KRYOCLIM®

PIPES and FITTINGS for cold applications
Centralised AIR CONDITIONING
Secondary REFRIGERATION

ISSUE
SEPTEMBER 2007

GIRPI

safety for your pipeworks

TECHNICAL
DOCUMENTATION

CERTIFICATION

N° QUAL/1995/3526a

GIRPI

CONCEPTION, FABRICATION PAR INJECTION, FACONNAGE ET VENTE DE PIECES ET ACCESSOIRES EN MATIERES PLASTIQUES POUR LE BATIMENT ET L'INDUSTRIE.

DESIGN, MANUFACTURING BY INJECTION MOULDING, SHAPING AND SALE OF PLASTIC PARTS AND ACCESSORIES FOR THE BUILDING TRADE AND THE INDUSTRY.

Rue Robert Ancel BP 36 FR-76700 HARFLEUR

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AFAQ AFNOR Certification certifies that all the arrangements covering the above mentioned activities and locations established to meet the requirements of the international standard:

ISO 9001 : 2000

ont été examinées et jugées conformes.
have been examined and found conform.

2006-12-08

(année/mois/jour) Il est valable jusqu'au* *It is valid until** **2009-11-02** (year/month/day)

Directrice Générale d'AFAQ AFNOR Certification
Managing Director of AFAQ AFNOR Certification

F. MÉAUX

Le Représentant de l'Entreprise
On Behalf of the Firm

M. DIVANACH

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GIRPI

KRYOCLIM® SYSTEM

TECHNICAL DOCUMENTATION
SUMMARY

Technical Sheet

0.0

IMPORTANT DETAIL : The date on each page of this documentation is not a printing date but an updating date.

GENERAL CHARACTERISTICS
APPLICATIONS

GIRPI is part of an international group present in many countries (Aliaxis).

Thanks to its long experience in the fields of refrigeration and air conditioning with its different products, **GIRPI** developed a complete system which answers the needs of the following applications :

- Centralised Air conditioning applications :
  - ➤ chilled water (comfort cooling)

- Industrial applications :
  - ➤ cooling
  - ➤ process

- Food industry
  - ➤ refrigerated warehouses
  - ➤ industrial kitchens

KRYOCLIM® benefits from the low temperature performance of its main custom-designed component called H.P.F.®.

The system is particulary suitable for commercial and industrial secondary refrigeration and indirect air conditioning applications.

Thanks to its wide range of pipes (diameter 20 to 160), fittings and accessories especially developed to be adapted to existing networks, KRYOCLIM® enables the installation of every kind of commercial and industrial refrigeration and indirect air conditioning networks from -30° to +40° C based on the following secondary fluids : chilled water, gylcols...

The practice, which is well known in centralised air conditioning applications is being chosen more and more for complete commercial and industrial refrigeration applications.

GENERAL CHARACTERISTICS
BENEFITS

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The KRYOCLIM® system offers a lot of benefits against traditional materials:

Corrosion resistant:
KRYOCLIM® is non-corrodible and allows to avoid expensive film-forming treatments. The networks remain perfectly leak-proof.

Strength-Impact Resistant:
The KRYOCLIM® manufactured of HPF® alloy withstands impacts even at low temperatures.

Fire classification:
The KRYOCLIM® system is M1 rated and certified by the CSTB (Scientific and Technical Centre for Building). KRYOCLIM® is non flammable to ensure safety in case of fire.

Non-permeability:
KRYOCLIM® is non-permeable to oxygen, thus eliminating the formation of sludge inside the pipes.

Hydraulic performances:
The smooth internal surface of KRYOCLIM® products reduces frictional losses.

Thermal conductivity cœfficient:
Enables energy savings. Heat losses drop by up to 30 % in comparison with steel.

Condensation:
Less condensation than with traditional materials. The external temperature of KRYOCLIM® pipes is several degrees higher.

Chemical resistance:
KRYOCLIM® has been developed to have a perfect compatibility with the fluids listed on sheet 9.1.

Installation time under control:
Easy- to-install system
- Lightweight pipes.
- Simple tools.
- No fire permit required for installation.

The KRYOCLIM® system can be built-in, embedded or buried.

Recycling friendly:
KRYOCLIM® made from H.P.F.® is totally recyclable.

GENERAL CHARACTERISTICS

1. PHYSICAL CHARACTERISTICS

Characteristics	Standards	Units	Values
Physical aspect	EN 1452-2/3	—	—
Fire classification			M1
Volumic mass	ISO 1183 meth A	kg/m^3	≈ 1350
Linear expansion dilation	ASTM D 696-70	mm/m °C	0,09
Transversal vesistivity (under 1000 V)	ASTM D 257/76	Ohm.cm	10^{15}
Termal conductivity λ	ASTM C 177-76	W/m°C	0,17
Shrinkage at 150°C	EN 743	%	≤ 4

2. MECHANICAL CHARACTERISTICS

Characteristics	Standards	Units	Values
Bending under load temperature	NF T 51-005/meth.A - ISO 877	°C	≈ 55
VICAT softening temperature (5 daN load)	NF T 51-021/meth.B - ISO R 306 NF T 54-034 - ISO 2056/2507	°C	≥ 76
Resistance to static pressure		—	
• at 20°C time ≥ 1 h	NF EN 921	—	4,2 x PN
Resistance to alternating pressure	NF EN 921		
(on fittings and glued jointings)	T 54-094		
Pressure : min 20 bar/max. 60 bar			
• ø 20 to 90 : frequency 1Hz		Cycles	≥ 5000
• ø 110 : frequency 0,42 Hz		Cycles	≥ 2500
Impact resistance at -20° (pipe)	NF EN 744	J	> 100
Pipe elongation at break	NF EN ISO 6259-1		
• Rr		MPA	> 32
• A %		%	120

1 MPa = 10 bars

3. QUALITY CONTROLS

To provide a normal quality level for its products and to guarantee its users that the stated performances are respected, GIRPI has implemented the control regulations imposed by the different French and international standards.

The controls concern the physical and mechanical characteristics of the systems.

However in addition to the above verifications and to guarantee the maximum reliability level in actual operating conditions, GIRPI has developed and carries out additional tests, one of which is currently undergoing standardization (NF T 54-094 standard).

Thus, a crushing operation on the couplings associated with an alternate pressure test (on solvent cement fittings assemblies) is regularly carried out. The couplings are subjected to fluid hammer cycles (20/50 bar) at 2000 cycles/hour for diameters 20 to 90 and 1500 cycles/hour for diameters 110 and 160.

Furthermore, operational tests are constantly carried out on our laboratory's testing rigs. This enables us to guarantee the adaption of each component in the pipework to its own function.

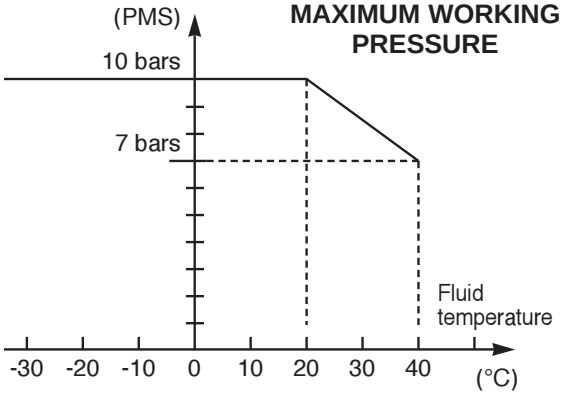
The ISO 9001 Version 2000 certified procedures at all stages (production, quality, control etc...) guarantee the quality of GIRPI's products globally.

GENERAL CHARACTERISTICS
OPERATIONS CONDITIONS

2007

WORKING PRESSURE AND TEMPERATURE
10 bar from - 30°C to + 20°C

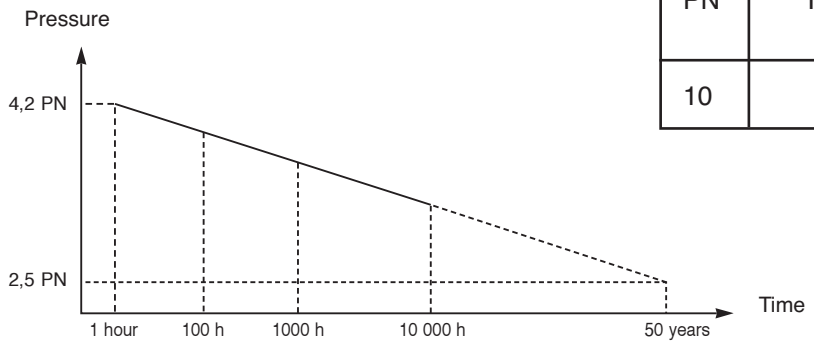
The flow temperature of some networks (such as process or defreezing of convection fans) can reach more than 20°C. KRYOCLIM® allows a maximum working temperature of 40°C with a maximum working pressure of 7 bar.



■ WORKING LIFETIME:

The working pressure and temperature indicated in the following tables are determined for a working life of **50 years without interruption.**

■ TESTING PRESSURE:



PN	Testing pressure 1 hour (20°C)
10	42 bar

A pressure pipework can be classified as PN 10 (with a safety factor of 2.5 after 50 years) if it can tolerate, during one hour, a pressure equal to 4.2 times its PN. The characteristics of the system can only be guaranteed for 50 years by combining these two parameters.
The readings for the breaking pressures for KRYOCLIM® change, as shown in a straight-line in logarithmic co-ordinates.
Considering the safety cœfficients, the pressure ratio between 50 years and one hour ranges from 4.2 to 2.5. This straight line is drawn on the basis of the 1 h, 100 h, 1000 h and 10,000 h tests, and is then extrapolated to 50 years.

■ GUARANTEES:

- For all applications specified in the technical documentation, regardless of pipe diameter, GIRPI has an insurance to guarantee installations which are carried out in accordance with its own general recommendations, and which respect the temperature and pressure conditions and the nature of fluids specified in this document.

- **KRYOCLIM® is a complete system especially developped to bring global reliability. Therefore, all of the system's elements must imperatively be used. The use of components of external origin will make GIRPI's guarantee null and void.**

GIRPI

KRYOCLIM® SYSTEM

RANGE

Technical Sheet

2.1

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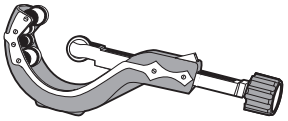
Description	Ref.	Diameters in mm											See Technical sheet
		20	25	32	40	50	63	75	90	110	125	160	
PIPES 	TUBF	■	■	■	■	■	■	■	■	■	■	■	7.1
ELBOWS 90° 	F4M	■	■	■	■	■	■	■	■	■	■	■	7.1
ELBOWS 45° 	F8M	■	■	■	■	■	■	■	■	■	■	■	7.2
STRAIGHT COUPLINGS 	FMA	■	■	■	■	■	■	■	■	■	■	■	7.2
EQUAL TEES 90° 	FTE	■	■	■	■	■	■	■	■	■	■	■	7.2
CAPS 	FBO	■	■	■	■	■	■	■	■	■	■	■	7.3
PLAIN NIPPLES 	FMC	■	■										7.3
TEES REDUCED 90° 	FTR		■	■	■	■	■	■	■	■			7.3
REDUCING BUSHES SHORT PATTERN 	FRS		■	■	■	■	■	■	■	■			7.4
REDUCING BUSHES LONG PATTERN 	FRD			■	■	■	■	■	■	■	■	■	7.4
3 PIECE UNIONS 	F3P	■	■	■	■	■							7.5
SERRATED STUB FLANGES 	FCS	■	■	■	■	■	■	■	■	■		■	7.5
3 PIECE UNIONS female brass 	F3G/L	■	■	■	■	■	■						7.5
3 PIECE UNIONS female brass 	F3F/L	■	■	■	■	■	■						7.6
THREADED FITTINGS female adaptor 	FMML	■	■	■	■	■	■						7.6
THREADED FITTINGS male adaptor 	FEAL	■	■	■	■	■	■						7.6
THREADED ELBOWS female brass 	F4GL	■	■										7.7
ADAPTORS 1/2" female brass 	FMIL									■		■	7.7
ADAPTORS 3/4" female brass 	FMIL									■		■	7.7
BALL VALVES 	VFCEP	■	■	■	■	■	■						8.1
BALL VALVES 	VFFEP							■	■	■			8.3
BALL VALVES, FLANGED 	VFP	■	■	■	■	■	■						8.2
INSULATION KITS FOR VALVES 	VK	■	■	■	■	■	■						
INSULATION RINGS FOR COLLARS 	FB	■	■	■	■	■	■	■	■	■			
SUPPORTING TRAYS 	GIRFIL												
WELDING POLYMER 	HPFIX												

WORK ON PIPES AND FITTINGS
TOOLS

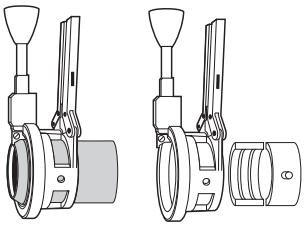
2007

■ CUTTING



• The roller plastic pipe-cutter
Ref. GIRPI **CT1240** Ø 12 to 40 mm
Ref. GIRPI **CT1263** Ø 12 to 63 mm
Ref. GIRPI **CT50110** Ø 50 to 110 mm

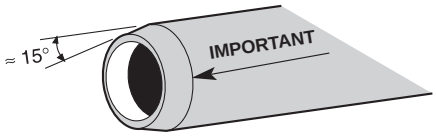
• The chamfering pipe-cutter
This tool cuts and chamfers the pipe after cutting, in one single operation. It is designed to cut the Ø 63, 110 or 160 pipes without accessories.



Ref. GIRPI **CTC63** Ø 32 to 63 mm
Ref. GIRPI **CTC110** Ø 75 to 110 mm
Ref. GIRPI **CTC160** Ø 160 mm

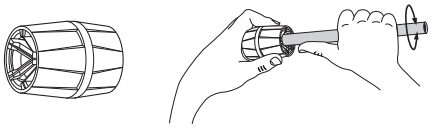
■ TRIMMING - CHAMFERING

After cutting, the pipe must be trimmed inside and **a chamfer must be made on the outside.**

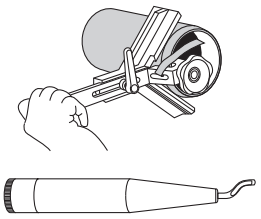


These operations can be performed by means of a 1/2-round bastard file in the absence of dedicated tools:

• **Trimming and chamfering cone**: This tool can be used on the pipe, on the other side it chamfers the outside. Ref. GIRPI **CONE 50 U** for pipes Ø 12 to 50 mm.



