

## 1.High Density Polyethylene , composition and characteristics

### 1.1 HDPE raw material

FILGÁS pipes are composed by high-density polyethylene. The high density polyethylene (PEAD) is a semi-crystalline thermoplastic polymer. PEAD is composed of macromolecules, formed through a polymerisation process. Polymerisation should be considered as a chemical reaction during which a quick and successive monomers addition leads to the formation of a macromolecule, creating long chains of simple ramifications as presented in fig.2. The used monomer is the ethylene, a pure hydro-carbonate, that is not easily inflammable despite being a combustible (auto ignition high point). In the event of combustion the products are not toxic, being even recommended by the environmental organisms for facilities where the fire risk is present.

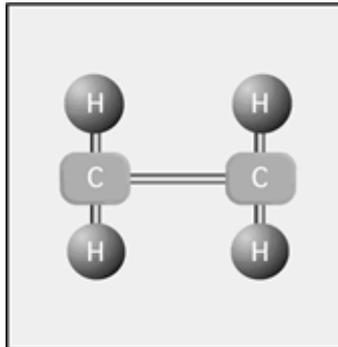


Fig. 1 - Monomer of Ethylene

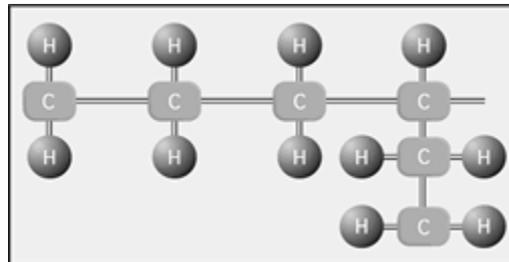
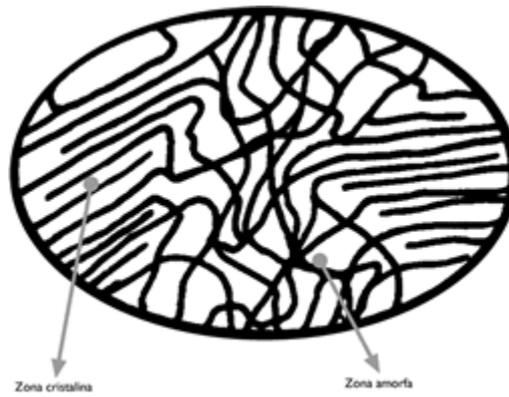


Fig. 2 - Macromolecule of PEAD

Fig. 1–Monomer of Ethylene

Fig. 2–Macromolecule of PEAD

Polyethylene is a partially crystalline material, designation that comes from the fact of existing in its structure long and perfectly lined up chains whose density is higher (crystalline areas) and chains highly disordered with lower partial densities (amorphous areas). These two areas have different fusion points, near 130°C for the amorphous areas and temperatures close to 200°C for crystalline areas, for what it is necessary to carry out an extrusion at temperatures close to the last one so that the raw material may become fluid.



The crystalline areas allow the high density polyethylene a higher resistance, for different thermal cycles, recovering its shape and maintaining its properties along the years.

The thermoplastics of totally amorphous nature are more fragile, not supporting with the same effectiveness the variations of temperature, not presenting the resistance of high density polyethylene even with temperatures near 20°C.

The raw material presents the following medium properties:

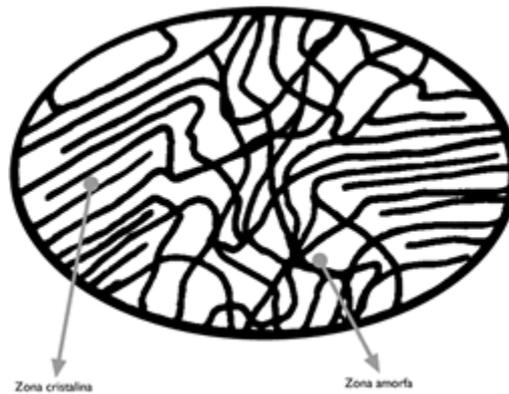


Chart 1–Medium Properties of the raw materials

The mentioned properties are properly specified in standards DIN8075.

## 2. Production Range

For the production of FILGÁS pipes two different resins are used, classified in PE80 and PE100.

Each one of them supports a different required minimum tension (MRS), 8.0 and 10.0 Mpa respectively, keeping in mind a 50 year-old durability with a working temperature of 20°C, to which correspond tangential tensions ( $\sigma$ ) of 6.3 and 8Mpa.

| PE  | MRS (MPa) | ( $\sigma$ ) MPa |
|-----|-----------|------------------|
| 80  | 8,0       | 6,3              |
| 100 | 10,0      | 8,0              |

Chart 2 - MRS relation, tangential tension for resins P80 and PE100

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The relation between tangential tension ( $\sigma$ ) and MRS (minimum required strength) is verified by the following formula:

$$\sigma = \frac{MRS}{1,25^*}$$

\*Coefficient of security PE

Considering the mentioned tangential tensions, the dimension of the tubes is based on the following formula:

$$PN = \frac{10 \times \sigma}{S} \cdot S = \frac{SDR - 1}{2} \text{ ou } PN = \frac{20 \times \sigma}{SDR - 1}$$

Where,

PN - Nominal pressure (20°C)

DN - Nominal diameter.

S- Class or series (according to ISO 4065)

SDR - Reason between DN and nominal thickness of the pipe wall (in)

Concerning the pipes for gas distribution (FILGÁS) the minimum thickness is of 3.0 mm.

### 2.1. FILGÁS

FILGÁS pipes are dimensioned according the standard ISO 4437 and to the project of the european standard prEN 1555, being supplied in yellow colour or in black colour with four yellow longitudinal stripes, for the following dimensions:

|     | PE 80      | SDR 11 - S 5 | PE 100     | SDR 17,6 - S 8,3 |     | PE 80      | SDR 11 - S 5 | PE 100     | SDR 17,6 - S 8,3 |
|-----|------------|--------------|------------|------------------|-----|------------|--------------|------------|------------------|
| DN  | Emin. (mm) |              | Emin. (mm) |                  | DN  | Emin. (mm) |              | Emin. (mm) |                  |
| 16  | 3,0        |              | 3,0        |                  | 140 | 12,7       |              | 8,0        |                  |
| 20  | 3,0        |              | 3,0        |                  | 160 | 14,6       |              | 9,1        |                  |
| 25  | 3,0        |              | 3,0        |                  | 180 | 16,4       |              | 10,3       |                  |
| 32  | 3,0        |              | 3,0        |                  | 200 | 18,2       |              | 11,4       |                  |
| 40  | 3,7        |              | 3,0        |                  | 225 | 20,5       |              | 12,8       |                  |
| 50  | 4,6        |              | 3,0        |                  | 250 | 22,7       |              | 14,2       |                  |
| 63  | 5,8        |              | 3,6        |                  | 280 | 25,4       |              | 15,9       |                  |
| 75  | 6,8        |              | 4,3        |                  | 315 | 28,6       |              | 17,9       |                  |
| 90  | 8,2        |              | 5,2        |                  | 355 | 32,3       |              | 20,2       |                  |
| 110 | 10,0       |              | 6,3        |                  | 400 | 36,4       |              | 22,8       |                  |
| 125 | 11,4       |              | 7,1        |                  | -   | -          |              | -          |                  |

Chart 5 - FILGÁS production range (50 and 100 m coils for diameters up to 110 - 6 and 12 m bars for diameters of 110 up to 400 mm)

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According to standard ISO 4437 and technical specification GDP-034 the branding should contain:

- manufacturer • Technical-specification or standard • gas / maximum pressure (bar) • operator • order of production
- Commercial designation • Resin designation • DN/Series of thickness • date • Metric brand

Branding example:

DUOFIL • FILGÁS • ISO 4437 • PE80 • Gas 4 bar • I60/SRD II • 12-12-2000 • OP 71 • PEG 01673/00 • 6mt

FILGÁS pipes are packed with double plastic film, first with a bubble plastic and later with black plastic, being the extremities properly corked.

