CONTAIN-IT Plus
Planning Fundamentals

Plan, Build, Operate

2044693
Planning Fundamentals CONTAIN-IT (08/2024)

CH-8201 Schaffhausen/Switzerland

Double Containment Solutions

CONTAIN-IT Plus

Content

CONTAIN-IT Plus

1.1 Introduction – Double Containment System

EHSQ – Environment, Health, Safety, Quality

Double containment systems are used for the safe transport of hazardous liquids or gaseous media. They protect the environment, people, production plants and ensure the quality of the end product (EHSQ: Environment, Health, Safety, Quality).

United Nations – Sustainable development goals

Georg Fischer Piping Systems addresses numerous sustainable development goals of the United Nations by providing the CONTAIN-IT Plus double containment system.

Responsible environmental awareness and an increased need for safety are becoming increasingly important in today's world. The transport of hazardous media can lead to personal injury in the event of unexpected leakage, property damage and environmental pollution. Corroded steel pipes, as well as unexpected leakages – especially creeping leakages from underground pipes – pose a serious risk for ensuring the good quality of our global water resources.

The goals of the United Nations are already reflected in various guidelines on environmental protection and personal safety. At European level, the Water Framework Directive 2000/60/EC (Environmental protection) and the Occupational Health and Safety Framework Directive 89/391/ EEC (Employee protection) have already entered into force. Numerous EU member states already consider Double containment systems in their national legislation and define these as a measure for the safe transport of hazardous media (protection of the environment and of employees).

Trend - Zero Pollution Action Plan (EU)

The Zero Pollution Action Plan was published in May 2021 and focuses on the implementation and enforcement of all EU pollution preventing legislation.

This approach will be increasingly reflected in national legislation, bringing the use of double containment piping systems into focus.

Impacts – Uncontrolled leakages

The CONTAIN-IT Plus double containment system from Georg Fischer Piping Systems minimizes the expensive impacts of leakages to a minimum. Consequently, liquid and gaseous media escaping unexpectedly from medium-carrying inner pipe do no longer pose a risk to the surrounding and help planners and plant operators to comply with the principle of concern.

Costly consequences such as heavy fines, high process and decontamination costs, long-term image loss, as well as tiresome occupational accidents, can be minimized or even eliminated by conducting hazard assessments and defining measurements like double containment systems. Moreover, depending on local legislation, double containment systems may be mandatory for the legally compliant operation of a plant.

Applications

Collection points

Double containment systems are used to ensure the safe transport of hazardous media from the truck intakte to the storage tanks.

Distribution systems

Double containment systems are used to ensure the safe transport of hazardous media (pressure pipings) from storage tanks into the production process. The structural situation often requires an underground double containment system. Depending on the transported medium, a double containment system must be used even for the smallest amounts of hazardous substances, since creeping leakages can escape unnoticed for many years and thus have a massive impact on water quality.

Wastewater systems

The safe transport of hazardous/contaminated pressureless wastewater mixtures is realized by using underground and overground double containment systems for the treatment of wastewater.

Wastewater treatment

The treatment of wastewater requires environmentally hazardous chemicals. The safe transport of hazardous media - from the storage tanks to the wastewater treatment plant - is ensured by means of double containment pipes.

Plant availability

There are also further applications that requires a high degree of process safety – to protect production-relevant equipment such as servers, machines, etc. – and where the piping system has to remain in operation, despite leakages.

A double containment system is likewise recommended for highly diffusing media such as HF, HCL, HNO3, as well as for valuable liquid media.

Market segments

Double containment systems are used in all market segments where uncontrolled leakage of a media-carrying pipe can cause damage.

Main fields of application:

- Microelectronics
- Data centers
- Batteries
- Water treatment plants
- Chemical process industry
- Food and beverage industry
- Pharmaceutical
- Mining industry
- Hospitals
- Municipal wastewater
- etc.

Legal provisions – Protection of the environment

Germany

According to the German Water Management Act (Section 62 g WHG), the principle of concern applies to the storage, filling, production and treatment of substances hazardous to water, as well as for in-plant piping systems.

Facilities for handling substances hazardous to water must be designed, installed, maintained and operated in such a way that there is no reason to fear contamination of water bodies. In accordance with a verdict of the federal administrative court, the principle of concern implies that there must be no probability, however slight, of water contamination.

Requirement of the German regulation on installations for handling substances that are hazardous to water (Section 17 AwSV)

- Plants must be planned, erected, constructed and operated in such a way that
  - substances that are hazardous to water cannot escape,
  - leakages on any parts of the installation coming into contact with substances that are hazardous to water can be identified quickly and reliably,
  - leaking substances hazardous to water are quickly and reliably detected and retained and properly disposed of; the same applies for splash and drip losses occurring during operation, and
  - in the event of a malfunction of the plant, any mixtures that may contain leaked substances hazardous to water are retained and properly disposed of as waste or disposed of as wastewater.
- Installations must be leak-tight, stable and adequately resistant to the expected mechanical, thermal and chemical influences.
- Single-walled, underground vessels for liquid substances that are hazardous to water are not permitted. Single-walled, underground vessels for gaseous substances that are hazardous to water are not permitted, if the gaseous substances which are hazardous to water emerge in a liquid state, are heavier than air or dissolve in existing moisture in the ground after escaping.
- When decommissioning a plant or parts of a plant, the operator must remove all substances hazardous to water contained in the plant or parts of the plant, as far as technically possible. He must secure the plant against misuse.

The above mentioned requirements for piping systems can be fulfilled by the existing containment room in-between inner and outer pipe of the double containment system.

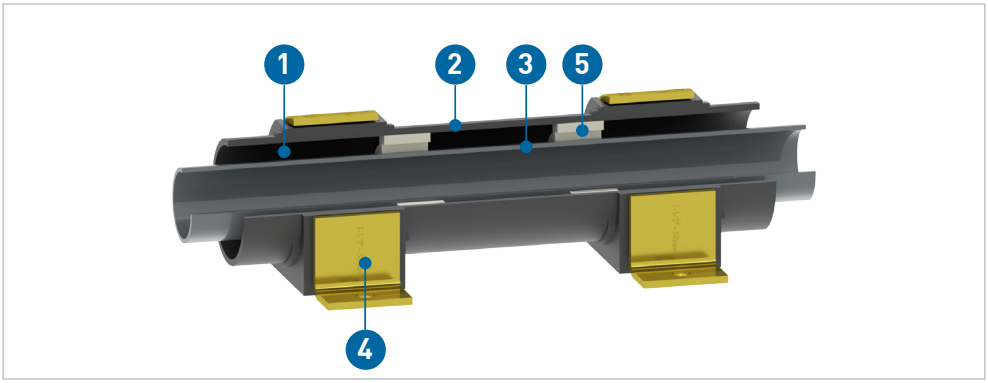
Switzerland

The regulation on the protection against failures (Section 3, General safety measures) states that operators must take all suitable measures for reducing the risk into account. This includes measures to reduce the hazard potential, prevent incidents, and limit their environmental impact.

The federal law on the protection of waters (Section 22, General requirements) states, that operators of plants with water-hazardous substances must ensure, that the constructional and instrumental equipments for the protection of waters are regularly inspected, properly operated and maintained. Liquid losses must also be prevented in storage and handling areas, and escaping liquids must be contained.

1.2 Double containment system – CONTAIN-IT Plus

1.2.1 CONTAIN-IT Plus – General design information

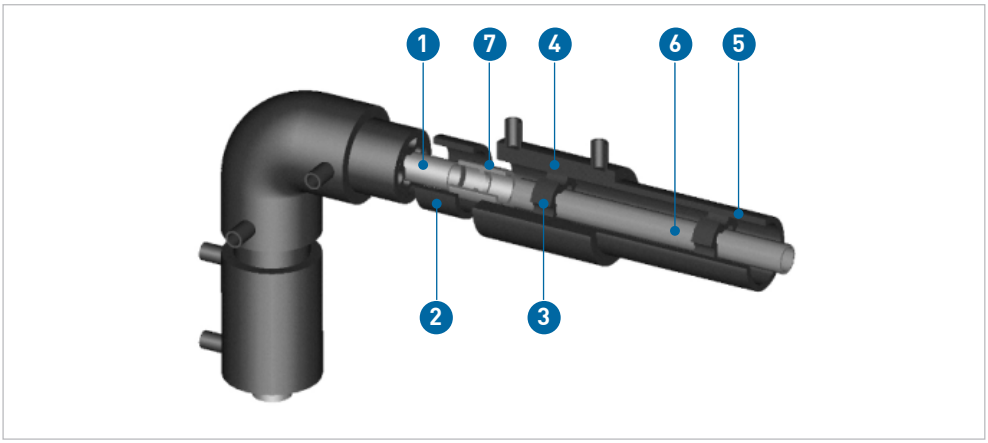


1 Monitoring room
2 Containment pipe
3 Inner pipe
4 Support clamps
5 Spacers

The CONTAIN-IT Plus system consists of a media-carrying inner pipe and an containment pipe, which provides protection for the environment, people and production facilities in the event of an unexpected leakage of the medium carrying inner pipe. The inner pipe is centralized in the containment pipe by the use of spacers to prevent buckling from the inner pipe in the containment pipe. Leakage detection devices have to be connected to the monitoring room so that operators can detect unexpected leakages after a maximum of 72 hours and initiate appropriate countermeasures.

1.2.2 CONTAIN-IT Plus – Basics connection technology

The patented double containment connection technology allows a double containment pipe to be connected in the same way as a single pipe using the familiar and proven jointing techniques in accordance with DVS Directive 2210-2. In the CONTAIN-IT Plus system, the inner and containment pipes are joined after each other . This unique connection technology makes it possible to visually inspect every internal piping connection and to execute a pressure-test of the internal pipe before the external pipe is joined. So-called "last connections", which occur with other system in each change of direction and then usually have to be done blind, are thus eliminated.



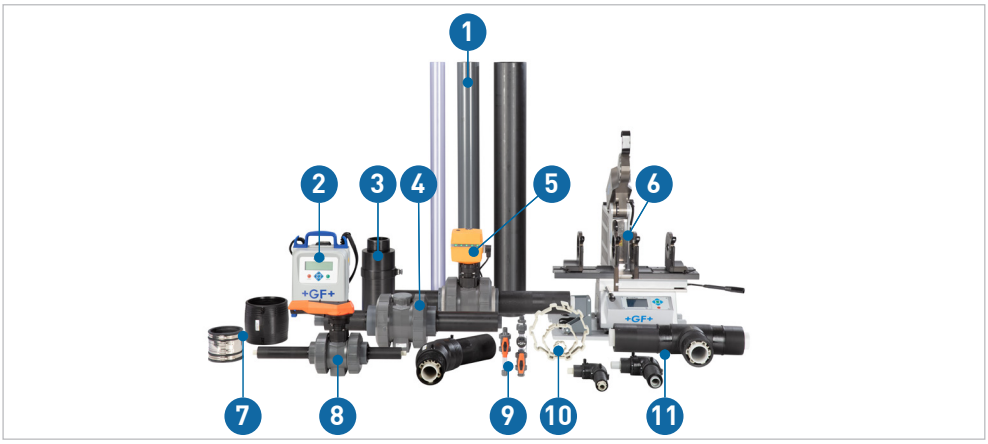
1 Fitting
2 Snap ring
3 Spacers
4 Electrofusion coupler
5 PE containment pipe
6 Inner pipe
7 Cementing/welding socket

Example: PE100 containment pipe

Further information relevant to planning and installation can be found in the chapters "Planning instructions" and "Installation instructions".

1.2.3 CONTAIN-IT Plus Product range

Georg Fischer Piping Systems offers a broad product portfolio of double containment fittings, ball valves, mechanical connections, leak detections solutions and numerous connection technologies, all the way through to expanded services.



1 Containment pipes
2 MSA Electro fusion machine
3 Termination fitting/End fitting
4 Double containment mechanical connection
5 Electrical/pneumatic double containment ball valve
6 Fusion machines
7 Couplers
8 Double containment ball valves
9 Leak detection solutions
10 Spacers
11 Double containment fittings

1.2.4 CONTAIN-IT Plus delivery program – Inner pipe

The selection of materials and connection technologies are crucial for operational safety and a long service life. The diverse choice of materials from various plastics for the inner pipe allows an optimal adaptation of the pipe material to the physical and chemical requirements: PVC-U, PVC-C, PP-H, PE, PVDF, ECTFE and PFA.

Georg Fischer Piping Systems provides comprehensive support in the selection of the materials and connection technologies based on your project-specific operation conditions in the "Questionnaire for static evidence and stress calculation".

The online tool: Chemical resistance - Georg Fischer Piping Systems (www.gfps.com) can be used as a general guidance for a rough material pre-selection.

Sulfuric Acid, > 78 - 93% solution

Formula: H_2SO_4
Synonyme:
Comments: Chemical de-rating factors apply only to metric DIN and not to ASTM SCH systems.

- not applicable | 0 individual evaluation, please contact GF | + (AF) conditionally applicable | ++ unconditionally applicable

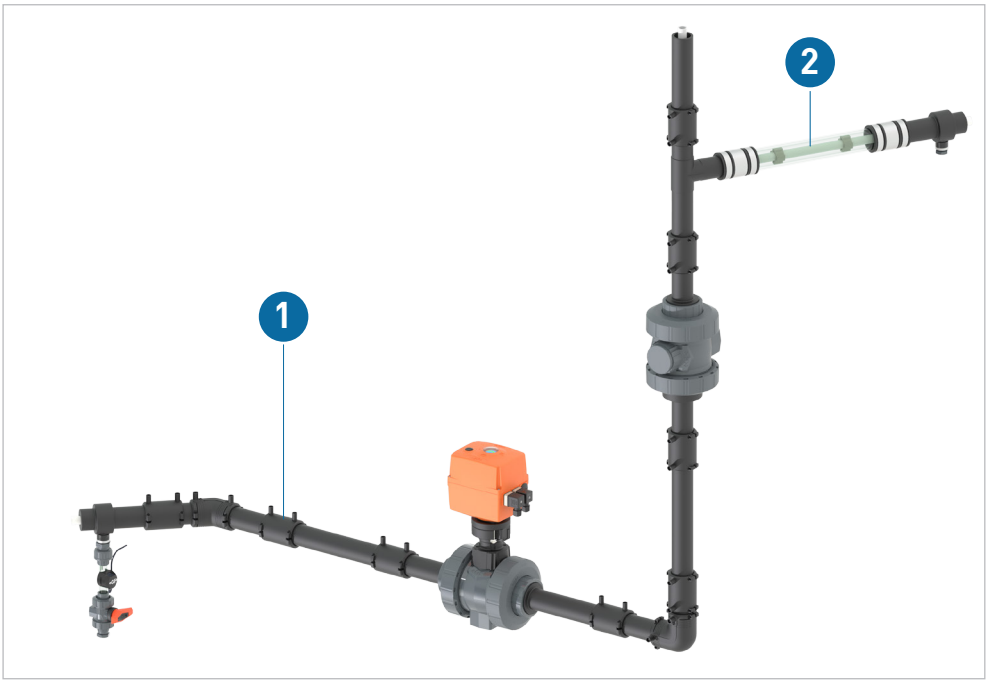
Piping Systems	20 °C	40 °C	60 °C	80 °C	100 °C	120 °C	140 °C
PVC-U	+ (1.1)	+ (1.1)	-				
PVC-C	++	++	0	-			
PE	-						
PP	-						
PVDF	+ (1.3)	+ (1.3)	0	-			
ECTFE	++	++	++	++	0	-	
EPDM	-						
FKM	++	++	++	0	0	-	

Jointing of PVC	20 °C	40 °C	60 °C	80 °C	100 °C	120 °C	140 °C
Tangit PVC-U	-						
Tangit PVC-C	-						

1.2.5 CONTAIN-IT Plus delivery program – Containment pipe

The containment pipe of the CONTAIN-IT Plus system can be designed with a pressure-resistant PE and a pressureless PVC-U (transparent) pipe from Georg Fischer Piping Systems. The outer fittings of the CONTAIN-IT Plus system are always made of PE100.

The prime considerations for selecting the containment pipe material are the installation and operating conditions like temperatures, pressures, impact, notch rupture strength, UV resistance, etc. The chemical resistance of both materials is sufficient, due to the fact that the containment pipe is just in contact with the medium under full load in case of leakage and hence only for a max. period of 72 h.



1 Variant 1: PE containment pipe
- Tensile-tight and pressure-resistant system
- Installation underground/above ground/inside/outside of buildings
- UV-resistant system
- Good impact and notching resistance

2 Variant 2: PVC-U (transparent) containment pipe
- Non-tensile-tight and non-pressure-resistant system
- Installation in buildings
- Simple visual leakage detection

Containment pipe variants: System overview

	Variant 1: PE100	Variant 2: PVC-U (transparent)
Connection technology	Electrofusion coupler (ELGEF Plus)	EPDM couplers and cementing sockets
		 
Tensile-tight connection	Yes	No
Containment pipe dimension	50mm – 315mm	50mm – 160mm
Nominal pressure	PN6*/PN10*/PN16*	PN1

*The nominal pressure of the inner and containment pipe is based on the component with the lowest nominal pressure. Pressure decreasing containment pipe components are, among others, mechanical connections, as well as ball valves with a nominal pressure of PN6 (housing).

Variant 1: Pressurized PE containment pipe

The containment pipe designed to encapsulate the medium-carrying inner pipe is made from polyethylene PE100. This material is characterized by good chemical resistance to acids, alkalis and salts, as well as numerous organic and inorganic solvents.

The advantages of PE100 are clear:

- High UV resistance thanks to black (stabilized with black carbon) polyethylene.
- Insusceptibility to notching
- Flexibility and impact strength even at temperatures down to -50°C.

Consequently, PE100 is ideally suited as a containment pipe material for installations indoor, outdoors and underground.

i The code numbers and wall thicknesses of the containment pipes – PE100 – are provided in the CONTAIN-IT Plus product catalog.

Connection technology:

The containment pipe out of PE100 is welded pressure-tight with the ELGEF Plus electrofusion couplers.

Both the inner and the outer protective pipe are reliable, quality-controlled pressure piping systems, which are implemented without changes. The jointing techniques correspond without exception to the relevant guidelines for pressure piping system construction.

Variant 2: Splash protection PVC-U (transparent) containment pipe

The external protective pipe designed to encapsulate the medium-carrying internal pipe is made from PVC-U (transparent). The splash protection system differs from the pressure-tight system in usage of an EPDM rubber collar with a V2A metal band for connecting the containment pipe. This connection is neither tensile-tight nor pressure-tight, and is therefore used almost exclusively inside buildings under constant operating and ambient conditions.

i The code numbers and wall thicknesses of the containment pipes – PVC-U (transparent) – are provided in the CONTAIN-IT Plus product catalog.

Connection technology

EPDM sleeves are used at every transition from PVC-U (transparent) containment pipe to the PE molded parts. The containment pipe materials offered by Georg Fischer Piping Systems can be connected to one another quickly and easily using the EPDM sleeves. The procedure for connecting the fittings is the same as for the pressure-resistant system.

For pipe-to-pipe connections, standard cemented connections (socket cementing) are used.

Containment pipe variants: wall thicknesses

Inner pipe	Containment pipe			
		Variant 1	Variant 2*	
Dimension [mm]	Dimension [mm]	PE100	PVC-U	PVC-U transparent
20	50	SDR 11	SDR 13.6	SDR 13.6
25	50	SDR 11	SDR 13.6	SDR 13.6
32	63	SDR 11	SDR 13.6	SDR 13.6
40	75	SDR 11	SDR 21	SDR 21
50	90	SDR 17.6	SDR 21	SDR 21
63	110	SDR 17.6	SDR 21	SDR 21
75	125	SDR 17.6	SDR 34.4	
90	140	SDR 17.6	On request	
110	160	SDR 17.6	On request	
125	180	SDR 17.6		
140	200	SDR 17.6		
160	225	SDR 17.6		
200	280	SDR 17.6		
225	315	SDR 17.6		

*Spacer PVC-U (transparent): Spacers can be adjusted for thin-walled pipes (on request)!

1.2.6 CONTAIN-IT Plus product range – Fittings

The CONTAIN-IT Plus double containment system is available in a wide range of different materials, dimensions, connection technologies and components.

Materials, dimensions, connection technology

The choice of materials from various plastics for the inner pipe allows the pipe material to be optimally adapted to meet the physical and chemical requirements: PVC-U, PVC-C, PP-H, PE, PVDF, ECTFE and PFA.

The containment fittings are always out of PE100 and are therefore completely independent of the inner pipe material and the inner pipe connection technology.

- Compatible with butt and infrared welding (IR)

Other combinations such as WNF welding connection (free of beads and crevices) on request.

Dimension (mm)	Inner pipe											
	Socket cementing				Socket fusion			Butt welding				IR welding
	PVC-U Tangit	PVC-U Dytex	PVC-C Tangit	PVC-C Dytex	PP-H	PE80	PVDF	PP-H SDR11	PE100 SDR11	PVDF SDR21	PVDF SDR33	ECTFE SDR21
d20/D50	✓	✓	✓	✓	✓	✓	✓	•	•	•		✓
d25/D50	✓	✓	✓	✓	✓	✓	✓	•	•	•		✓
d32/D63	✓	✓	✓	✓	✓	✓	✓	•	•	•		✓
d40/D75	✓	✓	✓	✓	✓	✓	✓	•	•	•		✓
d50/D90	✓	✓	✓	✓	✓	✓	✓	•	•	•		✓
d63/D110	✓	✓	✓	✓	✓	✓	✓	•	•	•		✓
d75/D125	✓	✓	✓	✓	✓	✓		•	•	•		✓
d90/D140	✓	✓	✓	✓	✓	✓		•	•	•		✓
d110/D160	✓	✓	✓	✓	✓	✓		•	•	•		✓
d125/D180	✓							✓	✓		✓	
d140/D200	✓							✓	✓		✓	
d160/D225	✓							✓	✓		✓	
d200/D280	✓							✓	✓		✓	
d225/D315	✓							✓	✓		✓	

The factory-welded connections on the fitting are made with infrared fusion wherever possible. The infrared fusions are logged internally (fusion log) and each connection is provided with a label.

Components and their layout

The individual fittings for the inner and containment pipe are injection molded using the latest quality assured procedures. Fittings are factory-made and supplied ready to install. With the CONTAIN-IT Plus system, the containment fitting – consisting of polyethylene (PE100) – is loosely centered on the inner fitting at the factory.

90° elbow	45° elbow	T90°	End fitting
			

Specially designed and patented termination fittings, with an Rp½ connection to the monitoring space, are installed at the start and end of the double containment system. End fittings have two EPDM O-rings or lip seals in series, which are required at the transition from double containment pipe to single pipe to seal the monitoring space in case of a leakage. Specially designed and patented termination fittings, with an Rp½ connection to the monitoring space, are installed at the start and end of the double containment system.

