# **POLYETHYLENE SERVICE LINE CONSTRUCTION**

# ET 602

Revision No. 4 | 10 April 2023



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# **Technical Specification**

# POLYETHYLENE SERVICE LINE CONSTRUCTION

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# **Register of revisions**

Revision number	Date	Motif	
0	2007-11-16	Initial wording	
1	2020-07-16	General revision and replacement of the reference "EDP Gás Distribuição" by "Portgás" and integration of the internal procedure PO. DT/AEE-021 - "Criteria and technical conditions for the execution of service lines on secondary network".	
2	2021-05-13	General revision and extension of the scope to service lines to be built at the same time as distribution networks	
3	2021-12-14	Amended scope: §2, extending application to networks to be buil §8.7, Table 1; §10.1 b)	
4	2023-04-10 General revision carried out by IDOM Consulting, Engineering Architecture, SAU		

# Information classification

Confidential		Restricted		Internal use		Public	$\boxtimes$
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# **Distribution of the document**

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Caption:	
CA: Board of Directors	ACR: Clients and Networks Area
AT: Technical Area	ACR-DC: Clients and Networks Area - Commercial
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Elaborated:	Check:	Approved:	
Carlos Correia	Ricardo Moreira		Rui Bessa
The approval of this docume	nt formalised in this page, prevails over	the totality of its contents.	

Technica	Spec	citica	ntion

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#### Preamble

As part of the "H2 REN Programme" aimed at adapting technical specifications to prepare assets to receive hydrogen up to 100%, Portgás identified this regulation to be subject to assessment and consequent revision.

The revision now presented results from the work conducted by IDOM Consulting, Engineering, Architecture, SAU, who introduced the necessary changes to the specification in order to ensure that the "Polyethylene service line construction" performed in accordance with this specification ensures that the infrastructure is ready to receive hydrogen.

This revision of ET 602 cancels and replaces the previous revision of this ET, dated 14<sup>th</sup> December 2021, and it is advisable to read this technical specification in full for a correct application of its provisions.

This technical specification should be given the status of a Portgás standard which establishes the rules to be followed to achieve the discriminated objective.

## 1. Objective

The purpose of this Technical Specification for Construction is to define the requirements and conditions to be met when constructing and assembling polyethylene (PE) service lines for interconnecting gas installations to gas distribution networks.

## 2. Scope

This Technical Specification applies to all assemblies of polyethylene (PE) service lines from the Distribution Network in service or to be constructed: Secondary Network, made of steel or polyethylene (maximum pressure 4 bar - low pressure).

This specification is valid for pressures up to 4 bar. Polyethylene is technically unsuitable for the carriage of hydrogen at pressures above 4 bar. For transporting hydrogen at pressures above 4 bar it is recommended to use another material (i.e. polyamide 12).

## 3. References

All undated documents should be considered in their latest version.

#### 3.1. External

#### Despacho nº 806-B/2022, de 19 de janeiro

"Regulamento da Rede Nacional de Distribuição de Gás."

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# <u>Portaria n.º 361/98, de 26 de junho</u>, com as alterações introduzidas pela <u>Portaria n.º 690/2001, de 10 de</u> julho

"Aprova o regulamento técnico relativo ao projeto, construção, exploração e manutenção das instalações de gás combustível canalizado em edifícios."

<u>Portaria n.º 362/2000</u>, de 20 de junho, (alterada pelo <u>Decreto-Lei n.º 7/2000</u>, de 3 de fevereiro, <u>Portaria n.º 690/2001</u>, de 10 de julho, <u>Portaria n.º 1358/2003</u>, de 13 de dezembro, <u>Lei n.º 15/2015</u>, de 16 de fevereiro e <u>Decreto-Lei n.º 97/2017</u>, de 10 de agosto)

"Aprova os procedimentos relativos às inspeções e à manutenção das redes e ramais de distribuição e instalações de gás e o estatuto das entidades inspetoras das redes e ramais de distribuição e instalações de gás."