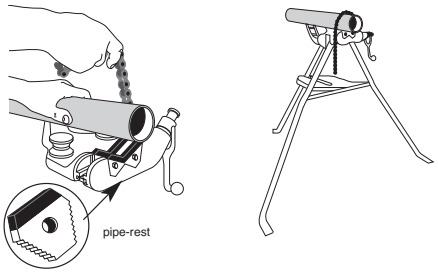
• **Chamfering tool:** This tool chamfers the pipe outside from Ø 50 to Ø 160.
Ref. GIRPI **CHANF160**



• **Chamfering pipe-cutter:** *See cutting section.*

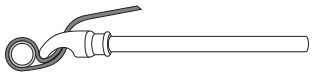
• **Trimmer:** This deburrs reams the inside of pipes of all diameters.
Ref. GIRPI **EBAV1** Ø 20 to 160 mm

■ HOLDING TOOLS



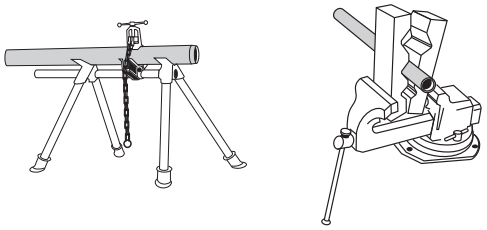
• **Chain vice**
Polyurethane pipe-rests hold the pipe without any scratching.

• **Strap wrench**
Maximum gripping power, with no risk of deforming the pipes or fittings (braided nylon strap).

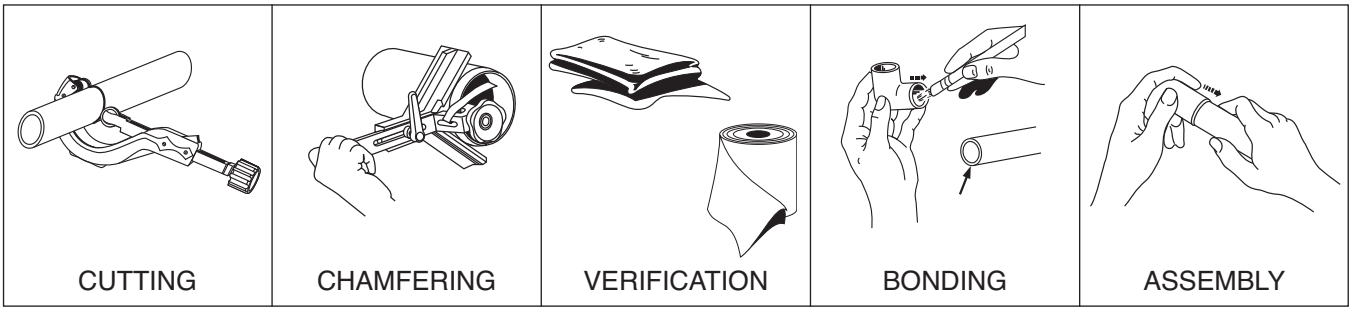


• **Chain bench vice**

• **Vice (traditional)** In this case all the necessary precautions must be taken so that the pipe is neither crushed nor scratched by the jaws. For this purpose, a “hard wood tool” can be cheaply produced. The pipe should be placed in the corresponding notch ; by tightening up the vice the tool clamps the pipe.



WORK ON PIPES AND FITTINGS
TOOLS



CUTTING | CHAMFERING | VERIFICATION | BONDING | ASSEMBLY

■ CHECKS BEFORE BONDING

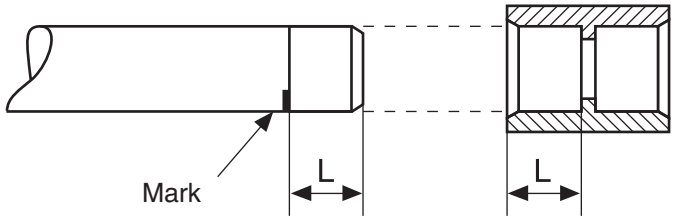
The operations of abrading and cleaning are canceled.
Before bonding, it is important to make certain checks: the pipes must be clean and dry. The working zone must be clean, otherwise it is necessary to clean the pipes and the fittings with a clean cloth, or even D 171 cleaner.

⚠ IMPORTANT

- **Water impairs the welding action of the cement** and subsequently the welding quality. No cold welding will therefore succeed if the parts to be assembled are damp (they must be dry).
- With **HPFIX** the assembly can be made when the temperature is over +5°C and under +35°C, **these are mandatory limits**.
- The atmospheric conditions (temperature, humidity) considerably affect the curing time (drying, evaporation of solvents) of the cement.
- At low temperature, the parts when assembled should be held together for 20 to 30 seconds.
- In hot weather, the cement should be applied rapidly and the parts immediately jointed.
- So as to avoid evaporation of the solvent contained in the cement, the pot must be closed after each cold welding operation.

■ MARKING OF THE SOCKET LENGTH

- It is useful, in the case of the pipe, to trace on it (using a thick pencil or felt marker) a mark at a distance equal to the corresponding socket depth.



This mark enables the application of the cement over the necessary length, and helps the installer to check whether the penetration length of the male end in the socket is correct.

GENERAL CHARACTERISTICS
WELDING PROCEDURE

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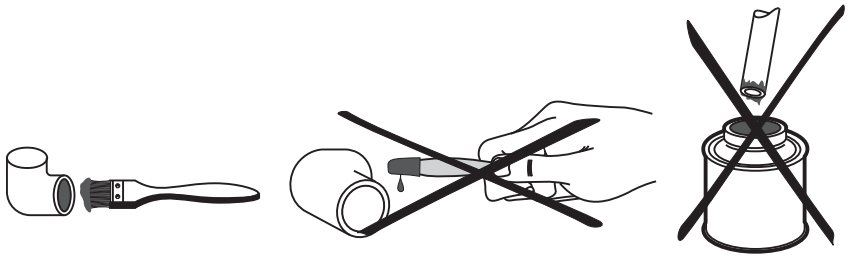
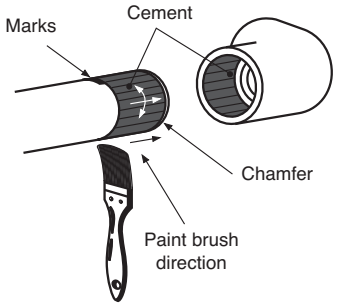
■ COLD WELDING

- When the checks and marking have been done, then apply the cement.
- **HPFIX** cement must be employed. Do not use any other cement.

To apply the welding polymer, use the provided brush. The use of any other means or method is prohibited.



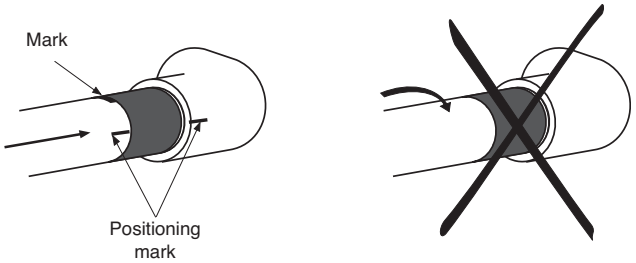
Apply the cement moderately (in a thin coat) over the whole (the female) interlock length and over the whole length of the male end (marked on pipe). The cement should be applied in 2 thin cross-coats, the second coat being in the longitudinal direction. See NF T 54-035 standard. For surfaces with a large diameter, use a large enough brush .



Owing to the standardized tolerance ranges of the male ends and the sockets, some gap may appear.
In this case, double quantities of cement must be applied. This consists in coating the male end once, then the socket and the male end a second time, then jointing them.

■ JOINTING

Immediately after applying the cement, joint the two elements right home (as far as the marks previously traced) pushing longitudinally and, above all, **without twisting**. For surfaces with a large diameter, two people must be present in order to assemble the fittings (one operator coats the socket part while the other operator coats the spigot part).



NB: In certain cases it is necessary to mark the position of one element in relation to the other (see sketch above). This mark should be done before scouring.
- After jointing and in case of surplus cement featured by a bead of cement, it is necessary to reduce it without completely eliminating the trace of cement. This bead should be reduced using a clean cloth or cotton wool.

WORK ON PIPES AND FITTINGS
RECOMMENDATIONS - DETERMINING CEMENT AND CLEANER QUANTITIES

■ DRYING TIME

With HPFIX cement, the drying times before pressure tests are the following:

Ø (in mm)	20 - 63	75 - 110	160
Ambient temperature	**for 6 bar pressure test, at 20°C**		
5 to 10°C	2 h	4 h	24 h
11 to 35°C	1 h	2 h	24 h

■ HANDLING AND STORAGE

Like all building materials, the final quality of the installation depends on the conditions in which they are transported, handled and stored. The pipes and fittings will be stored separately on an even area, away from dust and the direct sunlight. In all cases, take special care to avoid rough handling, impacts and especially with projecting, cutting or heavy objects, particularly in cold weather.

■ THERMOFORMING

Thermoforming of the KRYOCLIM® pipes is strictly prohibited on the work site and involves cessation of the GIRPI guarantee. For all changes in direction, make use of standard KRYOCLIM® fittings only. In case of force majeure, the fabrications will be made in the workshop, without direct flame heating and according to the indications to be requested in writing from GIRPI.

■ CONNECTIONS OF KRYOCLIM® FITTINGS INTO THREADED METAL COMPONENTS

The fittings with screwed or threaded brass inserts molded from a casting : FMML, FEAL, FEBL, F4GL, F4GP must be used for high tightening torques on metallic fittings. The sealing may be then carried out by traditional means, **except for anaerobic resins**.

Excluding connection to wall brackets (GAAP reference), obtained by means of tap connectors (HDR reference), connections of the KRYOCLIM® to metal pipes, fittings and equipment, whether male or female threaded (tapered or cylindrical), must be made by means of KRYOCLIM®/metal couplings provided for this purpose.

If sockets, elbows, tees or other KRYOCLIM® fittings are used with the original tapping or threading in the material itself, they will be screwed by hand, only the last quarter turn if necessary will be made preferably by using a strap wrench. In this case, in order to seal tight, the use of tow or a similar material or anaerobic resin is **forbidden**, as excessive tightening may provoke irremediable damages.

■ APPROXIMATIVE QUANTITIES FOR 100 JOINTINGS DEPENDING ON PIPE DIAMETER

Ø PIPE	20-25-32	40-50-63	75	90-110	160
QUANTITY WELDING POLYMER	200 ml	1 liter	2 liters	3,5 liters	6 liters

These figures were estimated from the tests that we carried out in our laboratory. Because of many variables met on building sites, these figures have only an indicative value.

INSPECTIONS, TESTS AND PUTTING INTO SERVICE

2007

■ GENERAL

The KRYOCLIM® system pipes and fittings are inspected throughout their manufacture and are guaranteed for a use complying with their design within the limits indicated.
During the installation and before putting the KRYOCLIM® network into service, it is advisable to make a certain number of checks as with all the other materials.

■ INSPECTION

a) Visual inspection
When assembling, the pipes and fittings should be inspected so as to eliminate doubtful elements containing abnormalities such as impacts or deep scores caused by unsuitable handling. Before the tests, the whole network will be visually inspected to eliminate any part showing deep cuts or notches, significant deformations due to impacts, traces of blow torch burns, etc.
Any damaged part should be replaced before putting into service. The aim of the visual inspection is also to ensure that the installation complies with the drawings and hence the correct installation of all the component parts (connections, supports, monitoring and safety mechanisms, etc.).

b) Leak tests
Before completing the network, a leak test will be made (all the sections of the network must be visible and accessible during the test).

c) Pressure test
The network is filled with water (drive the air out of all the high points), then held under pressure throughout the time necessary for the visual inspection of all the junctions with a minimum of 30 minutes (for large installations, proceed by sections).

The pressure test will be made at 1,5 times **the maximum service pressure** with a maximum of 10 bar at a temperature of 20°C.

- in case of a leak on a glued joint, replace the faulty section then recommence the test.
- in case of a leak on a screwed joint, tighten up the fitting or replace the seal.

■ PUTTING INTO SERVICE

When the leak tests have been made, it is advisable, in order to remove all foreign matter, to clean the inside of the network. Before putting into service, all the tests and inspections must be made in accordance with the rules of the trade and the regulations applicable to the installation whilst taking account of the characteristics of the material.

OPERATING CONDITIONS

Whatever the case of use, the safety mechanisms necessary for the traditional protection of networks (anti water hammer, pressure reduction and limitation, temperature regulation and limitation, isolating mechanisms, etc). should be provided, installed and kept in perfect working order during the operation.

a) Vibrations
Vibrations can be a source of disorders both on the pipework and on the supports; it is highly advisable to install a suitable system preventing their propagation when necessary.

b) Heat sources and UV
Like all thermoplastic materials, the KRYOCLIM® System should in no case be installed close to a heat source causing a rise in temperature greater than its limits of use, nor in places continuously exposed to the sun (ultraviolet rays). If this type of installation proves to be inevitable, a minimum number of precautions must be taken such as using interposing a protective screen impermeable to ultraviolet or heat rays.

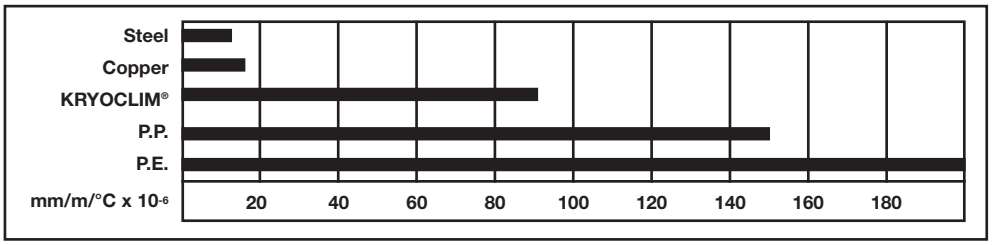
c) Prevention of impacts
As with all networks conveying pressurised fluids, KRYOCLIM® pipeworks should be protected against impacts which might occur in places of passage frequented by handling machinery or suspended loads in movement (use of safety barriers, railings, etc.).

CONTRACTION - EXPANSION
PHENOMENON - CALCULATIONS

THE PHENOMENON

All materials not specially stressed, under the effect of thermal variations in relation to the reference temperature (installation temperature):
- expand when the temperature rises
- contract when the temperature drops

Comparison between coefficients α



Steel	12,8 x 10^{-6} m/m°C
Copper	16,5 x 10^{-6} m/m°C
KRYOCLIM®	70 x 10^{-6} m/m°C
P.P.	150 x 10^{-6} m/m°C
P.E.	200 x 10^{-6} m/m°C

CALCULATION PARAMETERS FOR KRYOCLIM®

The linear expansion coefficient of KRYOCLIM® is: α = 0,07 millimeter per meter per °C (mm/m/°C)

The implementation of the system would take account of the elongation or contraction of the pipe which is calculated by the relation:

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

in which α = expansion-contraction coefficient (linear)

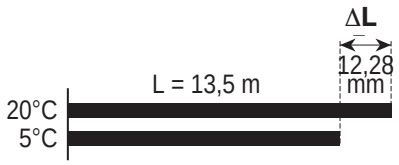
L = length of the piping when installed, in meters

Δ**T** = temperature deviation in degrees Celsius
(difference between the maximum or minimum temperature in service and the installlation temperature)

Δ**L** = length deviation
(difference in length between L on installation and L in operation, i.e. elongation or shrinkage length).