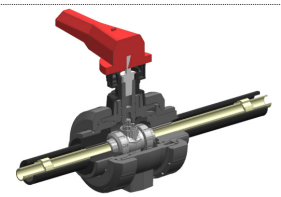
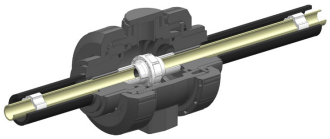
i Customized designs such as T45°, fixed point fittings inner and containment pipe (see chapter "Questionnaire for static evidence and stress calculation") are possible on request!

1.2.7 CONTAIN-IT Plus product range – Valves and mechanical connections

The CONTAIN-IT Plus Double Containment System is supplied in a wide range of different materials, dimensions, connection technologies and components.

Components and design

Double containment ball valves and mech. connections are factory-made and can be integrated into the double containment system in the same way as the fittings. Valves can be operated manually/automated from outside and can be opened radially for maintenance purposes and for pressure testing of the inner piping system. In addition, the monitoring room is continuous, so that leaks can spread easily. All fittings have Rp½ connections for the simple and flexible integration of leakage detection solutions into the monitoring room.

Ball valve Inner pipe: d20-d63	Mechanical connection Inner pipe: d20-d63
	
	

i Larger, pressure-resistant ball valves (d75, d90, d110) available on request!

i Seals: For the construction of the inner pipe, the sealing material must be selected according to the given operating conditions. EPDM, FKM and additionally FFKM (on request) are available for the ball valves (Valves with actuators on request).

Automation

Thanks to their modular design, double containment ball valves can be supplied from the factory with electric or pneumatic actuators or retrofitted with an actuator by adding an adapter set. Please contact your local sales office.

Electric actuators Type EA	Pneumatic actuators Type PA	Ball valve adapter set Type 546 Pro
		

1.2.8 CONTAIN-IT Plus delivery program – Leakage detection

For leakage detection, both manual and automatic solution are available. If further project-specific solutions are required (leakage location cables, vacuum or overpressure), Georg Fischer Piping Systems has the corresponding partner companies. Further information on leakage detection relevant to planning and installation can be found in the following chapters.

Manual leakage detection	Automatic leakage detection
	

Connection clamps/saddles

Depending on the isometry and local conditions, connection clamps are required for leakage detection and must be selected on the basis of the selected containment pipe variant/ dimension.

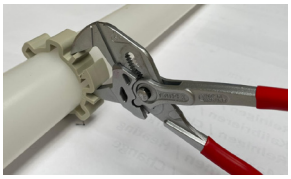
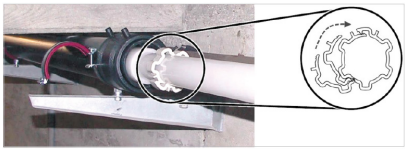
PP connection clamp with NBR seal (PE/PVC-U containment pipe = d50) (Mechanical connection)	**PE connection saddle** (PE containment pipe ≥ d63) (Electrofusion)	**PE adapter for saddle connector** (For connecting the leakage detection system)
		
For d50 containment piping: 753 211 610 with reducer (63/50): 753 901 658		

Connection clamps/saddles that can be retrofitted to the containment pipe enables flushing of the monitoring room, venting at the highest point of the pipeline, or can be used as a spigot for the pressure test of the containment pipe

1.2.9 CONTAIN-IT Plus product range – Spacers and snap rings

Spacers

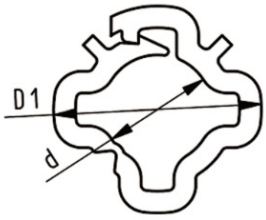
Spacers (PP-H) are a necessary component of a double containment system. Spacers prevent the inner pipeline from buckling in the outer pipeline due to thermal effects, for example, and contribute to an extended service life of the overall system. The number of spacers required or the distance between two spacers must be checked on the basis of the results of the "Questionnaire for static evidence and stress calculation".

Description	Spacers
"Click system" spacers are clamped to the inner pipe, which is then pushed into the outer pipe – double containment pipes are not pre-fabricated. The pipes can also be used as standard single pipes.	
	

Containment pipes with the appropriate wall thickness must be used so that the spacers fit as closely as possible to the containment pipe. This prevents the internal pipe from hanging through. With thin- walled PVC-U (transparent) pipes, the inner pipe may hang through in the containment pipe. Special spacers can be supplied on request.

Spacer dimensions

Inner pipe diameter d [mm]	Containment pipe diameter D1 [mm]
20	38
25	38
32	48
40	57
50	76
63	94
75	104
90	118
110	138
125	152
140	173
160	195
200	238
225	267



Snap rings

The CONTAIN-IT Plus double containment system is characterized by a staggered connection between the inner and containment pipe. This connection technology ensures a 100% visual inspection of the inner pipe connection. The 30 mm wide control gap in the containment pipe, which is needed for the visual inspection, is closed by a snap ring once the internal pipe connection has been successfully inspected.

1.2.10 CONTAIN-IT Plus – Bill of material

The calculation table below provides an overview of the required sockets, snap rings, ELGEF Plus electrofusion coupler and EPDM collars.

Material requirement checklist

Inner piping connection: Socket fusion or cementing

Quantity required per item	Pressure-tight solution ELGEF Plus Socket	Splash protection solution EPDM collars	Socket Equal	Snap ring
Connection technology	Electrofusion	Mechanical		
Containment piping material	PE	PVC-U (Transparent)		
90° elbow	2	2	1	2
45° elbow	2	2	1	2
T-90° equivalent	3	3	2	3
End fitting	1	1	0	1
Segmentation fitting	2	2	1	2
Inner pipe	0	0	*	0
Containment pipe (PE)	*	0	0	*
Containment pipe (PVC-U)	0	0	**	0

Inner pipe connection: Butt fusion

Quantity required per item	Pressure-resistant solution ELGEF Plus Coupler	Splash protection solution EPDM collars	Socket Equal	Snap ring
Connection technology	Electrofusion	Mechanical		
Containment piping material	PE	PVC-U (Transparent)		
90° elbow	2	2	0	2
45° elbow	2	2	0	2
T-90° equivalent	3	3	0	3
End fitting	1	1	0	1
Segmentation fitting	2	2	0	2
Inner pipe	0	0	0	0
Containment pipe (PE)	*	0	0	*
Containment pipe (PVC-U)	0	0	**	0

* For segmenting the monitoring room into monitoring sections

** 1 item per pipe rod to be processed

1.3 Planning instructions

1.3.1 Critera for a safe system

DVS Guideline 2210-2 (German Association of Welding Technology) must be taken into account for the project planning, design and installation of a double containment piping system.

This includes the following topics, among others, which contribute to safe operation:

Planning and installation

- Inner pipe: For safety reasons, the components of the media-conveying inner pipe should not be altered from their standard version. This ensures the consistent, tested quality of our DIBt-approved (German Institute for Building Technology) individual components of the fittings for the following materials: PVC-U Z-40.23-2; PE80 and PE100 Z-40.23-282; PP-H Z-40.23-264 and PVDF Z-40.23-262. The pipes have to be DIBt-approved.
- Connections: The DVS (German Association for Fusion Technology) fusion guidelines and KRV (Plastic Pipe Association) solvent cementing instructions are applicable without exception, especially to double containment piping systems.
- Static evidence and installation: Due to different operation conditions (temperatures, pressure ratings, etc.) between inner and containment pipe, as well as the use of different materials with different expansion coefficients for inner and containment pipe, high stresses can be caused by inhibited longitudinal expansion between inner and containment pipe, depending on the application. Georg Fischer Piping Systems calculates these stresses and other fundamental installation parameters, which are relevant to planning and installation for a straight pipe section (based on your project specific information in the "Questionnaire for static evidence and stress calculation") and provides the results to the planner and installer free of charge.
- Staff training: Only persons trained and authorized by Georg Fischer Piping Systems are allowed to install the CONTAIN-IT Plus double containment systems.
- Quality control and assessment: "Blind connections" cannot be tolerated in double containment systems. Especially the visual inspection of the inner pipe connection during the jointing process is an important quality feature. A successful pressure test of the inner pipe must be guaranteed before the containment pipe is sealed. A successful and recorded pressure test of the containment pipe represents the end of the installation work and is an integral part of the installation.
- Leakage detection: Manual or automated leakage detection solutions must be taken into account for double containment systems. These must be taken into account by the operator in the supervision and maintenance plan, among other things.
- Advanced planning service: Georg Fischer Piping Systems recommends the use of the advanced engineering service, especially in the case of complex isometrics. This service analyzes the entire isometry, which can then be used as a basis for cost optimization proposals to the customer (support clamp distances, etc.).

Operation

- Maintenance: For maintenance purposes, subsequent extensions, and for repair cases, the Georg Fischer Piping Systems product range includes mechanical and radially expandable separators.
- Operators: Operators of double containment systems must hold operating instructions, including all relevant documents such as a supervision and maintenance plan, an emergency plan and immediate measures to be taken into account in case of a leakage.

1.3.2 Selecting the material of the medium-carrying inner pipe

The choice of material and the pressure rating of the pipe components are important for both, operating safety and for attaining the specified minimum operational lifetime of the system.

The decisive factors are the following:

- Operating pressure
- Operating temperature
- Conveyed medium
- Time of operation

A preselection can be done by using the list of chemical resistances and the material-related pressure and temperature diagrams.

i The ChemRes PLUS tool is available on https://www.gfps.com/com/de/downloads-tools/online-tools/chemical-resistance.html

1.3.3 Selecting the material of containment pipe

In case of a leak, both containment systems (PVC-U and PE100) provide sufficient chemical resistance to contain the escaping medium for at least 72 h in the monitoring room. However, it should be noted that the pressure rating of the containment piping system depends on the component with the lowest pressure rating

Variant 1: PE containment pipe

The pressure rating of the PE containment piping system (PN10/PN16, with fittings PN6) must be at least equal to the operating pressure rating of the inner piping system until the incident is fixed. The PE system is suitable for underground applications due to excellent impact resistance. Moreover, thanks to the wide temperature range (-50 ... +60°C) and excellent UV resistance, it can be used in harsh environments, especially for above-ground installations outside buildings. Due to its excellent properties, the PE system can be used in almost all applications.

Variant 2: PVC containment pipe (transparent)

The pressure rating of the PVC-U containment piping system (PN1) must be at least equal to the operating pressure of the inner piping system until the incident is fixed. In the event of a leak, no higher pressure (including static pressure) than PN1 is allowed in the containment pipe, including at the lowest point of the monitoring section. Due to the limited temperature range of PVC-U (0°C ... 60°C) and the mechanical connections (EPDM-Collars) of the outer pipe, which is not a tensile-tight connection, the PVC-U (transparent) system can only be installed indoors under constant operation conditions.

Combination of variants 1 and 2:

Depending on the isometric drawings, a combination of the two containment piping materials may also be suitable. At well-accessible short pipe sections (1-2m) - at the lowest point of the monitoring room - a PVC-U (transparent) containment piping system can be used for visual leak detection. However, when using a PVC-U (transparent) system, the limited pressure rating of the containment piping system to PN1 must be considered.

i A leakage of the inner pipe usually does not require an immediate shutdown of the double containment system, which means that production processes may still be completed. However, Georg Fischer Piping Systems recommends that operators define appropriate immediate measures in the event of a leakage and carry out a risk assessment before commissioning the double containment system. Depending on the installation conditions, a short-term shutdown may be necessary to ensure that the containment pipe is undamaged and that the leakage only affects the medium-carrying inner pipe.

1.3.4 Inner pipe sizing

The pipe diameter is determined by calculating the pressure loss within the pipe. This depends not only on the diameter, length or pipe material but, also on the flow medium and the flow rate. A calculation can be done based on DVS 2210.

1.3.5 Isometric drawing

The 30° isometric drawing (see example of cutting length calculation) provides an accurate view of the piping layout. When the axis dimensions are entered, the cutting lengths can be calculated and the installation direction of the fittings determined. This can be used to represent the ventilation, rinsing and shut-off requirement, as well as the installation position of the end and sectional fittings.

1.3.6 Questionnaire for static evidence and stress calculation

The questionnaire for the static evidence is a mandatory document. The results and recommendations must be taken into account during planning and installation phase. Within the scope of the standard service provided free of charge by Georg Fischer Piping Systems, a straight double containment section is considered. The entire isometric drawing is not analyzed, but only one straight pipe section. This calculation is informative enough for a standard installation.

The static evidence offers the following advantages:

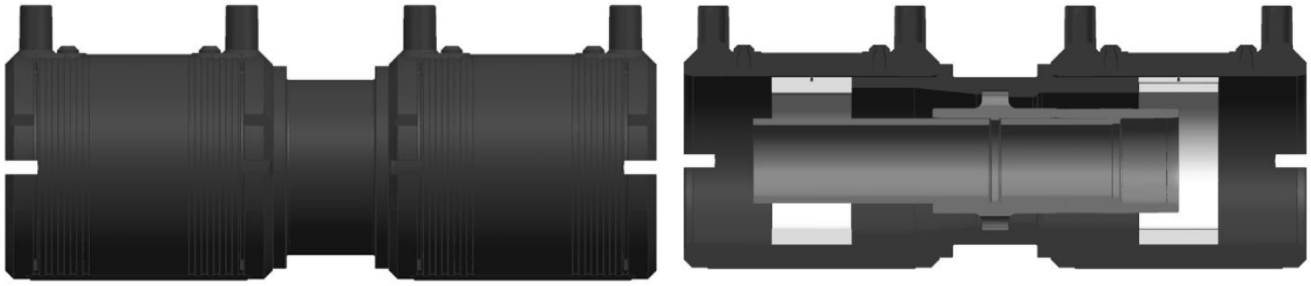
1. Material check: Based on the questionnaire for static evidence and stress calculation, Georg Fischer Piping Systems checks if the selected inner pipe material is suitable under the specified operating conditions.

2. Steel structure dimensioning: For fixed point installation - prevented linear expansion of the containment pipe - the resulting stresses and forces applied to the fittings are calculated. These stresses and forces must be absorbed by the fixed pipe clamps at every change of direction. Additional support clamps must be installed between the fixed points, due to the pipe deflection or due to a pipe routing that is not exactly aligned. The support clamps must be designed for lateral forces of approx. 10-15% of the axial forces applied to the fixed points. The support clamps are to be designed for lateral forces amounting to approx. 10-15% of the axial forces acting on the fixed points. The results of the static verification take into account the axial forces acting on the fixed points, the lateral forces acting on the support clamps, both in the operating case and in the leakage case, and the support clamps distances.

> i The expansion of the containment pipe in the pipeline run does not have to be taken into account thanks to the fixed point installation, so that no additional expansion bends are necessary.

3. Expected system stresses: If the calculated stresses in the changes of direction become too large, the operating conditions or the material must be changed. Alternatively, an axial connection in the form of a fixed joint between the inner and outer piping ("fixed point fitting") must be considered to absorb the stresses before the change in direction. Experts at Georg Fischer Piping Systems will recommend a fixed point fitting based on your information in the "Questionnaire for Determination of Static Proof and Stress Calculation" if required.
   In particular, straight pipe lengths of more than 10m and significant delta T need to be checked for the necessity of fixed point fittings.
   In addition, there are various other options, such as trace heating cables with insulation, to overcome this behavior.

Example of a fixed point: Cementing variant



The described fixed point design has a pass-through, so that leakage can spread easily.

4. Spacer distances: Spacer distances must be calculated individually for each application. Spacers prevent buckling and hence excessive expansion of the inner pipe (own weight) in the containment pipe. The calculation results of the static evidence also includes a calculation of the spacer distances based on the project specific information provided in the questionnaire.

GF Piping Systems

CONTAIN-IT Plus Systems

Questionnaire for Static Evidence and Stress Calculation DVS 2210-2

General project information

Project name	
Customer	
CRM/Order number	

Flow media

Flow media		%
Density (in g/cm³)		
MSDS (Material Safety Data Sheet) attached?	☐ Yes	☐ No

Operation conditions			Total load time	
Maximum working temperature		°C	in percent	%
Minimum working temperature		°C	in percent	%
Maximum working pressure		bar	in percent	%
Minimum working pressure		bar	in percent	%
Period w/o media/empty			in percent	%
Ambient temperature	Minimum	°C	Maximum	°C
Required service life	☐ 10 years	☐ 25 years		

Parameter pipes	Inner pipe	Outer pipe
Material		☐ PE-100 ☐ PVC-U (transparent)
Outer diameter d		
Wall thickness e		
Nominal pressure PN		
Standard dimension ratio (SDR)		
Expected connection technology		

Installation details	Installation detail 1	Installation detail 2
Additional system data	☐ Above the ground ☐ In the ground (buried)	☐ In building ☐ Outdoor
	Longest straight pipe run >10m?	☐ Yes ☐ No
	Heat tracing?	☐ Yes ☐ No
	Insulation thickness	mm
Installation temperature	Minimum °C	Maximum °C

Leak detection information

Leak detection information	☐ Optical	☐ Sensor	☐ Detection cable
	☐ Overpressure difference ☐ Underpressure	[mbar]	☐ No pressure

Comments	
Attachements	☐ Isometric drawing ☐ ☐

Your contact
Georg Fischer Piping Systems Ltd.
Ebnatstrasse 111, 8201 Schaffhausen / Switzerland
gss@georgfischer.com / www.gfps.com

GFDO_OP_00037b_EN (03.21)

1.3.7 Results of static evidence and stress calculation

Various materials and operating conditions require measures to ensure the expected service life time and safe operation of a double containment system.

Explanation

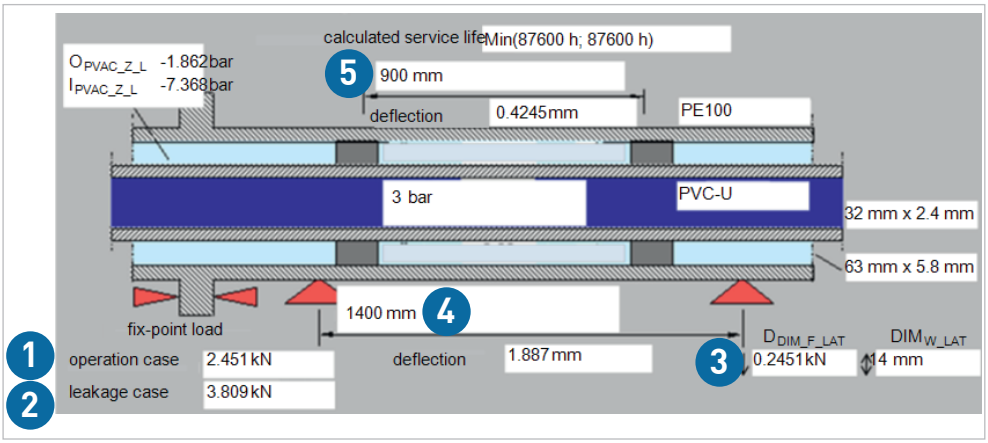
Double containment piping systems must be designed as fixed point installations due to diverse process conditions. The containment pipe must therefore be fixed to the steel structure at every change of direction to prevent thermal expansion/contraction. Inner piping materials such as PVC-C, PVC-U, ECTFE, PVDF, PP, PE, as well as outer piping materials such as PE, PVC-U (transparent) are exposed to different operating conditions. Depending on the combination, they have different expansion coefficients and thus, among other things, lead to different changes in length. Georg Fischer Piping Systems calculates the expected stress for a straight pipe section based on the project-specific information provided in the questionnaire. In this respect, it is also important, among other things, that filling lines in particular are taken into account in the questionnaire, as these are only occasionally operated under process conditions (temperature, etc.).

Material	Temperature range (°C)	α Expansion coefficient (mm/mxK)	L Pipe length (m)	ΔT Temperature change (K)	ΔL Length change (mm)
Steel		0.012	100	10	12
PVC-C	20...80	0.06...0.07	100	10	60...70
PVC-U	20...60	0.07...0.08	100	10	70...80
ECTFE	20...80	0.08...0.14	100	10	80...140
PVDF*	20...120	0.12...0.18	100	10	150...180
PP	20...80	0.16...0.18	100	10	160...180
PE	20...60	0.15...0.20	100	10	150...200

*The linear expansion coefficient increases in line with temperature.

Steel structure forces

The expected forces on the steel construction can be extracted from the result of the static evidence and must be taken into account during planning and installation phase, in particular for the pipe routing and the selection of pipe clamps, see extract from an example project:



1 Axial load at fixed point during operation [kN]
2 Axial load at fixed point in case of a leak [kN]
3 Lateral load at guide bearings [kN]
4 Guide bearing distances [mm]
5 Spacer distances [mm]

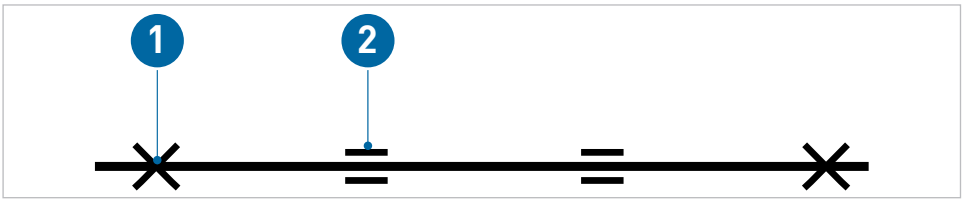
Determining the layout

The cable routing should be protected from mechanical and thermal effects. In addition, the required minimum distance from walls and ceilings must be observed.

In the case of high fixed point forces, the possibility of fastening to the building structure should be checked. If structural components cannot absorb the calculated fixed point force (e.g. trapezoidal sheet metal roofs), the forces must be absorbed by means of stable mounting rails that run with the structure.

Fixed point installation

Double containment systems must be installed as a fixed point installation due to a wide range of process conditions. Thanks to this installation technique, among other things, a meaningful service life time of the double containment system can also be calculated (see result static evidence "calculated service life time").



1 Fixed point
2 Guide bearings

Selecting the fixed point/support clamps

The appropriate load class must be taken into account when selecting the pipe supports.

Georg Fischer Piping Systems offers "Georg Fischer Stress Less" support types suitable for plastics in accordance with static proof.

https://www.gfps.com/en-us/products-solutions/systems/stress-less.html

1.3.8 Determining the leakage detection

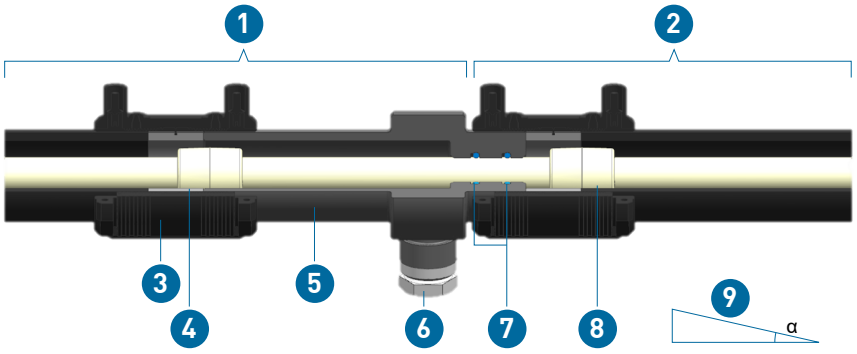
The design of the leakage monitoring is a central requirement of all double containment systems. Solutions for leakage monitoring must already be taken into account in the planning phase. In order to ensure that the double containment pipe does not become a single pipeline unnoticed in the event of a leak of the inner pipe, it must be ensured that leaks are detected within 72 hours. Various leakage monitoring solutions are available for monitoring the pipe or the monitoring room.