FILGÁS pipes are verified by the Institute of Welding and Quality (ISQ) and by the Technological Institute of the Gas (ITG), whose rehearsals were made with positive results.

## 2.2 Stokage

For FILGÁS pipes supply in pallets the quantities are as follows:

| Diameter (mm) | Quantity | Layers | Height (mm) | Width (mm) |
|---------------|----------|--------|-------------|------------|
| 110           | 43       | 5      | 600         | 1060       |
| 125           | 38       | 5      | 670         | 1070       |
| 140           | 33       | 5      | 735         | 1050       |
| 160           | 17       | 3      | 545         | 1030       |
| 180           | 14       | 3      | 600         | 970        |
| 200           | 14       | 3      | 655         | 1070       |
| 225           | 11       | 3      | 725         | 970        |
| 250           | 11       | 3      | 795         | 1070       |
| 280           | 8        | 3      | 875         | 910        |
| 315           | 6        | 2      | 735         | 1015       |
| 355           | 4        | 2      | 815         | 780        |
| 400           | 4        | 2      | 905         | 800        |

Chart 6 - (Identical Value for 6 and 12 meters bars)

Chart 6:(Identical Value for 6 and 12 meters bars)

### 3. Durability

The durability of FILGÁS pipes is sustained by the valid standards. Keeping in mind the maximum service pressure specified for each one of the pipe series, considering a 20°C temperature, a 50 year duration is expected

The behaviour of the high density polyethylene pipes for different temperatures may be observed in the following charts:

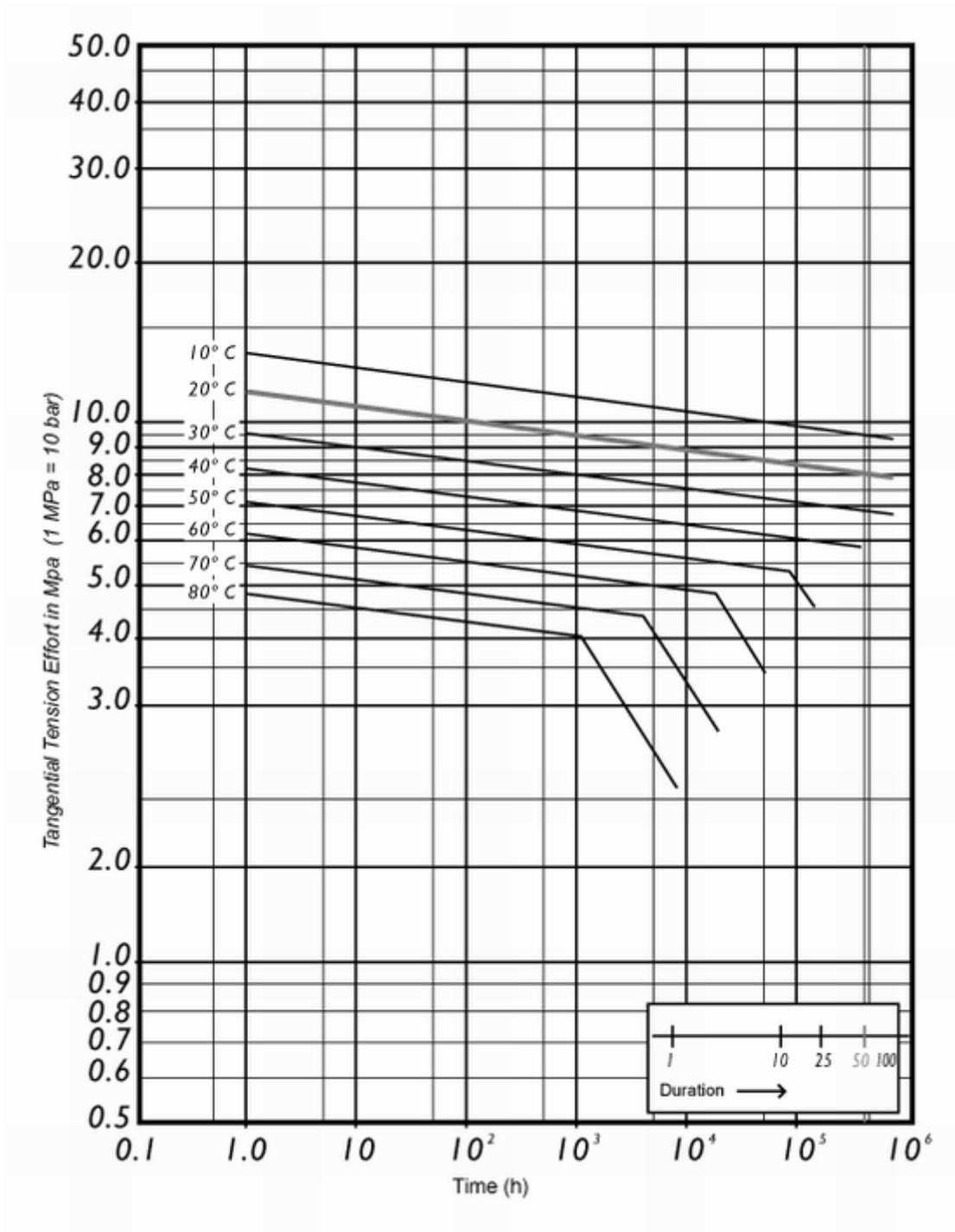


Fig. 3 - Regression curves PE80 (Source DIN 8074)

