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Building construction machinery and equipment — Concrete spraying machines — Terminology and commercial specifications

Machines et matériels pour la construction des bâtiments — Machines à projeter le béton — Terminologie et spécifications commerciales

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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Foreword

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ISO 21592 was prepared by Technical Committee ISO/TC 195, *Building construction machinery and equipment*, Subcommittee SC 1, *Machinery and equipment for concrete work*.

Introduction

This International Standard deals with concrete spraying machines used for concrete mix delivery and spraying. Typically, this equipment finds application in the execution of linings (placing of a concrete layer on reinforcements) in constructions such as tunnels, underground mines, tanks, strengthening of slopes and repairs of concrete structures. Concrete mix can be sprayed on bases of concrete, rock, walls of bricks, formworks of wood and steel structures. Cement-concrete and various types of polymer and epoxy cement concrete are used as spreading mediums. Apart from spraying operations, the equipment also finds application in sandblasting and concrete mix transfers.

Building construction machinery and equipment — Concrete spraying machines — Terminology and commercial specifications

1 Scope

This International Standard establishes terminology and commercial literature specifications for concrete spraying machines, typically used for the execution of linings covering reinforcements of concrete structures and on bases of rock, walls of bricks, steel structures and wooden formworks. The figures in Annex A show examples of machine types, structures and dimensional characteristics.

2 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

2.1
concrete mixture sprayer
concrete sprayer
machine for spraying concrete mixture on buildings or other structures

2.2
concrete mix spraying
operation to produce concrete layer by spraying

NOTE Two types of concrete spraying processes are identified:

— dry mixture spraying;

— wet mixture spraying.

2.3
wet mixture sprayer
wet sprayer
machine intended for concrete mix spraying using ready concrete mix

EXAMPLE Concrete pump type sprayers, rotor type sprayers.

NOTE Piston type and screw type plastering units are occasionally used for small-sized wet spraying works as well.

2.4
dry mixture sprayer
dry sprayer
machine intended for concrete mix spraying, which operates by feeding separate flows of cement and aggregates, carried by compressed air in a hose, and of water under appropriate pressure to a spraying nozzle, where the components are mixed

NOTE 1 The basic component of the dry mixture sprayer is a rotor, whose role is to deliver dry components from a space of atmospheric pressure to pressure chamber.

NOTE 2 Depending on the type of the work to be executed, the following types of rotors are identified:

— dry spraying;

— wet spraying;

— concrete mix transfer and fire proof materials spraying.

2.5
wet and dry mixture sprayer
wet and dry sprayer
machine intended for execution of wet and dry spraying operations, alternatively and after its reconfiguration

2.6
rotor type sprayer
machine in which the material is charged from the receiving hopper to the rotor, then distributed into the hose by air pressure and spread through the nozzle

NOTE 1 Rotor type sprayers are used for both wet and dry mixture spraying.

NOTE 2 See Annex A for examples.

2.7
concrete pump type sprayer
machine in which a concrete mixture is transported by the concrete pump, then mixed with pressurized air and spread by means of a nozzle

NOTE See Annex A for examples.

2.8
impeller type sprayer
machine in which a concrete mixture supplied from a concrete pump is mixed with a quick-setting admixture and spread by a rotating impeller

NOTE See Annex A for examples.

2.9
spraying boom
folded and/or telescopic boom fixed to the carrier and provided with spraying nozzle, whose role is to deliver spraying concrete mix to work areas within its reach

NOTE See Annex A for examples.

2.10
sprayer carrier
machine that provides mobility for and supports the mass of the sprayer

NOTE Wheeled, crawler and rail carriers are typically used for concrete sprayer mounting.

2.11
cleaning device
unit used for the cleaning of the agitator, spraying unit, piping units and spraying nozzle

2.12
cable reel
device used for winding up the electrical connecting cables which supply electric energy to the concrete pump, air compressor and other machine component(s)

2.13
quick-setting admixture
additive added to concrete mix before the mix reaches the spray nozzle for quick setting of cement-concrete

2.14
operating mass
mass which includes the basic unit in operating mode, spraying boom (if any), carrier (if any), ballast (if any), hydraulic and cooling and cleaning water, tanks full, hand tools and attachment(s) specified by the manufacture

3 Classification

3.1 General

The design of a concrete mixture sprayer is determined according to the following criteria:

— spraying process for which the machine is intended (3.2);

— principle of the machine's operation (3.3);

— method of control of the spraying device (nozzle/impeller) (3.4);

— type of carrier (3.5);

— type of prime mover (3.6).

Figures A.1 to A.14 show examples of these.

3.2 Type of spraying process for which the machine is intended

Sprayers are classified by their process:

— by wet mixture spraying/wet mixture sprayer (see Figure A.1);

— by dry mixture spraying/dry mixture sprayer;

— by wet and dry mixtures spraying/wet and dry mixture sprayer.

3.3 Principle of machine operation

Sprayers are classified by their type of operation:

— by rotor type sprayers/rotor sprayer;

— by concrete pump type sprayers/concrete pump sprayer.

3.4 Method of control of spraying device (nozzle/impeller)

Sprayers are classified by the method of control of their spraying device:

— by hand-controlled spraying devices;

— by mechanically controlled spraying devices fixed to a boom.

3.5 Type of carrier

Sprayers are classified by their means of transport:

— by self-propelled sprayers on wheeled or crawler carrier;

— by towed sprayers on their own chassis;

— by skid-mounted sprayers;

— manually propelled.

3.6 Type of prime mover

Sprayers are classified by their type of prime mover:

— electric;

— internal combustion with spark ignition;

— internal combustion with compression ignition;

— hybrid combination.

4 Commercial specifications

4.1 Basic sprayer characteristics

Specify the following.

a) Model and type.

b) Manufacturer's name.

c) Application (wet or dry or wet-dry spraying).

d) Spraying performance

   1) Concrete to be used:

      — maximum size of aggregate, in millimetres (mm);

      — minimum slump value, in centimetres (cm);

   2) Spraying capacity, in cubic metres per hour (m^3/h).

e) Spraying reach range (see Figures A.13 and A.14), in millimetres (mm).

f) Maximum distance of conveyance:

   — wet mixture spraying, in metres (m);

   — dry mixture spraying, in metres (m).

g) Power installed, in kilowatts (kW).

h) Voltage and frequency of electric power supply, in volts (V) and hertz (Hz).

i) Overall dimensions:

   — length, in millimetres (mm);

   — width, in millimetres (mm);

— height, in millimetres (mm).

j) Operating mass, in kilograms (kg).

4.2 Complementary data on particular sprayer types

4.2.1 Rotor type sprayer (see Figures A.2, A.4 and A.9)

Specify the following.

a) Driving method.

b) Operating air pressure, in megapascals (MPa) or bar.

c) Air consumption, in cubic metres per minute (m^3/min).

d) Inner diameter of hose, in millimetres (mm).

e) Hopper capacity, in cubic metres (m^3).

f) Hopper height from the ground, in millimetres (mm).

g) Main electric motor:

— type;

— power and revolutions, in kilowatts (kW) and min^{-1};

— voltage and frequency, in volts (V) and hertz (Hz).

h) Vibration motor:

— type;

— power and revolutions, in kilowatts (kW) and min^{-1};

— voltage and frequency, in volts (V) and hertz (Hz).

