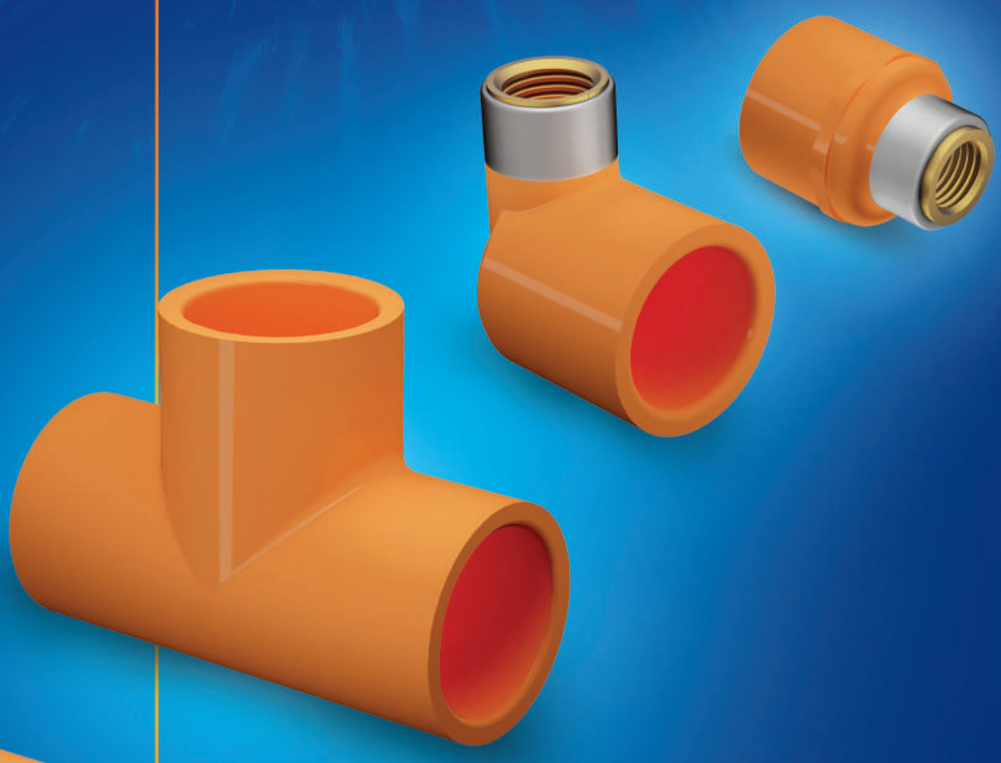
TIGRE



TIGREFire®

Technical Catalogue and Products

Group TIGRE

A better world is in the making.

A BETTER TOMORROW FOR EVERYONE. THIS IS OUR BRAND IN THE WORLD.

Each of our actions or our products has a single goal: to build a better world for all.

Better for our professionals who, united and guided by solid values, create innovative solutions to transform reality and people's lives.

Better for our customers, who receive the technology and trust that only a market-leading brand for decades can offer.

And better for the planet, which has every drop of its most precious natural resource respected and preserved with all affection.

Today, we are an admired multinational worldwide, with 24 manufacturing units (10 in Brazil and 14 abroad), present in more than 40 countries. All this done by more than 5,000 dedicated and passionate employees.

These numbers fill us with pride, but what really inspires us is knowing that a better world is at work.

And if it depends on Tigre, he will be better and better for everyone.

Our solutions

When it comes to building or renovating, count on Tigre! More than 75 years of history and innovation with a complete line of products for each stage of your project. After all, as important as a pioneering and transformative stance, it is to bring to the homes of millions of Brazilians solutions that guarantee tranquility and comfort. Whether for home renovation, collective, industrial and building works, real estate and artistic painting, sanitary metals, drainage projects, basic sanitation, agriculture, mining, among other applications, Tigre products guarantee innovative solutions ranging from infrastructure to finishing. And the best part: they are easy to install and very safe.

- Water
- Sewage
- Drainage
- Accessories
- Electrical
- Painting Tools - Real Estate
- Painting Tools - Artistic
- Industry
- Irrigation
- Infrastructure
- Fire Fighting System
- Residential Gas

Summary

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1. TIGRE Fire®
The easiest and safest way to install your sprinkler network

A pioneer in innovations for building systems, infrastructure, irrigation and industry, TIGRE brings to Brazil the newest solution for conducting water in sprinkler systems - automatic showers - for protection and firefighting, the TIGRE Fire® line.

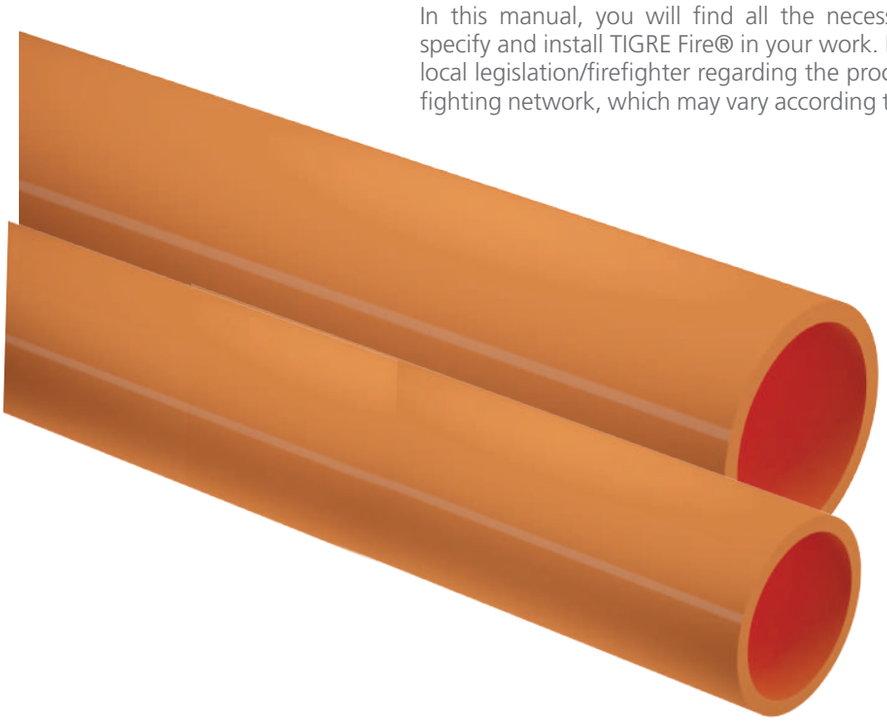
Manufactured with a special compound based on the thermoplastic CPVC Poly(chlorinated vinyl chloride), developed especially for application in protection and firefighting systems, the TIGRE Fire® solution offers total safety and durability superior to traditional systems.

Tests carried out in the laboratories of the Technological Research Institute of the State of São Paulo (IPT) prove its resistance. Having met all the requirements of the Brazilian Standard for Fire Protection by Automatic Shower (NBR 10897), TIGRE Fire® had its final test in the fire exposure test. Remaining exposed to flames, it suffered no damage or reduction in any of its mechanical properties.

With installation simplified by the weldable joint system similar to Aquatherm® and ease of transport and handling due to the lightness of the material, TIGRE Fire® provides speed and efficiency in the installation of the automatic shower network, allowing a reduction in the total execution time of the work.

In addition to the use recommended in new works by reducing the delivery time of the project, the application in retrofits (adaptation of the internal infrastructure of the building to current needs and requirements) is also recommended because it does not use torches or require the making of threads.

In this manual, you will find all the necessary information to design, specify and install TIGRE Fire® in your work. It is important to consult the local legislation/firefighter regarding the procedures for installing the fire fighting network, which may vary according to each region.



1.1.Function/Application

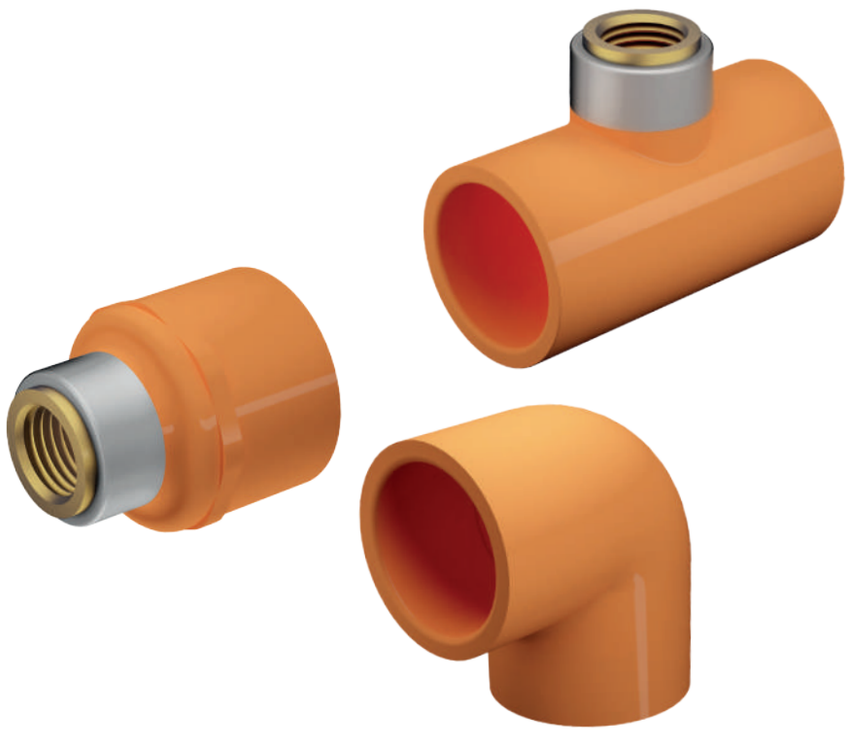
The TIGRE Fire® line of CPVC pipes and fittings was developed for water conduction in protection and firefighting systems with automatic sprinklers for rapid response.

Its use is recommended for areas classified as LOW RISK, those where the quantity and/or likelihood of combustion of the existing content (fire load) is low, that is, it has relatively low heat and proportion of the fire.

In addition, its use is recommended only with quick-response showers. Examples: offices, hotels, residences, churches, clubs, schools, hospitals, bookstores, museums, nursing homes, restaurants, theaters and auditoriums, attics and plumbing of residential buildings, as defined in NBR 10897. TIGRE Fire® is also recommended for retrofit, due to the simplicity of its joint execution process, made by cold welding with plastic adhesive, without the need for special equipment.

The TIGRE Fire® CPVC line must be installed in wet systems: fixed piping networks permanently filled with water under pressure, where automatic showers (sprinklers) are installed in their branches. Automatic showers play the simultaneous role of detecting and fighting fire. In this system, water is only discharged by sprinklers that have been triggered by heat or fire. Do not use in compressed air and other gas systems.

Use of this product is restricted to low risk areas. Cannot be used in parking and related locations due to the presence of fuels in these areas.



1.2. Benefits and Differentials

Ease of Installation
Ease of execution of joints by the simple cold soldering process.

Lightness
Ease of transport and handling at the facility due to the lightness of the material.

Easy maintenance
Ease to perform repairs to the facilities and project changes.

Durability
Manufactured in CPVC, it does not suffer chemical attack from water substances, avoiding oxidation, rust or corrosion of components and scale that would compromise hydraulic performance over time.

Savings
Possibility of using smaller gauges than those used by copper and cast iron with the same water flow rate because of the factor of CPVC roughness.

1.3. Technical Characteristics

Material: the raw material used for the manufacture of the TIGRE Fire® System is a compound based on CPVC Poly(chlorinated vinyl chloride), specially developed for water conduction in fire prevention and fire fighting systems. Having all the properties inherent to PVC, the conduction resistance of liquids under pressure and high temperatures is added.

Color: orange.

Sizing: the TIGRE Fire® System complies with the criteria of the international standard ASTM (American Society for Testing and Materials) D1784:2003.

