

Galvanising is a very commonly used process for increasing the corrosion resistance of iron based materials.
Zinc is in fact a relatively base metal and corrodes quickly in the presence of oxygen, but in the process it forms a very homogeneous outer layer, which protects from further corrosion.

Georg Fischer malleable cast iron fittings are hot dip galvanised to the requirements in EN 10242, using special procedural technique ensuring that uniform coating thicknesses significantly above the norm-requirement (500 g/m² equivalent to 70 µm in average) are achieved.
Due to the use of highly pure zinc raw material continuous receiving inspections and liquid zinc inspections Georg Fischer ensures the conformity with drinking water requirements and several other regulations (e.g. RoHS)

Thread

General

Threads for pipes, valves, fittings and other pipework components which have a threaded connection are determined by international and national standards.

A basic distinction must be made between:

- **Jointing threads:**
Pipe threads where pressure tight joints are made on the threads according to **EN 10226-1/-2*** respectively ISO 7-1. The respective national issue of EN 10226 replaced DIN 2999, BS 21,
- **Fastening threads:**
Thread for joints not sealing on the threads according to **EN ISO 228-1**.

* EN 10226-2 covers the taper internal thread Rc. This type of thread is not used in Continental Europe. As it is not produced by Georg Fischer no further explanations are given.

Full designation of pipe threads

using the example of thread size 1 ½

Jointing thread to EN 10226-1

Internal thread (right-hand)	parallel	Rp 1 ½
External thread (right-hand)	taper	R 1 ½
Comment: the symbol LH is added to designate left-hand thread. Example: Rp 1 ½ - LH		

Electroplating

With electroplating zinc is deposited from an electrolyte by applying an electric current to the surface of the workpiece.

The zinc coating achieved in this way is simply a thin protection layer which is deposited on the base material (no alloy formation takes place with the base material).

The zinc coat thickness is a maximum of 25 µm.
Due to the lower corrosion protection electroplated zinc surfaces are not suitable for drinking water application (see also chapter steel fittings page 74).

Difference between jointing threads/ fastening threads

The fundamental difference consists of the fact that:

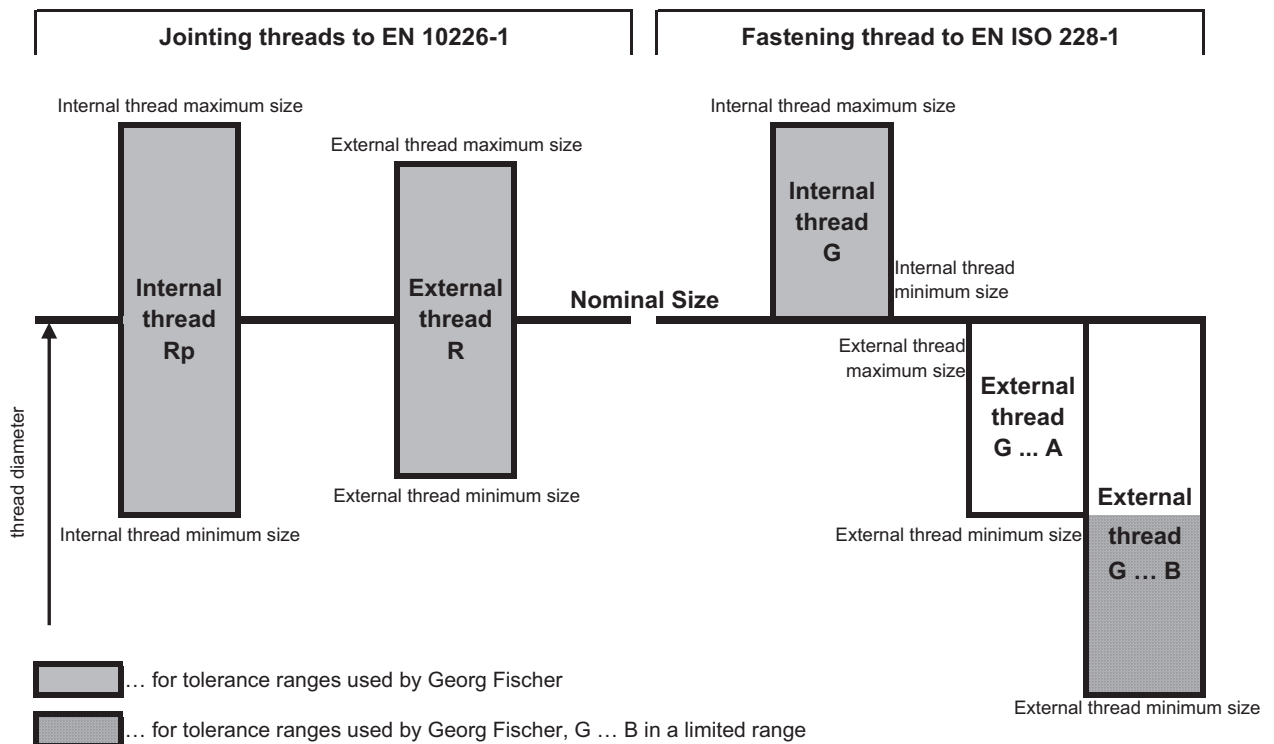
- the pipe thread to **EN 10226-1** achieves a seal on the thread, mainly as a result of metallic compression (taper/parallel) of the interlocking thread surfaces in the jointing area. The sealing effect is improved by using an appropriate jointing medium.
- In contrast, the pipe thread to **EN ISO 228-1** is a purely mechanical fastening thread. Sealing of the components being connected is achieved between sealing faces with flat seat gaskets or by metal sealing surfaces.