4.2.2 Concrete pump type sprayer (see Figures A.3 and A.10)

Specify the following.

a) Driving method.

b) Concrete cylinder diameter, in millimetres (mm).

c) Concrete cylinder stroke, in millimetres (mm).

d) Number of cylinders.

e) Concrete pressure, in megapascals (MPa) or bar.

f) Air pressure, in megapascals (MPa) or bar.

g) Air consumption, in cubic metres per minute (m^3/min).

h) Hopper capacity, in cubic metres (m^3).

i) Hopper height from the ground, in millimetres (mm).

j) Type of mixing/agitating unit.

k) Hydraulic power unit

1) Hydraulic pump:

— model;

— maximum output volume, in litres per minute (l/min);

— output pressure, in megapascals (MPa) or bar.

2) Oil tank volume, in litres (l).

3) Prime mover:

— type;

— power and revolutions, in kilowatts (kW) and min^{-1};

— voltage and frequency, in volts (V) and hertz (Hz).

4.3 Characteristics of sprayer components

4.3.1 **Spraying boom** (see Figure A.6)

Specify the following.

a) Model.

b) Manufacturer.

c) Type of operation (e.g. folded or telescopic).

d) Slewing mechanism, slewing angle, in degrees.

e) First arm:

— inclination up/down, in degrees;

— extension, in millimetres (mm).

f) Second arm:

— inclination up/down, in degrees;

— extension, in millimetres (mm).

g) Third arm:

— inclination up/down, in degrees;

— extension, in millimetres (mm).

h) Nozzle:

— type of operation;

— nozzle diameter, in millimetres (mm);

i) Hydraulic power unit

   1) Hydraulic pump:

      — model;

      — maximum output volume, in litres per minute (l/min);

      — output pressure, in megapascals (MPa) or bar.

   2) Oil tank volume, in litres (l).

   3) Electric motor:

      — type;

      — power and revolutions, in kilowatts (kW) and min^{-1};

      — voltage and frequency, in volts (V) and hertz (Hz).

j) Overall dimensions in transport position:

   — length, in millimetres (mm);

   — width, in millimetres (mm);

   — height, in millimetres (mm).

k) Mass, in kilograms (kg).

4.3.2 Carrier (see Figures A.7 and A.8)

Specify the following.

a) Model.

b) Manufacturer.

c) Transfer speed, in kilometres per hour (km/h).

d) Working speed in spraying operation, in metres per minute (m/min).

e) Maximum longitudinal gradient, in percent (%).

f) Driving method (mechanical, hydrostatics, other).

g) Minimum turning radius, in millimetres (mm).

h) Characteristics of tyres or tracks:

   — at the front wheels (marking, pressure), in megapascals (MPa) or bar;

   — at the rear wheels (marking, pressure), in megapascals (MPa) or bar;

   — width of crawler plates, in millimetres (mm);

   — pitch of track link, in millimetres (mm).

i) Number of certificate on exhaust gas measurement.

j) Black smoke purification device:

- model;
- manufacturer;
- serial number.

k) Prime mover characteristics:

- model;
- manufacturer;
- power, in kilowatts (kW);
- rated torque, in newton metres (N · m);
- displacement, in cubic centimetres (cm^3);
- revolutions, in min^{-1};
- number of cylinders;
- cooling.

l) Lighting device:

- front;
- rear;
- working lights.

m) Outriggers.

- model;
- front;
- rear.

4.3.3 Cleaning device

Specify the following.

a) Model.

b) Output, in litres per minute (l/min).

c) Output pressure, in megapascals (MPa) or bar.

d) Tank capacity, in litres (l).

e) Electric motor:

— type;

— power and revolutions, in kilowatts (kW) and min^{-1};

— voltage and frequency, in volts (V) and hertz (Hz).

f) Overall dimensions:

— length, in millimetres (mm);

— width, in millimetres (mm);

— height, in millimetres (mm).

g) Mass, in kilograms (kg).

4.3.4 Cable reel

Specify the following.

a) Model.

b) Cable length, in metres (m).

c) Cable model.

d) Driving method.

4.3.5 Air compressor(s)

Specify the following.

a) For unit No. 1:

— output volume, in cubic metres per minute (m^3/min);

— output pressure, in megapascals (MPa) or bar.

b) For unit No. 2 (if required for a large capacity spraying machine):

— output volume, in cubic metres per minute (m^3/min);

— output pressure, in megapascals (MPa) or bar.

4.3.6 Quick-setting admixture

Specify the following.

a) Type.

b) Control:

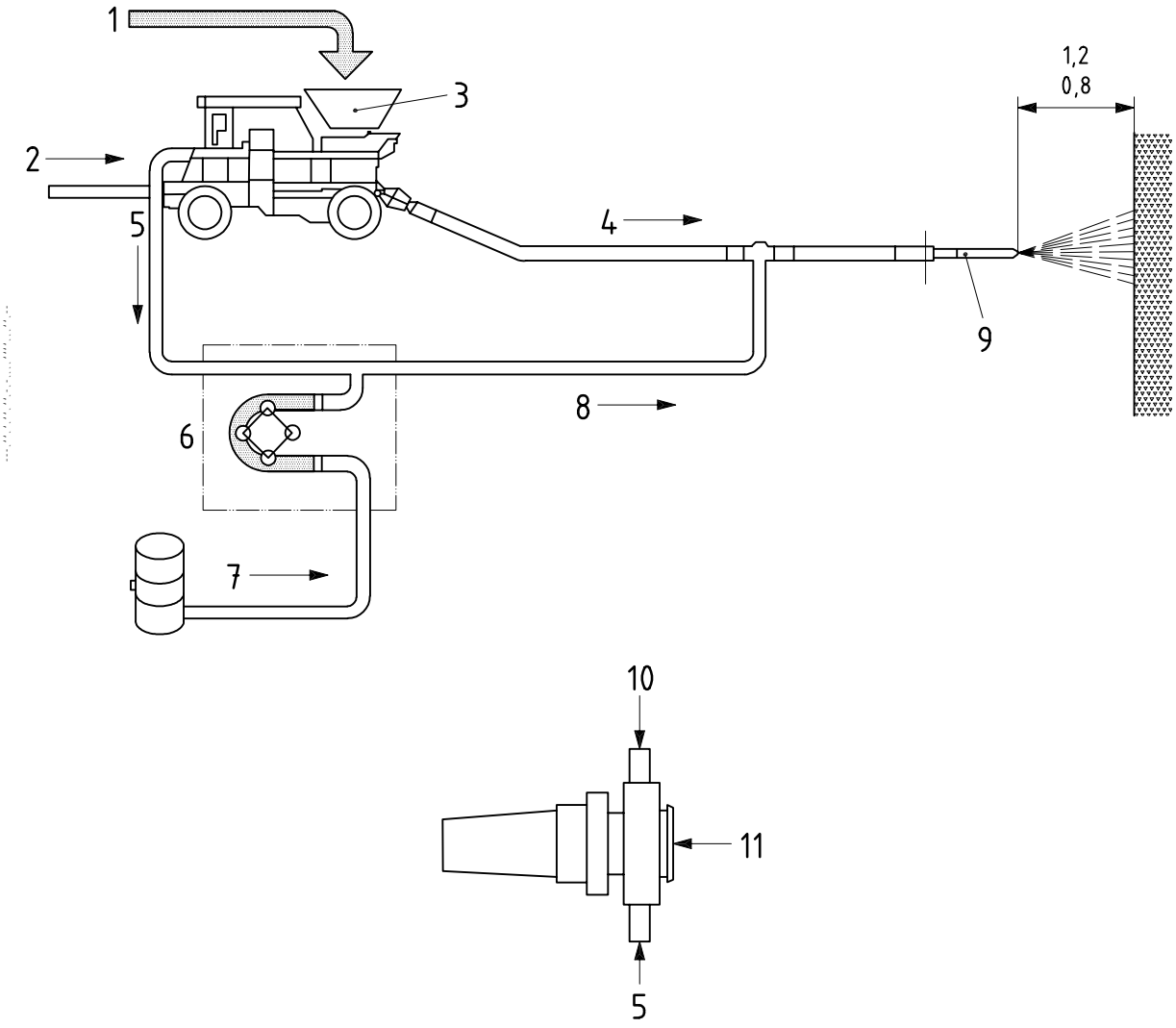
— mechanical;