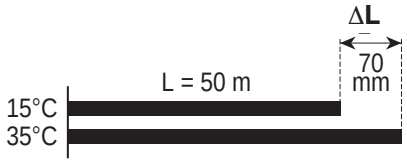
Ex 1: Air Conditioning
- Installation temperature = + 20°C
- Chilled water temperature = + 7°C

L = 5 levels (1 level = 2,7 m) = 13,5 m
ΔT = 20 - 7 = **13°C**
ΔL = 0,07 x 13,5 x 13 = **12,28 mm contraction**



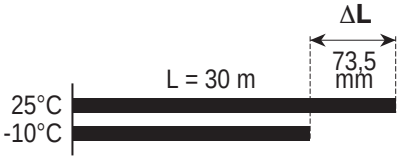
Ex 2: Industrial process (return)
- Installation temperature = + 15°C
- Fluid temperature = + 35°C (maximum)

L = 50 m
ΔT = 35 - 15 = **20°C**
ΔL = 0,07 x 50 x 20 = **70 mm expansion**



Ex 3: Network for industrial kitchen
- Installation temperature = + 25°C
- Fluid temperature (glycol) = - 10°C

L = 30 m
ΔT = = **25 -(-10) = 35°C**
ΔL = 0,07 x 30 x 35 = **73,5 mm contraction**



CONTRACTION - EXPANSION
CONSEQUENCES

2007

CONSEQUENCES OF CONTRACTION-EXPANSION AND SOLUTIONS

In certain conditions, the elongation due to the expansion causes compression of the pipe resulting in deflections, conversely the shortening due to the contraction of the pipe generates tension. The sketches below illustrate a number of cases of compression or tension, which cause abnormal working of the material and may cause noticeable disorders.

The DTU, ATEC, GUIDES LINE concerning the installation of piping, whatever their nature, generally indicate that «when installing, it is necessary, in order to avoid disorders which may be caused by variations in length, to know about them and remedy them».

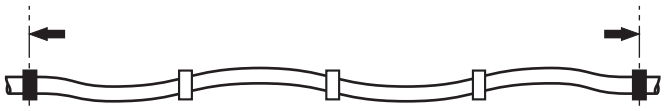
: Anchor Point

: Longitudinal Guide

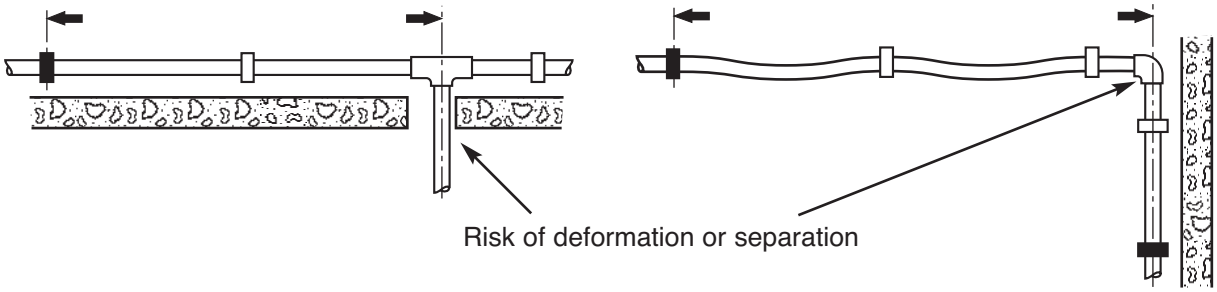
: Action on the stops and couplings

a) Expansion (compression between fixed points)

■ deflection of the pipe between anchor points

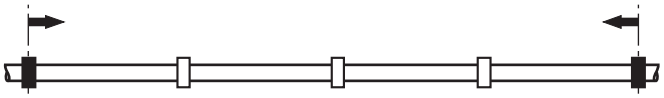


■ Thrust on the works, obstacles, joints or on the equipment forming a fixed point.

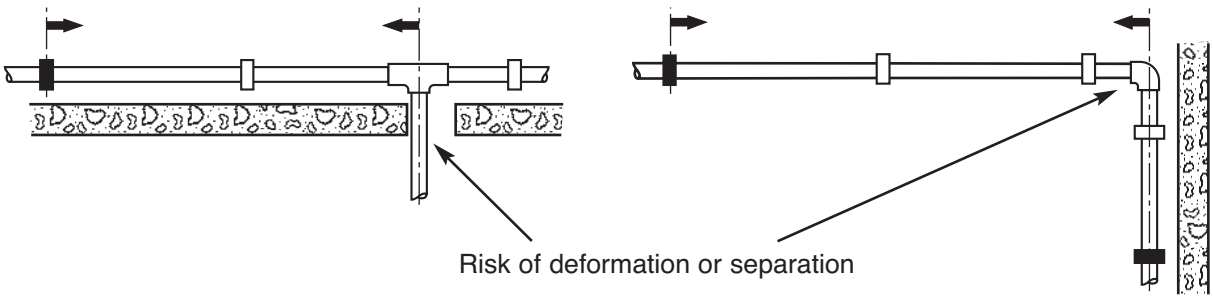


b) Contraction (tension between fixed points)

■ Tensioning of pipes, mechanical couplings, joints between fixed points



■ Tensioning between works, obstacles, joints or equipment forming a fixed point



(1) PF: Anchor point this is a support blocking the piping system at one point, in order to “direct” the movements caused by expansion and contraction.

(2) LG: Longitudinal guides they uphold the pipes while allowing them to expand and shrink (expansion and contraction).

CONTRACTION - EXPANSION
REMEDIES

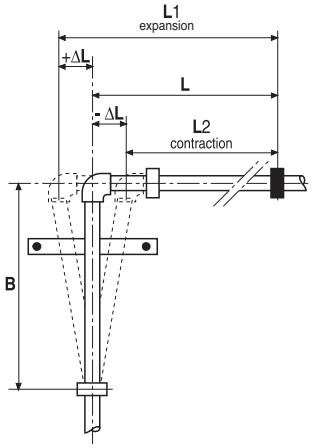
c) The remedies

In order to avoid the disorders subsequent to the movements of the pipe, it is necessary to let the latter expand and contract freely.

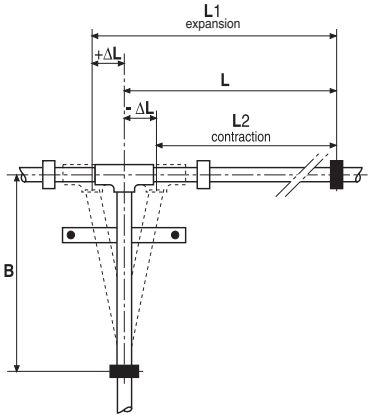
It is therefore necessary to:
- use supports whereby the longitudinal movements of the pipe can be guided
- see that there is never a straight length of pipe between 2 fixed points, either by using a change in direction, or a loop (see illustration below).

1° Change in direction, which is **sufficient in most cases**

CHANGE IN DIRECTION

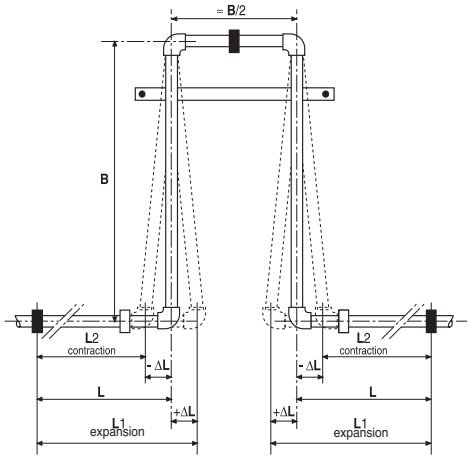


BRANCH

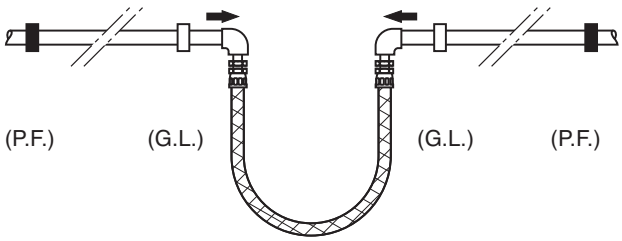


2° Loop made with KRYOCLIM® pipes and fittings

LOOP



3° Flexible expansion joint (HCD/L - HCD/G)



L	: Length of pipework section during installation
L1	: Length at Max temperature
L2	: Length at Min temperature (fluid or ambient)
ΔL	: Length difference between L1 (or L2) and L
B	: Length of loop leg

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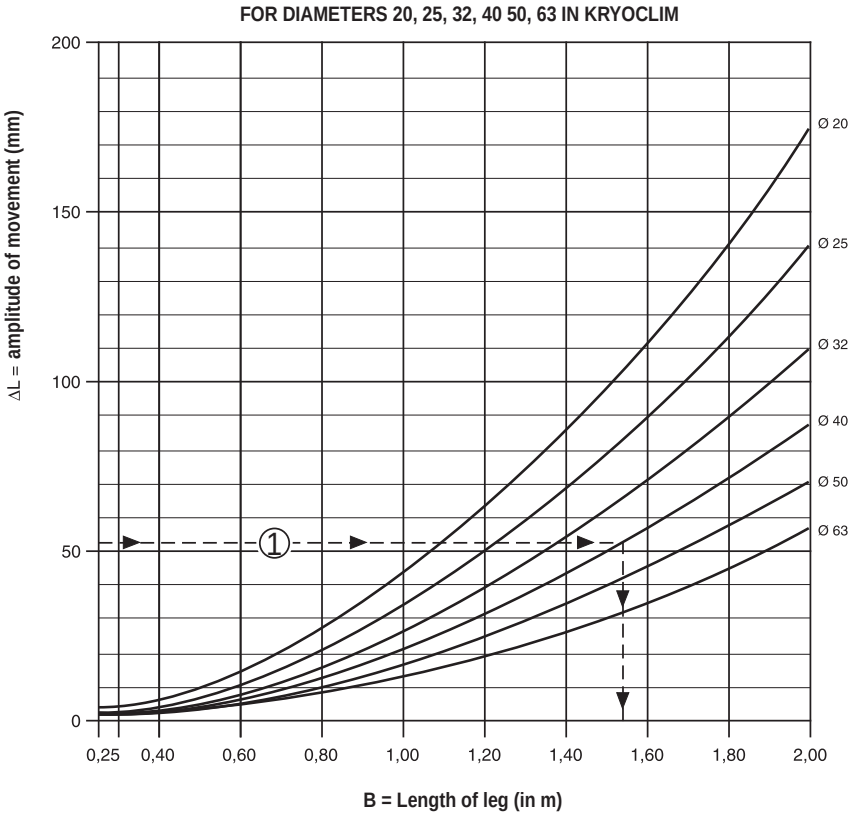
KRYOCLIM® SYSTEM

CONTRACTION - DILATATION
HOW TO DETERMINE LEG B

Technical Sheet

4.4

EXAMPLE ①:
Determine **B** for a Ø 40 mm pipe and a ΔL of 53 mm
Result : **B** = 1,56 m.



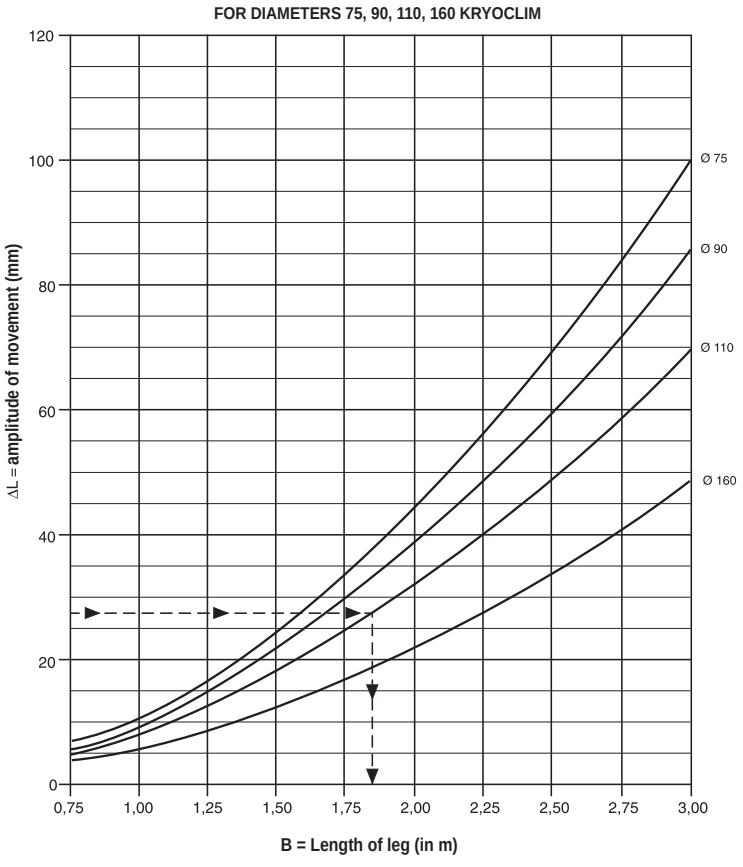
Calculation formula of loop arm:

$$\mathbf{B} = 34 \sqrt{\varnothing \times \Delta \mathbf{L}}$$

with 34 : constant for KRYOCLIM®

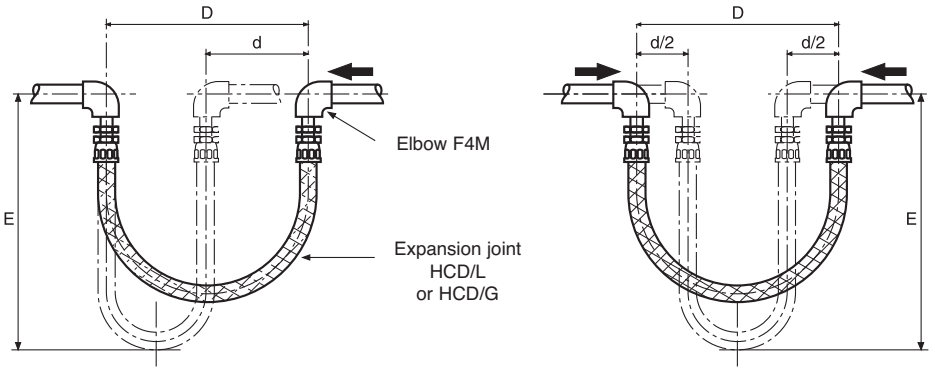
Ø : external diameter

ΔL : length variation



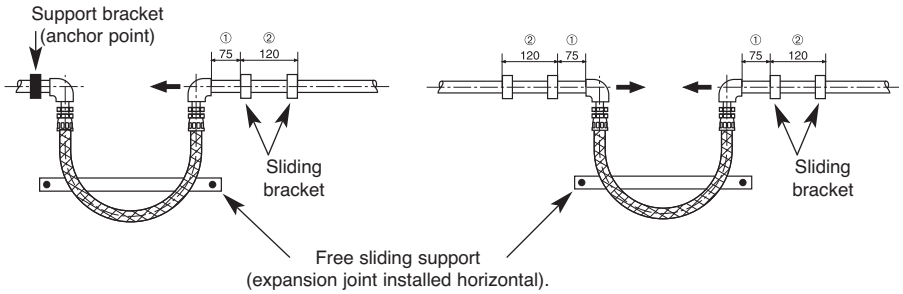
EXAMPLE ②:
Determine **B** for a Ø 110 mm pipe and a ΔL of 28 mm
Result : **B** = 1,88 m

EXPANSION - CONTRACTION
REMEDIES - FLEXIBLE EXPANSION JOINTS



∗ According to the flexible joint's connections:
Threaded adaptor : FMM(L)
Adaptor nipple : FEA(L)
3 piece unions : HPF/BRASS - F3G/L

→ : Direction of expansion .
D : Distance on installation.
d : Absorbed expansion length (ΔL).
E : Max. dimension.



