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ISO 7135

Second edition
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Earth-moving machinery — Hydraulic excavators — Terminology and commercial specifications

Engins de terrassement — Pelles hydrauliques — Terminologie et spécifications commerciales

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 7135 was prepared by Technical Committee ISO/TC 127, *Earth-moving machinery*, Subcommittee SC 4, *Terminology, commercial nomenclature, classification and ratings*.

This second edition cancels and replaces the first edition (ISO 7135:1993), which has been technically revised.

Earth-moving machinery — Hydraulic excavators — Terminology and commercial specifications

1 Scope

This International Standard establishes terminology and the content of commercial literature specifications for self-propelled crawler and wheeled hydraulic excavators and their equipment and attachments.

It is applicable to common components and does not cover terms or commercial specifications specific to walking excavators.

2 Normative references

The following referenced documents are indispensable for the application 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 3450, *Earth-moving machinery — Braking systems of rubber-tyred machines — Systems and performance requirements and test procedures for braking systems*

ISO 5010, *Earth-moving machinery — Rubber-tyred machines — Steering requirements*

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

ISO 6015, *Earth-moving machinery — Hydraulic excavators and backhoe loaders — Methods of determining tool forces*

ISO 6165:2006, *Earth-moving machinery — Basic types — Identification and terms and definitions*

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

ISO 6746-2:2003, *Earth-moving machinery — Definitions of dimensions and codes — Part 2: Equipment and attachments*

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

ISO 10265, *Earthmoving machinery — Crawler machines — Performance requirements and test procedures for braking systems*

ISO 10567, *Earth-moving machinery — Hydraulic excavators — Lift capacity*

ISO 14396, *Reciprocating internal combustion engines — Determination and method for the measurement of engine power — Additional requirements for exhaust emission tests in accordance with ISO 8178*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 6165, ISO 6746-1 and ISO 6746-2 and the following apply.

3.1 General

3.1.1
excavator
self-propelled machine on crawlers, wheels or legs, having an upper structure capable of a 360° swing and with mounted equipment, which is primarily designed for excavating with a bucket, without movement of the undercarriage during the work cycle

NOTE 1 An excavator work cycle normally comprises excavating, elevating, swinging and discharging of material.

NOTE 2 An excavator can also be used for object or material handling/transportation.

NOTE 3 Figures 1 to 3 describe the types of excavator defined in 3.1.1.1 to 3.1.1.3.

3.1.1.1
minimal swing radius excavator
MSRX
excavator designed for operation in a confined space, having an upper structure with a short swinging radius, with its equipment and attachment swinging within 120 % of the width of the undercarriage

3.1.1.2
compact excavator
excavator with an operating mass less than or equal to 6 000 kg

3.1.1.3
walking excavator
excavator with three or more supporting legs, which can be articulated, telescopic or both, and that can be fitted with wheels

3.1.2
base machine
excavator with a cab or canopy and operator-protective structures if required, without equipment or attachments, but possessing the necessary mountings for such equipment and attachments

NOTE Figures 4 and 5 describe the base machine and its dimensions.

3.1.3
cab riser
any spacer that increases the height of the SIP greater than 250 mm relative to the normal configuration or a system that raises the cab away from the excavator in an upward direction either through a mechanical or hydraulic system

NOTE For the SIP (seat index point), see ISO 5353.

3.1.4 Equipment and attachment positions

3.1.4.1
transport position
orientation in which the equipment and its affixed attachment is placed when the excavator is positioned for shipment or transport on a flat level surface, such as a rail car or flat bed trailer, as recommended by the manufacturer

NOTE The minimal overall length and height of the excavator will result from this position.

3.1.4.2
manoeuvring position
orientation in which the equipment and its affixed attachment is placed when the excavator is positioned as recommended by the manufacturer for travel requiring numerous turns

3.1.4.3
travel position
orientation in which the equipment and its affixed attachment is placed when the excavator is positioned as recommended by the manufacturer for long-distance straight-line travel

3.2 Masses

3.2.1
operating mass
OM
mass of the base machine, with equipment and empty attachment 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

[ISO 6016:2008, definition 3.2.1]

3.2.2
shipping mass
SM
mass of the base machine without an operator, and with fuel level at 10 % of tank capacity or with 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), if required, and with or without equipment, ballast, attachment, cab, canopy, operator-protective structures, wheels and counterweights as stated by the manufacturer

NOTE If the manufacturer intends that the machine be partially disassembled for shipping purposes, the masses of the disassembled items will also be stated.

[ISO 6016:2008, definition 3.2.6]

3.3 Attachments

3.3.1
attachment
assembly of components that can be mounted onto the base machine or equipment for specific use

[ISO 6746-2:2003, definition 3.5]

NOTE Attachments for hydraulic excavators normally are the working tool attached to the end of the arm or a telescopic boom that provides the digging, cutting, grabbing and processing function of the excavator.

3.3.2
hoe bucket
hoe-type bucket
bucket attached to the arm or telescopic boom and linkage equipment that generally cuts towards the machine

See Figure 12.

3.3.3
grab-type bucket
grab bucket
clamshell bucket
clamshell-type bucket
bucket attached to the arm and linkage equipment that digs or grabs in a generally vertical direction, discharging below and above the ground reference plane (GRP)

See Figures 16 and 17.

3.3.4
shovel bucket
shovel-type bucket
bucket attached to the arm and linkage equipment that cuts away from the machine and generally upwards, discharging above the ground reference plane (GRP)

See Figure 18.

3.3.5
quick coupler
assembly of components attached to the end of the arm and linkage that facilitates the quick mounting and removal of the attachment from the arm and linkage

NOTE A quick coupler can be considered as part of the equipment if integrated directly into the arm.

3.3.6
blade
component mounted on the undercarriage of the base machine that is generally used for backfilling trenches and for limited excavation, and which can also be used as a stabilizer

3.4 Equipment

3.4.1
equipment
set of components mounted onto the base machine to provide the primary design function of the excavator

NOTE 1 The definitions given in 3.4.2 to 3.4.6 are based on the main geometrical digging curves of most common applications of hydraulic excavators.

NOTE 2 Other equipment and derivatives are available.

NOTE 3 Figures 6 to 21 show types of equipment.

3.4.2
telescopic boom equipment
boom, with the necessary mountings for an attachment, which can be extended and retracted, and that generally cuts toward the machine through the telescoping action of the boom

See Figure 21.

NOTE It is primarily used for excavation and/or grading of slopes either above or below ground level.

3.4.3
hoe equipment
boom, arm and linkage with the mountings for a hoe-type bucket that generally cuts towards the machine

See Figure 6.

NOTE It is primarily used for below-ground level excavation.

3.4.4
shovel equipment
boom, arm and linkage that use a shovel-type bucket attached at the end of the arm that cuts away from the machine and generally upwards

See Figure 18.

NOTE It is primarily used for above-ground level excavation.

3.4.5
grab equipment
clamshell equipment
boom, arm and linkage that uses a grab-type or clamshell-type bucket that digs or grabs in a generally vertical direction, discharging below and above the GRP

See Figure 25.

3.4.6
swing-type boom
boom assembly mounted on the front of the undercarriage that can articulate, allowing the machine to excavate at various angles relative to the longitudinal centreline of the machine

NOTE A swing-type boom can allow the machine to excavate adjacent to a vertical surface.

4 Base machine

4.1 Classification by type

The excavators shall be classified by their undercarriage and by their equipment.

See also Clause 5.

a) **Undercarriage**

- Crawler excavator (see Figure 1)
- Wheeled excavator (see Figure 2)
- Walking excavator (see Figure 3)

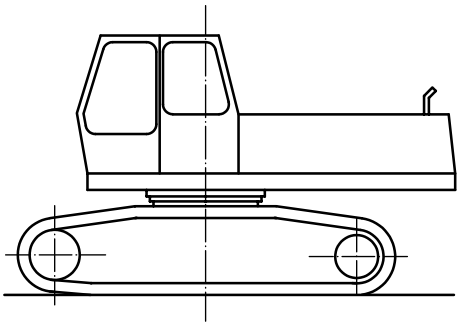


Figure 1 — Crawler excavator

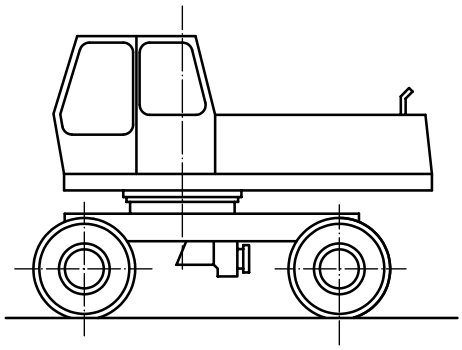


Figure 2 — Wheeled excavator

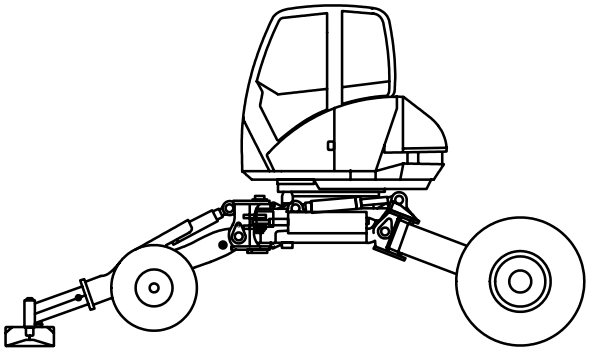


Figure 3 — Walking excavator

b) **Equipment**

— Backhoe (see Figure 23)

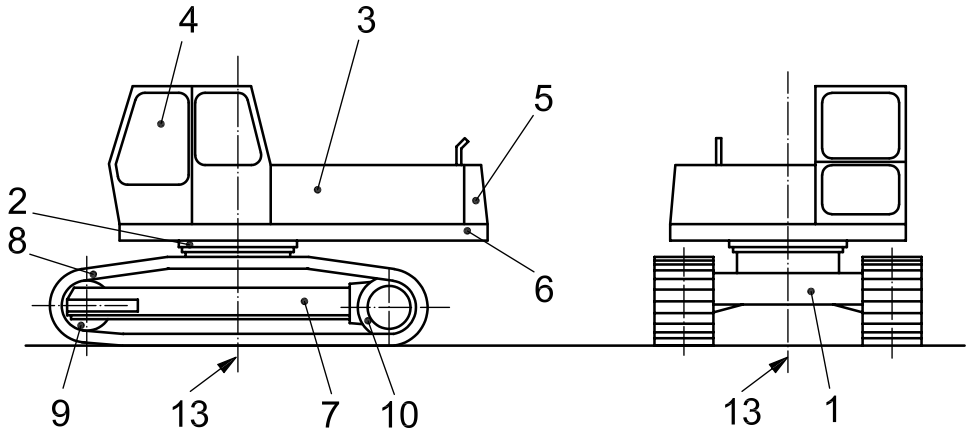
— Shovel (see Figure 24)

— Clamshell (see Figure 25)

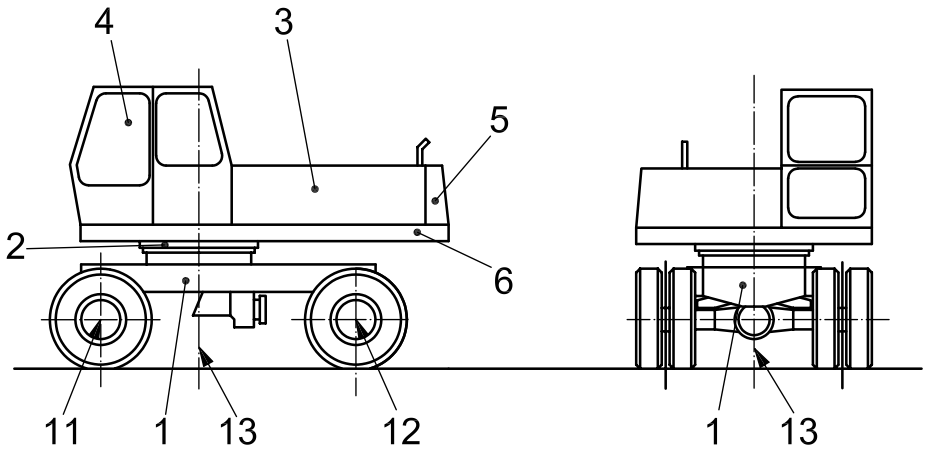
— Telescoping boom (see Figure 26)

4.2 Component nomenclature

Component nomenclature shall be in accordance with Figure 4 a) or b), according to whether the base machine is a crawler or wheeled excavator.



a) Crawler excavators



b) Wheeled excavators

Key

1	undercarriage	8	crawler tracks
2	swing bearing	9	idler
3	upper structure	10	sprocket
4	cab	11	steering axle (front)
5	counterweight	12	rigid axle (rear)
6	revolving frame	13	axis of rotation
7	track frame		

