भारतीय मानक

Indian Standard

IS 16730 (Part 1) : 2018
ISO 21573-1 : 2014
[Superseded IS/ISO 21573-1 : 2006]

भवन निर्माण की मशीनरी और उपकरण — कंक्रीट पंप

भाग 1 शब्दावली तथा वाणिज्यिक विशिष्टि

Building Contruction Machinery and Equipment — Concrete Pumps

Part 1 Terminology and Commercial Specifications

ICS 19.220

भारतीय मानक ब्यूरो
BUREAUOFINDIANSTANDARDS
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www.bis.gov.in www.standardsbis.in

March 2018 **Price Group**

Construction Plant and Machinery Sectional Committee, MED 18

NATIONAL FOREWORD

This Indian Standard which is identical with ISO 21573-1 : 2014 'Building construction machinery and equipment — Concrete pumps — Part 1 Terminology and commercial specifications' issued by the International Organization for Standardization (ISO) was adopted by the Bureau of Indian Standards on the recommendation of the Construction Plant and Machinery Sectional Committee and approval of the Mechanical Engineering Division Council.

The Indian Standard supersedes IS/ISO 21573-1 : 2006 'Building construction machinery and equipment — Concrete pumps — Part 1 Terminology and commercial specifications '

The main changes in this revision are as follow:

a) editorial correction of numbering of table/figure reference;
b) addition of electric motor as drive power for concrete pump;
c) editorial corrections in figures to clarify part names and callout.

ISO 21573 consists of the following parts, under the general title 'Building construction machinery and equipment ― Concrete pumps':

Part 1 Terminology and commercial specifications
Part 2 Procedure for examination of technical parameters.

In the adopted standard certain terminology and conventions are not identical with those used in Indian Standards; attention is drawn specially to the following:

a) Comma (,) has been used as a decimal marker while in Indian Standards the current practice is to use a point (.) as the decimal marker.
b) Wherever the words 'International Standard' appear, referring to this standard, they should be read as 'Indian Standard'.

In this adopted standard, reference appears to the following International Standard, for which Indian Standard also exists. The corresponding Indian Standard which is to be substituted in their places, is listed below along with its degree of equivalence for the edition indicated:

International Standard	*Title*
ISO 11375 : 1998	Building construction machinery and equipment — Terms and definitions

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

BUILDING CONTRUCTION MACHINERY AND EQUIPMENT — CONCRETE PUMPS

PART 1 TERMINOLOGY AND COMMERCIAL SPECIFICATIONS

1 Scope

This part of ISO 21573 establishes terminology and commercial-literature specifications for concrete pumps which are used on building sites for concrete-mix delivery.

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 11375:1998, *Building construction machinery and equipment — Terms and definitions*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 11375 and the following apply.

3.1
piston-type concrete pump
pump in which a piston is used to impart energy to the concrete mix, with the intent of transporting the mix to and through the conveying pipe and/or hose

Note 1 to entry: See Figure A.1.

3.2
rotary-type concrete pump
pump in which a peristaltic action is used to impart energy to the concrete mix with the intent of transporting the mix to and through the conveying pipe and/or hose

Note 1 to entry: See Figures A.6, A.7, A.8 and A.9.

3.3
stationary-type concrete pump
skid, rail or wheeled-chassis mounted concrete pump intended for long-term operation on one building site

Note 1 to entry: See Figure A.13.

3.4
piston-type concrete pump valve system
system composed of cut-off valves successively locking and opening concrete mix flow from the hopper to the concrete cylinder and from the latter to the conveying pipe

Note 1 to entry: See Figures A.2, A.3, A.4 and A.5.

Note 2 to entry: The operation of the valves is synchronised so that, when the concrete-mix flow from the hopper to the concrete cylinder is opened, the flow to the conveying pipe is closed. Various types of valve systems are identified.

3.5
distributing boom
folded boom with fixed concrete mix conveying pipe the role of which is to deliver concrete mix to work areas within its reach

Note 1 to entry: See Figures A.10 and A.14.

Note 2 to entry: The boom has the possibility of folding in the vertical plane and slewing around the vertical axis. Typically, a rubber hose is fixed to the end of the conveying pipe, to facilitate concrete-mix distribution.

3.6
maximum applicable aggregate size
largest size of aggregate that can be consistently delivered through the concrete pump without blockage, including any conveying pipe that is normally supplied on the finished product

3.7
minimum applicable slump
minimum value of slump applicable for conveying by concrete pump

3.8
maximum theoretical pumping capacity
theoretical delivery volume which is obtained at the maximum strokes/revolutions per minute of concrete pump

Note 1 to entry: The actual delivery volume is calculated through application of the volumetric efficiency and the theoretical delivery volume of the concrete pump. Using concrete of slump value of 18 cm to 21 cm, the volumetric efficiency is about 90 %.

$$Q_{\text{th}} = \left(\pi \times d^2 / 4\right) \times s \times n \times 10^{-9}$$

$$Q_{\text{a}} = Q_{\text{th}} \times \eta_v$$

where

Q_{th} is the theoretical delivery volume (m^3/h);

Q_{a} is the actual delivery volume (m^3/h);

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

s is the stroke (mm);

n is the number of strokes per hour;

η_v is the volumetric efficiency, equal to 0,8 to 0,9.