■ EXPANSION JOINT SUPPORTING:

1) The first sliding brackets guide will be at a distance (1) ≈ 75 mm (max spacing position), the next bracket in line will be at a distance (2) ≈ 120 mm from the first.

2) The surface finish of the sliding support supporting the hose will be such that the hose braiding is not deteriorated by friction.

KRYOCLIM pipe ø	Expansion joint reference	D	d	E
20	HCD/G20	220	100	282
25	HCD/G25	280	100	338
32	HCD/G32	350	100	407
40	HCD/G40	420	100	442
50	HCD/G50	500	100	591

■ PRINCIPLES OF IMPLEMENTING EXPANSION JOINTS:

To guarantee correct operation, the following rules must be respected when designing the installation and installing the expansion joints.

- Ensure that the expansion joint is not subjected to twisting during installation or during operation.
- Provide appropriate supporting in cases where the hose is overhanging.

MONOKLIP BRACKETS
GENERAL - SPACING

2007

■ GENERAL

Monoklip brackets are designed to be used with KRYOCLIM® pipes.
The choices concerning the material they are made from, their shape, closing and fastening system are the responsibility of the installer.

KRYOCLIM® is a complete system especially developped to bring global reliability. Therefore, all of the system's elements must imperatively be used. The used of components of external origin will make Girpi's guarantee null and void especially the use of another brackets.

The supports :
- should in no event injure nor damage the pipework,
- should continue to support their load even under temperature effects,
- should continue to support their load even with enough clearance from any wall or obstacle so as to allow for expansion movements and also the assembly and disassembly of the mechanical couplings and accessories (unions, flanges, valves, pressure limiters, etc...).

IMPORTANT

Any rise in temperature in the H.P.F. components produces a weakening of their mechanical characteristics.
This weakening is all the greater when the temperature is high.
This state of things can cause punching or compression of the pipe by unsuitable supports or buckling between supports that are too far from each other, whose effect would be to hinder or even prevent the movements generated by expansion and contraction.

The Monoklips ø 20 to 110 may be heightened by 20 mm wedges (ref CALE 1225) made for that purpose.
For Monoklips ø 32 to 63 use wedges 20 mm or 4 mm (ref CALE 3263) which can be piled up.
For Monoklips ø 75 to 110 use wedges 20 mm (ref CALE 75110) which can be piled up.

NETWORKS FILLED WITH FLUID, SPECIFIC WEIGHT OF FLUID = 1 (APPROX. DENSITY AT T ≤ 20°C)							
Pipe Ø (mm)		20 to 32	40 to 50	63 to 75	90	110	160
Spacing of supports (in metres)	Horizontal pipes	1,00	1,25	1,5	1,75	2	2,25
	Vertical pipes	1,3	1,6	2,00	2,3	2,6	3

■ SPACING OF SUPPORTS

These spacings indicated in function of the temperature and the diameter of the pipe enable the latter to remain straight.
Valves or heavy accessories must be independently supported.

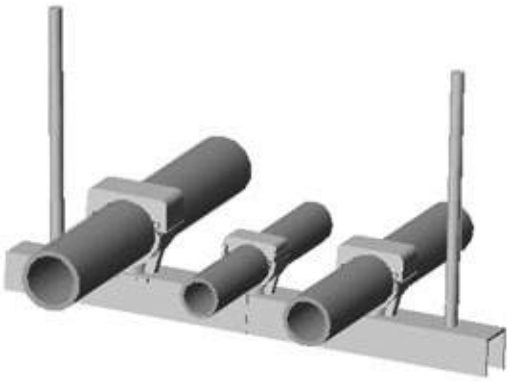
■ N.B. : CORRECTION FACTORS

• Fluid temperature > 20°C.
In this case, these distances can be multiplied by 0,9 at 30°C and by 0,8 at 40°C.

MONOKLIP BRACKETS
EXAMPLES

■ EXAMPLE OF SUPPORTS :

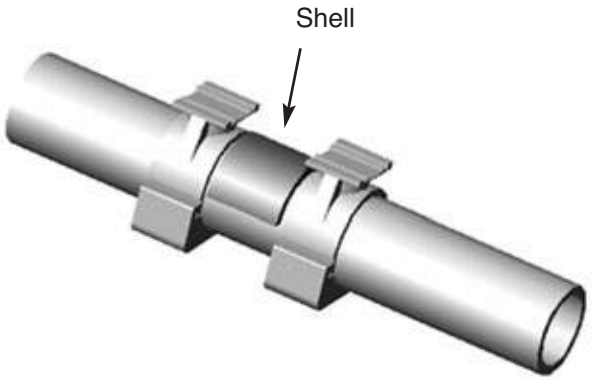
MONOKLIP brackets



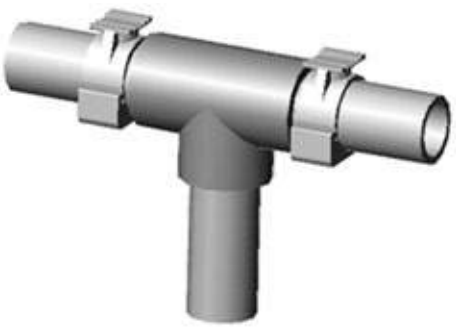
SUPPORT OF RISER'S BOTTOM

■ ANCHOR POINT

The shell pieces are made from longitudinally cut sections of KRYOCLIM® straight couplings which are cleaned and deprived from their internal stops coated with HPFIX, welded on to the degreased and HPFIX coated pipes.



Anchor point on a pipe



Anchor point on a tee

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KRYOCLIM® SYSTEM

SUPPORTS
ACCESSORIES - SPECIAL POINTS

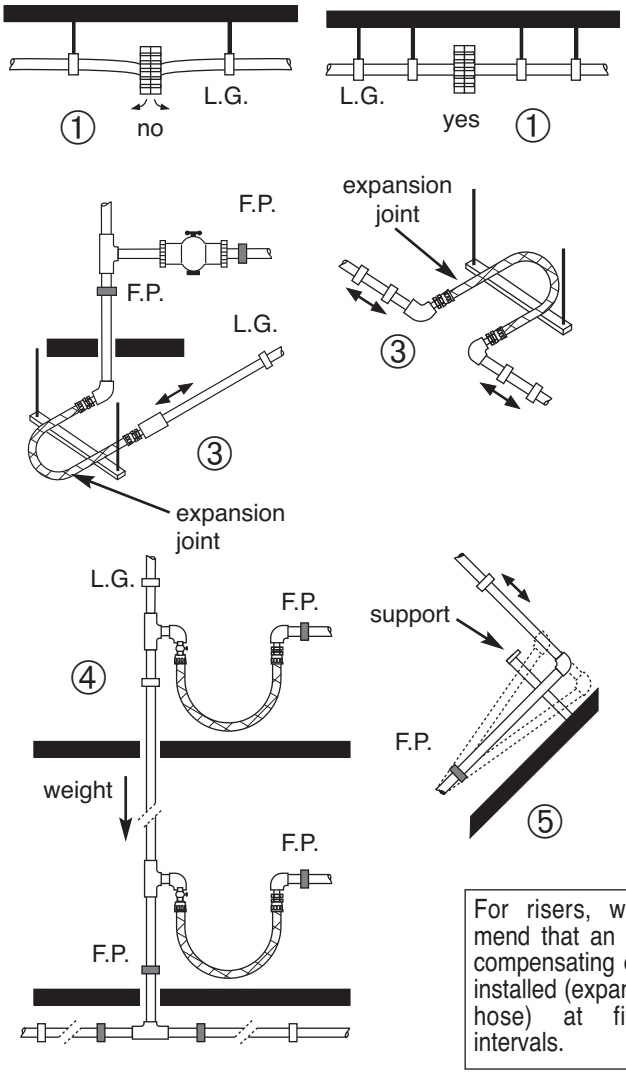
Technical Sheet

513

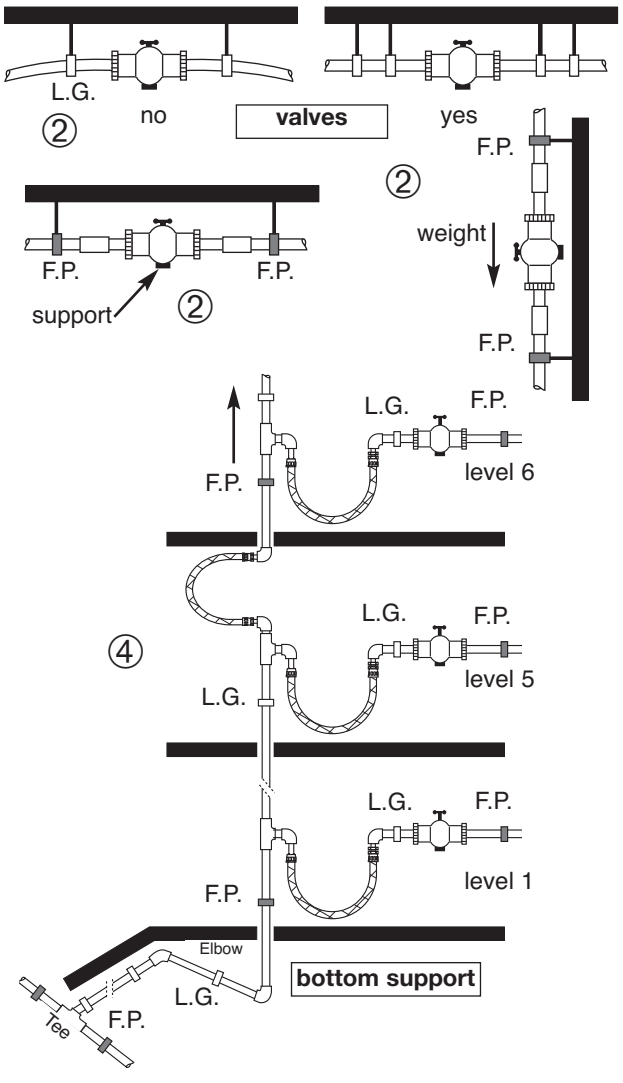
Various accessories or special points require specific supporting: this supporting must be carefully designed in each case, to prevent the pipes from being subjected to mechanical forces.

	CASE	TYPES OF SUPPORT	REASONS
①	• KRYOCLIM male and female threaded fittings and tap connectors	guides or anchors on either side (double support)	to avoid tension on threads due to movement out of axis
②	• Valves and fittings on pipe and threads	on either side and often with anchor point (double support)	weight, must operate without twisting
③	• Hoses	(see technical sheet 4.5)	to allow movement without rotation, without moving out of axis and without chaffing
④	• Riser bottoms	guides or anchors depending on the case	to support the weight of the riser
⑤	• Direction changes	forming a right angle	to allow translation of the loop arm, to prevent sag and wear.

IMPORTANT:
The sliding supports must be positioned in such a way that the couplings or accessories do not come in contact with them when the pipes expand and contract.

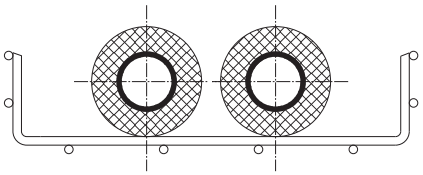


For risers, we recommend that an expansion compensating element is installed (expansion joint, hose) at five level intervals.



BASKET TRAY - GIRFIL

■ GENERAL



In many cases :
- insulated networks,
- need of large support spacing,

the use of GIRFIL basket trays is an excellent solution.

GIRFIL was designed to answer the needs (burden, contraction, expansion, branches,...) met on KRYOCLIM® networks.

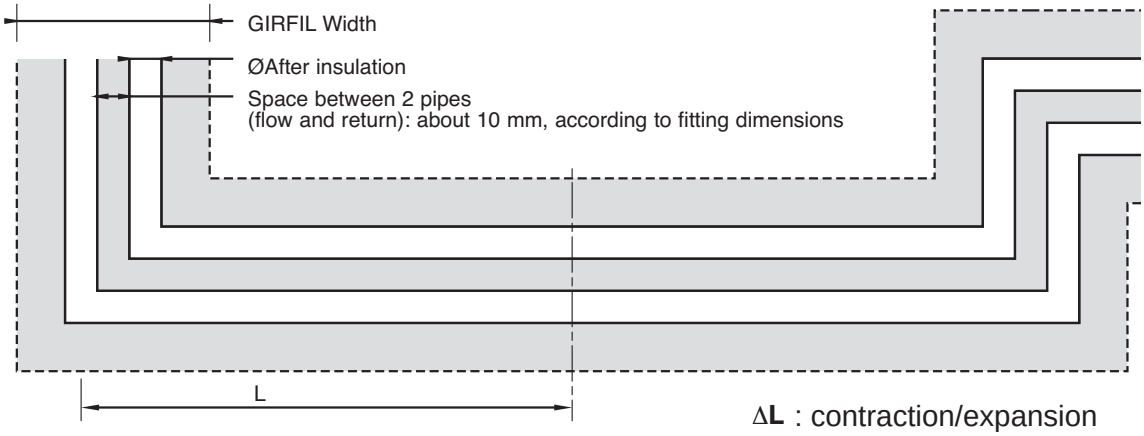
The standard version allows a spacing of 2,50 meters with a minimal shaft. GIRPI can propose you solutions for exceptional spacing of 5 ; 7,5 and 10 meters.