In addition, there are other possibilities in the design of the system available, which contribute to a fast leak localization and a quick recommissioning in case of a leak.

System segmentation: fast leakage localization and recommissioning

For rapid leakage localization and recommissioning of the double containment system in the event of a leakage, it is recommended to divide the interstitial space into smaller, freely selectable interstitial sections. This allows the leaking medium to spread only in a small monitoring section.

End fitting as a segmentation fitting:



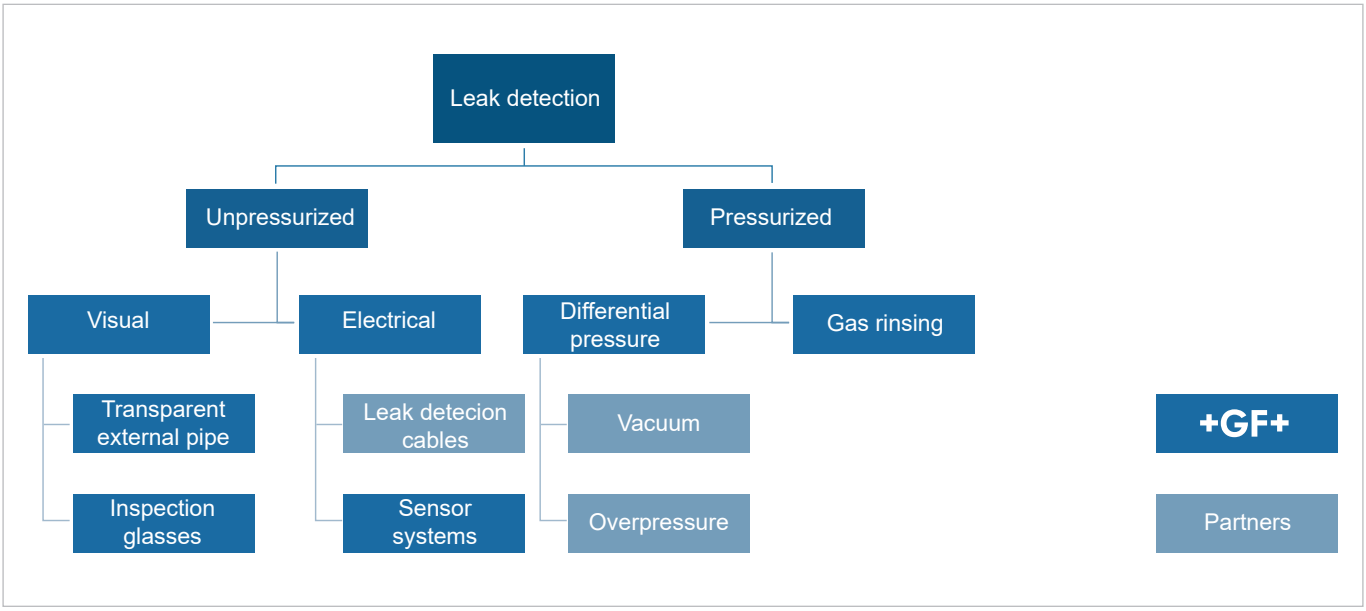
1 Section 1 - Monitoring section
2 Section 2 - Monitoring section
3 Electric welding socket
4 Snap ring
5 PE support of end fitting
6 Leackage detection connection
7 EPDM seals (2x)
8 Inner pipe with socket connection
9 Gradient to be observed

To ensure that the leakage can be reliably detected at the lowest point, it is very important to consider the installation position of the end fitting as a subdivision fitting (see illustration).

Standardized Georg Fischer Piping Systems end fittings can be used for the system segmentation (see illustration). The end fittings have two EPDM O-rings in series or a EPDM lip sealing, which ensure sufficient protection in case of a leakage and separate the monitoring rooms from each other. According to DVS- 2210-2 and based on internal experience, monitoring sections of 20m to 50m are well established.

Leakage monitoring solutions

Georg Fischer Piping Systems provides three possibilites for pressureless leakage detection.
A leakage monitoring solution is required for each monitoring system segmentation.



Further information can be found in the chapter "Leakage detection and containment".

Pipe routing: Low point leakage solutions

When using low-point solutions, such as inspection glasses and sensor systems, a slight slope of the containment pipe should be taken into account. As a result, even creeping leaks are detected at an early stage and are always led to the lowest point of the monitoring section.

Monitoring room: Accessibility

Georg Fischer Piping Systems offers a wide range of flexible possibilities to get access into the monitoring room. Many standardized components such as end fittings, ball valves and mechanical connections are equipped with an Rp ½" connection to get access into the monitoring room in their standard version. In addition, it is possible to use connection clamps or saddles (PE and PP), which also allow access to the monitoring room after installation (see chapter "1.2.8 CONTAIN-IT Plus delivery program – Leakage detection").

1.4 Installation instructions

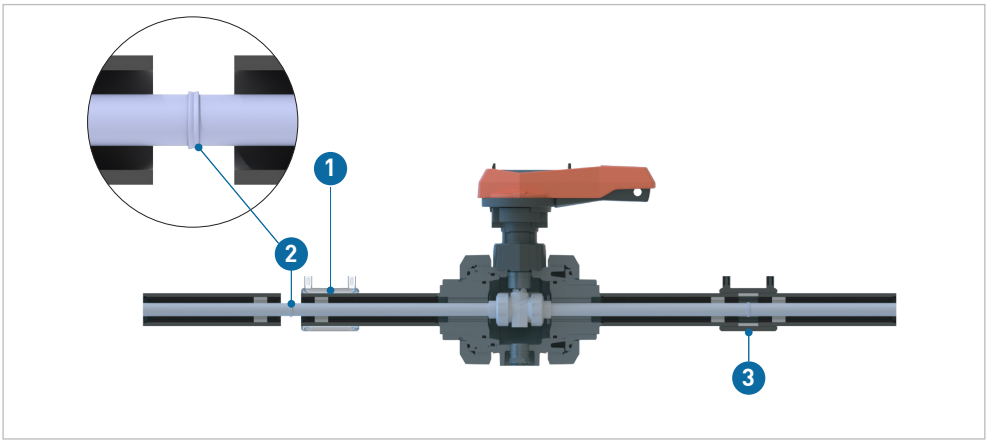
1.4.1 Authorization of installation personnel

Easy-to-learn technology, strict adherence to standards and regulations as well as many decades of experience in plastic piping system construction are the marks of distinction of the double containment piping system from Georg Fischer Piping Systems. Added to these essential requirements, in the interest of safety, is the careful training of the installers. Double containment systems may be installed only by persons who have been specifically trained and authorized by Georg Fischer Piping Systems.

1.4.2 Introduction – double containment connection technology

The patented double containment piping connection technology allows a double containment pipe to be connected in the same way as a single pipe by using the established and proven connection technologies in accordance with DVS guidelines 2210-2. In the CONTAIN-IT Plus system, the inner pipe and containment pipe sections are connected with a staggered connection. This unique connection technology allows a visual inspection of each inner pipe connection and pressure testing of the inner pipe before closing the containment pipe. So-called "last connections", which occur with every change of direction in other systems and then usually have to be executed "blindly", are thus eliminated.

Connection Plus – Highest quality



1 ELGEF electrofusion coupler; alternative: EPDM coupler
2 Visual inspection of inner pipe connection and pressure test of inner pipe
3 Centering of the snap ring in the ELGEF electrofusion coupler (gray) and closing of the containment pipe

Explanation on connection technology

1. Step: The inner pipe connection is realized by using proven and quality-assured connection technologies based on the selected material.
2. Step: A small gap in the containment pipe enables a visual inspection of the inner pipe connection.
3. Step: The initial pressure test of the inner pipe can be executed while the outer pipe is open, so that possible leaks in the inner pipe can be quickly located and repaired.
4. Step: After the pressure test of the inner piping system has been successfully completed, a PE snap ring (cutted PE pipe) is inserted to close the containment pipe.
5. Step: The electrofusion coupler (ELGEF Plus) is centered over the snap ring and afterwards welded.
6. Step: Pressure test of the containment pipe

1.4.3 Introduction – double containment installation steps

The essential processes for installing a double containment system are explained briefly below. Detailed explanations can be found in the corresponding sub-chapters.

Overview of the key installations steps

1. **Step: Cutting length calculation**
   The dimensions between axes (Z-dimension) for the 90° angle, the 45° angle and T-pieces are always identical and indicated on the bag labels of the fittings. The external pipe has a different length dimension to the internal pipe. The two pipes must be calculated separately and is based on the internal pipe connection technology (welding losses among others, etc.) and material. Detailed information on calculating the cutting length can be found in the chapter "Calculating the cutting length of the internal and external piping".

2. **Step: Preparation pipes**
   Before the internal pipe is joined, it is necessary to ensure that the spacers are mounted on the internal pipe according to the results of the static evidence (spacer distances) and that the protective pipe has been pulled over the internal pipe. The ELGEF sockets or EPDM sleeves must be pulled onto the external pipe or the long fitting side before the internal pipe is connected. Detailed information on preparing the pipes can be found in the chapter "Preparing the internal and external piping".

3. **Step: Connection inner pipe**
   Proven and well-known standard connections have been taken into account for the connections of the inner pipeline. Depending on the material and dimensions, the following are available: Solvent cementing, socket fusion, butt fusion and the infrared fusion. The selection is based on suitability based on operating conditions. PVDF BCF welded joints (bead- and crevice-free) can be performed on request.
   Cemented connection (PVC-U and PVC-C)
   A quick jointing method that is carried out without extensive use of tools or machinery.
   Heating element socket fusion (PP, PE and PVDF)
   Socket fusion is particularly suited for dimensions from d20/50 up to d110/160. Up to and including dimension d50/90, these joints can be easily made in the piping system route, using hand fusion equipment.
   Heating element butt fusion (PP, PE and PVDF)
   In pressurized pipe systems, all butt fusion joints must be executed with a butt fusion machine and not by hand.
   Infrared fusion (PP, PE100, PVDF and ECTFE)
   In IR fusion, the parts to be connected (pipe and fitting) are heated to fusion temperature in the fusion area and fused in a contact-free process. This low-stress welding process allows smaller weld beads and reduces the risk of contamination due to the non-contact process.
   For detailed information on connecting the innerl pipe, see chapter "Connecting the inner pipe".

4. **Step: Pressure test and visual inspection of the inner pipe**
   Once the inner pipe is connected, a 30 mm gap remains in the containment pipe.
   This gap allows the inner pipe connection to be visually inspected and assessed. The pressure test of the inner pipe has to be performed before the containment pipe is closed so that leaking inner pipe connections can be quickly localized and rectified.

   The pressure test of the inner pipe requires that the inner pipe sections are ready for operation. Georg Fischer Piping Systems recommends a section-by-section pressure test, especially for long double containment piping systems and in tight locations. For further information on how to carry out the pressure test, please refer to the chapter "Instructions for internal and external pressure testing".

5. **Step: Connecting containment pipe**
   After successful verification of the inner piping system, the containment pipe can be closed (see chapter "Connection containment pipe").
   A pressure-resistant version with electrofusion coupler (ELGEF Plus) and a splash protection version with EPDM sleeve is available. Before closing the containment pipe, make sure that the 30mm gap in the containment pipe is closed by the 30mm wide snap ring (cutted PE pipe). The insertion depth of the sleeve/collar must be determined precisely so that the snap ring is centered in the sleeve/collar.

   After welding the ELGEF Plus electrofusion coupler or tightening the EPDM sleeve, the pressure test of the containment pipe can be carried out.

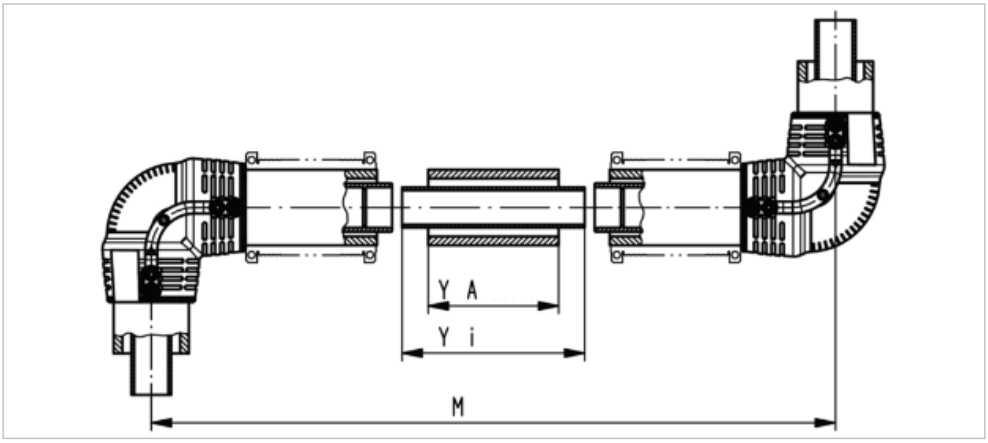
6. **Step: Pressure test containment pipe**
   The containment pipe is pressure tested when the inner pipe is completely filled and under internal pressure (the internal pressure of the inner pipe should be at least equal to or higher than the internal pressure of the containment pipe) in order to prevent the inner pipe being exposed to external overpressure. Further information on performing the pressure test can be found in the chapter "Instructions for internal and external pressure test".

   Once the pressure test of the outer pipe has been successfully completed and the connections to the interstitial space (flushing connections, pressure test connections, etc.) have finally been closed and the leakage detection units have been functionally tested, the double containment system is ready for operation from a technical point of view.

1.4.4 Cutting length calculation of internal and containment pipes

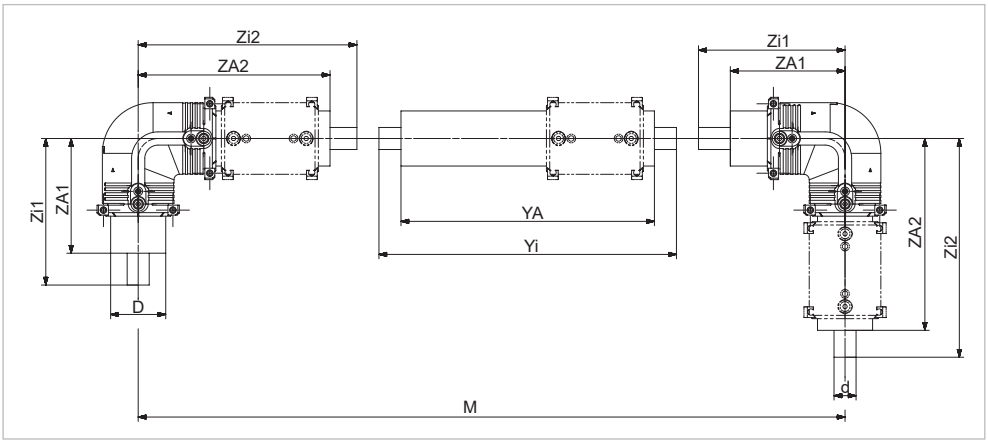
Definitions

The required axial measurement "M" can be taken from the isometric drawing or determined by precise measurement.



M ≈ Length between axes
YA ≈ cutting length
Containment pipe
Yi ≈ Cutting length
Inner pipe

For the cutting length calculation of the inner pipe "Yi" and the containment pipe "YA", the Z measures of the fittings must be taken into account in advance.

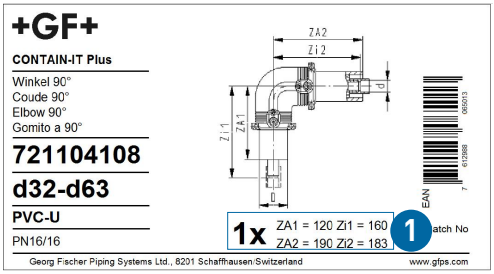


Z-dimensions of fittings

Every item of the double containment system is packaged in a bag in the factory and delivered with a bag label. The label includes all relevant Z-dimensions for calculating the cutting lengths of the inner and containment pipe.

1 Z-dimension

Labeling	Packaging with label

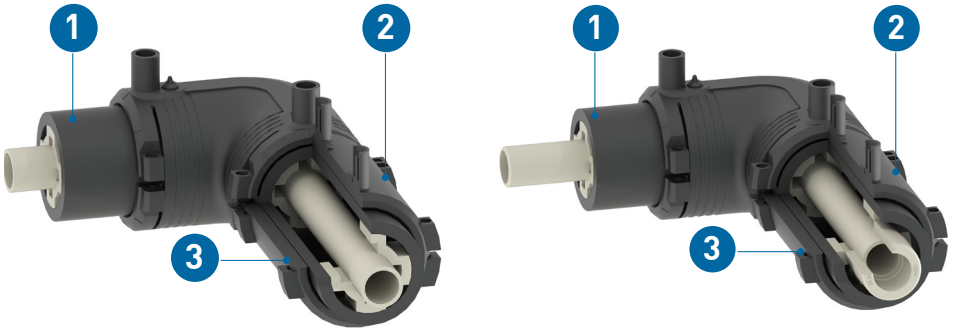


The Z-dimensions for the 90° elbow, the 45° elbow and T-pieces are identical.

Explanation of the Z-dimension

Each item of the double containment system has a short and a long side (see illustration). The shortest axial measurement can be achieved by combining the short fitting side with the long fitting side, in order to apply the ELGEF sleeve or the EPDM coupler.

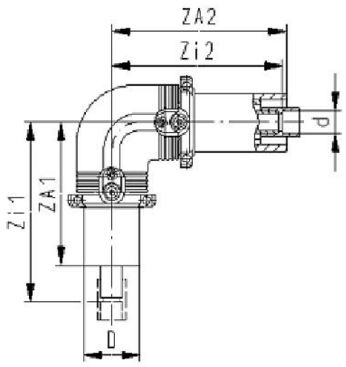
Fitting-Butt Fusion	Fitting-Socket fusion/cementing



1 Short side (S)
2 Long side (L)
3 ELGEF electrofusion coupler or EPDM sleeve

CAD files (https://bim.gfps.com): AUTODESK REVIT, AVEVA

Designation	Explanation	Side
ZA1	Z-dimension of containment pipe	Short side
Zi1	Z-dimension of inner pipe	Short side
ZA2	Z-dimension of containment pipe	Long side
Zi2	Z-dimension of inner pipe	Long side

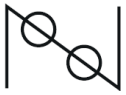


Legend

Abbreviation	Designation	Symbol	Example of 90° elbow
S	Short fitting side		
L	Long fitting side		
E	End fitting		

Case assessment

Before calculating the cutting lengths (Yi, YA), it is mandatory to consider the isometry and the corresponding installation case. The cases differ depending on the arrangement of the fittings. The following case scenarios may occur (see table). GF strongly recommends to always consider the combination "Short fitting side - Pipe - Long fitting side" for the connection.

Abbreviation	Designation	Symbol
S – P – L	**S**hort fitting side – **P**ipe – **L**ong fitting side	
S – P – S	**S**hort fitting side – **P**ipe – **S**hort fitting side	
S – L	**S**hort fitting side – **L**ong fitting side	
L – P – L	**L**ong fitting side – **P**ipe – **L**ong fitting side	
S – E	**S**hort fitting side – **E**nd fitting	
S – P – E	**S**hort fitting side – **P**ipe – **E**nd fitting	
L – P – E	**L**ong fitting side – **P**ipe – **E**nd fitting	

Depending on the isometry, the Z measures of the fittings must be selected accordingly, i.e. Zi1 and ZA1 or Zi2 and ZA2 or ZA and Zie.

30° allowance sheet - Z-Measure method

Before calculating the cutting length, the isometric drawing must be taken into account to define how the fittings should be installed in the most practical case. With the combination of "short fitting side" to "long fitting side", the shortest axial measurement M can be realized.

GF Piping Systems

Double Containment system CONTAIN-IT Plus

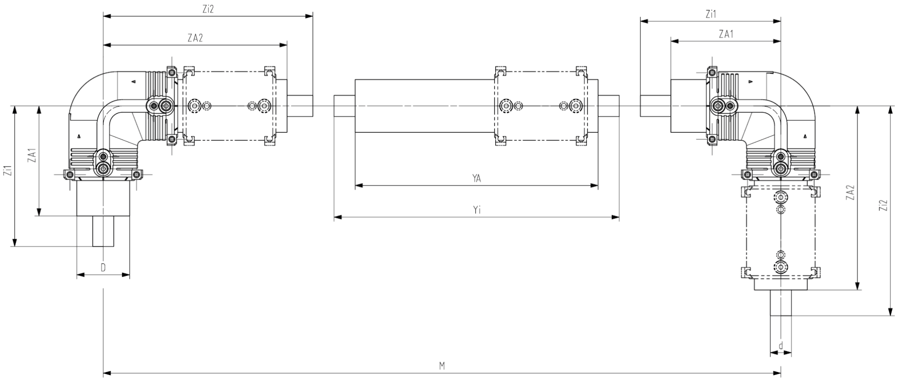
Date: _____ Client: _____
Sheet No./Number: _____/_____ Construction object: _____

Material of inner pipe:		Dimension of inner pipe:	
☐ Cementing	☐ Sockets	☐ Conventional butt	☐ Infrared butt

Legend		
Short fitting side (S)	Long fitting side (L)	Endfitting (E)
		

Z-Mass Method

Case study: Long fitting side – Pipe – Short fitting side



☐ Conventional butt & IR fusion joint

Z-Mass 90°/45°/T90°

Short fitting side:
ZA1 : ____________
Zi1 : ____________
Long fitting side:
ZA2 : ____________
Zi2 : ____________

ZA : ____________
Zi : ____________

Calculation – "Short-Pipe-Long":

- **Yi Cutting length inner pipe**
  M - Fitting1 Zi1 - Fitting2 Zi2 + (material loss x (number of inner pipe connections))
- **YA Cutting length outer pipe**
  M - Fitting1 ZA1 - Fitting2 ZA2 - (30mm x number of snap rings)

  Material loss butt/infrared fusion [mm]:

  ____

The material losses must be taken into account in the cutting length calculation for pipe-to-pipe connections.

