International Standard

ISO 11886

Drilling and foundation machinery — Soil or soil and rock mixture drilling and foundation machines — Commercial specifications

Machines de forage et de fondation — Machines de forage et de fondation pour sols ou mélanges de sols et de roches — Spécifications commerciales

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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This document was prepared by Technical Committee ISO/TC 195, *Building construction machinery and equipment*, Subcommittee SC 3, *Drilling and foundation machinery and equipment*.

This second edition cancels and replaces the first edition (ISO 11886:2002), which has been technically revised. It also incorporates the Technical Corrigendum ISO 11886:2002/Cor 1:2006.

The main changes are as follows:

— extension of the scope to drilling and foundation machines, except horizontal directional drilling (HDD) machines.

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Drilling and foundation machinery — Soil or soil and rock mixture drilling and foundation machines — Commercial specifications

1 Scope

This document establishes content for commercial specifications for drilling machines and foundation machines. It explains concepts related to their applications, working methods, machine types, and main components of the machines.

This document is applicable to:

— mobile drill rigs for civil and geotechnical engineering;

— foundation equipment including piling machines;

— diaphragm walling equipment;

— jetting, grouting and injection equipment;

— interchangeable auxiliary equipment.

This document does not apply to:

— machines specifically designed for mining application (e.g. rock drilling, raise boring, jumbo machines);

— horizontal directional drilling (HDD) machines (covered by ISO 21467[1]).

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 6014, *Earth-moving machinery — Determination of ground speed*

ISO 6707-1, *Buildings and civil engineering works — Vocabulary — Part 1: General terms*

ISO 6746-1, *Earth-moving machinery — Definitions of dimensions and codes — Part 1: Base machine*

ISO 6746-2, *Earth-moving machinery — Definitions of dimensions and codes — Part 2: Equipment and attachments*

ISO 9249, *Earth-moving machinery — Engine test code — Net power*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6707-1, ISO 6746-1, ISO 6746-2 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

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3.1 General

3.1.1
machine family
group of machines designed for the same type of operation

Note 1 to entry: *Drilling and foundation equipment* (3.4.1) comprises the following machine families:

— soil or soil and rock drill rigs [*drill rig* (3.4.2)];

— horizontal directional drilling (HDD) (covered in ISO 21467[1]);

— *piling equipment* (3.4.3)

— *diaphragm walling equipment* (3.4.4);

— *injection* (3.3.8)*grouting* (3.3.7) equipment;

— interchangeable equipment [*interchangeable auxiliary equipment* (3.4.8)].

Note 2 to entry: Annex C provides guidance on identifying the machine family of the various types of drilling and foundation equipment.

3.2 Drilling and foundation components or elements

3.2.1
pile element
foundation element installed in the soil made of concrete (precast or cast in situ), or steel [tubes, beams or *sheet piles* (3.2.2)], wood or plastic material

Note 1 to entry: Piles can have an interlocking feature to enable pile sections to be joined together.

3.2.2
sheet pile
flat vertical structural member with restricted width compared to its depth, intended to be driven into the soil in a continuous row, usually to resist lateral pressure

3.2.3
borehole
narrow shaft bored in the ground by a *drilling tool* (3.2.4)

Note 1 to entry: A borehole can be constructed for many different purposes, e.g. the extraction of water, geotechnical investigation, environmental site assessment, foundation works, for geothermal installations.

3.2.4
drilling tool
device attached to, or forming an integral part of, the *drill string* (3.2.6), designed as a tool for penetrating the geological formation

3.2.5
drill bit
consumable device attached to the *drill string* (3.2.6), designed as a tool to penetrate the formation being drilled by the drilling method employed

3.2.6
drill string
all components [e.g. drill rods, *drill bit* (3.2.5), rod stabilisers] that are coupled together for transforming the rotation, percussion energy, vibration energy, separately from or in combination with, the drill or rotation unit and are inserted into the hole when drilling

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3.2.7
carriage
trolley
mechanical transmission between the *leader* (3.5.1) and the drilling head which guides the tool in the drilling direction

3.2.8
injection plant
assembly of units to produce and inject products into ground

Note 1 to entry: Examples of units include pumps, mixers, agitators, *silos* (3.2.11), *screw conveyors* (3.2.12).

3.2.9
high-pressure pump
pump for pumping water, mud, or cement grout to a high-pressure jetting system [*jet-grouting* (3.3.9)]

Note 1 to entry: Typically, the pressure borne by the pump is over 40 MPa.