The standard treatment (EZ) allows an internal use in many environments.

GIRFIL basket trays (length: 3 meters) are self splicing.

■ DETERMINATION OF THE GIRFIL WIDTH

- The total burden must be centered on the basket tray.
- Allow for enough space (for contraction and expansion) at the changes in direction.
- Make clean openings (no sharp edges) to avoid damaging the insulating material and the pipe.

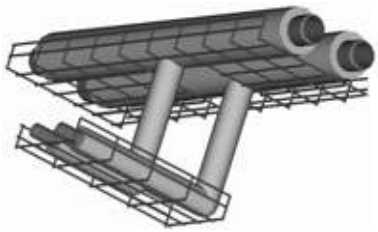


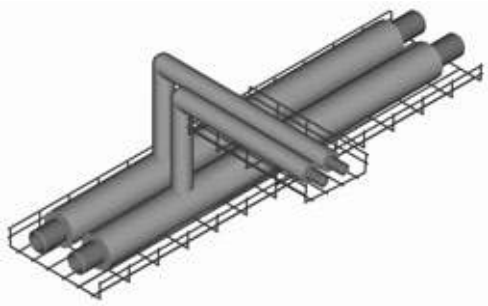
GIRFIL width ≥ (2ø + E) + 2ΔL maxi

If the space between the pipe and the basket tray is not enough to compensate the contraction or the expansion, use one of the solutions presented on sheet 4-3:
- loop
- expansion joint

■ BRANCHES

When basket trays are used, branches can be made above or below the pipes provided that a sufficiently large opening is made, so that sharp edges do not damage the insulating material or the pipe during contraction movements.





BASKET TRAY - GIRFIL
EXAMPLES - RANGE

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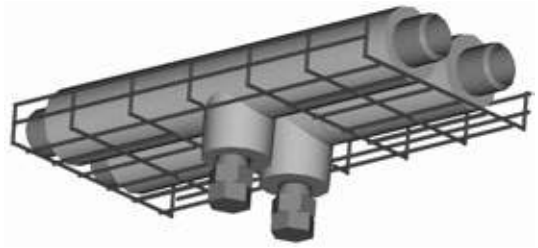
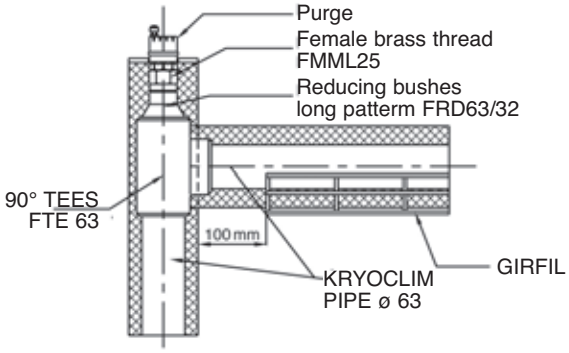
■ EMPTYING

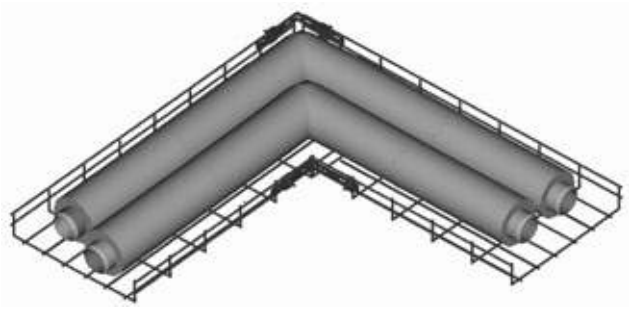


Make a sufficiently large opening to allow contraction movements without damaging the insulating material.

■ PURGE

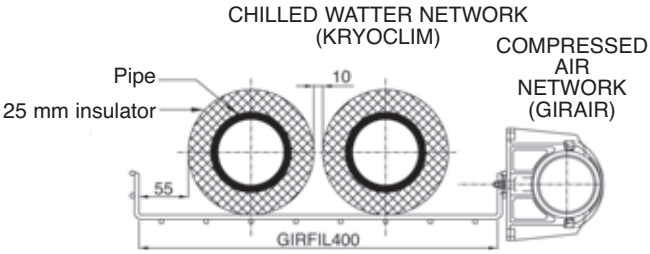


■ CHANGE IN DIRECTION (FILKIT)

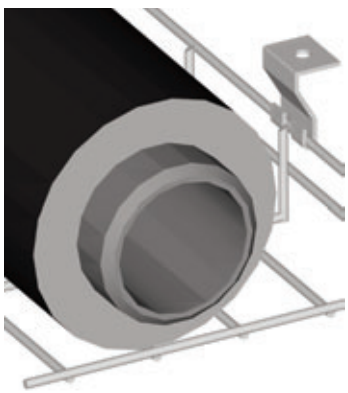


The change in direction is made with the “FILKIT”.

■ BASKET TRAY + MONOKLIP



■ HANGING CLIP (FATT)



The universal fastener allows to hitch GIRFIL with small chains or threaded bolts M8. Their shape makes the disconnection easy in order to install the pipes.

■ CLIPS SUPPORT (FSUP)

The multiposition support can be fixed on a wall or directly on the ceiling in a plenum (versions 200 and 300).

INSULATION
INSULATED PIPEWORKS

■ INSULATION

The low thermal conductivity cœfficient (λ = 0.17 W/mK) of H.P.F.® allows to reduce the heat losses and to delay the condensation phenomena.

Like other materials, KRYOCLIM® must be insulated to be protected against frost, to reduce the heat losses and to avoid condensation when the outside pipe temperature is below dew point.

Most of insulation products can be used if the cement needed for their implementation or if their chemical composition are compatible with KRYOCLIM®.
Check with the insulation product's manufacturer or with GIRPI for the compatibility.

Condensation phenomena have no physical effect upon KRYOCLIM®. H.P.F.® properties reduce condensation in comparison with metallic materials.
■ The calculation of the surface temperature shows that KRYOCLIM® provides you with a safety margin in case of insulation failure.

Example:

		Surface temperature (non insulated)		
		Metallic pipe	KRYOCLIM® pipe	KRYOCLIM® coupling
T_{fluid} = 7°	ø 25	7°C	9°C	11°C
T_{ref} : ambient : 23°C	ø 63	7°C	10°C	13°C
he = 8 W/m²K T_{dew} = 16,1°C	ø 110	7°C	12°C	15°C

■ The following table shows the heat losses (W/m) of KRYOCLIM® pipeworks (with or without insulation).

T_{fluid} = 7°C $T_{ref. : ambient}$ = 23°C he = 8 W/m²K	No insulating material	Insulation material (λ=0.039W/mK) Thickness = 13mm	Insulation material (λ=0.039W/mK) Thickness = 19mm	Insulation material (λ=0.039W/mK) Thickness = 32mm
ø 25	8,7	4,1	3,4	2,7
ø 63	19,8	7,9	6,4	4,8
ø 110	30,5	12,1	9,7	7,1

■ APPLICATIONS: Building, Tertiary, Industry, Food industry.

Applications	Example Fluid temperature	Insulation product internal use	Recommended thickness internal use (mm)*
Cooling system	+15°C	Foam rubber	0 - 9
Comfort cooling (air conditioning)	+7/12°C : chilled water	Foam rubber μ ≥ 5000	13 - 19
Negative temperature network (Industrial kitchen, warehouse...)	-10°C water and glycol	Foam rubber μ ≥ 7000	19 - 32
		Extruded and cutout polystyren + anti vapour treatment	25 - 30
Refrigerated room	-25°C water and glycol	Extruded and cutout polystyren + anti vapour treatment	30 - 40

** The thicknesses are only indicative and depend on each building site and on each network. Check with a specialised consultant.*

Ask GIRPI for detailed technical sheets for each application and for a personalised heat loss study.
Phenolic foams can provoke stress corrosion cracking phenomena on brass components.
Please contact foam manufacturers for instructions.

N.B. : μ : material permeability.
he : external superficial exchange cœfficient (average value: 8).

LAGGING PROCEDURES
ELEMENTARY RULES

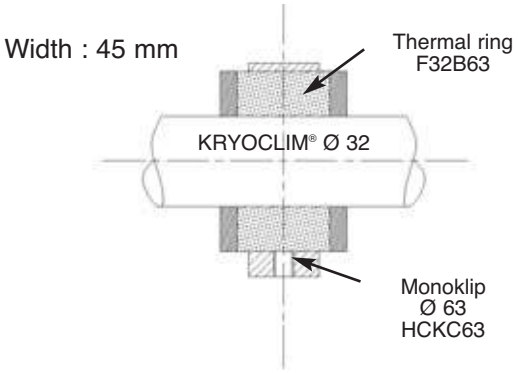
2007

Lagging must be done according to the DTU 61.1 (thermal insulation of refrigerating pipeworks) and to the DTU 65.20.
The KRYOCLIM® system does not need any anti-corrosion treatment before insulation.
The fire resistance of the insulating products must comply with the security standard against fire in the public buildings.
It is better not to glue directly the insulating materials on the KRYOCLIM® pipes and fittings.

■ THERMAL RING

Outside France, observe local rules and standards.
To prevent the insulating material from flattening out at collar level, a thermal ring must be used. They allow the KRYOCLIM® pipe to expand and contract freely.

Example for ø 32 pipe



Thermal ring Reference	Ø pipe KRYOCLIM® Diameter int.	Ø Monoklip Diameter ext.	Theoretical thickness
F16B40	16	40	12
F20B50	20	50	13
F25B50	25	50	13
F32B63	32	63	16
F40B75	40	75	18
F50B90	50	90	20
F63B110	63	110	24
F75B125	75	125	25
F90B140	90	140	25
F110B160	110	160	25

■ LAGGING PROCEDURE : FOAM RUBBER, EXTRUDED AND CUTOUT POLYESTYRENE

The procedure to install this kind of insulation must be respected according to the manufacturer's documentation.

PRESSURE LOSSES

■ CALCULATION BASIS

The quality of the internal surface of KRYOCLIM® pipes gives the guarantee of a better flow capacity (for an equivalent cross section) than that of metallic pipes.

To calculate HPF pipes' pressure losses, taking in to consideration a perfect internal surface condition (therefore a low cœfficient of roughness which is specific to our pipes), GIRPI has ordered from CATED a nomogram of pressure losses at 7°C (see sheet 6.2).
This nomogram is established using the REEF formula.

■ THE REEF FORMULA

J : Pressure losses (mmCE/m) - U : fluid speed (m/s)
D : internal pipe diameter

$$J = k \times U^{1,75} \times D^{-1,25} \quad (mmCE/m)$$

V : kinematic viscosity (m^2/s) - W : volumic mass (kg/m^3)
g : gravitational acceleration = 9,81 (m/s^2)
N.B. : ε = absolute roughness of the material = 0,001 mm.

$$k = 0,3264 \times V^{0,25} \times \frac{W}{2g}$$

Correction cœfficient

• Following the percentage of NEUTRAGEL® used, the pressure losses increase due to the variation of the kinematic viscosity and the density of the fluid. Therefore, it is necessary to multiply the pressure losses read on the nomogram at 7°C - 0 % by a correction cœfficient in case of a regular and smooth fluid circulation.

% NEUTRAGEL volume	0%	10%	15%	25%	30%	35%	40%	45%	50%
Fluid temperature (°C)	7 à 5	4	2	-5	-10	-15	-20	-25	-30
Machine protection* temperature (°C)	-	-2	-5	-10	-15	-20	-25	-30	-35
Pressure losses correction cœfficient	nomogramme x 1	x 1,1	x 1,2	x 1,4	x 1,6	x 1,8	x 2	x 2,4	x 2,8
Flow correction	x 1	x 0,95				x 0,9			

* Estimated values, check with the manufacturer.

• For example: in case of an air conditioning network at 7°C, during winter when the outside pipework does not work, the pipes must be protected against frost. Use one of the following methods:

1) Drain the pipework while it is stopped.
2) Protect the pipework with a self regulated heating cord covered by a lagging with a big wall thickness. (ex.: 32 mm).
3) Using NEUTRAGEL® in sufficient quantity and oversizing some items of the installation.

% NEUTRAGEL	0%	30%	40%
Fluid temperature (°C)	7°C		
Pressure loss correction cœfficient	nomogram x 1	x 1,4	x 1,5

• MIXIGEL® is used pure.
Its viscosity at low temperature is much lower than that of Propylene Glycol.