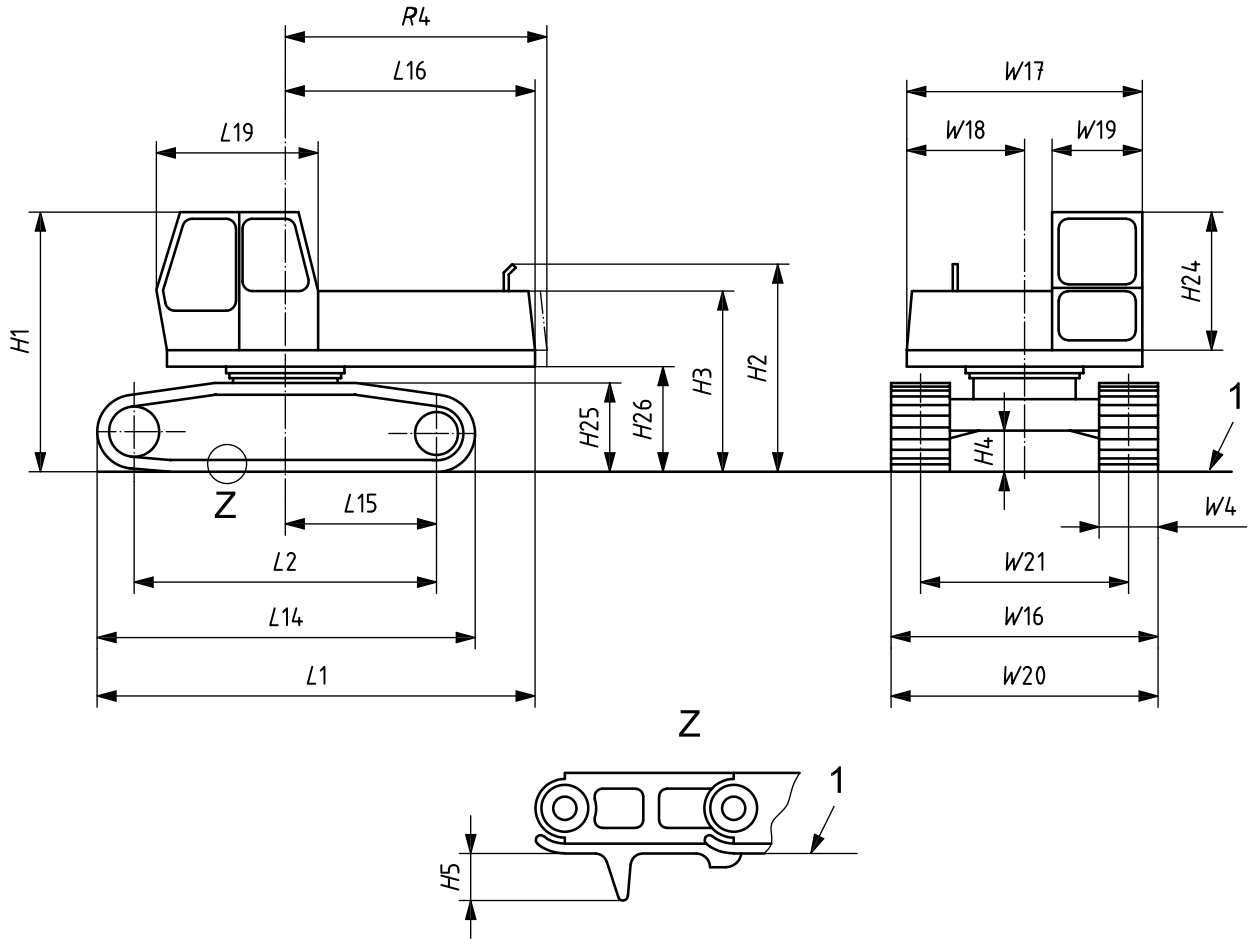
Figure 4 — Base machine nomenclature

4.3 Dimensions

The base-machine dimensions shall be in accordance with Figure 5.

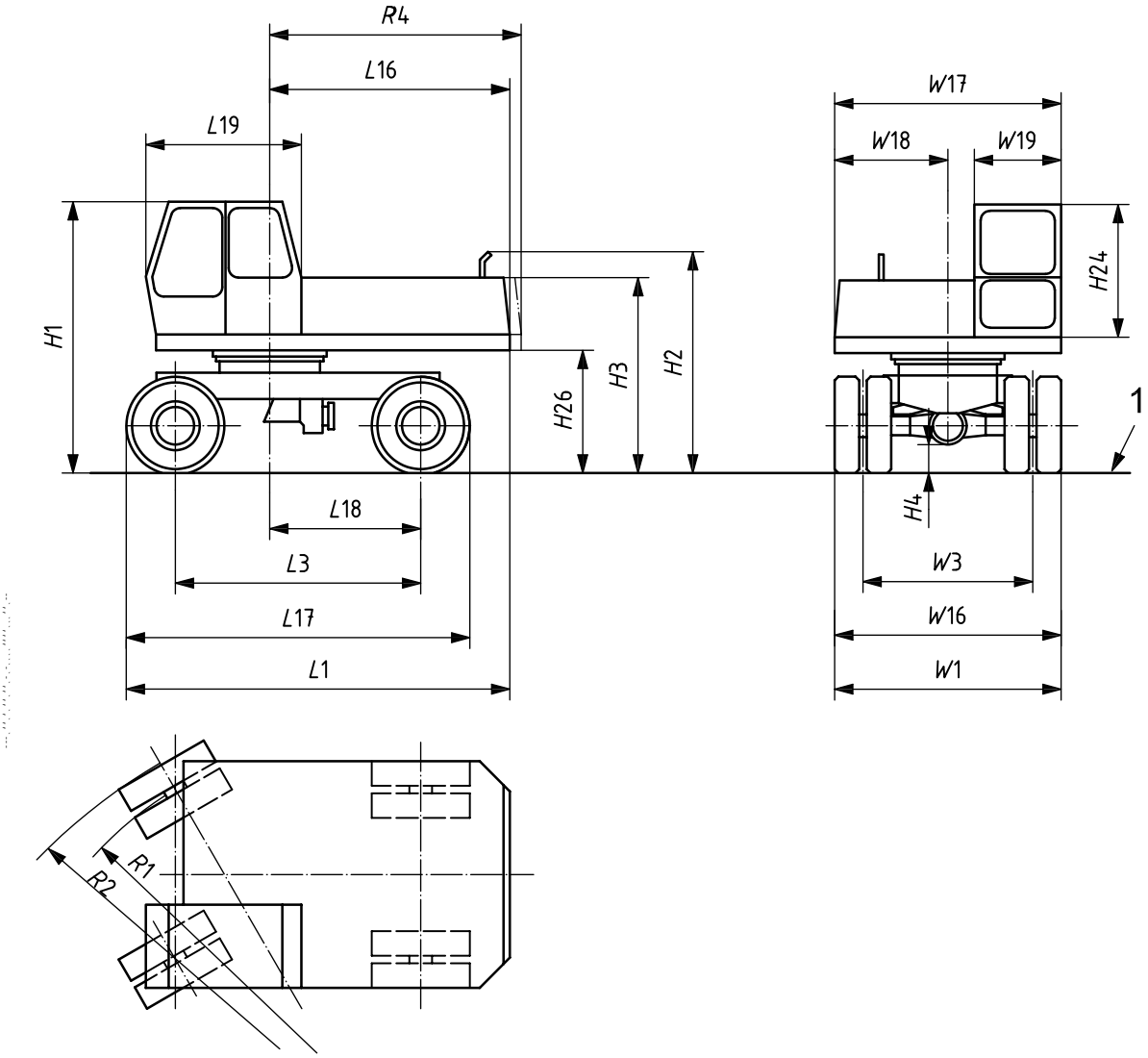
The definitions of those base-machine dimensions common to earth-moving machinery are given in ISO 6746-1.

The base-machine dimensions shown in Figure 5 that are specific to hydraulic excavators are defined in Annex A.



a) Crawler excavators

Figure 5 — Base machine dimensions



b) Wheeled excavators

Key

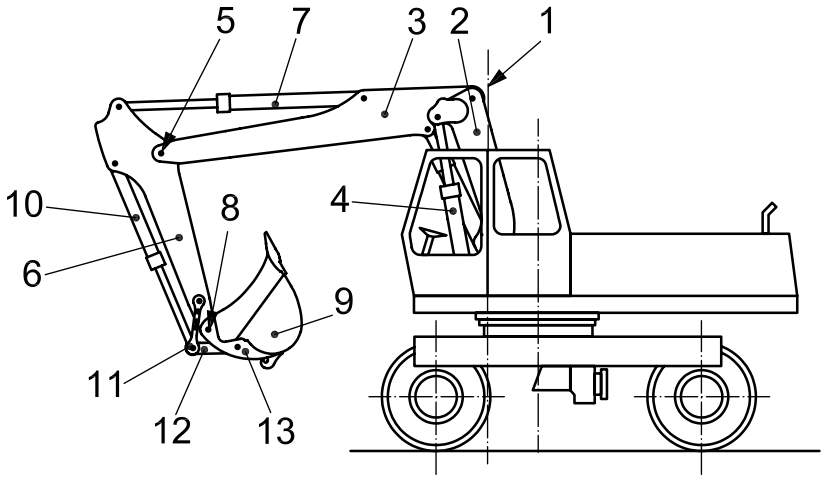
1 ground reference plane (GRP)

Figure 5 — Base machine dimensions (*continued*)

5 Equipment and attachments

5.1 Equipment and attachments nomenclature

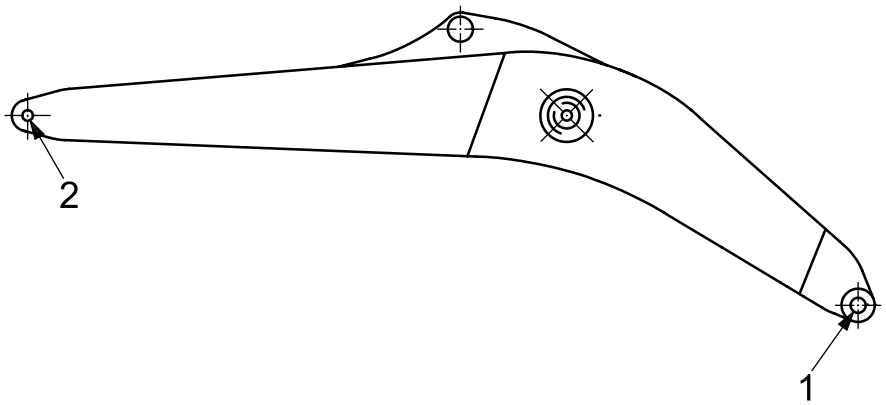
Equipment and attachments nomenclature shall be in accordance with Figures 6 to 22.



Key

1 boom pivot
2 stub
3 intermediate boom
4 boom cylinder
5 arm pivot
6 arm
7 arm cylinder
8 bucket pivot
9 bucket
10 bucket cylinder
11 guide linkage
12 bucket linkage
13 attachment bracket

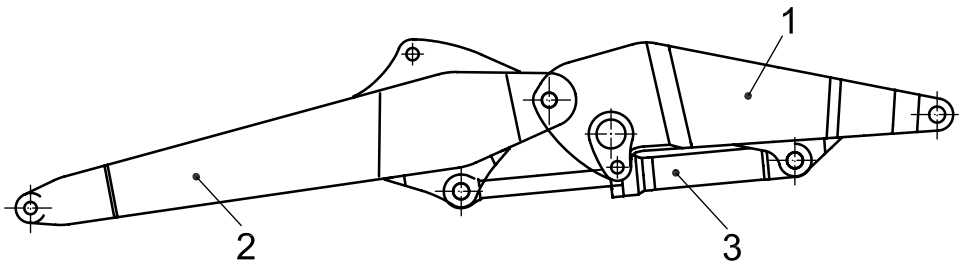
Figure 6 — Hoe



Key

1 boom pivot
2 arm pivot

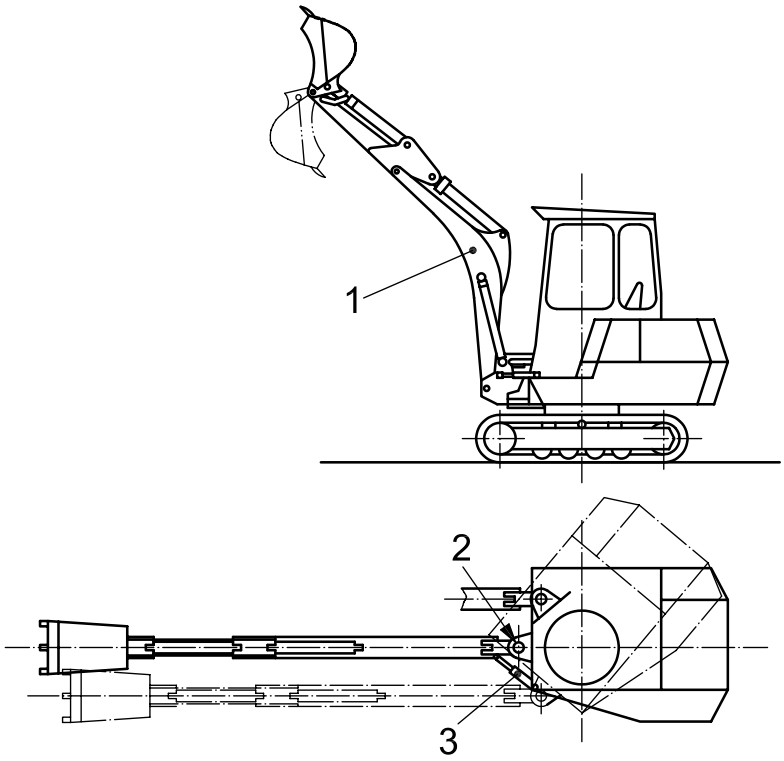
Figure 7 — Front-mounted one-piece boom



Key

1 stub
2 intermediate boom
3 cylinder, boom adjustment

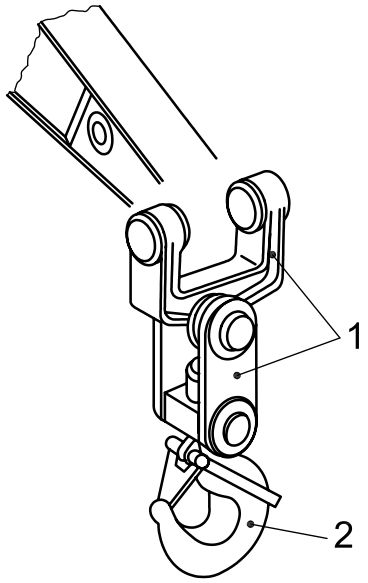
Figure 8 — Hydraulic boom, adjustable height attachment