## 3.2. Internal

- ET 301 "Polyethylene gas pipes."
- ET 302 "Polyethylene gas fittings."
- ET 303 "Metal/polyethylene transitions."
- ET 304 "Polyethylene valves."
- ET 305 "Protective sleeves for steel and polyethylene nets."
- ET 403 "Sealing materials: seals and security labels"
- ET 501 "Trenching".
- ET 502 "Ditch closing and pavement repositioning".
- ET 605 "Welding of polyethylene tubing."
- **ET 1105** "Personal protective equipment."
- **ET 1106** "Guidelines for quality, environment and safety in operations".
- **ET 1126** "Regulation: Quality, Environmental and Safety Requirements for Specific Infrastructure Contracts".
- PO. DT/AEX-068 "Monitoring and gasification of polyethylene service lines."

MAN.DT-AEX-001 - "Infrastructure Security Management Manual."

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#### 4. Definitions / Acronyms

#### Contractor

Entity accredited as an Installing Entity by the Directorate-General for Energy and Geology (DGEG), with staff organization, competence and suitability to ensure, according to the established criteria, the execution of the works inherent to the construction of polyethylene service lines.

#### Extension

Section of the network that originates from the secondary gas distribution network, in service, and ends at the building's general shut-off valve.

#### TEX

Exploration Technician.

#### Inspection

Supervision activity that aims to ensure compliance of work carried out by third parties (Contractors) for Portgás, respecting and enforcing what is contractually established and ensuring compliance with all legally applicable standards, from local, national or community sources, as well as Portgás' technical specifications and procedures.

This activity may be carried out by an entity outside Portgás (Inspection Entity) or by a duly qualified Portgás technician.

## AT-ED

Technical Area - Engineering and Development

## PRM

**Regulation and Measurement Post** 

#### SHST

Health, Hygiene and Safety at Work

## 5. Responsibilities

#### Contractor

- a) Carrying out all civil construction, mechanical installation and testing work.
- b) Restore the pavement.

## TEX

To monitor and coordinate, on site, the mechanical installation and gasification work of the isolated service lines, to be performed by the Contractor.

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# Inspection

It is its responsibility to verify and control the technical aspects within the scope of its attributions, under the terms defined in this technical specification.

# 6. Occupational Safety, Hygiene and Health (OSH&H)

- a) The works to be carried out within the scope of this technical construction specification shall comply with all the provisions set out in the "Infrastructure Safety Management Manual", complemented with the provisions explained in this same specification, namely those set out in ET 1126.
- b) It is the Contractor's responsibility to ensure that all OHS requirements are met by everyone involved in the works. In the presence of TEX, the latter's determinations regarding OHS requirements must be respected.

# 7. Environmental practices

In order to minimise/eliminate the environmental impacts associated with the "construction of insulated polyethylene service lines", the Contractor must bear in mind that:

- a) The work to be carried out within the framework of this technical construction specification must comply with all the provisions set out in technical specification ET 1106.
- b) Waste resulting from work carried out within the scope of this specification (remains of polyethylene tubing, material from excavation, empty packaging, unused consumables and others) should be collected daily and sent to the Contractor's yard, where it should be separated, stored and identified by type of waste, for subsequent forwarding to properly licensed waste operators.

# 8. Criteria and characteristics of the service lines to be built

- a) The service lines for public gas distribution are made of polyethylene (PE) pipes, with a maximum service pressure under normal conditions of 4 bar, from Polyethylene or Steel Networks.
- b) The making of a service line presupposes the prior existence of the minimum conditions, namely those referred to in the following points:

# 8.1. Formation of sidings

- a) Service lines from Polyethylene Networks:
  - On-load tapping in accordance with ET 302;
  - section of pipe in accordance with ET 301;
  - electro weldable connection (ET 302);

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- Polyethylene valve, where applicable, according to ET 304.
- b) Service lines from Steel Networks:
  - Steel service line tee (spherical seal);
  - section of pipe in accordance with ET 301;
  - Steel transition/PE, according to ET 303
  - Polyethylene valve, where applicable, according to ET 304.

#### 8.2. Decision Criteria for Network or Service Line Construction

- a) If the existing polyethylene network is in front of the general cut-off box, on the same side of the street, the supply solution will involve the construction of a direct service line, perpendicular to that same network.
- b) If the network is on the opposite side of the street, or on the carriageway (where there are likely to be future restrictions from the subsoil manager), the solution will normally involve the construction of a network derivation to the kerb or verge, on the side of the general cut-off box, with the mains service line running from that network.
- c) An exception to the above rule is when the network duplication does not guarantee a minimum distance of 4 metres between parallel pipelines. In this case, it may be decided to build a direct connection to the general supply box, subject to prior validation by the construction manager.
- d) In the specific case of connection to the secondary steel grid, a network branching should be preferred to a direct service line. The execution of a direct service line from the steel network will be a last resort solution, and this measure must be previously validated by the AT-ED.