Fastening thread to EN ISO 228-1

Internal thread (right-hand)	parallel	G 1 ½
External thread (right-hand) Tolerance class A	parallel	G 1 ½ A
External thread (right-hand) Tolerance class B	parallel	G 1 ½ B
Comment: the symbol LH is added to designate left-hand thread. Example: G 1 ½ - LH		

For external threads to EN ISO 228-1 Georg Fischer exclusively uses part of the class B tolerances (see illustr. 1).

Comparison of the tolerances of jointing and fastening threads



illustr. 1 Tolerances of jointing and fastening threads

Combination of jointing threads (sealing on the thread) with fastening threads (not sealing on the thread)

Connection of a parallel external thread according to EN ISO 228-1 with a parallel internal thread according to EN 10226-1: Due to the overlapping of the tolerance fields of the thread diameter (illustr. 1) of G ... A and G ... B with Rp it is not ensured that both threads can be screwed together. This can be secured by manufacturing the external thread G ... B with limited range (illustr. 1 – lower half of G ... B). Because of the missing metallic contact between the threads a sealing joint is not automatically achieved.

Connection of a taper external thread according to EN 10226-1 with a parallel internal thread according to EN ISO 228-1: Other than in the first case there is no problem in screwing both threads together / with the thread diameter. But EN ISO 228-1 does not require a minimum length of the internal thread or a fully shaped thread profile. Both may lead to sealing problems and thus has to be regulated in the norm of the product foreseeing the G - thread.

Pipe threads (EN 10226/ISO 7) and threaded pipes (EN 10255/ISO 65)