Key

1 boom
2 articulation bearing
3 articulation cylinder

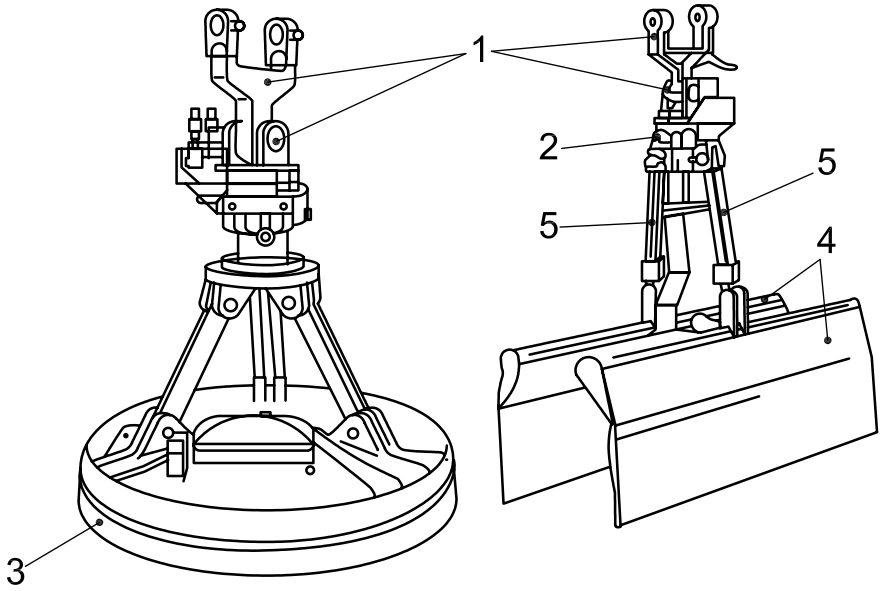
Figure 9 — Swing-type boom



Key

1 attachment linkage
2 hook with safety latch

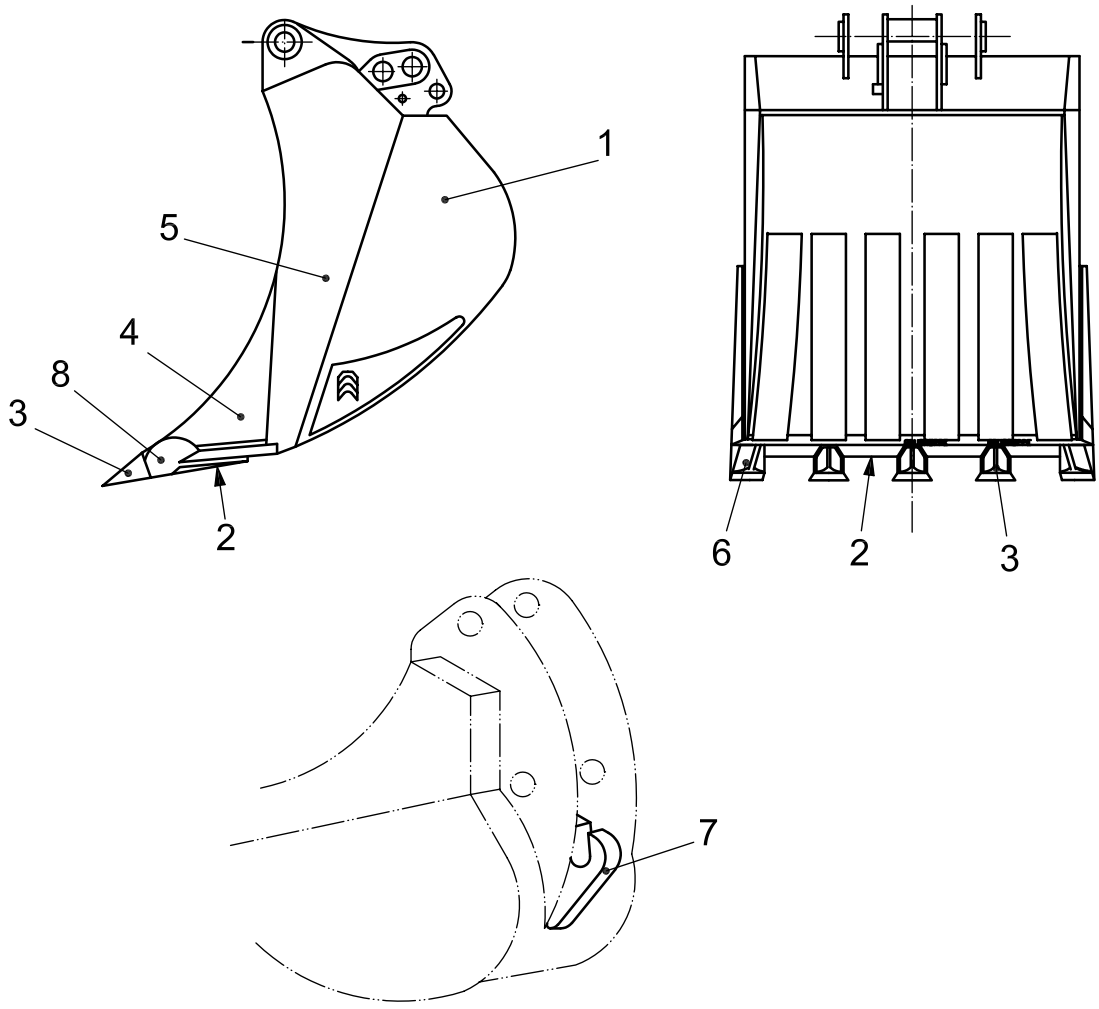
Figure 10 — Hook attachment



Key

1 attachment linkage
2 rotator
3 magnetic plate
4 special clamp plate
5 cylinder

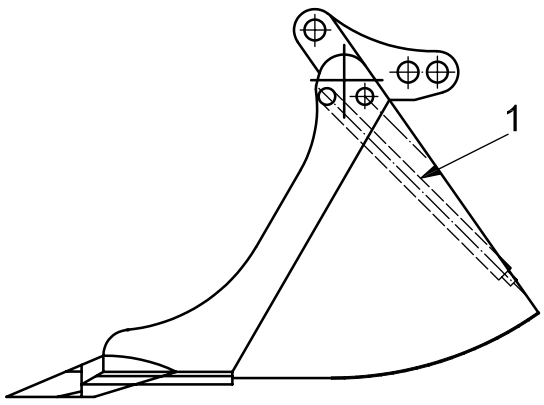
Figure 11 — Magnet and clamp attachments



Key

1	bucket body	5	cutting side wall
2	cutting edge	6	side tooth
3	tooth	7	hook or eye
4	side cutter	8	tooth adapter

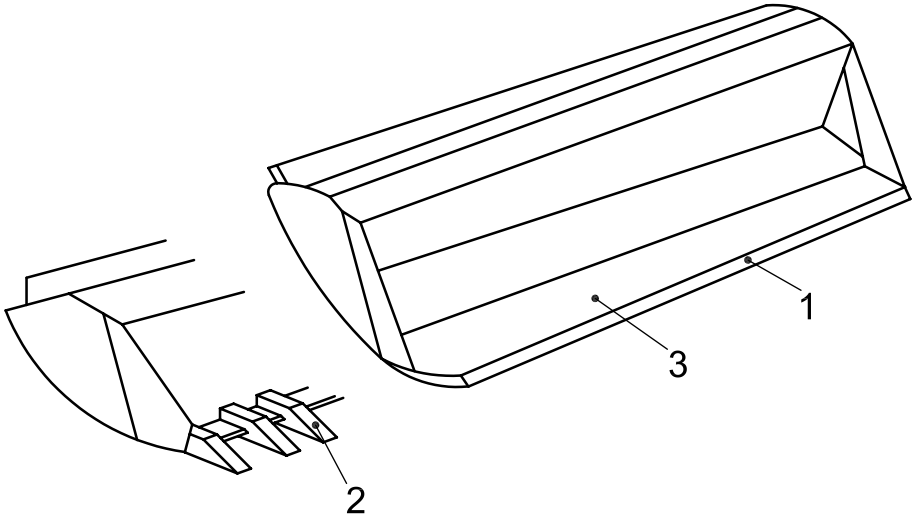
Figure 12 — Hoe bucket



Key

1 ejector

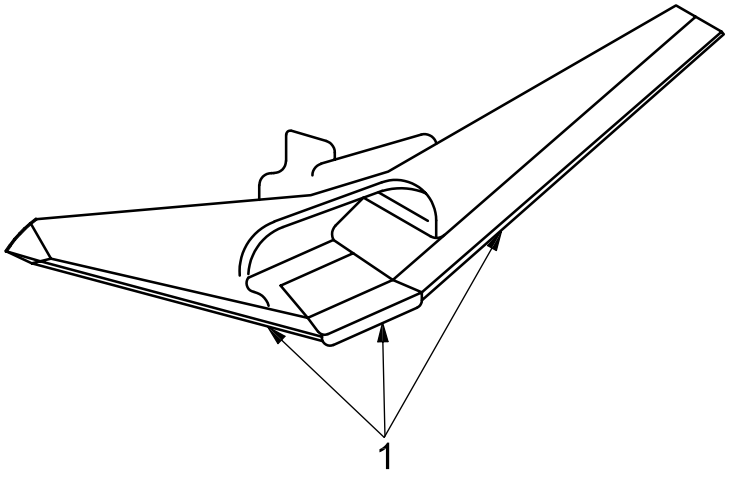
Figure 13 — Drainage [ejector] bucket



Key

1 cutting edge
2 tooth
3 cutting blade (replaceable)

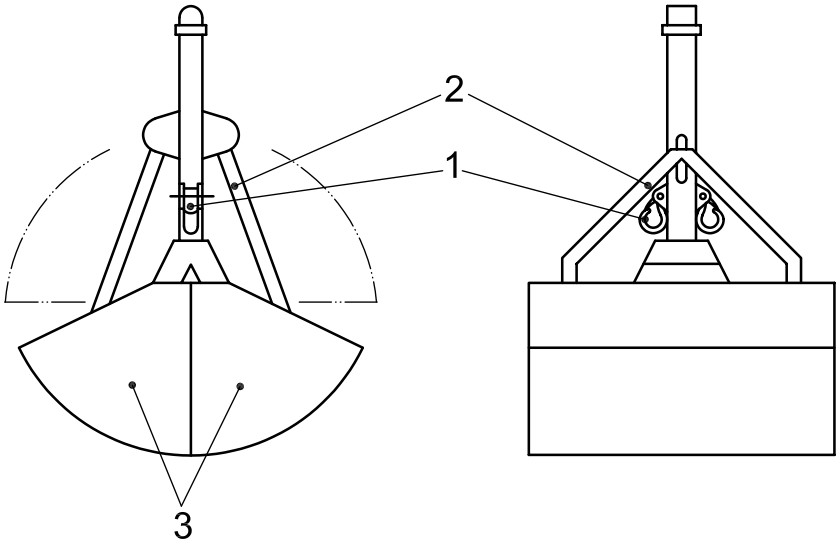
Figure 14 — Trench [ditch] cleaning bucket