Gauges: 3/4", 1", 1 1/4", 1 1/2", 2", 2 1/2" and 3" SDR 13.5 according to ASTM 442 /F442M:2005, for maximum working pressure of 1.2 MPa (120 m.c.a or 175 psi).

Below, see the list of reference standards that govern the manufacture of the TIGRE Fire® System and that ensure excellent performance, providing a high degree of safety to the facilities.

REFERENCE STANDARDS	
ANSI/UL 1821:2003	Thermoplastic Sprinkler Pipe and Fittings for Fire Protection Service.
ASTM D 1784:2003	Standard Specifi cations for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) Compounds.
ASTM 1598:2002	Standard Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure.
ASTM F 437:1999	Standard Specifi cation for Threaded Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
ASTM F 438:1999	Standard Specifi cation for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
ASTN F 439:2006	Standard Specifi cation for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
ASTM F 442M:2005	Standard Specifi cation for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe (SDR - PR).
NBR 10897	Automatic shower fire protection.
NBR 14264:1999	PVC fittings - Dimensional check.
NM 85:2005	PVC pipes - Dimensional check.

ABNT NBR 10897 - Automatic Shower Fire Protection

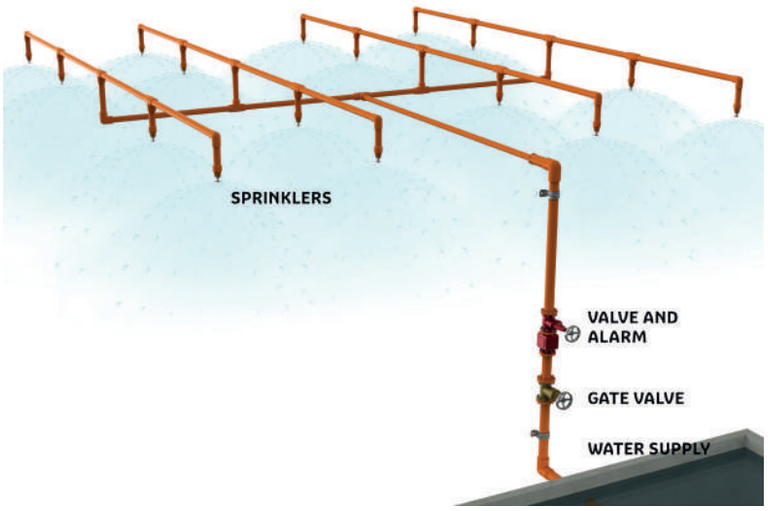
Standard NBR 10897 allows the application of CPVC in protection and fire fighting networks by automatic showers, as shown in the quote below:

"Other types of pipes may be used, provided that they are proven to be tested by laboratories of entities or institutions of recognized technical competence, meeting the requirements regarding their applicability in automatic shower fire protection systems, including, but not limited to, Poly(chlorinated vinyl chloride) CPVC pipes joined by welded fittings according to ASTM F 442, ANSI/UL 1821, NBR 15647 and NBR 15648, for low risk occupations, up to pressures of 1.21 MPa and at ambient temperatures up to 65°C."

1.4. Systems with Automatic Showers

There are different types of automatic shower systems.
TIGRE Fire® must always be applied to the wet piping system, as provided for in NBR 10897. Wet piping is when the system is permanently filled with water and under pressure.

Example Wet Pipe System



1.5. Application Areas

The application of TIGRE Fire® is recommended for low risk occupations, that is, those that comprise the occupations or part of the occupations of a building where the quantity and/or combustibility of its content (fire load) is low, tending to moderate, and where a low to medium rate of heat release is expected.

For this classification (LOW RISK), see some examples of occupation classification, according to ANNEX A - Table A.1 of NBR 10897:
"Churches, clubs, public and private schools (1st, 2nd and 3rd degrees), hospitals with outpatient clinics, surgery, health centers, hotels, libraries and reading rooms, (except rooms with high shelves), museums, nursing homes and nursing homes, office buildings, including data processing, dining areas in restaurants, (except service areas), theaters and auditoriums, (except stages and prosceniums), public administration buildings, etc."

1.5.1. Protection Area

The maximum area that can be protected by an automatic shower system according to the risk class and fed by a single column is presented in the table below, as provided for in NBR 10897.

Table 1 - Maximum area served by a feed column per pavement

RISK CLASS	MAXIMUM AREA M²
Mild	4.800
Ordinary	4.800
Extraordinary (Table)	2.300
Extraordinary (Calculation)	3.700

1.6. Guidelines

1.6.1. Isolation of Risks by Compartmentation

The compartmentalization of the risks of a building enables the installation of TIGRE Fire® in projects that comprise multiple risks. This type of development can be exemplified as a hotel, where almost all of it is classified as a low risk, but the kitchen and parking can be classified as an ordinary risk.

According to item 3.3 of NBR 10897, the concept of compartment is "a space completely enclosed by walls and ceiling. The compartment may have openings to a neighboring space, provided that the distance of the yard from the opening is at least 200 mm". This compartmentalization can be horizontal or vertical.

1.6.2. Sprinkler Thermal Sensitivity

According to item 7.5.1 of NBR 10897, all new automatic showers installed in low risk occupations must be rapid response, regardless of the material used in the piping, CPVC, steel or copper.

How to Identify a Quick Response Sprinkler Nozzle:

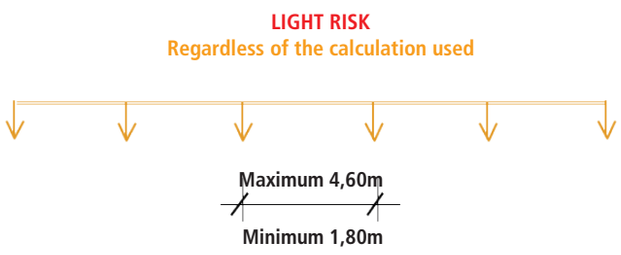
Quick response:
diameter of the 3 mm glass ampoule is valid for ALL new designs, made of steel, copper or TIGRE Fire®.

1.6.3. Pipe Identification

Item 5.1.4 of NBR 10897 says that "the apparent sections of the installation of the automatic shower system must be red in color. Optionally, the pipeline can be identified with rings painted in red, 0.20 m wide, every 5 meters away."

1.6.4. Maximum and Minimum Spacing between Showers:

Maximum and minimum distance between automatic showers:



1.6.5. Technical Characteristics of Automatic Shower Systems

Pressure:

Minimum Operation: **50 kPa = 0.5 Kgf/cm²**

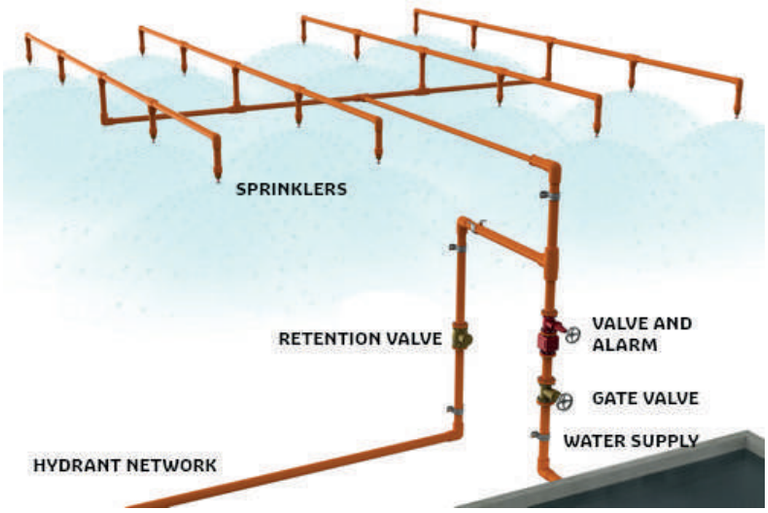
Maximum Operation: **1200 kPa = 12 Kgf/cm²**

Water Supply

Automatic shower systems must have at least two sources of water supply and must be able to power the system for at least 60 minutes.

Internal own source
Where there may be an upper reservoir filled by gravity with or without a pump or a lower reservoir, this always equipped with a pump or a pressure tank.

External source
This source allows the supply from the pumping tank of the Fire Department or from the public water network. Through an extension of a canalization of the automatic shower system to the external front of the building where the hydrant of settlement or passage made connection with the CB car and repressed to the system is located.



1.6.6. Distribution Network

In some projects, the same pipe intended for supplying the hydrant network is also admitted, supplying the network of automatic showers, provided that the diameters and flows are respected to meet the two systems, hydrants and sprinklers.

1.6.7. Distribution Network Types

- A Hydraulic networks of automatic showers can be "Open" or "Closed".

Open Networks: In open hydraulic distribution networks, water circulates in the branches only in one direction, supplying the sub-branches, where the automatic showers are connected, only by one of their ends, that is, they have a branched or "fishbone" arrangement.

Closed Networks: In closed hydraulic distribution networks, the branches are connected to each other in such a way that they can be fed with water by their two ends, thus reducing the pressure drop due to the division of the flows and the diameters of the pipes.

1.6.8. Water Reserve

The effective capacity of the fire reservoir for automatic showers must be in accordance with the following table, found in item 8.4.1 of NBR 10897.

Table 2 - Water Demand for Systems

Risk class	Operation time (min)	Minimum output from the pump (includin hydrants) (L/min)	Minimum volume (m3)
Low	30	1.900	57
	60	2.850	168
Regular	60	3.200	192
	90	5.650	513

1.7. Sizing

The sizing can be calculated by table or hydraulically.

Per table: The pipe diameters are selected in tables prepared according to the occupation classification and in which a given number of showers can be fed by specific pipe diameter, as shown in the table below:

Table 3 - Sizing for Light Risk

Steel		Copper	
DN20	—	DN20	—
DN25	2 showers	DN25	2 showers
DN32	3 showers	DN32	3 showers
DN40	5 showers	DN40	5 showers
DN50	10 showers	DN50	12 showers
DN65	30 showers	DN65	40 showers
DN80	60 showers	DN80	65 showers
DN90	100 showers	DN90	115 showers
DN100	Ver 7.3	DN100	Ver 7.3

Hydraulically: Piping diameters are selected based on head loss so as to provide the required water density, minimum pressure and flow rate per shower, distributing with a reasonable degree of uniform water over a specific area.

The maximum coverage area that a shower can meet will depend on the type of ceiling, material and calculation method. No automatic shower will exceed 21.00 m2. With the standard shower, the areas covered can be calculated in two ways: by table or calculated hydraulically. Using the calculation by table, the maximum coverage area will not be allowed to exceed 18.6 m2.

Calculated hydraulically, we can save approximately 10% sprinklers.

According to item 9.5.1.1 of NBR 10897, "for new systems, the sizing with the tables can only be used if the system area is less than 465 m2. However, sizing tables may be used for extensions or modifications of existing systems that were originally calculated by this method. Item 9.5.1.2 of NBR 10897 presents the systems that must always be designed by hydraulic calculation:

a) Systems with automatic showers of rated K-factor other than 80.
b) Systems using piping other than steel or copper.
c) Systems in extra risk areas groups 1 and 2.

Due to the previous item, it is NOT possible to make a direct conversion of projects made of steel or copper (usually calculated by tables).

In addition, the use of TIGRE Fire® in projects originally made of steel or copper requires recalculation by the Hydraulic Method and, consequently, a new approval process with the Fire Department.

In any case, this table could also be used in the wrong way, implying undersized projects, in cases where they can be used indiscriminately to convert table-sized projects into steel and copper for TIGRE Fire®. See hydraulic head loss calculation on page 33.