The most important dimensions

Thread size Nominal diameter DN		$\frac{1}{8}$ 6	$\frac{1}{4}$ 8	$\frac{3}{8}$ 10	$\frac{1}{2}$ 15	$\frac{3}{4}$ 20	1 25	1 $\frac{1}{4}$ 32	1 $\frac{1}{2}$ 40	2 50	2 $\frac{1}{2}$ 65	3 80	4 100
Pipe threads													
Plug gauge diameter (thread external diameter in the measuring plane)	mm	9,728	13,157	16,662	20,955	26,441	33,249	41,910	47,803	59,614	75,184	87,884	113,030
Pitch	mm	0,907	1,337	1,337	1,814	1,814	2,309	2,309	2,309	2,309	2,309	2,309	2,309
Number of threads per inch		28	19	19	14	14	11	11	11	11	11	11	11
Gauge length «a» (external thread)	mm	4,0	6,0	6,4	8,2	9,5	10,4	12,7	12,7	15,9	17,5	20,6	25,4
Tolerance for «a»	mm	± 0,9	± 1,3	± 1,3	± 1,8	± 1,8	± 2,3	± 2,3	± 2,3	± 2,3	± 3,5	± 3,5	± 3,5
Fitting allowance «b»	mm	2,5	3,7	3,7	5,0	5,0	6,4	6,4	6,4	7,5	9,2	9,2	10,4
Number of threads length [ca.=approx.]	pitch ca. mm	2 $\frac{3}{4}$ 7,0	2 $\frac{3}{4}$ 10,0	2 $\frac{3}{4}$ 10,0	2 $\frac{3}{4}$ 13,0	2 $\frac{3}{4}$ 15,0	2 $\frac{3}{4}$ 17,0	2 $\frac{3}{4}$ 19,0	2 $\frac{3}{4}$ 19,0	3 $\frac{1}{4}$ 24,0	4 27,0	4 30,0	4 $\frac{1}{2}$ 36,0
Threaded pipes													
Outside diameter	mm	10,2	13,5	17,2	21,3	26,9	33,7	42,4	48,3	60,3	76,1	88,9	114,3
Surface area of the pipe	ca. m ² /m	0,032	0,042	0,054	0,067	0,085	0,106	0,133	0,152	0,189	0,239	0,279	0,359
Medium duty													
Wall thickness	ca. mm	2,0	2,3	2,3	2,6	2,6	3,2	3,2	3,2	3,6	3,6	4,0	4,5
Inside diameter	ca. mm	6,2	8,9	12,6	16,1	21,7	27,3	36,0	41,9	53,1	68,9	80,9	105,3
Clear opening	ca. cm ²	0,30	0,62	1,25	2,04	3,70	5,85	10,18	13,79	22,15	37,28	51,40	87,09
Capacity	ca. l/m	0,030	0,062	0,125	0,204	0,370	0,585	1,018	1,379	2,215	3,728	5,140	8,709
Pipe mass, plain end black pipe	ca. kg/m	0,40	0,64	0,84	1,21	1,56	2,41	3,10	3,56	5,03	6,42	8,36	12,20
Heavy duty													
Wall thickness	ca. mm	2,6	2,9	2,9	3,2	3,2	4,0	4,0	4,0	4,5	4,5	5,0	5,4
Inside diameter	ca. mm	5,0	7,7	11,4	14,9	20,4	25,7	34,4	40,3	51,3	67,1	78,9	103,5
Clear opening	ca. cm ²	0,19	0,47	1,02	1,74	3,27	5,19	9,29	12,76	20,66	35,36	48,89	84,13
Capacity	ca. l/m	0,020	0,047	0,102	0,174	0,327	0,519	0,929	1,276	2,066	3,536	4,889	8,413
Pipe mass, plain end black pipe	ca. kg/m	0,49	0,77	1,02	1,44	1,87	2,93	3,79	4,37	6,19	7,93	10,30	14,50

For details see the relevant standards

Length tolerances

The permitted length tolerances for standardised types of fittings are given in the table below.

For straight parts (nipples, sockets, etc.) the tolerance refers to the face to face dimension.

For fittings with changes of direction (bends, elbows, tees) the tolerance refers to the face to centre (axis) dimension.

The stated tolerances for **unions** are referring to the individual union parts and not to the complete fitting.