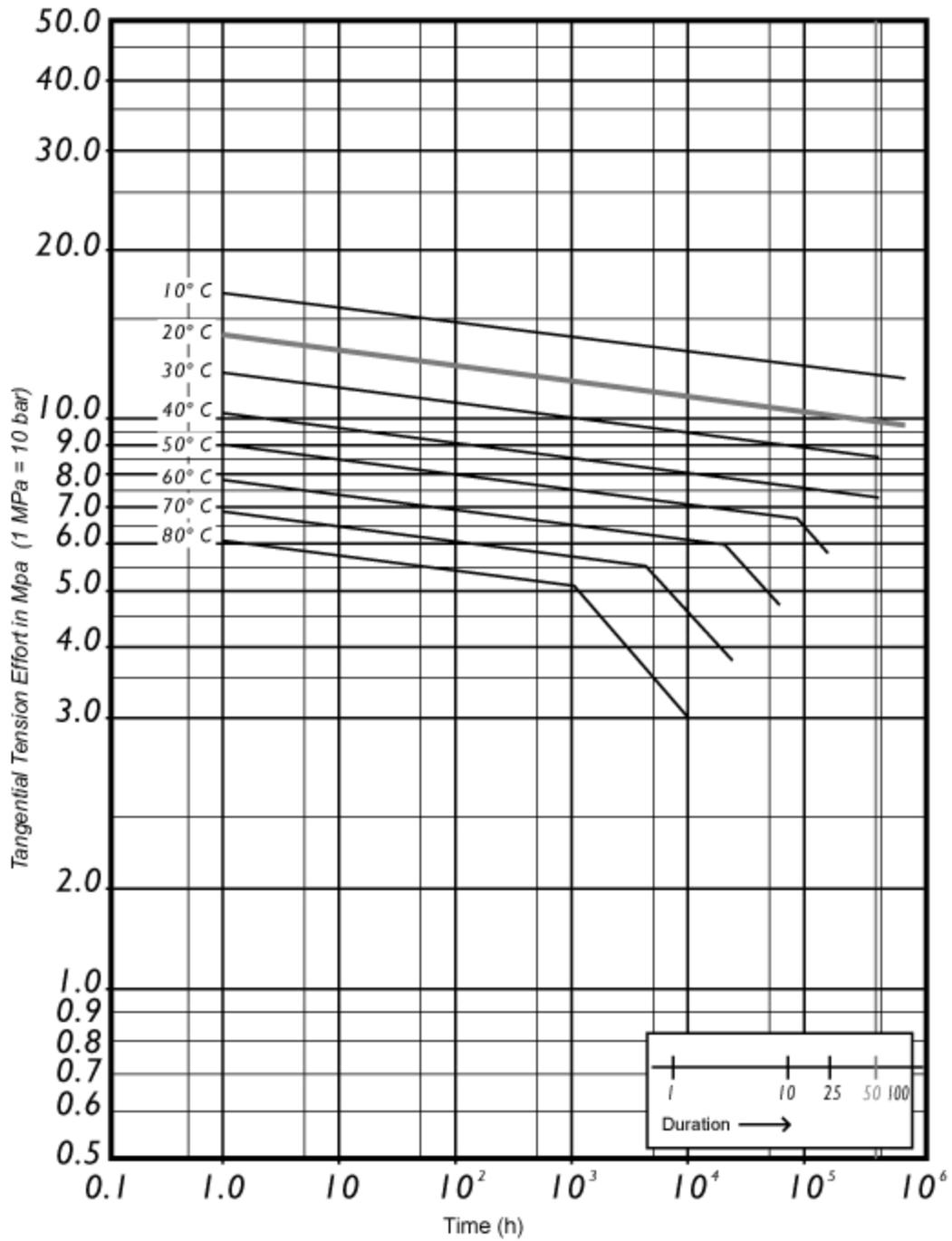


Fig. 4 - Regression curves PE100 (Source DIN 8074)

Fig.3 - Regression curves PE80 (Source DIN 8074)

Fig. 4-Regression curves PE100 (Source DIN 8074)

#### **4. FILGÁS characteristics**

- Long durability, maintaining their properties along the years.
- Not toxic in case of fire.
- Great chemical resistance, to chemical agents and aggressive soils;
- Excellent welding possibility, an inherent characteristic of thermoplastics;
- Reduced weight, for an easier handling and transport.
- Low coefficient of interior rugosity. Its inner surface almost flat allows the execution of systems with reduced charge loss, compared with another type of pipes.
- Good resistance to abrasion, due to the tenacity of the materials.
- Good flexibility. The pipes in polyethylene are easily bended, easing up their installation in layouts with curves and also allowing a good behaviour with low temperatures.
- Excellent resistance to the ultraviolet rays, when pigmented with black colour (through the addition of black smoke).
- Low thermal conductivity.
- Low electric conductivity.
- More ecological product than metals - less quantities of raw material and of energy necessary to produce the same quantity of finished product. It is a product easily re-used either for the production of other products or for combustion (ex: thermal energy)

## 5.Recomendations

### 5.1 Handling

Cables, metallic accessories or any other type of equipment which may somehow damage the product can not be used, being obligatory the use of appropriate waistbands for the effect.

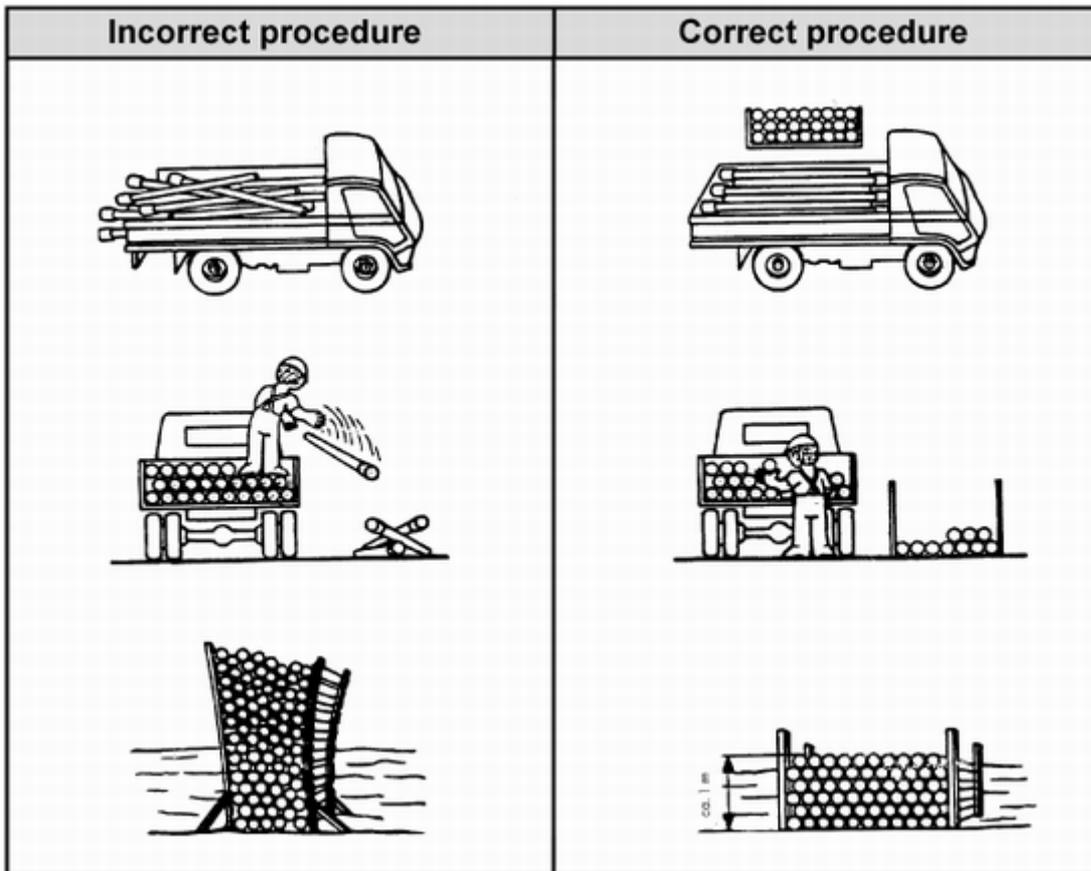
### 5.2 Storage

During the storage you should not:

- place the pipes in contact with any solvent.
- pile loose tubes with a height superior to 1m.
- pile more than 3 pallets of pipes.
- subject the pipes to a temperature superior to 40°C.
- the pipes, when stored in coils, should maintain the extremities tied and corked.