Table 4 - Diameter Equivalence - Standard

DN Standard	DN Steel	DN TIGRE Fire®	DN Copper
20	—	3/4	22
25	1	1	28
32	1.1/4	1.1/4	35
40	1.1/2	1.1/2	42
50	2	2	54
65	2.1/2	2.1/2	66
80	3	3	79
90	3.1/2		104
100	4		104

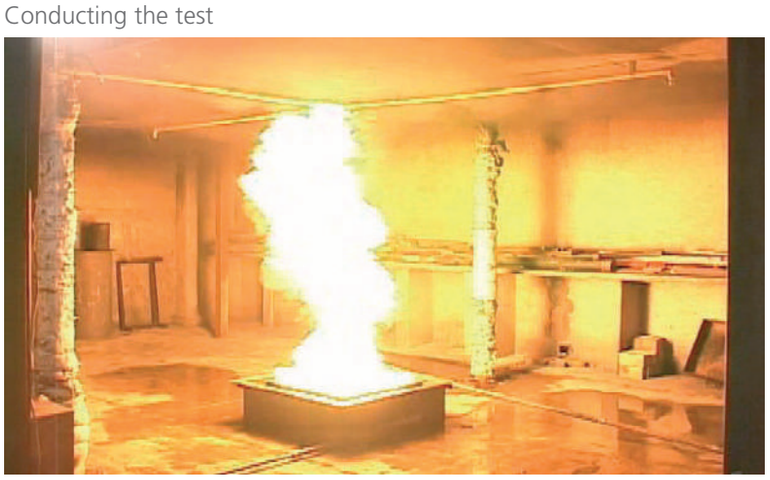
1.8.Tests for Product Approval

- Verification of resistance to exposure to the environment.
- Checking the operating capacity of the automatic high pressure fire shower.
- Determination of the coefficient of friction of the pipe.
- Determination of the equivalent length of the connection.
- Checking crush strength.
- Verification of flexural strength.
- Impact resistance check.
- Vibration resistance check.
- Verification of torsional resistance.
- Assembly check.
- Checking the resistance to short-term hydrostatic pressure.
- Determination of the pressure cycle.
- Determination of the temperature cycle.
- Verification of the permanence of the marking.
- Checking resistance to fire exposure.

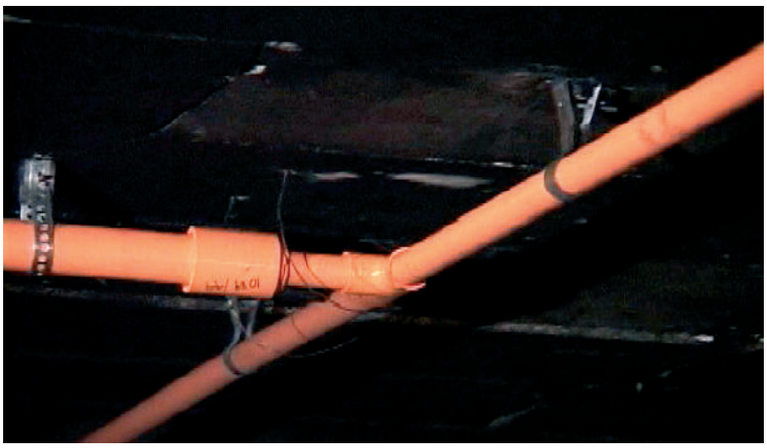
1.8.1. Fire Exposure Resistance Verification Test - IPT (Technological Research Institute of the State of São Paulo)

Installation preparation

Conducting the test



TIGRE Fire® installation intact after 10 minutes of fire exposure.



1.9. Execution of Weldable Joints

Always keep the piping dry and free of dirt before welding with the plastic adhesive. Make a quick check before starting the welding operation of the CPVC Industrial pipes and observe the adjustment between the pipe tip and the connection bag.

It is necessary that there is an interference between the parts, as welding is not established if there is no pressure between the surfaces that are being joined.

1.9.1. Installation Instructions for Diameters up to 2”

1. With the aid of a brush, apply the adhesive homogeneously first to the tip of the pipe and then to the connection bag.

2. Fit at once the ends to be welded, give 1/4 turn and keep the joint under manual pressure for approximately 30 seconds, until the adhesive acquires strength. Remove the excess adhesive with the aid of a tow and wait 8 hours to fill the piping and for pressure testing refer to the adhesive drying time according to table 5.

Table 5 - Adhesive Curing Time x Temperature

Ambient Temperature (°C)	< 0°	1° to 10°	11° to 20°	21° to 30°	> 30°
Drying Time (hours)	192	120	60	36	24

1.9.2. Installation Instructions for 2 1/2" Equal or Larger Diameters

Due to the contact area of the adhesive being larger in larger diameters, the following steps are indicated for correct installation:

1. With the aid of a brush, apply Aquatherm® TIGRE Adhesive to the tip of the pipe to be welded.

2. Dip the brush back into the Aquatherm® TIGRE Adhesive and apply to the connection pouch.

3. Lastly, dip the brush back into the Aquatherm® TIGRE Adhesive and reapply to the tip of the pipe where the adhesive had already been applied in step 1 and snap into the connection. It is not necessary in this case to turn 1/4 turn.

1.10. Execution of Threadable Joints

For the coupling of the pipes with metallic materials and in the derivations for sprinklers, the threadable fittings of the line must be used, as well as the sealing material, the TIGRE Thread Sealing Tape. Apply the tape so that each turn passes through the other half a centimeter, always clockwise, until it covers all the threads of the connection, a total of 3 to 4 turns for TIGRE Fire® Nozzle Adapters and 5 to 6 turns for TIGRE Fire® Transition Sleeves.

Example of Application of TIGRE Thread Sealing Tape in Sprinkler

Nozzle Adapters - 3 to 4 turns

TIGRE Fire® Nozzle Adapter Tee

TIGRE Fire® Nozzle Adapter

90° Elbow Adapter for TIGRE Fire® Nozzle

Transition Sleeve - 5 to 6 turns

TIGRE Fire® Transition Sleeve

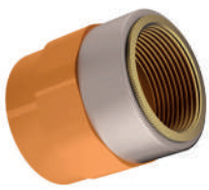
Screw the fittings as much as possible with manual tightening and, after this step, use a pipe wrench giving 1 or 2 turns, at most, for the final tightening.

- Maximum torque: 27 N x m.
- Use the tools recommended by the shower manufacturer to tighten the shower.
- NPT and BSP threads are interchangeable at 1/2" gauge.

CAUTION
Do not exceed the torque limit, avoiding damage to the product.

1.10.1. Transition to Metal Pipes

The TIGRE Fire® Line has 3 transition fittings for metallic pipes.



TIGRE Fire® Transition Sleeve

TIGRE Fire® Connector

TIGRE Fire® flange

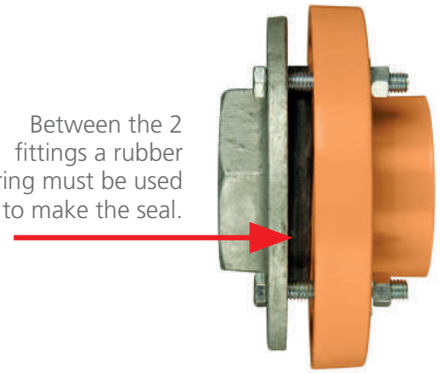
To transition between the TIGRE Fire® Line and a metallic pipe up to 2", the Transition Sleeve must be used, together with the Metallic Nipple.

TIGRE Fire® Transition Sleeve with Metallic Nipple

To transition between the TIGRE Fire® Line and a 2 1/2" and 3" metal piping, the TIGRE Fire® Connector connection or the TIGRE Fire® Flange can be used together with a Metal Flange.

TIGRE Fire® Connector

Between the 2 fittings a rubber ring must be used to make the seal.

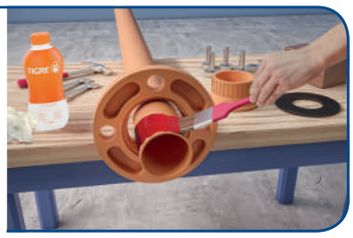


TIGRE Fire® Flange with Metallic Flange

1.11. Flanged Joint Execution

1. Clean the pipe tip and flange pouch with a white tow.

2. Place the free flange on the pipe and apply the TIGRE Adhesive to the flange bag and the tip of the pipe.

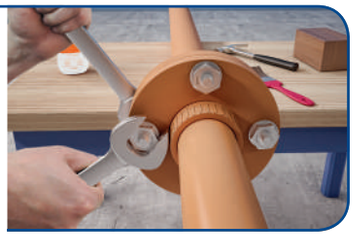


3 Using a piece of wood and using a hammer, insert the nozzle of the flange into the pipe until it reaches its backrest.

4 Set the gasket in position. It is recommended to use a flat type sealing gasket with approximate thickness of 3 mm in rubber with approximate hardness of 70 shore "A".

5 The alignment of the holes is easily achieved as the flanges are free.

6 The screws should be tightened gradually, always trying to tighten the one diametrically opposite the one being tightened.



Notes: It is important that the flanges to be joined in an installation follow the same drilling pattern in the case of the TIGRE Fire® Standard ANSI B 16.5 Flange. Attention should be paid to the correct choice of parts, especially when transitioning with other materials.

Drilling and Screws

When assembling the flanges, it is essential to use screws and washers of appropriate dimensions. As for drilling, check a table with the drilling dimensions of the flanges provided by TIGRE.

Table 6 - Flange Drilling Dimensions and Quantity of Screws

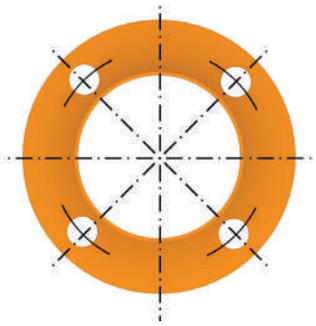
DN Ref.	Drilling Dia. (mm)	Number of Screws	Hole diam. per screw (mm)	Screw Gauge (mm)
2 1/2"	140	4	19	16
3"	152	4	19	16

Fixing

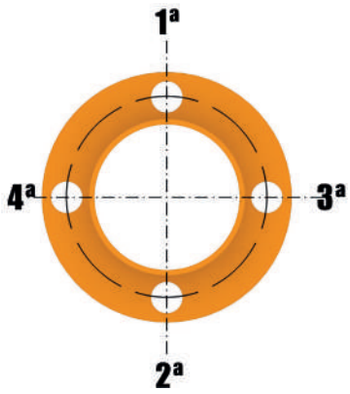
With regard to fixation, it is recommended to observe two aspects:

1 - Position of holes

The drilling of the flanges must be symmetrical in relation to the main axes, as shown in the figure below.



- **2 - Tightening / Torque**
- The recommended torque for tightening the screws of the TIGRE Fire® Flanges is 34 N x m. Try not to torque more than mentioned, as it may damage the fittings.
- The screws should be tightened gradually, always trying to tighten the one diametrically opposite the one being tightened.



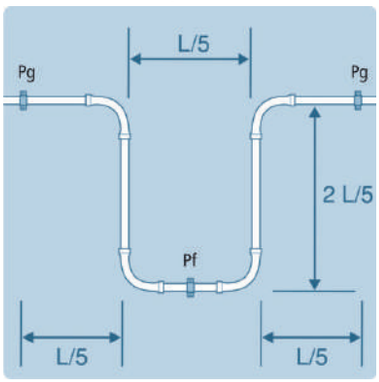
1.12. General Instructions

1.12.1. Thermal Expansion and Contraction

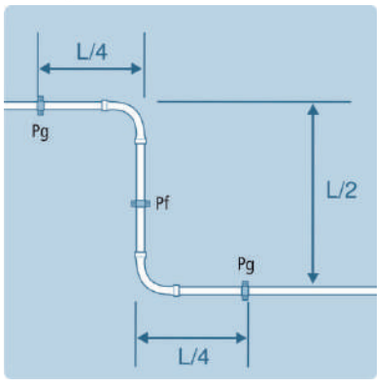
Like most materials, CPVC is also subject to the effects of thermal expansion, expanding and contracting as a function of room temperature.