#### 8.3. Minimum conditions for implementation

The construction of service lines presupposes compliance with the following minimum requirements / conditions:

- a) Pre-existence of the general cut-off box, installed in accordance with the requirements recommended by Portgás, containing at least the following components / equipment:
  - Suitably fixed general shut-off valve, with manual interlock for individual customers and automatic interlock for collective or public buildings, on which it must be assured a minimum distance of 10 cm between the base of the valve and the top face of the service line protection sleeve;

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- Polyethylene service line protection sleeve, whose characteristics must comply with the legal provisions, namely Despacho n° 806-B/2022, of 19 January and in accordance with the Technical Specification (ET 305);
- Crossing for the reduction / metering equipment to avoid the risk associated with subsequent brazing inside the general cutting box.
- b) Guaranteed perpendicular between the extension line and the network to which it is to be connected.
- c) Positioning of the general cut-off box or PRM so that the service line does not have to travel along winding paths.
- d) In the case of pre-installation of a copper service line section, if any intervention on the building façade is unfeasible or if there are advanced basements making it impossible to make the service line exclusively in polyethylene under normal execution conditions, Portgás may, exceptionally, accept the section embedded in the building's exterior face as an integral part of the service line to be made. In this case, the PE/Cu interconnection must be made with a "monoblock" type transition accessory, and a polyethylene valve must be installed before the said transition. This exceptional situation must always be validated by the AT-ED.

## 8.4. Partial Service Line (cupped)

The execution of any service line presupposes compliance with the conditions indicated in the previous sub-paragraph. This solution should not be recommended for isolated connections. However, Portgás may exceptionally authorise the execution of partial service line (at the point), totally buried and cupped at the end, if it is confirmed that it is impossible to execute them in the future, namely if the street is resurfaced.

In these cases, the location of the general shut-off box must be defined in order to guarantee the alignment of the service line with it, and a polyethylene valve must be installed in the service line. The end of the service line should be fitted with a mechanical protection device, sleeve or metal sheath, dug into the ground to a minimum depth of 0.2 m, properly fixed and accompanying the service line up to the height estimated for the installation of the general shut-off box, up to a maximum of 1.10 m. The upper part of the metal sleeve or sheath must be conveniently covered with a device that ensures that no debris is deposited inside and that can be easily dismantled when it is necessary to connect the mains to the gas installation via the general supply box or the PRM. This exceptional situation must always be validated by the AT-ED.

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# 8.5. Criteria for execution sites

The execution of network service line/derivations is not permitted in the following situations:

- a) On the sections between the crossing section valves, in the specific case of crossings at special points and open trench crossings of heavily trafficked roads such as National Roads (EN), Main Trunk Roads (IP), Secondary Roads (IC) and Motorways (AE).
- b) In the sections that correspond to the crossing of other roads, not mentioned above, because they imply intervention in places of increased risk due to the circulation of vehicles.

# 8.6. Criteria for valve installation

Manoeuvrable valves that are accessible from the outside (public domain locations) should be installed in the service lines in the following situations:

- a) In the service lines for industrial installations and those which receive the public (e.g. the tertiary market).
- b) In service lines from distribution networks made of steel (all diameters) and polyethylene for PE160 and PE200 diameters.
- c) In cases where the main switch box is located in places where access is restricted (e.g. interposition with a gate).
- d) On service lines bigger than 10 m.
- e) For service lines leading to general cut-off boxes that do not respect the minimum height of 0.30 m between the base of the general cut-off box or PRM and ground surface.
- f) On partial service lines (topped).
- g) On service lines using copper pre-installations.

As the valves are safety equipment, they should, whenever possible, be installed on the pavement in order to allow better access and visibility. If it is physically impossible to comply with this requirement, the valves should be placed following this priority:

1 - Outside the carriageway, preferably in places where parking is prohibited;

2 - On the carriageway, preferably in places where parking is prohibited. Under these circumstances, valves may not be installed in areas of poor road visibility (bends, crossings, narrow passages, etc.).

3 - In the case of service lines crossing, the valves should normally be installed before the crossing, even if they are on the carriageway. However, in order to safeguard against any exceptions to this rule, all these cases must be analysed beforehand, and the solution authorised by Portgás (in this

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cases, it is mandatory to upload Portgás' authorization on the service line process previous to the execution schedule).