### 5.3. Transport

During the load, the transfer of product should be soft, with no stretching, blows or dragging so that it is avoided damages in the material. The pipes should be held in at all their extension.



## 6.Application Fields

### 6.1 FILGÁS

FILGÁS pipes find their application in the construction of gas distribution buried nets, which is justified by its excellent resistance to the gas components.



## 7.FILGÁS Systems

FILÁGUA and FILGÁS systems are used with two types of fittings: butt fusion and e-fusion fittings

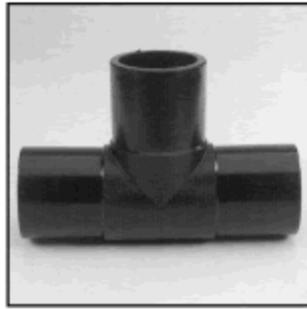
### 7.1 Butt-fusion fittings



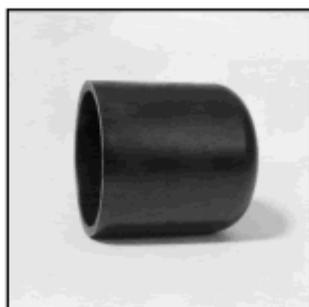
| Long elbow 90°<br>PE 80 S5-SDR 11 |            |
|-----------------------------------|------------|
| Reference                         | Dimensions |
| <i>AP.001.020000.2000</i>         | 20         |
| <i>AP.001.025000.2300</i>         | 25         |
| <i>AP.001.032000.3000</i>         | 32         |
| <i>AP.001.040000.3700</i>         | 40         |
| <i>AP.001.050000.4600</i>         | 50         |
| <i>AP.001.063000.5800</i>         | 63         |
| <i>AP.001.075000.6800</i>         | 75         |
| <i>AP.001.090000.8200</i>         | 90         |
| <i>AP.001.110000.1000</i>         | 110        |
| <i>AP.001.125000.1100</i>         | 125        |
| <i>AP.001.140000.1200</i>         | 140        |
| <i>AP.001.160000.1400</i>         | 160        |
| <i>AP.001.180000.1600</i>         | 180        |
| <i>AP.001.200000.1800</i>         | 200        |



| <b>Long elbow 45°<br/>PE 80 S5-SDR 11</b> |                   |
|---|-------------------|
| <b>Reference</b>                          | <b>Dimensions</b> |
| <i>AP.002.020000.2000</i>                 | <i>20</i>         |
| <i>AP.002.025000.2300</i>                 | <i>25</i>         |
| <i>AP.002.032000.3000</i>                 | <i>32</i>         |
| <i>AP.002.040000.3700</i>                 | <i>40</i>         |
| <i>AP.002.050000.4600</i>                 | <i>50</i>         |
| <i>AP.002.063000.5800</i>                 | <i>63</i>         |
| <i>AP.002.075000.6800</i>                 | <i>75</i>         |
| <i>AP.002.090000.8200</i>                 | <i>90</i>         |
| <i>AP.002.110000.1000</i>                 | <i>110</i>        |
| <i>AP.002.125000.1100</i>                 | <i>125</i>        |
| <i>AP.002.140000.1200</i>                 | <i>140</i>        |
| <i>AP.002.160000.1400</i>                 | <i>160</i>        |
| <i>AP.002.180000.1600</i>                 | <i>180</i>        |
| <i>AP.002.200000.1800</i>                 | <i>200</i>        |



| <b>Long Tee<br/>PE 80 S5-SDR 11</b> |                   |
|-------------------------------------|-------------------|
| <b>Reference</b>                    | <b>Dimensions</b> |
| <i>AP.003.020000.2000</i>           | <i>20</i>         |
| <i>AP.003.025000.2300</i>           | <i>25</i>         |
| <i>Ap.003.032000.3000</i>           | <i>32</i>         |
| <i>AP.003.040000.3700</i>           | <i>40</i>         |
| <i>AP.003.050000.4600</i>           | <i>50</i>         |
| <i>AP.003.063000.5800</i>           | <i>63</i>         |
| <i>AP.003.075000.6800</i>           | <i>75</i>         |
| <i>AP.003.090000.8200</i>           | <i>90</i>         |
| <i>AP.003.110000.1000</i>           | <i>110</i>        |
| <i>AP.003.125000.1100</i>           | <i>125</i>        |
| <i>AP.003.140000.1200</i>           | <i>140</i>        |
| <i>AP.003.160000.1400</i>           | <i>160</i>        |
| <i>AP.003.180000.1600</i>           | <i>180</i>        |
| <i>AP.003.200000.1800</i>           | <i>200</i>        |



| <b>Cap<br/>PE 80 S5-SDR 11</b> |                   |
|--------------------------------|-------------------|
| <b>Reference</b>               | <b>Dimensions</b> |
| <i>AP.011.020000.2000</i>      | <i>20</i>         |
| <i>AP.011.025000.2300</i>      | <i>25</i>         |
| <i>AP.011.032000.3000</i>      | <i>32</i>         |
| <i>AP.011.040000.3700</i>      | <i>40</i>         |
| <i>AP.011.050000.4600</i>      | <i>50</i>         |
| <i>AP.011.063000.5800</i>      | <i>63</i>         |
| <i>AP.011.090000.6800</i>      | <i>75</i>         |
| <i>AP.011.090000.8200</i>      | <i>90</i>         |
| <i>AP.011.110000.1000</i>      | <i>110</i>        |
| <i>AP.011.125000.1100</i>      | <i>125</i>        |
| <i>AP.011.140000.1200</i>      | <i>140</i>        |
| <i>AP.011.160000.1400</i>      | <i>160</i>        |
| <i>AP.011.180000.1600</i>      | <i>180</i>        |
| <i>AP.011.200000.1800</i>      | <i>200</i>        |



| Reducing bush<br>PE 80 S5-SDR 11 |            |
|----------------------------------|------------|
| Reference                        | Dimensions |
| AP.005.025020.2320               | 25/20      |
| AP.005.032020.3020               | 32/20      |
| AP.005.032025.3023               | 32/25      |
| AP.005.040020.3720               | 40/20      |
| AP.005.040025.3723               | 40/25      |
| AP.005.040032.3730               | 40/32      |
| AP.005.050025.4623               | 50/25      |
| AP.005.050032.4630               | 50/32      |
| AP.005.050040.4637               | 50/40      |
| AP.005.063032.5830               | 63/32      |
| AP.005.063040.5837               | 63/40      |
| AP.005.063050.6346               | 63/50      |
| AP.005.075050.6846               | 75/50      |
| AP.005.075063.6858               | 75/63      |
| AP.005.090063.8258               | 90/63      |
| AP.005.090075.8268               | 90/75      |
| AP.005.110063.1058               | 110/63     |
| AP.005.110090.1082               | 110/90     |
| AP.005.125063.1158               | 125/63     |
| AP.005.125090.1182               | 125/90     |
| AP.005.125110.1110               | 125/110    |
| AP.005.140125.1211               | 140/125    |
| AP.005.160090.1482               | 160/90     |
| AP.005.160110.1410               | 160/110    |
| AP.005.160125.1411               | 160/125    |
| AP.005.160140.1412               | 160/140    |
| AP.005.180125.1611               | 180/125    |
| AP.005.180160.1614               | 180/160    |