Key

1 cutting edge

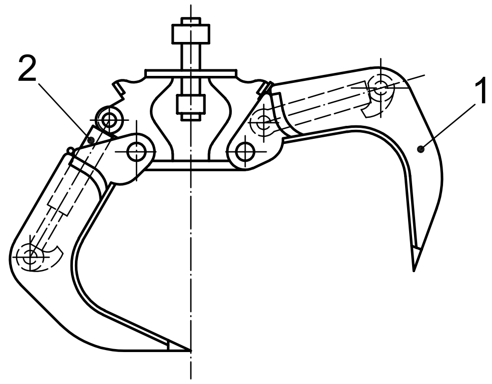
Figure 15 — Profile bucket



Key

1 hook
2 shell
3 linkage

Figure 16 — Clamshell bucket



Key

1 arm

2 arm cylinder

Figure 17 — Multi-claw grab

Key

1 boom pivot

2 boom

3 boom cylinder

4 arm pivot

5 arm

6 arm cylinder

7 bucket pivot

8 bucket

9 bucket cylinder

10 guide linkage

11 shovel linkage

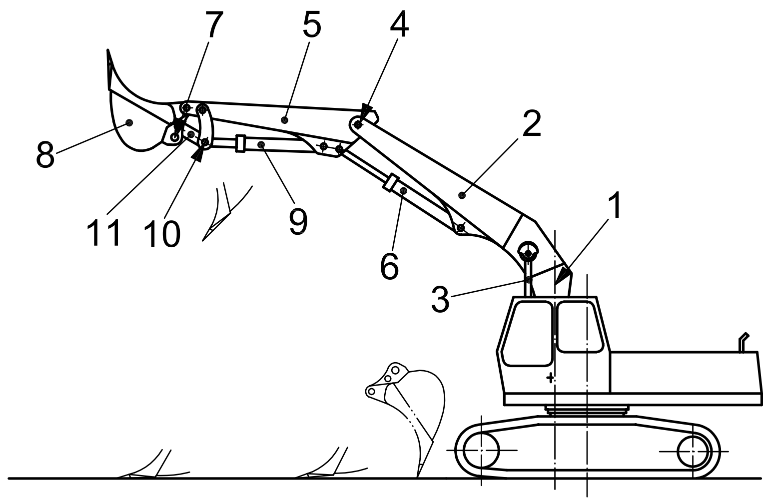


Figure 18 — Shovel

Key

1 bucket body

2 cutting edge

3 tooth

4 side cutter

5 cutting side wall

6 tooth adapter

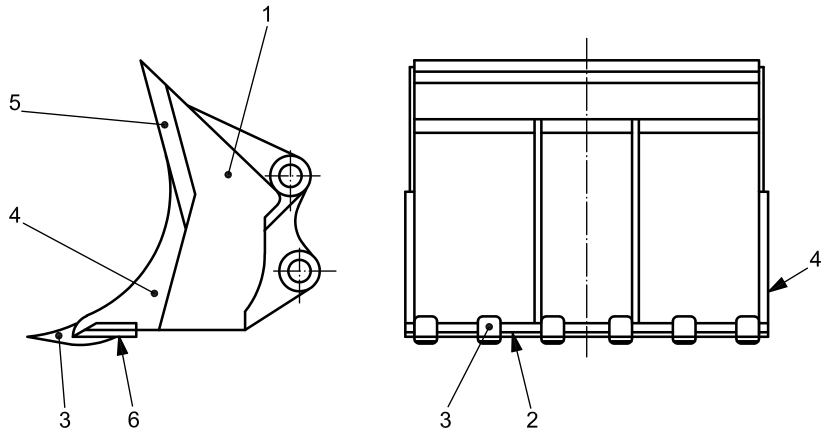
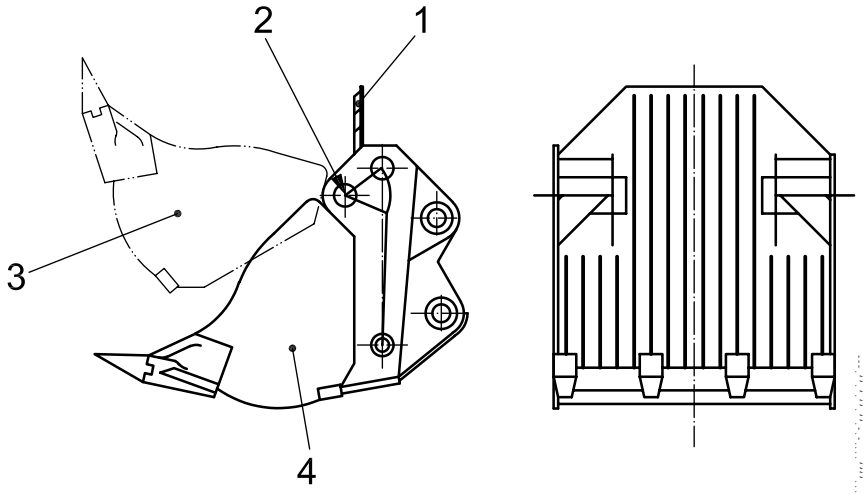


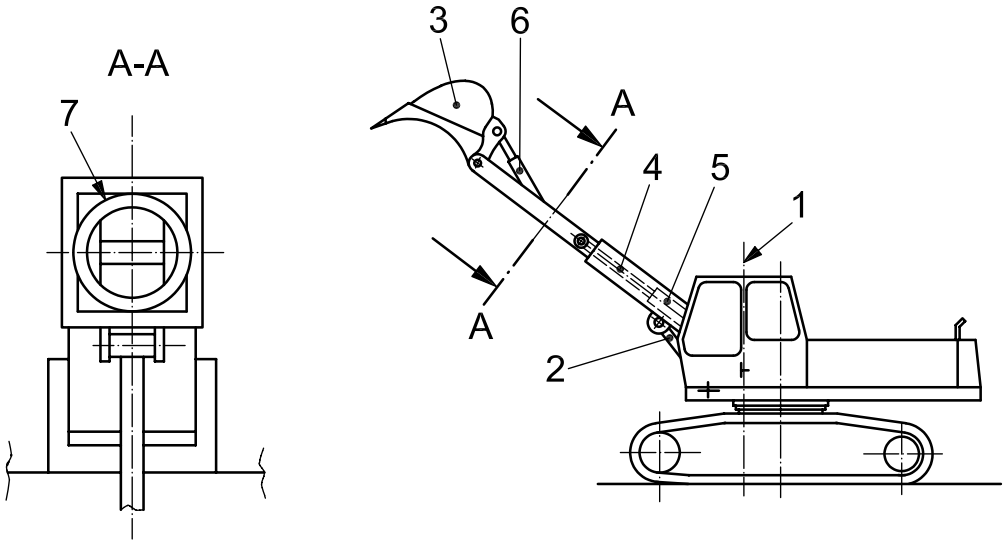
Figure 19 — Shovel bucket



Key

1 spill guard
2 joint pin
3 shovel in raised position
4 shovel in rear position

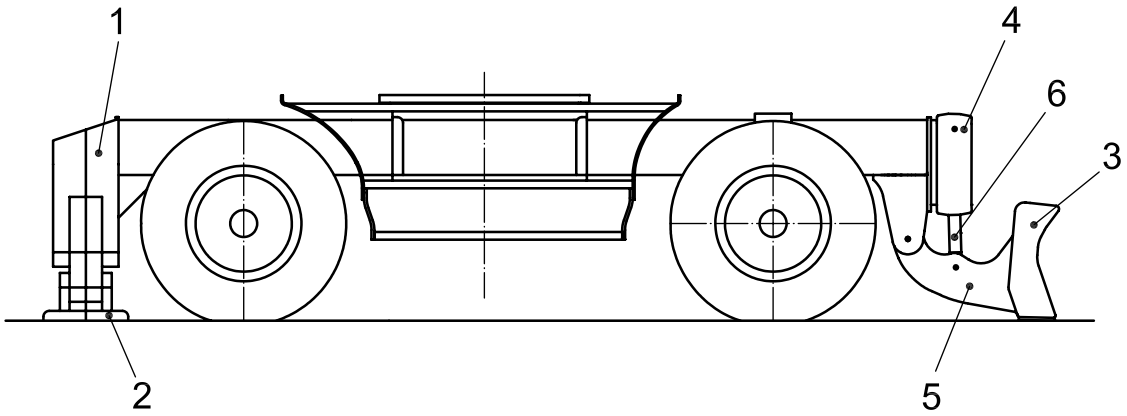
Figure 20 — Bottom-dump-type shovel bucket



Key

1 boom pivot
2 boom cylinder
3 bucket
4 telescopic boom
5 telescopic cylinder
6 bucket cylinder
7 boom swivel bearing

Figure 21 — Telescopic boom



Key

1 rear outriggers
2 outrigger pad
3 blade
4 cylinder, lift
5 beam, push
6 blade linkage

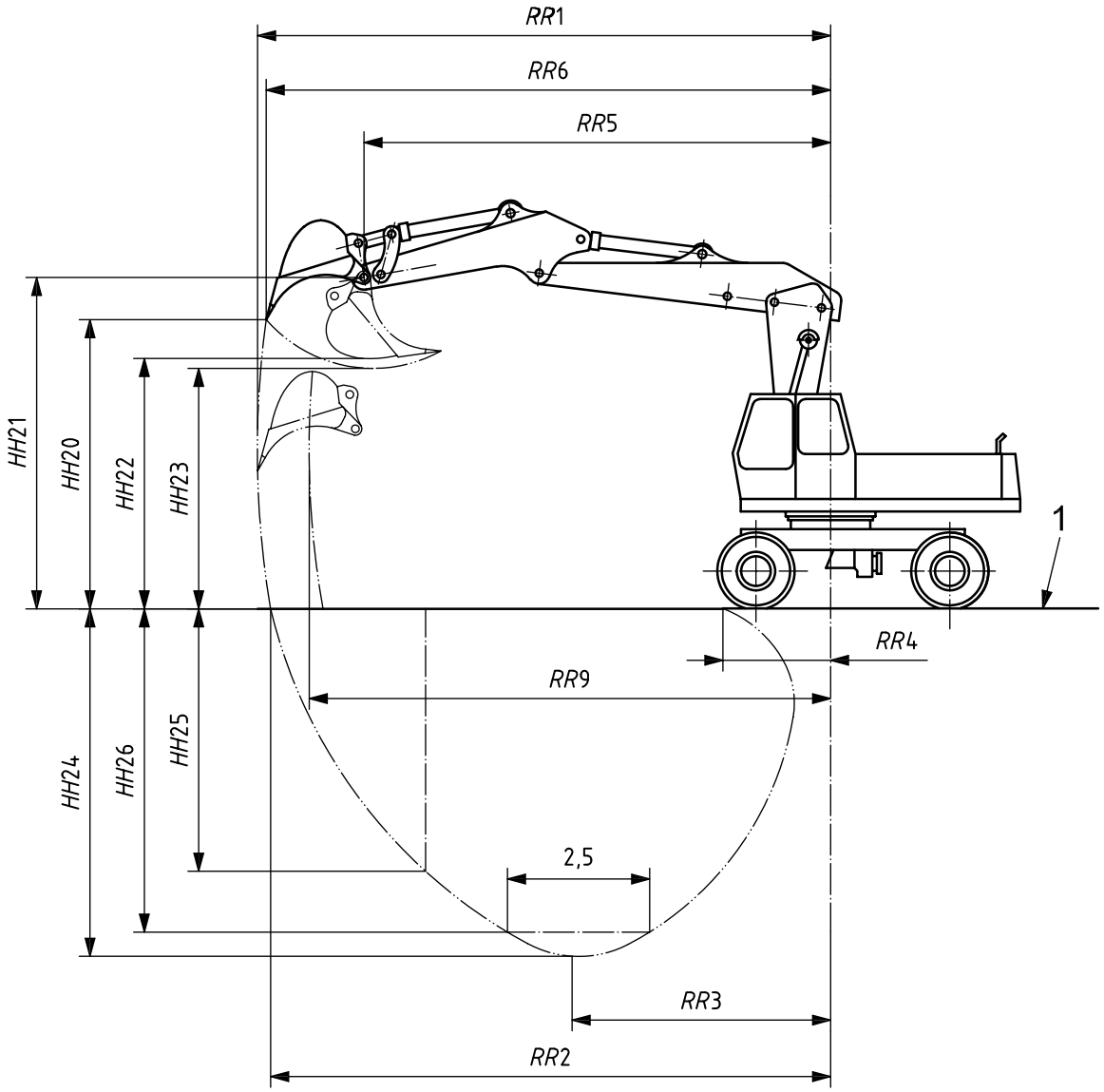
Figure 22 — Dozer blade and outrigger

5.2 Dimensions

The dimensions of the equipment and attachments on hydraulic excavators shall be in accordance with Figures 23 to 26.

For the definitions of the dimensions, see Annex B.

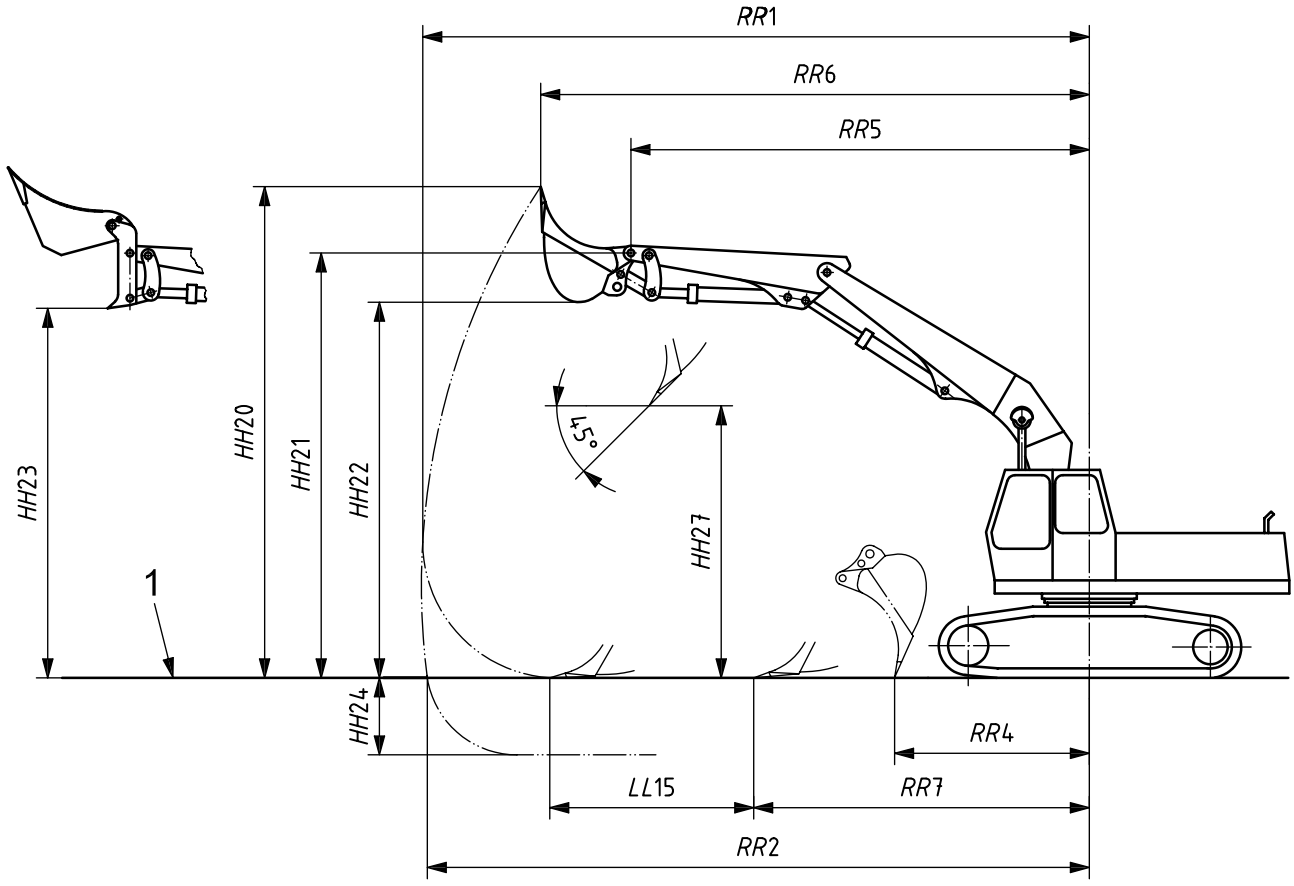
Dimensions in metres



Key

1 ground reference plane (GRP)