Length tolerance Dimensions in mm

Dimensions (overall lengths)		tolerance
to 30		± 1,5
over 30	to 50	± 2,0
over 50	to 75	± 2,5
over 75	to 100	± 3,0
over 100	to 150	± 3,5
over 150	to 200	± 4,0
over 200		± 5,0

Angle tolerance

The axis of the fitting threads may deviate by a maximum of 0.5° from the specified angle.

Width across flats for malleable iron fittings

The catalogue section gives the sizes of wrenches required.

Steel fittings

Some fittings up to max. $\frac{3}{8}$ inch with straight design are exclusively offered by Georg Fischer in steel material. This option is foreseen by EN 10242, because of (casting-) technological reasons. These steel fittings are marked with **"ST"** in the catalogue section. For technical reasons the zinc coating of the steel fittings is done by electroplating. Galvanised steel fittings are therefore not suitable for drinking water installations. Georg Fischer steel fittings (apart from cat. nos. 290, 291, 531, 596) can be recognised by a code groove on the hexagon.

Taper seat unions

Before use, seats of metallic sealing unions must be cleaned and lubricated. For potable water applications lubrication must be done with a potable water-approved non hardening thread sealant (e.g. thread sealing paste according to DIN 30660).

If taper seat unions are reused, Georg Fischer do not take over a warranty for the sealing performance.

Conical/spherical and spherical sealing seat unions

Fig. 342 and 342a offer high sealing efficiency due to specially formed sealing surfaces. Fig. 346 with spherically produced sealing surfaces allows a smooth angular movement from 0 to 6°. Limits for the use of fig. 342, 342a and 346 see page 77. Fig. 342 and 342a are not suitable for use in drinking water installations.

Guideline for tightening taper seat unions fig. 340, 341 and 344 (Final assembly) valid also for fig. 342, 342a, and 346

Fitting size	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{4}$	1	1 $\frac{1}{4}$	1 $\frac{1}{2}$	2	2 $\frac{1}{2}$	3	4
Tightening torque Nm	15	20	30	50 **) 60	65 **) 80	80 **) 100	150	180	240	310	350	470
max. allowable revolutions *)	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$	$\frac{1}{2}$

*) maximal nut-revolutions after hand-tight fastening

**) deviating tightening torques for 342, 342a and 346

Union piece parts

Most Georg Fischer flat seat union piece parts are available as «spare parts» (refer to chapter Product Range).

Piece parts of unions with metallic sealing, should not be exchanged or reused. Metallic sealing union piece parts are therefore only offered after technical clarification.

The dimensions of cast on flanges respectively seats of both, flat seat and metallic sealing union piece parts, are not standardised, neither on European nor on International level. They are subject to a works standard, which may be revised for technical reasons. Georg Fischer does not grant warranty for pressure tightness, if piece parts are exchanged or reused especially in connection with other brands and for re-use of unions with metallic sealing.

Application notes

Range of application

Malleable cast iron fittings are used for conveying liquids and gases up to the pressure and temperature limits specified in standard ISO 49 and EN 10242. Fittings and union piece parts are tested individually for leak tightness. The test pressures are above the values stipulated in the standard. Unless otherwise specified (see specially pressure tested fittings), the following working pressures and temperatures apply for the parts in the Georg Fischer range of malleable iron fittings.

Working temperature °C *)	Maximum permissible working pressure bar **)
-20 up to 120	25
between 120 and 300	interpolated values
300	20

*) The values are fluid temperatures under continuous operation conditions. Applications with specific environment temperatures require further technical assessment.

**) 1 bar = 10^5 N/m² = 100 kPa

Standardisation and certification

Georg Fischer actively participates in international product- and application-related standardisation and important national standardisation projects. An active handling of actual and prospective regulations is of high importance as well.