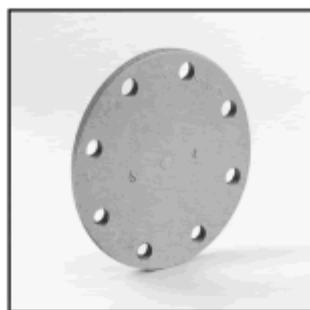
| <b>Eccentric bush<br/>PE 80 S5-SDR 11</b> |            |
|---|------------|
| Reference                                 | Dimensions |
| AP.006.025020.2320                        | 25/20      |
| AP.006.032025.3023                        | 32/25      |
| AP.006.040025.3723                        | 40/25      |
| AP.006.040032.3730                        | 40/32      |
| AP.006.050032.4630                        | 50/32      |
| AP.006.050040.437                         | 50/40      |
| AP.006.063032.5830                        | 63/32      |
| AP.006.063040.5837                        | 63/40      |
| AP.006.063050.5846                        | 63/50      |
| AP.006.075050.6846                        | 75/50      |
| AP.006.075063.6858                        | 75/63      |
| AP.006.090063.8258                        | 90/63      |
| AP.006.090075.8268                        | 90/75      |
| AP.006.110063.1058                        | 110/63     |
| AP.006.110090.1082                        | 110/90     |
| AP.006.125063.158                         | 125/63     |
| AP.006.125090.1182                        | 125/90     |
| AP.006.125110.1110                        | 125/110    |
| AP.006.140125.1211                        | 140/125    |
| AP.006.160090.1482                        | 160/90     |
| AP.006.160110.1410                        | 160/110    |
| AP.006.160125.1411                        | 160/125    |
| AP.006.160140.1412                        | 160/140    |
| AP.006.180090.1682                        | 180/90     |
| AP.006.180125.1611                        | 180/125    |
| AP.006.180160.1614                        | 180/160    |
| AP.006.200160.1814                        | 200/160    |
| AP.006.200180.1816                        | 200/180    |



| <b>Long reducing Tee<br/>PE 80 S5-SDR 11</b> |                   |
|--|-------------------|
| <b>Reference</b>                             | <b>Dimensions</b> |
| <i>AP.004.063050.5846</i>                    | <i>63/50</i>      |
| <i>AP.004.075032.6830</i>                    | <i>75/32</i>      |
| <i>AP.004.075050.6846</i>                    | <i>75/50</i>      |
| <i>AP.004.075063.6858</i>                    | <i>75/63</i>      |
| <i>AP.004.090063.8258</i>                    | <i>90/63</i>      |
| <i>AP.004.090075.8268</i>                    | <i>90/75</i>      |
| <i>AP.004.110063.1058</i>                    | <i>110/63</i>     |
| <i>AP.004.110075.1068</i>                    | <i>110/75</i>     |
| <i>AP.004.110090.1082</i>                    | <i>110/90</i>     |
| <i>AP.004.125090.1182</i>                    | <i>125/90</i>     |
| <i>AP.004.125110.1110</i>                    | <i>125/110</i>    |
| <i>AP.004.160063.1458</i>                    | <i>160/63</i>     |
| <i>AP.004.160075.1468</i>                    | <i>160/75</i>     |
| <i>AP.004.160090.1482</i>                    | <i>160/90</i>     |
| <i>AP.004.160110.1410</i>                    | <i>160/110</i>    |
| <i>AP.004.180090.1682</i>                    | <i>180/90</i>     |
| <i>AP.004.180110.1610</i>                    | <i>180/110</i>    |
| <i>AP.004.180160.1614</i>                    | <i>180/160</i>    |



| <b>Stub end<br/>PE 80 S5-SDR 11</b> |                   |
|-------------------------------------|-------------------|
| <b>Reference</b>                    | <b>Dimensions</b> |
| <i>AP.007.020000.2000</i>           | <i>20</i>         |
| <i>AP.007.025000.2300</i>           | <i>25</i>         |
| <i>AP.007.032000.3000</i>           | <i>32</i>         |
| <i>AP.007.040000.3700</i>           | <i>40</i>         |
| <i>AP.007.050000.4600</i>           | <i>50</i>         |
| <i>AP.007.063000.5800</i>           | <i>63</i>         |
| <i>AP.007.075000.6800</i>           | <i>75</i>         |
| <i>AP.007.090000.8200</i>           | <i>90</i>         |
| <i>AP.007.110000.1000</i>           | <i>110</i>        |
| <i>AP.007.125000.1100</i>           | <i>125</i>        |
| <i>AP.007.140000.1200</i>           | <i>140</i>        |
| <i>AP.007.160000.1400</i>           | <i>160</i>        |
| <i>AP.007.180000.1600</i>           | <i>180</i>        |
| <i>AP.007.200000.1800</i>           | <i>200</i>        |



| <b>Blind flange<br/>PE 80 S5-SDR 11</b> |                   |
|---|-------------------|
| <b>Reference</b>                        | <b>Dimensions</b> |
| <i>AV.208.020000.0016</i>               | <i>20</i>         |
| <i>AV.208.025000.0016</i>               | <i>25</i>         |
| <i>AV.208.032000.0016</i>               | <i>32</i>         |
| <i>AV.208.040000.0016</i>               | <i>40</i>         |
| <i>AV.208.050000.0016</i>               | <i>50</i>         |
| <i>AV.208.063000.0016</i>               | <i>63</i>         |
| <i>AV.208.075000.0016</i>               | <i>75</i>         |
| <i>AV.208.090000.0016</i>               | <i>90</i>         |
| <i>AV.208.110000.0016</i>               | <i>110</i>        |
| <i>AV.208.125000.0016</i>               | <i>125</i>        |
| <i>AV.208.140000.0016</i>               | <i>140</i>        |
| <i>AV.208.160000.0016</i>               | <i>160</i>        |
| <i>AV.208.180000.0016</i>               | <i>180</i>        |
| <i>AV.208.200000.0016</i>               | <i>200</i>        |



| <b>Backing Flange<br/>PE 80 S5-SDR 11</b> |                   |
|---|-------------------|
| <b>Reference</b>                          | <b>Dimensions</b> |
| <i>AV.209.020000.0016</i>                 | 20                |
| <i>AV.209.025000.0016</i>                 | 25                |
| <i>AV.209.032000.0016</i>                 | 32                |
| <i>AV.209.040000.0016</i>                 | 40                |
| <i>AV.209.050000.0016</i>                 | 50                |
| <i>AV.209.063000.0016</i>                 | 63                |
| <i>AV.209.075000.0016</i>                 | 75                |
| <i>AV.209.090000.0016</i>                 | 90                |
| <i>AV.209.110000.0016</i>                 | 110               |
| <i>AV.209.125000.0016</i>                 | 125               |
| <i>AV.209.140000.0016</i>                 | 140               |
| <i>AV.209.160000.0016</i>                 | 160               |
| <i>AV.209.180000.0016</i>                 | 180               |
| <i>AV.209.200000.0016</i>                 | 200               |