— electronic.

Annex A
(informative)

Examples of concrete sprayer types, their processes, structure and dimensional characteristics

Dimensions in metres

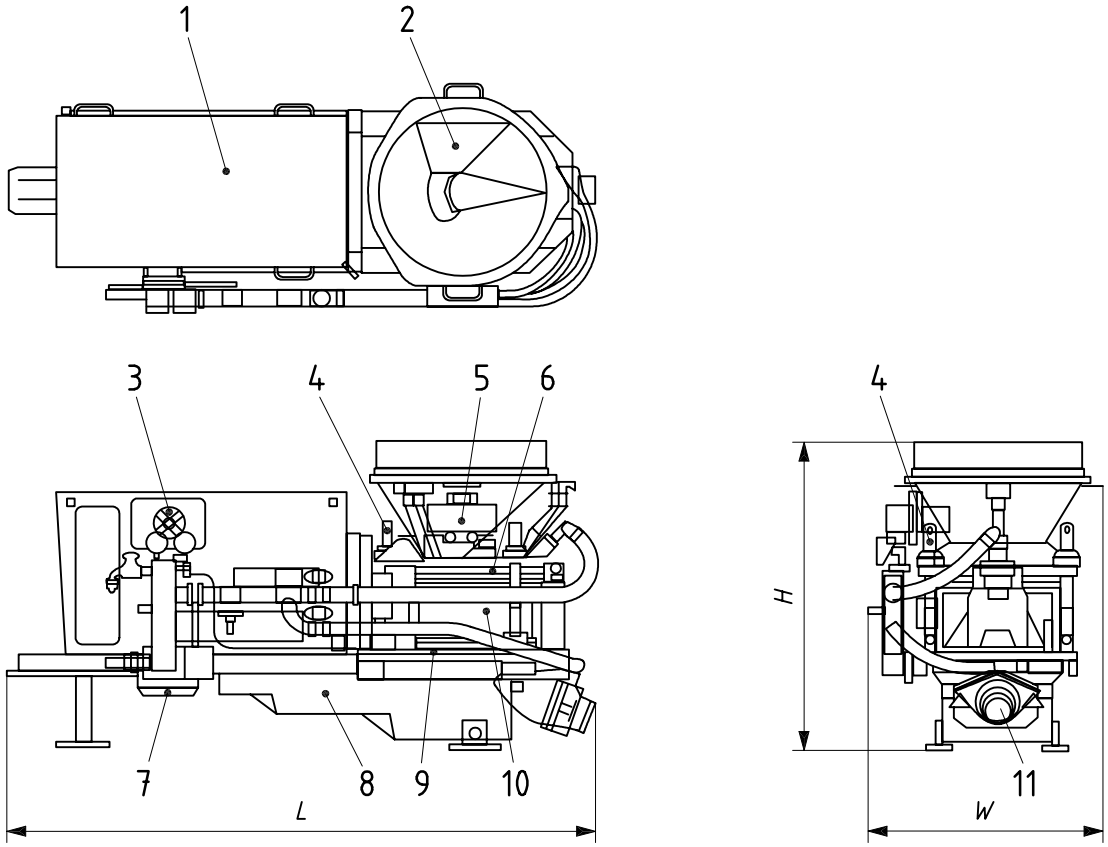


Alternative nozzle type

Key

1 wet mix
2 compressed air
3 rotor type sprayer
4 pneumatic conveyance (thin stream)
5 air
6 accelerator dosage unit
7 liquid accelerator
8 accelerator + air
9 nozzle
10 quick-setting admixture
11 concrete