3.2.10
agitator tank
buffer container for mud, grout or concrete to keep the mixture fluid

3.2.11
silo
buffer tank used, during a certain period of time, to contain bulk material(s), e.g. aggregates, cement or bentonite, or liquids, e.g. water, mud

Note 1 to entry: The silo is usually charged from the top and discharged from one or more outlets at the bottom or side.

3.2.12
screw conveyor
conveyor for loose bulk materials with a trough tube as the carrying medium, with the material being moved by the action of a rotating screw

Note 1 to entry: This rotating screw can be rigid or flexible to take curves.

3.3 Methods and processes

3.3.1
vibration drilling
resonance drilling
sonic drilling
method with or without rotation by which the hole is formed by transmission of high frequency continuous compression waves through the drill rods which fluidise the ground immediately adjacent to the *drill bit* (3.2.5)

3.3.2
percussive drilling
method by which the hole is produced by crushing the ground or rock at the bottom of the *borehole* (3.2.3) while also striking it with the *drilling tool* (3.2.4) and then removing the cuttings out of the borehole

Note 1 to entry: Percussive drilling is either *top percussive drilling* (3.3.2.1) or *down the hole percussive drilling* (3.3.2.2).

Note 2 to entry: The cuttings can be continuously removed out of the borehole by a flushing medium which is carried to the drilling tool.

3.3.2.1
top percussive drilling
method where a piston strikes the top of the *drill string* (3.2.6) which then transmits the percussive energy to the *drill bit* (3.2.5)

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3.3.2.2
down the hole percussive drilling
method where a piston strikes directly on the *drill bit* (3.2.5) at the bottom of the *drill string* (3.2.6)

Note 1 to entry: The piston is typically powered by either hydraulic fluid, water or compressed air. At the same time the drill bit is rotated either continuously or intermittently.

3.3.3
rotary drilling
method where the *drilling tool* (3.2.4) at the bottom of the *borehole* (3.2.3) rotates while a feed force is applied by a *feed system* (3.5.12) or weight of *drill string* (3.2.6)

Note 1 to entry: The ground or rock at the bottom of the borehole is crushed or cut by pressure, shear or tensile stress produced by the different drilling tools. The cuttings are periodically or continuously removed out of the bore hole.

3.3.4
rotary percussive drilling
method that combines the *percussive drilling* (3.3.2) and *rotary drilling* (3.3.3)

3.3.5
double-head drilling
method in which the inner rods and outer casing are driven independently by two rotation heads

3.3.6
soil mixing
method where the soil material is disaggregated and mixed with binder, filler or both to produce a concrete part in soil

Note 1 to entry: Soil mixing is possibly done mechanically or hydraulically.

3.3.7
grouting
method for filling *borehole* (3.2.3) void

Note 1 to entry: The pressure of the grout pump is up to 0,3 MPa.

3.3.8
injection
method for either *grouting* (3.3.7) liquid mixtures or resins into voids/pores or for injecting of ground anchors or micro piles

Note 1 to entry: Two different methods can be distinguished: the injection of solid matter in a liquid mixture, e.g., cement, bentonite; and the injection of chemicals, e.g., water, waterglass, hardener.

Note 2 to entry: The pressure of the injection pump is up to 11 MPa.

3.3.9
jet-grouting
jetting
process where the soil or weak rock is disaggregated by means of high-pressure jet of fluid(s), then mixed with, and partially replaced by a cementing agent

Note 1 to entry: The pressure of the jetting or *high-pressure pump* (3.2.9) is up to 60 MPa, which creates an exit velocity of the jet from the nozzle of more than 100 m/s.

Note 2 to entry: Typical applications are underpinning of foundations of existing buildings, produce a dense pit or densify the pit floor, stabilize the soil while tunnelling or erect a dense screen for dams.

3.3.10
vibro-floatation
method by which the soil is being compacted by putting a vibrating *vibro-float* (3.4.6) vertical in the ground

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3.3.11
stone columning
process where the tool is advanced to create a hole either for *soil displacement* (3.3.12) into the ground or for soil removal, then feeding the hole with materials, e.g. stones

3.3.12
soil displacement
process consisting of advancing the tool into the ground with a *rotary drilling* (3.3.3) rig using both torque and crowd force, the soil being not removed but compacted by its displacement generated by the torque

3.3.13
diaphragm walling
method to process a wall made of cast in situ concrete or precast concrete panels constructed in a trench mainly temporarily supported by bentonite or polymer suspension

3.3.14
sheet piling
process of driving *sheet piles* (3.2.2) into the soil in a continuous row, usually to resist lateral pressure

3.4 Machines and equipment

3.4.1
drilling and foundation equipment
integrated machine, *interchangeable auxiliary equipment* (3.4.8) or machine equipped with interchangeable auxiliary equipment designed for one or more of the following applications:

— performing holes into soil or soil and rock mixture, for construction, exploration, water wells, soil and soil and rock mixture investigation;

— preparing, installing or retracting of longitudinal elements for foundations [e.g. *sheet piles* (3.2.2)], retaining-walls, slurry-walls, soil improvement;

— preparing and installing contiguous panels for retaining-walls and cut-off walls;

— installing elements for ground improvement as drainage or *injection* (3.3.8);

— installing elements for soil or soil and rock mixture nailing

Note 1 to entry: If drilling and foundation equipment is designed for different applications, it may consist of an assembly of machines and components.

3.4.2
drill rig
machine for drilling in soil or soil and rock mixture using either *percussive drilling* (3.3.2), *rotary drilling* (3.3.3) or *vibration drilling* (3.3.1) methods or a combination of these methods such as *rotary percussive drilling* (3.3.4) which can involve the addition of drill rods, tubes, casings or augers etc., normally threaded, as the hole extends

3.4.2.1
pre-armouring underground drill rig
drill rig (3.4.2) specifically designed for and solely intended to be used underground, for advanced roof and side wall ground reinforcement, e.g. pre-armouring, fore-poling or spilling, in a horizontal or almost horizontal orientation

Note 1 to entry: The machine can be fitted with one or more feed beams and a *boom* (3.5.2) mounted working platform. Reinforcement bar loader may be present depending on the reinforcement technology.

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3.4.2.2
suspended drill rig
non-self-propelled *drill rig* (3.4.2), not mounted on powered undercarriage and with external power system designed to work on steep slopes, near to vertical inclines or in very narrow spaces

Note 1 to entry: They are mounted in a fixture which can be:

— suspended in ropes;

— mounted in a stand;

— suspended by other means e.g. hydraulic jacks.

3.4.3
piling equipment
assembly of machines and components designed for installation or extraction of *pile elements* (3.2.1), which are either dynamic type (e.g. impacting and vibration) [(*impact extractor* (3.4.3.3)] or static type [e.g. *hydraulic pile press-in and extraction machinery* (3.4.3.5))

3.4.3.1
piling rig
carrier machine (3.4.10) complete with *leader interface* (3.5.3) and *leader* (3.5.1), but without pile installation *attachment* (3.5.4) and other equipment

3.4.3.2
impact hammer
equipment that drives piles or longitudinal elements into the soil

Note 1 to entry: Impact hammers can be:

— winch operated: the striking mass is raised by a wire rope on a winch or similar means (see Figure 18);

— steam or air operated: the striking mass is raised by air or steam pressure (see 5.4.4.2);

— diesel-powered: the striking mass is raised by the expansion of gases resulting from the combustion of fuel and air; normally the power source is diesel, but can also be kerosene, methanol or other fluid (see Figure 13);

— hydraulically powered: the striking mass is raised by hydraulic pressure (see Figure 21).

Note 2 to entry: Raising the striking mass produces the striking energy of a hammer. At the end of the subsequent downward motion, the ram impacts directly or indirectly on the pile, transferring its energy in a relative short time.

Note 3 to entry: In the case of indirect impact on the pile there are interface assemblies between the striking mass and the pile, which may comprise an anvil together with any form of pile cap assembly described in this document.

Note 4 to entry: An impact hammer can be combined with an *impact extractor* (3.4.3.3).

3.4.3.3
impact extractor
equipment that withdraws, by backward impacts, piles or longitudinal elements from the soil

Note 1 to entry: The striking energy of an extractor is derived from the upward or backward kinetic energy of a rising mass being transferred to the head of a pile by means of a linkage, wire rope connection or other mechanical means.

Note 2 to entry: An impact extractor can be combined with an *impact hammer* (3.4.3.2).

3.4.3.4
vibratory driver and extractor
machine that generates unidirectional vibrations, in most instances vertical vibrations, designed to install or extract piles or longitudinal elements

Note 1 to entry: For an example, see Figure 22, Figure 23 and Figure 24.

Note 2 to entry: Vibration can be produced by eccentric masses or other means, while a device, placed above the vibratory body dampens the vibrations for the protection of the *carrier machine* (3.4.10).

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Note 3 to entry: The element to be installed into or extracted from the ground is rigidly held under the vibratory gearbox by means of one or several clamps. However, for units designed for annular grip, the *clamping device* (3.5.6) can be located on the side(s) of the vibratory gearbox(es).