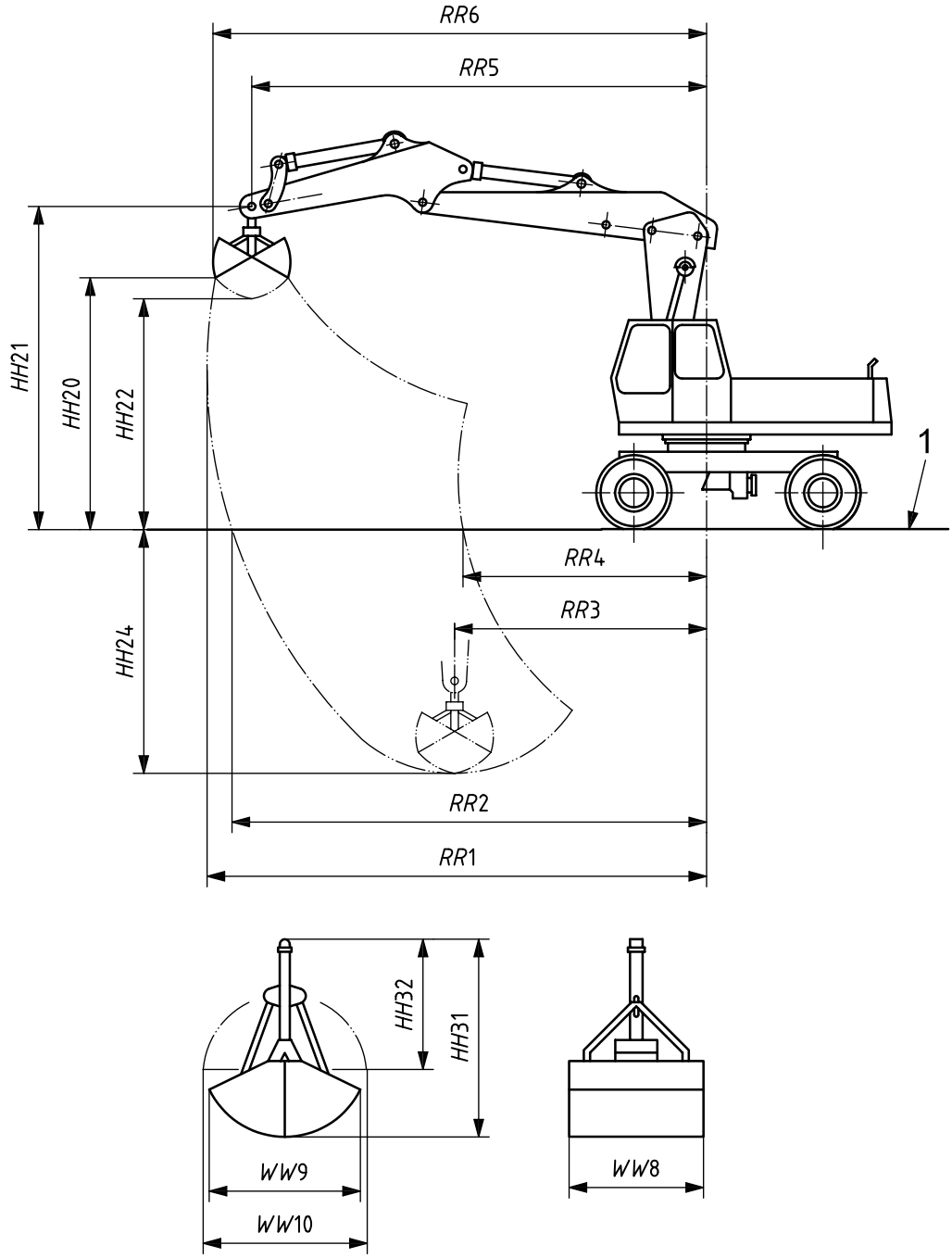
Figure 23 — Hoe equipment dimensions



Key

1 ground reference plane (GRP)

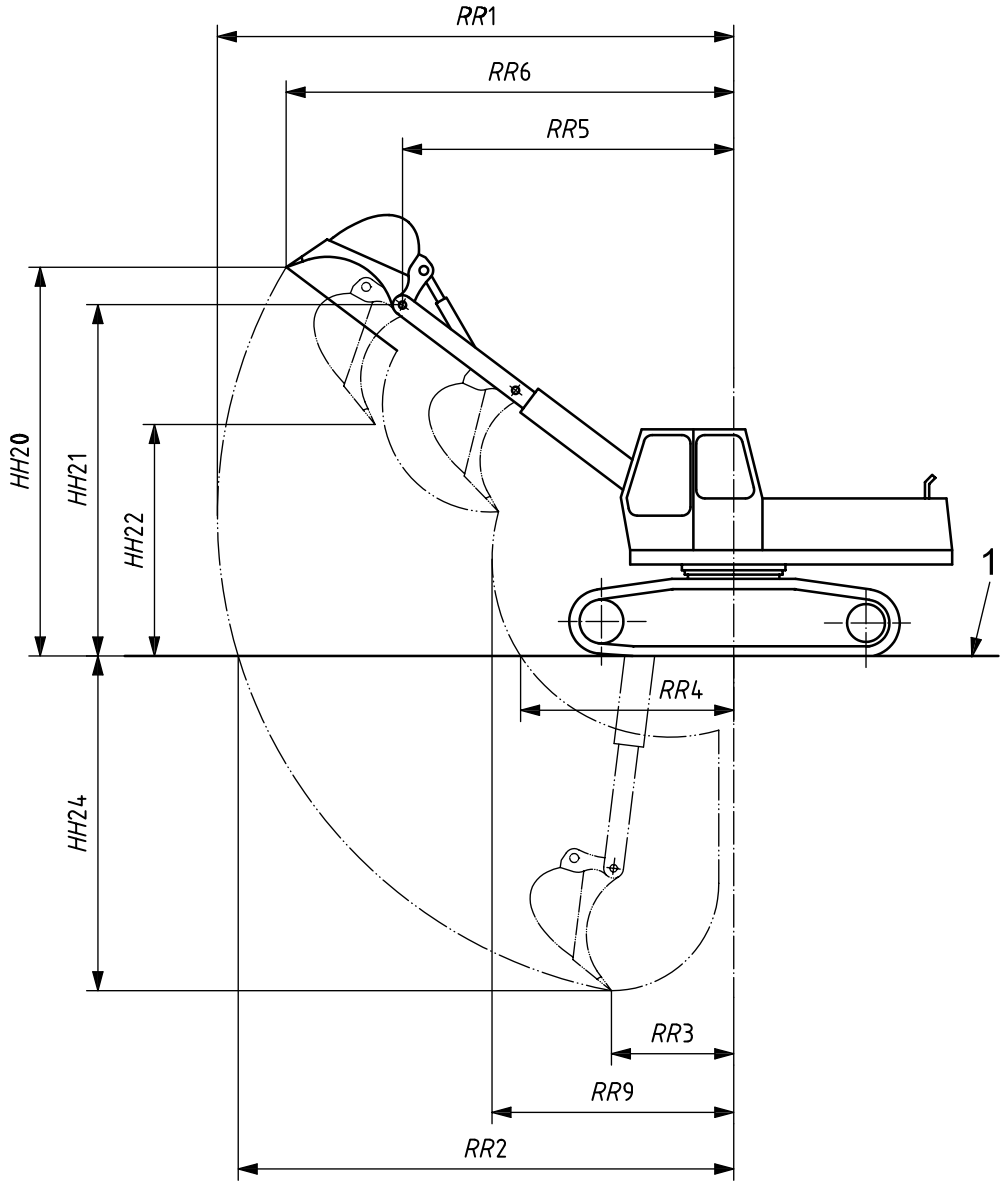
Figure 24 — Shovel equipment dimensions



Key

1 ground reference plane (GRP)

Figure 25 — Grab/clamshell equipment dimensions



Key

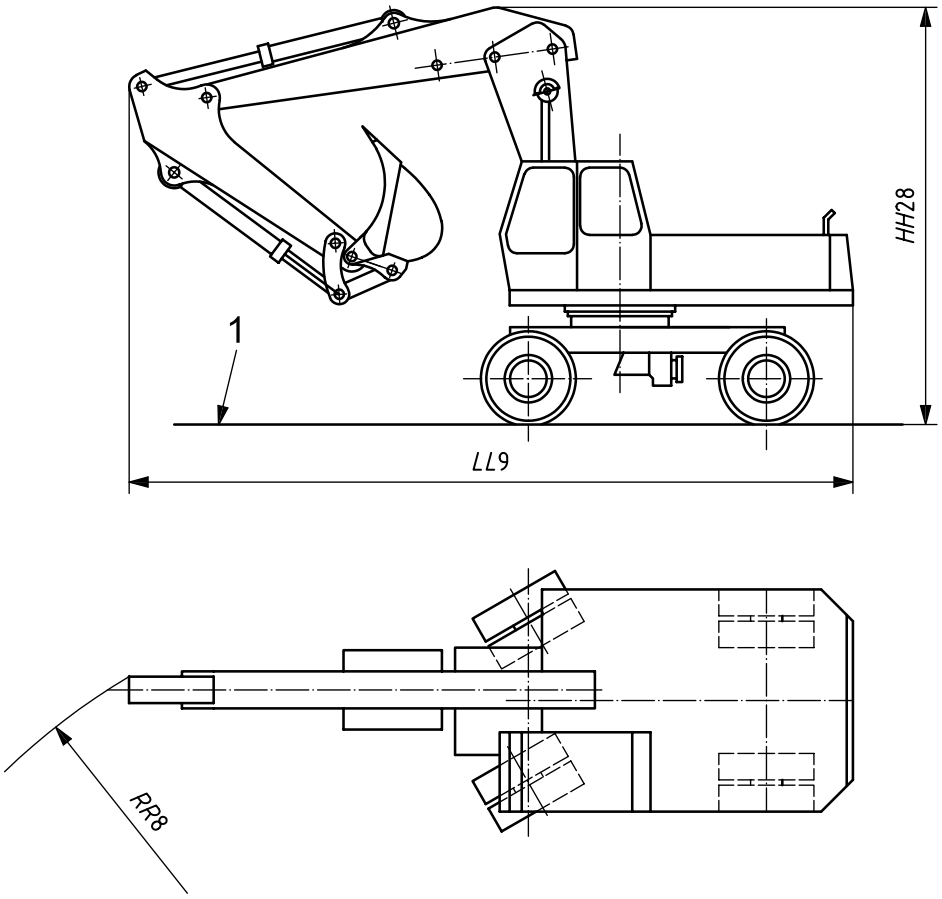
1 ground reference plane (GRP)

Figure 26 — Telescopic boom equipment dimensions

5.3 Manoeuvring, road travelling and shipping

Dimensions related to the manoeuvring, road travelling and shipping of hydraulic excavators shall be in accordance with Figures 27 to 30.