Figure A.1 — Wet mixture spraying process — Rotor type sprayer

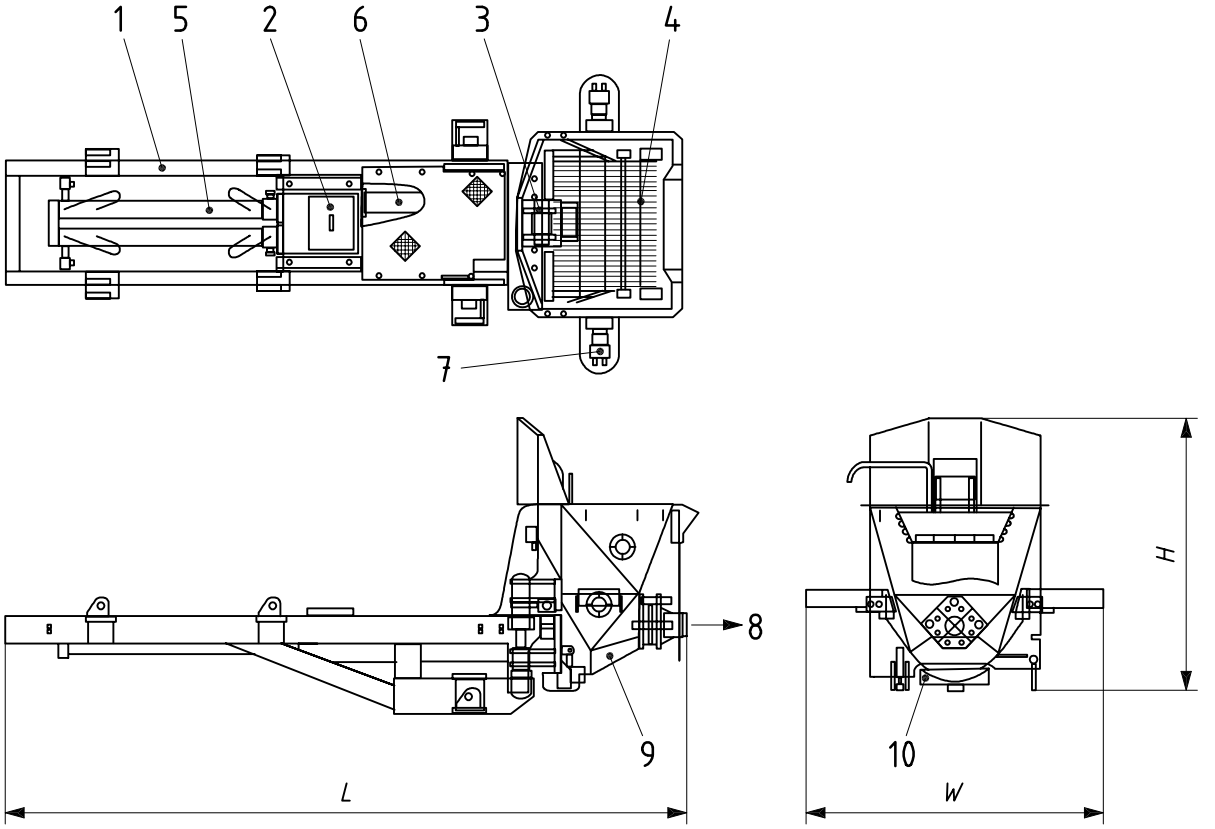


Key

L length [a]
W width [a]
H height [a]
1 motor case
2 hopper
3 variable speed controller
4 tension spindle
5 vibrator
6 joint plate
7 electric drive
8 gear box
9 rotor plate
10 rotor
11 air chamber

[a] Overall dimension.

Figure A.2 — Rotor type concrete sprayer

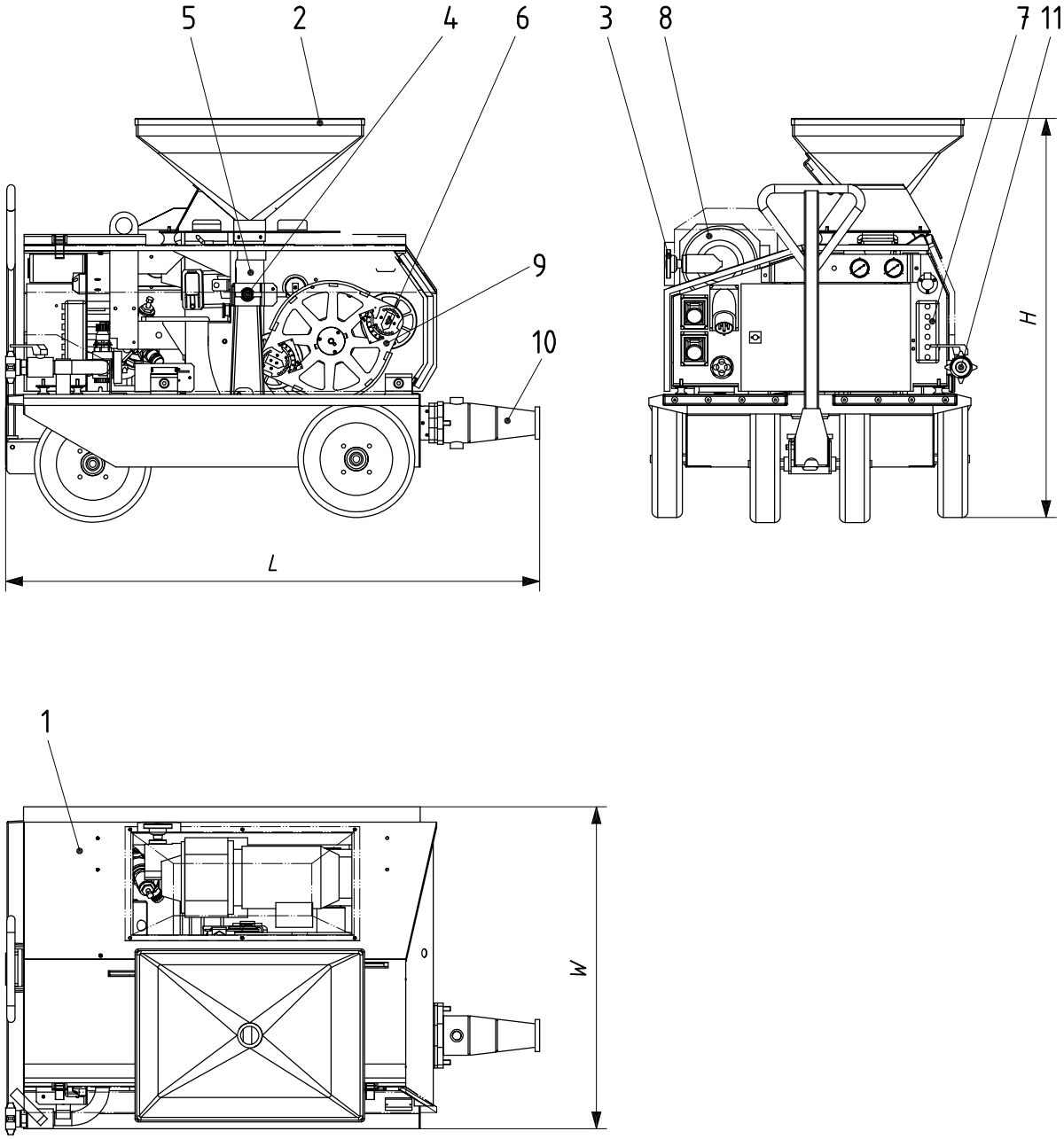


Key

L length [a]
W width [a]
H height [a]
1 frame
2 washing chamber
3 external vibrator
4 hopper screen
5 hydraulic cylinder
6 concrete cylinder
7 agitator
8 concrete discharge port
9 hopper
10 bottom flap

[a] Overall dimension.

Figure A.3 — Concrete pump type sprayer

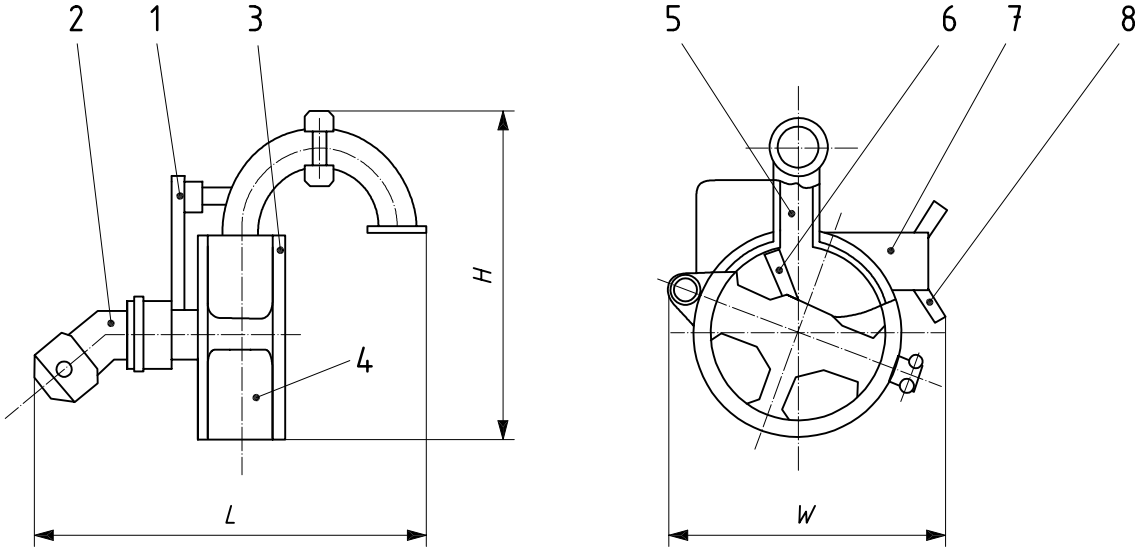


Key

L	length [a]	5	peristaltic hose
W	width [a]	6	roller
H	height [a]	7	electric drive
1	motor case	8	gear box
2	hopper	9	rotor
3	variable speed controller	10	outlet
4	rotating shutter	11	air inlet

[a] Overall dimension.