3.4.3.5
hydraulic pile press-in and extraction machinery
machinery or movable device designed for installing or extracting piles or longitudinal elements by applying a static force to them using several vertical hydraulic jacks, implying a reaction force

Note 1 to entry: The reaction force can be taken by the weight of the machinery or by clamping on a number of *sheet piles* (3.2.2) that have previously been installed into the ground.

Note 2 to entry: For an example, see Figure 26 to Figure 28.

3.4.4
diaphragm walling equipment
carrier machine (3.4.10) and cutting tools to cut panels for diaphragm walls

3.4.4.1
diaphragm wall grab
rope operated or hydraulic excavating device composed of *clamshell* (3.4.4.2) and a guiding device for cutting a diaphragm wall

Note 1 to entry: For an example, see Figure 32 and Figure C.17.

3.4.4.2
clamshell
bucket attached to the bottom end of the grab frame that digs or grabs in a generally vertical direction, discharging below and above the ground reference plane (GRP)

[SOURCE: ISO 7135:2009,[5] 3.4.5, modified — The preferred term has been changed from "grab equipment" to "clamshell"; "boom, arm and linkage that uses a grab-type or clamshell-type bucket" has been replaced by "bucket attached to the bottom end of the grab frame".]

3.4.4.3
diaphragm wall cutter
assembly of counter-rotating wheels hydraulically or electrically driven within a guide body designed to break up soil or rock for cutting a diaphragm wall, comprising a mud pump or air-lift system to remove the cuttings

3.4.5
jetting, grouting and injection equipment
machine for mixing, pumping or injecting grout, cement, concrete and drilling fluids

3.4.5.1
jet grouting pump unit
grout pump unit
power-driven displacement pump with necessary power-source, transmission and structural supporting elements for *jet-grouting* (3.3.9)

Note 1 to entry: A pump unit itself, which terminates at the inlet and outlet connections, can include ancillary equipment, such as relief valves or pulsation suppression devices, when furnished by the supplier and mounted on the pump or pump unit.

3.4.5.2
pumping system
system consisting of a pump or pumps and those interacting or interrelating elements, which together accomplish the specified performance work

Note 1 to entry: The pumping system generally includes (but is not necessarily limited to) the *pump driver* (3.6.4), drives, cabling, control and monitoring devices and those piping elements that transfer liquid from and to the pump.

[SOURCE: ISO 17769-2:2012,[6] 2.1.7, modified — Note 2 to entry has been removed.]

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3.4.5.3
rotary positive displacement pump
pump in which liquid is trapped in confined volumes and transported from an inlet port to an outlet port by a rotational movement of the pumping element or elements

[SOURCE: ISO 14847:1999,[7] 3.1, modified — "a machine" has been replaced by "pump"; note 1 to entry has been removed.]

3.4.5.4
centrifugal pump
non-volumetric pump in which the flow of the liquid is achieved by means of one or more impellers

[SOURCE: ISO 12809:2020,[8] 3.2]

3.4.5.5
roller rotary pump
hose pump
peristaltic pump that discharges liquid material by squeezing an elastic tube by one or several rotating rollers

3.4.6
vibro-float
deep vibrator
equipment to densify the soil by using a vertical lance driven into the ground, where vibrations are generated by an unbalanced rotating mass at the bottom part of the lance

Note 1 to entry: The hole which is generated by densifying the ground is filled with soil improving material such as gravel. This material can be fed by a special material tube alongside the deep *vibrator* (3.4.15) or by filling the emerging hole with gravel by loaders. The apparatus can be rope suspended or guided on a *leader* (3.5.1). The vibrations are normally generated by hydraulic or electric power and have a usual range between 25 Hz and 60 Hz.

3.4.7
cutter soil mixing equipment
assembly of counter-rotating wheels hydraulically or electrically driven within a guide body designed to cut and mix soil or rock with cement and water mixture simultaneously injected

3.4.8
interchangeable auxiliary equipment
supplementary equipment that can be attached to a *carrier machine* (3.4.10) to allow it to be used for drilling and foundation operations

3.4.9
stone columning rig
machine for performing *stone columning* (3.3.11) process by using stone columning equipment

Note 1 to entry: Examples of stone columning technics are wet top feed, dry bottom feed.

3.4.10
carrier machine
machine providing mobility for and supporting the weight of the *drilling and foundation equipment* (3.4.1), together with the accessories and the load (e.g. pile, excavated soil)

Note 1 to entry: The carrier is part of the drilling and foundation equipment in integrated machines.

Note 2 to entry: A carrier machine may also accommodate the necessary power source and controls of the drilling and foundation equipment.

Note 3 to entry: It may be an adapted lifting crane or earth moving machine or other machine specifically designed or adapted for this purpose.

