Technical Specification

ASSEMBLING POLYETHYLENE NETS

ET 601

Revision No. 3 | 10 April 2023



Technical Specification



ASSEMBLING POLYETHYLENE NETS

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Register of revisions

Revision number	Date	Motif
0	2007-11-16	Initial wording.
1	2016-09-28	Revision of section §13 [Placement depth and distances].
2	2020-05-05	General revision and replacement of the reference "EDP Gás Distribuição" by "Portgás".
3	2023-04-10	General revision carried out by IDOM Consulting, Engineering, Architecture, SAU

Information classification

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Distribution of the document

External	Contractors $oxtimes$ Qualified for Allotments $oxtimes$ Internet $oxtimes$ Other \Box	
Internal	AT-ED 🗆 AT-EX 🗆 AT-GE 🗆 AT-MS 🗆	
	ACR-DC 🗆 ACR-GC 🗆 ACR-RD 🗆	
Nominal	< name, function, position >	

Caption:	
CA: Board of Directors	ACR: Clients and Networks Area
AT: Technical Area	ACR-DC: Clients and Networks Area - Commercial
AT-ED: Technical Area - Engineering and Development	Development
AT-EX: Technical Area - Exploration	ACR-GC: Clients and Networks Area - Large Consumption
AT-GE: Technical Area - Energy Management	ACR-RD: Clients and Networks Area - Networks
AT-MS: Technical Area - Maintenance and Systems	

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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, which introduced the necessary changes to the specification in order to ensure that the "Assembly of polyethylene nets" performed in accordance with this specification ensures that the infrastructure is ready to receive hydrogen.

This revision of ET 601 cancels and replaces the previous revision dated 5 May 2020, 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

This Technical Specification for Construction establishes the requirements, standards and technical conditions to which the assembly of polyethylene nets must conform.

2. Scope

This technical specification applies to all polyethylene pipes and fittings intended for the construction of distribution networks: Secondary network (maximum pressure 4 bar) for operating temperatures between -5°C and 50°C.

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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3.2. Internal

- ET 114 Warning strip.
- ET 301 Polyethylene pipes for gas.
- ET 302 Polyethylene fittings for gas.
- ET 304 Valves in polyethylene.
- ET 305 Protection sleeves for steel and polyethylene nets.
- **ET 307** Ø 200" truncated cone manhole for secondary network valves.
- ET 501 Trench digging.
- ET 502 Trench closing and pavement repositioning.
- ET 603 Identification of secondary network valves.
- **ET 604** Installation of purges in the secondary polyethylene network.
- ET 605 Welding of polyethylene pipes.
- ET 651 Mechanical resistance and tightness tests: distribution network secondary network.
- ET 1105 Personal protective equipment.
- ET 1106 Guidelines for quality, environment and safety in operations.

4. Definitions / Acronyms

Environment and safety coordinator on site (CASE)

Natural or legal person who performs, during the execution of the work, the tasks of coordination in matters of environment, safety and health provided for in this document.

Contractor

Entity accredited as an Installer 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 works intrinsic to the construction, maintenance or renovation of polyethylene gas distribution networks.

Technical Manager

Portgás employee, who is assigned the responsibility of managing the construction activities related to a certain infrastructure development project.

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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.

Inspector

Inspection Collaborator, who supervises the execution of the work, in accordance with the approved project, as well as compliance with the applicable legal and regulatory provisions.

5. Responsibilities

Site safety coordinator (CASE)

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

Contractor

It is your responsibility to fully comply with this technical specification.

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.

Inspector / Technical Manager

It is their responsibility to coordinate, monitor and supervise the methodology for executing the work under the terms defined in this technical specification.

6. Occupational Safety and Health (OSH)

- a) The works to be carried out within the scope of this technical construction specification should obey all the provisions contained in the health and safety plan (HSP), or safety procedure sheets (SDS), complemented with the provisions explained in this same specification.
- b) It is the responsibility of the CASO/Inspector/Technical Manager to ensure that all occupational safety and health (OSH) requirements are met by all those involved in the work.



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7. Environmental practices

- a) In order to minimise/eliminate the environmental impacts associated with the "assembly of polyethylene nets", the Contractor must bear in mind that:
 - a1) 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 1006, supplemented by the provisions explained in this same specification.
 - a2) The waste resulting from the work carried out within the scope of this specification (remains of polyethylene piping, material from excavation, empty packages, 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.
- b) The Inspector/Technical Manager is responsible for ensuring that all environmental requirements are met by all those involved in the work.