☐ Cementing & socket connections

Z-Mass 90°/45°/T90°

Short fitting side:
ZA1 : ____________
Zi1 : ____________
Long fitting side:
ZA2 : ____________
Zi2 : ____________

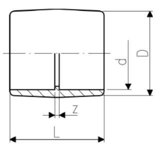
ZA : ____________
Zi : ____________

Calculation – "Short-Pipe-Long":

- **Yi Cutting length inner pipe**
  M - Fitting 1 Zi1 - Fitting2 Zi2 - (joint width z x number of pipe-to-pipe connections)
- **YA Cutting length outer pipe**
  M - Fitting1 ZA1 - Fitting2 ZA2 - (30mm x number of snap rings)

  Z-Value of welding/solvent cement socket [mm]:

  ____



The Z-Value must be taken into account when calculating the cutting length for pipe-to-pipe connections.

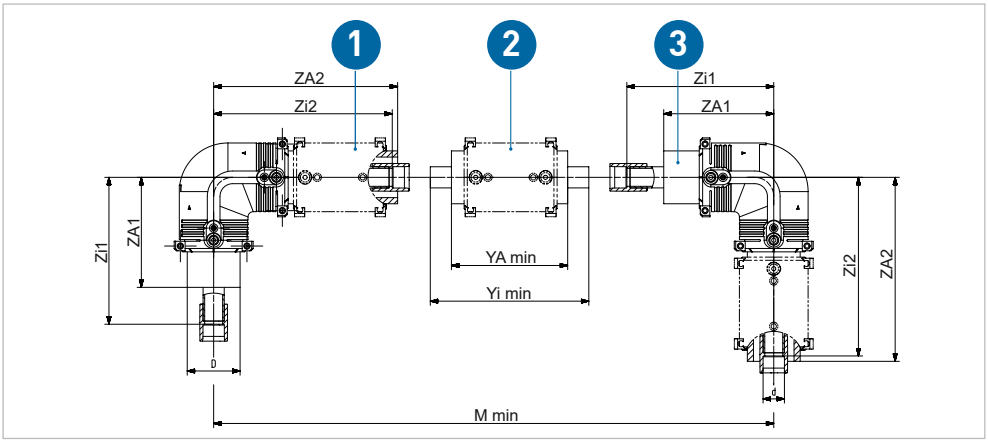
Cutting length calculation

Pipe Section No.: ________ Case: ________ M: ________ Yi: ________ YA: ________	Pipe Section No.: ________ Case: ________ M: ________ Yi: ________ YA: ________	Pipe Section No.: ________ Case: ________ M: ________ Yi: ________ YA: ________	Pipe Section No.: ________ Case: ________ M: ________ Yi: ________ YA: ________
Pipe Section No.: ________ Case: ________ M: ________ Yi: ________ YA: ________	Pipe Section No.: ________ Case: ________ M: ________ Yi: ________ YA: ________	Pipe Section No.: ________ Case: ________ M: ________ Yi: ________ YA: ________	Pipe Section No.: ________ Case: ________ M: ________ Yi: ________ YA: ________
Pipe Section No.: ________ Case: ________ M: ________ Yi: ________ YA: ________	Pipe Section No.: ________ Case: ________ M: ________ Yi: ________ YA: ________	Pipe Section No.: ________ Case: ________ M: ________ Yi: ________ YA: ________	Pipe Section No.: ________ Case: ________ M: ________ Yi: ________ YA: ________
Pipe Section No.: ________ Case: ________ M: ________ Yi: ________ YA: ________	Pipe Section No.: ________ Case: ________ M: ________ Yi: ________ YA: ________	Pipe Section No.: ________ Case: ________ M: ________ Yi: ________ YA: ________	Pipe Section No.: ________ Case: ________ M: ________ Yi: ________ YA: ________

Minimum meassures between axes M min. (Case: S – P - L)

If a very short pipe is required between two fittings, the minimum measurement between the axes must be taken into account. The shortest possible axis measurement - except for the direct fitting-to-fitting connection - can be realized by combining "Short fitting side" to "Long fitting side" (see illustration).

A sleeve/coupler can still be pushed onto the long fitting side. The second sleeve/coupler, however, has to be pushed onto the containment pipe. This leads to the fact that the outer pipe must have at least the length of the sleeve/coupler.



1 Long side
2 Coupler on containment pipe
3 Short side

General formula:

M min = 2* snap ring width + Fitting 1 ZA 1 + Fitting 2 ZA 2 + coupler length

Explanation:

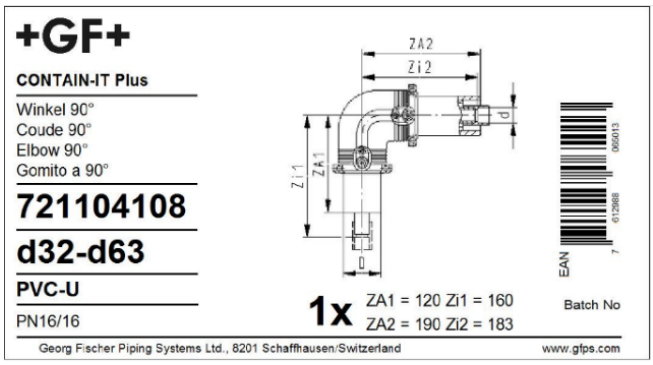
- Snap rings: Two snap rings are always required, which leads to a control gap of 30 mm for each outer pipe connection.
- Coupler length: Choice to be made between EPDM sleeves and ELGEF Plus electrofusion coupler.

Overview of socket lengths:

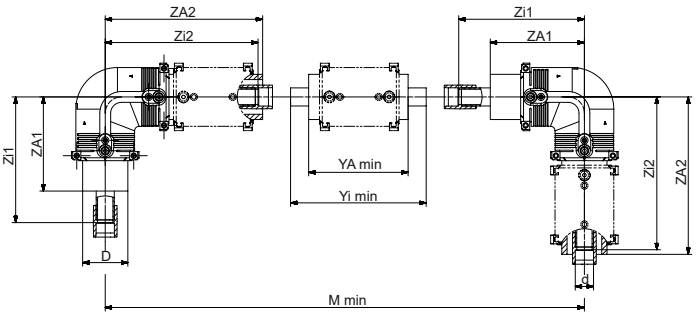
Dimension of containment pipe d [mm]	ELGEF Plus coupler (SDR11) L [mm]	EPDM sleeve L [mm]
50	88 (SDR11)	90
63	96 (SDR11)	90
75	96 (SDR11)	110
90	113 (SDR11)	100
110	138 (SDR11)	120
125	154 (SDR11)	120
140	172 (SDR11)	120
160	180 (SDR17)	120
180	192 (SDR17)	
200	206 (SDR17)	
225	225 (SDR17)	
280	252 (SDR17)	
315	267 (SDR17)	

Example for determining the minimuM dimensions between axes M min:
Long fitting side – Pipe – Short fitting side

Labeling



Measures



M min = 2*30 mm + Fitting 1 ZA1 + Fitting 2 ZA2 + Coupler length (d63 ELGEF Plus electrofusion coupler)

M min = 60 mm + 120 mm + 190 mm + (1 x 96 mm) = 466 mm

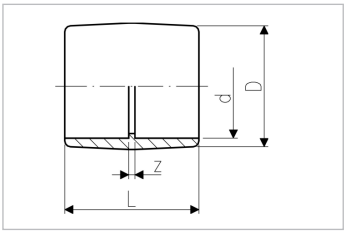
1.4.5 Cutting length calculation – Cementing

Relevant information before the calculation:

- **M dimension between axes:** This dimension either has to be measured on-site or taken from the isometric drawing.
- **Case assessment:** The case assessment is required to ensure that the correct Z-dimensions are considered for the calculation.
- **Z-dimension of double containment item:** The Z-dimensions must be gathered from the bag labels.

i To ensure a proper calculation, the use of the pipe layout chart 30° sheet is recommended.

Calculation with case example (short-pipe-long):

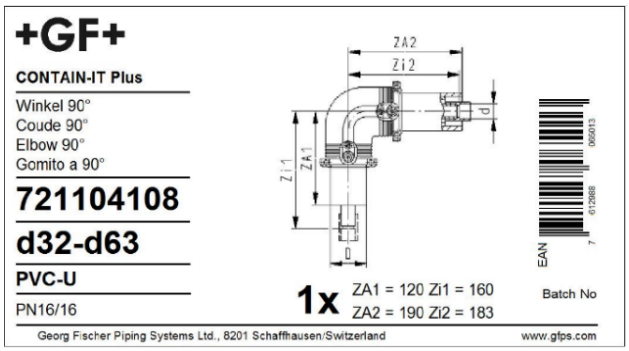


- **Yi** cutting length of inner pipe = M – Fitting 1 Zi1 – Fitting 2 Zi2 – (Z-Value z x number of pipe-to-pipe connections)
  The Z-dimensions have to be adapted in line with the isometry (case)!
- **YA** cutting length of containment pipe = M – Fitting 1 ZA1 – Fitting 2 ZA2 – (30mm x quantity of snap rings)
  The Z-dimensions have to be adapted in line with the isometry (case)!

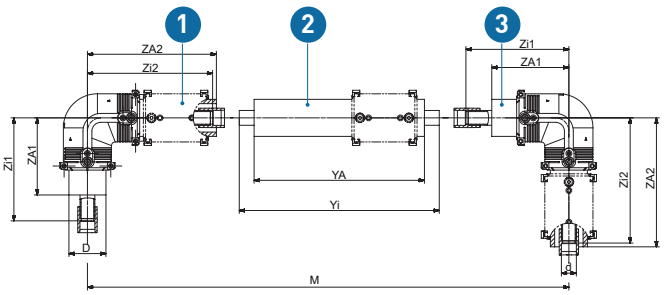
i It is essential to consider the width of the pipe stop "z" of the sockets for pipe-to-pipe connections (see illustration).

Example:

Fitting labels



Case assessment: Long side – Pipe – Short side



Case assessment: Long – Pipe – Short

M = Measure between axes = 1000 mm

1 Long side
2 Pipe
3 Short side

Yi = M – Fitting 1 Zi1 – Fitting 2 Zi2 – (Z-Value x number of pipe-to-pipe connections) = (1000 – 160 – 183) – (3 x 0) = 657 mm

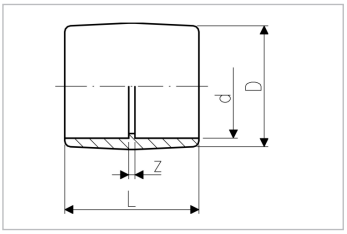
YA = M – Fitting 1 ZA1 – Fitting 2 ZA2 – (30mm x number of snap rings) = 1000 – 120 – 190 – (30 x 2) = 630 mm

1.4.6 Cutting length calculation – Socket fusion

Relevant information before the calculation:

- **M dimensions between axes:** This dimension either has to be measured on-site or taken from the isometric drawing.
- **Case assessment:** The case assessment is required to ensure that the correct Z-dimensions are considered for the calculation.
- **Z-dimension of double containment item:** The Z-dimensions must be gathered from the bag labels.

It is essential to consider the width of the pipe stop "z" of the sockets for pipe-to-pipe connections (see illustration).



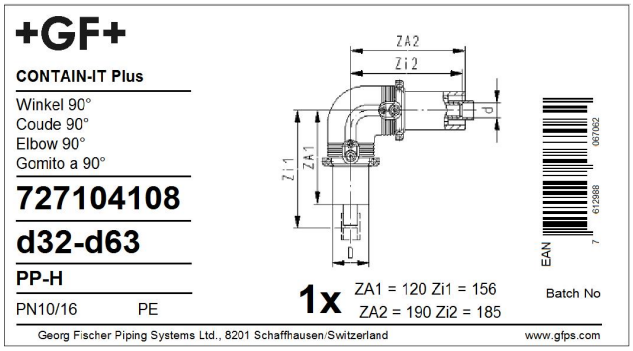
Calculation with case example (short-pipe-long):

- **Yi** cutting length of inner pipe = M – Fitting 1 Zi1 – Fitting 2 Zi2 – (Z-Value x number of pipe-to-pipe connections)
  The Z-dimensions have to be adapted in line with the isometry (case)!
- **YA** cutting length of containment pipe = M – Fitting 1 ZA1 – Fitting 2 ZA2 – (30mm x quantity of snap rings)
  The Z-dimensions have to be adapted in line with the isometry (case)!

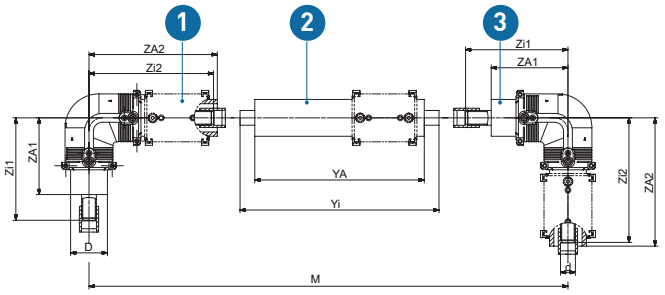
It is essential to consider the Z-Value of the sockets for pipe-to-pipe connections, see illustration.

Example:

Fitting labels



Case assessment: Long side – Pipe – Short side



Case: Long – Pipe – Short

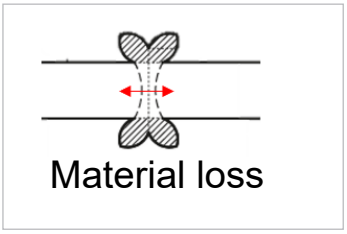
M = Measure between axes = 1000 mm

1 Long side
2 Pipe
3 Short side

Yi = M – Fitting 1 Zi1 – Fitting 2 Zi2 – (Z-Value x number of pipe-to-pipe connections) = 1000 – 156 – 185 – (3 x 0) = 659mm

YA = M – Fitting 1 ZA1 – Fitting 2 ZA2 – (30mm x number of snap rings) = 1000 – 120 – 190 – (30 x 2) = 630 mm

1.4.7 Cutting length calculation – Conventional butt fusion



Relevant information before the calculation:

- **M dimensions between axes:** This dimension either has to be measured on-site or taken from the isometric drawing.
- **Case assessment:** The case assessment is required to ensure that the correct Z-dimensions are considered for the calculation.
- **Z-dimensions of double containment item:** The Z-dimensions must be gathered from the bag labels.
- **Material loss, planing loss and welding loss:** Test welds per installer are suitable for determining the material loss, since the material loss depends on the variable planing dimension.

To ensure a proper calculation, the use of the pipe layout chart 30° is recommended.

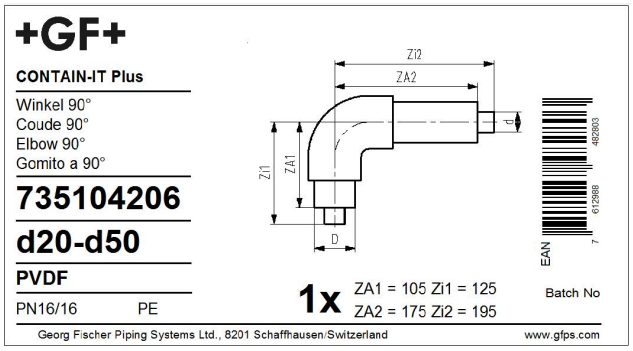
Calculation with case example (Short-Pipe-Long):

- **Yi** cutting length of inner pipe = M – Fitting 1 Zi1 – Fitting 2 Zi2 + (material loss x (number of inner pipe connections))
- **YA** cutting length of containment pipe = M – Fitting 1 ZA1 – Fitting 2 ZA2 – (30mm x quantity of snap rings)

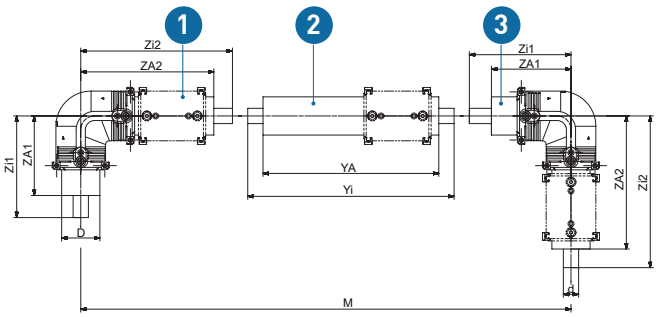
Material losses must be taken into account for inner pipe connections.

Example:

Fitting labels



Case assessment: Long side – Pipe – Short side



Case: Long – Pipe – Short , material PVDF

M = Measure between axes = 1000 mm

Material loss of test weld = 4.5 mm

1 Long side
2 Pipe
3 Short side

Yi = M - Fitting 1 Zi1 - Fitting 2 Zi2 + (material loss x (number of inner pipe connections)) = 1000 – 125 – 195 + (4.5 x 2) = 689 mm

YA = M - Fitting 1 ZA1 - Fitting 2 ZA2 - (30mm x number of snap rings) = 1000 – 105 – 175 – (30 x 2) = 660 mm

1.4.8 Cutting length calculation – infrared fusion

Relevant information before the calculation:

- **M dimensions between axes:** This dimension either has to be measured on-site or taken from the isometric drawing.
- **Case assessment:** The case assessment is required to ensure that the correct Z-dimensions are considered for the calculation.
- **Z-dimension of double containment item:** The Z-dimensions must be gathered from the bag labels.
- **Material losses, planing loss and welding loss:** With IR fusion, the material losses depend on the machine, material and dimensions. The expected material losses are shown in the tables below.

Infrared fusion machine IR-63 Plus - material losses

d (mm)	PE100 (SDR11) (mm)	PP-H (SDR11) (mm)	PVDF (mm)	ECTFE (mm)	PFA (mm)
20	5.5	5.0	4.5	4.5	4.5
25	5.5	5.0	4.5	4.5	4.5
32	5.5	5.0	4.5	4.5	4.5
40	6.0	5.0	4.5	4.5	4.5

Infrared fusion IR-110 Plus - material losses

d (mm)	PE100 (SDR11) (mm)	PP-H (SDR11) (mm)	PVDF (mm)	ECTFE (mm)	PFA (mm)
20	5.5	5.0	4.5	5.0	4.5
25	5.5	5.0	4.5	5.0	4.5
32	5.5	5.0	4.5	5.0	4.5
40	5.5	5.0	4.5	5.0	4.5
50	5.5	5.0	5.0	5.0	4.5

Infrared fusion IR-225 Plus - material losses

d (mm)	PE100 (SDR11) (mm)	PP-H (SDR11) (mm)	PVDF (mm)
63	6.5	6.0	4.5
75	6.5	6.0	4.5
90	6.5	6.0	5.0
110	6.5	6.0	5.0
125	6.5	6.0	5.0

To ensure a proper calculation, the use of the pipe layout chart 30° sheet is recommended.

Calculation with case example (Short-Pipe-Long):

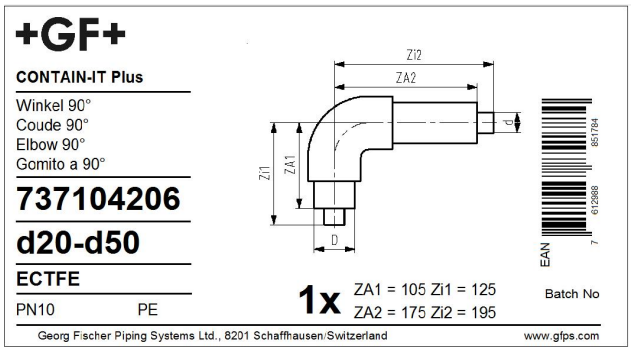
Cutting length calculation – infrared fusion

- **Yi** cutting length of inner pipe = M – Fitting 1 Zi1 – Fitting 2 Zi2 + (material loss x (number of inner pipe connections))
- **YA** cutting length of containment pipe = M – Fitting 1 ZA1 – Fitting 2 ZA2 – (30mm x number of snap rings)

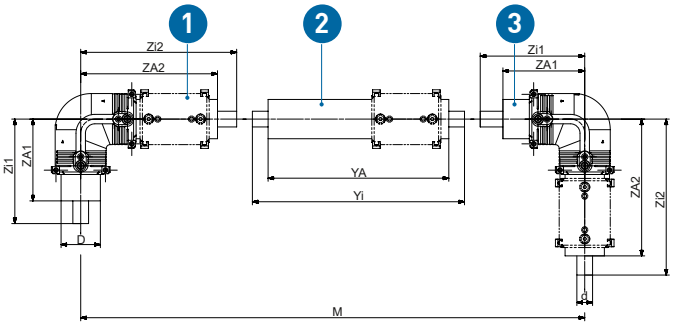
Material losses must be taken into account for inner pipe connections.

Example:

Fitting labels



Case assessment: Long side – Pipe – Short side



Case: Long – Pipe – Short , material ECTFE

M = Measures between axes = 1000 mm

1 Long side
2 Pipe
3 Short side

Yi = M - Fitting 1 Zi1 – Fitting 2 Zi2 + (material loss x (number of inner pipe connections)) = 1000 – 125 – 195 + (4.5 x 2) = 689 mm

YA = M - Fitting 1 ZA1 – Fitting 2 ZA2 – (30mm x number of snap rings) = (1000 – 105 – 175 – (30 x 2) = 660 mm

The spigots of the double containment components are supplied slightly longer and more or less consider the material losses of a mandatory weld (welder-dependent)

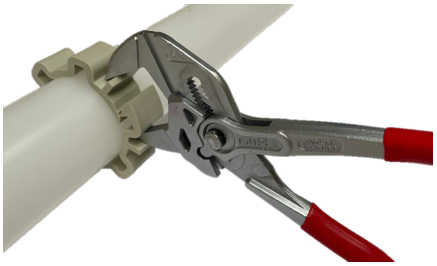
1.4.9 Preparations for inner piping system and containment piping system

Cutting the pipes

After calculating the cutting lengths, the inner and containment pipes must be cutted precisely and in a right angle according to the calculation. In addition, the pipes must be cleaned from coarse dirt to prepare them for the fusion process. It is recommended to number the cuttled pipes.

Spacers on inner pipe

The spacers must be carefully mounted/clipped onto the inner pipe by hand or with a pipe wrench. The spacer distances are specified in the results of the static evidence and stress calculation provided by Georg Fischer Piping Systems.