The technique used to absorb the effects of temperature variations is the use of "horseshoe loops" or changes of direction in the pipeline layout, as shown below:

Horseshoe loop



Change of Direction



Pg: guide point **Pf:** fixed point

Formula for Calculating Thermal Expansion

$$\Delta L = L \times e \times \Delta t$$

Where:
ΔL = Length variation (m)
L = Pipe length (m)
e = Coefficient of thermal expansion of CPVC (6.12 x 10^{-5} / °C)
Δt = Temperature variation (°C)

Table 7 - Thermal Expansion Values

Changes in Temperature ΔT °C	Length of the stretch in meters													
	1	2	4	6	8	10	12	14	16	18	20	30	40	50
	AL thermal expansion (in centimeters)													
10	0,06	0,12	0,25	0,37	0,50	0,62	0,74	0,87	0,99	1,12	1,24	1,86	2,48	3,10
15	0,09	0,19	0,37	0,56	0,74	0,93	1,12	1,30	1,49	1,67	1,86	2,79	3,72	4,65
20	0,12	0,25	0,50	0,74	0,9	1,24	1,49	1,74	1,98	2,23	2,46	3,72	4,96	6,20
25	0,16	0,31	0,62	0,93	1,24	1,55	1,86	2,17	2,48	2,79	3,10	4,65	6,20	7,75
30	0,19	0,37	0,74	1,12	1,49	1,86	2,23	2,60	2,98	3,35	3,72	5,58	7,44	9,30
35	0,22	0,43	0,87	1,30	1,74	2,17	2,60	3,04	3,47	3,91	4,34	6,51	8,68	10,85
40	0,25	0,50	0,99	1,49	1,98	2,46	2,98	3,47	3,97	4,46	4,96	7,44	9,92	12,40
45	0,28	0,56	1,12	1,67	2,23	2,79	3,35	3,91	4,46	5,02	5,58	8,37	11,16	13,95
50	0,31	0,62	1,24	1,86	2,48	3,10	3,72	4,34	4,96	5,58	6,20	9,30	12,40	15,50

For ease and speed of calculation in consultations on total length "L" of the lyres, see the table calculated below, considering CPVC expansion coefficient = 6.12 X 10^{-5} / °C (average):

Table 8 - Length of Horseshoe Loops

Diameter	Pipe length in meters													
	1,52	3	4,5	6	7,5	9	10	12	13	15	21	27	36	48
	Section Length (m)													
3/4″	0,2	0,3	0,3	0,4	0,4	0,5	0,5	0,5	0,6	0,6	0,7	0,8	0,9	1,1
1″	0,2	0,3	0,4	0,4	0,5	0,5	0,6	0,6	0,6	0,7	0,8	0,9	1,0	1,2
1 1/4″	0,2	0,3	0,4	0,5	0,5	0,6	0,6	0,7	0,7	0,8	0,9	1,0	1,2	1,3
1 1/2″	0,3	0,4	0,5	0,6	0,6	0,6	0,7	0,7	0,8	0,8	1,0	1,1	1,2	1,4
2″	0,3	0,4	0,5	0,6	0,6	0,7	0,8	0,8	0,9	0,9	1,1	1,2	1,4	1,6
2 1/2″	0,3	0,5	0,5	0,6	0,7	0,8	0,8	0,9	0,9	1,0	1,2	1,3	1,5	1,8
3″	0,3	0,5	0,6	0,7	0,8	0,8	0,9	1,0	1,0	1,1	1,3	1,5	1,7	2,0

Table calculated with average temperature differential of 20°C.

Formula for Calculation of Lyre Length/Change of Direction

$$L = \sqrt{\left(\frac{3 \times E \times DE \times \Delta L}{S} \right)}$$

Where:
E = Modulus of elasticity (Pa), according to table 8
De = Pipe O.D. (m)
ΔL = Length variation (m)
S = Allowable stress (Pa)

Table 9 - Modulus of Elasticity and Permissible Stress for CPVC

Temperature (°C)	Modulus of Elasticity (Pa)	Allowable Voltage (Pa)
20	2.982.238.410	14.352.920
30	2.796.931.910	12.564.127
40	2.611.625.410	10.775.333
50	2.426.318.910	8.986.540
60	2.241.012.409	7.197.746
70	2.055.705.909	5.408.953
80	1.870.399.409	3.620.159

1.12.2. Specifications for Supports

The clamps must have a minimum width of approximately 13 mm, with a smooth surface, without sharp corners, and cannot restrict the axial movement of the pipe. In case of use of metal valves or valves in the piping, install clamps close to the product to support its weight. The supports should always be as close as possible to the changes of direction. When passing the piping through beams or another element of the building structure, leave a spacing greater than the diameter of the piping to allow its free movement.

In any vertical fixing, the pipes must be firmly attached without, however, strangling them. The maximum spacing between supports for vertical pipes must be 3.0 m. Vertical plumb lines must have sufficient supports so that the weight of the pipe is not supported by the fittings in order to avoid tension at these points. To avoid such effects, see the chapter on Thermal Expansion and Contraction.

For horizontal pipelines, the following spacings must be respected:

Table 10 - Spacing between Supports for Horizontal Pipes

Maximum Support Spacing	
Diameter (in.)	**Distance (m)**
3/4"	1,7
1"	1,8
1 1/4"	2,0
1 1/2"	2,1
2"	2,4
2 1/2"	2,7
3"	3,0

When it comes into operation, sprinklers cause vibration on the piping that can cause it to move if it is not properly supported. Clamps must be installed according to the maximum distance of tables 10 and 11, referring to the figure below.

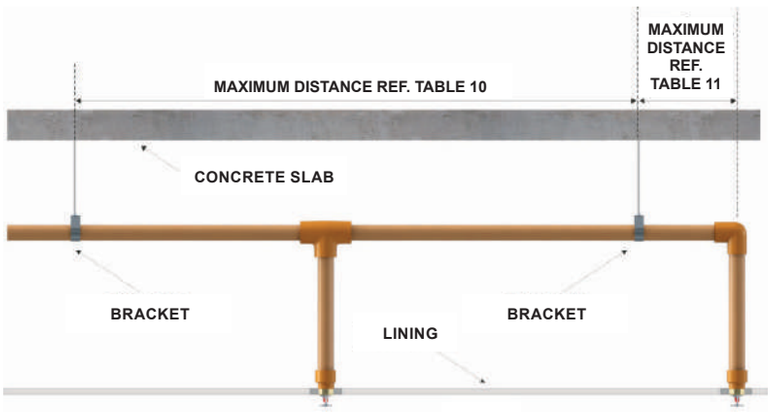


Table 11 - For Sprinklers Installed After Tee Type Connection

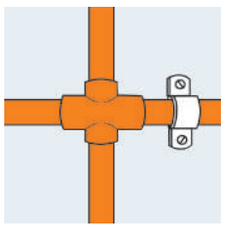
Diameter (in.)	Distance (m)	
	Pressure below 69 m.c.a.	Pressure above 69 m.c.a.
3/4"	1,22	0,91
1"	1,52	1,22
1 1/4"	1,83	1,52
1 1/2"	2,13	2,13
2"	2,13	2,13
2 1/2"	2,13	2,13
3"	2,13	2,13

Table 12 - For Sprinklers Installed After Elbow Type Connection

Diameter (in.)	Distance (mm)	
	Pressure below 69 m.c.a.	Pressure above 69 m.c.a.
3/4"	229	152
1"	305	229
1 1/4"	406	305
1 1/2"	610	305
2"	610	305
2 1/2"	610	610
3"	610	610

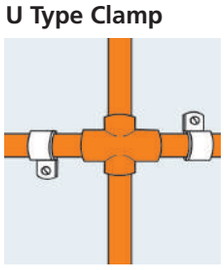
According to the information previously recommended on the supports for the pipes of the TIGRE Fire® line, some references follow:

Flat Clamp



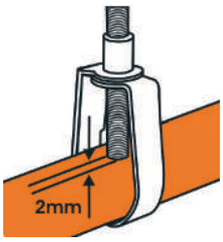
Intended for CPVC pipelines, the fixing of the bracket is in the vertical position, and the fixing screw is horizontal. This clamp can be used to restrict the movement of the pipe when the clamp attachment is below the pipe, but cannot be used as a pipe support to support the weight of the system. It can also be used as a pipe guide when it is supported on beams, and the beam supports the weight of the pipe. This type of clamp cannot be used on CPVC systems below the liner or other flat horizontal surface.

U Type Clamp

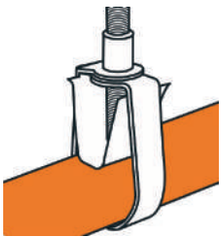


Intended to attach CPVC pipelines when they are together to a smooth, horizontal surface and with fixing screws vertically, or when the piping is vertically. It can be used as a guide for the piping when it is supported on beams and the beam supports the weight of the system.

Strap Type Clamp



Intended to attach CPVC pipelines together with threaded rod that is fixed to the ceiling or other smooth horizontal surface. The threadable rod must be properly installed before placing the support and must not touch the pipe after installation, in a gap of approximately 2 mm.



When installed as the example on the side, protection must be provided between the threaded rod and the pipe to avoid punctual efforts on the piping. This type of support is intended to protect against system blows and must be used on the supports near the showers.

1.12.3. Pipe Deflection

Installations with TIGRE Fire® may be subject to deflections. The information below determines the maximum allowable deflection for different pipe lengths and gauges.

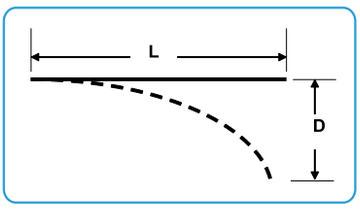


Table 13 - Maximum Pipe Deflection

Diameter (in.)	Pipe length (L in cm)													
	60	150	210	305	366	457	518	610	762	914	1067	1220	1370	1524
	Pipe deflection (D in cm)													
3/4"	3,3	19,8	39,1	79,5	114,6	179,1	230,1	316,0	497,6	716,5	975,1	-	-	-
1"	2,5	16,0	31,2	63,5	91,4	143,0	183,6	254,3	397,5	572,0	778,8	1017,0	-	-
1 1/4"	2,0	12,7	24,6	50,3	72,4	113,3	145,5	201,4	314,7	453,1	616,7	805,7	1019,6	-
1 1/2"	1,8	10,9	21,6	43,9	63,2	99,1	127,3	176,0	274,8	396,0	539,0	703,8	890,8	1099,8
2"	1,5	8,9	17,3	35,3	50,8	79,2	101,6	140,7	220,0	316,7	431,0	563,1	712,7	879,9
2 1/2"	1,3	7,4	14,2	29,0	41,9	65,5	84,1	116,3	181,6	261,6	356,1	465,1	588,8	726,9
3"	1,0	6,1	11,7	23,9	34,3	53,8	69,1	95,5	149,4	214,9	292,6	382,0	483,6	597,2

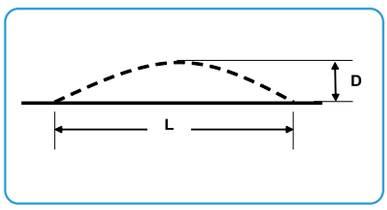


Table 14 - Maximum Pipe Arrow

Diameter (in.)	Pipe length (L in cm)													
	60	150	210	305	366	457	518	610	762	914	1067	1220	1370	1524
	Pipe deflection (D in cm)													
3/4"	0,8	5,1	9,7	19,8	28,7	44,7	57,4	79,5	124,5	179,1	243,8	318,5	403,1	497,6
1"	0,8	4,1	7,9	16,0	22,9	35,8	46,0	63,5	99,3	143,0	194,6	254,3	321,8	397,5
1 1/4"	0,5	3,0	6,1	12,7	18,0	28,4	36,3	50,3	78,7	113,0	154,2	201,4	255,0	314,7
1 1/2"	0,5	2,8	5,3	10,9	15,7	24,6	31,8	43,9	68,8	99,1	134,6	176,0	222,8	274,8
2"	0,3	2,3	4,3	8,9	12,7	19,8	25,4	35,3	54,9	79,2	107,7	140,7	178,1	220,0
2 1/2"	0,3	1,8	3,6	7,4	10,4	16,3	21,1	29,0	45,5	65,5	89,2	116,3	147,1	181,6
3"	0,3	1,5	3,0	6,1	8,6	13,5	17,3	23,9	37,3	53,8	73,2	95,5	120,9	149,4

1.12.4. Apparent Unlined Installations

CPVC pipes and fittings may be installed without (exposed) protection, subject to the following limitations:

- The system should be designed based on the flows indicated by the selected sprinkler model, considering that the flow for a single sprinkler should not be less than 37.9 liters/min and the flow for several sprinklers should not be less than 30.6 liters/min.
- All the main pipes of the system must be perpendicular to the beams, and all the derived lines must be parallel to the beams, as shown in figures 1 and 2.
- Sprinklers must be installed with their deflectors at a minimum of 4.5 cm below the lower limit of the beams, providing for a future lining installation (see figure 3).
- The maximum operating pressure of the system in flow (dynamic) should not exceed 69 m.c.a. (6.9 kgf/cm²), thus avoiding changes in the flow regime and speed in the shower nozzle.