8. On-site handling and storage of pipes, valves and fittings

8.1. General

- a) The Contractor must have in its possession the batch certificates and respective transport notes, making this documentation available to the Inspector/Technical Manager whenever requested.
- b) The Contractor shall take all precautions to ensure that pipes, valves and fittings are not damaged during transportation, loading, unloading and storage operations. Portgás will not accept the use of any damaged pipes, valves or accessories.
- c) Mechanical handling of loads should be used whenever it is not possible to ensure adequate manual handling.
- d) Together with the polyethylene pipes, pipes or fittings of any other kind, stones, machinery or tools of any kind, as well as any material likely to cause damage or contamination to the piping, are not allowed.
- e) The transportation of materials should be carried out, bearing in mind the principle of cargo carried, cargo safe.

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8.2. Handling

- a) When pipes, in coil or bundle, are too heavy to be lifted by hand, non-metallic lifting slings or a forklift with adequately secured forks should be used. Under no circumstances should they be pushed or dragged from platforms or loading bins.
- b) When lifting slings are used to load or unload pipes (whether in coils or in rods), they should be nonmetallic with rounded edges, at least 10 cm wide. These operations should be carried out in such a way as to avoid damaging the pipes.

The use of cables, chains, ropes or any other type of material that can in any way constitute a "cutting" element is forbidden.

- c) For pipe diameters greater than DN63, mechanical unwinders must be used.
- d) When handling the pipe, either on a roll or on a pole, the pipe ends must remain effectively plugged.

8.3. Storage gem on site

- a) Pipes should be kept off the ground by means of wooden sleepers, planks, pallets or other system that will not damage them.
- b) During temporary storage on site, the pipes, whether in coils or poles, should be stacked in such a way as not to constitute a danger to the safety of persons or property, and the ends should remain effectively plugged.
- c) Pipes on poles should not be stacked crosswise.
- d) The height of the piles, excluding the thickness of the wooden sleepers, may not exceed 1 m.
- e) Valves and accessories should be stored in their original protective packaging for as long as possible until they are used.
- f) Pipes, valves and fittings shall be protected against ultraviolet radiation by covering them with appropriate protective means. It is strictly forbidden to subject pipes, valves and fittings to temperatures above 40°C.
- g) Pipes, valves and fittings must not be stored near heat sources. The storage area must be far enough away from electrical cables, oil and fuel tanks, bituminous products or other flammable substances.

9. Trenching

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

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10. Welding of pipes and fittings

The welding of pipes and fittings complies with Portgás' technical specification ET 605 "Welding of polyethylene pipes".

11. Piping: alignment, cutting and changing direction

- a) The alignment of straight sections of pipe along the trench will be done on rollers.
- b) The polyethylene pipe should only be cut with pipe cutters or guillotine shears.
- c) Wherever possible, changes in direction of polyethylene piping in plan or longitudinal profile shall be performed cold by elastic bending with the following condition for the bend radius (R):
 - R> 30 x DN, for DN< 160mm,
 - R> 50 x DN, for DN \ge 160mm.
- d) What is mentioned in c) presupposes that the following conditions are met:
 - Tensile stresses resulting from bending must be absorbed by adequate locking;
 - In no case are the forces resulting from bending allowed to affect a weld, branch, transition fitting, drain or any other connection upstream or downstream of the bend.
- e) Where it is not possible to meet the requirements set out above, changes in pipe direction will be made with fittings.
- f) A branch tee must be placed far enough away from any other constituent elements of the network (tees, valves, on-load sockets, end-of-line plugs) so that the replacement of any of these constituent elements does not affect the integrity of the derivation.

12. Pipe laying

- a) Before the piping is laid, the bottom of the trench must be levelled and ready to receive the piping in accordance with the provisions of technical specification ET 501.
- b) When laying the pipes, the following conditions must be respected:
 - The pipes must not contain any objects inside;
 - The pipes must be laid without any tension;
 - The pipes must be laid completely flat along their entire length on the laying bed, and wedges or wedges may not be used.