% MIXIGEL	0%	Pur = 100%	
Fluid temperature	7°C	-20°C	-30°C
Pressure losses corrector cœfficient	nomogram x 1	x 2,2	x 2,7

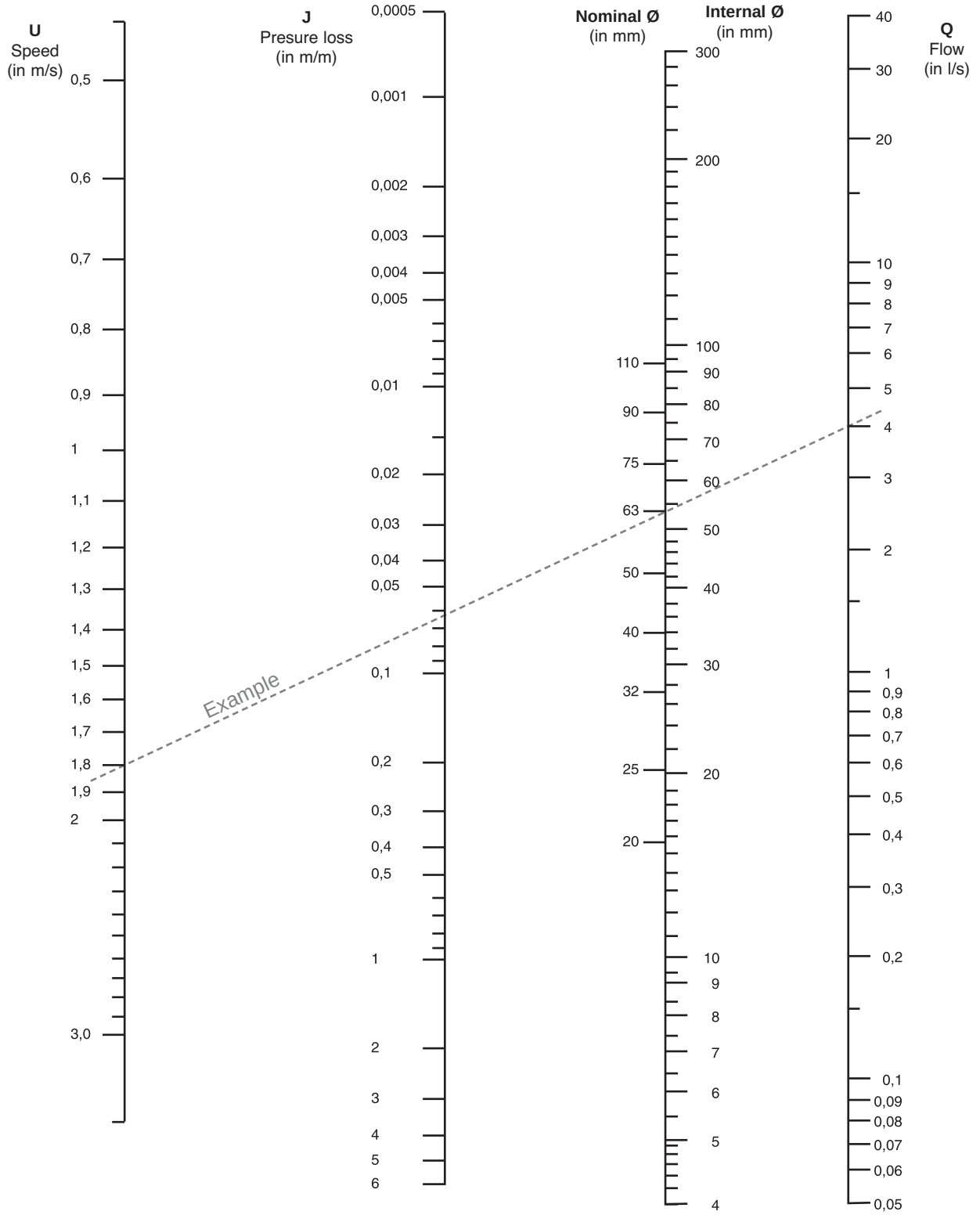
Ex 1 : • Reading on the nomogram (see sheet 6.2), pure water.
Flow rate: 4l/s
Speed: 1,8 m/s ⇨ Pressure losses: 0,06 mCE/m
External pipe ø: 63 mm

• In case of a fluid at -20°C, with 35% of NEUTRAGEL®
Flow rate: 4l/s
Speed: 1,8 m/s ⇨ Pressure losses: 0,06 x corrector cœfficient = 0,06 x 1,8 = 0,108 mCE/m
External pipe ø: 63 mm

For the compatibility with the fluids see sheet 9.1.

PRESSURE LOSSES
NOMOGRAM AT 7°C - FLUID: WATER

2007



METHOD: mark two of the installation's working parameters, trace a straight line between those two points, read missing parameter values on this line.
Designed and produced by CATED.

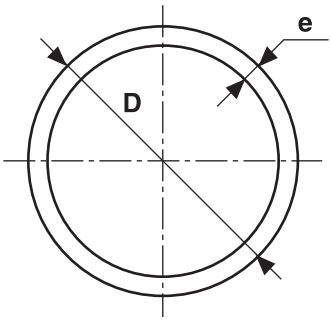
DIMENSION SHEET

IMPORTANT NOTE :

With the constant concern to improve the range and quality of its products within the context of the standards used at present, GIRPI reserves the right to modify the dimensional characteristics of its pipes and fittings together with the scope of its ranges, without prior notice.

KRYOCLIM® PIPES

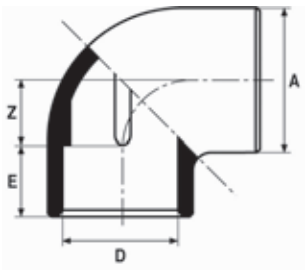
4 m lengths with plain ends



D	Dn	Reference	Pack (*)	PN	Mini	Weight kg/m	Internal Ø	Cont. l/m
20	10	TUBF20	10	10	2,3	0,188	15,4	0,186
25	15	TUBF25	10	10	2,3	0,235	20,4	0,327
32	20	TUBF32	10	10	2,4	0,314	27,2	0,581
40	25	TUBF40	10	10	3	0,490	34,0	0,908
50	32	TUBF50	5	10	3,7	0,756	42,6	1,425
63	40	TUBF63	5	10	4,7	1,210	53,6	2,256
75	50	TUBF75	1	10	5,6	1,680	64,0	3,217
90	50	TUBF90	1	10	6,7	2,430	76,8	4,632
110	50	TUBF110	1	10	8,1	3,640	93,6	6,911
160	50	TUBF160	1	10	11,8	7,800	136,4	14,6

(*) Quantity of pipes per bandle

ELBOWS 90°

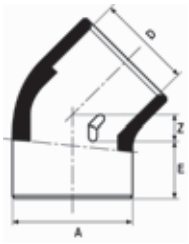


D	Dn	Reference	Z	E	A
20	15	F4M20	11	17	26
25	20	F4M25	14,5	19,5	30,5
32	25	F4M32	18	23	38
40	32	F4M40	23	27	49
50	40	F4M50	27	31,5	58
63	50	F4M63	33	38	73
75	65	F4M75	39	44	92,5
90	80	F4M90	49	52,5	112
110	100	F4M110	58	62	131,5
160	150	F4M160	82	89	190

DIMENSION SHEET

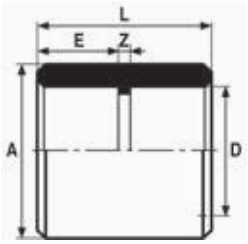
2007

ELBOWS 45°



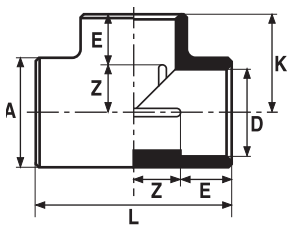
D	Dn	Reference	Z	E	A
20	15	F8M20	4,5	17	25,5
25	20	F8M25	5,5	19,5	31,5
32	25	F8M32	8	23	39,5
40	32	F8M40	9,5	27	49
50	40	F8M50	11,5	32	58
63	50	F8M63	14	38	72,5
75	65	F8M75	18	44	92
90	80	F8M90	22	52	109
110	100	F8M110	24	62	131,5
160	150	F8M160	33	88	190,5

COUPLINGS



D	Dn	Reference	Z	E	A	L
20	15	FMA20	3	17	26	37
25	20	FMA25	2,5	20	31,5	42,5
32	25	FMA32	3,5	23	38	49,5
40	32	FMA40	4	26,5	48	57
50	40	FMA50	3	32	59,5	67
63	50	FMA63	4	38	75,5	80,0
75	65	FMA75	4	45	91	94
90	80	FMA90	5	52	106,5	109
110	100	FMA110	6	62	126,5	130
160	150	FMA160	9	87	187,5	183

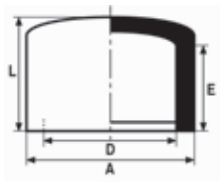
EQUAL TEES 90°



D	Dn	Reference	Z	E	A	L	K
20	15	FTE20	11	17	26	56	28
25	20	FTE25	14	19	31,5	66,5	34
32	25	FTE32	18,5	22,5	39,5	82	41
40	32	FTE40	22	27	49,5	97,5	50
50	40	FTE50	26,5	31	61	115	58
63	50	FTE63	32,5	38,5	78	142	72
75	65	FTE75	39	44,5	91,5	166,5	83
90	80	FTE90	45	53	112	196,5	98
110	100	FTE110	55,5	62,5	132	236	119
160	150	FTE160	84	87	191	342	170

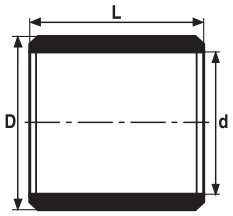
DIMENSION SHEET

CAPS



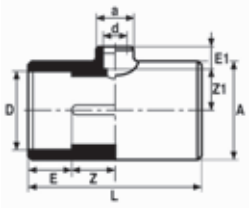
D	Dn	Reference	E	A	L
20	15	FBO20	17,5	26	22
25	20	FBO25	19,5	31,5	25,5
32	25	FBO32	24	39,5	30
40	32	FBO40	28	48	36,5
50	40	FBO50	33	59,5	43
63	50	FBO63	40,5	75	52,5
75	65	FBO75	52	91	77
90	80	FBO90	59	107,5	91,5
110	100	FBO110	66	129	109,5
160	150	FBO160	87,5	186	154

PLAIN NIPPLES



D	Dn	Reference	L	d
20	15	FMC20	37	15,5
25	20	FMC25	42	19,5

TEES REDUCED 90°

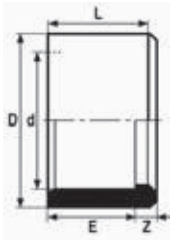


D-d	Dn	Reference	Z	Z1	E	E1	A	a	L
25-20	20-15	FTR2520	13,5	13	19,5	16	31	26	66
32-20	25-15	FTR3220	17,5	18,5	23,5	16,5	39	26,5	82
32-25	25-20	FTR3225	18	20	23	19	39	31,5	82
40-20	32-15	FTR4020	22	23	27	17	49,5	26,5	97,5
40-25	32-20	FTR4025	22	23	27	19,5	49,5	31,5	97,5
40-32	32-25	FTR4032	22	22	27	23	49,5	39,5	97,5
50-20	40-15	FTR5020	26,5	28	31	17	61	33	115
50-25	40-20	FTR5025	26,5	28	31	20	60,5	33	114,5
50-32	40-25	FTR5032	26,5	28	31	23	61	41	115
50-40	40-32	FTR5040	26,5	27	31	26	61	50	115
63-20	50-15	FTR6320	33,5	34	38,5	18	80	37	144
63-25	50-20	FTR6325	33,5	35	38,5	20	80	37	144
63-32	50-25	FTR6332	33,5	35	38,5	23,5	80	45	144
63-40	50-32	FTR6340	33,5	36	38,5	27,5	80	54,5	144
75-20	65-15	FTR7520	39	40	44,5	17	92,5	37	167
75-25	65-20	FTR7525	39	40	44,5	19,5	92,5	37	167
75-40	65-32	FTR7540	39	40	44,5	27	92,5	54	167
90-25	80-20	FTR9025	46	46,5	52,5	19,5	114,5	37,5	197
90-40	80-32	FTR9040	46	46,5	52,5	32,5	114,5	65	197
110-32	100-25	FTR1132	57	67,5	62	23,5	135	65	238
110-50	100-40	FTR1150	57	56	62	31,5	135	65	238

DIMENSION SHEET

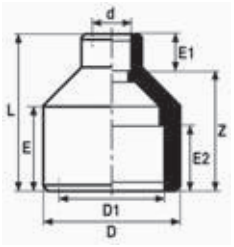
2007

REDUCING BUSHES SHORT PATTERN



D-d	Dn	Reference	Z	E	L
25-20	20	FRS25	3,5	17,0	20,5
32-25	25	FRS32	5	19,5	24,5
40-32	32	FRS40	6	23	29
50-40	40	FRS50	5	27	32
63-50	50	FRS63	7	31,5	38,5
75-63	65	FRS75	7,5	37	44,5
90-75	80	FRS90	8	44	52
110-90	100	FRS110	10,5	52	62,5

REDUCING BUSHES LONG PATTERN

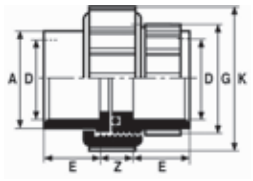


D-d	Dn	Reference	D1	Z	E	E1	E2	L
32-20	25-15	FRD3220	25	31	22,5	17	19,5	48
40-20	32-15	FRD4020	32	36,5	27	17	23	53,5
40-25	32-20	FRD4025	32	36,5	27	19,5	21,5	56
50-20	40-15	FRD5020	40	45	32,5	17	27,5	62
50-32	40-25	FRD5032	40	45	32	23	27,5	68
63-25	50-20	FRD6325	50	55	38,5	19,5	32	74,5
63-32	50-25	FRD6332	50	55,5	38,5	23	32	78,5
63-40	50-32	FRD6340	50	55,5	38,5	27	32	82,5
75-40	65-32	FRD7540	63	62,5	45	27	38	89,5
75-50	65-40	FRD7550	63	62	45	32	38,5	94
90-40	80-32	FRD9040	75	75	53	27	44,5	102
90-50	80-40	FRD9050	75	74,5	53	32	44	106,5
90-63	80-50	FRD9063	75	75	53	38,5	44,5	113,5
110-50	100-40	FRD1150	90	90,5	62	32	52,5	122,5
110-63	100-50	FRD1163	90	92	63,5	38	54	130
110-75	100-65	FRD1175	90	90,5	62	44,5	52,5	135
160-75	150-65	FRD1675	140	126,5	88	44,5	77	171
160-90	150-80	FRD1690	140	127	87	52	78,5	179
160-110	150-100	FRD1611	140	126	87	62	87	188

NB : Reducer's large ends for references FRD32 to 110 (except FRD 7532, 7540 and 7550) can be used as sockets and spigots, with one size interval.