# 8.7. Sizing

Mains diameter	Maximum flow expected (Nm <sup>3</sup> /h)	Service line diameter	Service line valve (where applicable)	Transition	General shut-off valve
PE40 <b>(*)</b> to PE200	Q ≤ 30	PE20	PE32	PE20/cal 15	cal 15
PE63 to PE200	30 < Q ≤ 65	PE32	PE32	PE32/cal 25	cal 25
PE63 to PE200	65 < Q ≤ 105	PE40	PE40	PE40/cal 32	cal 32
PE63 to PE200	105 ≤ Q ≤ 270	PE63	PE63	No	According to the inlet pipe

Table 1: criteria for service line dimension

(\*) In the case of service line connected to PE40 pipes, these should be made by using electro weldable service line fittings (tees) and not by using load sockets.

# 9. Requirements for the enforcement procedure

## 9.1. Materials and equipment

- a) The Contractor shall provide all necessary material and equipment for executing and testing of the mains.
- b) Only materials suitable for the proper execution of the work should be used, in compliance with the applicable Portgás legislation and technical specifications.

## 9.2. Staff preparation

- a) Within the scope of service line construction, the personnel called to assemble the PE materials must have the appropriate skills and training to carry out the work, namely certification and up-to-date licenses to perform the duties assigned to them.
- b) The training aims to ensure that all persons responsible for such work can carry it out to specification.

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c) It is the Contractor's responsibility to ensure that personnel comply with technical operating procedures.

#### 9.3. Handling and storage on site

- a) Special precautions should be taken to ensure that materials and tools remain perfectly clean during handling and storage on the job site. They should only be removed from their original packaging or from the boxes in which they are stored when they are to be used.
- b) Special care should be taken when handling the tubes so that they do not scratch themselves when touching sharp objects.
- c) To prevent foreign matter from entering the pipes, temporary plugs will be placed at their ends until the time of assembly.
- d) Pipe coils will have to be stored horizontally and stacking is limited.

#### 9.4. Trenching

Trench digging work complies with Portgás ET 501 "Trench Digging" technical specification.

#### 9.4.1. Layout

The route must be as straight as possible, and the service line must always be perpendicular to the network. If a change of direction is necessary, first consider the possibility of cold bending the pipe with a radius of at least 30 times the pipe's outer diameter. If the minimum bending radius cannot be maintained, bends in electro weldable fittings should be used.

#### 9.4.2. Crossing with other infrastructures

In many circumstances it is necessary to resort to specific technical solutions, namely with the use of protection sleeves. In these situations, the conditions established in the applicable technical specifications must be respected, namely in ET 305 (Protection sleeves for steel and polyethylene nets).

## 9.5. Pipe laying

#### 9.5.1. Preparation of the pipe sections

a) When the pipe is in coil, it must be withdrawn from the coil by pulling it out from the inside and simultaneously rotating it to avoid a helical winding, thus avoiding tension in the unwound part. Likewise, if the pipe is in coil, its extraction must be accompanied by the rotation of the coil, whether this is placed horizontally or vertically, in order to prevent twisting, which would make it impossible to properly lay the pipe at the bottom of the trench, as well as causing kinks and deterioration of the pipe.

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- b) During uncoiling, the outer surface of the pipe must be checked: any suspect element must be removed.
- c) The pipe will be cut to a length that is sufficient for proper laying. During this operation, the ends of the pipe must be kept plugged with temporary plugs to prevent foreign bodies from entering.

## 9.5.2. Pipe laying

- a) The pipe is laid in the trench during the unrolling of the roll or coil. The pipe should finally be cut at a point that avoids having to be pulled during laying, during backfill.
- b) The pipe is generally pushed through the existing protective sleeve for protection of the section emerging from the ground outside buildings, to the general shear box. The use of a pull cable may be justified if the length or profile of the sleeve so requires.

## 9.6. As Built Designs

After the service lines have been executed, they must be represented on a drawing, to be made by the contractor, in accordance with specification ET 550.

# 9.7. Trench closing and pavement repositioning

Upon completion of the work, the contractor shall promptly close the trench and replace the pavement, in accordance with ET 502.

