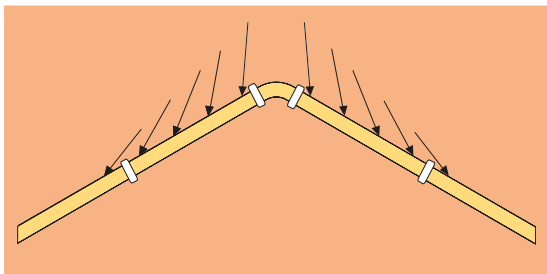


# Anchoring



The contractor is responsible for analyzing and eliminating any risks during installation (especially the use of personal protective equipment). All the values contained in this document are provided by SAINT-GOBAIN PAM for guidance only. They are no substitute for carrying out prior studies or enlisting the services of a consultant.

## 1 CONSTRUCTION RECOMMENDATIONS

The self-anchoring of push-in joints represents an alternative technique to concrete anchor blocks for withstanding the hydraulic thrust of buried pipelines.

The anchoring lengths suggested below have been calculated for the most frequently encountered types of soil and laying conditions (minimum height of cover = 1 m).

**If the laying conditions are not covered by the following tables, contact SAINT-GOBAIN PAM.**

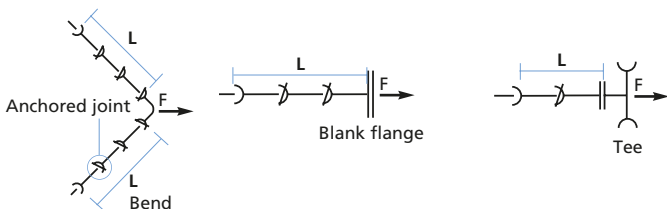
Anchoring is recommended in case of space constraints (urban areas) or non-cohesive soils.

The length to be anchored **does not depend on the anchoring joint used.**

The length to be anchored **depends on the pipe's type of external coating:**

- Usual coatings: BioZinalium, Zinalium or Zinc
- Special coatings: Standard TT, PUX, ZMU or PE sleeve

Length **L** to be anchored according to the diagrams below:



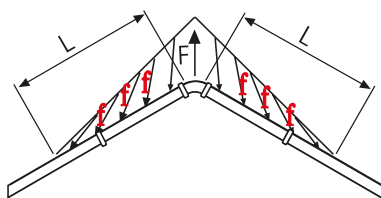
## 2 ANCHORING PRINCIPLE

# Anchoring

**F** : hydraulic thrust on the joint

**f** : soil/pipe friction

**L** : length to be anchored



The technique involves anchoring joints over a sufficient length  $L$  on both sides of a bend so as to harness the friction forces ( $f$ ) between the anchored sections ( $L$ ) and the soil to withstand the hydraulic thrust ( $F$ ).

## 3 SOIL CHARACTERISTICS

The values below are those generally accepted for soil characterization. They are no substitute for actual site or laboratory measurements.

Soil type	Dry / wet		Submerged	
	$\phi$	$\gamma$	$\phi$	$\gamma$
	degrees	t/m <sup>3</sup>	degrees	t/m <sup>3</sup>
<b>Fragmented rock</b>	40	2	35	1.1
<b>Gravel, sands</b>	35	1.9	30	1.1
<b>Gravel, sands Silts / clays</b>	30	2	25	1.1
<b>Silts / clays</b>	25	1.9	15	1.1
<b>Humus Organic clays / silts</b>	15	1.5	no mean characteristics	

$\phi$ : soil internal friction angle

$\gamma$ : soil density

(standard geotechnical data)

# Anchoring

## 4 ANCHORING LENGTHS

### Assumptions for the calculation:

- Internal friction:  $\phi = 30^\circ$
- Soil strength:  $\sigma = 0.6 \text{ daN/cm}^2$
- Mass density:  $\gamma = 2 \text{ t/m}^3$
- No groundwater