4 Classification of the concrete pumps

In general terms, concrete pumps are typically classified by the following five main characteristics (see Table 1):

— type of pumping unit;

— mode or frequency of transportation;

— form of conveying;

— concrete mix delivery with assistance;

— drive system.

Table 1 — Classification of the concrete pumps

Classification	Type	Current examples	Reference figures
Type of pumping unit	Piston	Hydraulic driven	Figure A.1
		Mechanical driven	—
		Single-piston	—
		Multi-piston	Figure A.1
	Rotary	Vacuum	Figure A.6, A.7
		Elastic	Figure A.8, A.9
Mode or frequency of transportation	Self-propelled mobile	Truck-mounted	Figures A.10, A.11, A.14 and ISO 11375, Figure 41
	Non self-propelled mobile	Trailer-mounted (with tires on highway)	Figure A.12 and ISO 11375, Figure 42
		Trailer-mounted, steel wheels (rides on rails)	—
		Trailer-mounted, track	—
	Stationary	Skid-mounted/Fixed in place	Figure A.13
		Trailer mounted (with tires off-road)	ISO 11375, Figure 42
Form of conveying	With integral distribution boom	Truck mounted	Figure A.10, A.14 and ISO 11375, Figure 41
		Trailer-mounted	ISO 11375, Figure 43
	With separate distribution boom	Tower-mounted boom	ISO 11375, Figure 44
		Articulating distribution arm (with support legs)	—
	With connected conveying line	Pipe and/or hose run from pump to placement	—
Concrete-mix delivery with assistance	With pressurized air	Concrete spraying	—

5 Commercial specifications

5.1 General characteristics

The following characteristics shall be specified:

— model and type;

— manufacturer's name;

— maximum theoretical pumping capacity (m^3/h);

— maximum theoretical pressure in concrete (MPa);

— diameter of concrete pumping cylinder (mm);

— stroke of concrete pumping cylinder (mm);

— number of strokes per minute (min^{-1});

— outlet diameter of concrete valve device (mm);

— capacity of hopper (m^3);

— engine power (kW);

— acceptable leaning angle of the machine during pumping operation (degrees);

— operating mass (kg).

Specify the mass of the concrete pump under the following conditions:

— ready to run;

— with or without cab (to be stated);

— including standard equipment;

— with a driver of mass 75 kg;

— with fuel tank half full;

— with cleaning water, cooling, lubrication and hydraulic systems full.

The manufacturer shall provide means for correlating the machine's theoretical maximum concrete line pressure to the theoretical pumping distance capability.

5.2 Applicable concrete

Specify the following:

— maximum applicable size of aggregate (mm);

— minimum applicable slump value (cm).

5.3 Drive

Specify the type of the concrete pump's drive:

— by the vehicle engine and additional gear box for hydraulic pump driving;

— by separate engine and gear box driving the hydraulic system.

5.4 Dimensional characteristics

Specify the following:

— overall dimensions:

— length, *L* (mm);

— width, *W* (mm);

— height, *H* (mm);

— wheel base, *L*1 (mm);

— hopper height from the ground, *H*1 mm;

— reach of distributing boom (m).

For maximum out-reach of the distributing boom, see Figure A.14.

5.5 Conveying-pipe cleaning device

Specify the following:

— model;

— operation method (water or pneumatic system);

— performance:

  — delivery volume (l/min);

  — delivery pressure (MPa).

5.6 Chassis cleaning device

Specify the following:

— model;

— cleaning-water tank capacity (l).

5.7 Distributing boom

Specify the following:

— model;

— maximum reach in vertical (m);

— maximum reach in horizontal (m);

— swing device:

  — model;

  — swing angles α, β, γ, δ (see Figure A.14) (degrees);

— diameter of the conveying pipe on the boom (mm);

— length of the rubber distributing hose (m);

— number of boom sections;

— mass of the distributing boom (kg).

5.8 Outrigger component

Specify the following:

— model;

— maximum extended width:

  — front (mm);

  — rear (mm);

— maximum load capacity of each outrigger.

5.9 Hydraulic system

Specify the following:

— number of hydraulic pumps;

— hydraulic oil-tank capacity (l);

— boom control block (proportional or nominal directional valve).

For each pump, specify:

— application (concrete cylinders drive, cutting-off valves drive, distributing boom drive, outriggers drive, hopper agitator drive);

— model;

— delivery volume (l/min);

— delivery pressure (MPa).

5.10 Truck chassis

Specify the following:

— general data;

— model;

— load capacity (N);

— number of axles;

— maximum permissible load on axles:

  — front (N);

  — rear (N);

— engine characteristics:

  — model;

  — rated output/engine speed (kW/min^{-1});

  — maximum torque/engine speed ($N{\cdot}m/min^{-1}$);

  — displacement (m^3);

— fuel tank capacity (l).

5.11 Trailer chassis

Specify the following:

— model;

— type of trailer — single or double axle;

— load capacity (N);

— maximum permissible load on axle (N).

For a double-axle trailer, specify the permissible load on the front and rear axles.