3.4.11
external mechanised tool handling system
mechanised handling system for either rods or tools, or both, that is not part of the *drill rig* (3.4.2)

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3.4.12
desanding plant
equipment used to clean the drilling mud from gravel, sand or silt, or all, the separation of the solid particles from the drilling mud being achieved by using centrifugal force and by sieving the mud through screens and shakers

3.4.13
top drilling equipment
equipment to drill large diameter piles in hard rock conditions, fitted with a *drill string* (3.2.6) carrying roller bits to allow the removal of the spoil through the central tube of the drill string

3.4.14
top drilling equipment with reverse circulation spoil removal
top drilling equipment (3.4.13) to drill large diameter piles in hard rock conditions, fitted with a *drill string* (3.2.6) carrying roller bits and a reverse fluid circulation system, to allow the removal of the spoil through the central tube of the drill string

3.4.15
vibrator
equipment to install or extract piling elements by high-frequency oscillation into or out of the ground

Note 1 to entry: The force is generated by vibrations, which have a usual range between 20 Hz and 50 Hz. These vibrations will soften the ground; the weight or pull down or pulling force will move the elements. The vibrations are generated by unbalanced weights, which are driven by hydraulic or electric power. Vibrators can be mounted at the *leader* (3.5.1) of a *piling rig* (3.4.3.1) or can be free riding at top of the element, suspended by a rope or connected to a cardan or universal joint to the carrier machine (3.4.10).

3.5 General components and systems

3.5.1
leader
mast
structure mounted to the *carrier machine* (3.4.10) guiding the installation and extraction equipment

3.5.1.1
direct mounted leader
direct mounted mast
leader (3.5.1) directly coupled to the *carrier machine* (3.4.10)

Note 1 to entry: The major weight of leader, pile etc. is taken by the *leader interface* (3.5.3) near the bottom of the leader.

3.5.1.2
boom supported leader
boom supported mast
leader (3.5.1) connected to and extending above the *boom* (3.5.2) head of the *carrier machine* (3.4.10)

Note 1 to entry: The major weight of leader, pile etc. is taken by the *leader interface* (3.5.3) at its fixing with the boom head. A further steadying connection is made by another part of the leader interface at the lower leader structure.

3.5.1.3
suspended leader
suspended mast
leader (3.5.1) with free hanging structure from the *carrier machine* (3.4.10)*boom* (3.5.2) head

Note 1 to entry: The carrier machine can be a mobile crane or a cable excavator.

3.5.2
boom
structure for positioning of the *leader* (3.5.1), feed beam or working platform, or for directly supporting an excavating tool

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3.5.3
leader interface
optional component (e.g. universal joints, sliding or telescopic elements) that ensures connection between the *carrier machine* (3.4.10) and the *leader* (3.5.1)

Note 1 to entry: It may be attached to the carrier machine for mobility in a number of ways, depending upon the leader type.

3.5.4
attachment
assembly of components that can be mounted onto the *carrier machine* (3.4.10) or equipment for specific use

[SOURCE: ISO 6165:2022,[9] 3.1.13, modified — "base machine" has been replaced by "carrier machine".]

3.5.5
stabilising device
device and system designed to stabilise the machine by either supporting or levelling, or both, of the complete structure

EXAMPLE Outrigger, jacks, suspension locking devices, extending axles.

3.5.6
clamping device
hydraulically or mechanically actuated assembly which can grip the *sheet piles* (3.2.2), steel beams or tubes and allows the transmission of vibrations from a *vibrator* (3.4.15), extraction forces from an *impact extractor* (3.4.3.3), or forces from a *hydraulic pile press-in and extraction machinery* (3.4.3.5)

Note 1 to entry: These assemblies can also be integral with the construction of the pile installation or extraction equipment.

3.5.7
pile threader
pile handling device designed to insert *sheet piles* (3.2.2) into one another to form a structure (e.g. a curtain wall)

Note 1 to entry: The pile threader dispenses with the need to post an operator near the lifted sheet pile or at height.

3.5.8
pile guide
device either fixed to or guided by the *leader* (3.5.1) to provide location and support to the pile when at forward or backward inclinations

3.5.9
acoustic shroud
means enclosing part or all of the *piling equipment* (3.4.3) and pile to reduce the emission of noise during pile operations

3.5.10
shock and vibration absorber
device to isolate the supporting structure from the shocks and vibrations being transmitted from the *drilling and foundation equipment* (3.4.1)

Note 1 to entry: It is commonly associated with *vibratory driver and extractor* (3.4.3.4) and *impact extractor* (3.4.3.3).