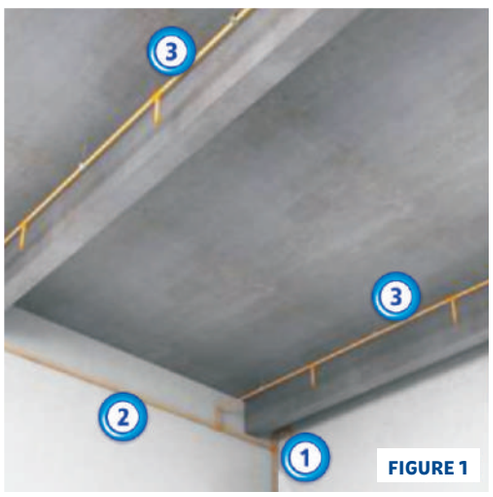


FIGURE 1

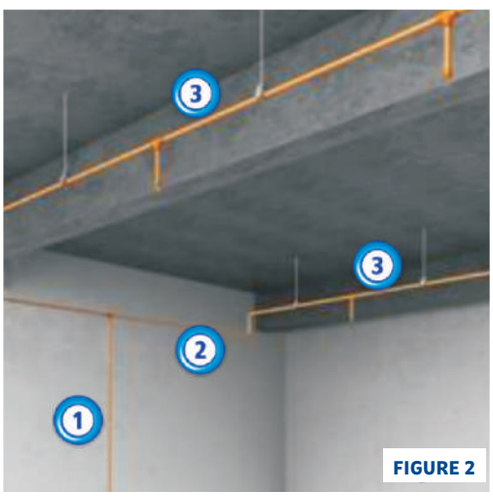


FIGURE 2

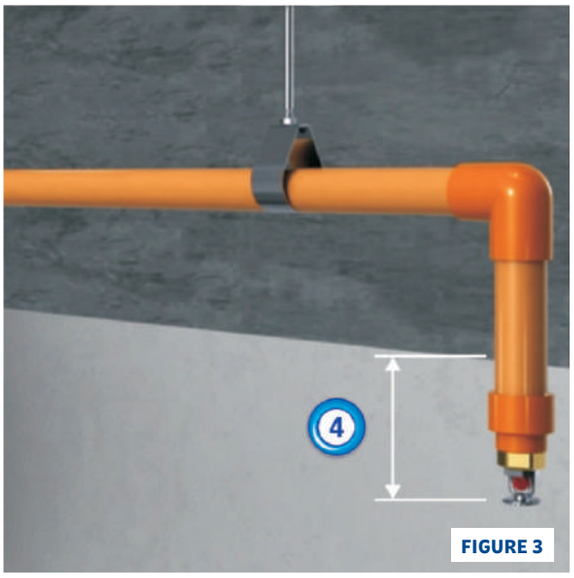


FIGURE 3

1. General Piping
2. Sub General Piping
3. Extensions
4. 4.5 cm below the lower limit of the beams

1.12.5. Storage and Transport

- For storage, one should look for places of easy access and shade, free of direct exposure to the sun. In works, the stocked material must be protected with a cover formed by a slatted grid or cover structure for simple disassembly.
- The first layer of pipes must be fully supported, where a wooden board or rafters (level) spaced 1.50 m apart, placed transversely to the stack of pipes, can be used.
- A stacking with a maximum height of 1.50 m can be done, regardless of the gauge or thickness of the pipes.
- Another stacking alternative is cross-layered (campfires), in which the pipes are arranged in transverse layers.
- Do not drag the pipes and do not walk on them.

1.12.6. Maintenance

If corrective maintenance is required on TIGRE Fire® pipes or fittings, due to damage caused, it is recommended to replace the damaged pipe section with a new section (or replacement of the connection), using the weldable sleeves available on the line for coupling. Welding must be carried out with Aquatherm® Adhesive or TIGRE Special Adhesive, as described in the item on execution of joints.

1.12.7. Recommendations

1.12.7.1. For Excellent Fire Installation with the TIGRE Fire® Line

- Use TIGRE Fire® only in wet piping systems.
- Use only CPVC compatible materials for thread sealing (TIGRE Thread Sealing Tape).
- Keep the products in their original packaging before installation.
- Use proper tools for handling TIGRE Fire® during installation (do not use pipe wrench, hammer, etc.).

- Cut the ends of the pipes always in the square.
- Eliminate burrs from cut ends of pipes prior to welding.
- Rotate the pipe 1/4 turn when running the joint.
- Remove any excess adhesive after welding.
- Ensure that there is no adhesive on the automatic showers and on the threads.
- Ensure that the adhesive will not obstruct the passage of water in the automatic showers.
- Release water into the system to remove possible burrs and other dirt inside the piping before starting pressure tests.
- Slowly fill the lines so that the air is cleared and the system is fully filled with water before pressure testing.
- Secure the pipelines with brackets near the automatic showers to prevent the piping from moving vertically when the showers are activated.
- Use only water and glycerin solution to prevent freezing of water inside the pipeline.
- Allow expansion and contraction movement of the system.
- Always keep up to date with technical information about firefighting systems.

1.12.7.2. What should be avoided:

- Prevent piping and fittings from remaining exposed to the sun and weather.
- Do not use oil as a lubricant on threads and seals.
- Use only CPVC compatible materials for thread sealing (TIGRE Thread Sealing Tape). Do not use solvent or petroleum based sealant/lubricant, not even oil as lubricant on threads.
- Do not install electrical cables in direct contact with the system piping.
- Do not use any glycol-based solution as an antifreeze solution.
- Do not mix glycerin solution and water in contaminated containers.
- Do not use expired, discolored or gelled adhesives.
- Do not thread or groove TIGRE Fire® pipes.
- Do not use adhesive near sources of heat, flame or smoke.
- During installation, avoid keeping the ends open. They must be closed with pieces of cloth.
- Do not perform pressure test with air.
- Do not perform the pressure test before the recommended time for curing of the adhesive has been reached.
- Do not use pipes and fittings stored in weather exposure, unprotected and discolored.
- Do not allow direct contact of the threaded rod of the support with the TIGRE Fire® pipes.
- Do not install TIGRE Fire® at low temperatures without allowing it to expand.
- Do not install TIGRE Fire® on dry piping systems.

1.13. Load Loss on TIGRE Fire® Pipes and Fittings

The hydraulic calculations for the sizing of the TIGRE Fire® CPVC pipes must be carried out using a "C" Hazen-Williams factor of 150. To

facilitate the process, refer to the head loss table for TIGRE Fire® pipelines, given in meters of water column per meter of piping (mca/m).

Table 15 - Load Loss in TIGRE Fire® Pipes

DN	3/4" / 20	
Internal Diameter [mm]	22,6	
Flow rate [l/ min]	Load Loss [mca/m]	Speed [m/s]
3,8	0,00181	0,15
7,6	0,00679	0,34
11,4	0,01425	0,49
15,1	0,02420	0,64
18,9	0,03642	0,82
22,7	0,05112	0,98
26,5	0,06786	1,13
30,3	0,08709	1,31
34,1	0,10812	1,46
37,9	0,13142	1,62
41,6	0,15676	1,80
45,4	0,18413	1,95
49,2	0,21353	2,13
53,0	0,24497	2,29
56,8	0,27823	2,44
60,6	0,31351	2,62
64,4	0,35084	2,77
68,1	0,38997	2,93
71,9	0,43091	3,11
75,7	0,47389	3,26
79,5	0,51686	3,41
83,3	0,56527	3,60
87,1	0,61368	3,75
90,8	0,66390	3,90
94,6	0,71592	4,07
98,4	0,76976	4,24
102,2	0,82540	4,39
106,0	0,88286	4,57
109,8	0,94212	4,72
113,6	1,00320	4,88
117,3	1,06585	5,06
121,1	1,13032	5,21
124,9	1,19660	5,36
128,7	1,26446	5,55
132,5	1,33413	5,70
136,3	1,40561	5,88
140,1	1,47867	6,04
143,8	1,55354	6,19
147,6	1,65000	6,37
151,4	1,70804	6,52
155,2	1,78788	6,68
159,0	1,86954	6,86
162,8	1,95256	7,01
166,6	2,03738	7,16
170,3	2,12402	7,35
174,1	2,21201	7,50

DN	3/4" / 20	
Internal Diameter [mm]	22,6	
Flow rate [l/ min]	Load Loss [mca/m]	Speed [m/s]
177,9	2,30181	7,65
181,7	2,39320	7,83
185,5	2,48639	7,99
189,3	2,58094	8,14
196,8	2,77525	8,47
204,4	2,97589	8,81
212,0	3,18309	9,11
219,6	3,39662	9,45
227,1	3,61649	9,78
234,7	3,84269	10,12
242,3	4,07499	10,42
249,8	4,31386	10,76
257,4	4,55861	11,09
265,0	4,80992	11,40

DN	1" / 25	
Internal Diameter [mm]	28,3	
Flow rate [l/ min]	Load Loss [mca/m]	Speed [m/s]
3,8	0,00068	0,09
7,6	0,00226	0,21
11,4	0,00452	0,30
15,1	0,00792	0,40
18,9	0,01176	0,52
22,7	0,01651	0,61
26,5	0,02217	0,73
30,3	0,02828	0,82
34,1	0,03506	0,91
37,9	0,04275	1,04
41,6	0,05090	1,13
45,4	0,05972	1,22
49,2	0,06944	1,34
53,0	0,07962	1,43
56,8	0,09048	1,55
60,6	0,10179	1,65
64,4	0,11400	1,74
68,1	0,12667	1,86
71,9	0,14002	1,95
75,7	0,15382	2,04
79,5	0,16852	2,16
83,3	0,18367	2,26
87,1	0,19928	2,38
90,8	0,21557	2,47
94,6	0,23253	2,56
98,4	0,25018	2,68