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- c) During laying, the pipe and welded joints must not suffer any damage. If any weld seam/ fitting is damaged, it must be removed and the pipe must be checked for damage, which, if it is damaged, will mean the weld seam/ fitting will have to be cut out and a new weld made.
- d) The external surfaces of pipes and fittings must be clean and free of any defect. When this requirement is not assured, the Technical Inspector/Manager will order the removal of the defective component.
- The pipe marking should be positioned at the top of the pipe wherever possible. e)
- f) The ends of the pipes must be sealed to prevent the entry of any kind of debris.
- g) The presence of water or dirt inside the pipes is considered a serious fault of the Contractor. In this eventuality, the Inspector/Technical Manager shall establish for each case separately the method to be used for the complete cleaning and drying of the pipeline and may order the replacement of the piping.

The removal of this type of anomaly is the sole responsibility of the Contractor.

- It is strictly forbidden to drag the pipe over the bottom of the trench. If there are assembly constraints h) that force the pipe to be dragged, the following precautions must be taken:
 - Install the pipe and drag it on suitable rollers (these must be in perfect working order and made of material that does not attack the polyethylene);
 - Apply the pulling force to the pipe continuously and never by stretching it.
- i) The unrolling and laying of the polyethylene pipes supplied on a reel complies with the following requirements:
 - Unwinding should be done by continuous movement and never by stretching;
 - The speed of rotation of the reel during unwinding must be constantly checked;
 - The polyethylene tube should be unrolled from the bottom of the coil, in order to avoid the spiral effect that prevents proper placement at the bottom of the trench;
 - During the unrolling process, the outer surface of the pipe should be checked to ensure that there are no defects, crushing, the introduction of foreign objects or any other suspicious findings to ensure that the pipe is not installed under these conditions;
 - Sufficient rollers must be placed at the bottom of the trench, along the route, so that the pipe does not touch or drag on the ground; they are also placed to avoid the pipe rubbing against obstacles as well as in curves whose radius is greater than 30 times the diameter of the pipe.
- j) The laying of the pipe shall be carried out in such a way that the pipe covering requirements can be met in accordance with the provisions of technical specification ET 502.



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- k) At the end of each day's work, the piping should be covered in order to protect it.
- I) Whenever there are no suitable curves for the real conditions in the range of curves on the market, segmented curves can be used. The execution form as well as its assembly must be approved by the Technical Inspector/Manager.

13. Depth and placing distances

13.1. Trench depth: normal conditions

- a) The pipe laying depth is the distance measured vertically between the pipe's upper geratrix and the ground surface restored to its final state.
- b) Portgás recommends the following minimum depths at which the polyethylene networks should be installed, as shown in figure 1:





- H = 60cm: under floors not subject to rolling loads;
- H = 80cm: under floors subject to rolling loads.

These depths may be increased in situations that are defined differently in terms of licences issued by third parties.



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13.2. Trench depth: exception conditions

- a) In occasional and localized situations, when the depths referred to in paragraph 13.1 b) cannot, for whatever reason, be respected, the installed piping should be protected with a simple sleeve (fig. 2), simple concrete (fig. 3), reinforced concrete with sunken mesh (fig. 4), or using concrete slabs (fig. 5) with the following dimensions:
 - Length between 30 cm and 1 m;
 - Minimum width of 30 cm, which should be as close as possible to the width of the trench;
 - Minimum thickness of 4 cm.

Note: In exceptional cases where it is not possible to guarantee a minimum pipe depth of at least 40cm (e.g.: crossings in civil engineering works, intersections with infrastructure that cannot be diverted or circumvented from below or other specific cases), the installed pipe should be protected with a sleeve concreted with sun mesh, as shown in Figure 6.

In all cases, the piping protection solution must be approved in advance by Portgás.



Fig. 2

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Fig. 3



Fig. 4

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Fig. 5



Fig. 6

In specific cases and duly proven by the Technical Inspector/Manager, of rock areas whose extension a) implies serious difficulties in opening the trench and other inconveniences due to the slowness of execution and the means involved, the depth of the piping referred to in paragraph 13.1 b) may be reduced to a minimum of 40cm.

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In these cases, an upper protection of the pipe must be placed with the use of concrete slabs with the characteristics indicated in paragraph a), leaning against each other along the length of the trench, according to figure 5.

Alternatively, the top protection of the pipes can be carried out by means of a concrete slab with a minimum thickness of 10cm, reinforced with a minimum mesh size of 3mm in diameter and 100mmx100mm mesh, as shown in figure 4.

