 Singapore, Tel. +65(0)7/47 06 11, Fax +65(0)7/47 05 77, e-mail: info@georgfischer.com.sg
USA George Fischer Inc., 2882 Dow Avenue, Tustin, CA 92780-7258, Tel. +1(714) 731 88 00, Toll Free 800/854 40 90, Fax +1(714) 731 62 01
e-mail: info@us.piping.georgefischer.com, Internet: http://www.us.piping.georgefischer.com
Export Georg Fischer Wavin AG, Ebnatstrasse 111, Postfach, CH-8201 Schaffhausen, Tel. +41(0)52 631 38 41, Fax +41(0)52 631 28 14
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