### Usual coatings:

- BioZinalium, Zinalium or Zinc

Anchoring lengths (in m) calculated with the above assumptions																
Joint type		1/4 bend			1/8 bend			1/16 bend			1/32 bend			Blank flange, valve or tee		
Height of cover (m)		1	1.5	2	1	1.5	2	1	1.5	2	1	1.5	2	1	1.5	2
DN	Test pressure	Lengths to be anchored (m)														
60	10	4.6	3.1	2.4	2.9	1.9	1.5	1.6	1.1	0.8	0.8	0.6	0.4	5.8	4.0	3.0
	16	7.3	5.0	3.8	4.6	3.1	2.3	2.6	1.7	1.3	1.4	0.9	0.7	9.4	6.4	4.8
	25	11.5	7.8	5.9	7.1	4.8	3.7	4.0	2.7	2.1	2.1	1.4	1.1	14.6	9.9	7.5
80	10	5.8	4.0	3.0	3.6	2.5	1.9	2.0	1.4	1.0	1.1	0.7	0.6	7.4	5.0	3.8
	16	9.3	6.3	4.8	5.8	3.9	3.0	3.2	2.2	1.7	1.7	1.2	0.9	11.8	8.1	6.1
	25	14.5	9.9	7.5	9.0	6.1	4.7	5.1	3.4	2.6	2.7	1.8	1.4	18.5	12.6	9.5
100	10	7.0	4.7	3.6	4.3	2.9	2.2	2.4	1.7	1.3	1.3	0.9	0.7	8.9	6.0	4.6
	16	11.1	7.6	5.8	6.9	4.7	3.6	3.9	2.6	2.0	2.1	1.4	1.1	14.2	9.7	7.3
	25	17.4	11.9	9.0	10.8	7.4	5.6	6.1	4.1	3.1	3.2	2.2	1.7	22.1	15.1	11.5
125	10	8.4	5.8	4.4	5.2	3.6	2.7	2.9	2.0	1.5	1.6	1.1	0.8	10.7	7.3	5.6
	16	13.5	9.2	7.0	8.4	5.7	4.3	4.7	3.2	2.4	2.5	1.7	1.3	17.2	11.7	8.9
	25	21.1	14.4	10.9	13.1	8.9	6.8	7.3	5.0	3.8	3.9	2.7	2.0	26.8	18.3	13.9
150	10	9.9	6.8	5.1	6.1	4.2	3.2	3.4	2.4	1.8	1.8	1.2	0.9	12.6	8.6	6.5
	16	15.8	10.8	8.2	9.8	6.7	5.1	5.5	3.8	2.9	2.9	2.0	1.5	20.1	13.8	10.5
	25	24.7	16.9	12.9	15.3	10.5	8.0	8.6	5.9	4.5	4.6	3.1	2.4	31.4	21.5	16.4
200	10	12.7	8.7	6.7	7.9	5.4	4.1	4.4	3.0	2.3	2.3	1.6	1.2	16.2	11.1	8.5
	16	20.3	14.0	10.7	12.6	8.7	6.6	7.1	4.9	3.7	3.8	2.6	2.0	25.9	17.8	13.6
	25	31.8	21.9	16.7	19.7	13.6	10.4	11.1	7.6	5.8	5.9	4.0	3.1	40.4	27.8	21.2
250	10	15.4	10.7	8.1	9.6	6.6	5.1	5.4	3.7	2.8	2.8	2.0	1.5	19.6	13.6	10.4
	16	24.6	17.0	13.0	15.3	10.6	8.1	8.6	5.9	4.5	4.5	3.1	2.4	31.3	21.7	16.6
	25	38.5	26.6	20.4	23.9	16.5	12.7	13.4	9.3	7.1	7.1	4.9	3.8	49.0	33.9	25.9
300	10	18.0	12.5	9.6	11.2	7.8	6.0	6.3	4.4	3.3	3.3	2.3	1.8	22.9	15.9	12.2
	16	28.8	20.0	15.4	17.9	12.4	9.5	10.0	7.0	5.3	5.3	3.7	2.8	36.6	25.5	19.6
	25	45.0	31.3	24.0	27.9	19.4	14.9	15.6	10.9	8.4	8.3	5.8	4.4	57.2	39.8	30.6
350	10	20.5	14.4	11.0	12.7	8.9	6.9	7.1	5.0	3.8	3.8	2.7	2.0	26.1	18.3	14.1
	16	32.8	23.0	17.7	20.4	14.3	11.0	11.4	8.0	6.1	6.1	4.2	3.3	41.8	29.2	22.5
	25	51.3	35.9	27.6	31.9	22.3	17.1	17.9	12.5	9.6	9.5	6.6	5.1	65.3	45.7	35.1
400	10	23.0	16.1	12.4	14.3	10.0	7.7	8.0	5.6	4.3	4.2	3.0	2.3	29.3	20.5	15.8
	16	36.8	25.8	19.9	22.8	16.0	12.4	12.8	9.0	6.9	6.8	4.8	3.7	46.8	32.9	25.3
	25	57.5	40.3	31.1	35.7	25.1	19.3	20.0	14.0	10.8	10.6	7.5	5.7	73.1	51.4	39.6

# Anchoring

A **safety factor** may be applied to the length to be anchored, depending on the:

- **Laying conditions**
- **Quality** and **compaction** of the **backfill**
- **Uncertainties surrounding the physical characteristics** of the backfill

Where applicable, allowance should be made for any partial presence of groundwater by correcting the weight of the full pipe and applying the corresponding Archimedes' value.

## **If using a polyethylene sleeve:**

Apply a multiplier of 1.9 to the length to be anchored.

## **If using pipes with a polyethylene (TT) or polyurethane (PUX) coating:**

Apply a multiplier of 1.5 to the length to be anchored.

**Other cases: contact us.**