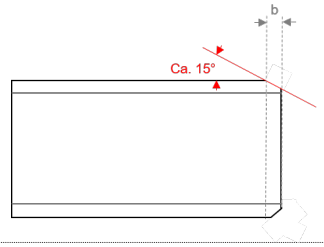
Variant 1: Preparing PE containment pipe

The PE containment pipe must be peeled with a rotary peeler. The peeling length on the pipe must be determined according to the type of the ELGEF Plus electrofusion coupler, half or full socket length. New fittings, which are taken out of the packaging just before processing do not have to be peeled. The pipe ends should be cleaned/degreased with TANGIT KS Cleaner and absorbent, clean paper.

d (mm)	Min. chip thickness (mm)	Permissible minimum pipe outer diameter (mm)
50	0.20	49.5
63	0.20	62.5
75	0.20	74.4
90	0.20	89.4
110	0.20	109.4
125	0.20	124.4
140	0.20	139.4
160	0.20	159.4
180	0.20	179.4
200	0.20	199.4
225	0.20	224.4
280	0.20	279.3

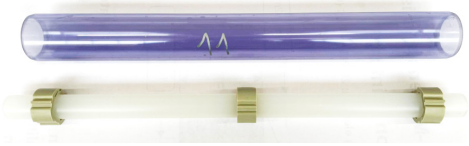
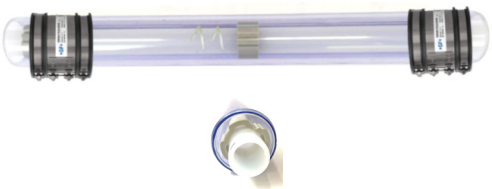
Variant 2: Preparing PVC-U containment pipe

The PVC-U (transparent) containment pipe must be chamfered and deburred for pipe-to-pipe connections. This allows the pipe to be easily centered in the socket and does not shift the adhesive. Chamfering and deburring has also proven effective for pipe-fitting connections for easy sliding on of the EPDM sleeve and prevents surface damage to the sealing material.



d (mm)	b (mm)
6-16	1-2
10-55	2-3
63-160	3-6

Overview

Variant 1: PE Containment pipe	Variant 2: PVC-U (transparent) Containment pipe
1. The cleaned containment pipe has a different length compared to the inner pipe (gray/ white, with clipped-on spacers).	
Peeled and cleaned welding surfaces	Chamfered and deburred pipe ends
	
2. The inner pipe is pushed into the containment pipe. Thanks to the spacer, the inner pipe is centered in the outer pipe.	
3. ELGEF Plus couplers or EPDM couplers must be mounted on the containment pipes or the long fitting sides before the connection of the inner pipe.	
Immediately before use, remove the ELGEF Plus electrofusion coupler from the bag without contaminating it. The center stop must be removed and the coupler must be pushed completely over the peeled pipe end. Especially in the case of outdoor installations, a PE stretch foil is strongly recommended to protect the welding areas from contamination or moisture.	The pipe ends and long fitting sides must be be cleaned/degreased with TANGIT KS Cleaner and absorbent paper. Finally the EPDM sleeves must be pushed on it.
	
	
In the next step, the inner pipe connection can be realized.	

1.4.10 Connection the inner pipe

The welding directives of the DVS (German Welding Society) and the cementing instructions of the KRV (Kunststoffrohrverband e.V.) are applicable without restriction to both the containment and inner pipe connections. The following chapter deals with the special features of the double containment pipe system. Detailed information on the connection technology of the inner- and containment pipes are provided in the relevant chapters of the Planning Fundamentals.

Overview of the inner pipe connection technologies

Dimension (mm)	Inner pipe											
	Socket cementing				Socket fusion			Butt welding				IR fusion
	PVC-U Tangit	PVC-U Dytex	PVC-C Tangit	PVC-C Dytex	PP-H SDR11	PE80 SDR11	PVDF SDR21	PP-H SDR11	PE100 SDR11	PVDF SDR21	PVDF SDR33	ECTFE SDR21
d20/D50	✓	✓	✓	✓	✓	✓	✓	•	•	•		✓
d25/D50	✓	✓	✓	✓	✓	✓	✓	•	•	•		✓
d32/D63	✓	✓	✓	✓	✓	✓	✓	•	•	•		✓
d40/D75	✓	✓	✓	✓	✓	✓	✓	•	•	•		✓
d50/D90	✓	✓	✓	✓	✓	✓	✓	•	•	•		✓
d63/D110	✓	✓	✓	✓	✓	✓	✓	•	•	•		✓
d75/D125	✓	✓	✓	✓	✓	✓		•	•	•		✓
d90/D140	✓	✓	✓	✓	✓	✓		•	•	•		✓
d110/D160	✓	✓	✓	✓	✓	✓		•	•	•		✓
d125/D180	✓							✓	✓		✓	
d140/D200	✓							✓	✓		✓	
d160/D225	✓							✓	✓		✓	
d200/D280	✓							✓	✓		✓	
d225/D315	✓							✓	✓		✓	

- Compatible with butt and infrared fusion (IR)

1.4.11 Inner pipe – Socket cementing

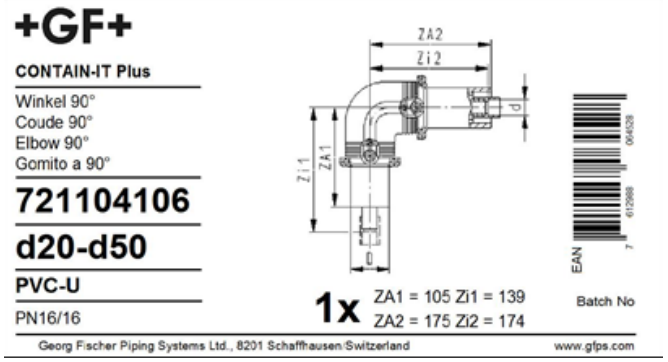
Detailed information on the connection technology for the inner pipe is provided in the Planning Fundamentals and/or the cementing instructions (KRV) and are valid without any limitation.

Fitting design

Since the axial dimension (Z-dimension) is the same for 90° angle, 45° angle and T-piece, only the 90° angles are listed here. However, this only applies to fittings made of the same material and using the same jointing method.

Double containment fittings are provided with a socket on the long fitting side at the factory. This allows direct "fitting to fitting" connections with the shortest possible axial dimension, ("fitting side long" directly to "fitting side short"). The Z-dimensions are noted on the bag label, (see illustration).

Fittings - PVC-U/PVC-C (cementing)



ELGEF Plus sockets and EPDM couplers must be ordered separately.

Final inspection before cementing

ELGEF Plus sockets or EPDM couplers must be pushed onto the containment pipe ends or the long fitting sides before the inner pipe connection is done.

1.4.12 Inner pipe – Socket fusion

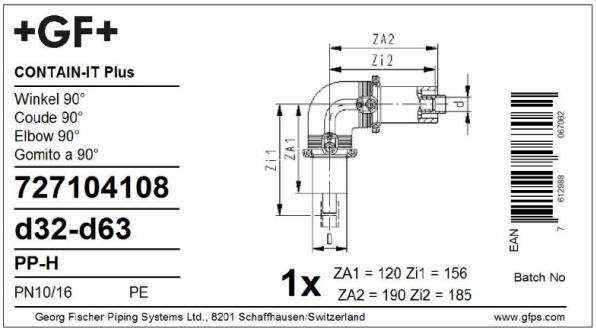
Due to the fact that the axis dimensions (Z-dimensions) are the same for angle 90°, angle 45° and T-piece, only the 90° angles are listed here. This applies only to fittings made of the same material and the same connection method.

Fitting design

Since the axial dimension (Z-dimension) is the same for 90° angle, 45° angle and T-piece, only the 90° angles are listed here. However, this only applies to fittings made of the same material and using the same jointing method.

Double containment fittings are provided with a socket on the long fitting side at the factory. This allows direct "fitting to fitting" connections with the shortest possible axial dimension, "fitting side long" directly to "fitting side short". The Z-dimensions are noted on the bag label (see illustration).

Fittings - PP-H (Socket fusion)



ELGEF Plus sockets and EPDM couplers must be ordered separately.

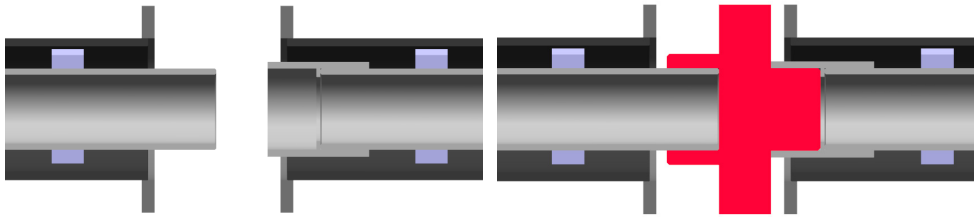
Final inspection before welding

ELGEF Plus couplers or EPDM couplers must be pushed onto the containment pipe ends or the long fitting sides before the inner pipe connection is done.

Fusion machines – Overview

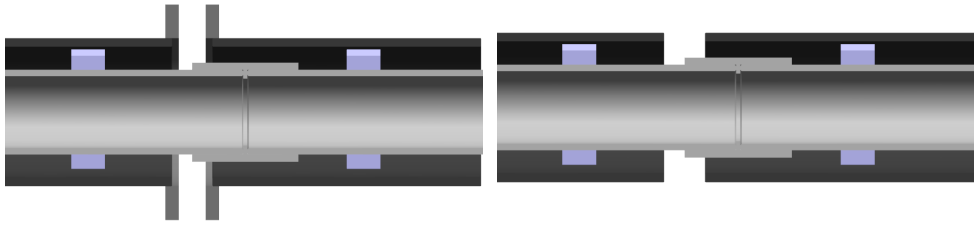
Dimension		SG 160	
			
Inner pipe	Containment pipe	Fitting – Fitting	Fitting – Pipe
d20	D50	✓ (*)	✓
d25	D50	✓ (*)	✓
d32	D63	✓ (*)	✓
d40	D75	✓ (*)	✓
d50	D90	✓ (*)	✓
d63	D110	✓ (*)	✓
d75	D125	✓ (*)	✓
d90	D140	✓ (*)	✓
d110	D160	✓ (*)	✓ (*)
d125	D180		
d140	D200		
d160	D225		
d200	D280		
d225	D315		
*Notes:		Adjusting the machine stop (pipe dependent)!	Unscrew the sheet metal of the prism!

Socket fusion – Procedure



1. **Clamping:**
   Clamping collars shell inner pipe and/or socket

2. **Standard Heating element socket fusion:**
   Inner pipe and socket are heated up simultaneously

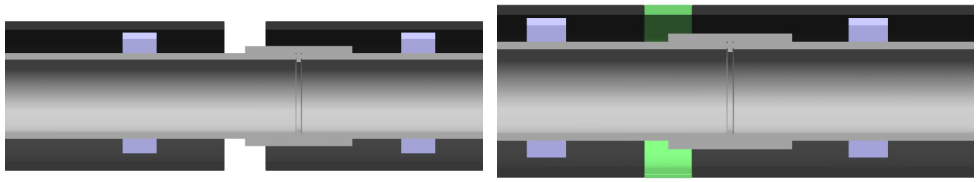


3. **Fusion:**
   Inner pipe and socket are overlapped together

4. **Cooling time and unclamping:**
   Waiting for cooling time, unclamping, control gap remains in outer tube (30mm)

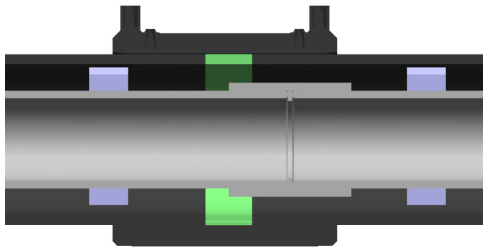
Next steps

For a detailed description, see chapters "Pressure test and visual inspection of the inner pipe", "Sealing the containment pipe" and "Instructions for internal and external pressure test"



5. **Visual inspection of inner pipe connection:**
   Visual inspection and evaluation of the inner pipe connection, followed by a pressure test

6. **Snap ring in control gap:**
   Place a snap ring (30 mm) between the ends of the containment pipe



7. **Sealing containment pipe and pressure test:**
   ELGEF Plus electrofusion coupler creates a pressure-resistant seal on the containment pipe or the EPDM coupler provides splash protection, followed by a pressure test of the containment pipe

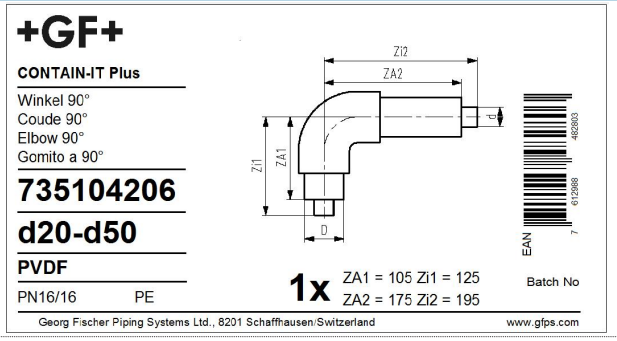
1.4.13 Inner pipe – conventional butt welding

Detailed information on the connection technology for the inner pipe is provided in the Planning Fundamentals and/or the cementing instructions issued by the DVS and are valid without any limitation.

Fitting design

From the central axis to the leading edge/spigot end, all fitting types have the same Z-dimensions (i.e. same axis mass). This only applies to fittings made of the same material and using the same joining method!
The Z-dimensions are noted on the bag label, see illustration.

Fitting - PVDF (Butt Fusion)

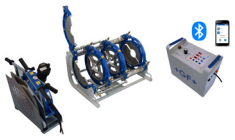
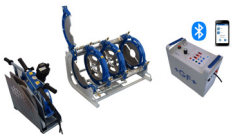


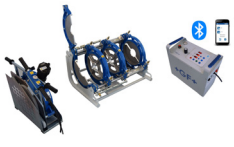
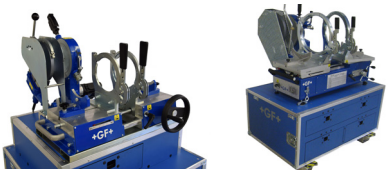
ELGEF Plus sockets and EPDM couplers must be ordered separately.

Final inspection before welding

ELGEF Plus couplers or EPDM couplers must be pushed onto the containment pipe ends or the long fitting sides before the inner pipe connection is done.

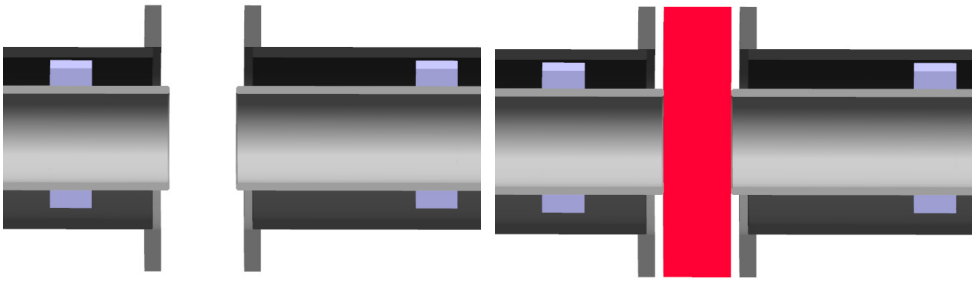
Welding machines – Overview

Dimension		SG 160		TM 160		TM 250		TM 315 RU 315	
											
Inner pipe	Containment pipe	Fitting – Fitting	Fitting – Pipe	Fitting – Fitting	Fitting – Pipe	Fitting – Fitting	Fitting – Pipe	Fitting – Fitting	Fitting – Pipe
d20	D50								
d25	D50								
d32	D63	✓	✓						
d40	D75	✓	✓	- (*)	✓ (*)				
d50	D90	✓	✓	- (*)	✓ (*)				
d63	D110	✓	✓	- (*)	✓ (*)				
d75	D125	✓	✓	- (*)	✓ (*)	- (*)	✓ (*)		
d90	D140	✓	✓	- (*)	✓ (*)	- (*)	✓ (*)	- (*)	✓ (*)
d110	D160	✓	✓			- (*)	✓ (*)	- (*)	✓ (*)
d125	D180					- (*)	✓ (*)	- (*)	✓ (*)
d140	D200					- (*)	✓ (*)	- (*)	✓ (*)
d160	D225							- (*)	✓ (*)
d200	D280							- (*)	✓ (*)
d225	D315								
*Notes:			Rake from machine	Finger protection!	Rake off machine!	Finger protection	Rake off machine!	Finger protection!	

Dimension		GF 400		IM 160		IM 315		MC 110	
											
Inner pipe	Containment pipe	Fitting – Fitting	Fitting – Pipe	Fitting – Fitting	Fitting – Pipe	Fitting – Fitting	Fitting – Pipe	Fitting – Fitting	Fitting – Pipe
d20	D50		Tested Q2/22					✓ (*)	✓ (*)
d25	D50		Tested Q2/22					✓ (*)	✓ (*)
d32	D63		Tested Q2/22	✓	✓			✓	✓
d40	D75		Tested Q2/22	✓	✓			✓	✓
d50	D90		Tested Q2/22	✓	✓			✓	✓
d63	D110		Tested Q2/22	✓	✓				✓
d75	D125		Tested Q2/22	✓	✓				
d90	D140		Tested Q2/22	✓	✓	✓	✓		
d110	D160		Tested Q2/22	✓	✓	✓	✓		
d125	D180		Tested Q2/22			✓	✓		
d140	D200		Tested Q2/22			✓	✓		
d160	D225		Tested Q2/22			✓	✓		
d200	D280		Tested Q2/22			✓	✓		
d225	D315		Tested Q2/22			✓	✓		
*Notes:		Finger protection!						IR Plus preferred due to weld bead size	

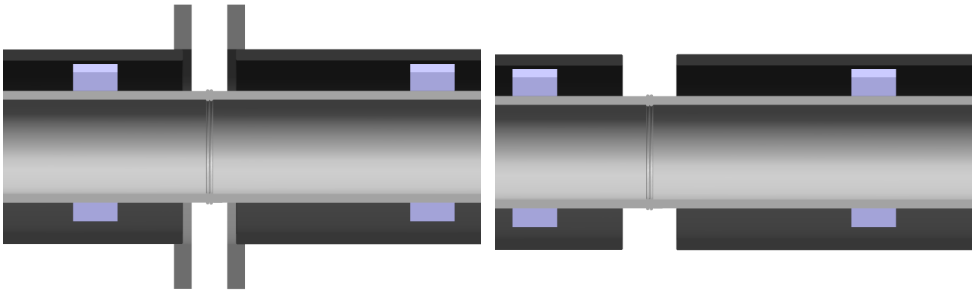
Dimension		MD 160	
			
Inner pipe	Containment pipe	Fitting – Fitting	Fitting – Pipe
d20	D50		
d25	D50		
d32	D63		
d40	D75		
d50	D90	✓	✓
d63	D110	✓	✓
d75	D125	✓	✓
d90	D140	✓	✓
d110	D160	✓	✓
d125	D180		
d140	D200		
d160	D225		
d200	D280		
d225	D315		
*Notes:			

Conventional butt weld – procedure



1. **Clamping:**
   Clamping collars hold inner pipe and/or internal fitting

2. **Heating element butt welding:**
   Inner pipe and fitting are heated up at the same time

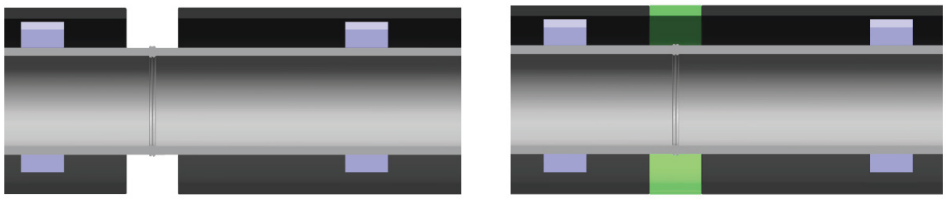


3. **Joining:**
   Inner pipe and fitting are welded together

4. **Cooling down time and unclamping:**
   Wait for the cooling down time to end before unclamping, safety gap remains in containment pipe (30 mm)

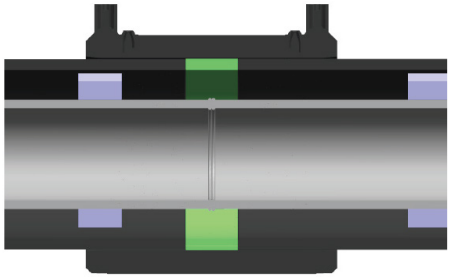
Next steps

For a detailed description, see chapters "Pressure test and visual inspection of the inner pipe", "Sealing the containment pipe" and "Instructions for internal and external pressure test"



5. **Visual inspection of inner pipe connection:**
   Visual inspection and assessment of the inner pipe connection, followed by a pressure test

6. **Snap ring in safety gap:**
   Place a snap ring (30 mm) between the ends of the containment pipe



7. **Sealing containment pipe and pressure test:**
   ELGEF Plus electrofusion coupler creates a pressure-resistant seal on the containment pipe or the EPDM coupler provides splash protection, followed by a pressure test of the containment pipe

1.4.14 Inner pipe – infrared butt fusion

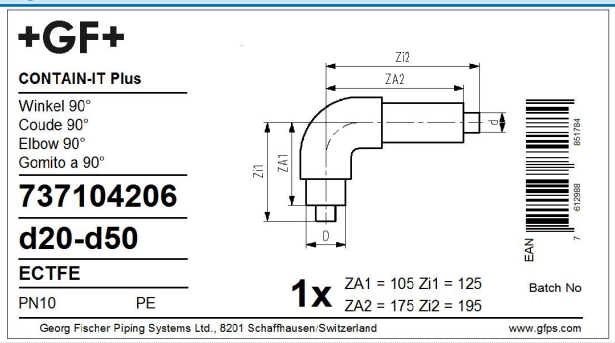
Detailed information on the connection technology for the inner pipe is provided in the Planning Fundamentals and/or the cementing instructions issued by the DVS and are valid without any limitation.

Fitting design

From the center axis to the front edge/spigot end, all fitting types have the same Z-dimensions (i.e. same dimension between axes). This applies only to fittings made from the same material using the same jointing method.

The Z-dimensions are noted on the bag label (see figure).

Fitting - ECTFE (IR-Fusion)



ELGEF Plus sockets and EPDM couplers must be ordered separately.

Final inspection before welding

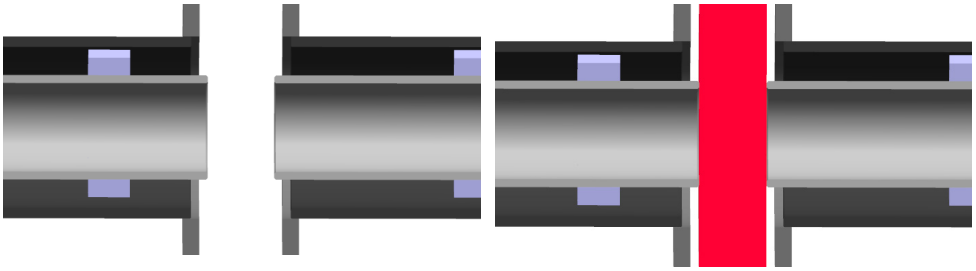
Before the inner pipe connection is made, ELGEF Plus couplers or EPDM couplers must be pushed onto the containment pipe ends or onto the long fitting sides.

