

Health and Safety Standard: Trenches and Excavations

Code: **NT. 00064**

Version: **3**



The data pertaining to the approval of this document are available on the Regulations Document Manager



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Health and Safety Standard: Trenches and Excavations

1. Purpose

The purpose of this Health and Safety Standard is to establish the minimum health and safety measures for the execution of trenches and excavations and work inside or in their vicinity, in order to avoid incidents or accidents that may affect the integrity of **workers**, third parties or the facilities.

2. Scope

It is applicable to all companies of the Naturgy group and to those in which it has responsibility for its operation and/or management, both in work carried out by its own personnel and by collaborating companies and subcontractors.

In all cases, the national legislation applicable in each territorial area and the aspects covered by this Health and Safety Standard shall be complied with.

3. Reference documents

PG.00043: General Health and Safety Standards Management Procedure.

NT.00034.-PT.01: Health and Safety Standard: Prior Control, Documented Inspections and Meetings Coordination with Collaborating Companies. Part 1: Pre-work checks.

NT.00039: Health and Safety Standard: Working at Heights.

NT.00040: Health and Safety Standard: Driving safely.

NT.00043: Health and Safety Standard: Work Permit.

NT.00052: Health and Safety Standard: Confined Spaces.

NT.00053: Health and Safety Standard: Signage.

NT.00068: Health and Safety Standard: Handling of loads with self-loading cranes and self-propelled mobile cranes.

4. Definitions

Excavation: includes the execution of the operations of emptying the land and levelling the areas on which the facilities provided for in the work will be located or from which existing facilities will be accessed.

Trench: long, narrow excavation (width less than 2 metres).

Shaft / Pit: excavation in which the dimensions of width and length are of a similar order of magnitude or in which its depth predominates over its other dimensions.

Shoring: any demountable fortification installed for the containment of earth. This structure, built with auxiliary means such as planks, wooden panels, metal or other firm elements



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installed horizontally or vertically, will support and fix the unstable ground, thus preventing possible landslides or landslides over the trench.

Full shoring: covers the entire surface of the excavation walls.

Semi-deep or semi-complete shoring: covers approximately 50% of the surface of the excavation walls.

Light shoring: the area covered is less than 50% of the area of the excavation walls.

Backfill: filling material used to cover the excavation after the work has been carried out.

Cohesive soil: a soil that maintains its cohesion even when submerged in water; it is usually characterised by a high clay content.

Loose soil: soil with very low cohesion and strength in its natural state and no cohesion and strength when submerged in water; it usually consists of gravels and sands with low clay content or fill material.

Excavations with possible serious risk of burial or subsidence: Those whose depth is equal to or greater than 1.30 metres, or 0.80 metres in the case of loose ground. No persons are allowed inside without a specific work and shoring permit as defined in Annex I.

Works Manager (WM): competent technician appointed by Naturgy who performs the functions of control and supervision of the work or work in accordance with the applicable regulations in order to ensure adequate safety, health, quality and environmental management conditions.

Risk assessment document: details the risks identified according to the execution process and the collective and individual prevention and protection measures for each of them.

5. Responsibilities

Business unit:

- Appoint the Works Manager.
- Design the layout or delineate the excavation area, taking into account the location of existing or planned overhead or buried utilities or structures.
- Where applicable:
 - Carry out the commissioning of the project in the established application.
 - Have a geotechnical study of the land.
 - Manage the relevant licenses before the affected municipalities and bodies.
 - Ensure that the executing company has been provided with the technical regulations applicable to the execution of the work.
 - Reflect the progress of works in the works management application and ensure the transfer of the final plans to the mapping unit.
 - Ensure the legalisation of the work before the competent bodies.



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- Review and authorise (if applicable) any Specific Work Permits that may be required.

Works Manager (WM):

- Verify compliance by the executing company with the safety, technical, quality and environmental aspects required in accordance with the technical project or applicable documentation.
- If different alternatives or technical solutions are presented in the execution of the work, choose the most appropriate option in accordance with the requirements of the work.
- Where applicable:
 - Approve modifications made to the project, keeping documented records of the scope of the modifications and the agreements reached.
 - Carry out the final works certificate ensuring compliance with the applicable legal regulations.
 - Ensure the transfer of the final construction documentation to the relevant business unit.