5.12 Attachments and tools

Specify the following:

— remote-control panel (if any);

— operation manual;

— tools;

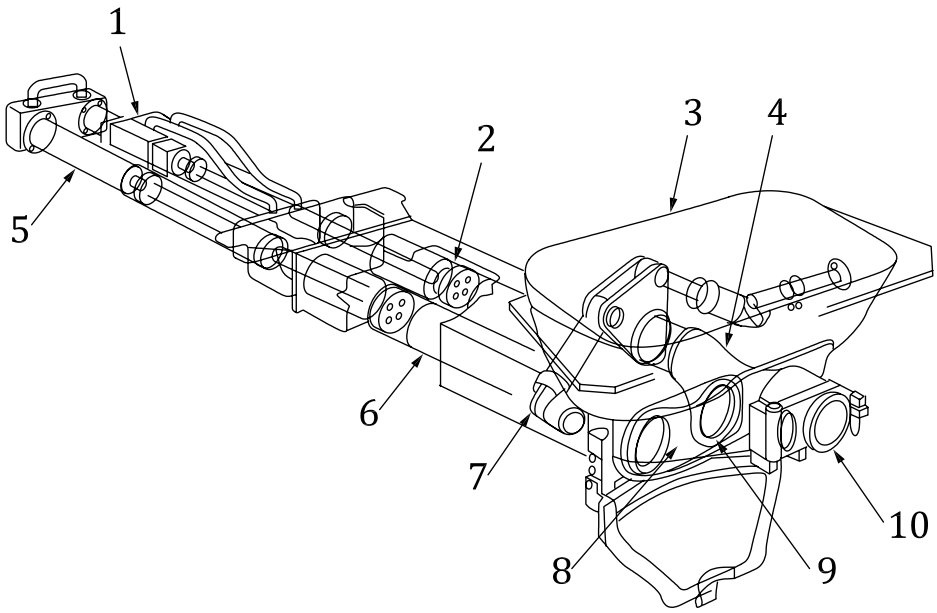
— spare parts;

— reduction connection for pipeline with clamp.

Annex A
(informative)

Examples of concrete pump designs and their assemblies

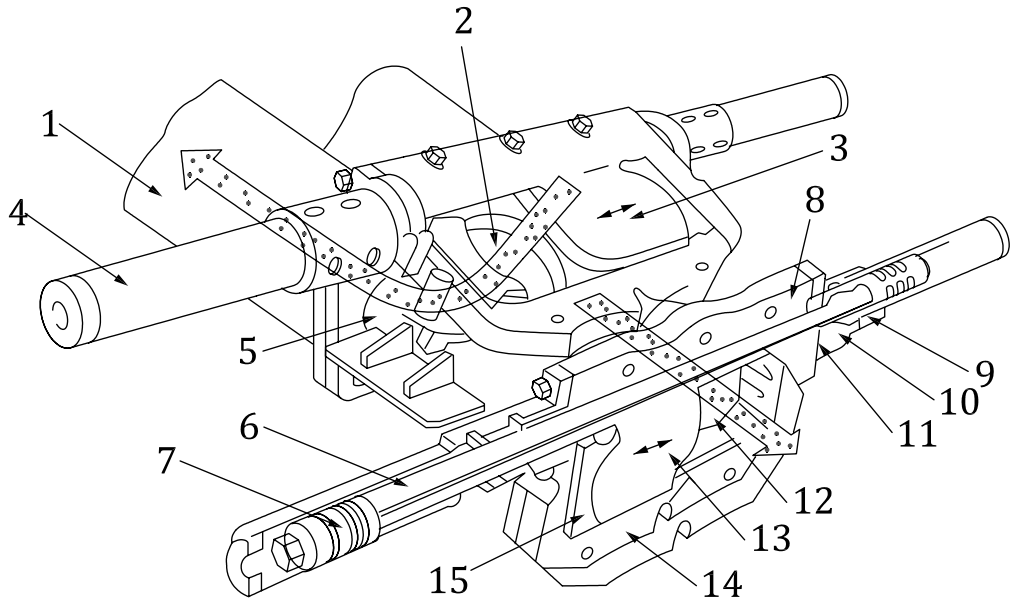
See Figures A.1 to A.14.



Key

1 hydraulic valve
2 concrete piston
3 concrete hopper
4 swing pipe
5 hydraulic cylinder
6 concrete cylinder
7 hydraulic cylinder (valve)
8 wear plate
9 wear ring
10 outlet port

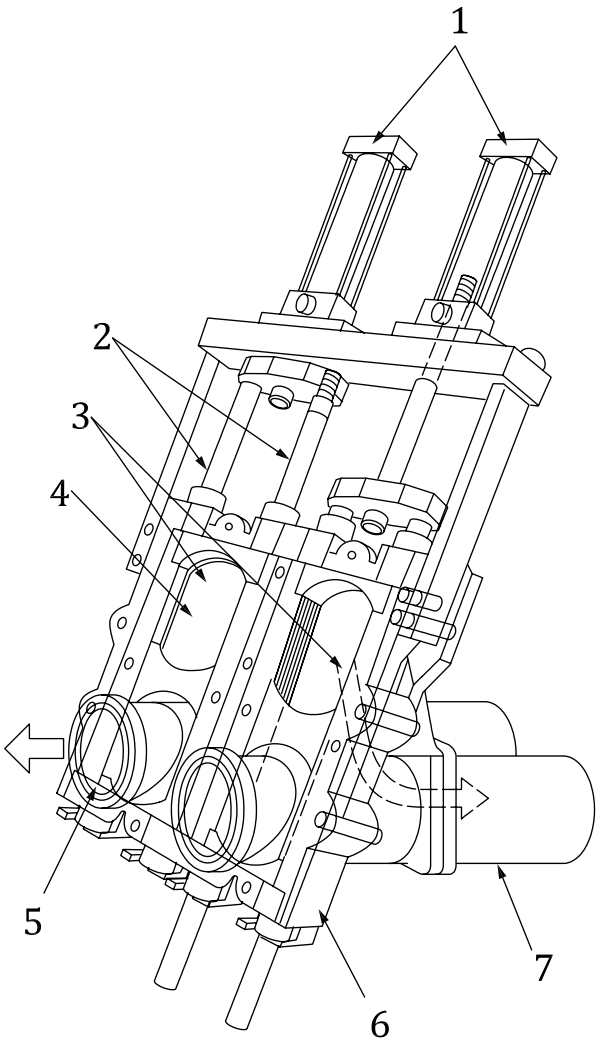
Figure A.1 — Structure of piston-type concrete pump (swing-valve type)