Fusion machines - overview

Dimension	IR-63 Plus			IR-110 Plus			IR-225 Plus		
									
Inner pipe	Contain-ment pipe	Fitting – fitting	Fitting – pipe	Special half shell	Fitting – fitting	Fitting – pipe	Special half shell	Fitting – fitting	Fitting – pipe	Special half shell
d20	D50	✓	✓	790 131 090	✓	✓	790 132 190			
d25	D50	✓	✓	790 131 091	✓	✓	790 132 191			
d32	D63	✓	✓	790 131 092	✓	✓	790 132 192			
d40	D75	✓	✓	790 131 093	✓	✓	790 132 193			
d50	D90				✓	✓	790 132 194			
d63	D110							✓	✓	790 133 090
d75	D125							✓	✓	790 133 091
d90	D140							✓	✓	790 133 092
d110	D160							✓	✓	790 133 093
d125	D180							✓	✓	790 133 094
d140	D200									
d160	D225									
d200	D280									
d225	D315									

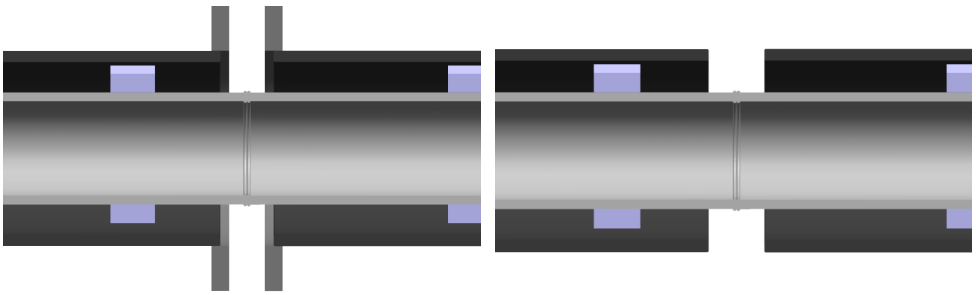
Automated infrared fusion machines cannot be used for the CONTAIN-IT Plus system.

Infrared butt weld – procedure



1. **Clamping:**
   Clamping collars hold inner pipe and/or internal fitting

2. **Heating element butt welding:**
   Pipe and fitting are heated up at the same time

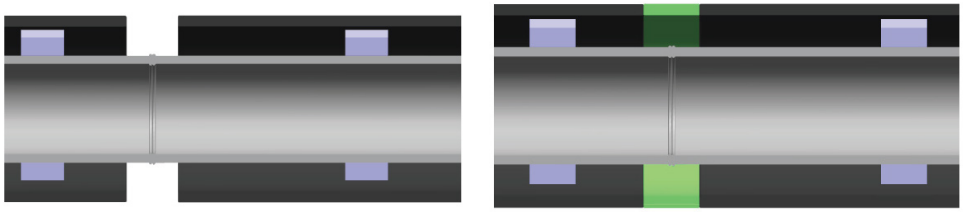


3. **Joining:**
   Inner pipe and fitting are welded together

4. **Cooling down time and unclamping:**
   Wait for the cooling down time to end before unclamping, safety gap remains in containment pipe [30 mm]

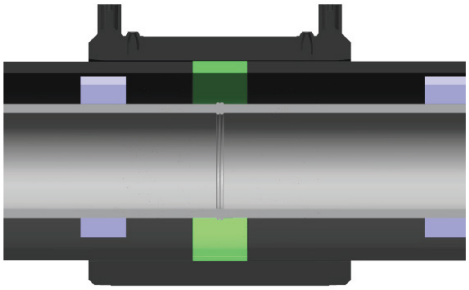
Next steps

For a detailed description, see chapters "Pressure test and visual inspection of the inner pipe", "Sealing the containment pipe" and "Instructions for internal and external pressure test"



5. **Visual inspection of inner pipe connection:**
   Visual inspection and assessment of the inner pipe connection, followed by a pressure test

6. **Snap ring in safety gap:**
   Place a snap ring [30 mm] between the ends of the containment pipe

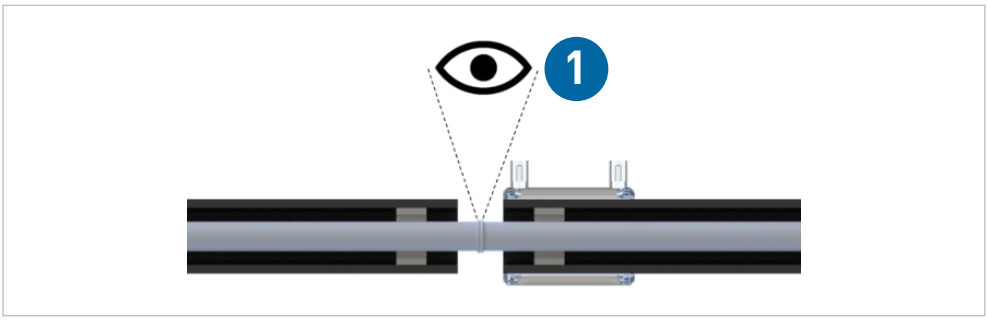


7. **Sealing containment pipe and pressure test:**
   ELGEF Plus electrofusion coupler creates a pressure-resistant seal on the containment pipe or the EPDM coupler provides splash protection, followed by a pressure test of the containment pipe

1.4.15 Visual inspection of the inner pipe and pressure test

Visual inspection of the inner pipe

Thanks to the innovative connection technology, a gap of 30 mm appears in the containment pipe and this allows a visual inspection and assessment of the inner pipe connection in accordance with DVS 2210-2 among others. As a result of this technology, there are no blind connections anywhere in the piping system.



1 Visual inspection and pressure test of the inner pipe!

Pressure test

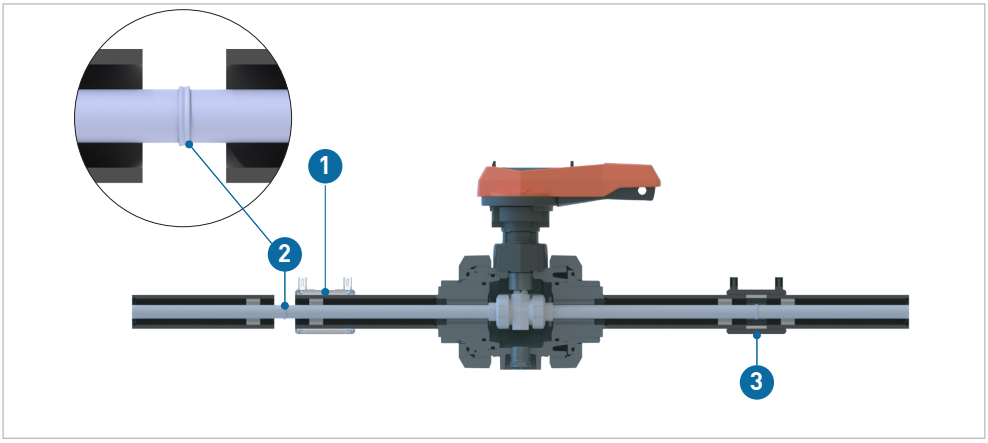
The pressure test of the inner pipe requires the pipe or pipe sections to be operational. A section-by-section pressure test is the suitable method, depending on the accessibility and length of the pipe (in-situ welding, etc.). The test pressure load ought to furnish experimental proof of operational safety. The precise procedure for the internal pressure test is described in the chapter "Pressure test of inner pipe".

1.4.16 Sealing the containment pipe

After a successful visual inspection of the inner pipe connection and a successful pressure test of the inner pipe, the containment pipe is sealed.

Various procedures are followed, depending on the containment pipe material:

- Variant 1 with PE100 System: ELGEF Plus electrofusion couplers
- Variant 2 with PVC-U (transparent) system: EPDM couplers and cementing



1 ELGEF electrofusion coupler; alternative: EPDM coupler
2 Visual inspection of inner pipe connection and pressure test of inner pipe
3 Centering of the snap ring in the ELGEF electrofusion coupler (gray) and closing of the containment pipe

Variant 1 – containment pipe material PE100

The connections in the containment pipe system are made by means of pressure-resistant and tight ELGEF Plus electrofusion couplers. The instructions for the electrofusion of sockets must be followed (clean welding zone, etc.). Holding devices are to be used wherever possible to ensure a stress-relieved welding process.

Calculating the insertion depth:

The 30 mm long gap in the containment pipe must be sealed by a PE snap ring prior to welding. This gap of 30 mm should be included in the calculation of the insertion depth and reduces the insertion depth by 15 mm on each side, see calculation.

Insertion depth = ½ socket length – snap ring(mm)

$$\text{Snap ring width} = \frac{30\ \text{mm}}{2} = 15\ \text{mm}$$

Insertion depth = ½ socket length – 15 mm

Length: ELGEF Plus electrofusion couplers

d (mm)	SDR	L (mm)	Insertion depth ½L – 15 (mm)	SDR pipe
50	11	88	29.0	9.0 - 11.0
63	11	96	33.0	9.0 - 17.6
75	11	110	40.0	9.0 - 17.6
90	11	125	47.5	9.0 - 17.6
110	11	145	57.5	9.0 - 17.6
125	11	156	63.0	9.0 - 17.6
140	11	166	68.0	9.0 - 17.6
160	17	180	75.0	9.0 - 26.0
180	17	192	81.0	9.0 - 26.0
200	17	206	88.0	9.0 - 26.0
225	17	225	97.5	9.0 - 26.0
280	17	252	111.0	9.0 - 26.0
315	17	267	118.5	9.0 - 26.0

Marking

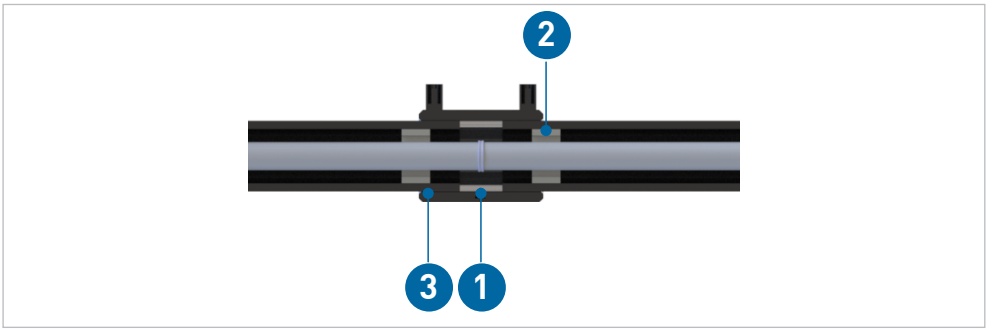
The calculated insertion depth has to be marked on both sides (pipe-pipe, pipe-fitting, etc.) two markings per connection.

Snap ring

Next, the snap ring has to be pushed over the 30 mm wide safety gap. The containment pipe ends must be in contact with the snap ring without any gap. Generally, distances of <2mm (up to d110) per side from snap ring to pipe ends are within tolerance. This calls for a highly precise measurement and the containment pipe to be cut at right angles.

Welding process

The PE stretch foil has to be removed from the ELGEF Plus socket immediately before the containment pipe is sealed. The ELGEF Plus socket must then be pulled over the safety gap/ snap ring and closed flush with the markings on both sides. If the electrofusion coupler is pulled over without a snap ring, the containment pipe can move and a reliable sealing is then no longer guaranteed. The snap ring must be located in the middle of the ELGEF Plus socket (cold zone).

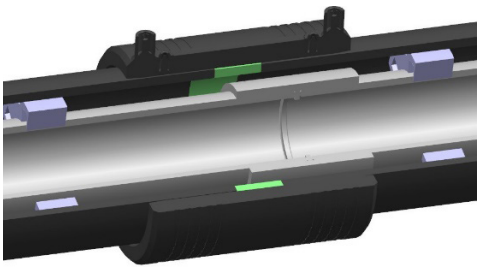


1 Snap ring
2 Spacer
3 ELGEF electrofusion coupler; alternative: EPDM coupler

Welding machine and connection

Next, stress-relieved welding must be carried out using a MSA welding tool and a holding device.

Snap ring 30 mm

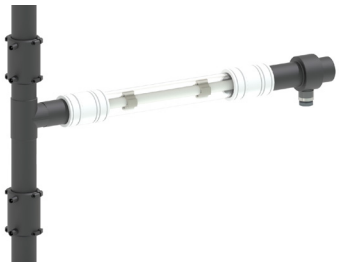


MSA welding tool for ELGEF Plus socket with GPS function

Variant 2 - containment pipe material PVC-U (transparent)

The pipes to fitting connections in the containment pipe systems are made using non-tensile-tight and splash protection EPDM couplers (PN1). The straight pipe connections (pipe-pipe) are made as a cemented connection (Tangit).

EPDM coupler



Mechanical connections: fitting to pipe or fitting to fitting

EPDM couplers are used for the transition between PVC-U pipe (transparent) and the CONTAIN-IT Plus fitting (PE).

Cemented connection: pipe to pipe

Since the EPDM coupler does not offer tensile strength itself, Georg Fischer Piping Systems recommends cemented connections (PVC-U cementing sockets) for straight pipe runs. Information on the cementing process is provided in the chapter PVC-U (transparent) in the "Georg Fischer Planning Fundamentals" and is valid without any limitation.

Calculating the insertion depth: EPDM coupler

The 30 mm wide gap between PVC-U pipe and PE fitting needs to be sealed using a PE snap ring. The gap of 30mm must be taken into account when calculating the insertion depth and reduces the insertion depth by 15mm per side (see calculation).

Insertion depth = ½ socket length – snap ring(mm)

$$\text{Snap ring width} = \frac{30\ \text{mm}}{2} = 15\ \text{mm}$$

Insertion depth = ½ socket length – 15 mm

Length: EPDM couplers

d (mm)	EPDM coupler L (mm)	Insertion depth ½L – 15 (mm)
50	90	30
63	90	30
75	110	40
90	100	35
110	120	45
125	120	45
140	120	45
160	120	45

Calculating the insertion depth: cementing sleeve

$$t = \frac{d}{2} + 6\ \text{mm}$$

t = insertion depth for pipes (mm)

d = pipe external diameter (mm)

Marking

The calculated insertion depth is marked on the pipe ends, as well as on the fitting supports. Therefore, each connection has two markings.

Snap ring

The snap ring must be located in the middle of the EPDM coupler. The containment pipe ends must be in contact with the snap ring without any gap. Snap rings must not be used for cementing sockets.

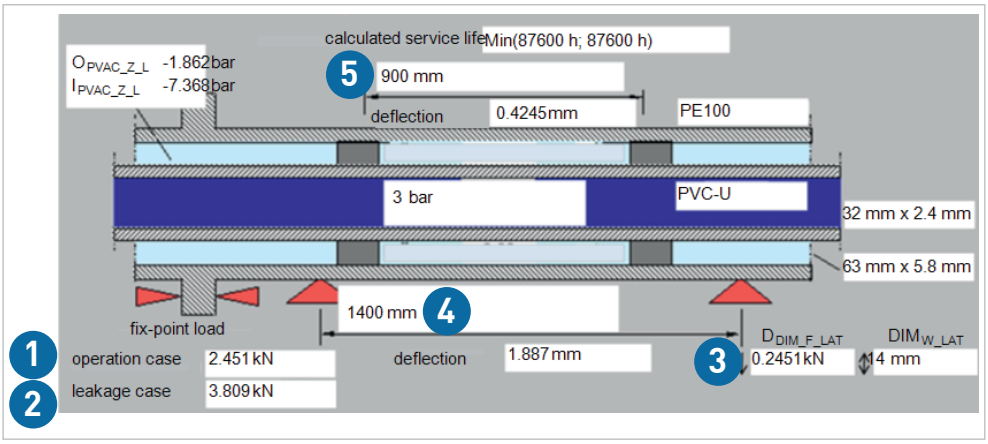
Connection

Clean the right angle cut containment pipe with a clean cloth and slide the sleeve over the safety gap/snap ring. The snap ring must be centered in the rubber sleeve. Tighten the rubber sleeve according to the torque on the label.

1 Snap ring: 30 mm
2 Inner pipe connection
3 PVC-U (transparent) pipe
4 CONTAIN-IT Plus components (PE containment pipe)

1.4.17 Fixed point installation

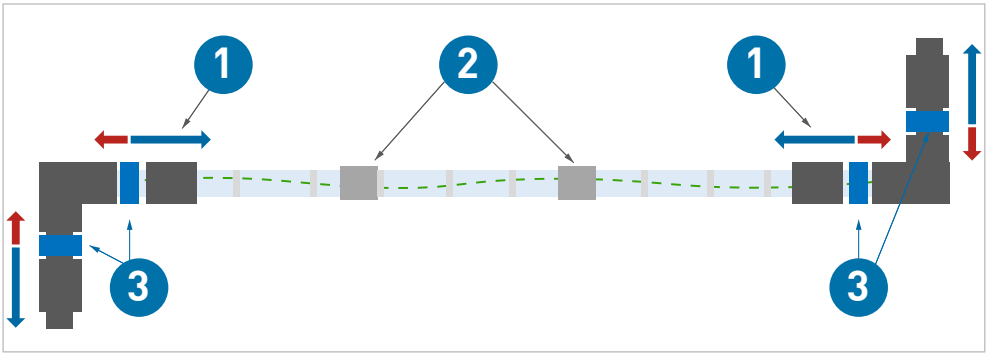
A central component of a safe installation is the result of the "Questionnaire for Static Proof and Stress Calculation". Based on this information, the steel structure (pipe clamps, guide bearing distances, etc.) must be designed.



1 Axial load at fixed point during operation [kN]
2 Axial load at fixed point in case of a leakage [kN]
3 Lateral load at support clamps [kN]
4 Suport clamp distances [mm]
5 Spacer distances [mm]

Installation technology data

Due to a variety of process conditions, double containment systems must be installed as a fixed point installation. To prevent thermal expansion/contraction, the containment pipe must be fixed to the steel structure at every change of direction.



1 Connection with EPDM coupler
2 Connection with cementing sockets
3 Fixed point to steel structure

Thanks to this connection technology, no additional expansion loops or compensators are required.

Installation example of a fixed point installation:

1.4.18 Leakage detection and containment

For the operation of a double containment system, devices for the control, indication or permanent monitoring of a leakage must be provided.

When dividing the interstitial space into monitoring sections by means of end fittings, it must be ensured that each section is equipped with a monitoring device.

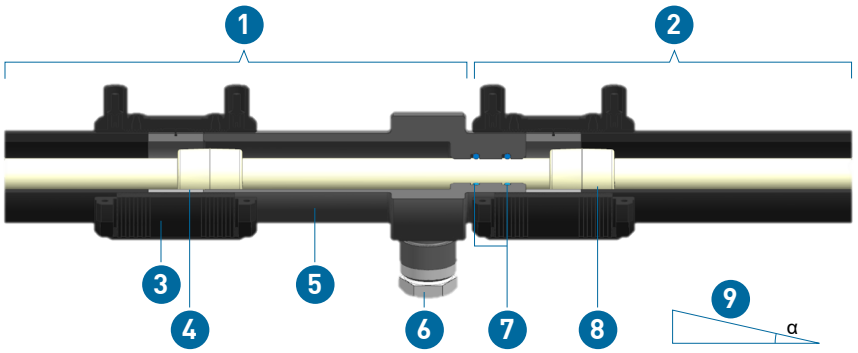
Leakage containment: Segmentation into monitoring sections

When dividing a large interstitial space into leakage monitoring sections using end fittings, the leaking medium can only spread in the pipe section or interstitial space between the installed end fittings (EPDM seals).

For more information on planning, see chapter "Determining leakage detection".

Advantages

- Fast and reliable leakage detection
- Only the identified section of the containment pipe has to be purged and cleaned
- Length of the leakage detection sections is freely selectable

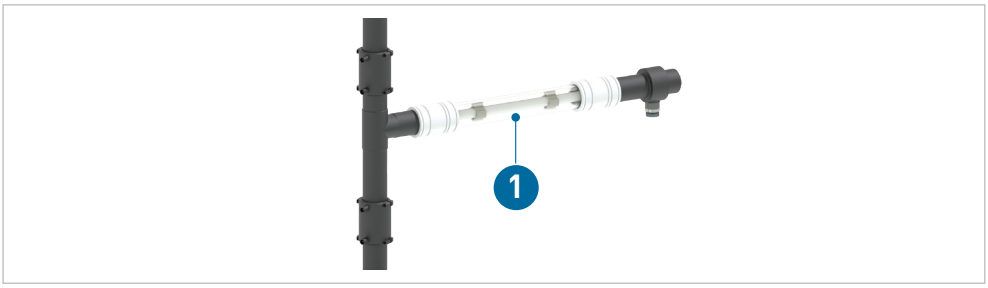


1 Section 1 - Monitoring section
2 Section 2 - Monitoring section
3 Electrofusion coupler
4 Snap ring
5 PE support of end fitting
6 Connection for leackage detection
7 EPDM seals (2x)
8 Inner pipe with socket connection
9 Gradient to be considered

Attention! If end fittings are used to connect a low point leakage detection solution, the installation direction of the end fittings should be taken into account since there is only one connection per end fitting in an monitoring room (section). In addition, the pipe should be installed on a gradient (min. 2-3°) so that creeping leakages can be detected as quickly as possible at the lowest point of the monitoring section. Further information can be found in the chapter "Defining the leakage detection solution".

Leakage detection solutions

1. Visual solution: transparent containment pipe



1 PVC-U: Transparent containment pipe

The PVC-U Transparent Splash Protection System (PN1) is an ideal solution for quick leakage localization. Due to the transparent containment pipe system, leaks on straight pipe sections can be quickly detected and repaired.

Routine checks needs to be determined by the operator according to the risk assessment and are mandatory for safe operation!

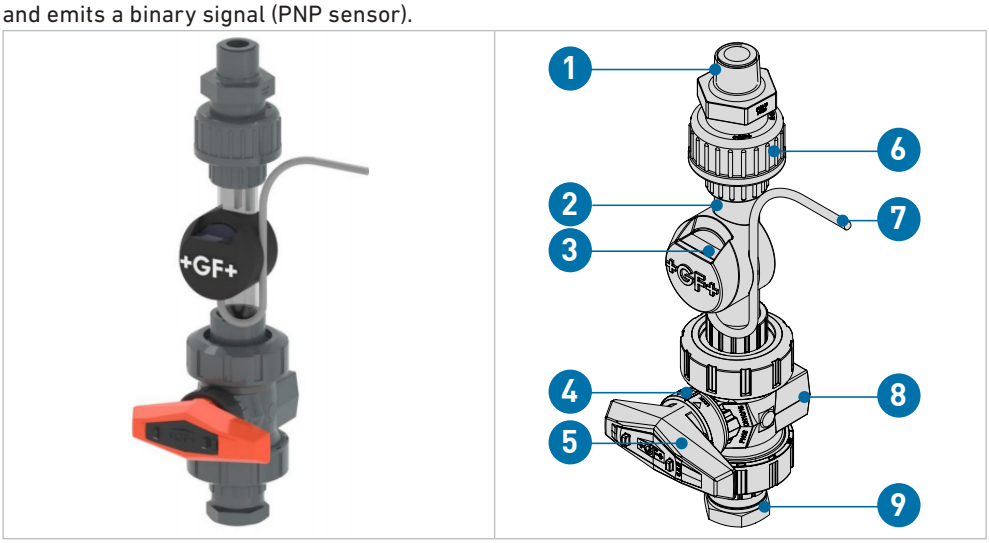
2. Inspection glass: transparent monitoring pipe

For optical leakage monitoring by means of a inspection glass, a 546 Pro ball valve (d20) with a transparent monitoring tube made of PVC-U is attached to the Rp ½" connection of the end fitting or to the connection clamp. Alternatively, the standard fittings also offer a connection option.