## 7.2 E-fusion fittings



| <b>Socket<br/>PE 100 S5-SDR 11</b> |                   |
|------------------------------------|-------------------|
| <b>Reference</b>                   | <b>Dimensions</b> |
| <i>AP.101.020000.0010</i>          | <i>20</i>         |
| <i>AP.101.025000.0010</i>          | <i>25</i>         |
| <i>AP.101.032000.0010</i>          | <i>32</i>         |
| <i>AP.101.040000.0010</i>          | <i>40</i>         |
| <i>AP.101.050000.0010</i>          | <i>50</i>         |
| <i>AP.101.063000.0010</i>          | <i>63</i>         |
| <i>AP.101.075000.0010</i>          | <i>75</i>         |
| <i>AP.101.090000.0010</i>          | <i>90</i>         |
| <i>AP.101.110000.0010</i>          | <i>110</i>        |
| <i>AP.101.125000.0010</i>          | <i>125</i>        |
| <i>AP.101.140000.0010</i>          | <i>140</i>        |
| <i>AP.101.160000.0010</i>          | <i>160</i>        |
| <i>AP.101.180000.0010</i>          | <i>180</i>        |
| <i>AP.101.200000.0010</i>          | <i>200</i>        |



| <b>Elbow 90°<br/>PE 100 S5-SDR 11</b> |                   |
|---------------------------------------|-------------------|
| <b>Reference</b>                      | <b>Dimensions</b> |
| <i>AP.102.020000.0010</i>             | <i>20</i>         |
| <i>AP.102.025000.0010</i>             | <i>25</i>         |
| <i>AP.102.032000.0010</i>             | <i>32</i>         |
| <i>AP.102.040000.0010</i>             | <i>40</i>         |
| <i>AP.102.050000.0010</i>             | <i>50</i>         |
| <i>AP.102.063000.0010</i>             | <i>63</i>         |
| <i>AP.102.075000.0010</i>             | <i>90</i>         |
| <i>AP.102.090000.0010</i>             | <i>110</i>        |
| <i>AP.102.110000.0010</i>             | <i>125</i>        |
| <i>AP.102.160000.0010</i>             | <i>160</i>        |



| <b>Elbow 45°<br/>PE 100 S5-SDR 11</b> |                   |
|---------------------------------------|-------------------|
| <b>Reference</b>                      | <b>Dimensions</b> |
| <i>AP.103.020000.0010</i>             | 20                |
| <i>AP.103.025000.0010</i>             | 25                |
| <i>AP.103.032000.0010</i>             | 32                |
| <i>AP.103.040000.0010</i>             | 40                |
| <i>AP.103.050000.0010</i>             | 50                |
| <i>AP.103.063000.0010</i>             | 63                |
| <i>AP.103.075000.0010</i>             | 75                |
| <i>AP.103.090000.0010</i>             | 90                |
| <i>AP.103.110000.0010</i>             | 110               |
| <i>AP.103.125000.0010</i>             | 125               |
| <i>AP.103.160000.0010</i>             | 160               |



| <b>Tee<br/>PE 100 S5-SDR 11</b> |                   |
|---------------------------------|-------------------|
| <b>Reference</b>                | <b>Dimensions</b> |
| <i>AP.104.020000.0010</i>       | <i>20</i>         |
| <i>AP.104.025000.0010</i>       | <i>25</i>         |
| <i>AP.104.032000.0010</i>       | <i>32</i>         |
| <i>AP.104.040000.0010</i>       | <i>40</i>         |
| <i>AP.104.050000.0010</i>       | <i>50</i>         |
| <i>AP.104.063000.0010</i>       | <i>63</i>         |
| <i>AP.104.075000.0010</i>       | <i>75</i>         |
| <i>AP.104.090000.0010</i>       | <i>90</i>         |
| <i>AP.104.110000.0010</i>       | <i>110</i>        |
| <i>AP.104.125000.0010</i>       | <i>125</i>        |
| <i>AP.104.160000.0010</i>       | <i>160</i>        |



| <b>Cap<br/>PE 100 S5-SDR 11</b> |                   |
|---------------------------------|-------------------|
| <b>Reference</b>                | <b>Dimensions</b> |
| <i>AP.107.020000.0010</i>       | 20                |
| <i>AP.107.025000.0010</i>       | 25                |
| <i>AP.107.032000.0010</i>       | 32                |
| <i>AP.107.040000.0010</i>       | 40                |
| <i>AP.107.050000.0010</i>       | 50                |
| <i>AP.107.063000.0010</i>       | 63                |
| <i>AP.107.075000.0010</i>       | 75                |
| <i>AP.107.090000.0010</i>       | 90                |
| <i>AP.107.110000.0010</i>       | 110               |
| <i>AP.107.125000.0010</i>       | 125               |
| <i>AP.107.140000.0010</i>       | 140               |
| <i>AP.107.160000.0010</i>       | 160               |
| <i>AP.107.180000.0010</i>       | 180               |
| <i>AP.107.200000.0010</i>       | 200               |

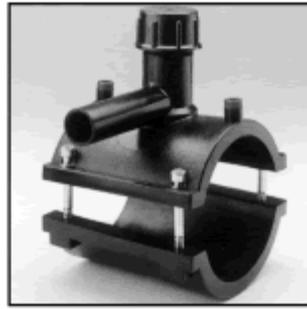


| <b>Reducing bush<br/>PE 100 S5-SDR 11</b> |                   |
|---|-------------------|
| <b>Reference</b>                          | <b>Dimensions</b> |
| <i>AP.106.025020.0010</i>                 | <i>25/20</i>      |
| <i>AP.106.032020.0010</i>                 | <i>32/20</i>      |
| <i>AP.106.032025.0010</i>                 | <i>32/25</i>      |
| <i>AP.106.040020.0010</i>                 | <i>40/20</i>      |
| <i>AP.106.040025.0010</i>                 | <i>40/25</i>      |
| <i>AP.106.040032.0010</i>                 | <i>40/32</i>      |
| <i>AP.106.050025.0010</i>                 | <i>50/25</i>      |
| <i>AP.106.050032.0010</i>                 | <i>50/32</i>      |
| <i>AP.106.050040.0010</i>                 | <i>50/40</i>      |
| <i>AP.106.063032.0010</i>                 | <i>63/32</i>      |
| <i>AP.106.063040.0010</i>                 | <i>63/40</i>      |
| <i>AP.106.063050.0010</i>                 | <i>63/50</i>      |
| <i>AP.106.075050.0010</i>                 | <i>75/50</i>      |
| <i>AP.106.075063.0010</i>                 | <i>75/63</i>      |
| <i>AP.106.090063.0010</i>                 | <i>90/63</i>      |
| <i>AP.106.110063.0010</i>                 | <i>110/63</i>     |
| <i>AP.106.110090.0010</i>                 | <i>110/90</i>     |
| <i>AP.106.160090.0010</i>                 | <i>160/90</i>     |
| <i>AP.106.160110.0010</i>                 | <i>160/110</i>    |