# 10. Requirements of the commissioning process for single service lines

## 10.1. Connections

- a) The on-load socket must be installed at a minimum distance of 50 cm from the end of the network (end-of-line plug), or from the vent if there is one.
- b) The PE value to be mounted on the mains, where applicable, shall not be coupled to the outlet union of the on-load tapping. The values shall be installed in straight sections of the mains. Values shall not be placed within 20 cm of service line fittings, joints, bends and load tapping.
- c) After the service lline pipework has been laid in the trench, the ends will be connected either to the main shut-off valve installed in the shelter box, or to the mounted load socket, the latter remaining to be welded to the main pipework.
- d) The welding of pipes and fittings complies with Portgás' technical specification ET 605 "Welding of polyethylene pipes".

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# 10.2. Service Line Gasification

This operation must be carried out in the presence and under the guidance of TEX, who, on arrival at the site, must see that the following conditions are met by the Contractor:

- a) Mains pipework installed and connected to the main shut-off valve;
- b) Open trench in the connection zone to the network and all the electro welding's made;
- c) Unwelded load socket.

The service line gasification, which takes place when the socket is drilled, presupposes that the welding of the socket is previously carried out, the Mechanical Resistance tests are carried out and the tightness check is performed in accordance with that described in point 10.3 below.

# 10.3. Mechanical resistance test and watertightness check

The PE service lines are built for a maximum service pressure of 4 bar relative to the service pressure and must be subjected to the tests and leakage tests, which are the responsibility of the Contractor, who will carry them out, in the presence of TEX, according to the following procedures.

# 10.3.1. Pre-testing of isolated service line

The testing of the service lines comprises the following steps:

- 1 Without piercing the on-load tap of the service line, these should be pressurised to 6.5 bar (±0.5 bar) and remain so for 10 minutes;
- 2 Using a pressure gauge, check that there is a decrease in pressure during this period. The pressure gauge to be used must have a range of 0 to 10 bar, a resolution of 0.05 bar, a valid calibration certificate and a maximum uncertainty of 0.5%;
- 3 After this time and using a foaming solution, the Contractor shall check all welds and joints for leaks;
- 4 If leaks are detected, the Contractor must repair them and repeat the test.
- 5 If no leaks are detected, the contractor must depressurize the air contained in the pipes to about
  500 mbar (±50 mbar) and record the pressure value using a pressure gauge with the characteristics given in point 2.
- 6 Using a foaming solution, the Contractor must search all welds and joints for leaks.

The result shall be considered satisfactory if, after completion of this test, there is no change in pressure and no leakage.

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#### 10.3.2. Drilling of the on-load tap and quick leak test, with gas delivered

This step concerns the expedite test with the gas dispensed, which is the responsibility of the Contractor, who will carry it out in the presence of TEX, respecting the following steps:

- 1 Drilling of the on-load socket;
- 2 Raise the cutter to the top of the on-load socket and, using a foaming solution, carry out a tightness check;
- 3 Place and tighten the cover of the on-load socket and, using a foaming solution, carry out a tightness check;
- 4 Purge the extension;
- 5 Block and plug the general shut-off valve and, using a foaming solution, carry out a tightness check; if there is a leak, the Contractor must repair it and repeat steps 10.3.1. and 10.3.2.
- 6 After having done what is described in the previous item, the valve must be sealed, by TEX, in the jammed position. The seal used must comply with ET 403 "Safety Seals".

The result is considered satisfactory if, after carrying out this expeditious test, no leakage occurs. This fact should be evidenced by TEX, in the appropriate place of the resolution of the work order.

# 11. Requirements of the process of commissioning service lines at the same time as distribution networks

All the service lines executed simultaneously with the polyethylene net are an integral part of it. As such, they shall fulfil the same requirements as those established for the "net", in addition to the provisions mentioned in this paragraph.

#### 11.1. Connections

The same rules as for single service lines, indicated in 10.1, should be followed.

#### **11.2.** Service Line pre-testing

For mains connections made at the same time as the network, the Contractor must first carry out a pretest on these connections, in accordance with ET651.

Only after completion of this pre-test, and if no leakage is detected, should the on-load sockets be drilled.

#### **11.3.** Mechanical resistance test and watertightness check

PE service lines are built for a maximum operating pressure of 4 bar and must be subject, together with the distribution network to which they are associated, to watertightness tests and checks, which are the responsibility of the Contractor, who will carry them out in accordance with the provisions of ET651.

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