Key

1 concrete cylinder
2 suction port
3 inlet gate valve
4 hydraulic cylinder
5 casing
6 valve rod
7 hydraulic piston
8 bushing
9 packing (hydraulic cylinder)
10 lubricate bushing
11 packing (gate valve)
12 discharge port
13 outlet gate valve
14 valve housing
15 stopper

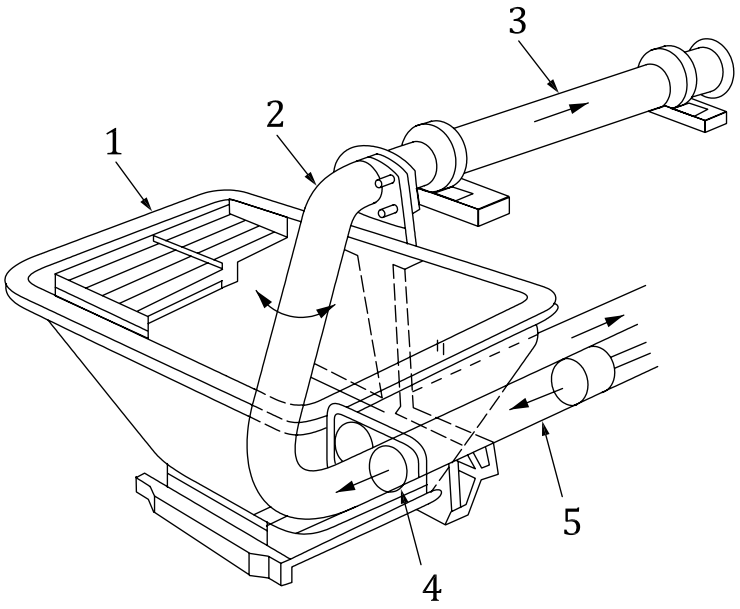
Figure A.2 — Structure and principle of operation of the gate valve system (horizontal type)



Key

1 hydraulic cylinder
2 valve rod
3 suction port
4 valve plate
5 discharge port
6 valve casing
7 concrete cylinder

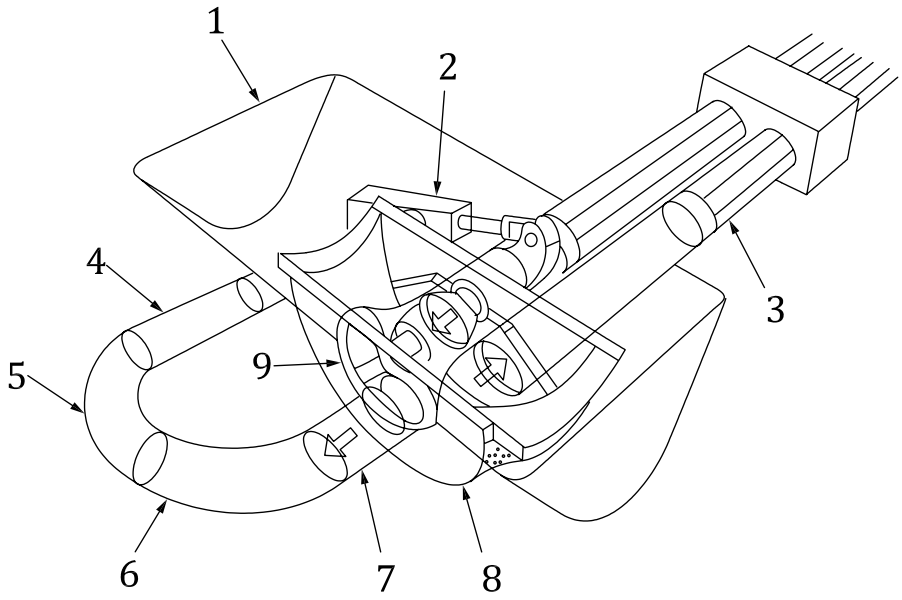
Figure A.3 — Structure and principle of operation of the gate-valve system (vertical type)



Key

1 concrete hopper
2 swing valve
3 outlet pipe
4 intake-outlet port
5 concrete cylinder