In the latter case, at most every 2m of extension, a discontinuity should be created (for example, by placing separation plates in expanded polystyrene or another material before concreting, to be removed after the concrete has dried) in order to facilitate subsequent access to the gas piping, if necessary.

13.3. Placement distances

a) The distance between parallel gas and water pipes, in horizontal projection, must not be less than 20cm.

If it is not possible to respect this safety distance, the ducts shall be separated using a protective sleeve in accordance with the technical specification ET 305, over the whole length where this minimum distance is not respected.

- b) The distance, in horizontal projection, between the gas pipes and the nearest generators of electric, telephone or similar cables, whether in parallel routes or at intersections, may also not be less than 20cm, except for "earth connections". If it is not possible, on a given section, to respect the stipulated minimum distance, the gas piping shall be protected by a sleeve established in technical specification ET 305, the ends of which shall be at least 20cm away from electric, telephone or similar cables.
- c) The minimum distance between the nearest branches of the gas mains and the sewage system shall not be less than 50 cm, both in parallel routes and at intersections. If it is not possible to respect this distance in each section, the gas mains shall be surrounded by a protective sleeve enshrined in technical specification ET 305, the ends of which shall be at least 50cm away from the sewage system.
- d) The gas tubes shall not be enclosed in the protective sleeve by means of a longitudinal cut of the protective sleeve. In such a case the sleeve shall be concreted in order to ensure its strength.



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14. Valve installation

14.1. General

The polyethylene valves to be used for network assembly comply with Portgás' technical specification:

• ET 304 "Valves in polyethylene".

14.2. Installation of "network valves"

- a) Valves should be installed on straight sections of pipe. Valves shall not be installed closer than 50cm to branch fittings, bends and branches.
- b) The installation of the valves includes the following steps:
 - b1) Enlarge and adapt the trench in place of the isolating valve or the bypass with valve;
 - b2) Weld valves and fittings end-to-end or by butt-weld, depending on diameter;
 - Wrapping the valves, with compacted sand, up to the level of the valve bonnet; b3)
 - b4) For access to the valve operating head, the telescopic sleeve supplied with the valve and cover should be fitted to prevent the ingress of mud or other foreign bodies that could compromise the valve's manoeuvrability.

The connection of the telescopic sleeve to the valve bonnet should be sealed by wrapping this assembly in compacted sand up to the level of the concrete support ring.

- b5) Installation of a concrete support ring and a Ø200 manoeuvring box (ET 307) at floor level above each valve.
- c) In paved areas, the valve box cover should be located at the same level as the resurfaced pavement.
- In unpaved areas, the valve box cover should be 20mm above ground level. d)
- e) The valves shall be installed by a method that does not damage the valve or the adjustable shaft, either during or after installation. The method should ensure easy operation and the longest service life of the valve.
- Throughout the installation process the following conditions must be guaranteed: f)
 - The base plate is horizontal and located on a fixed, stable layer.
 - The valve is installed on a straight section (either horizontally or vertically).
 - The cover around the valve base is compacted.
 - The valve operates smoothly, and movements can be absorbed by the valve base.
 - The telescope tube cover is below ground level.
 - The telescopic tube is vertical during filling.
 - The top of the telescope tube is protected against collision before the cover is installed.



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- The cover is fitted in accordance with the cover design. •
- The height of the cover corresponds to the re-established ground level.
- The valve is in the open position.
- g) The "mains valves" shall be identified in accordance with the provisions of ET 603 [Identification of secondary network valves].

14.3. Installation of "bleed valves"

The installation of "bleed valves" complies with Portgás technical specification ET 604 [Installation of bleeders in the secondary polyethylene network].

Branch from building 15.

- a) All the branches 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.
- b) The dimensioning of a building branch is established by Portgás.
- A building branch stems perpendicularly from the main distribution network pipe and extends to the c) general building shut-off valve.
- A branch will only "feed" a main shut-off valve. d)

Testing the nets 16.

The polyethylene networks are tested in accordance with Portgás' technical specification:

ET 651 "Mechanical resistance and tightness tests: distribution network - secondary network".

Pipe signalling 17.

At 30cm above the upper surface of the buried pipeline, a warning strip shall be continuously placed. The material requirements are explained in the Portgás ET 114 technical specification.

18. Trench closing and pavement repositioning

Trench closure and pavement replacement works comply with the Portgás ET 502 "Trench closure and pavement replacement" technical specification.

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