To ensure that even a small amount of the escaping medium covers the measuring point in the event of a leak, the inspection glass must be mounted at the lowest point of the interstitial space. Routine checks needs to be determined by the operator according to the risk assessment and are mandatory for safe operation!

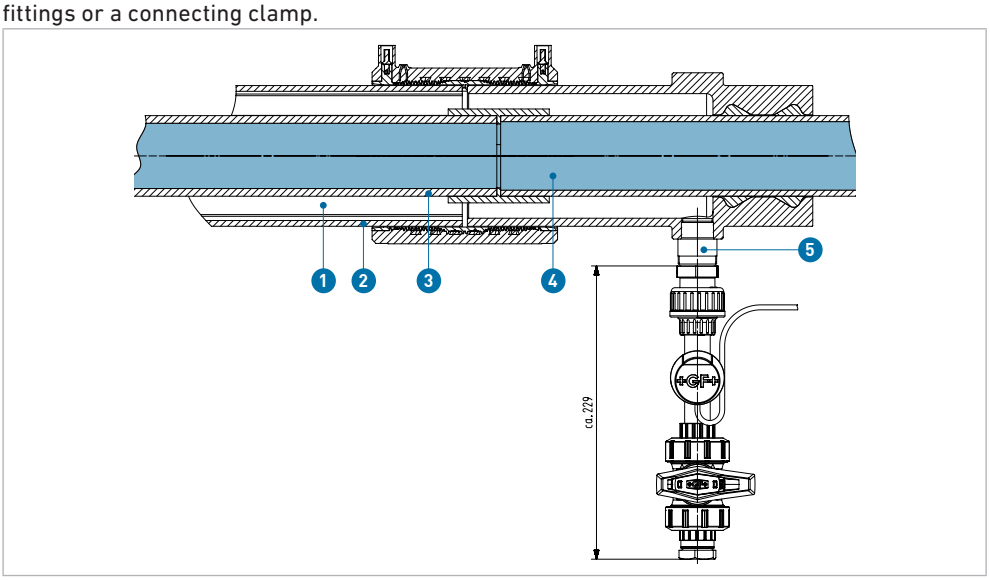
3. Electrical solutions: capacitive sensor

The double containment leakage detection sensor detects escaping fluids (dielectric constant εr > 4.0) in the monitoring room of Georg Fischer Piping Systems double containment system and emits a binary signal (PNP sensor).



1 Monitoring room connection R½"
2 Transparent monitoring tube
3 Type 2286 sensor with LED indicator (green/yellow)
4 Locking mechanism
5 Ball valve handle (closed)
6 Union nut
7 Connection cable 5 m (3x 0.14 mm²)
8 Ball valve type 546 Pro
9 Flushing connection (Rp ½") with plug (R½")

To ensure that in the event of a leakage even a small amount of the escaping medium covers the measuring point, which thus leads to a change in the dielectric permettivity, the double containment detection sensor must be mounted at the lowest point of the interstitial space. Access to the interstitial space can be realized by means of the Rp ½" connections of the end fittings or a connecting clamp.



Detailed information can be found in the operating instructions of the Type 2286 Leakage Sensor.

4. Leakage detection cable

Alternatively, a cable can be installed in the space between the inner and containment pipe, which reacts either to conductive liquids or to chemicals, and triggers an alarm. The installation of a leak detection cable requires special attention and represents an additional effort in production, planning and installation. The installation of a leak detection cable in Georg Fischer Piping Systems standard double containment fittings is not possible and requires a detailed consultation with the local Georg Fischer Piping Systems branch. Custom solutions may be possible on request.

Advantages	Disadvantages
• Leaking point is indicated with an accuracy of 1 m • Automatic alarm triggering	• Containment pipe is not monitored • Relatively expensive • Retrofits not possible • Containment pipe may need to have a larger external diameter, depending on the system • Susceptible to condensate

5. Differential pressure monitoring

	Overpressure monitoring	Vacuum monitoring (underpressure monitoring)
General	In differential pressure monitoring with overpressure, the interstitial space between the inner and containment pipe is pressurized with nitrogen. In the event of a pressure drop in the interstitial space, the associated alarm switchgear indicates the leakage.	In differential pressure monitoring with vacuum, a vacuum in the range of 600 to 700 mbar is generated in the space between the inner and containment pipe with the aid of a pump. In the event of a possible leak, the vacuum pump is switched on via a vacuum switch (PU). At the same time, the alarm is triggered visually by an indicator light and acoustically by a buzzer.
Advantages	• Inner and containment pipe are monitored for leak-tightness • Retrofit installation is possible • TÜV test certificate • Automatic alarm	• No pressure loading on the inner pipe • Inner and containment pipe are monitored for leak-tightness • Retrofit installation is possible • TÜV test certificate • Automatic alarm
Disadvantages	The injected nitrogen must have a higher pressure than the medium-carrying inner pipe, thus the inner pipe must be checked for collapse, taking into account the operating conditions (please refer to the questionnaire for the "static evidence").	• Pumping head of the vacuum pump must be at least 750 mbar with clear intake • If the volume of the space between the inner and outer pipe is large, the vacuum pump must be dimensioned accordingly or divided into leakage sections, each with a vacuum pump (division with end fitting, refer to chapter "End fittings - Tools for leakage localization").
Leak locating	• Containment pipe direct • Inner pipe through exploratory borehole in the containment pipe	• Containment pipe direct • Inner pipe through exploratory borehole in the containment pipe

Suppliers of differential pressure monitoring systems

SGB Sicherungsgerätebau GmbH

Hofstrasse 10

57076 Siegen, Germany

Ph.: +49 271 48 964-0

Fax: +49 271 48 964-6

www.sgb.de

1.5 Pressure testing the inner and containment pipe

1.5.1 Pressure test of the inner pipe

General

The internal pressure test forms the conclusion of the installation work and requires a ready-to-operate pipeline or ready-to-operate test sections. The stress caused by the test pressure is intended to provide experimental proof of operational safety. The test pressure is not based on the operating pressure, but on the internal pressure load capacity, starting from the pipe wall thickness.

The following information is based on supplement 2 to DVS 2210-1. This completely replaces the information in DVS 2210-1. The reasons for these adaptations are listed below:

- The reference value "nominal pressure (PN)" for determining the test pressure (1.5 x PN or 1.3 x PN) is increasingly being dropped and replaced by SDR.
- Possible short-term overstressing up to shortening of the service life if the pipe wall temperature TR = 20 °C is exceeded by more than 5 °C during the nominal pressure-dependent internal pressure test.

Therefore, the test pressures are determined depending on the SDR and the pipe wall temperature. The value of 100 hours from the creep diagram is taken as the test stress.

Test parameters

The following table provides recommended methods for performing the internal pressure test.

Object	Pre-test	Main test
Test pressure Pp (depends on the pipe wall temperature or the permissible test pressure of the installed components, see section "Determination of the test pressure")	≤ P_p (perm)	≤ 0.85 P_p (perm)
Test duration (depends on the length of the piping system or the piping system sections)	L ≤ 100 m: 3 h 100 m < L ≤ 500 m: 6 h	L ≤ 100 m: 3 h 100 m < L ≤ 500 m: 6 h
Checks during the test (test pressure and temperature progression must be recorded)	At least 3 checks, distributed over the test duration with restoring the test pressure	At least 2 checks, distributed over the test duration without restoring the test pressure

Pre-test

The purpose of the pre-test is to prepare the piping system for the actual test (main test). During the pre-test, a stress-strain equilibrium is established in the piping system in conjunction with an increase in volume. This results in a material-dependent pressure drop, which necessitates repeated re-pumping to restore the test pressure and often retightening of the flange connection bolts.

The guidelines for an expansion-related pressure decrease in pipe are:

Material	Pressure drop (bar/h)
PVC-U	0.5
PVC-C	0.5
PP	0.8
PE	1.2
PVDF	0.8
ECTFE	0.9

Main test

During the main inspection, a much lower pressure drop can be expected if the pipe wall temperatures remain approximately constant, so that there is no need for re-pumping. The checks can concentrate on the tightness of the flange connections and possible changes in the position of the pipeline.

⚠ If a valve is located at the end of a pipeline (end or shut-off valve), the valve, and thus the end of the pipeline, must be closed off by means of a blind flange or cap. This prevents medium from escaping or the inside of the valve from being contaminated by unintentional actuation of the valve.

Filling the piping system

Before starting with the internal pressure test, the following points must be checked:

- Was installation done according to the available plans?
- All pressure relief devices and flap traps mounted in the flow direction?
- All end valves shut?
- Valves of devices are shut to protect against pressure?
- Visual inspections of all joints, pumps, measurement devices and tanks?
- Waiting time after last fusion/cementing observed?

Now the piping system can be filled from the geodetic lowest point. Special attention must be paid to the venting. For this purpose, vents must be provided at all high points of the pipeline, if possible, and must be open when filling the system. The flushing speed must be at least 1 m/s.

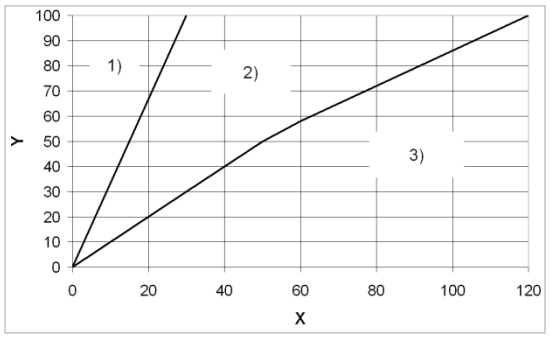
Reference values for the filling volume are given in the following table:

DN (mm)	V (l/s)	DN (mm)	V (l/s)
≤ 80	0.15	250	2.0
100	0.3	300	3.0
150	0.7	400	6.0
200	1.5	500	>9.0

i Between filling and testing the pipeline, allow sufficient time for the air in the pipeline system to escape via the vents: approx. 6 to 12 hours, depending on the pipe diameter.

1.5.2 Applying the test pressure

⚠ The test pressure is applied according to the diagram. Make sure that the pressure increase rate does not cause any impact stop!



Y Test pressure (%)
X Time for pressure increase (min)
1) Pressure increase rate up to DN100
2) Range of pressure increase rates between DN100 and DN400
3) Values for pressure increase rate DN500 and higher is: 500/DN (bar/10 min)

Determining the test pressure

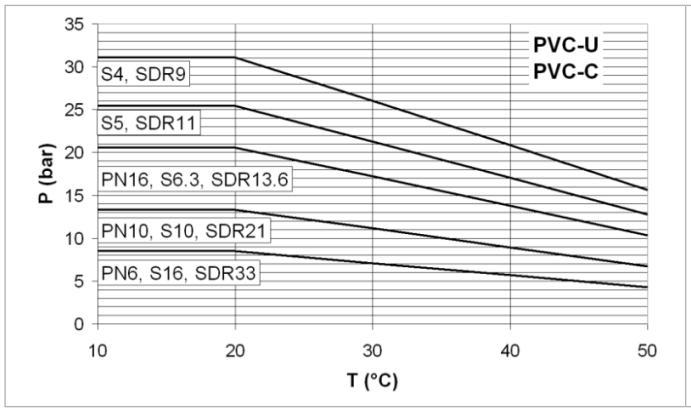
The permissible test pressure is calculated according to the following formula:

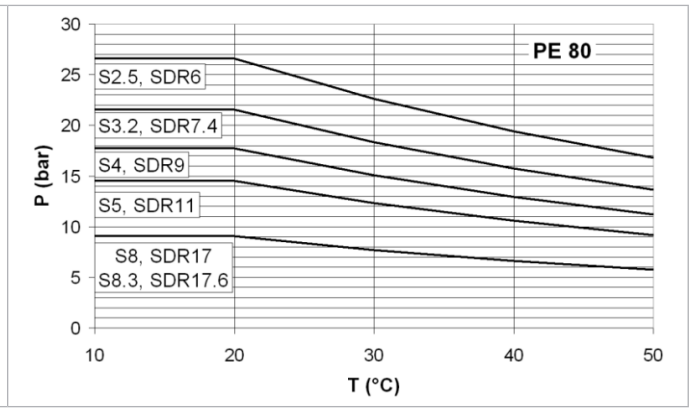
$$P_{p(zul)} = \frac{1}{SDR} \cdot \frac{20 \cdot \sigma_{v(T,\,100\,h)}}{S_p \cdot A_G}$$

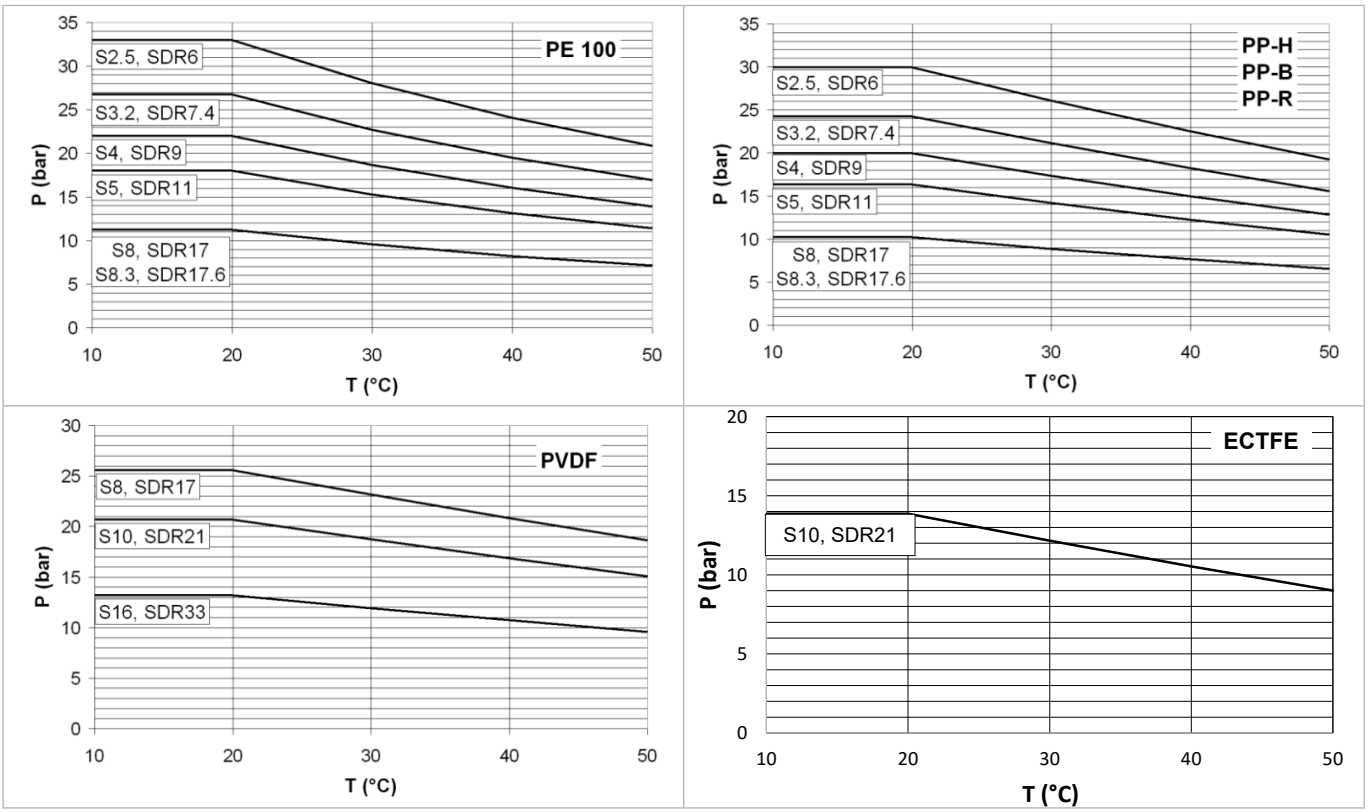
$\sigma_{v\,(T,100\,h)}$ Long-term creep strength for pipe wall temperature TP (at t = 100 h)
S_p Minimum safety factor for long-term creep strength
A_G Processing or geometry-specific factor that reduces the permissible test pressure (if the AG factor is less than zero, you need to use the reciprocal (1/AG)
T_R Pipe wall temperature: average value of test medium temperature and pipe surface temperature

⚠ If the piping system contains diaphragm valves, the maximum permissible test pressure is limited to the nominal pressure of the diaphragm valves.

To make things easier, the permissible test pressures can be taken directly from the following diagrams.







P Permissible test pressure (bar)
T Pipe wall temperature (°C)

Checks during testing

The following measurement values must be recorded consistently during testing:

- Internal pressure at the absolute lowest point of the piping system
- Medium and ambient temperature
- Water volume input
- Water volume output
- Pressure drop rates

Leak test

If an internal pressure test with water is not possible (e.g. keeping pipelines dry), a leak test can be carried out with slight overpressure. For safety reasons, the test pressure must then be limited to a maximum of 0.5 bar (gauge pressure).

During the leak test, all connection points must be sprayed with a foam-forming agent and checked. Since the efficiency of the leak test is significantly limited due to the slight load, it should preferably be used for systems with operating pressures of less than 0.5 bar.

1.5.3 Pressure test of the containment pipe

General

The test of the containment pipe is carried out with the inner pipe completely filled and under internal pressure (internal pressure of the inner pipe should be at least equal to or greater than the internal pressure of the containment pipe), in order to avoid loading of the inner pipe by external overpressure. Suitable filling and venting facilities must be provided on the containment pipe for carrying out the pressure test.

After the installation of the double containment piping system has been completed, the pressure connection (pressure joint) for the leakage indicator, or a test union to monitor the proper operation of the leakage indicator, is installed as near as possible to (no further than 1 m from) or directly inside the termination fitting and at the end of each length of piping. The leak test of the space between the pipe is carried out at room temperature (20 °C).

⚠ Thin-walled inner pipes in particular can collapse due to the overpressure in the annular space. The maximum permissible test or overpressure in the annular space depends on the load capacity of the medium-carrying inner pipe, whereby it must be ensured that the internal pipe pressure load (PN stage) does not correspond to the external pipe pressure load.

Water is the preferred test medium. However, complete draining must be ensured. In many cases, air or inert gas are also suitable test media.

The following points should be noted:

- Compressor oils can contain damaging elements for the pipe.
- Depending on the temperature, various materials tend to splinter when subjected to mechanical action and internal pressure from compressed media.
- Appropriate safety precautions must be taken against the effects of a splintering break in the containment pipe, especially in the case of transparent PVC-U.
- The maximum gas pressure depends on the material and should not exceed the values in the following table.

CONTAIN-IT Plus test parameters

Test medium for piping systems	**PE100 containment pipe, pressure-resistant welded with ELGEF Plus coupler**		**PVC-U containment pipe, spray protection with EPDM rubber collar (not to be applied when there are axial forces)**	
	SDR11, SDR17, SDR17.6			
	Pre-test	Main test	Pre-test	Main test
Water	≤ Pp (perm)	≤ 0.85 Pp (perm)	1 bar	1 bar
Inert gas	0.5 bar	0.5 bar	0.3 bar	0.3 bar

Testing time

The piping system is kept under test pressure until all connection parts, valves, flanges, etc. have been tested for leaks using a foaming agent. It is best to use soap solution, which can be easily removed with water.

⚠ Commercially available leak detection sprays can trigger stress cracks in plastics. If these sprays are used, residue-free removal is required after testing.

No overloading of the components

The adjustment of the test pressure at the corresponding components must be taken into account. In the case of installed valves, for example, the protective line in the flameproof system may only be pressurized to less than or equal to 6 bar.

Test medium for double containment valves	PE100 containment pipe, pressure-resistant welded with ELGEF Plus coupler		Containment pipe PVC-U splash guard with EPDM rubber sleeve (not tension-proof)	
	SDR11, SDR17, SDR17.6			
	Pre-test	Main test	Pre-test	Main test
Water	6 bar	6 bar	1 bar	1 bar
Inert gas	0.5 bar	0.5 bar	0.3 bar	0.3 bar

1.6 Operating and maintenance instructions

General information

In case of maintenance (sealing of ball valve, diaphragm valve, mechanical separation, etc.), leakage, or system expansion, please contact your local safety representative before opening the containment and inner pipes. Operators must maintain an operating manual with a monitoring plan, maintenance plan, emergency plan and specified immediate measures in the event of a leak.

Operation

- If the system consists of several double containment piping systems or several leakage monitoring sections, all these interstitial spaces must be equipped with leakage detection devices (manual/automatic). Leakages must be detected within 72 hours and defined countermeasures must be initiated to ensure the safe condition of the system.
- Routine checks are mandatory when using a visual leak detection solution for rapid leak detection and for initiating the defined countermeasures. When using electrical monitoring systems, regular functional checks are mandatory. These routine checks and functional tests are to be defined by the operator in accordance with a risk assessment and taking into account the existing local legislation and the operating instructions.
- Double containment piping systems must be protected against uncontrolled thermal and mechanical influences.
- In the event of a leakage, the double containment piping system becomes a single pipe. The safety measures according to section Repair must be observed.

Maintenance

- To carry out maintenance work, it is mandatory to contact the safety officer in advance.
- Before performing maintenance, appropriate precautions such as checking the leakage warning system, complete draining of the inner and containment pipe, etc. must be taken into account.

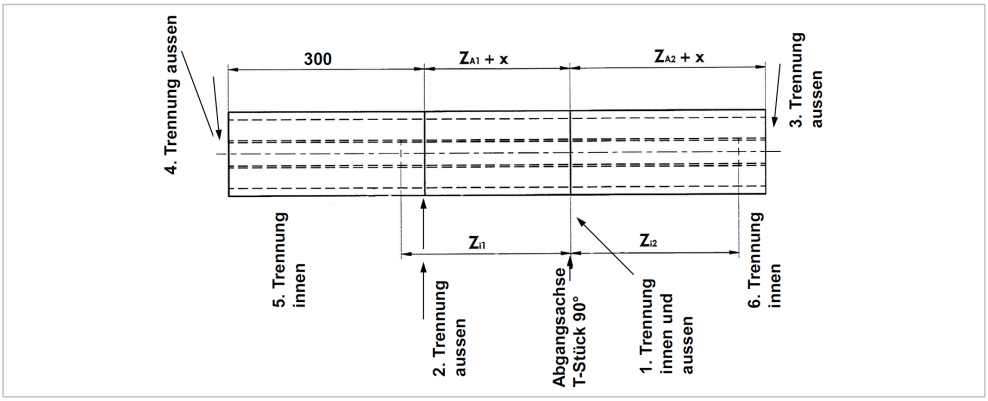
Repair – Case of a Leakage:

- The safety officer must be contacted in advance before carrying out any repair work!
- If a leakage occurs, the procedure defined in advance by the operator of the double containment system must be followed.
- Before starting any repair work, comply with the precautionary measures such as complete draining, flushing of the inner and outer pipe, prevention of dripping, protective clothing, etc... If a leak cannot be located precisely, it is helpful to proceed in sections.
- Leakage detection may only be carried out with water to protect employees, the environment and equipment.
- In order to roughly locate/limit the leakage, test holes can be carefully drilled on the underside of the containment pipe using the mechanically fixed tapping clamp with half outlet. When drilling out containment pipe, make sure that the medium-carrying inner pipe is not damaged. The clamp is later closed again with a PVC plug.
- Georg Fischer Piping Systems recommends dividing the pipeline into leakage detection sections by means of end fittings already during new construction.
- The pipeline must be replaced in compliance with the Georg Fischer Piping Systems installation instructions.