DN	1" / 25	
Internal Diameter [mm]	28,3	
Flow rate [l/ min]	Load Loss [mca/m]	Speed [m/s]
98,4	0,25018	2,68
102,2	0,26805	2,77
106,0	0,28682	2,87
109,8	0,30605	2,99
113,6	0,32595	3,08
117,3	0,34631	3,17
121,1	0,36712	3,29
124,9	0,38861	3,38
128,7	0,41078	3,51
132,5	0,43340	3,60
136,3	0,45647	3,69
140,1	0,48022	3,81
143,8	0,50465	3,90
147,6	0,52953	3,99
151,4	0,55487	4,11
155,2	0,58088	4,21
159,0	0,60735	4,33
162,8	0,63426	4,42
166,6	0,66186	4,51
170,3	0,68991	4,63
174,1	0,71864	4,72
177,9	0,74782	4,82
181,7	0,77745	4,94
185,5	0,80753	5,03
189,3	0,83830	5,12
196,8	0,90141	5,33
204,4	0,96678	5,55
212,0	1,03396	5,76
219,6	1,10340	5,94
227,1	1,17466	6,16
234,7	1,24817	6,37
242,3	1,32372	6,58
249,8	1,40131	6,77
257,4	1,48071	6,98
265,0	1,56236	7,19
272,5	1,64606	7,41
280,1	1,73156	7,59
287,7	1,81910	7,80
295,3	1,90868	8,02
302,8	2,00029	8,23
310,4	2,09371	8,41
318,0	2,18916	8,63
325,5	2,28666	8,84
333,1	2,38596	9,05
340,7	2,48707	9,24
348,3	2,59044	9,45
355,8	2,69563	9,66
363,4	2,80262	9,85
371,0	2,91165	10,06
378,5	3,02248	10,27
416,4	3,60518	11,31
454,2	4,23492	12,31
492,1	4,91080	13,35

DN	1 1/4" / 32	
Internal Diameter [mm]	35,7	
Flow rate [l/ min]	Load Loss [mca/m]	Speed [m/s]
3,8	0,00023	0,06
7,6	0,00068	0,12
11,4	0,00136	0,18
15,1	0,00249	0,24
18,9	0,00385	0,34
22,7	0,00520	0,40
26,5	0,00701	0,46
30,3	0,00905	0,52
34,1	0,01108	0,58
37,9	0,01357	0,64
41,6	0,01606	0,70
45,4	0,01900	0,76
49,2	0,02194	0,82
53,0	0,02511	0,88
56,8	0,02873	0,98
60,6	0,03235	1,04
64,4	0,03619	1,10
68,1	0,04004	1,16
71,9	0,04434	1,22
75,7	0,04886	1,28
79,5	0,05338	1,34
83,3	0,05813	1,40
87,1	0,06311	1,46
90,8	0,06831	1,52
94,6	0,07374	1,62
98,4	0,07917	1,68
102,2	0,08505	1,74
106,0	0,09093	1,80
109,8	0,09704	1,86
113,6	0,10337	1,92
117,3	0,10971	1,98
121,1	0,11627	2,04
124,9	0,12328	2,10
128,7	0,13029	2,16
132,5	0,13730	2,26
136,3	0,14477	2,32
140,1	0,15223	2,38
143,8	0,15992	2,44
147,6	0,16784	2,50
151,4	0,17576	2,56
155,2	0,18413	2,62
159,0	0,19250	2,68
162,8	0,20109	2,74
166,6	0,20969	2,80
170,3	0,21874	2,90
174,1	0,22778	2,96
177,9	0,23706	3,02
181,7	0,24633	3,08
185,5	0,25606	3,14
189,3	0,26579	3,20
196,8	0,28569	3,32
204,4	0,30627	3,47
212,0	0,32776	3,60

DN	1 1/4" / 32	
Internal Diameter [mm]	35,7	
Flow rate [l/ min]	Load Loss [mca/m]	Speed [m/s]
219,6	0,34971	3,72
227,1	0,37233	3,84
234,7	0,39562	3,96
242,3	0,41960	4,11
249,8	0,44403	4,24
257,4	0,46937	4,36
265,0	0,49515	4,48
272,5	0,52162	4,60
280,1	0,54876	4,75
287,7	0,57658	4,88
295,3	0,60486	5,00
302,8	0,63381	5,12
310,4	0,66344	5,24
318,0	0,69376	5,39
325,5	0,72474	5,52
333,1	0,75619	5,64
340,7	0,78831	5,76
348,3	0,82088	5,88
355,8	0,85436	6,04
363,4	0,88829	6,16
371,0	0,92267	6,28
378,5	0,95796	6,40
416,4	1,14254	7,04
454,2	1,34204	7,68
492,1	1,55626	8,32
530,0	1,78494	8,96
567,8	2,02811	9,60
605,7	2,28530	10,24
643,5	2,55651	10,88
681,4	2,84152	11,52
719,2	3,14056	12,16
757,1	3,45317	12,80
794,9	3,77935	13,44
832,8	4,11888	14,08
870,6	4,47197	14,72
908,5	4,83842	15,36
946,4	5,21776	16,03

DN	1 1/2" / 40	
Internal Diameter [mm]	40,9	
Flow rate [l/ min]	Load Loss [mca/m]	Speed [m/s]
3,8	0,00000	0,06
7,6	0,00045	0,12
11,4	0,00068	0,18
15,1	0,00136	0,24
18,9	0,00204	0,34
22,7	0,00271	0,40
26,5	0,00362	0,46
30,3	0,00452	0,52
34,1	0,00566	0,58
37,9	0,00701	0,64

DN	1 1/2" / 40	
Internal Diameter [mm]	40,9	
Flow rate [l/ min]	Load Loss [mca/m]	Speed [m/s]
41,6	0,00837	0,55
45,4	0,00973	0,58
49,2	0,01131	0,64
53,0	0,01289	0,67
56,8	0,01470	0,73
60,6	0,01651	0,79
64,4	0,01855	0,82
68,1	0,02058	0,88
71,9	0,02285	0,91
75,7	0,02511	0,98
79,5	0,02737	1,04
83,3	0,02986	1,07
87,1	0,03257	1,13
90,8	0,03506	1,16
94,6	0,03800	1,22
98,4	0,04072	1,28
102,2	0,04366	1,31
106,0	0,04682	1,37
109,8	0,04976	1,40
113,6	0,05316	1,46
117,3	0,05632	1,52
121,1	0,05994	1,55
124,9	0,06334	1,62
128,7	0,06696	1,65
132,5	0,07057	1,71
136,3	0,07442	1,77
140,1	0,07827	1,80
143,8	0,08234	1,86
147,6	0,08618	1,89
151,4	0,09048	1,95
155,2	0,09455	2,01
159,0	0,09885	2,04
162,8	0,10337	2,10
166,6	0,10790	2,13
170,3	0,11242	2,19
174,1	0,11717	2,26
177,9	0,12192	2,29
181,7	0,12667	2,35
185,5	0,13165	2,38
189,3	0,13662	2,44
196,8	0,14680	2,53
204,4	0,15744	2,62
212,0	0,16852	2,74
219,6	0,17983	2,83
227,1	0,19137	2,93
234,7	0,20335	3,02
242,3	0,21579	3,11
249,8	0,22846	3,23
257,4	0,24136	3,32
265,0	0,25470	3,41
272,5	0,26827	3,51
280,1	0,28207	3,60
287,7	0,29655	3,72

DN	1 1/2" / 40	
Internal Diameter [mm]	40,9	
Flow rate [l/ min]	Load Loss [mca/m]	Speed [m/s]
295,3	0,31103	3,81
302,8	0,32595	3,90
310,4	0,34111	3,99
318,0	0,35672	4,08
325,5	0,37255	4,21
333,1	0,38884	4,30
340,7	0,40535	4,39
348,3	0,42209	4,48
355,8	0,43928	4,57
363,4	0,45670	4,69
371,0	0,47457	4,79
378,5	0,49244	4,88
416,4	0,58744	5,36
454,2	0,69014	5,85
492,1	0,80030	6,34
530,0	0,91792	6,83
567,8	1,04278	7,32
605,7	1,17511	7,80
643,5	1,31445	8,29
681,4	1,46125	8,78
719,2	1,61484	9,27
757,1	1,77567	9,75
794,9	1,94328	10,24
832,8	2,11791	10,73
870,6	2,29955	11,22
908,5	2,48797	11,70
946,4	2,68318	12,19
984,2	2,88495	12,68
1022,1	3,09351	13,17
1059,9	3,30885	13,66
1097,8	3,53076	14,14
1135,6	3,75944	14,63
1173,5	3,99447	15,12
1211,3	4,23605	15,61
1249,2	4,48419	16,09
1287,0	4,73889	16,58

DN	2" / 50	
Internal Diameter [mm]	51,2	
Flow rate [l/ min]	Load Loss [mca/m]	Speed [m/s]
3,8	0,00000	0,03
7,6	0,00023	0,06
11,4	0,00023	0,09
15,1	0,00045	0,12
18,9	0,00068	0,15
22,7	0,00090	0,18
26,5	0,00113	0,21
30,3	0,00158	0,24
34,1	0,00181	0,27
37,9	0,00226	0,30

DN	2" / 50	
Internal Diameter [mm]	51,2	
Flow rate [l/ min]	Load Loss [mca/m]	Speed [m/s]
41,6	0,00271	0,34
45,4	0,00317	0,37
49,2	0,00385	0,40
53,0	0,00430	0,43
56,8	0,00498	0,46
60,6	0,00543	0,49
64,4	0,00611	0,52
68,1	0,00679	0,55
71,9	0,00769	0,58
75,7	0,00837	0,61
79,5	0,00905	0,64
83,3	0,00995	0,67
87,1	0,01086	0,70
90,8	0,01176	0,73
94,6	0,01267	0,76
98,4	0,01357	0,79
102,2	0,01448	0,82
106,0	0,01561	0,88
109,8	0,01651	0,91
113,6	0,01764	0,94
117,3	0,01877	0,98
121,1	0,01991	1,01
124,9	0,02104	1,04
128,7	0,2217	1,07
132,5	0,02352	1,10
136,3	0,02466	1,13
140,1	0,02601	1,16
143,8	0,02737	1,19
147,6	0,02873	1,22
151,4	0,03008	1,25
155,2	0,03144	1,28
159,0	0,03303	1,31
162,8	0,03438	1,34
166,6	0,03597	1,37
170,3	0,03732	1,40
174,1	0,03891	1,43
177,9	0,04049	1,46
181,7	0,04207	1,49
185,5	0,04388	1,52
189,3	0,04547	1,55
196,8	0,04886	1,62
204,4	0,05248	1,68
212,0	0,05610	1,74
219,6	0,05994	1,80
227,1	0,06379	1,86
234,7	0,06763	1,92
242,3	0,07171	1,98
249,8	0,07600	2,04
257,4	0,08030	2,10
265,0	0,08483	2,16
272,5	0,08935	2,23
280,1	0,09387	2,29
287,7	0,09862	2,35

DN	2" / 50	
Internal Diameter [mm]	51,2	
Flow rate [l/ min]	Load Loss [mca/m]	Speed [m/s]
295,3	0,10360	2,41
302,8	0,10858	2,47
310,4	0,11355	2,53
318,0	0,11876	2,62
325,5	0,12396	2,68
333,1	0,12939	2,74
340,7	0,13482	2,80
348,3	0,14047	2,87
355,8	0,14613	2,93
363,4	0,15201	2,99
371,0	0,15789	3,05
378,5	0,16400	3,11
416,4	0,19544	3,41
454,2	0,22959	3,72
492,1	0,26646	4,02
530,0	0,30560	4,36
567,8	0,34699	4,66
605,7	0,39110	4,97
643,5	0,43747	5,27
681,4	0,48633	5,58
719,2	0,53745	5,88
757,1	0,59106	6,22
794,9	0,64671	6,52
832,8	0,70484	6,83
870,6	0,76546	7,13
908,5	0,82812	7,44
946,4	0,89304	7,77
984,2	0,96022	8,08
1022,1	1,02966	8,38
1059,9	1,10137	8,69
1097,8	1,17511	8,99
1135,6	1,25134	9,30
1173,5	1,32960	9,63
1211,3	1,40990	9,94
1249,2	1,49247	10,24
1287,0	1,57729	10,55
1324,9	1,66415	10,85
1362,7	1,75328	11,19
1400,6	1,84443	11,49
1438,5	1,93763	11,80
1476,3	2,03309	12,10
1514,2	2,13058	12,41
1552,0	2,23011	12,71
1627,7	2,43550	13,35
1703,4	2,64925	13,96
1779,1	2,87116	14,60
1854,8	3,10120	15,21
1930,6	3,33939	15,82
2006,3	3,58572	16,46
2082,0	3,84020	17,07
2157,7	4,10236	17,68
2233,4	4,37267	18,32
2309,1	4,65090	18,93