Figure A.4 — Peristaltic (a rotor type) sprayer

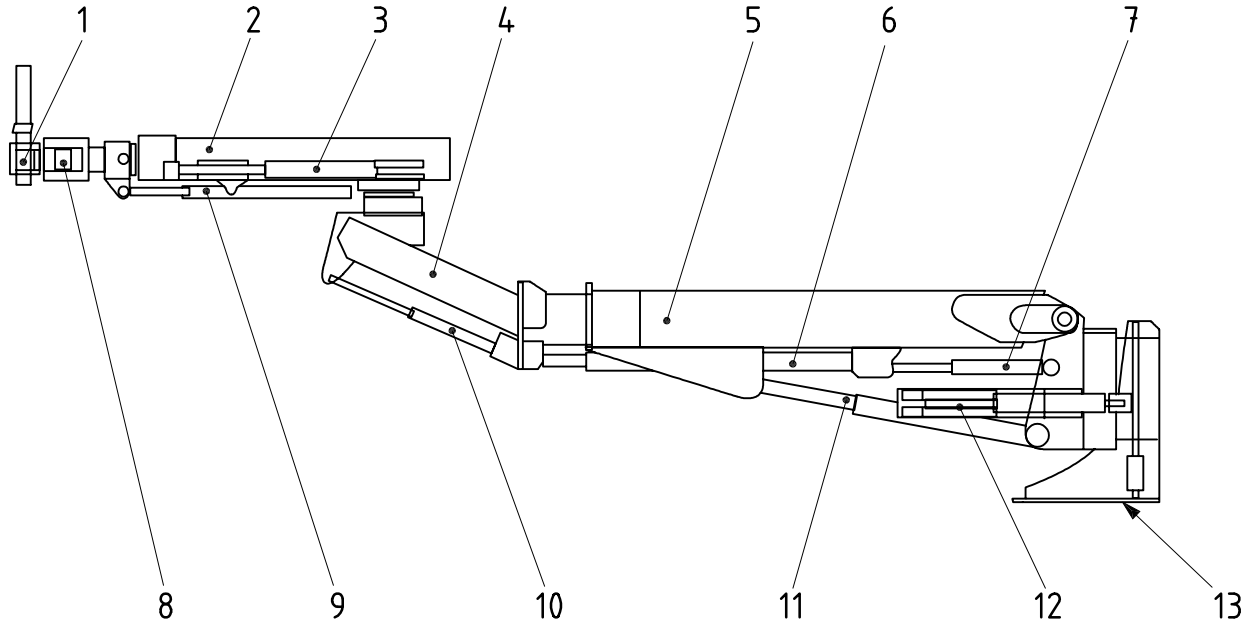


Key

L length [a]
W width [a]
H height [a]
1 base plate
2 hydraulic motor
3 upper casing
4 lower casing
5 concrete inlet port
6 impeller blade
7 discharge port
8 quick setting admixture nozzle

[a] Overall dimension.

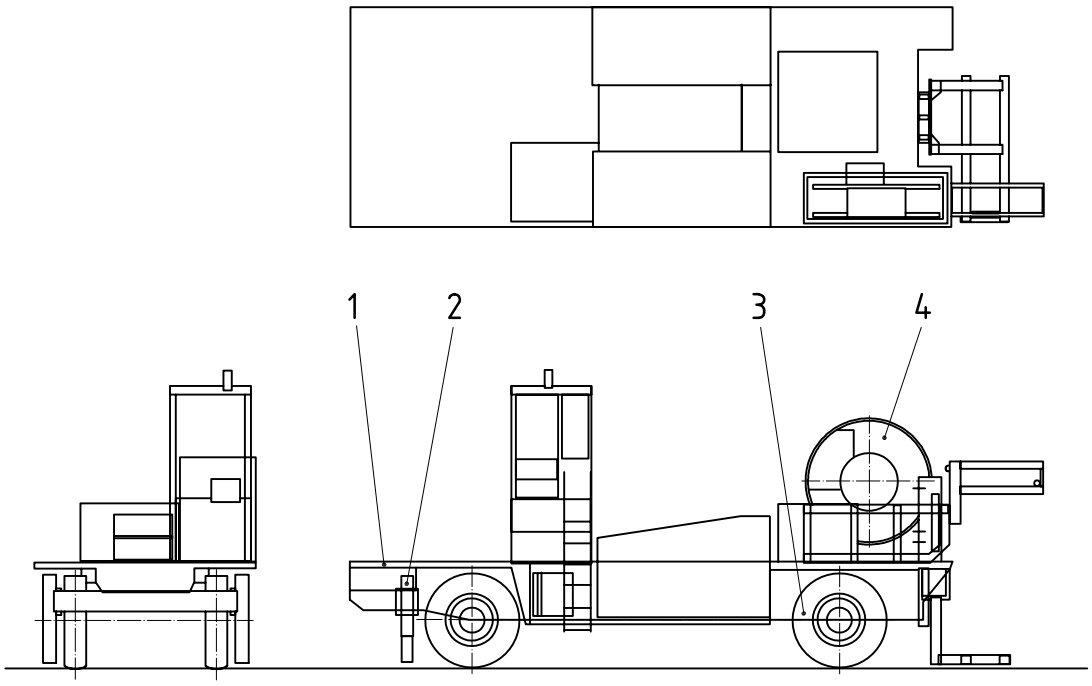
Figure A.5 — Impeller type sprayer nozzle



Key

1 nozzle oscillating device (forward, backward)
2 No. 3 arm (telescopic arm)
3 No. 3 arm swing cylinder
4 No. 2 arm (tip arm)
5 No. 1 arm
6 No. 1 arm telescopic cylinder
7 levelling cylinder
8 nozzle oscillating device (right, left)
9 No. 3 arm telescopic cylinder
10 No. 3 arm derrick cylinder
11 No. 1 arm derrick cylinder
12 No. 1 arm slewing cylinder
13 boom basement