Executing company:

- Before starting work, locate and identify on site the existing services in the area (overhead or underground), using the necessary means, including the following (non-exhaustive list):
 - The dimensioned plans of other services.
 - The identification of overhead or underground power lines that may pose a risk during the execution of the work.
 - Checking the covers or existing records on the surface.
 - The identification of connections, electrical panels, transformation centres, traffic lights, fixed radars, parking meters, luminous signage, etc. that may indicate the presence of possible services affected.
 - If there is any doubt or suspicion, by consulting the proprietors or owners of the land, or the competent bodies.
 - The use of the detector, tracer or ground-penetrating radar.
 - The opening of the necessary perforations.
 - Any other relevant means to help identify the presence of services and to locate them accurately.

If the presence of services is detected, the indications described in Annex 02 shall be followed.

- The site/work manager or foreman shall be responsible for the request and detection of the possible services concerned. In the event of detecting conductors in the area, in the case of construction sites, these shall be recorded on the construction site plan or sketch. In addition, the site manager or foreman must record the detection carried out and the result of the detection in the site logbook



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- If services are identified or detected, the information must be passed on to all personnel involved in the execution of the work and the preventive measures taken in each case.
- Draw up the risk assessment document and comply with the measures specified therein.
- Execute the works in accordance with the project (if it exists), the technical standards of application and good construction practice, ensuring compliance with safety, quality and execution deadlines.
- Coordinate and direct work teams.
- Deliver the final documentation of the work to the Works Manager.

6. Risks and basic protective and preventive measures

Each work or work must have a risk assessment document, which will include the risks identified according to the execution process and the conditions of the environment and the collective and individual protection and prevention measures to be applied for each of them.

6.1. Identifying risks

The most common risks in excavation work are, among others, the following:

- Collisions, blows and collisions with vehicles (on or off site).
- Knocks/cuts by objects or tools and machinery.
- Falls of people at different or the same level.
- Falling or toppling of objects and dislodged objects.
- Landslide
- Particle and dust projection.
- Handling of loads, overexertion.
- Work in confined areas
- Work in the presence of flammable or toxic gases; asphyxiation due to air displacement.
- Interference with other installations or services: proximity or contacts with electrical installations (overhead or underground), thermal contacts, etc. (Annex 02)
- Exposure to noise, vibration, climatic conditions, flooding.
- Exposure to chemical agents (dust).
- Entrapment caused by the overturning of equipment, vehicles, machinery.



6.2. Protective and preventive measures

6.2.1. General

- Work permit: a work permit is required for excavations with a serious risk of burial or subsidence (those with a depth of 1.30 metres or more, or 0.80 metres or more in the case of loose ground). If a worker is going to enter a trench or shaft with a depth of 1.30 metres or more (or 0.80 metres in the case of loose ground), a Specific Work Permit is required.
- In cases where repetitive and high frequency work is carried out (e.g. installation of supports), a temporary Work Permit may be issued to cover all work of this type (instead of specific Work Permits for each site), but this can only be done if there is a procedure, instruction or technical document describing the scope of the work, its execution, the associated risks and the preventive measures to be adopted depending on the terrain and the circumstances that may arise on site.
- Preliminary check: daily and before starting any activity, the personnel who will carry out the work will conduct the basic health and safety checks and identify the unique aspects in the environment that may affect the risks or the necessary protection and prevention measures.
- Detection of affected services: prior to the excavation work, the detection of live cables, non-voltage cables, pipes, ducts, as well as the location of other possible services will have been carried out. If excavation work uncovers the installations of other services, proper precautions shall be taken to avoid damaging them, leaving them in their original condition at the end of the work.
- Signage and fencing:
 - The marking or delimitation of the works shall be carried out in accordance with the specific applicable legislation. The site must be clearly signposted with panels, fences, etc. and have an effective system for night-time lighting in the event of night work or proximity to traffic routes, as well as possible alternative measures where feasible (e.g. restriction of access at night).
 - In public areas accessible to people outside the work, fences or similar elements will be placed delimiting the work area **continuously**, to keep the passage of pedestrians free and safe, avoiding possible falls at the same or different levels, and allowing access to existing buildings.
 - Whenever possible, the perimeter of the bounded area must be no less than 1 metre from the edge of the cut in the case of pedestrian traffic and no less than 2 metres in the case of vehicles; if it is not possible to respect these distances in excavations of a depth of 1.30 metres or more (or 0.80 metres in loose ground), the executing company will define the complementary safety measures to be adopted.
 - Where it is necessary to walk over trenches or excavations, the passage of persons over the excavation shall be by means of **sturdy** footbridges with solid **handrails** at least 1 metre high.