DN	2 1/2" / 60	
Internal Diameter [mm]	62,0	
Flow rate [l/ min]	Load Loss [mca/m]	Speed [m/s]
3,8	0,00000	0,03
7,6	0,00000	0,03
11,4	0,00000	0,06
15,1	0,00023	0,09
18,9	0,00023	0,09
22,7	0,00045	0,12
26,5	0,00045	0,15
30,3	0,00068	0,18
34,1	0,00068	0,18
37,9	0,00090	0,21
41,6	0,00113	0,24
45,4	0,00136	0,24
49,2	0,00158	0,27
53,0	0,00181	0,30
56,8	0,00204	0,30
60,6	0,00226	0,34
64,4	0,00249	0,37
68,1	0,00271	0,40
71,9	0,00294	0,40
75,7	0,00339	0,43
79,5	0,00362	0,46
83,3	0,00385	0,46
87,1	0,00430	0,49
90,8	0,00452	0,52
94,6	0,00498	0,52
98,4	0,00543	0,55
102,2	0,00566	0,58
106,0	0,00611	0,58
109,8	0,00656	0,61
113,6	0,00701	0,64
117,3	0,00746	0,67
121,1	0,00792	0,67
124,9	0,00837	0,70
128,7	0,00882	0,73
132,5	0,00927	0,73
136,3	0,00973	0,76
140,1	0,01041	0,79
143,8	0,01086	0,79
147,6	0,01131	0,82
151,4	0,01199	0,85
155,2	0,01244	0,88
159,0	0,01312	0,88
162,8	0,01357	0,91
166,6	0,01425	0,94
170,3	0,01470	0,94
174,1	0,01538	0,98
177,9	0,01606	1,01
181,7	0,01674	1,01
185,5	0,01742	1,04
189,3	0,01810	1,07
196,8	0,01945	1,10
204,4	0,02081	1,16
212,0	0,02217	1,19

DN	2 1/2" / 60	
Internal Diameter [mm]	62,0	
Flow rate [l/ min]	Load Loss [mca/m]	Speed [m/s]
219,6	0,02375	1,22
227,1	0,02511	1,28
234,7	0,02669	1,31
242,3	0,02850	1,37
249,8	0,03008	1,40
257,4	0,03189	1,43
265,0	0,03348	1,49
272,5	0,03529	1,52
280,1	0,03710	1,55
287,7	0,03913	1,62
295,3	0,04094	1,65
302,8	0,04298	1,71
310,4	0,04501	1,74
318,0	0,04705	1,77
325,5	0,04909	1,83
333,1	0,05112	1,86
340,7	0,05338	1,92
348,3	0,05565	1,95
355,8	0,05791	1,98
363,4	0,06017	2,04
371,0	0,06243	2,07
378,5	0,06492	2,13
416,4	0,07736	2,35
454,2	0,09093	2,53
492,1	0,10541	2,74
530,0	0,12079	2,96
567,8	0,13730	3,17
605,7	0,15472	3,38
643,5	0,17304	3,60
681,4	0,19250	3,81
719,2	0,21263	4,02
757,1	0,23389	4,24
794,9	0,25606	4,45
832,8	0,27890	4,66
870,6	0,30288	4,88
908,5	0,32776	5,09
946,4	0,35332	5,30
984,2	0,38002	5,52
1022,1	0,40739	5,73
1059,9	0,43589	5,94
1097,8	0,46507	6,16
1135,6	0,49515	6,37
1173,5	0,52614	6,58
1211,3	0,55804	6,80
1249,2	0,59061	7,01
1287,0	0,62409	7,22
1324,9	0,65847	7,44
1362,7	0,69376	7,62
1400,6	0,76682	7,83
1438,5	0,76682	8,05
1476,3	0,80459	8,26
1514,2	0,84305	8,47
1552,0	0,88241	8,69

DN	2 1/2" / 60	
Internal Diameter [mm]	62,0	
Flow rate [l/ min]	Load Loss [mca/m]	Speed [m/s]
1627,7	0,96384	9,11
1703,4	1,04844	9,54
1779,1	1,13620	9,97
1854,8	1,22714	10,39
1930,6	1,32146	10,82
2006,3	1,41895	11,25
2082,0	1,51961	11,67
2157,7	1,62344	12,10
2233,4	1,73043	12,50
2309,1	1,84036	12,92
2384,8	1,95369	13,35
2460,5	2,06996	13,78
2536,2	2,18916	14,20
2611,9	2,31176	14,63
2725,5	2,50109	15,27
2839,1	2,69721	15,91
2952,6	2,90034	16,55
3066,2	3,11002	17,19
3179,7	3,32650	17,80
3293,3	3,54953	18,44
3406,9	3,77935	19,08
3520,4	4,01573	19,72
3634,0	4,25867	20,36
3785,4	4,59254	21,21

DN	3" / 75	
Internal Diameter [mm]	75,7	
Flow rate [l/ min]	Load Loss [mca/m]	Speed [m/s]
3,8	0,00000	0,00
7,6	0,00000	0,03
11,4	0,00000	0,03
15,1	0,00000	0,06
18,9	0,00000	0,06
22,7	0,00023	0,09
26,5	0,00023	0,09
30,3	0,00023	0,12
34,1	0,00023	0,12
37,9	0,00045	0,15
41,6	0,00045	0,15
45,4	0,00045	0,18
49,2	0,00068	0,18
53,0	0,00068	0,21
56,8	0,00090	0,21
60,6	0,00090	0,24
64,4	0,00113	0,24
68,1	0,00113	0,24
71,9	0,00113	0,27
75,7	0,00136	0,27
79,5	0,00136	0,30
83,3	0,00158	0,30
87,1	0,00158	0,34

DN	3″ / 75	
Internal Diameter [mm]	75,7	
Flow rate [l/ min]	Load Loss [mca/m]	Speed [m/s]
90,8	0,00181	0,34
94,6	0,00181	0,37
98,4	0,00204	0,37
102,2	0,00226	0,40
106,0	0,00226	0,40
109,8	0,00249	0,43
113,6	0,00271	0,43
117,3	0,00294	0,46
121,1	0,00294	0,46
124,9	0,00317	0,46
128,7	0,00339	0,49
132,5	0,00362	0,49
136,3	0,00385	0,52
140,1	0,00385	0,52
143,8	0,00407	0,55
147,6	0,00430	0,55
151,4	0,00452	0,58
155,2	0,00475	0,58
159,0	0,00498	0,61
162,8	0,00520	0,61
166,6	0,00543	0,64
170,3	0,00566	0,64
174,1	0,00588	0,67
177,9	0,00611	0,67
181,7	0,00633	0,70
185,5	0,00656	0,70
189,3	0,00701	0,70
196,8	0,00746	0,73
204,4	0,00792	0,76
212,0	0,00860	0,79
219,6	0,00905	0,82
227,1	0,00973	0,85
234,7	0,01018	0,88
242,3	0,01086	0,91
249,8	0,01154	0,94
257,4	0,01221	0,98
265,0	0,01289	1,01
272,5	0,01357	1,04
280,1	0,01425	1,07
287,7	0,01493	1,10
295,3	0,01561	1,13
302,8	0,01651	1,16
310,4	0,01719	1,16
318,0	0,01810	1,19
325,5	0,01877	1,22
333,1	0,01968	1,25
340,7	0,02058	1,28
348,3	0,02126	1,31
355,8	0,02217	1,34
363,4	0,02307	1,37
371,0	0,02398	1,40
378,5	0,02488	1,43
416,4	0,02963	1,58

DN	3″ / 75	
Internal Diameter [mm]	75,7	
Flow rate [l/ min]	Load Loss [mca/m]	Speed [m/s]
454,2	0,03483	1,71
492,1	0,04049	1,86
530,0	0,04637	2,01
567,8	0,05270	2,13
605,7	0,05926	2,29
643,5	0,06650	2,44
681,4	0,07374	2,56
719,2	0,08166	2,71
757,1	0,08958	2,87
794,9	0,09817	3,02
832,8	0,10699	3,14
870,6	0,11604	3,29
908,5	0,12577	3,44
946,4	0,13549	3,57
984,2	0,14567	3,72
1022,1	0,15630	3,87
1059,9	0,16716	3,99
1097,8	0,17825	4,15
1135,6	0,18978	4,30
1173,5	0,20177	4,45
1211,3	0,21399	4,57
1249,2	0,22643	4,72
1287,0	0,23932	4,88
1324,9	0,25267	5,00
1362,7	0,26601	5,15
1400,6	0,27981	5,30
1438,5	0,29406	5,43
1476,3	0,30854	5,58
1514,2	0,32324	5,73
1552,0	0,33840	5,85
1627,7	0,36961	6,16
1703,4	0,40196	6,43
1779,1	0,43566	6,74
1854,8	0,47072	7,01
1930,6	0,50669	7,28
2006,3	0,54424	7,59
2082,0	0,58269	7,86
2157,7	0,62250	8,17
2233,4	0,66367	8,44
2309,1	0,70574	8,72
2384,8	0,74917	9,02
2460,5	0,79374	9,30
2536,2	0,83965	9,57
2611,9	0,88648	9,88
2725,5	0,95909	10,30
2839,1	1,03441	10,73
2952,6	1,11223	11,16
3066,2	1,19275	11,58
3179,7	1,27577	12,01
3293,3	1,36127	12,44
3406,9	1,44926	12,86
3520,4	1,55997	13,32
3634,0	1,63316	13,75
3785,4	1,76119	14,30

Load loss of fittings

The table below represents the head loss values for TIGRE Fire® fittings, described as equivalent pipe length.

Table 16 - Equivalent Load Loss for TIGRE Fire® Fittings

Equivalent Load Loss for TIGRE Fire® Fittings							
Product	**3/4"**	**1"**	**1 1/4"**	**1 1/2"**	**2"**	**2 1/2"**	**3"**
Bypass Tee	0,914m	1,52m	1,83m	2,44m	3,05m	3,66m	4,57m
90° bend	2,13m	2,13m	2,44m	2,74m	3,35m	3,6m	3,96m
45° bend	0,305m	0,305m	0,610m	0,610m	0,610m	0,914m	1,220m
Junction	0,305m	0,305m	0,305m	0,305m	0,305m	0,610m	0,610m
Tee direct passage	0,305m	0,305m	0,305m	0,305m	0,305m	0,610m	0,610m

1.14. Loss of Load Comparison - Iron X CPVC

Next, check out a comparison of the hydraulic performance of CPVC and galvanized iron pipes. For the calculations, the following data are used:

- Flow for project (Qm) - 2,000 l/min, estimated flow in the column for automatic shower installations, at low risk, according to NBR 10897.
- Hazen-Williams Factor (C) - 150 for CPVC and 120 for galvanized iron, according to NBR 10897.
- Internal diameter (dm) - 35.7 mm for CPVC gauge 1 1/4".