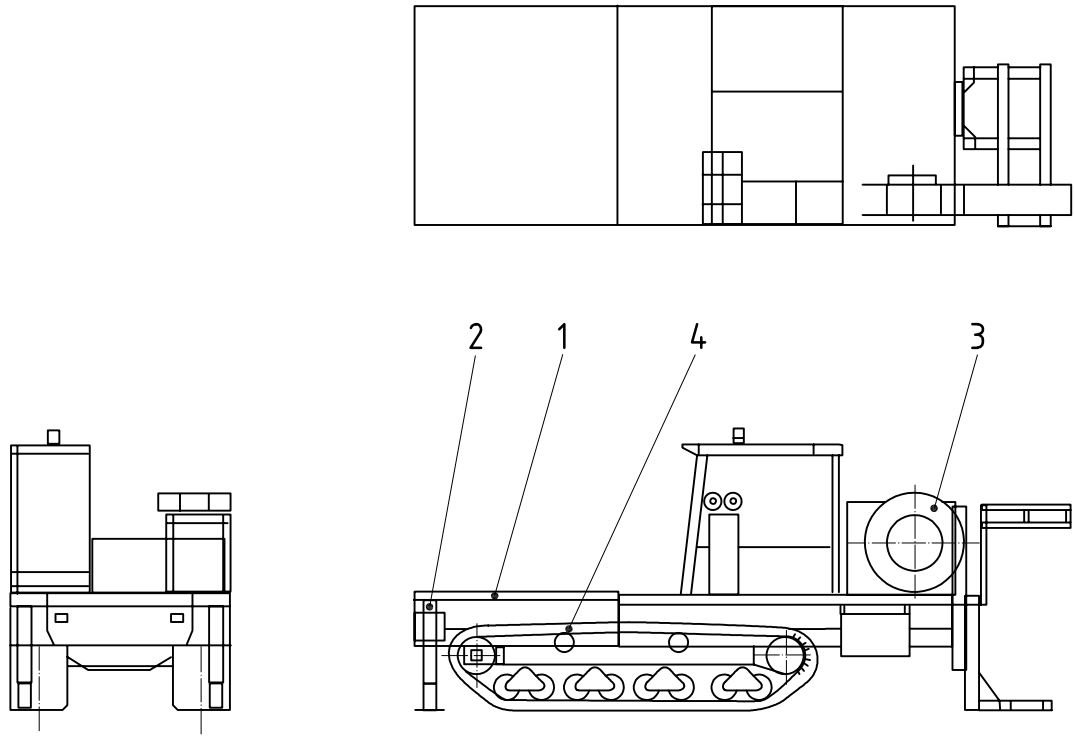
Figure A.6 — Folded and telescopic boom assembly



Key

1 carrier
2 outrigger
3 wheel
4 cable reel

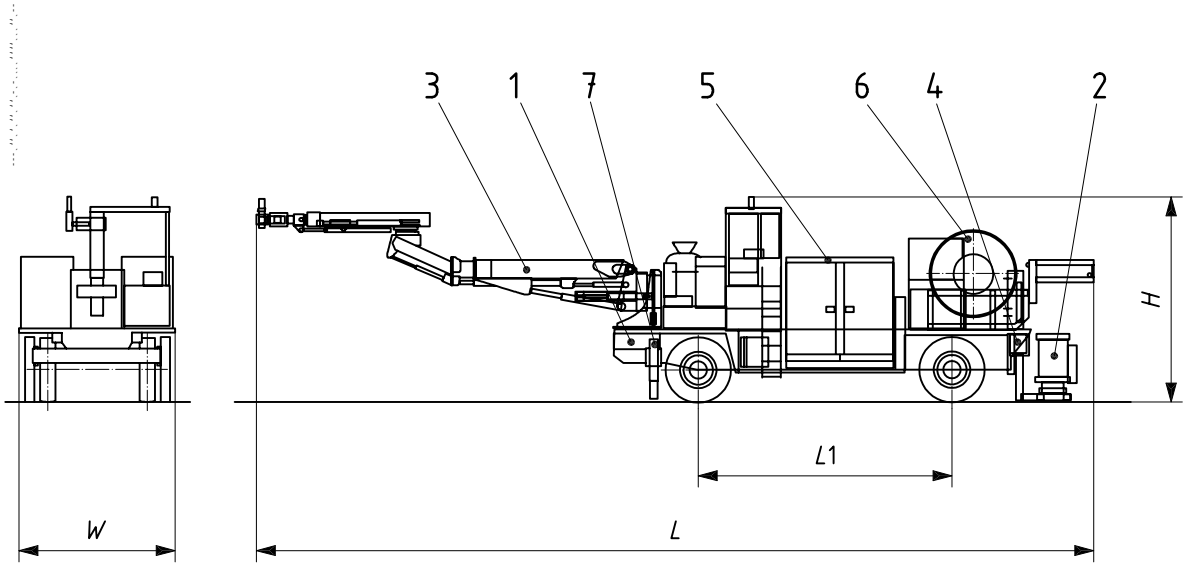
Figure A.7 — Wheeled carrier



Key

1 carrier
2 outrigger
3 cable reel
4 crawler

Figure A.8 — Crawler carrier

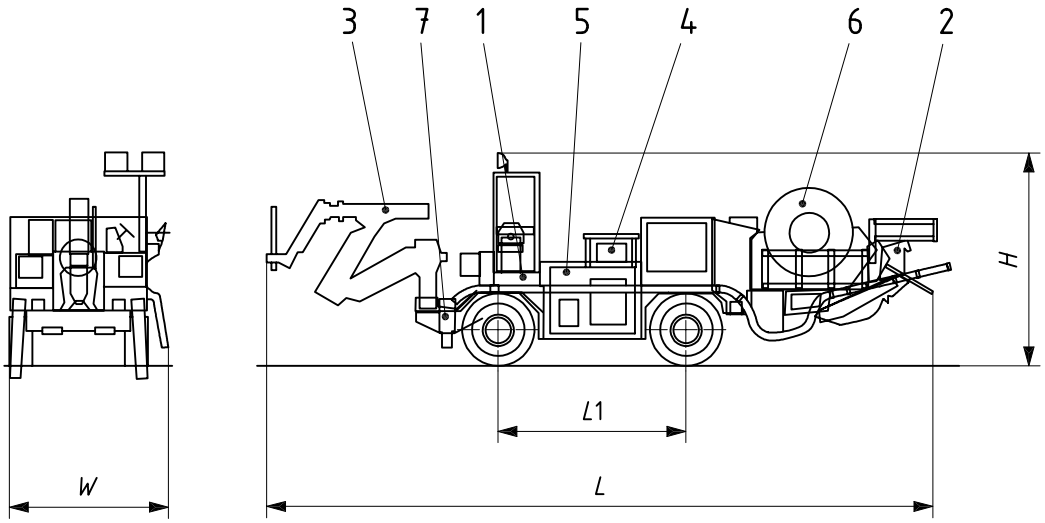


Key

L length [a]
$L1$ length of wheel base
W width [a]
H height [a]
1 carrier
2 rotor type spraying unit
3 boom assembly
4 water pump
5 air compressor
6 cable reel
7 outrigger

[a] Overall dimension.