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- If there are points on the construction site which may be accessible to outsiders (such as ditches, shafts, excavations and excavation pits, trenches or similar), they must always be fenced off or covered with suitably strong plates.
- Possible ditches or potholes that originate in vehicle passing areas must also be fenced off or protected with plates of adequate strength.
- If polyester plates or similar materials are used to protect dips, ditches, etc., fasteners must be introduced to prevent unwanted displacements or falls from the plates to the excavation (they can be screwed, shafts, shims or materials that prevent slipping, etc.).
- Prohibition of solo work: solo work in excavations is not allowed. If the depth is equal to or greater than 1.30 metres (or 0.80 metres in the case of loose ground) at least one person is required to remain outside the excavated area, or outside the danger zone in large excavations, provided that there is a worker inside the excavation.
- Safe access and evacuation routes:
 - Safe routes (at least two) into and out of the excavation shall be provided to enable workers to reach safety in the event of an emergency.
 - In excavations with a depth of 1.30 metres or more:
 - appropriate ladders or ramps shall be provided not more than 30 metres apart. Ladders shall be anchored at the top and firmly positioned and shall be 1 metre above the upper support points to facilitate entry and exit.
 - equipment will be available for the rescue and evacuation of people, given the risk of burial or subsidence (shovels, picks, elements to pry on stony ground, etc.)
- Breathable atmosphere:
 - it shall be ensured that a breathable atmosphere is maintained within the excavation during the execution of the work. Inside excavations at a depth of 1.30 metres or more in which workers are present and where gas pipes have been found to be present, or where toxic chemicals are to be used, or where there is a suspicion of a non-breathable atmosphere, continuous monitoring shall be carried out with gas detectors suitable for each specific case, unless natural ventilation can be ensured due to the extent of the excavation.
 - Special attention shall be paid to actions and constraints that could turn the excavated area into a confined space.
 - If a worker experiences symptoms of asphyxia, he/she shall stop work and move to a safe space with fresh air.
- Shoring: whenever there is a risk of collapse on people, adequate trench and excavation hardening or other alternative measures such as the execution of natural embankment, buttresses, etc., will be performed. The criteria to



determine the need for shoring in trenches and pits, and the type of shoring, are set out in Annex 01.

- Risk of falling from a height: workers may not carry out work at a height of less than 2 metres from the edge of a trench, a shaft or an excavation if the depth of the trench, shaft or excavation is to be regarded as work at a height (in accordance with NT.00039), unless the edge is protected up to a minimum height of 1 metre by supplementary shoring or suitably strong railings, or equivalent protective measures are taken.
- Prevention of earth and material from falling:
 - A space of at least 1 metre shall be provided between the edge of the excavation and the excavated earth, stockpiles of materials and tools or other objects. If it is not possible to maintain this distance, additional preventive measures (stoppers or other restraints) shall be taken.
 - It is forbidden to walk on the stockpiled land.
- Flood prevention:
 - In the event of flooding or heavy rainfall, the Chief Engineer shall inspect the entire route and determine whether it is practicable or requires additional protective measures.
 - If pockets of water are detected, they shall be removed or sealed.
 - If there is a possibility of flooding, the necessary detours shall be provided.
- Tidy and clean working area:
 - Depositing rubble and scrap metal on public roads shall be avoided.
 - Adjoining utility manholes shall not be blocked and trees, if present, shall be protected.
 - Evacuation routes shall be kept clear and the site shall be kept in an orderly and clean condition.

6.2.2. Protection when using civil engineering machinery

- All machinery used in the construction project must be in a good state of conservation and maintenance, being used solely and exclusively for the purpose for which it has been designed. It shall have all the safety and signage devices required by the regulations in force.
Loads shall only be lifted by machinery specifically designed for this purpose or by machinery whose instruction manual specifies that it may be used for this purpose.
- The machinery shall have a user's manual, maintenance book and mandatory inspections.
- The driver will use the seat belt from the moment he gets on until he/she gets off the machine.
- It is forbidden to work or remain within the range of the machine during earthmoving operations.



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- The transport of persons on machinery is prohibited, except in seats designed for this purpose by the manufacturer and which have a seat belt.
- Cranes shall be perfectly stabilised. All elements (hooks, latches, slings, etc.) shall be checked and it shall always be ensured that no one is under suspended loads.
- Each loading and unloading operation carried out with cranes must be directed by a single person (Manoeuvres Manager). The crane operator may act as Manoeuvres Manager as long as he is able to see the entire route of the load, as well as the manoeuvres necessary for the operation. When the crane driver is not able to see the entire route of the load, as well as the manoeuvres necessary for the operation, the presence of a Manoeuvres Manager other than the crane driver is necessary. In this case, the Manoeuvres Manager shall also act as signalman. All personnel carrying out these operations must be sufficiently qualified or specialised in these operations.
- Where heavy machinery is required to be located within 2 metres of the edge of the excavation, a safety perimeter shall be established inside the excavation so that a possible collapse does not affect any working person.
- When the machinery is not to be used for a certain period of time, it must remain correctly parked, with the engine and control unit stopped and in a safe position.