Note 2 to entry: It is often integral with the construction of the pile installation or extraction equipment.

3.5.11
kelly bar
transmission part of a *drilling tool* (3.2.4) which extends the drilling depth using a specific steel bar or tube designed for transferring torques and forces onto the drilling tool

Note 1 to entry: A kelly bar may be telescopic with friction transmission between element or with an interlockable function. Tools are attached to the lower end of the kelly.

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3.5.12
feed system
arrangement of drive elements, which force the rotary head, pile hammer or *vibrator* (3.4.15) to move the tool or *pile element* (3.2.1) into the ground or out of the ground in the forward or backward direction

Note 1 to entry: Drive elements can be a rope on a winch, a motor- and chain-arrangement, a cylinder- and chain-arrangement, a rack and pinion, a cylinder- and rope-arrangement or a combination of these.

Note 2 to entry: A feed system is possibly a pull-up or pull-down system in vertical operation.

3.5.13
rotary drill head
device guided by the *leader* (3.5.1) driving the *drill string* (3.2.6) in rotation providing speed and *torque capacity* (3.9.3.2)

3.6 Tools and accessories

3.6.1
spindle
part of drill head that transmits the drilling rotation speed and torque to the *drill string* (3.2.6)

3.6.2
drive cap
accessory located between the striking mass and the pile which is guided from a *leader* (3.5.1) or contained within the structure of the *piling equipment* (3.4.3)

Note 1 to entry: Accessories may incorporate cap filling or cushion material between the striking mass and the cap or other mechanical features, which influence the shape of the impact stress wave in the pile.

Note 2 to entry: Drive caps can be attached to a plate to enable larger profile piles to be driven.

3.6.3
helmet
drive cap (3.6.2) provided with a recess on its underside to locate a pile and accommodate additional cushioning material to protect pile heads from damage

3.6.4
pump driver
machine supplying mechanical energy to power the pump

Note 1 to entry: This can include, but is not limited to, electric motors, hydraulic motors, and internal combustion engines.

[SOURCE: ISO 17769-1:2012,[10] 2.1.17.23, modified — The admitted term "driver" has been removed; in note 1 to entry, "turbines" and "pneumatic motors" have been removed.]

3.6.5
variable speed drive
any device that can be utilized to vary the speed of the pump, either mechanically or electrically

Note 1 to entry: This can include, but is not limited to, eddy current drives, variable frequency drives, a hydraulic clutch, fluid drives, variable V-belt drives, and various variable mechanical drives.

[SOURCE: ISO 17769-2:2012,[6] 2.2.3, modified — In note 1 to entry, "magnetic drives" and "steam turbines and gas turbines" have been deleted.]

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3.7 Undercarriage types

3.7.1
crawler mounted
carrier machine (3.4.10) mounted on a tracked undercarriage

Note 1 to entry: For an example, see Figure 9, Figure 12, Figure 13, Figure 14, and Figure 29.

3.7.2
wheel mounted
carrier machine (3.4.10) mounted on a wheeled undercarriage

Note 1 to entry: For an example, see Figure 15 and Figure 16.

3.7.3
rail mounted
carrier machine (3.4.10) whose wheeled undercarriage runs on rails

Note 1 to entry: For an example, see Figure 17.

3.8 Design and performance characteristics

3.8.1
slewing
rotation of the upper structure of *drilling and foundation equipment* (3.4.1) in relation to a fixed reference frame on the ground

3.8.2
stability angle
α_{sr}
minimum among *tipping angles* (3.8.3) relative to all *tipping lines* (3.8.4) within a load case and position, to be found for all load cases, positions and all foreseen combinations of loads

3.8.3
tipping angle
angle a machine can be tilted before it becomes unstable while the machine is subjected to a system of loads (own weight, wind, accelerations, working loads)

Note 1 to entry: In case travel and operating on slopes is allowed, tilting starts from the maximum allowed operating slope.

3.8.4
tipping line
line about which *drilling and foundation equipment* (3.4.1) on various mountings can tip and which are designed to calculate the stability

Note 1 to entry: Tipping lines for drilling and foundation equipment, crawler and *wheel mounted* (3.7.2):

— in the direction of travel, the lines connecting the lowest support points of contact of the idlers, rollers or the drives of the tracks or the front wheels;

— in sideward direction (perpendicular to the direction of travel), the lines passing through the centres of the support contact areas on each side of the chassis.

Tipping lines for drilling and foundation equipment on support legs:

— the lines passing through the outer edges of the support contact areas on each side of the chassis.