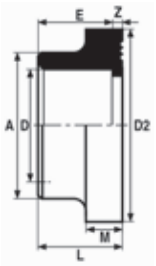
DIMENSION SHEET

3 PIECE UNIONS FF



D	Dn	Reference	Z	E	A	G	K	Nb sides
20	15	F3P20	14	17	27	1”	42	18
25	20	F3P25	14	19	35,5	1”1/4	55	12
32	25	F3P32	13,5	23	41,5	1”1/2	62,5	12
40	32	F3P40	17	26,5	52,5	2”	73,5	18
50	40	F3P50	17,5	32,5	58,5	2”1/4	81,5	18

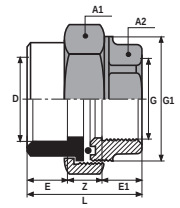
SERRATED STUB FLANGES



D	Dn	Reference	Z	E	A	D2	M	L
20	15	FCS20	3	17	27	34	6	20
25	20	FCS25	3	20	33	41	7	23
32	25	FCS32	3	23	41	50	7	26
40	32	FCS40	3	27	50	61	8	30
50	40	FCS50	3	32	61	73	8	35
63	50	FCS63	3	38,5	76	90	9	41,5
75	63	FCS75	3	44	90	106	10	47
90	80	FCS90	5	52	108	125	11	57
110	100	FCS110	5	62	131	150	12	67
160	150	FCS160	5	86	187	219	16	91

3 PIECE UNIONS KRYOCLIM - BRASS

with EPDM gasket



D	G	Dn	Reference	Z	E	E1	G1	A1	A2	L
20	1/2”	15	F3G/L20	8	17	14	1”	36	27	39
25	3/4”	20	F3G/L25	8	19,5	16	1”1/4	46	32,5	43,5
32	1”	25	F3G/L32	10,5	23	16,5	1”1/2	51,5	38,5	50
40	1”1/4	32	F3G/L40	10	27,5	21	2”	67	47	58,5
50	1”1/2	40	F3G/L50	12	32,5	18,5	2”1/4	72	53,5	63
63	2”	50	F3G/L63	11	38,5	22	2”3/4	89	65,5	71,5

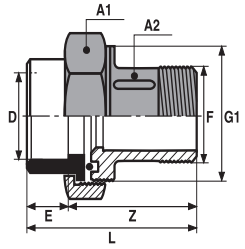
Soc x female thread

DIMENSION SHEET

2007

3 PIECE UNIONS KRYOCLIM - BRASS

with EPDM gasket

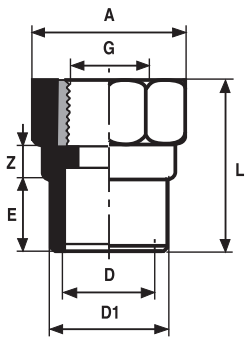


D	F	Dn	Reference	Z	E	A1	G1	A2	L
20	1/2”	15	F3F/L20	34	17	36	1”	24,5	51
25	3/4”	20	F3F/L25	50	19	46	1”1/4	31,5	69
32	1”	25	F3F/L32	54	23	52	1”1/2	37,5	77
40	1”1/4	32	F3F/L40	53	27	67	2”	47	83
50	1”1/2	40	F3F/L50	63,5	32,5	72	2”1/4	53	96
63	2”	50	F3F/L63	70	38,5	89,5	2”3/4	66	108,5

Soc x male thread

THREADED FITTINGS

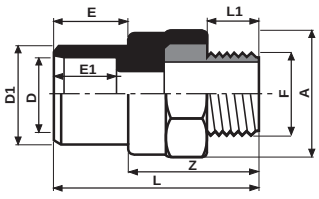
female adaptor (brass thread)



D-G	Dn	Reference	D1	Z	E	L	A	Nb sides
20-1/2”	15	FMML20	25	9	16,5	44	36	8
25-3/4”	20	FMML25	32	9,5	19,5	49	41,4	8
32-1”	25	FMML32	40	9,8	23	56,4	49,6	8
40-1”1/4	32	FMML40	50	7	31	64	60	8
50-1”1/2	40	FMML50	63	7	37,5	69,5	66	8
63-2”	50	FMML63	75	8	43,5	80,5	82	8

THREADED FITTINGS

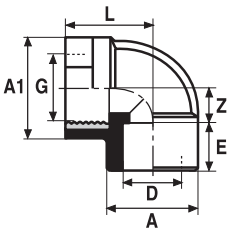
male adaptor (brass thread)



D-F	Reference	D1	Z	E	E1	A	L	L1	Nb sides
20-1/2”	FEAL20	25	41	19	17	36	60	15	8
25-3/4”	FEAL25	32	43	22,5	19,5	41	65	16	8
32-1”	FEAL32	40	49	27	23	49,5	76	19,5	8
40-1”1/4	FEAL40	50	55	31	26	60	87	22	8
50-1”1/4	FEAL50	63	55	37,5	31	66	92	22	8
63-2”	FEAL63	75	63	43,5	37,5	82	106	26	8

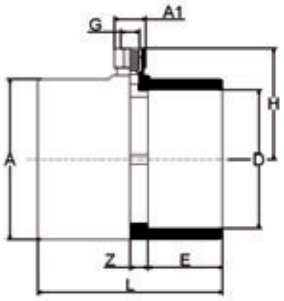
DIMENSION SHEET

THREADED ELBOWS



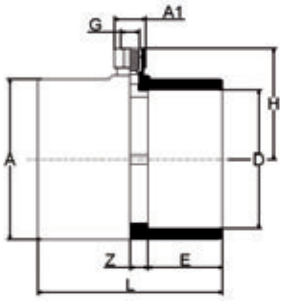
D-G	Dn	Reference	Z	E	A	A1	L
20-1/2"	15	F4GL20	16	16,5	29	36	32
25/3/4"	20	F4GL25	17	19,5	35	41	37,5

ADAPTORS 1/2"



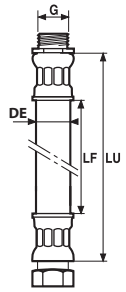
D-G	Dn	Reference	A1	Z	E	L	A	H	Nb sides
110-1/2"	110	FMIL110/12	36	20	61	163	132	100	8
160-1/2"	160	FMIL160/12	36	20,5	86	213	185	125	8

ADAPTORS 3/4"



D-G	Dn	Reference	A1	Z	E	L	A	H	Nb sides
110-3/4"	110	FMIL110/34	41	20	61	163	132	101	8
160-3/4"	160	FMIL160/34	41	20,5	86	213	185	126	8

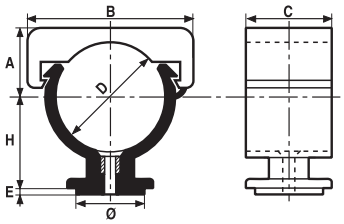
EXPANSION JOINTS



D-G	Dn	Reference	LF	LU	DE	DI
20-1/2"	15	HCD/G20	410	457	22	13
25-3/4"	20	HCD/G25	520	592	28	17
32-1"	25	HCD/G32	640	720	35	22
40-1"1/4	32	HCD/G40	760	825	42	28
50-2"	40	HCD/G50	980	1067	50	34

MONOKLIP BRACKETS Ø 16 to 25
With threaded metal insert M6, M8 of 7x150

Ø 20 - 25

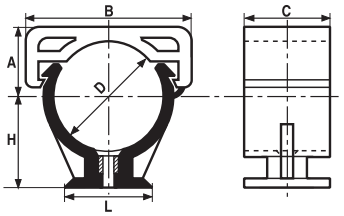


Embase 20 - 25

To be used with wedge
CALE 1225 - 20 mm high.

D	Dn	Reference	H	A	B	C	ø	E
M6 INSERT								
16	10	HCK16/6	18	12	26,5	20	16	1
20	15	HCK20/6	20	14	32	22	16	1
25	20	HCK25/6	22	16	38,5	25	16	1
M8 INSERT								
16	10	HCK16/8	18	12	26,5	20	16	1
20	15	HCK20/8	20	14	32	22	16	1
25	20	HCK25/8	22	16	38,5	25	16	1
7 x 150 INSERT								
16	10	HCK16/7	18	12	26,5	20	16	1
20	15	HCK20/7	20	14	32	22	16	1
25	20	HCK25/7	22	16	38,5	25	16	1

Ø 32 - 63

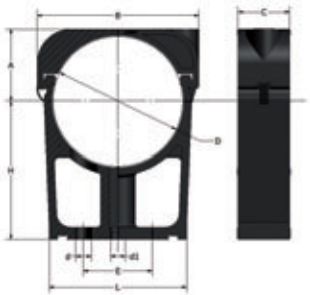


Embase 32 to 63

To be used with wedge
CALE 3263 - 20 mm high or
wedge CALE 3263/4 - 4 mm high.

D	Dn	Reference	H	A	B	C	L
M6 INSERT							
32	25	HCKC32/6	28	20	44	24,5	34
40	32	HCKC40/6	32	24	55	24,5	34
50	40	HCKC50/6	35	30	65,6	24,5	52
63	50	HCKC63/6	35	41	79,5	24,5	52
M8 INSERT							
32	25	HCKC32/8	28	20	44	24,5	34
40	32	HCKC40/8	32	24	55	24,5	34
50	40	HCKC50/8	35	30	65,6	24,5	52
63	50	HCKC63/8	35	41	79,5	24,5	52
7 x 150 INSERT							
32	25	HCKC32/7	28	20	44	24,5	34
40	32	HCKC40/7	32	24	55	24,5	34
50	40	HCKC50/7	35	30	65,6	24,5	52
63	50	HCKC63/7	35	41	79,5	24,5	52

Ø 75 to 160

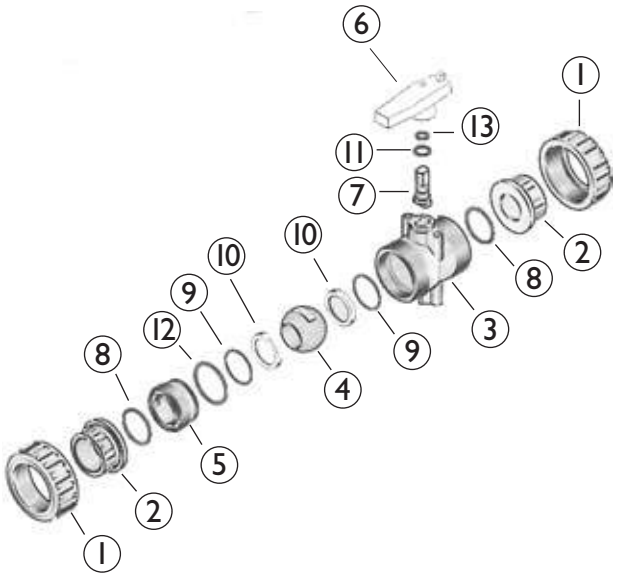


To be used with wedge
CALE 75110 - 20 mm high - only
compatible with Monoklip bracket
Ø 75 to 110.

D-dn	Reference	d1	H	A	B	C	L	d	E	J
M8 INSERT										
75-65	HCKC75/8	M8	80	42	96	30	80	9	40	7
90-80	HCKC90/8	M8	80	49	113	30	80	9	40	7
110-100	HCKC110/8	M8	80	60	130	30	80	9	40	7
125-125	HCKC125/8	M8	120	70	159	30	190	9	170	7
160-150	HCKC160/8	M8	120	85	194	30	230	9	210	7

CEMENTED SOCKET ENDS

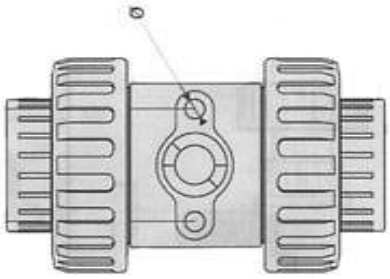
ø 20 to 63



KEY

①	Nut
②	Welded/threaded socket end union
③	Body
④	Ball
⑤	Support
⑥	Handle
⑦	Stem
⑧	Socket o'ring
⑨	Seat o'ring
⑩	Ball seat
⑪	Stem o'ring
⑫	Body o'ring
⑬	Stem o'ring

ANCHORING SYSTEM

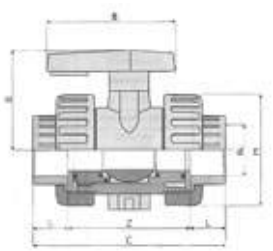


These ball valves have a built-in anchoring system.

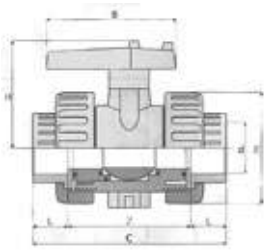
There are two holes underneath fitted with threaded brass inserts (use screw in accordance with data below).

Ø Ball valve	screw Ø for brass insert
20	5,5
25	5,5
32	6,5
40	8
50	8
63	8

Reference	d	G	DN	L	Z	C	E	H	B	g	X	Ø	Fig.
VFCEP20	20	1/2"	15	16	70	102	47	45	66	160	31	5,5	A
VFCEP25	25	3/4"	20	19	82	120	57	55	78	260	31	5,5	A
VFCEP32	32	1"	25	22	87	131	68	67	86	380	40	6,5	A
VFCEP40	40	1 1/4"	32	26	98	150	86	83	100	655	45	8	B
VFCEP50	50	1 1/2"	40	31	101	163	98	91	110	925	50	8	B
VFCEP63	63	2"	50	38	121	197	122	111	130	1695	50	8	B



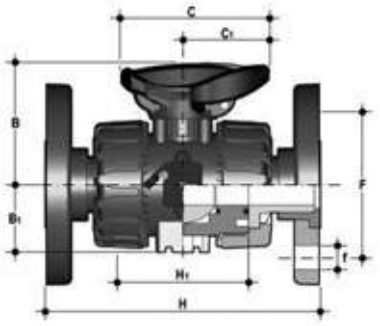
A



B

CEMENTED SOCKET ENDS

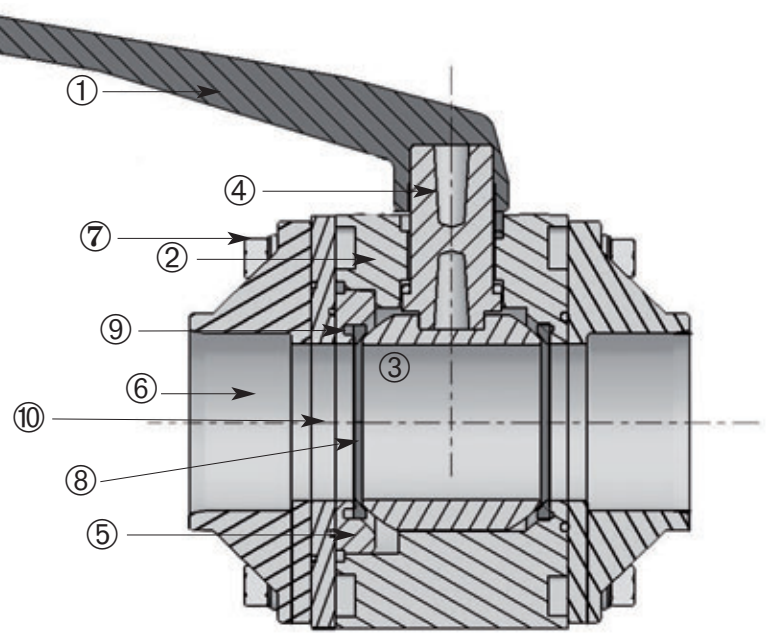
2007



Reference	d	DN	PN	H	H1	B	B1	C	C1	F	f	U	gr.
VFP20	20	15	16	130	65	54	29	67	40	65	14	4	547
VFP25	25	20	16	150	70	65	34,5	85	49	75	14	4	772
VFP32	32	25	16	160	78	69,5	39	85	49	85	14	4	1024
VFP40	40	32	16	180	88	82,5	46	108	64	100	18	4	1583
VFP50	50	40	16	200	93	89	52	108	64	110	18	4	2024
VFP63	63	50	16	230	111	108	62	134	76	134	18	4	3219

BALL / VALVES

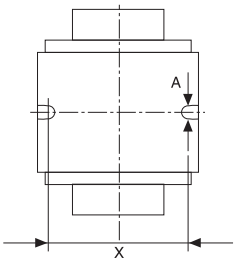
ø 75 to 110



KEY

①	Handle
②	Body
③	Ball
④	Stem
⑤	Support
⑥	Threaded socket
⑦	Bolt
⑧	Ball seat
⑨	O ring
⑩	Counterplate

ANCHORING SYSTEM



Ø ball valve	A	X (mm)
75	11	110
90	11	110
110	11	135

Because of their weights, these valves require adapted supporting to ensure good working conditions. There are two openings at the valves bases, so that they can easily be bolted outo their adapted supports. The table above indicates the openings' sizes and distance.