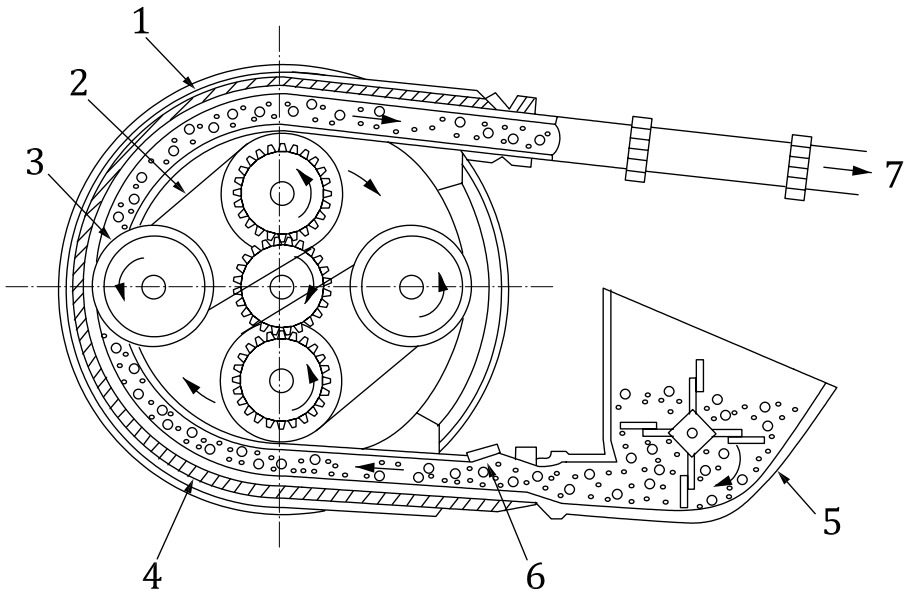
Figure A.4 — Structure and principle of operation of the swing-valve system



Key

1 concrete hopper
2 hydraulic cylinder (valve)
3 concrete cylinder
4 tapered pipe
5 bent pipe
6 tapered bent pipe
7 outlet pipe
8 rock-slicer
9 swing valve

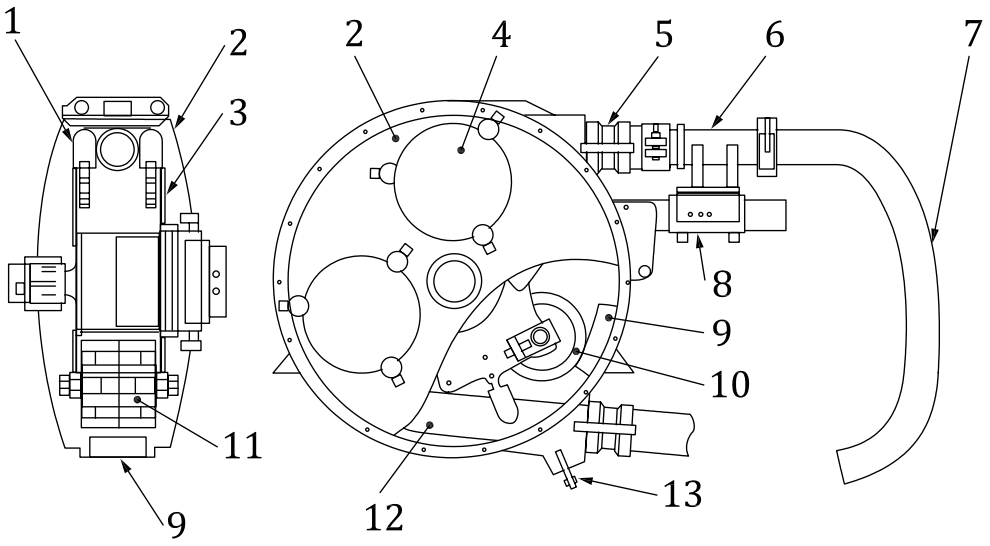
Figure A.5 — Structure and principle of operation of the swing-valve system



Key

1 rubber pad
2 drive chain
3 rubber roller
4 pumping tube
5 concrete hopper
6 suction port
7 discharge port

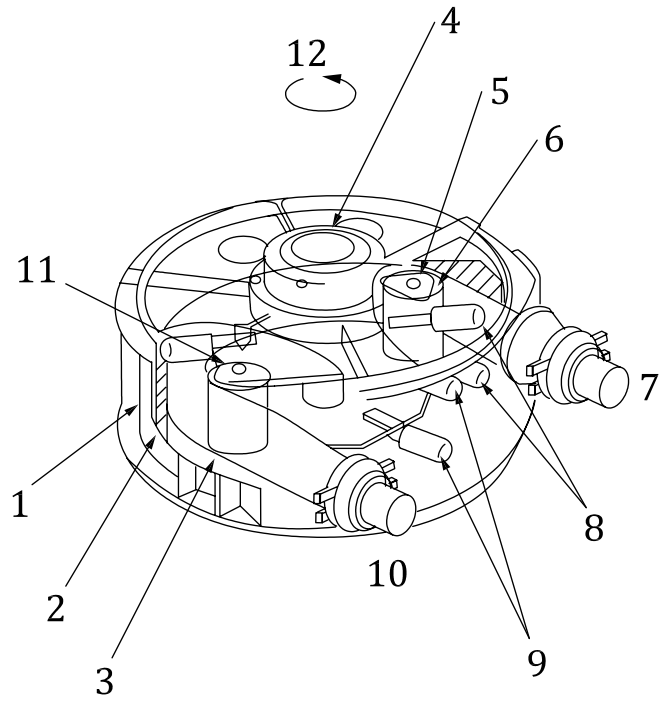
Figure A.6 — Structure and principle of operation of the rotary-type concrete pump