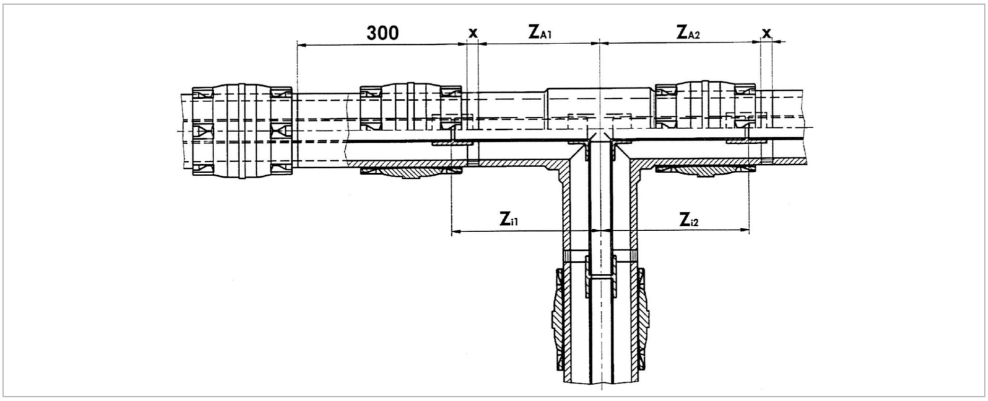
Extension of the existing piping system and subsequent installation of a T-piece

- The safety officer must be contacted in advance if extensions are to be carried out.
- Before any extension begins, appropriate precautions must be taken, such as complete draining, flushing of the inner and containment pipe, prevention of dripping, protective clothing, etc.
- The pipeline must be extended in accordance with the Georg Fischer Piping Systems installation instructions.

Explanation:



x = 30 mm



Pressure test - recommissioning

- A pressure test of the inner and containment pipe is mandatory as soon as a new connection has been made. See chapter "Pressure test for inner and containment pipe".

Safety and fire prevention measures

- Georg Fischer Piping Systems refers to the relevant safety datasheets of the plastic materials used.

Firestop collars

- Approved firestop collars for double containment pipe are available on the market.

Laying pipe in the ground

- If the pipe is laid in the ground, it must be ensured that the regulations regarding the creation of the trench, embedding of the double containment pipe and filling of the trench, as well as the relevant guidelines of professional associations and state authorities, are observed.

1.7 Double containment – CONTAIN-IT Plus - Valves and mechanical connections

1.7.1 CONTAIN-IT Plus - Valves and mechanical connections

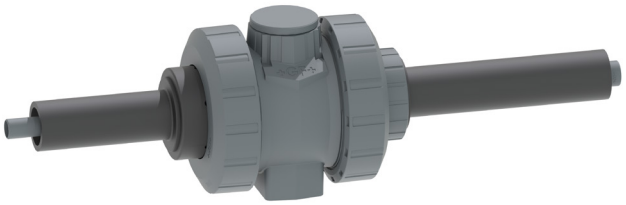
The CONTAIN-IT Plus mechanical connections are delivered as ready-to-install system units with a PVC-U PN6 protective housing.

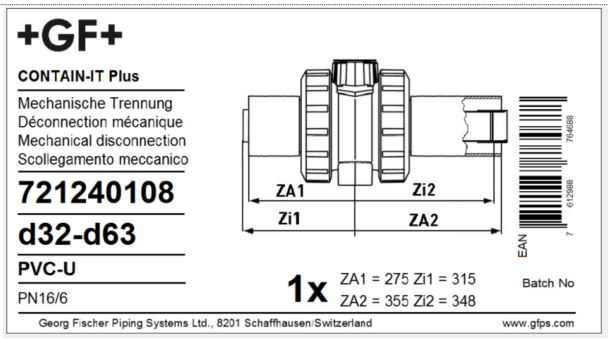
Application

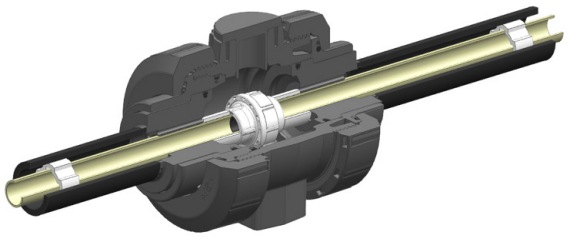
The mechanical separation finds its application primarily in hard-to-reach areas, where the use of welding machines is difficult. In addition, mechanical separation is often used for subsequent removal or repair.

Connection technology

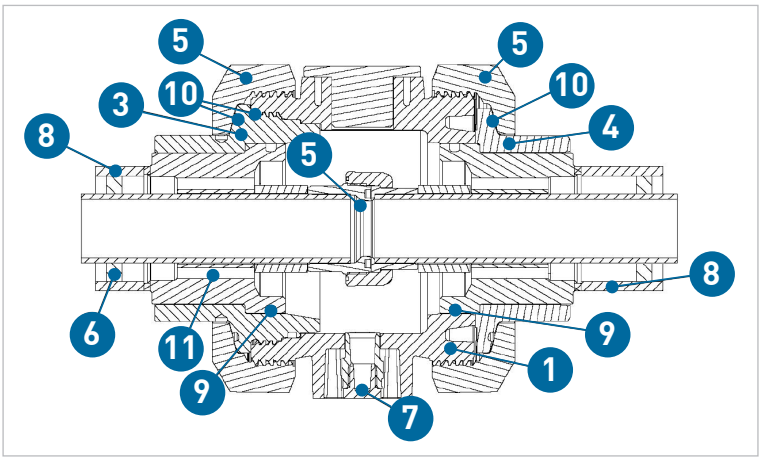
The connection technology used is analogous to the one used for double containment fittings. The double containment connection technology from Georg Fischer Piping Systems is based on the principle that the inner pipe is connected first according to the relevant connection technology. For details, see chapter "CONTAIN-IT Plus - principles of connection technology".







Design



1 Protective housing
2 Union
3 Union bush
4 Union end
5 Union nut of protective housing
6 Spacer
7 Adaptor for ½" leak detection or PVC-U ½" plug
8 PE support pieces
9 O-ring PE connecting element
10 O-rings for union bush/ union end
11 Bore-hole for leak detection of inner pipe

Connection technologies inner pipe

Dimension (mm)	Socket cementing		Socket fusion			Butt fusion IR fusion			
	PVC-U Tangit/ Dytex	PVC-C Tangit/ Dytex	PP-H	PE	PVDF	PP-H	PE	PVDF	ECTFE
d20/D50	✓	✓	✓	✓	✓	✓	✓	✓	✓
d25/D50	✓	✓	✓	✓	✓	✓	✓	✓	✓
d32/D63	✓	✓	✓	✓	✓	✓	✓	✓	✓
d40/D75	✓	✓	✓	✓	✓	✓	✓	✓	✓
d50/D90	✓	✓	✓	✓	✓	✓	✓	✓	✓
d63/D110	✓	✓	✓	✓	✓	✓	✓	✓	✓

Installation, pressure test and maintenance must be performed according to the corresponding installation manual. The installation manual is part of the product (see also the online product catalog at www.gfps.com).

Maintenance

Thanks to the possibility of a radial installation and removal, the inner pipe union can be easily maintained/replaced (O-Rings, etc.)

1.7.2 CONTAIN-IT Plus – Double containment ball valve

Double containment valves in their standard version have a PVC-U PN6 protective housing with an anti-overwinding handle.

Double containment valves from Georg Fischer Piping Systems are delivered as ready-to-install system units with a PVC-U PN6 protective housing.

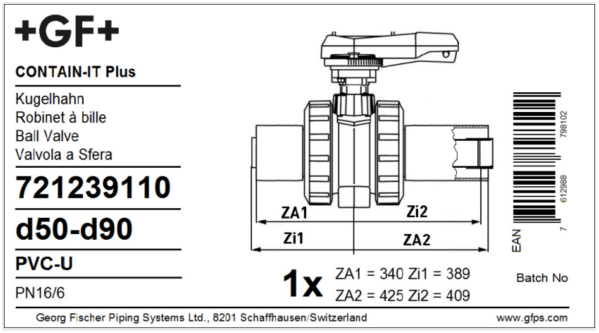
Double containment ball valves are also available in the following versions on request:

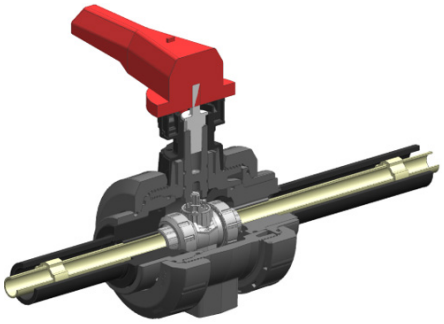
- Pneumatic actuator
- Electric actuator

i A manual CONTAIN-IT Plus ball valve can be upgraded at any time by using an adapter set.

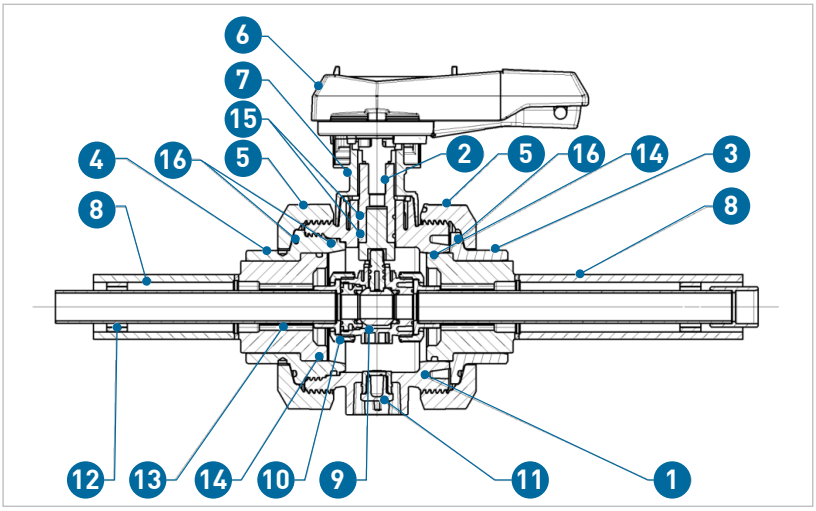
Connection technology

The connection technology used is analogous to the one used for double containment fittings. The principle of the double containment connection technology of Georg Fischer Piping Systems is based on the fact that first the inner pipe is connected according to the respective connection technology. For details, see chapter "CONTAIN-IT Plus - Principles of connection technology".





Design

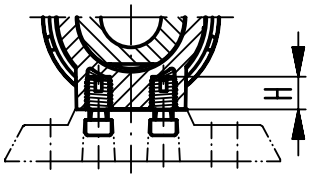


1 Protective housing
2 Stem
3 Union end
4 Union bush
5 Union nut of protective housing
6 Hand lever
7 Nuts and screws (to fix the hand lever)
8 PE supports
9 Ball valve type 546 (central part)
10 Ball valve type 546 coupling nut
11 Adaptor for ½" leak detection or PVC-U ½" plug
12 Spacer
13 Bore-hole for leak detection of inner pipe
14 O-ring PE connecting element
15 O-rings for stern
16 O-rings for union bush/ union end

Ball valve installation notes

Maximum insertion depth of the screws into the ball valve:

Dimension (mm)	Screw	Insertion depth H (mm)
d10/DN15	M6	12
d20/DN25	M6	12
d32/DN40	M8	15
d50	M8	15



Installation, pressure test and maintenance must be performed according to the corresponding installation manual. The installation manual is part of the product, see also the online product catalog at www.gfps.com

Replacement of the inner ball valve: When replacing an inner ball valve in the dimension d63/D110, it is mandatory to contact the Georg Fischer Piping Systems Global Service and Support Team. In this case, a slightly modified inner ball valve must be used!

Maintenance

Thanks to the option of radial installation and removal, the inner pipe ball valve is easy to maintain/replace (O-rings, etc.).

Inner pipe connection

Dimension (mm)	Socket cementing		Socket fusion			Butt welding & IR fusion		
	PVC-U Tangit/ Dytex	PVC-C Tangit/ Dytex	PP-H	PE	PVDF	PP-H	PE	PVDF
d20/D50	✓	✓	✓	✓	✓	✓	✓	✓
d25/D50	✓	✓	✓	✓	✓	✓	✓	✓
d32/D63	✓	✓	✓	✓	✓	✓	✓	✓
d40/D75	✓	✓	✓	✓	✓	✓	✓	✓
d50/D90	✓	✓	✓	✓	✓	✓	✓	✓
d63/D110	✓	✓	✓	✓	✓	✓	✓	✓

The installation, pressure test and maintenance work must be carried out as described in the relevant installation instructions. The installation instructions are delivered with the product, see also the online product catalog at www.gfps.com.

Customizing

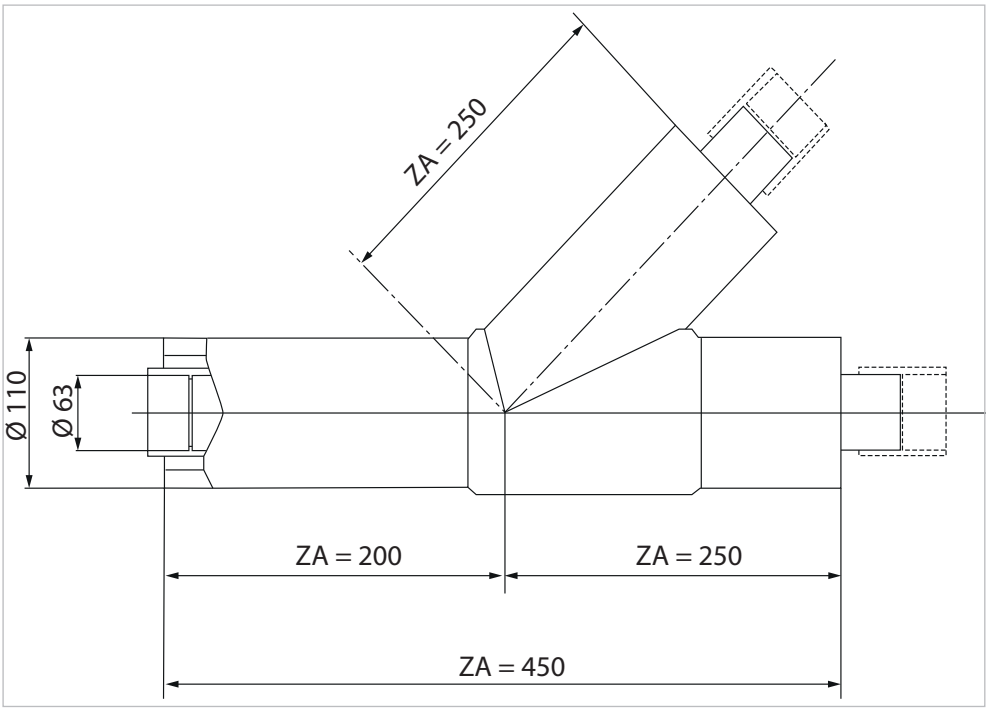
Larger dimensions are available on request. Please contact your local Georg Fischer Piping Systems branch.

1.7.3 Special components

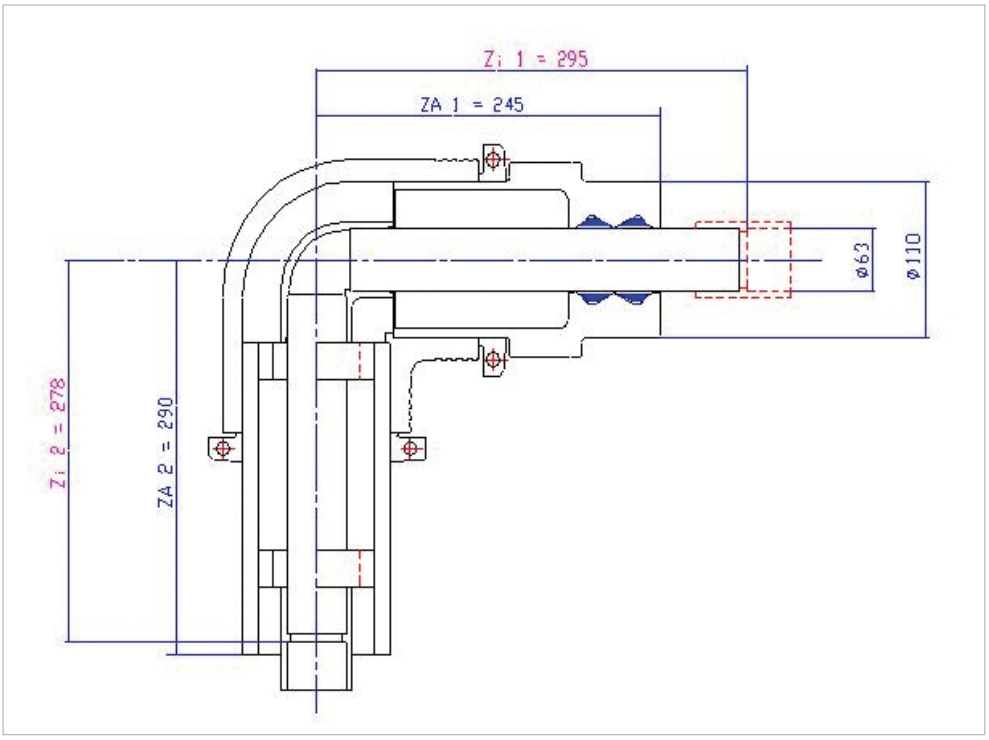
In the double containment product range, many components are manufactured according to customer requirements. Prefabricated tapping pieces, reducing T-pieces, end pieces integrated in the fitting or the prefabrication of entire assemblies can facilitate assembly on the construction site.

Customized fittings may require the inclusion of a reduction factor.
Contact your Georg Fischer Piping Systems representative for additional information.

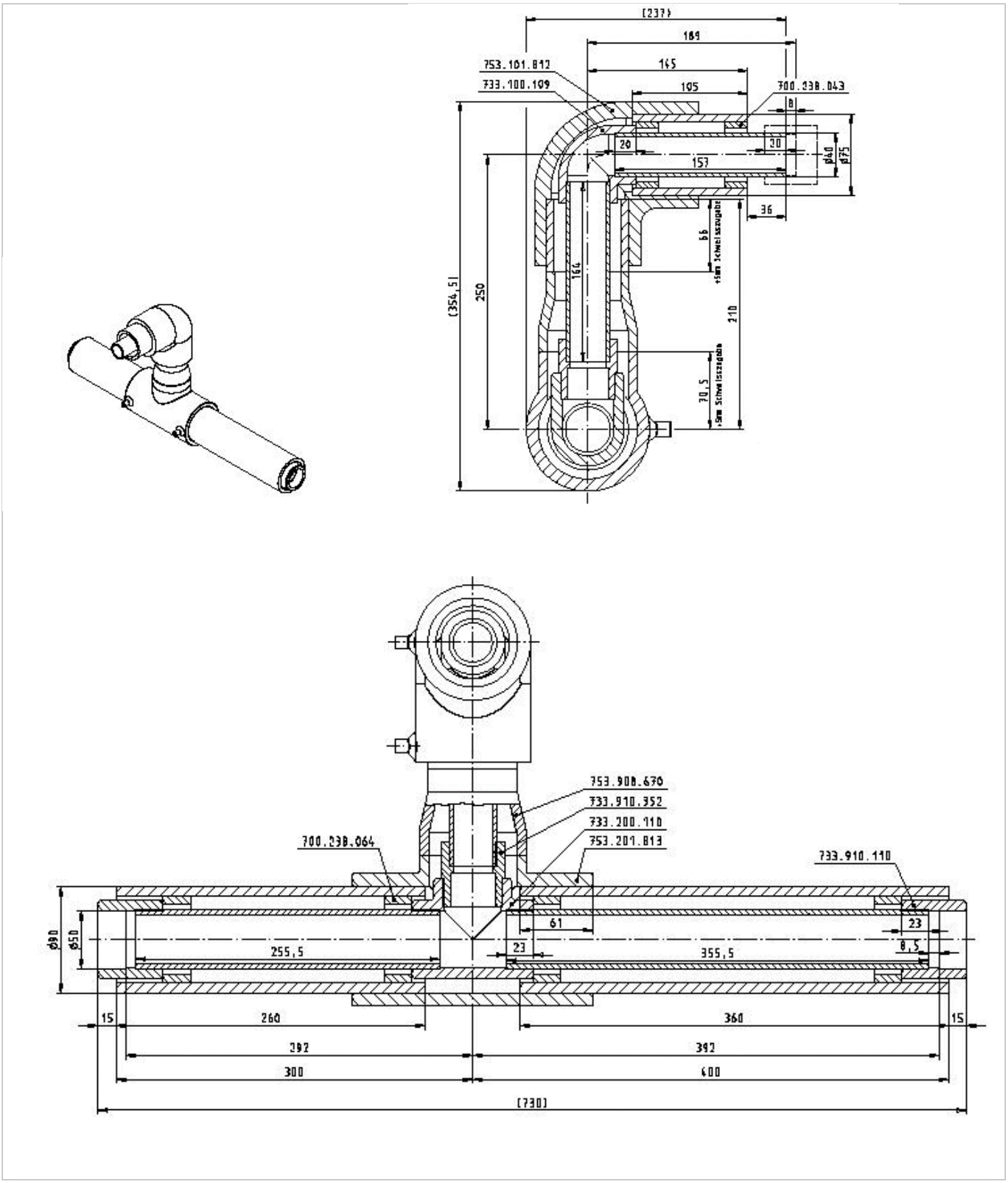
T-piece with 45° tapping point



90° elbow including termination fitting



Double containment T 90° reduced with elbow



Installation, pressure test and maintenance must be performed according to the corresponding installation manual. The installation manual is part of the product, see also the online product catalog at www.gfps.com

GF Piping Systems

Local support around the world

Visit our webpage to get in touch with your local specialist:
www.gfps.com/our-locations