Figure A.9 — Rotor type sprayer — Wheeled

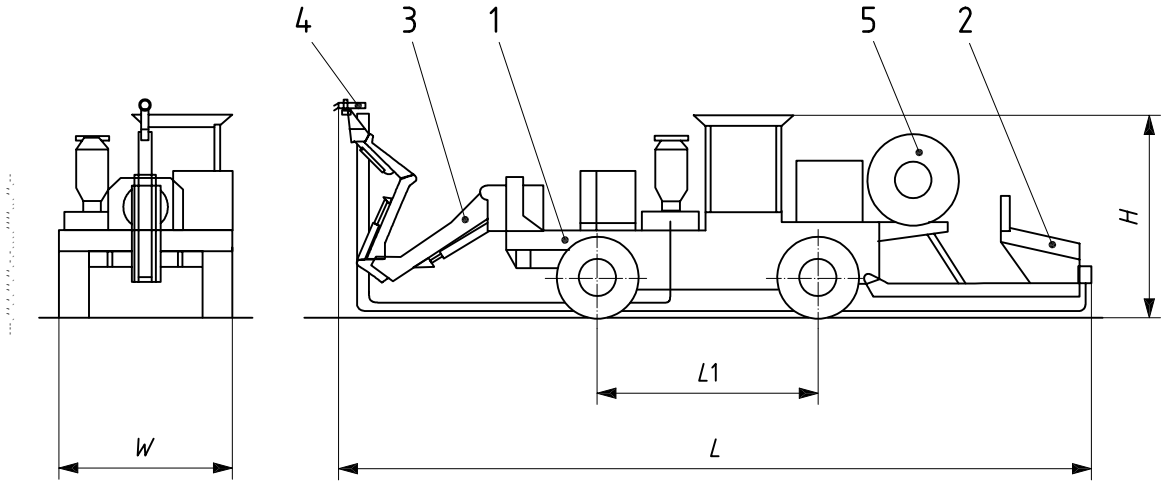


Key

L length [a]
$L1$ length of wheel base
W width [a]
H height [a]
1 carrier
2 concrete pump type spraying unit
3 boom assembly
4 water pump
5 air compressor
6 cable reel
7 outrigger

[a] Overall dimension.

Figure A.10 — Concrete pump type sprayer — Wheeled

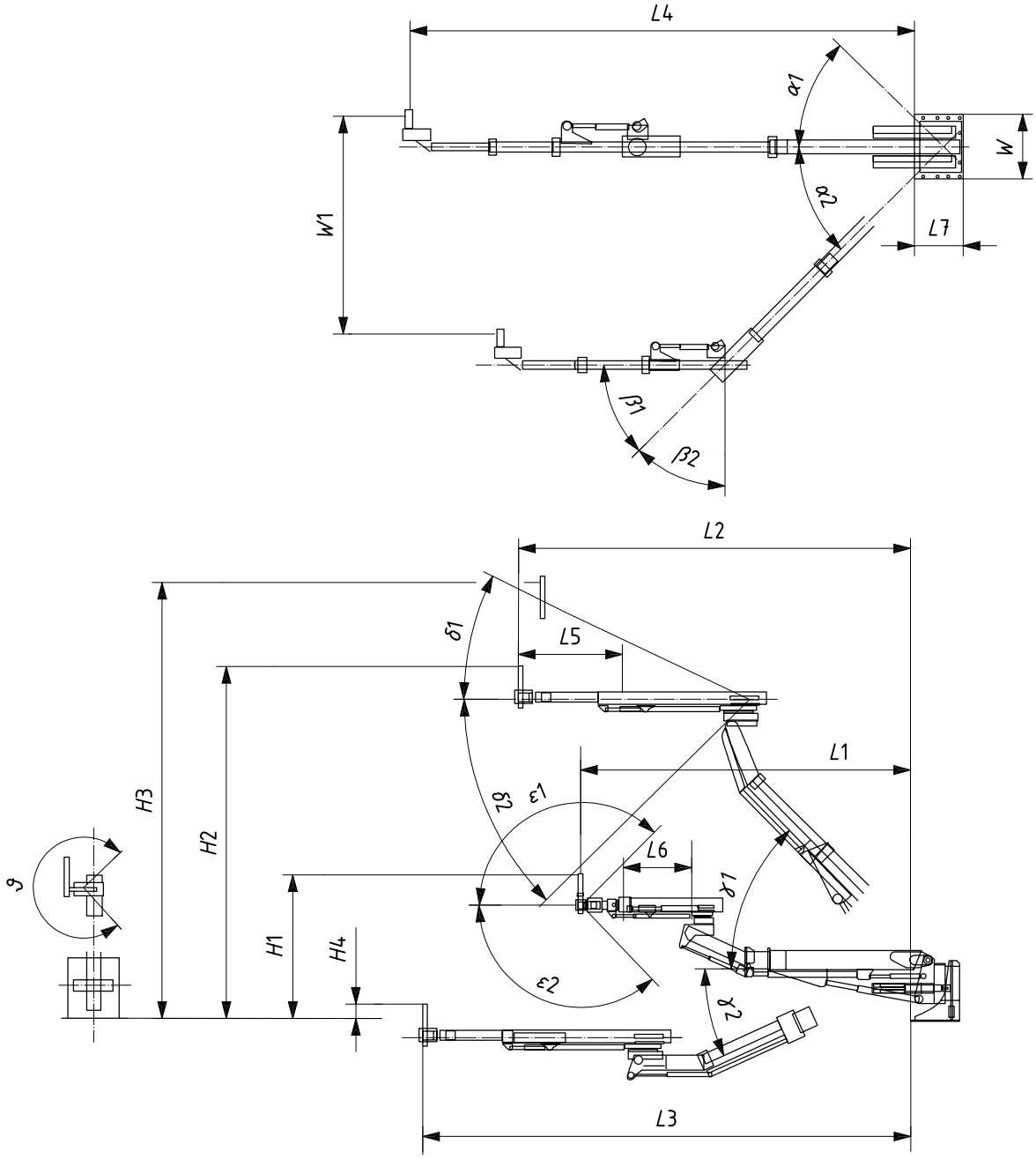


Key

L length [a]
$L1$ length of wheel base
W width [a]
H height [a]
1 carrier
2 concrete pump assembly
3 boom assembly
4 impeller type spraying unit
5 cable reel

[a] Overall dimension.