6.2.3. Protection when working with electrical conductors

- Prior to carrying out an excavation, the possible existing services will be identified and located on site, as described in section 5 in the responsibilities of the executing Company.
- If the presence of services is detected, the company owning the services shall be contacted and in any event the indications described in Annex 02 shall be followed.
- The handling of electrical conductors, following the instructions of the distribution company or owner of the installation, shall be carried out by personnel with the necessary qualifications in electrical risk, adopting the necessary collective and individual measures and under the supervision of the Chief Engineer.
- Machinery (excavators, cranes for unloading material, etc.) must maintain safety distances from overhead and underground power lines in the area, and if necessary, request their clearance from the company that owns them.
- Electrically hazardous activities shall be carried out by trained workers who are familiar with the health and safety measures to be adopted for each activity.
- If an electrical conductor is damaged, all persons in the vicinity of the incident shall be instructed to move away from the area to avoid potential hazards, and the owning company shall be notified immediately. If the damage is caused by



a machine, no person shall be allowed to approach it or its driver to leave it until instructions are received from the company owning the installation.

6.2.4. Protection in work involving the possible presence of flammable gases

Where there is a possibility of leakage or presence of flammable gases in the atmosphere during work operations or due to failure of work operations:

- If the presence of services is detected, the indications described in Annex 02 shall be followed.
- A gas detector (explosimeter) shall be used in all work where gas may be present in order to continuously monitor the non-formation of an explosive mixture.
- All operations shall be supervised from the outside by at least one worker.
- No flames or sparks will be generated in the vicinity of the work area. Anti-spark tools shall be used.
- If the piercing and leak-locating elements are not insulated, gloves shall be used to guide the piercing and leak-locating elements.
- No fire risk operations shall be carried out without first checking the purging and inerting of the piping.
- Sufficient gas pressure must be maintained to prevent the formation of an explosive mixture inside the piping.
- In the event that a section of the piping must be isolated due to the needs of the work by means of the sealing technique, it shall be adequately purged by periodically checking the presence of gas with an explosimeter and the pressure of the balloons used.
- If applicable, the PE pipe shall be earthed with moistened cotton tape.

In the case of scheduled work in the presence of gas, a specific plan shall be drawn up setting out all the safety measures to be taken.

7. Data log. Applicable formats

Not applicable



8. List of annexes

Annex 00 Review log

Version	Date	Reason for this version and/or summary of changes
1	25/11/2015	New draft.
2	07/10/2021	General review of technical content. Form adaptation and adaptation to organisational changes. Reviewed by standardisation and normalisation competence centre and ratified by H&S Operating Committee
3	19/07/2023	Revision of the document to clarify concepts and include additional measures derived from the documented inspections. Reviewed by standardisation and normalisation competence centre and ratified by H&S Operating Committee



Annex 01: Shoring criteria

Trenches and shafts in which there is a serious risk of burial or subsidence on people will be shored, in accordance with the criteria set out in the following table:

Type of shoring depending on the depth and characteristics of the terrain							
Type of terrain	Stress	Type of cut	Depth of cut in metres (P)				
			<0.80	0.80 ÷ 1.30	1.30 ÷ 2.00	2.00 ÷ 2.50	>2.50
Cohesive	Without stress	Ditch	(1)	(1)	Light	Semi-complete	Complete
		Shaft	(1)	(1)	Semi-complete	Complete	Complete
	With road stress ⁽²⁾	Ditch	(1)	Light	Semi-complete	Complete	Complete
		Shaft	(1)	Semi-complete	Complete	Complete	Complete
	With foundation stress ⁽³⁾	Any	(1)	Complete	Complete	Complete	Complete
Loose	Any	Any	(1)	Complete	Complete	Complete	Complete
Type of shoring							

NB:

⁽¹⁾ Shoring not generally required (at the discretion of the WM)

⁽²⁾ Roadway with vehicular traffic on one or both sides of the trench or with heavy vehicle stops nearby or dense traffic.

⁽³⁾ Roadways or pavements with nearby foundations supporting movement or vibration.

Other criteria equivalent to those described above may be used when they are established in a mandatory standard or a standard of recognised prestige; in any case they must be approved by the WM.