Key

1 guide roller
2 pump casing
3 rotor frame
4 hole cover
5 boots
6 transfer pipe
7 transfer hose
8 support beam
9 rubber pad
10 rubber roller
11 roller shaft
12 pumping tube
13 drain port

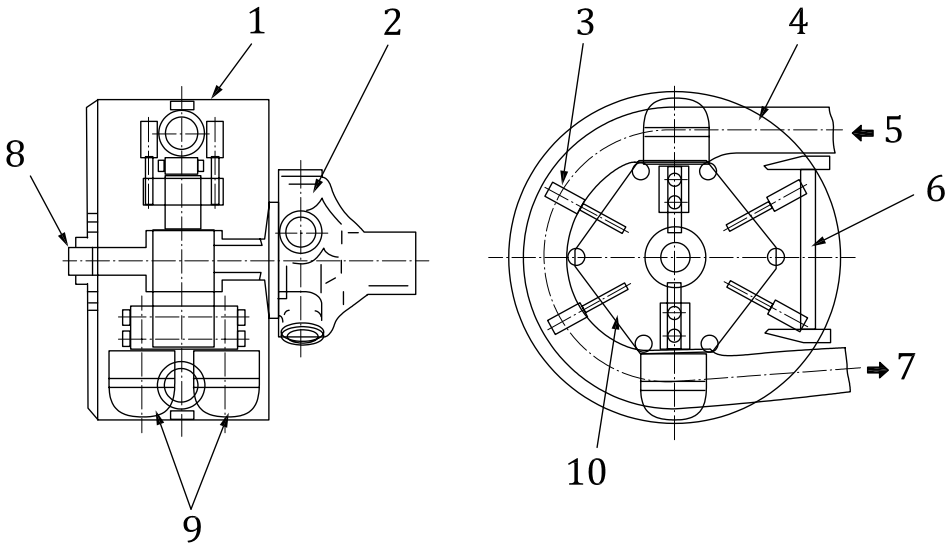
Figure A.7 — Structure of the rotary concrete pump (vacuum type)



Key

1 pump casing
2 rubber pad
3 pumping tube
4 hydraulic motor
5 adjusting screw
6 rubber roller
7 inlet port
8 guide roller (A)
9 guide roller (B)
10 outlet port
11 adjust indicator
12 direction of rotation

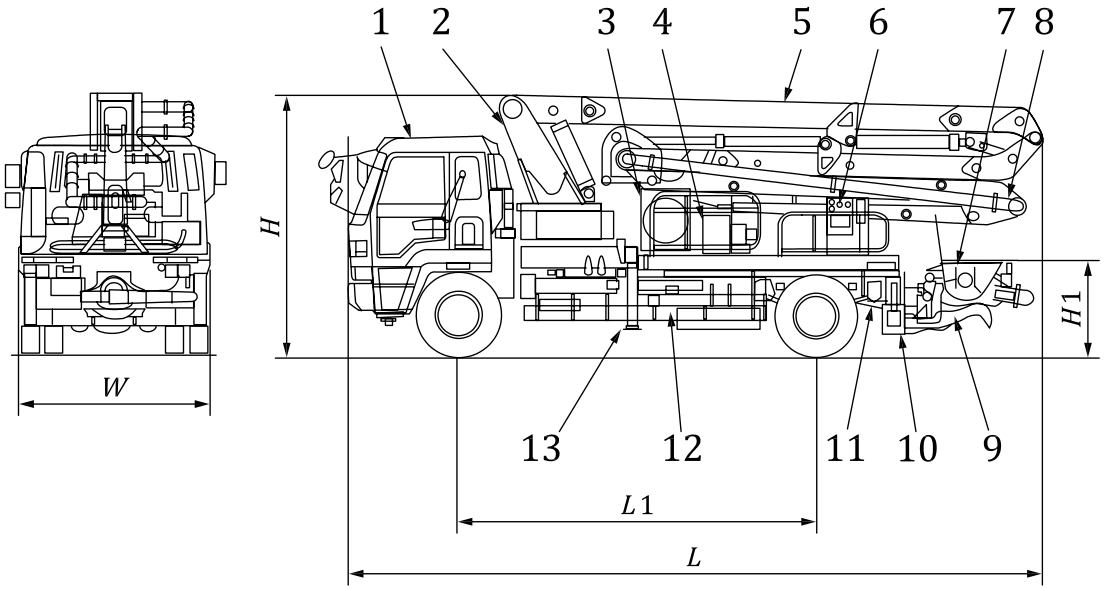
Figure A.8 — Structure of the rotary concrete pump (elastic-restore type)



Key

1 pump casing
2 hydraulic motor
3 guide roller
4 pumping tube
5 inlet port
6 tube guide
7 outlet port
8 bearing
9 press roller
10 rotor