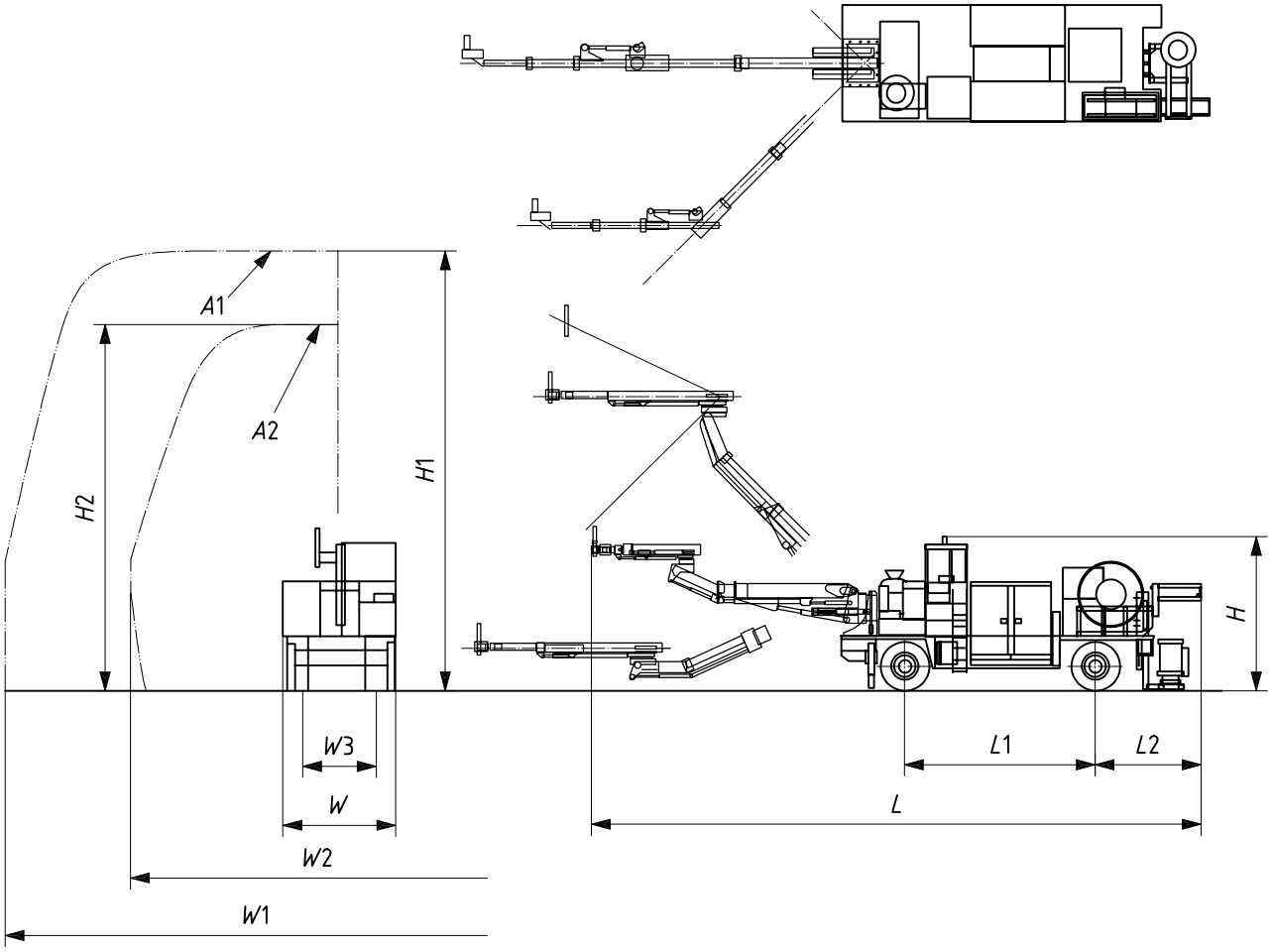
Figure A.11 — Impeller type sprayer



Key

$L1$	overall length at home position	$H2$	nozzle height at No.1 arm highest position
$L2$	maximum length at No.1 boom highest position	$H3$	nozzle height at Nos.1 and 3 arm highest position
$L3$	overall length at No.1 boom lowest position	$H4$	nozzle height at No.1 arm lowest position
$L4$	maximum boom reach	$\alpha1$, $\alpha2$	No. 1 arm slewing angle (right, left)
$L5$	No. 3 arm telescopic stroke	$\beta1$, $\beta2$	No. 3 arm swing angle (right, left)
$L6$	No. 1 arm telescopic stroke	$\gamma1$, $\gamma2$	No. 1 arm derrick angle (up, down)
$L7$	length of boom base	$\delta1$, $\delta2$	No. 3 arm swing angle (up, down)
W	width of boom base	$\varepsilon1$, $\varepsilon2$	nozzle oscillating angle (forward, backward)
$W1$	maximum displacement of the boom in horizontal plane	ϑ	nozzle oscillating angle (right, left)
$H1$	nozzle height at the boom home position		

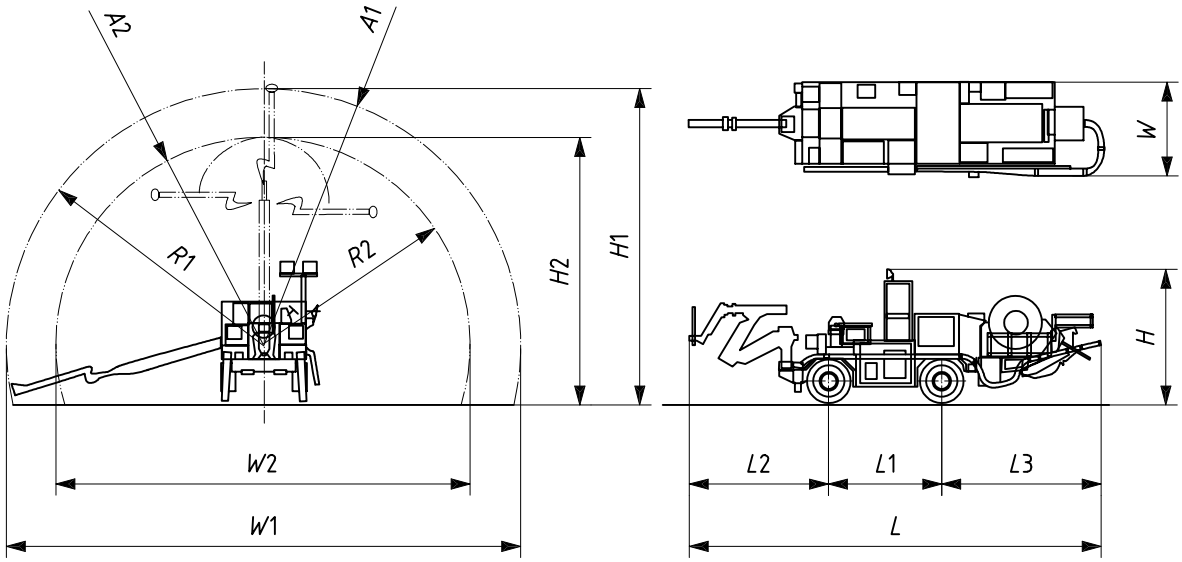
Figure A.12 — Spraying boom — Dimensional characteristics



Key

$A1$ spraying area
$A2$ nozzle moving area
H overall height at boom home position
$H1$ maximum spraying height
$H2$ maximum nozzle height
W overall width
$W1$ maximum spraying width
$W2$ maximum nozzle moving width
$W3$ tread
L overall length at boom home position
$L1$ wheel base
$L2$ rear overhang

Figure A.13 — Rotor type sprayer — Wheeled — Spraying area



Key

$A1$ spraying area
$A2$ nozzle moving area
H overall height at boom home position
$H1$ maximum spraying area
$H2$ maximum nozzle height
$R1$ maximum spraying radius
$R2$ maximum nozzle radius
W overall width
$W1$ maximum spraying width
$W2$ maximum nozzle moving width
L overall length at boom home position
$L1$ wheel base
$L2$ front overhang
$L3$ rear overhang

Figure A.14 — Concrete pump type sprayer — Spraying area

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Price based on 23 pages