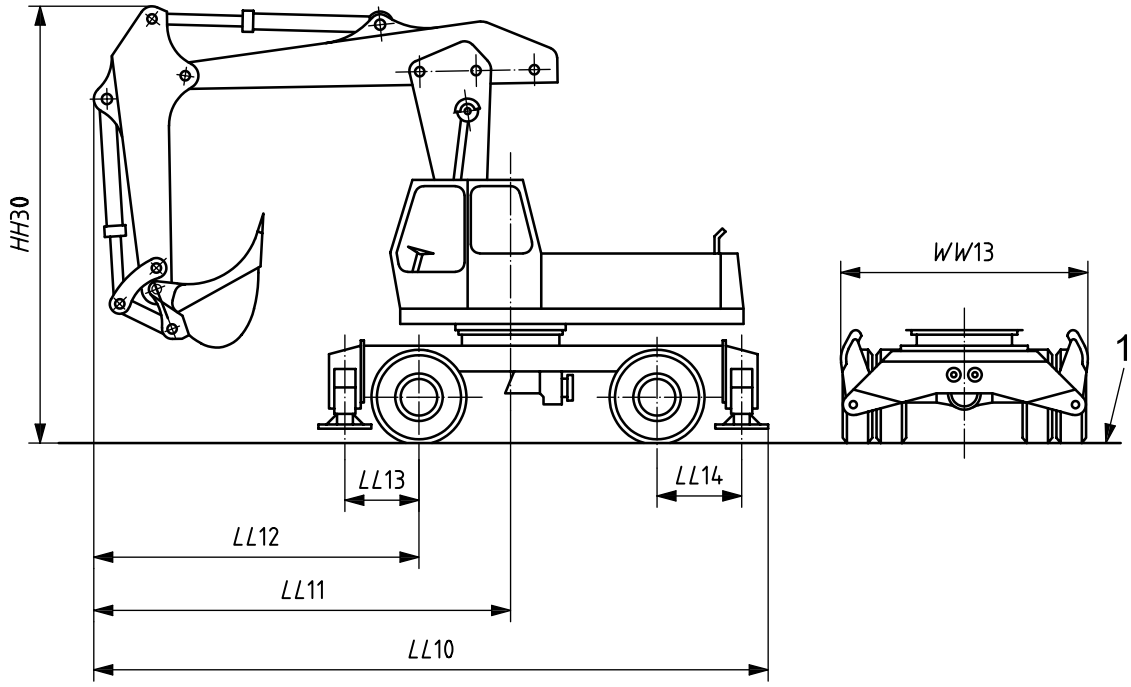
For the definitions of the dimensions, see Annex B.



Key

1 ground reference plane (GRP)

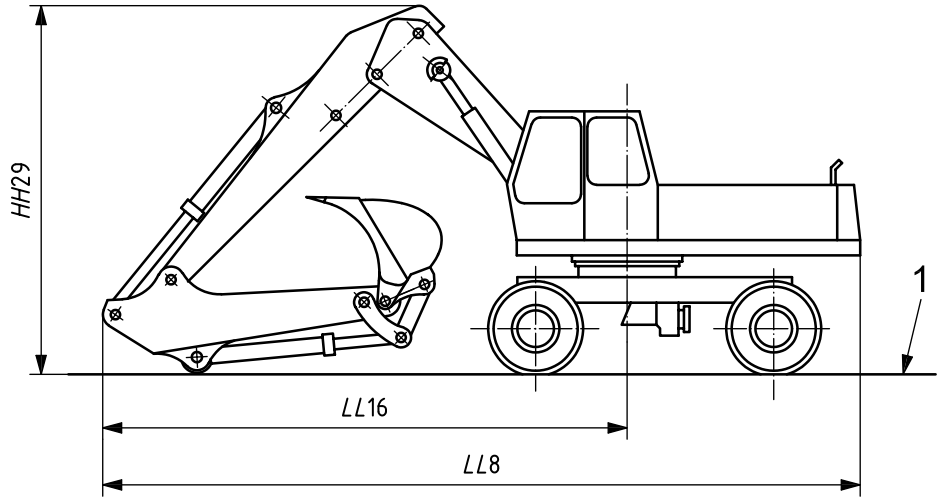
Figure 27 — Dimensions of wheeled excavator in manoeuvring position



Key

1 ground reference plane (GRP)

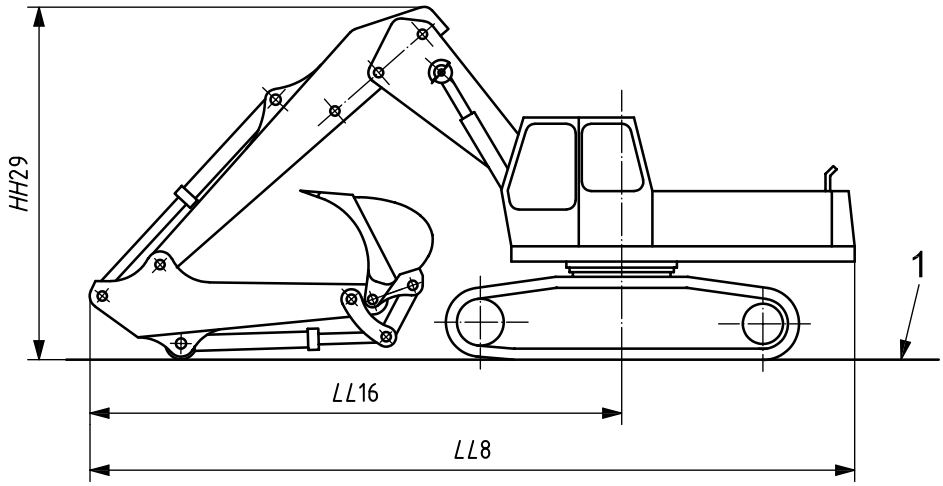
Figure 28 — Dimensions of wheeled excavator in travel position



Key

1 ground reference plane (GRP)

Figure 29 — Dimensions of wheeled excavator in transport position



Key

1 ground reference plane (GRP)

Figure 30 — Dimensions of crawler excavator in transport position

6 Performance terminology

6.1 ISO net power (engine)

See ISO 9249 and ISO 14396.

6.2 Maximum travel speed

This is maximum speed obtained on a hard, level surface with an empty bucket, determined according to ISO 6014.

6.3 Maximum swing speed

This is maximum rotation speed in revolutions per minute of the revolving frame and equipment.

6.4 Braking performance

See ISO 3450 for wheeled excavators.

See ISO 10265 for crawler excavators.

6.5 Steering (wheeled excavators only)

See ISO 5010.

6.6 Digging force

See ISO 6015.

— Maximum hoe tool force using bucket cylinder

— Maximum hoe tool force using arm cylinder

— Maximum shovel tool force using bucket cylinder

— Maximum shovel tool force using arm cylinder

6.7 Rated lift capacity

See ISO 10567.

7 Commercial literature specifications (SI units)

7.1 Engine

Specify the following:

a) ignition type, i.e. diesel or spark-ignition;

b) type of cycle, i.e. two or four stroke;

c) form of air aspiration, i.e. naturally aspirated, mechanically supercharged or turbocharged;

d) number of cylinders;

e) bore;

f) stroke;

g) displacement;

h) ISO net flywheel power at given engine speed;

i) maximum torque at a given engine.

The following are examples of other information relating to the engine that may be specified:

— manufacturer and model;

— cooling system, i.e. air- or liquid-cooled;

— type of fuel;

— starter type;

— electrical system voltage.

7.2 Hydraulic system

Specify the following:

a) pump flow at a given pressure and a given engine speed;

b) maximum normal system operating pressure.

Other information may be specified if desired.

7.3 System fluid capacities

Specify the capacities of

a) the fuel tank, and

b) the hydraulic system.

The following are examples of related information that may be specified:

— hydraulic tank;

— cooling system;

— engine crankcase;

— final drive case;

— pump drives;

— swing drive case.

7.4 Filtration system

The type of filtration system may be specified.

7.5 Crawler excavator

7.5.1 Steering and braking

Specify the type and actuation of the steering and braking systems.

EXAMPLE Drum or disc; wet or dry; hydraulic or mechanical.

7.5.2 Final drive

The type of final drive and related information may be specified.

EXAMPLE Single or double reduction, planetary; ratio; lubrication.

7.5.3 Track

Specify

a) type, and

b) dimensions.

The following are examples of other information that may be specified:

— ground contact area (calculation method to be defined);

— number of shoes (on each side);

— number of carrier rollers (on each side);

— number of track rollers (on each side).

7.6 Wheeled excavator

7.6.1 Driving axle

The type of driving axle may be specified.

EXAMPLE Fixed versus oscillating; bevel gear and pinion; differential; two-speed; hydrostatic; planetary final drive.

7.6.2 Steering

Specify the type of steering.

The following are examples of other information that may be specified:

— turning radius (left and right);

— articulation angle;

— machine clearance diameter.

7.6.3 Brakes

The following is information that may be specified:

— type and actuating system of the service brake;

— type and actuating system of the parking brake;

— type and actuating system of the secondary brakes;

— brake performance.

7.6.4 Tyres

Specify the size and type of the tyres.

The following are examples of other information that may be specified:

— tread;

— ply rating;

— rim size.

7.7 Operating mass

Specify the OM.

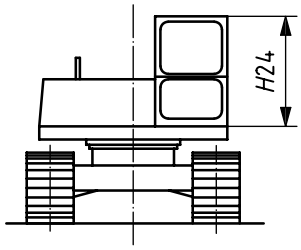
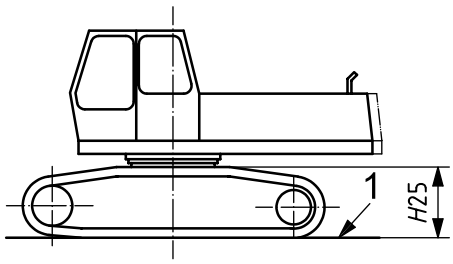
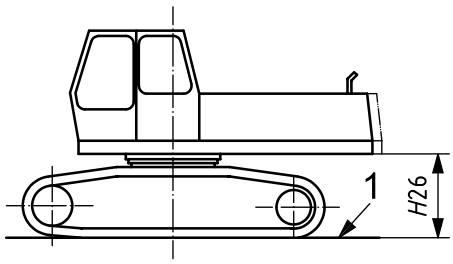
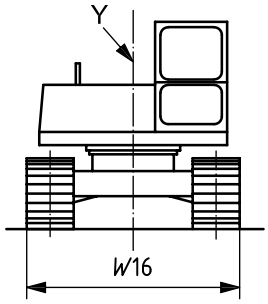
7.8 Shipping mass

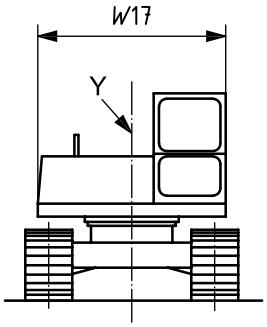
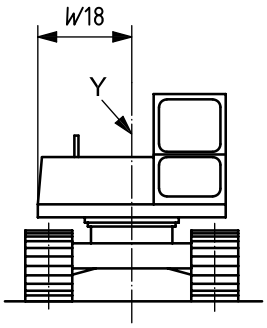
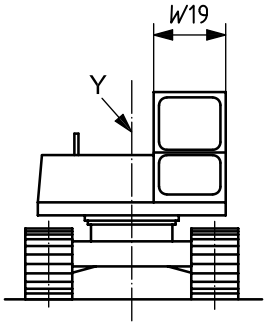
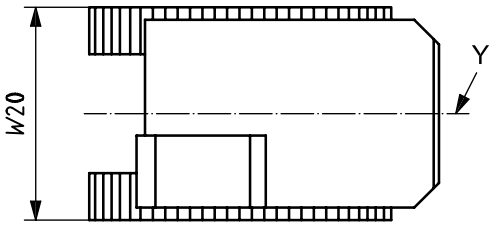
Specify the SM.

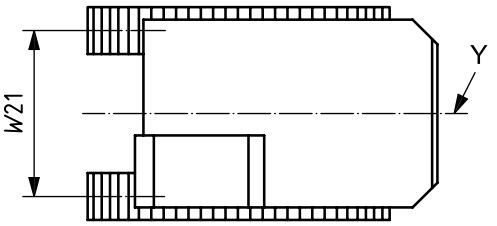
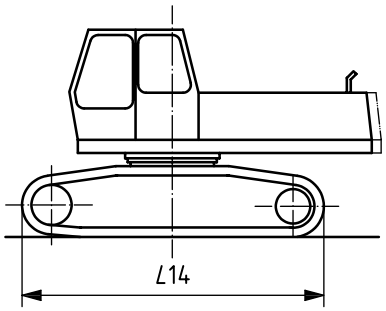
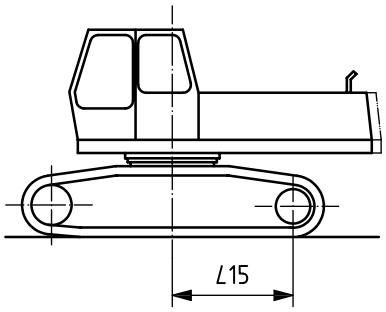
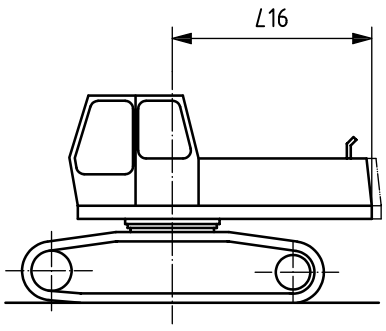
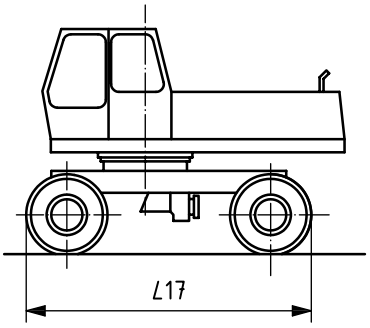
Annex A
(normative)

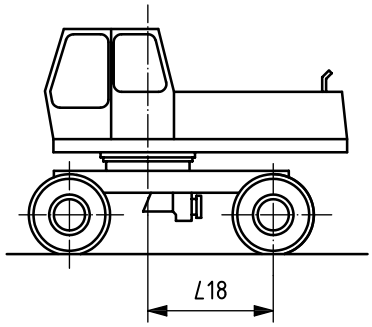
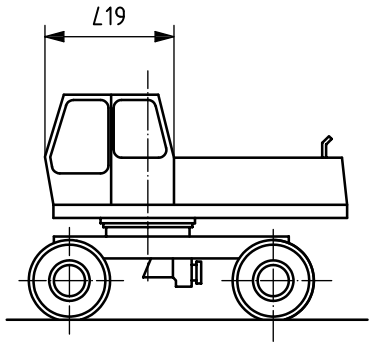
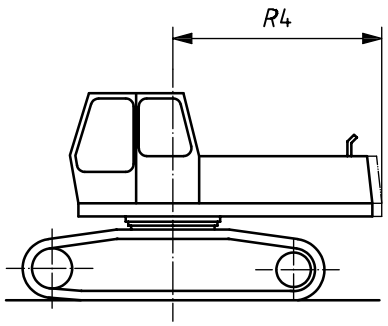
Base-machine dimensions

This annex defines base-machine height, width, length, radial and angular dimensions for excavators. See also Figure 5.