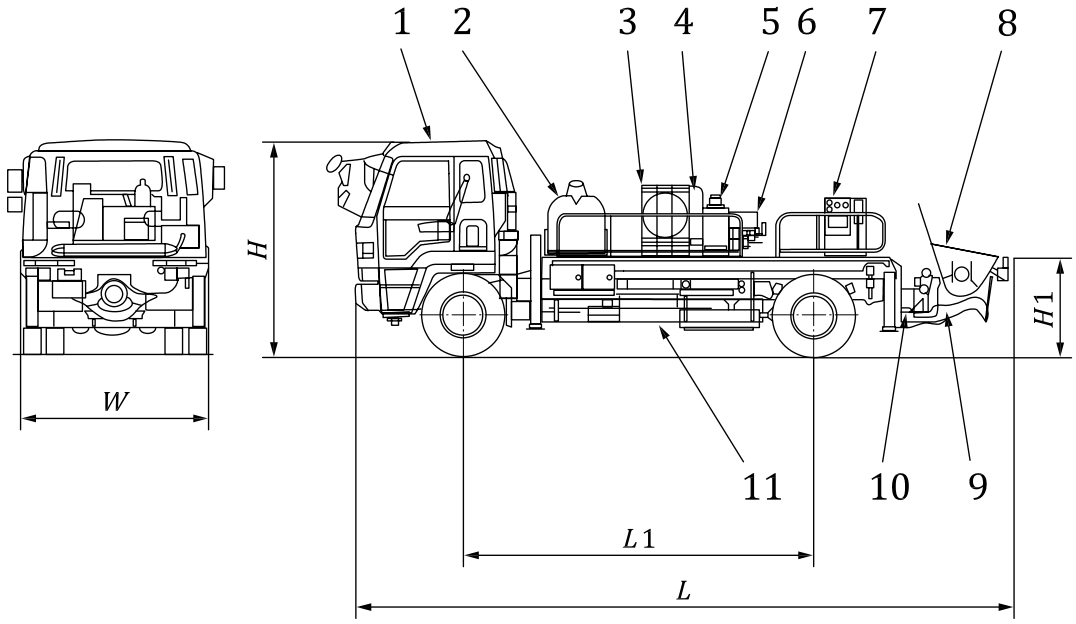
Figure A.9 — Structure of the rotary concrete pump with elastic restore (double roller pump)



Key

1 truck chassis
2 turn-table
3 oil cooler
4 oil tank
5 boom
6 control panel
7 concrete hopper
8 conveying pipe
9 concrete valve
10 rear outrigger
11 concrete cylinder
12 water pump
13 front outrigger
L overall length
*L*1 wheel base
W overall width
H overall height
*H*1 hopper height

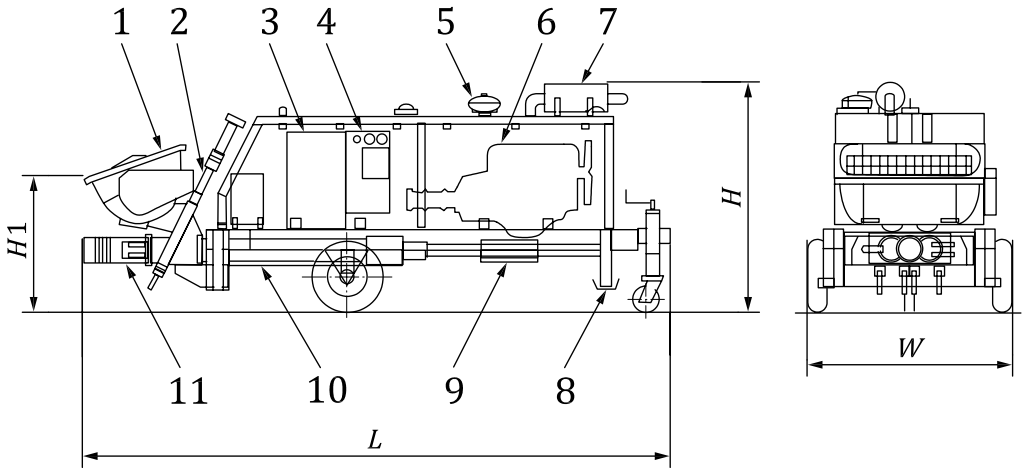
Figure A.10 — Truck- mounted concrete pump with distributing boom



Key

1 truck chassis
2 water tank
3 oil cooler
4 accumulator
5 oil tank
6 hydraulic valve
7 control panel
8 concrete hopper
9 concrete valve
10 concrete cylinder
11 water pump
L overall length
*L*1 wheel base
W overall width
H overall height
*H*1 hopper height

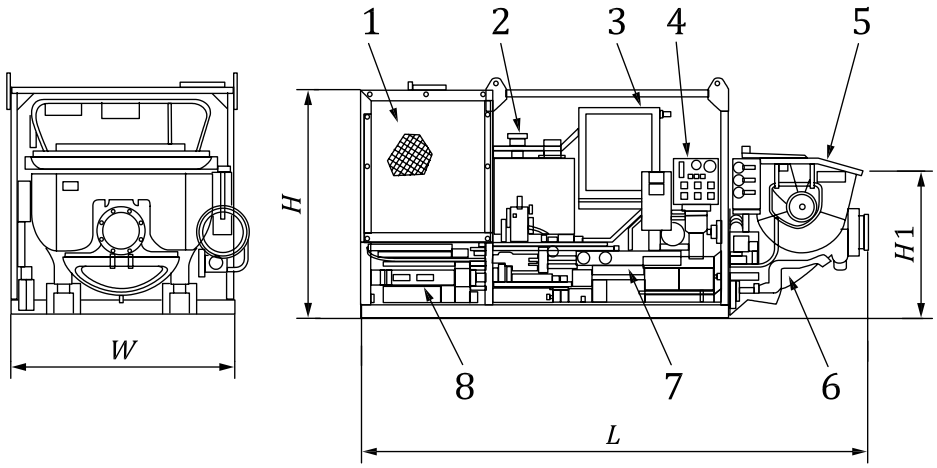
Figure A.11 — Truck-mounted concrete pump for connection of a conveying pipeline