According to NBR 10897, the head loss must be calculated by the Hazen-Williams equation, which follows:

$$J = 605 \times \left(\frac{Q_m^{1,85}}{C^{1,85} \times d_m^{4,87}} \right) \times 10^5$$

Calculation with CPVC

- **Flow for project (Qm) = 2,000 l/min, estimated** flow in the column for automatic shower installations, at low risk, according to NBR 10897.
- Hazen-Williams factor (C) = 150 for CPVC.
- Internal diameter (dm) = 35.7 mm for CPVC gauge 1 1/4".

$$J = 605 \times \left(\frac{2.000^{1,85}}{150^{1,85} \times 35,7^{4,87}} \right) \times 10^5$$

J = 200 kPa/m

Calculation with Iron

- **Flow for project (Qm) = 2,000 l/min, estimated** flow in the column for automatic shower installations, at low risk, according to NBR 10897.
- Hazen-Williams factor (C) = 120 for galvanized iron.

$$200 = 605 \times \left(\frac{2.000^{1,85}}{120^{1,85} \times \mathbf{X}^{4,87}} \right) \times 10^{5}$$

X= 38,85 mm Corresponds to 1 1/2"
CPVC = 1 ¼" **STEEL** = 1 ½"

Thus, it is possible to adopt smaller gauges for CPVC installations when compared to galvanized iron for the same water flow, due to the roughness factor of the materials.

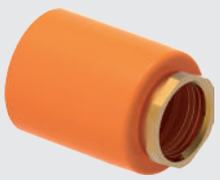
1.15. TIGRE Fire® Line Items

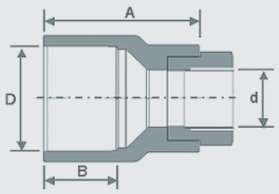
• TIGRE Fire® CPVC Pipe

DIMENSIONS (MM)

CODE	GAUGE	L	e	DE
17020056	3/4"	3000	2,5	33,3
17020080	1"	3000	2	26,6
17020110	1 1/4"	3000	3,2	42,1
17020153	1 1/2"	3000	3,6	48,1
17020188	2"	3000	4,6	60,2
17020226	2 1/2"	3000	5,5	72,9
17020250	3"	3000	6,6	88,8

• TIGRE Fire® Nozzle Adapter

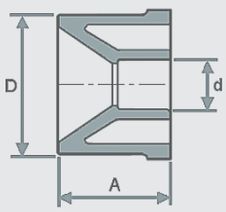




DIMENSIONS (MM)

CODE	GAUGE	A	B	D	d
22890034	3/4" x 1/2"	45,56	25,9	26,6	1/2"
22890042	1" x 1/2"	52,87	29,3	33,3	1/2"

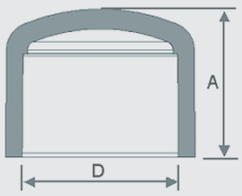
• TIGRE Fire® Reduction Bushing



DIMENSIONS (MM)

CODE	GAUGE	A	D	d
22890115	1" x 3/4"	35,7	33,3	26,6
22890123	1 1/4" x 3/4"	40,5	42,1	26,6
22890131	1 1/4" x 1"	43,6	42,1	33,3
22890166	1 1/2" x 1"	38,9	48,1	33,3
22890158	1 1/2" x 1 1/4"	39,7	48,1	42,1
22890190	2" x 1"	48,5	60,2	33,3
22890204	2" x 1 1/4"	42,9	60,2	42,1
22890174	2" x 1 1/2"	42,9	60,2	48,1
22890247	2 1/2" x 1.1/4"	61,1	73	42,1
22890255	2 1/2" x 1 1/2"	61,1	73	48,1
22890263	2 1/2" x 2"	57,9	73	60,2
22890301	3" x 2"	57,1	88,9	60,2
22890310	3" x 2 1/2"	58,7	88,9	73

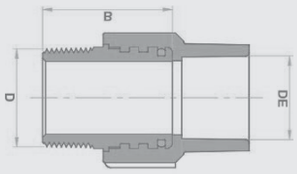
• TIGRE Fire® cap



DIMENSIONS (MM)

CODE	GAUGE	A	D
22890328	3/4"	35,40	26,7
22890344	1"	39,90	33,5

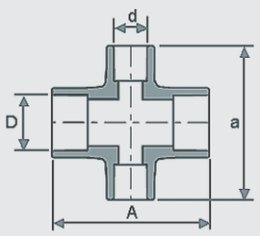
• TIGRE Fire® Male Connector



DIMENSIONS (MM)

CODE	GAUGE	B	D	DE
22892010	3/4"	35,5	3/4"	26,6
100021063	1"	39,3	1"	33,62
22892070	1 1/4"	55	1 1/4"	42,1
22892118	1 1/2"	57	1 1/2"	48,1
22892142	2"	66	2"	60,2
100021067	3"	87,1	3"	89,31

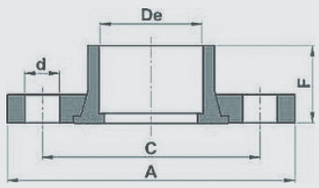
• TIGRE Fire® Crosshead



DIMENSIONS (MM)

CODE	GAUGE	A	a	D	d
22890549	3/4"	81,88	81,8	26,6	26,6
22890565	1"	82,02	82,0	33,3	33,3
22890557	1 1/4"	120,6	120,6	42,1	42,1
22890573	1 1/2"	133,3	133,3	48,1	48,1
22890581	2"	152,4	152,4	60,2	60,2
22890590	2 1/2"	173,0	173,0	73	73
22890603	3"	200,0	200,0	88,9	88,9

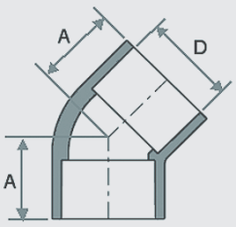
• TIGRE Fire® flange



DIMENSIONS (MM)

CODE	GAUGE	A	C	De	d	F
22891847	3″	190	152	88,9	19	57

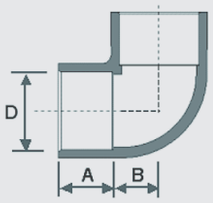
• TIGRE Fire® 45° elbow



DIMENSIONS (MM)

CODE	GAUGE	A	D
22891715	3/4″	33,3	26,6
22891723	1″	37,3	33,3
22891731	1 1/4″	41,3	42,1
22891740	1 1/2″	46,8	48,1
22891758	2″	54	60,2
22891766	2 1/2″	63,5	73
22891774	3″	69,8	88,9

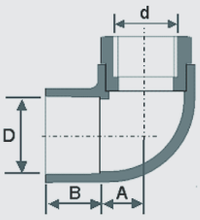
• TIGRE Fire® 90° elbow



DIMENSIONS (MM)

CODE	GAUGE	A	B	D
22890743	3/4″	24	15	26,7
22890760	1″	22,6	19,3	33,3
22890786	1 1/4″	31,8	24,5	42,1
22890808	1 1/2″	35,4	29,9	48,1
22890816	2″	38,3	37,14	60,2
22890824	2 1/2″	41,6	41,3	73
22890832	3″	46	48,4	88,9

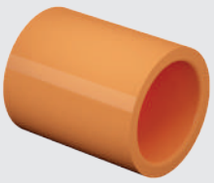
• 90° Elbow Adapter for TIGRE Fire® Nozzle

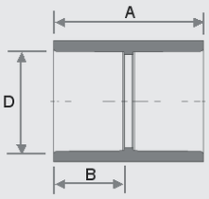


DIMENSIONS (MM)

CODE	GAUGE	A	B	D	d
22890646	3/4" x 1/2"	12,6	25,3	26,6	1/2"

• TIGRE Fire® sleeve

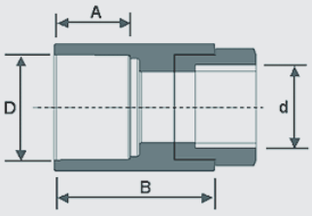




DIMENSIONS (MM)

CODE	GAUGE	A	B	D
22890840	3/4"	55,3	25,4	26,85
22890867	1"	62,5	28,7	33,63
22890883	1 1/4"	68	31,3	42,39
22890905	1 1/2"	75,4	35	48,51
22890921	2"	82,4	38,2	60,58
22890930	2 1/2"	94,2	44,6	73,3
22890948	3"	103,1	47,8	89,24

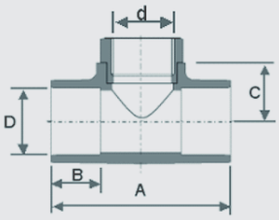
• TIGRE Fire® Transition Sleeve



DIMENSIONS (MM)

CODE	GAUGE	A	B	D	d
22891049	3/4"	28,72	46,16	26,7	3/4" ISO7
100021072	1"	27,77	48,73	33,48	1" ISO7
22891081	1 1/4"	31,72	57,80	42,1	1 1/4" ISO7
22891103	1 1/2"	35,43	62,42	48,1	1 1/2" ISO7
22891120	2"	37,66	65,79	60,2	2" ISO7

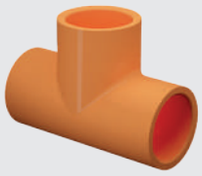
• TIGRE Fire® Nozzle Adapter Tee

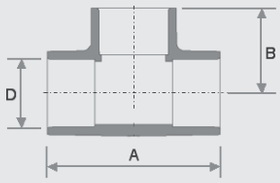


DIMENSIONS (MM)

CODE	GAUGE	A	B	C	D	d
22891464	1" x 1/2"	79,65	28,44	29,36	33,3	1/2"

• TIGRE Fire® Tee

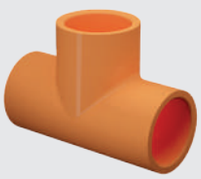


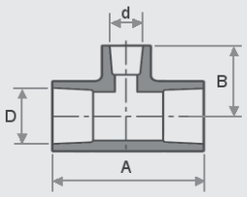


DIMENSIONS (MM)

CODE	GAUGE	A	B	D
22891243	3/4"	79,4	39,39	26,6
22891260	1"	91,97	45,8	33,3
22891286	1 1/4"	107,7	53,48	42,1
22891308	1 1/2"	129,5	64,77	48,1
22891324	2"	148,7	74,38	60,2
22891332	2 1/2"	169,9	84,9	73
22891340	3"	200	100	88,9

• TIGRE Fire® Reduction Tee





DIMENSIONS (MM)

CODE	GAUGE	A	B	D	d
22891510	1" x 3/4"	90,5	46	33,3	26,6
22891537	1 1/4" x 3/4"	96,8	50,8	42,1	26,6
22891545	1 1/4" x 1"	104,7	54	42,1	33,3
22891553	1 1/2" x 3/4"	106,3	71	48,1	26,6
22891570	1 1/2" x 1"	111,12	57,1	48,1	33,3
22891596	2" x 3/4"	112,7	61,9	60,2	26,6
22891600	2" x 1"	120,65	65	60,2	33,3
22891618	2" x 1 1/4"	129,4	65,8	60,2	42,1
22891626	2" x 1 1/2"	136,52	70,6	60,2	48,1
22891634	2 1/2" x 1"	134,9	48,4	73	33,3
22891642	2 1/2" x 2"	169,8	92	73	60,2
22891669	3" x 1"	168,3	94,5	88,9	33,3
22891677	3" x 1 1/4"	168,3	88,9	88,9	42,1
22891693	3" x 2"	168,3	84	88,9	60,2
22891707	3" x 2 1/2"	184,15	94,4	88,9	73

• Aquatherm® Adhesive Tube

CODE	INFORMATION DESCRIPTION
53010423	Aquatherm® Adhesive 17g tube
53010431	Aquatherm® Adhesive 75g tube

• Aquatherm® Bottle Adhesive

CODE	INFORMATION DESCRIPTION
53010407	Aquatherm® Adhesive 175g Bottle
53010415	Aquatherm® Adhesive 850g Bottle

• Thread Sealing Tape

CODE	DIMENSIONS (MM) MEASUREMENTS
54501854	18 mm x 10 m
54501900	18 mm x 25 m
54501951	18 mm x 50 m


Janesville, WI (United States)
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Celina, TN (United States)
Cota (Colombia)
Mosquera (Colombia)
Quito (Ecuador)
Lima (Peru)
La Paz (Bolivia)
Santa Cruz de La Sierra (Bolivia)
Lambaré (Paraguay)
Santiago (Chile)
Manaus
Escada
Marechal Deodoro
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