• Ø 75-110 valves are assembled for optimal results in our workshops. We strongly advise not to remove the counterplates which guarantee the assembly parameters integrily socket flanges can be removed.

Socket ends									Weight
d	Dn	Ref. EPDM	E	Z	L	D	H	A	(kg)
75	65	VFFEP75	44	147	235	210	170	211	7
90	80	VFFEP90	51,5	150	253	210	170	211	7
110	100	VFFEP110	62,5	176	301,	252	215	250	11

CHEMICAL RESISTANCE TABLES

2007

Most current antifreeze liquids are compatible with KRYOCLIM® e.g.: MEG (MonoEthylene Glycol), MPG (MonoPropylene Glycol), potassium Acetate, Potassium Formiate, NaCl, CaCl, ammonia-based water solutions.

All additional fluids (e.g. additives) may not be compatible with KRYOCLIM®. Please check with your supplier or the manufacturer.

Any other additive (anti-oxydation, protection films...) must not be used unless its compatibility with KRYOCLIM® has been ascertained with your supplier or the manufacturer.

Elements supplied in the tables below concern HPF®. Other materials used in the KRYOCLIM® system (brass, welding polymer, etc...). require separate compatibility studies.

The indications given in the tables below are extracts from French or foreign documents or the result of our own experiments.

They cannot be considered to be absolute or guaranteed, as they are not valid in all specific operating conditions. It must also be noted that the nature of chemical agents and their mixtures, the presence of impurities, and the degree of vulcanisation of elastomers, can lead to large variations in these indications; only practical tests in these cases can provide valid results.

We cannot be held liable for the indications given.

The chemical agents are classified in alphabetical order.

Meaning of symbols:
2: Good resistance **1:** Limited resistance (depending on conditions of use) **0:** Not resistant (use not recommended)

REACTIVE		H.P.F.®	EPDM
		20°C	20°C
Acetaldehyde		0	-
Acetic acid	0 - 20 %	2	2
Acetic acid	20 - 30 %	2	-
Acetic acid	30 - 60 %	2	-
Acetic acid	80 - 100 %	2	-
Acetic anhydride		0	-
Acetone		0	-
Acetylene		2	2
Acid wash water of ore processing		2	-
Adipic acid		2	2
Allyl alcohol	96 %	2	-
Alum		2	2
Aluminium chloride		2	2
Aluminium fluoride		2	2
Aluminium hydroxide		2	-
Aluminium nitrate		2	-
Aluminium oxychloride		2	-
Ammonia (liquid)		-	2
Ammonium bifluoride		2	-
Ammonium carbonate		2	2
Ammonium chloride		2	2
Ammonium fluoride		2	2
Ammonium hydroxide		0	-
Ammonium nitrate		2	2
Ammonium methaphosphate		2	-
Ammonium phosphate (ammoniacal and neutral)		2	2
Ammonium sulphate		2	2
Ammonium sulphite		2	-
Ammonium persulphate		2	-
Ammonium thiocyanate		2	-
Amyl acetate		0	-
Amyle chlorure		0	-

CHEMICAL RESISTANCE TABLES

REACTIVE		H.P.F.® 20°C	EPDM 20°C
Amy alcohol		2	2
Anhydrous nitric acid		0	-
Aniline		0	-
Aniline chlorate		2	-
Aniline hydrochloride		0	-
Antimony trichloride		2	2
Anthraquinone		2	-
Aqua regia	50 %	2	-
Aqua regia (nitrohydrochloric acid)		2	2
Arsenic acid	80 %	2	2
Asphalt		2	0
Barium carbonate		2	-
Barium chloride		2	2
Barium hydroxide		2	2
Barium sulphite		2	-
Barium sulphate		2	2
Beetroot (sweet liqueur)		2	-
Benzaldehyde		0	-
Benzine		0	-
Benzoic acid		2	2
Benzol		0	-
Bismudth carbonate		2	-
Borax		2	2
Boric acid		2	2
Boric trifluoride		2	-
Bromic water	10 %	2	2
Bromine liquid		0	-
Bromide sodium		2	-
Bromide water		2	-
Brine		2	2
Butadiene		2	0
Butyl alcohol		2	2
Butylene		2	2
Butylnediol (erythritol)		2	2
Butylphenol	100 %	2	-
Calcium bisulfite		2	-
Calcium chlorate		2	-
Calcium chlorate		2	2
Calcium hydroxide		2	-
Calcium hypochlorite		2	2
Calcium nitrate		2	2
Calcium sulphate		2	2
Cane sugar melasses		2	-
Carbonate de calcium		2	-
Carbonic acid		2	2
Castor oil		2	-
Caustic potash		2	2
Cellosolve		2	-

CHEMICAL RESISTANCE TABLES

2007

REACTIVE		H.P.F.® 20°C	EPDM 20°C
Chloral hydrate		2	-
Chlorate potassium		2	2
Chloroacetic acid		2	-
Chloroforme		0	-
Chloride ferric		2	2
Chloride sodium		2	2
Chlorine water	5 %	2	2
Chlorobenzine		0	-
Chlorosulphonic acid	100 %	2	-
Chlorure d'allyle		0	-
Coagulation bath of rayon		2	-
Copper cyanide		2	2
Copper chloride		2	2
Copper fluoride		2	2
Copper nitrate		2	2
Copper sulphate		2	2
Cresol	90 %	2	-
Crude acetic esters		2	0
Crude acetic esters		2	2
Chromic alum		2	2
Chromic acid	10 %	2	-
Chromic acid	30 %	2	-
Chromic acid	40 %	2	-
Chromic acid	50 %	2	-
Citric acid	20 %	2	2
Cyclohexanol		0	-
Cyclohexanon		0	-
Dextrin	18 %	2	2
Dextrose		2	-
Diazotization salts		2	-
Dichloroethylene		0	-
Dichromate sodium		2	-
Diglycolic acid	30 %	2	2
Dimethylamine		0	-
Dioctyl phthalate		0	-
Disodic phosphate		2	-
Distilled water		2	2
Ether		0	
Ethoxyl		0	-
Ethyl acetate		0	-
Ethyl acrylate		0	-
Ethyl alcohol	5 %	2	2
Ethylene bromide		0	-
Ethyl chloride		0	-
Ethyl chlorohydrine		0	-
Ethyl ether		0	-

CHEMICAL RESISTANCE TABLES

REACTIVE		H.P.F.®	EPDM
		20°C	20°C
Fatty acids		2	-
Ferrocyanide sodium		2	2
Ferric nitrate		2	2
Ferrous sulphate		2	2
Ferric sulphate		2	2
Fluoboric acid		2	-
Fluoboric acid		2	-
Formaldehyde		0	2
Formic acid		2	2
Foundry cores oil		2	-
Fresh water		2	2
Fructose		2	-
Furfural		0	-
Gallic acid		2	-
Gelatine		2	2
Glacial acetic acid		2	-
Glucose		2	2
Glycerine		2	2
Glycolic acid		2	2
Greasing oil		2	-
Hexane		2	-
Hydrochloric acid	20 %	2	2
Hydrochloric acid	0 - 25 %	2	2
Hydrochloric acid	25 - 40 %	2	-
Hydrofluoric acid	60 %	2	-
Hydrofluoric acid	40 %	2	-
Hydrocyanic acid		2	-
Hydrofluosilicic acid		2	-
Hydrogen peroxide	30 %	2	-
Hydrogen phosphide		2	-
Hydroquinone		2	-
Hydroxylamine sulphate	12 %	2	2
Hypochlorous acid		2	-
Kerosene		2	-
Lactic acid	28 %	2	-
Lauric acid		2	-
Lauryl chloride		2	-
Lauryl sulphate		2	-
Lead acetate		2	2
Lime sulfide		2	2
Linoleic acid		2	-
Magnesium carbonate		2	-
Magnesium chloride		2	2
Magnesium hydroxide		2	-
Magnesium sulphate		2	2
Magnesium nitrate		2	2
Maleic acid	35 %	2	2
Malic acid		2	2
Melasses		2	2

CHEMICAL RESISTANCE TABLES

2007

REACTIVE		H.P.F.®	EPDM
		20°C	20°C
Mercure		2	2
Mercuric chloride		2	2
Mercuric cyanide		2	2
Mercahenzothiazolate		0	-
Mercurous nitrate		2	2
Methyl alcohol	10 %	2	2
Methyl chloride		0	-
Methyl sulphate		2	-
Methylethylcetone		0	-
Methylene chloride		0	-
Monopropylene glycol		0	-
Naphta		2	-
Naphtalene		0	-
Nickel chloride		2	2
Nickel nitrate		2	2
Nickel sulphate		2	2
Nicotine		2	2
Nicotinic acid		2	-
Nitric acid	30 - 50 %	2	-
Nitric acid	50 - 60 %	2	0
Nitric acid	60 %	2	0
Nitric acid	68 %	2	0
Ocenol (non-saturated alcohol)		2	-
Oleic acid		2	-
Oleum		0	-
Oxalic acid		2	2
Palmitic acid	100 %	2	-
Peracetic acid	40 %	2	-
Perborate potassium		2	-
Perchloric acid	10 %	2	2
Perchloric acid	70 %	2	2
Permanganate potassium	10 %	2	2
Persulphate potassium		2	2
Phenol		2	0
Phenylhydrazine		0	-
Phenylhydrazine hydrochloride		2	2
Phosgene gas	100 %	2	2
Phosgene liquid		0	-
Phosphoric acid	0 - 25 %	2	2
Phosphoric acid	25 - 50 %	2	2
Phosphoric acid	50 - 85 %	2	2
Phosphorus pentoxide		2	2
Phosphorus trichloride		0	-
Photographic baths		2	2
Picric acid	1 %	0	2
Potassium bicarbonate		2	2
Potassium bichromate		2	2
Potassium bicarbonae		2	2
Potassium bromate		2	2

CHEMICAL RESISTANCE TABLES

REACTIVE		H.P.F.® 20°C	EPDM 20°C
Potassium bromide		2	2
Potassium carbonate		2	2
Potassium chromate		2	2
Potassium chloride		2	2
Potassium cyanide		2	2
Potassium dichromate		2	-
Potassium ferrocyanide		2	2
Potassium ferrocyanide		2	2
Potassium fluoride		2	2
Potassium hydroxide		2	-
Potassium nitrate		2	2
Potassium perchlorate	1 %	2	2
Potassium sulphate		2	2
Primary butanol		2	2
Propargyl alcohol		2	2
Propyl alcohol	1 %	2	2
Propylene dichloride		0	-
Pure acetic esters		0	
Pure acetic esters		0	
Saltwater	90 %	2	-
Secondary butanol		2	2
Secondary butanol		2	2
Selenic acid		2	-
Silinic acid		2	2
Silver cyanide		2	2
Silver nitrate		2	2
Silvering solutions		2	2
Soaps		2	2
Sodium acetate		2	-
Sodium acid phosphate		2	2
Sodium arsenite		2	-
Sodium benzoate		2	2
Sodium bicarbonate	36 %	2	2
Sodium bisulphate		2	-
Sodium bisulphite		2	2
Sodium carbonate (soda ashes)		2	2
Sodium chlorate		2	2
Sodium cyanide		2	2
Sodium fluoride		2	2
Sodium fluoride		2	2
Sodium hydroxide		2	2
Sodium hydroxide		2	2
Sodium hypochlorite		2	2
Sodium nitrate		2	2
Sodium nitrate		2	2
Sodium nitrite		0	-
Sodium silicate		2	2
Sodium sulphate		2	2
Sodium sulphite		2	-
Sodium sulphide		2	2
Sodium thisulphate (or hypo-)		2	2

CHEMICAL RESISTANCE TABLES

2007

REACTIVE		H.P.F.® 20°C	EPDM 20°C
Stannic chloride		2	2
Stannous chloride		2	2
Stearic acid		2	2
Sulphuric acid	0 - 40 %	2	2
Sulphuric acid	40 - 80 %	2	2
Sulphuric acid	80 - 90 %	2	0
Sulphuric acid	95 %	2	0
Sulphurous acid		2	-
Sulphur aluminium sulphate		2	2
Sulphuric anhydride		2	-
Sulphuric anhydride		2	-
Stoddard solvent		2	-
Tannic acid		2	-
Tartaric acid		2	2
Tertiary hexanol		2	2
Tetraethyl lead		2	-
Tetrahydrofurane		0	-
Thionyl chloride		0	-
Titanium tetrachloride		2	0
Toluol or toluene		0	-
Tributyl phosphate		0	-
Trichlorethylene		0	-
Tricresylphosphate		0	-
Triethanolamine		0	-
Triethylamine		2	-
Trimethylolpropane	10 %	2	2
Trisodic phosphate		2	-
Urea	30 %	2	2
Urine		2	2
Iron chloride		2	2
Vinyl acetate		0	-
Xylene or Xylol		0	-
Zinc chloride		2	2
Zinc chromate		2	2
Zinc cyanide		2	2
Zinc nitrate		2	2
Zinc sulphate		2	2

TECHNICAL SPECIFICATION AND IMPLEMENTATION

Material technical specification:

The pipes and fittings must be from the GIRPI KRYOCLIM® system or equivalent.

Fire resistance rating : M1 (being classified).

When needed, the manufacturer must be able to provide professional training courses on their premises.

Working conditions:

For conveying chilled fluids and air conditioning with temperatures and pressures as follows :

- -30°C to +20°C / 10 bars,
- Maximum working pressure and temperature : +40°C / 7 bar.

Assembly of KRYOCLIM pipes and fittings:

Please refer to guidelines 60.31 & 60.33 and to the manufacturer's current technical documentation.

The pipes shall be exclusively jointed by cold welding:

- cut pipe with plastic pipe cutters,
- trim and chamfer with chamfering tool,
- do not scour with D 171 Plus cleaner **if pipes and fittings are clean and dry,**
- bond with cement (HPFIX) using an adapted brush.

Implementation, contraction:

- Alpha cœfficient 0,07 mm/m/ °C.

Linear variations between fixed points shall be absorbed by :

- changes in direction,
- expansion loops made from pipes and fitting,
- flexible hoses.

Pressure tests:

- In compliance with guideline 60.1. and with the manufacturer's technical documentation.

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