Key

1 concrete hopper
2 concrete valve
3 oil tank
4 control panel
5 intake filter
6 diesel engine
7 exhaust muffler
8 outrigger
9 battery
10 concrete cylinder
11 connecting pipe
L overall length
W overall width
H overall height
*H*1 hopper height

Figure A.12 — Trailer-type concrete pump

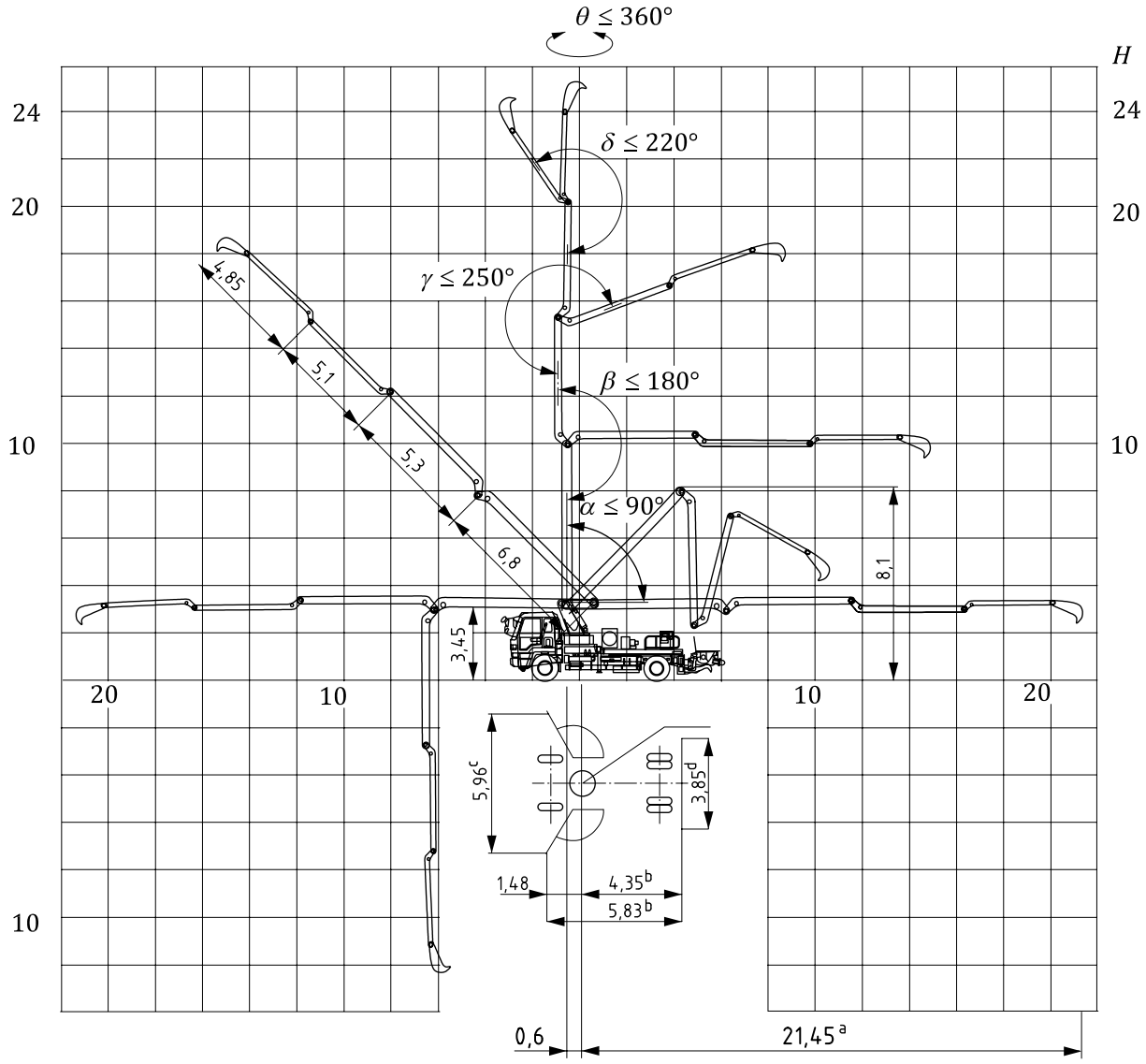


Key

1 engine radiator
2 air breather
3 oil cooler
4 control panel
5 concrete hopper
6 hopper gate
7 concrete cylinder
8 hydraulic cylinder
L overall length
W overall width
H overall height
*H*1 hopper height

Figure A.13 — Stationary-type concrete pump

Dimensions in metres



Key

H	boom vertical reach
α	hoist angle of boom 1
β	folding angle of boom 2
γ	folding angle of boom 3
δ	folding angle of boom 4
θ	slewing angle
a	$L1$ boom horizontal reach
b	$L2$ outrigger span
c	$W1$ outrigger front span
d	$W2$ outrigger rear span

Figure A.14 — Reach possibilities of the concrete pump with distributing boom

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards : Monthly Additions'.

This Indian Standard has been developed from Doc No. : MED 18 (1437).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Published by BIS, New Delhi