The Pressure equipment directive 2014/68/EU, the construction product regulation No. 305/2011, RoHS-Directive 2011/65/EU and REACH can be mentioned as example. Actual information and if required conformity declarations are available at

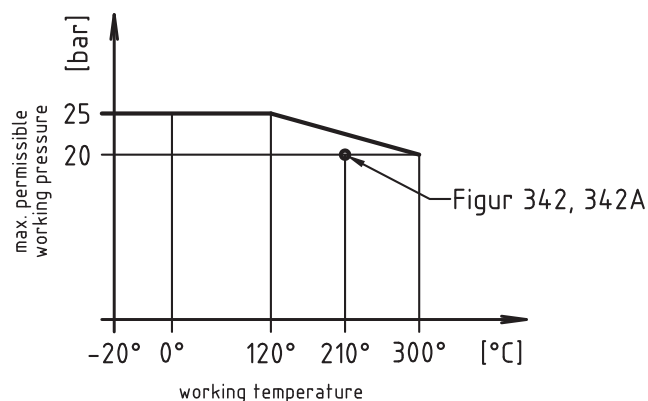
www.fittings.at/contactform



Georg Fischer holds national approvals for important applications, especially gas and drinking water installations. Articles which have the international FM approval for fire extinguishing systems are listed at page 67.

The actual certificates/approvals are shown at

www.fittings.at/approvals



Exceptions:

Figure 342, 342a max. 210°C / max. 20 bar
Figure 346 max. 300°C / max. 20 bar

Installations of malleable iron fittings

The limits of use for specific applications can be found in international, European and national guidelines (e.g. norms, rules, regulations of regional supply companies etc.).

Specially pressure tested fittings

Fittings for higher working pressures than 25 bar are available on request in the dimension range from 3/8 to 3.

They are subjected to a separate individual test (at 100 bar test pressure), they are marked with yellow colour and the letter "P".

A test report acc. to EN 10204 is available on request.

Type tested fittings

These fittings are mainly used in gas-high pressure fire extinguishing systems according to the German VdS-Rules. **A type test** is carried out on fitting samples. The fitting body must withstand a pressure of 300 bar without bursting. (Attention: These test pressure should not be mixed up with the permissible working pressure).

Before delivery these parts are subjected to a separate individual pressure test, they are marked with red colour and with the letter "D".

A test report acc. to EN 10204 is available on request.

There is only a limited range of Georg Fischer malleable iron fittings available as type tested fittings. The list of type tested fittings is available on request.

Drinking water installations with hot dip galvanised malleable iron fittings

All other fittings than the ones marked with "ST" in the catalogue section, are hot dip galvanised in accordance with EN 10242 (and ISO 49). The protective layer formed by hot dip galvanizing consists of several iron-zinc alloy layers covered by a layer of pure zinc. During the first period of operation the reaction with the drinking water forms a homogenous protective layer. In the normal case of the positive cooperation of the influencing criteria the outer layer formation is accompanied by the natural removal of the pure zinc layer. To achieve this formation and to prevent corrosion damages different requirements, described in EN 12502-3 must be fulfilled.

Summarising the above norm the mayor influencing criteria must be taken into account:

- material property
- water quality
- operation conditions
- design and installation of the pipework system

Aiming hygienic conditions for drinking water the German DIN 50930 has defined additional requirements in its last edition of October 2013. These requirements on the one hand refer to the chemical composition of the zinc layer and on the other hand to the water conditions. Malleable cast iron fittings and steel pipes are grouped under the term "hot dip galvanised iron materials".

According to DIN 50930-6:2013-10 hot dip galvanised materials are applicable if the drinking water fulfils the following criteria:

$K_{B8,2} \leq 0,20 \text{ mmol/l}$ and coefficient S_1 according to DIN EN 12502-3 < 1 .

For unavoidable accompanying elements in the zinc layer for malleable cast iron fittings it is defined:
 $Pb \leq 0,1 \%$, $Bi \leq 0,01 \%$, $Cd \leq 0,01 \%$, $As \leq 0,02 \%$ and $Sb \leq 0,01 \%$ (for steel pipes applies $Pb \leq 0,05\%$).