Code	Term and definition	Illustration
*H*24	**cab height** distance on Z coordinate between platform of upper structure and highest point of the cab	
*H*25	**crawler track height** distance on Z coordinate between the GRP (1) and the highest point of the crawler tracks	
*H*26	**clearance height under upper structure** distance on Z coordinate between the GRP (1) and the lowest point of the upper structure	
*W*16	**undercarriage overall width** distance on Y coordinate between two Y planes passing through the furthest points on the sides of the undercarriage	

Code	Term and definition	Illustration
*W*17	**upper structure overall width** distance on Y coordinate between two Y planes passing through the furthest points on the sides of the upper structure	
*W*18	**right-side upper structure distance from axis of rotation** distance on Y coordinate between two Y planes passing respectively through the axis of rotation and the furthest right side of the upper structure	
*W*19	**cab width overall** distance on Y coordinate between two Y planes passing through the furthest points on the side of the cab	
*W*20	**maximum width with track extended or retracted** distance on Y coordinate between two Y planes passing through the extended or furthest points of the track for extended track or distance on Y coordinate between two Y planes passing through the outer surfaces of the track when the track is in the retracted position for retracted track	

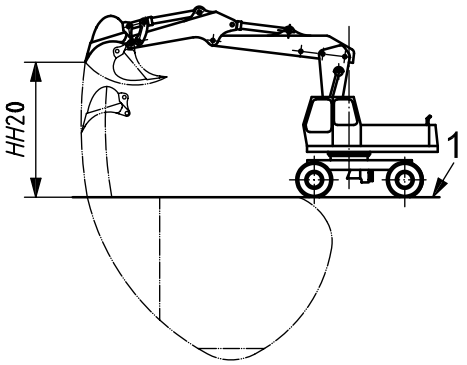
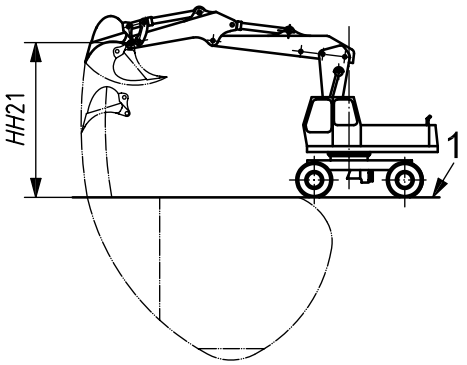
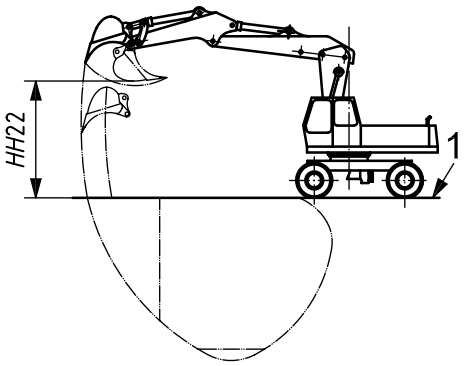
Code	Term and definition	Illustration
*W*21	**track gauge with track extended or retracted** distance on Y coordinate between two Y planes passing through the mid-width of the sprocket teeth	
*L*14	**crawler overall length** distance on X coordinates between two X planes passing through the furthest points on the front and rear of the crawler	
*L*15	**sprocket axis to axis of rotations** distance on X coordinate between two X planes passing respectively through the sprocket axis and the axis of rotation	
*L*16	**upper structure rearmost distance from axis of rotation** distance on X coordinate between two X planes passing respectively through the furthest point on the rear of upper structure and the axis of rotation	
*L*17	**undercarriage overall length** distance on X coordinate between two X planes passing respectively through the furthest points on the front and rear of the undercarriage	

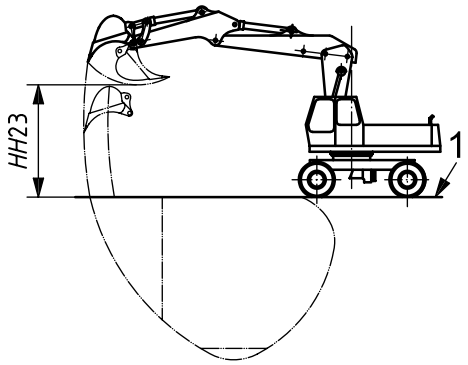
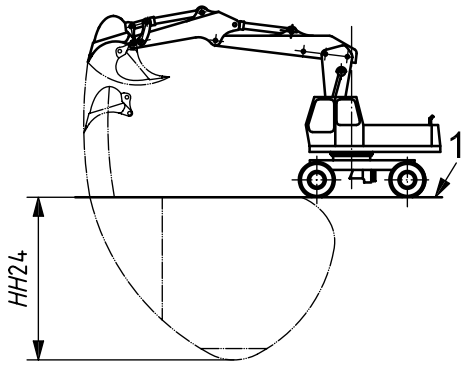
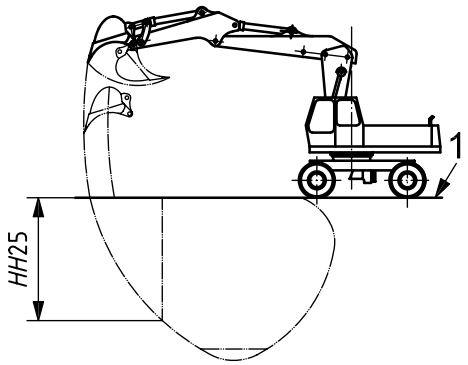
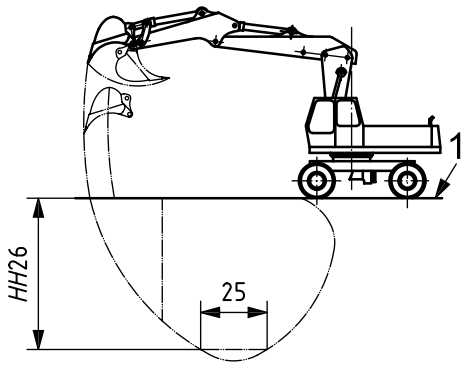
Code	Term and definition	Illustration
$L18$	**rear axle to axis of rotation** distance on X coordinate between two X planes passing respectively through the centre of the rear axle and the axis of rotation	
$L19$	**cab overall length** distance on X coordinate between two X planes passing through the furthest points on the front and rear of the cab	
$R4$	**swing radius** **rear-end radius** distance on Y coordinate (Z plane) between the axis of rotation and the furthest point of the upper structure	
The X, Y and Z coordinates and X, Y and Z planes comprise the three-dimensional coordinate system used for defining the dimensions of earth-moving machinery in accordance with ISO 6746-1; the ground reference plane (GRP), indicated by “1” in the illustrations, is also defined therein.		

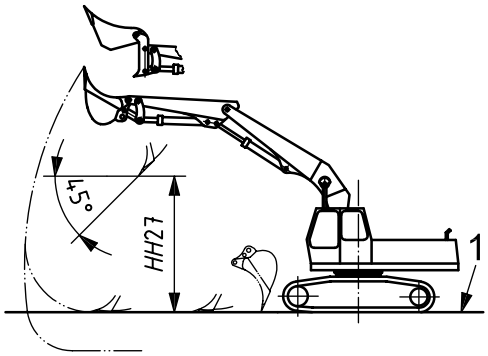
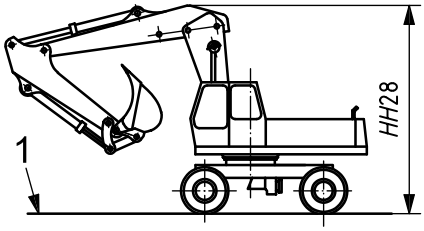
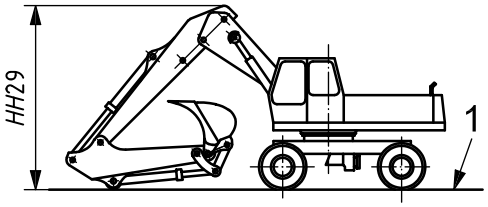
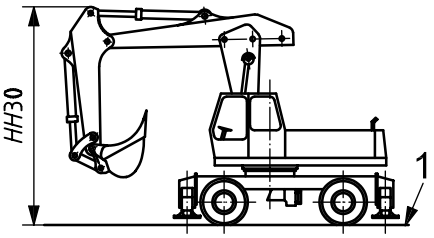
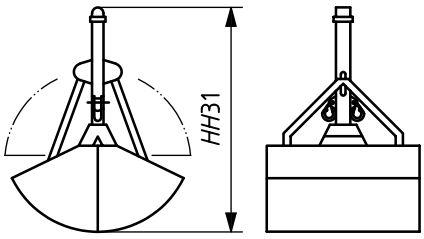
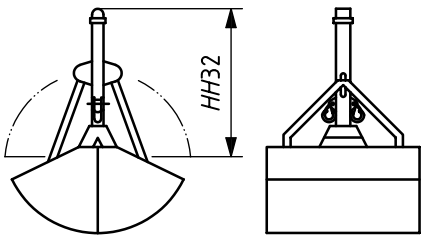
Annex B
(normative)

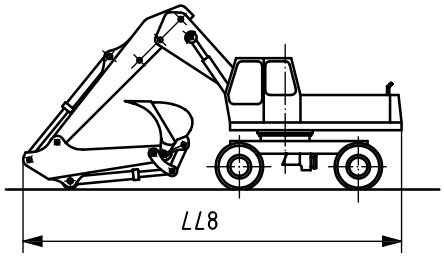
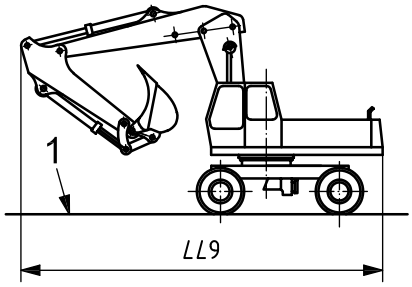
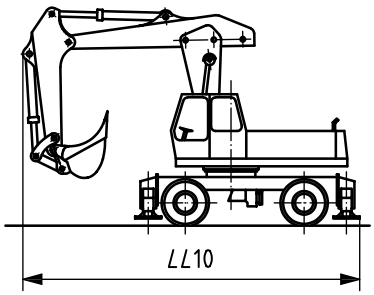
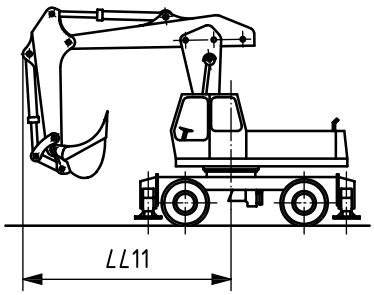
Dimensions of equipment and attachments

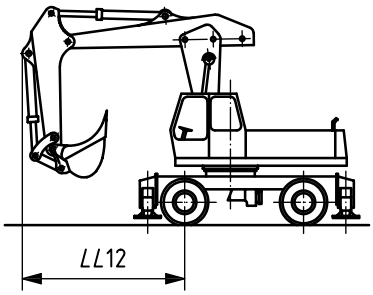
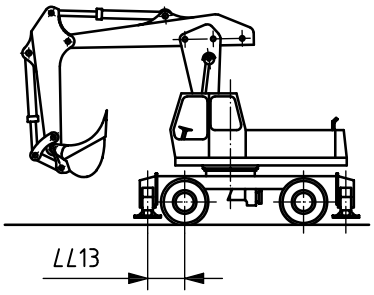
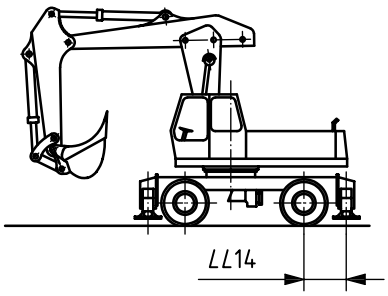
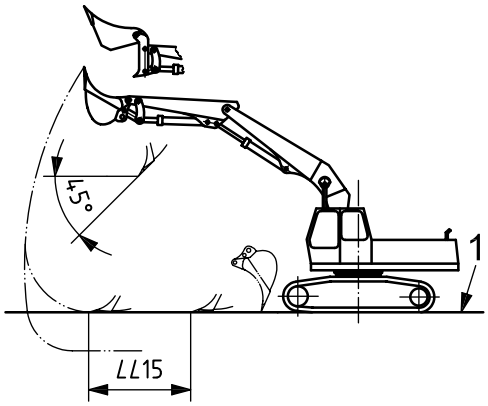
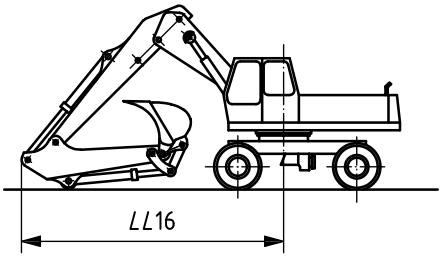
This annex defines height, width, length, radial and reach and angular dimensions for equipment and attachments used on hydraulic excavators. See also Figures 23 to 30.