**Spigot saddle with incorporated valve  
PE 100 S5-SDR 11**

| Reference                 | Dimensions    |
|---------------------------|---------------|
| <i>AP.302.063032.0058</i> | <i>63/32</i>  |
| <i>AP.302.090032.0058</i> | <i>90/32</i>  |
| <i>AP.302.110063.0058</i> | <i>110/63</i> |
| <i>AP.302.125063.0058</i> | <i>125/63</i> |
| <i>AP.302.140063.0058</i> | <i>140/63</i> |
| <i>AP.302.160063.0058</i> | <i>160/63</i> |
| <i>AP.302.180063.0058</i> | <i>180/63</i> |
| <i>AP.302.200063.0058</i> | <i>200/63</i> |



| Tapping saddle<br>PE 100 S5-SDR 11 |            |
|------------------------------------|------------|
| Reference                          | Dimensions |
| AP.201.063020.0030                 | 63/20      |
| AP.201.063025.0030                 | 63/25      |
| AP.201.063032.0030                 | 63/32      |
| AP.201.063040.0037                 | 63/40      |
| AP.201.063063.0058                 | 63/63      |
| AP.201.090020.0030                 | 90/20      |
| AP.201.090025.0030                 | 90/25      |
| AP.201.090032.0030                 | 90/32      |
| AP.201.090040.0037                 | 90/40      |
| AP.201.090050.0046                 | 90/50      |
| AP.201.090063.0058                 | 90/63      |
| AP.201.110020.0030                 | 110/20     |
| AP.201.110025.0030                 | 110/25     |
| AP.201.110032.0030                 | 110/32     |
| AP.201.110040.0037                 | 110/40     |
| AP.201.110050.0046                 | 110/50     |
| AP.201.110063.0058                 | 110/63     |
| AP.201.125020.0030                 | 125/20     |
| AP.201.125025.0030                 | 125/25     |
| AP.201.125032.0030                 | 125/32     |
| AP.201.125040.0037                 | 125/40     |
| AP.201.125050.0046                 | 125/50     |
| AP.201.125063.0058                 | 125/63     |
| AP.201.160020.0030                 | 160/20     |
| AP.201.160025.0030                 | 160/25     |
| AP.201.160032.0030                 | 160/32     |
| AP.201.160040.0037                 | 160/40     |
| AP.201.160050.0046                 | 160/50     |



| <b>PE ball valve<br/>PE 80 S5-SDR 11</b> |                   |
|--|-------------------|
| <b>Reference</b>                         | <b>Dimensions</b> |
| <i>AP.301.020000.0008</i>                | <i>20</i>         |
| <i>AP.301.025000.0008</i>                | <i>25</i>         |
| <i>AP.301.032000.0008</i>                | <i>32</i>         |
| <i>AP.301.040000.0008</i>                | <i>40</i>         |
| <i>AP.301.050000.0008</i>                | <i>50</i>         |
| <i>AP.301.063000.0008</i>                | <i>63</i>         |
| <i>AP.301.075000.0008</i>                | <i>75</i>         |
| <i>AP.301.090000.0008</i>                | <i>90</i>         |
| <i>AP.301.110000.0008</i>                | <i>110</i>        |
| <i>AP.301.125000.0008</i>                | <i>125</i>        |
| <i>AP.301.140000.0008</i>                | <i>140</i>        |
| <i>AP.301.160000.0008</i>                | <i>160</i>        |
| <i>AP.301.180000.0008</i>                | <i>180</i>        |
| <i>AP.301.200000.0008</i>                | <i>200</i>        |



| <b>Coupling PE-steel<br/>PE 80 S5-SDR 11</b> |                   |
|--|-------------------|
| <b>Referencia</b>                            | <b>Dimensions</b> |
| <i>AP.012.020012.20PO</i>                    | <i>20x1/2"</i>    |
| <i>AP.012.025034.23PO</i>                    | <i>25x3/4"</i>    |
| <i>AP.012.032100.30PO</i>                    | <i>32x1"</i>      |
| <i>AP.012.040114.37PO</i>                    | <i>40x1 1/4"</i>  |
| <i>AP.012.050112.46PO</i>                    | <i>50x1 1/2"</i>  |
| <i>AP.012.063200.58PO</i>                    | <i>63x2"</i>      |
| <i>AP.012.075300.68PO</i>                    | <i>90x3"</i>      |

## 8. Assembly instructions

### 8.1 Welding general instructions

a) The fluidity index of pipes and/or fittings is variable according to the raw material that composes it, fundamental aspect when proceeding to a welding. However, a gap between 0.2 and 1.3 g/10 min (190<sup>o</sup>1 5Kg) may be admitted.

b) The welding area should be protected from unfavourable weather conditions (humidity, wind, intensive UV radiation, temperatures inferior to 5<sup>o</sup>C), using an appropriate tent or awning. The acceptable temperatures for welding are between 5<sup>o</sup>C and 40<sup>o</sup>C.

c) Please keep in mind the following information when welding:

- E-fusion weldings may be made for all diameters.
- The gas butt-fusion welding can only be made from Ø90mm, inclusive.
- The flanged sockets should be as reduced as possible.

### 8.2 E-fusion welding

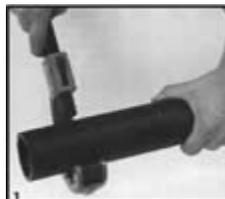
During e-fusion welding, pipes and fittings are welded through an heating produced by the electrical resistances incorporated in the fitting which, when heating up by the induced tension, weld the material in a uniform way.

#### 8.2.1. General e-fusion procedures

1) Cut the pipe perpendicularly to the radial axis, with the respective cutting tools. Mark the introduction length in the accessory.

2) Scrap the pipe in the axial direction using a proper scraper in order to eliminate the oxide layer coming from atmospheric influences, particularly UV rays. If the object to weld is a fitting, it should be preceded by the same operation.

3) Clean up pipes and fittings. Do not weld pipes or fittings that may not be properly cleaned up and entirely dried up, being advisable the use of a solvent (nail polish remover, alcohol...) and a soft paper.





- 4) Introduce the pipes in the fitting and verify if the marks are placed at the fitting's end. The length of the marks introduced in the pipes should correspond to halfway the length of the fitting.
- 5) Tighten up both pipes through an aligning clamp or another aligning equipment.
- 6) Place the fitting's wire clamps up.
- 7) Place the machine's cables so that their weight does not cause the rotation of the fitting.
- 8) Introduce the welding data in the machine through the reading of the code bar existing in the fitting or card. There are some equipments that allow the manual introduction of the welding code.