3.8.5
rotary spindle power
rotational power at the *spindle* (3.6.1) output

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3.8.6
maximum feed speed
maximum speed of movement of the tool or *carriage* (3.2.7) at no load in the advancing direction

3.8.7
maximum retracting speed
maximum speed of movement of the tool or *carriage* (3.2.7) at no load in the reverse direction

3.8.8
maximum forward feed force
maximum force measured to stall movement of the *carriage* (3.2.7) in the advancing direction

3.8.9
maximum pullback force
maximum force measured to stall movement of the *carriage* (3.2.7) in the retracting direction

3.8.10
maximum drilling fluid power
maximum power calculated from measured values of pressure of the drilling fluid and its flow simultaneously available at the fluid pump outlet

3.8.11
maximum drilling fluid pressure
maximum pressure measured at the fluid pump outlet

[SOURCE: ISO 21467:2023,[1] 3.7.1, modified — "spindle" has been changed to "fluid pump outlet".]

3.8.12
maximum drilling fluid flow
maximum flow measured at the fluid pump outlet

[SOURCE: ISO 21467:2023,[1] 3.7.2, modified — "spindle" has been changed to "fluid pump outlet".]

3.8.13
rotating speed
number of revolutions of the pump shaft in the considered time interval

3.8.14
flow rate
volume of liquid that flows through the pump per unit of time

3.8.15
pump power consumption
power given to the pump by the power source, measured at the inlet shaft of the pump

3.8.16
maximum theoretical pumping flow
theoretical delivery flow which is obtained by the maximum displacement volume per unit of time of a volumetric pump

Note 1 to entry: For a piston pump, the maximum theoretical pumping flow is calculated as follow:

$$Q_{\text{th}} = \left(\frac{\pi \cdot d^2}{4} \right) \cdot s \cdot n \cdot r \cdot 10^{-6}$$

where

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Q_{th} is the theoretical delivery volume (l/min);

d is the diameter of the cylinder piston (mm);

s is the stroke (mm);

n is the number of crankshaft revolutions per minute;

r is the number of plungers.

Note 2 to entry: The displacement volume is obtained, e.g. by linear piston or rotating screw of the pump.

3.8.17
measurement of performance characteristics
measurement carried out with the machine in *steady state* (3.8.18) under specified conditions (e.g. temperature, wind, moisture) that makes it repeatable and consistent

Note 1 to entry: In this document, the measurement of performance characteristics is considered when defining the following performance characteristics.

3.8.18
steady state
condition in which all relevant operational parameters are not significantly changing with time

3.8.19
slewing speed
rotation speed of the upper structure of *drilling and foundation equipment* (3.4.1) in relation to a fixed reference frame on the ground

3.8.20
maximum travel speed
speed of the *carrier machine* (3.4.10) in both forward and reverse directions at *operating mass* (3.9.1.1) at maximum engine rotational speed

3.8.21
maximum spindle torque
maximum torque transmitted by the *spindle* (3.6.1) before stalling

3.8.22
maximum spindle speed
maximum measured revolutions per minute of the *spindle* (3.6.1) under no load

[SOURCE: ISO 21467:2023,[1] 3.6.2]

3.9 Main characteristics of drilling and foundation equipment

3.9.1 General characteristics

3.9.1.1
operating mass
mass of the base machine, with equipment and empty *attachment* (3.5.4) in the most usual configuration as specified by the manufacturer, and with the operator (75 kg), full fuel tank and all fluid systems (i.e. hydraulic oil, transmission oil, engine oil, engine coolant) at the levels specified by the manufacturer and, when applicable, with sprinkler water tank(s) half full

Note 1 to entry: The mass of an operator is not included for non-riding machines.

Note 2 to entry: Ballast mass at delivery can be included if specified by the manufacturer.

[SOURCE: ISO 6016:2008,[12] 3.2.1, modified — The abbreviated term "OM" has been removed.]

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3.9.1.2
shipping mass
transport mass
mass of the base machine without an operator, with the fuel level at 10 % of tank capacity or with the minimum fuel level needed for machine shipping purposes as specified by the manufacturer, whichever is higher, with all fluid systems at the levels specified by the manufacturer and with empty sprinkler tank(s), when applicable, and with or without equipment, ballast, *attachment* (3.5.4), cab, canopy, operator-protective structures, wheels and counterweights as stated by the manufacturer

Note 1 to entry: If the manufacturer intends that the machine be partially disassembled for shipping purposes, the masses of the disassembled items will also be stated.

[SOURCE: ISO 6016:2008,[12] 3.2.6, modified — The abbreviated term "OM" has been removed; the admitted term "transport mass" has been added.]