By using highly pure raw-zinc and continuous inwards inspections and zinc bath analysis, Georg Fischer ensures the fulfilment of these high requirements for the zinc layer.

Reusability of dismantled fittings

When the threaded joint between fittings and threaded pipes is correctly made, no permanent deformation of fittings occurs and the fittings may be reused.

In contrast to that permanent deformation of the external thread at the pipe occurs. Therefore pipes should not be reused after dismantling.

Taper (metallic) seat unions and union piece parts see page 76.

Welding and brazing

The EN-GJMW-400-5 material used for Georg Fischer fittings is not ideal for welding and brazing.

The chemical analysis of this material differs from weldable materials especially in the silicon, sulphur, manganese and carbon content.

The conditions necessary for welding or brazing are a maximum carbon content of 0.3% which can be achieved with an additional heat treatment. Elongation values are established approximately as required for welding and brazing qualities - measured on a 9 mm test bar.

In summary the Georg Fischer EN-GJMW-400-5 material is only **suitable** for welding or brazing after additional heat treatment. After this **additional** heat treatment we recommend that on welding applications welding tests are carried out on test components to ascertain whether the required standards have been met. This is important for welded connections because compared with soldering, changes in the microstructure are greater because of the higher temperatures during welding.

In either case, apart from material specific instructions further constructive and process engineering conditions are required in case of welding and brazing joints.

Sealing material

Sealing material for thread connections

In a taper/parallel threaded joint, the sealing material has the task of filling in unavoidable deviations from the theoretical thread profile, and roughness at the thread surface. Tensile load, compressive stress or reversed bending stress on the joint is absorbed by the metal to metal contact.

Only permitted sealing materials should be used to seal threads on potable water and gas installations. Testing of sealing agents is carried out according to EN 751 : Part 1 - anaerobic jointing compounds, Part 2 - non-hardening jointing compounds, Part 3 - unsintered PTFE tapes.

The alignment of already assembled fittings sometimes requires turning back of taper/parallel joints up to a maximum of 45°. To assure that sealing materials meets these requirement in countries where this procedure is practiced, an additional test criteria has been imposed by EN 751-2.

Those sealing materials additionally have to be marked with "Rp".

With regard to the technical application (gas, heating system, ...) national regulations have to be considered. Supplementary to EN 751-2 for drinking water installations e.g. the German DIN 30660 – established due to a lack of international regulations – defines requirements with regard to hygienic aspects. As a general rule, tests carried out for national approvals/certificates are based on the norm requirements above.

Sealing materials have to be chosen according to the working conditions of the application. If no experience in this field has been made, the below table may serve as guideline.

In any case the working limits given by the sealing material manufacturer have to be considered.

Connections on gaslines and pipelines for higher pressure requirements call for special care. For other application fields the relevant regulations on the use of thread connections must be complied with.

sealing material	hemp with sealing compound	PTFE teflon standard sealing tape / PTFE sealing cord	PTFE teflon special sealing tape **)	Polyamid-cord impregnated with sealing compounds	anaerobic sealing compounds
medium					
Thread size	½ - 4	½ - 1 ¼	½ - 2	½ - 4	½ - 2 ½ 3 - 4
drinking water up to 60°C	●	●	●	●	● ○
waters within a system up to 130°C *)	●	●	●	●	● ○
natural gas, town gas and liquid gases	●	●	●	●	● ○
compressed air oiled and unoiled	●	●	●	●	● ○
steam up to 150°C	-	●	●	○	● ○
up to 200°C	-	-	●	-	● ○
up to 250°C	-	-	●	-	- -
heating and diesel oils, petrol max. 80°C	-	●	●	-	● ○
hydraulic oils up to 200°C	-	●	●	-	○ ○

● suitable ○ conditionally suitable - unsuitable

*) water for firefighting and waters within a system (in closed circuit systems inducted drinking water e.g. water in hot water heating, without chemical additives)

**) thick teflon tapes (with large area-related mass)