- 9) Proceed to the welding respecting the working instructions.
- 10) Respect the minimum cooling time, facilitating the solidification of the welding, fundamental aspect to guarantee the quality of the welding.

11) Whenever the e-fusion process is interrupted (electric power lack...), the same fitting can not be re-used.

### 8.3 Butt fusion welding

The butt fusion welding is characterised by three phases:

- 1) Preparation of the welding - line up the faces to weld through the facer tool and align the pipes.
- 2) Pre-heating - the pipe and/or fittings ends to be welded are pressed (at low pressure) against the heating plate until the welding temperature.
- 3) Connection and cooling – The heated parts are connected, under pressure, after having been withdrawn the heating element, until the necessary time to cooling of both parts is finished.

#### 8.3.1 welding parameters

To proceed to the welding, it is necessary to specify the necessary parameters so that this is made correctly. The following chart exemplifies time and pressure necessary for different thickness.

| Wall thickness (mm) | Height of the neck (mm)      | Pre-heating time (Seg.)       | Adjustment time (Seg.) | Application time for the union pressure | Cooling time (min.) |
|---------------------|------------------------------|-------------------------------|------------------------|---|---------------------|
|                     | P = 0.15(N/mm <sup>2</sup> ) | P = (0.02/N/mm <sup>2</sup> ) |                        | P = 0.15(N/mm <sup>2</sup> )            |                     |
| 2.0 – 4.5           | 0.5                          | 45                            | 5                      | 5                                       | 6                   |
| 4.5 – 7.0           | 1.0                          | 45 – 70                       | 5 – 6                  | 5 – 6                                   | 6 – 10              |
| 7.0 – 12.0          | 1.5                          | 70 – 120                      | 6 – 8                  | 6 – 8                                   | 10 – 16             |
| 12.0 – 19.0         | 2.0                          | 120 – 190                     | 8 – 10                 | 8 – 11                                  | 16 – 24             |
| 19.0 – 26.0         | 2.5                          | 190 – 260                     | 10 – 12                | 11 – 14                                 | 24 – 32             |
| 26.0 – 37.0         | 3.0                          | 260 – 370                     | 12 – 16                | 14 – 19                                 | 32 – 45             |
| 37.0 – 50.0         | 3.5                          | 370 – 500                     | 16 – 20                | 19 – 25                                 | 45 – 60             |
| 50.0 – 70.0         | 4.0                          | 500 – 700                     | 20 – 25                | 25 – 35                                 | 60 – 80             |

Chart 8 - Reference values for butt fusion welding of PE80 pipes and fittings at 20°C and below the air speed level

Chart 8- reference values for butt fusion welding of PE80 pipes and fittings at 20°C and below the air speed level

#### 8.3.2 Procedures for butt fusion welding

- 1) Prepare the welding place, in the event of needing to work under a tent or appropriate awning.
- 2) Read the machine's manual verify the correct operation of all its components.
- 3) Place the pipe and/or fittings with the respective areas to weld in parallel level, assuring the possibility of longitudinal movements.
- 4) Align the faces to weld (phase 1), clean any borders or other resulting particles from the rectification process.
- 5) Clean up the inside and outside of the pipe and/or fitting, using a cleaning agent.
- 6) Verify if the pipes and/or fittings are properly placed in the welding machine, leaning them against each other.

7) Seal the opposite part of the pipe so that a quick cooling of the interior temperature is avoided, in case of being detected the existence of air currents.

8) Determine the dragging pressure, which depends on the thickness and of the weight of the pipe to be dragged (pressure that will be added to the welding pressure).

9) Verify the temperature of the heating plate, (it is advisable to clean before each welding).

10) Insert the heating plate, leaning both ends against each other, imposing the determined pressure and time, so that a barb is created. The adjustment pressure should then be reduced and wait for the pre-heating time to be completed (phase 2).

11) Remove the heating plate and to unite both ends, slowly increasing the adjustment pressure during the time of fusion until the required value is attained. Maintain the adjustment pressure during the necessary time for the cooling.

12) Completed the welding, there must be a barb around the whole circumference with the following characteristics:

- Identical size of the two parts that compose the barb.
- Soft neck surface.



#### 8.4. Buried pipe systems

#### 8.4.1 FILGÁS

For the pipes destined to the distribution of gas, it was considered the Technical Regulation concerning the project, construction and maintenance of combustible gas nets distribution (Port 386/94).

- The coverage of the pipe should be, at least, of 60 cm. It may be installed at a smaller depth, as long as it does not collide with other pipes and is properly protected against excessive loads, and applying a protection sleeve, so that the equivalent conditions of security to a normal bury are guaranteed.
- The depth of the gutters should be flattened, eliminating any salience. The pipe should be settled on a layer of sweet sand or equivalent material, with a minimum thickness of 10 cm, being later totally involved with the referred material, keeping the minimum thickness indicated in all directions. The filling up of the ditch above this layer can be made with the available materials, whenever these are not an eventual danger for the pipe or its lining.
- The Polyethylene pipes can only be installed in the exterior of the buildings in buried parts.
- In the union with the distribution nets to the buildings, the pipes can only emerge from the floor 60 cm, being protected by a sleeve or metallic band that has to be nailed 20 cm below the soil level and properly fixed.
- The gas pipes should be at a minimum distance of 20 cm from other pipes, either in parallel situations or in cross sections, being an exception the drainage nets which should distance at least 50 cm. Inferior distances may be considered when installing an electric insulating sleeve, concrete or other materials non combustible whose ends distance, at least, 20 cm for electric cables, telephonic or similar. In the case of drainage nets, the distance between the extremities should be of 50 cm.
- In crossings or parallel layouts with pipes at high temperatures, should be kept in mind the distance and the necessary isolation so that the temperature of the gas pipes never passes the 20°C.
- The direction changes should be executed by cold bending of the pipes, with minimum bend radii equal to 30 times the diameter of the pipes or using fittings.

#### 8.5 - Pressure essays

All the pipes, before beginning to work, should be subject in all their length, of a single time or per short lengths, to the established rehearsals:

- The rehearsal of the pipes to place inside the sleeves, should be made separately with the pipe outside them, before the assembly in site, being also necessary the final essay to the complete net.
- The acceptable rehearsal fluids for pipes for the distribution of gas are air, azote or the gas distributed in the net, taking the necessary measures of security.
- The rehearsal pressure should be, at least, 1.5 times the working pressure of the pipe, but never inferior to 1 bar.
- For the execution of the essays it should be proceeded to the continuous measure of the pressures and temperatures, with the help of registration devices and of a gauged indicator of pressure, accompanied by the calibration certificate.
- The pressure values should be corrected having in mind the temperature variations of the fluid used in the essay, of the pipe wall, of the soil or of the ambient and elastic behaviour of the material.
- Lengths inferior to 500 m may be essayed, with the gas distributed, at the working pressure, as long as the verification of stagnation of all the junctions is made with the help of a foamy product, being unnecessary the eventual correction of the pressure, regarding the temperature.
- The result will be satisfactory if, after the stabilization of the rehearsal conditions, the pressure stays constant in the following six hours, with an eventual correction according to the temperature variation.