As the trench is opened, the necessary shoring will be put in place. As a guideline, shoring in 20 m sections is recommended. However, in the case of trenches in loose or plastic soil or in rainy weather, shoring should be used more frequently (even continuously), especially if excavation is carried out by hand, so that there is no risk to the worker.

Before the trench is completely backfilled, the shoring must be removed, provided that there is no risk to the worker.

It will be considered a cut of the land without nearby foundation or road stress when the following is verified:

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$P \leq (h + d/2)$ for close foundation stress

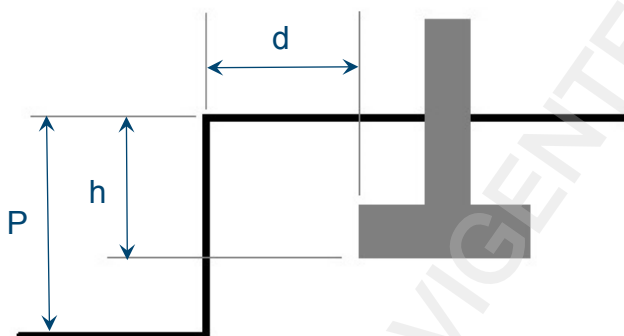
$P \leq d/2$ for road stress

Otherwise, it is considered to be under stress, even if the intensity determined in the calculation is zero. Where:

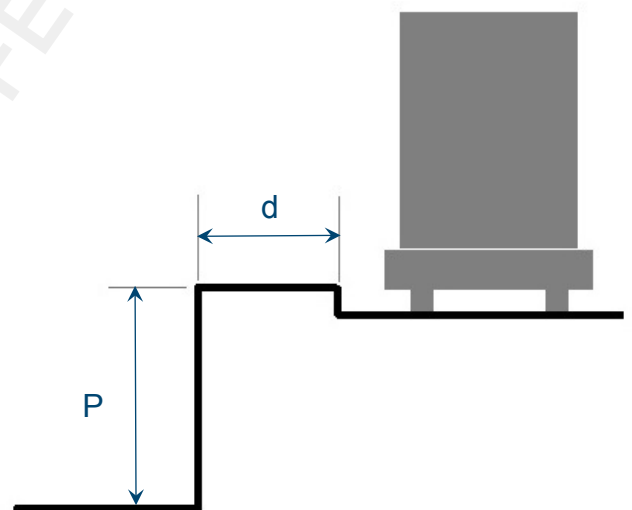
P = Depth of cut

h = Depth of the support plane of the nearby foundation. In the case of pile foundations, “h” shall be measured to the inside face of the pile cap.

d = Horizontal distance from the crown edge of the cut to the foundation or road.



Close foundation stress



Road stress



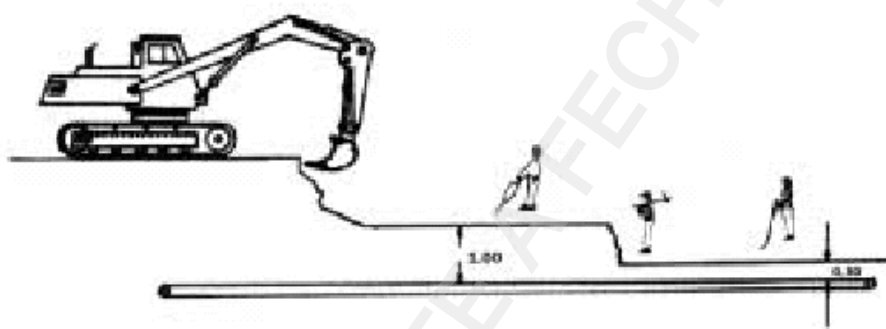
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Annex 02: Detection of interference with other affected services

If, prior to excavation, interference with installations or services is expected or detected, excavation shall be carried out with mechanical means to a depth of up to 1 metre before reaching the piping. Above this level, excavation shall be carried out manually with pneumatic drills, picks, etc. up to a depth of 0.5 metres before reaching the piping.

From that distance, the hand shovel will be used.

If the interferences are electrical wiring ducts, manual means (shovels, picks, etc.) with handles of non-conductive material shall be used.



Unknown sewage networks or galleries that could be found:

When an unplanned installation is detected during excavation, the personnel carrying out the work shall report it through their line manager, who shall immediately refer it to the **WM** so that the necessary measures can be taken.

Foundations, structures or trees:

In the case of work in the vicinity of supports, poles, walls, foundations, trees and other vertical elements whose stability may be compromised, the work will not begin until **such stability is guaranteed** before the start of the tasks.