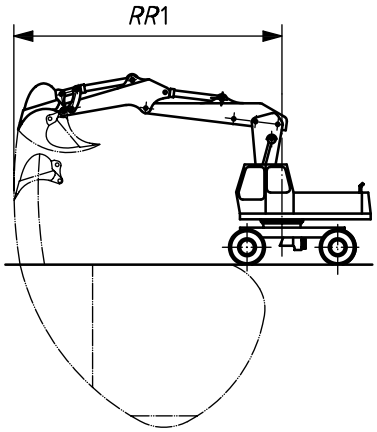
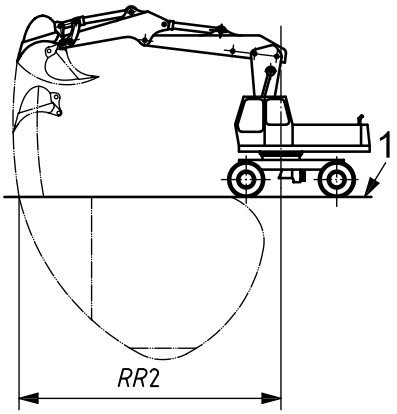
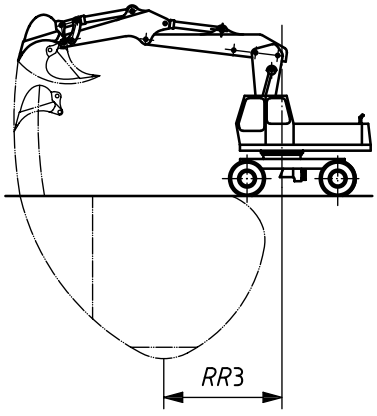
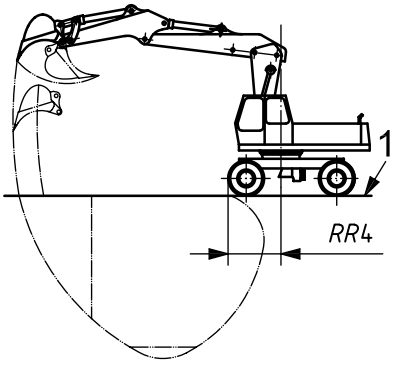
Code	Term and definition	Illustration
*HH*20	**maximum height of cutting edge** distance on Z coordinate between the GRP (1) and the cutting edge at the highest point which can be reached	
*HH*21	**maximum bucket hinge pin height** distance on Z coordinate between the GRP (1) and the bucket hinge pin at the highest point which can be reached	
*HH*22	**maximum bucket [grab] loading clearance** distance on Z coordinate between the GRP (1) and the lowest point of the bucket [grab] closed position when the bucket pivot is in the highest position	

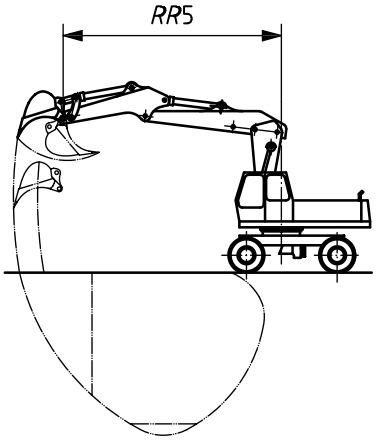
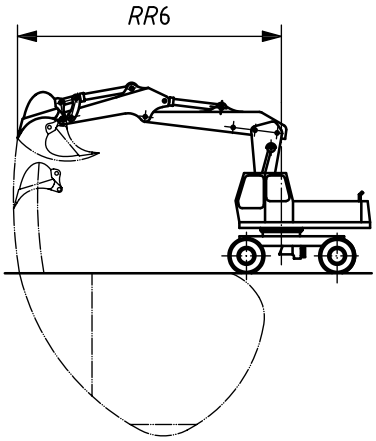
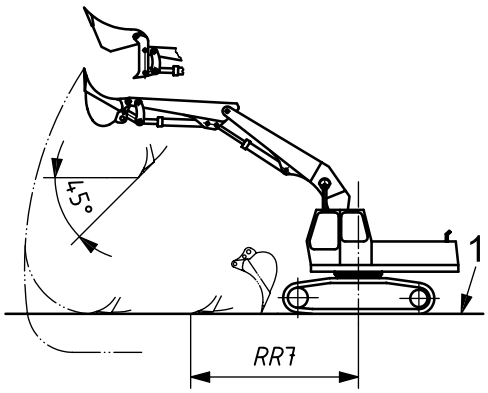
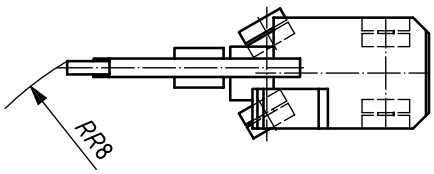
Code	Term and definition	Illustration
*HH*23	**maximum dumping height** distance on Z coordinate between the GRP (1) and the lowest attainable point of the bucket when the bucket pivot is in the highest position	
*HH*24	**maximum digging depth** distance on Z coordinate between the GRP (1) and the cutting edge at the deepest point which can be reached	
*HH*25	**maximum vertical digging depth** distance on Z coordinate between the GRP (1) and the cutting edge at the deepest point which can be reached vertically	
*HH*26	**maximum digging depth at 2,5 m floor length** distance on Z coordinate between the GRP (1) and the cutting edge at the deepest point which allows a 2,5 m floor length parallel to the X coordinate	

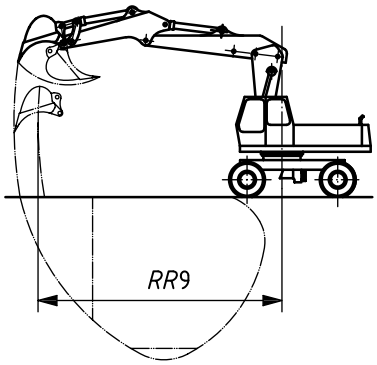
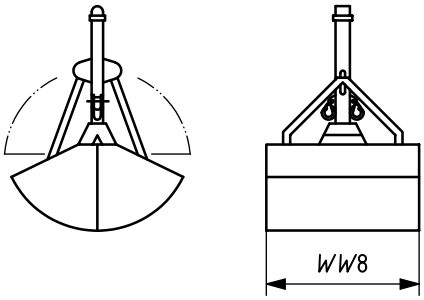
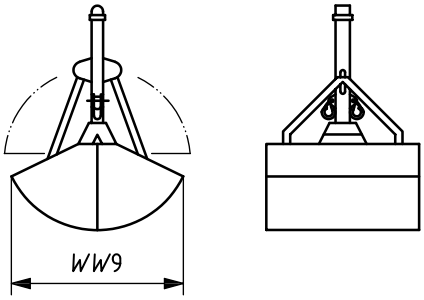
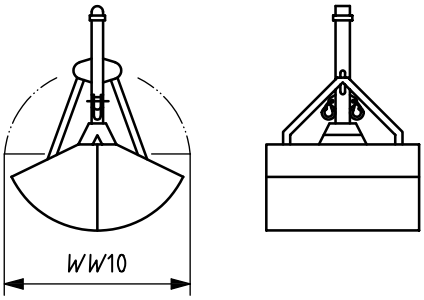
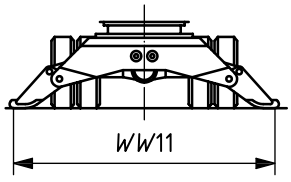
Code	Term and definition	Illustration
*HH*27	**maximum dumping height for shovel** distance on Z coordinate between the GRP (1) and the cutting edge at the highest point which can be reached when the dump angle is 45°	
*HH*28	**overall height in manoeuvring position** distance on Z coordinate between the GRP (1) and the highest point of the equipment in manoeuvring position	
*HH*29	**overall equipment height in transport position** distance on Z coordinate between the GRP (1) and the highest point of the equipment in transport position	
*HH*30	**overall height in travelling condition** distance on Z coordinate between GRP (1) and the highest point of the machine in travelling position	
*HH*31	**height of closed grab** distance on Z coordinate between two Z planes passing respectively through the grab pivot and the lowest point of the grabs in closed position	
*HH*32	**height of open grab** distance on Z coordinate between two Z planes passing respectively through the grab pivot and the lowest point of the grab in open position	

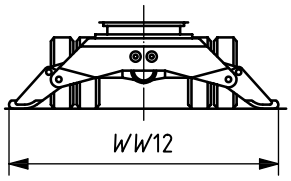
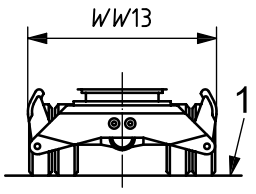
Code	Term and definition	Illustration
*LL*8	**overall length in transport position** distance on X coordinate between two X planes passing through the furthest points on the front and rear of the machine in transport position	
*LL*9	**overall length in manoeuvring position** distance on X coordinate between two X planes passing through the furthest points on the front and rear of the machine in manoeuvring position	
*LL*10	**overall length in travelling condition** distance on X coordinate between two X planes passing through the furthest points on the front and rear of the machine in travelling position	
*LL*11	**front distance to axis of rotation** distance on X coordinate between two X planes passing through the axis of rotation and the furthest point on the front of the machine including the equipment in travelling position	

Code	Term and definition	Illustration
*LL*12	**front distance to steering wheel centre** distance on X coordinate between two X planes passing respectively through the steering wheel centre and the furthest point of the machine including the equipment in travelling position	
*LL*13	**front pad centre to front axle** distance on X coordinate between two X planes passing respectively through the centre of the front axle and the front outrigger pads centreline	
*LL*14	**rear pad centre to rear axle** distance on X coordinate between two X planes passing respectively through the centre of the rear axle and the rear outrigger pads centreline	
*LL*15	**length of level floor cut** distance on X coordinate on the GRP (1) which can be generated by the shovel cutting edge	
*LL*16	**front distance to axis of rotation in transport position** distance on X coordinate between two X planes passing respectively through the furthest point of hoe equipment at transport position and the axis of rotation	

Code	Term and definition	Illustration
*RR*1	**maximum reach** distance on X coordinate (Z plane) between the axis of rotation and the farthest point of the cutting edge with the equipment extended to give maximum reach	
*RR*2	**maximum reach at GRP** distance on X coordinate (Z plane) between the axis of rotation and the farthest point of the cutting edge on the GRP (1) with the equipment extended to give maximum reach	
*RR*3	**reach at maximum digging depth** distance on X coordinate (Z plane) between the axis of rotation and depth point where the maximum digging (*HH*24) is reached	
*RR*4	**minimum reach at GRP** distance on X coordinate (Z plane) between the axis of rotation and the nearest point of the cutting edge on the GRP (1) to bucket centre pin	

Code	Term and definition	Illustration
*RR*5	**reach to bucket pin centre at minimum height** distance on X coordinate (Z plane) between the axis of rotation and the bucket pivot centre with equipment raised to give maximum height	
*RR*6	**reach at maximum height** distance on X coordinate (Z plane) between the axis of rotation and the cutting edge at its maximum height	
*RR*7	**minimum level floor radius** distance on X coordinate (Z plane) between the axis of rotation and the cutting edge in the nearest position to the machine on the GRP (1) fitted to generate the level floor (*LL*15)	
*RR*8	**outside machine clearance radius** distance on X coordinate (Z plane) between the turning centre and the furthest point of the machine, including equipment in travelling position, which is executing its smallest practicable turn	

Code	Term and definition	Illustration
*RR*9	**minimum reach** distance on X coordinate (Z plane) between the axis of rotation and the nearest point of the cutting edge with the equipment retracted to the shortest position	
*WW*8	**outside width of grab** distance between the furthest points of the grab sides	
*WW*9	**width of closed grab** distance in a Z plane between the furthest points of the closed grab	
*WW*10	**width of open grab** distance in a Z plane between the furthest points of the cutting edges of the open grab	
*WW*11	**width of pad centres outrigger or stabilizer extended** distance on Y coordinate between two Y planes passing through the pads centreline	

Code	Term and definition	Illustration
*WW*12	**overall width including outriggers and supporting plates** distance on Y coordinate between two Y planes passing through the furthest point on the sides of the outriggers and supporting plates	
*WW*13	**overall width including outriggers at road travelling position** distance on Y coordinate between two Y planes passing through the furthest point on the side of the outriggers at road travelling position	
The X, Y and Z coordinates and X, Y and Z planes comprise the three-dimensional coordinate system used for defining the dimensions of equipment and attachments for earth-moving machinery according to ISO 6746-2; the ground reference plane (GRP), indicated by “1” in the illustrations, is also defined therein.		

Bibliography

[1] ISO 5353, *Earth-moving machinery, and tractors and machinery for agriculture and forestry — Seat index point*

[2] ISO 6016:2008, *Earth-moving machinery — Methods of measuring the masses of whole machines, their equipment and components*

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