3.9.1.3
average ground pressure
drilling machine *operating mass* (3.9.1.1) divided by ground contact area

3.9.2 Dimensions

3.9.2.1 Overall dimensions

3.9.2.1.1
overall machine operating height
H
distance from the ground to the highest extremity in working position

Note 1 to entry: Dimension H is illustrated in Figure A.1.

3.9.2.1.2
overall machine operating length
L
longitudinal distance between the planes of the outer extremities in working position

Note 1 to entry: Dimension L is illustrated in Figure A.1.

3.9.2.1.3
overall machine operating width
W
transverse distance between the planes of the outer extremities in working position

Note 1 to entry: Dimension W is illustrated in Figure A.4.

3.9.2.2 Shipping dimensions

3.9.2.2.1
shipping height
transport height
H_2
height from the ground reference plane (GRP) to the highest point on the machine without the *boom* (3.5.2), counterweight, exhaust pipe, air cleaner inlet pipe, or other easily removable components

Note 1 to entry: Dimension H_2 is illustrated in Figure A.3.

Note 2 to entry: Foldable components can affect the shipping height if not folded.

[SOURCE: ISO 7136:2006,[11] 3.3.9, modified — The admitted term "transport height" has been added; the symbol has been changed from "H_3" to "H_2"; notes 1 and 2 to entry have been added.]

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3.9.2.2.2
shipping machine length
L_1
longitudinal distance between the planes of the outer extremities in shipping position

Note 1 to entry: Dimension L_1 is illustrated in Figure A.2.

3.9.2.2.3
overall width in transport position
W_1
overall width of the machine with the *boom* (3.5.2), counterweight, and counterweight support removed (if removable)

Note 1 to entry: Dimension W_1 is illustrated in Figure A.5.

3.9.2.3 Adjusting tilt angles of main frame

3.9.2.3.1
maximum adjusting tilt angle of main frame to the front
ϕ_1
maximum possible angle of main frame of the hydraulic pile press-in and extraction machine, from the vertical axis in the direction of the machine front

Note 1 to entry: Dimension ϕ_1 is illustrated in Figure 28.

3.9.2.3.2
maximum adjusting tilt angle of main frame to the rear
ϕ_2
maximum possible angle of main frame of the hydraulic pile press-in and extraction machine, from the vertical axis in the direction of the machine rear

Note 1 to entry: Dimension ϕ_2 is illustrated in Figure 28.

3.9.2.3.3
maximum angle of pile slope to the left and right
ϕ_3
maximum possible angle of the pile slope given by the angle of main frame of the hydraulic pile press-in and extraction machine, from the vertical axis in the direction of the machine left and right sides

Note 1 to entry: Dimension ϕ_3 is illustrated in Figure 28.

3.9.3 Drill rods characteristics

3.9.3.1
drill pipe mass
measured mass of an empty drill pipe

[SOURCE: ISO 21467:2023,[1] 3.5.2]

3.9.3.2
torque capacity
maximum torque the pipe can withstand without permanent deformation with the moment applied and resisted through the end connections

Note 1 to entry: For an example, see Figure 14.

3.9.3.3
push/pull capacity
maximum compressive and tensile loads the pipe can withstand without permanent deformation, when testing the pipe with axial opposite loads applied at both ends of the pipe

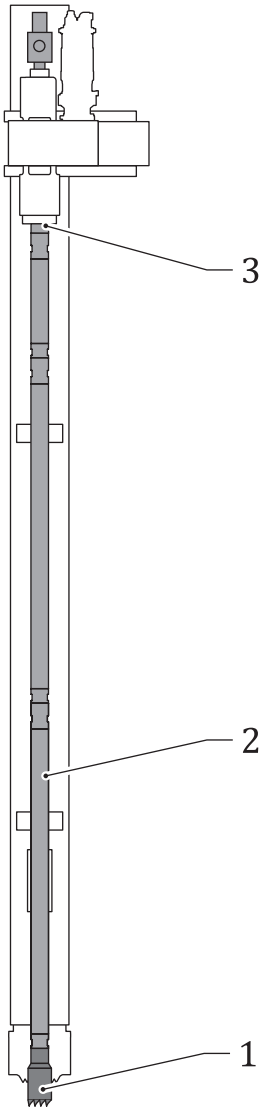
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3.9.3.4
make-up torque
manufacturer's recommended tightening torque when two joints of drill pipe are screwed together

4 Nomenclature

4.1 General components and systems

Figure 1 to Figure 8 show examples of general components and systems.



Key
1 drill bit
2 drill rod
3 spindle

Figure 1 — Example of a drill string

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