BS EN 1501-5:2011

BSI Standards Publication

Refuse collection vehicles — General requirements and safety requirements

Part 5: Lifting devices for refuse collection vehicles

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National foreword

This British Standard is the UK implementation of EN 1501-5:2011. Together with BS EN 1501-1:2011, it supersedes BS EN 1501-1:1998+A2:2009 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/508/1, Waste containers and associated lifting devices on refuse collection vehicles.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Foreword

This document (EN 1501-5:2011) has been prepared by Technical Committee CEN/TC 183 “Waste Management”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by February 2012, and conflicting national standards shall be withdrawn at the latest by February 2012.

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

This document together with EN 1501-1:2011 supersedes EN 1501-1:1998+A2:2009.

It also updates and improves the description of and the requirements for the lifting devices of EN 1501-2:2005+A1:2009 (3.14 to 3.20 and 6.4), EN 1501-3:2008 (3.15 to 3.17, 4.4 and 6.5) and EN 14803:2006 (Figure A.1).

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

The minimum essential criteria are considered to be of primary importance in providing safe, serviceable, economical and practical lifting devices.

This European Standard is one part of the series of co-ordinated standards EN 1501 about "Refuse collection vehicles — General requirements and safety requirements" dealing with specification; design, safety and testing of refuse collection vehicles (RCVs) and their associated lifting devices comprising the following parts:

— *Part 1: Rear loaded refuse collection vehicles;*

— *Part 2: Side loaded refuse collection vehicles;*

— *Part 3: Front loaded refuse collection vehicles;*

— *Part 4: Noise test code for refuse collection vehicles;*

— *Part 5: Lifting devices for refuse collection vehicles.*

The European Standards EN 1501-2:2005+A1:2009 and EN 1501-3:2008 will be revised after adoption of EN 1501-1 and this part of EN 1501.

For waste container lifting devices mounted on rear loaded RCVs, this Part 5 of the European Standard EN 1501 shall be enforced at the same time as Part 1 of this series.

In this document Annexes A and C are normative, Annexes B and ZA are informative.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

This European Standard is a type C standard as stated in EN ISO 12100.

The machinery concerned and the extent to which hazards, hazardous situations and hazardous events are covered are indicated in the scope of this European Standard.

When provisions of this type C standard are different from those which are stated in type A or B standards, the provisions of this type C standard take precedence over the requirements of the other standards, for machines that have been designed and built according to the requirements of this type C standard.

This European Standard should be read in conjunction with:

— the documents developed for refuse collection vehicles (EN 1501-1, EN 1501-2 and EN 1501-3) that are compatible with the waste container lifting devices specified in this standard;

— the documents developed for mobile waste containers (series of standards EN 840), for stationary waste containers (series of standards EN 12574) and for selective collection containers (series of standards EN 13071) that are compatible with the lifting devices specified in this European Standard;

— the documents developed for diamond and skip containers.

While producing this European Standard it was assumed that:

— only persons who have been appropriately trained will operate the lifting device;

— the guidelines issued by the chassis manufacturer have been taken into account;

— the guidelines issued by the RCV manufacturer have been taken into account;

— components without specific requirements are designed in accordance with the usual engineering practice and calculation codes, including all failure modes, of sound mechanical and electrical construction and made of materials with adequate strength and of suitable quality;

— harmful materials, such as asbestos, are not used as part of the lifting device;

— components are kept in good repair and working order, so that the required characteristics remain despite wear;

— this European Standard is designed for careful consideration by designers, manufacturers, suppliers and users of lifting devices and RCVs.

1 Scope

This European Standard deals with all significant hazards, hazardous situations and events relevant to lifting devices used for the emptying of designated waste containers into RCVs and their fitting onto the RCVs when they are used as intended and under conditions of misuse which are reasonably foreseeable by the manufacturer throughout their foreseeable lifetime as defined in Clause 4.

This European Standard is applicable to the design and construction of the waste container lifting devices and the mounting of other lifting devices so as to ensure that they are fitted for their function and can be operated, adjusted and maintained during their entire lifetime. It is not applicable to the end of life of the lifting devices.

This European Standard describes and gives the safety requirements of the lifting devices for emptying waste containers and their interfaces with the corresponding parts of the RCVs and shall be used in conjunction with Parts 1, 2 and 3 of EN 1501 for the rear, side and front loaded RCVs. It refers to EN 1501-4 for the noise test code.

This European standard is not applicable to:

— operation in severe conditions e.g. extreme environmental conditions such as:

  — temperatures below – 25° C and above + 40°C;

  — tropical environment;

  — wind velocity in excess of 75 km/h;

— contaminating environment;

— corrosive environment;

— operation in potentially explosive atmospheres;

— lifting and transportation of persons;

— emptying waste containers other than those manufactured according to EN 840, EN 12574, EN 13071, and those described as paladin, diamond, skip containers;

— loading bulky waste by means of platform or forks;

— handling of loads the nature of which could lead to dangerous situations (e.g. hot wastes, acids and bases, radioactive materials, contaminated waste, especially fragile loads, explosives);

— operation on ships;

— fitting and operation on stationary compactors.

This European Standard is not applicable to machinery which is manufactured before the date of its publication by CEN.

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.

EN 349:1993+A1:2008, *Safety of machinery — Minimum gaps to avoid crushing of parts of the human body*

EN 374-1:2003, *Protective gloves against chemicals and micro-organisms — Part 1: Terminology and performance requirements*

EN 574:1996+A1:2008, *Safety of machinery — Two-hand control devices — Functional aspects — Principles for design*

EN 818: 1996+A1:2008 (all parts) *Short link chain for llifting purposes*

EN 840-1:2004, *Mobile waste containers — Part 1: Containers with 2 wheels with a capacity up to 400 l for comb lifting devices, dimensions and design*

EN 840-2:2004, *Mobile waste containers — Part 2: Containers with 4 wheels with a capacity up to 1 300 l with flat lid(s), for trunnion and/or comb lifting devices — Dimensions and design*

EN 840-3:2004, *Mobile waste containers — Part 3: Containers with 4 wheels with a capacity up to 1 300 l with dome lid(s), for trunnion and/or comb lifting devices — Dimensions and design*

EN 840-4:2004, *Mobile waste containers — Part 4: Containers with 4 wheels with a capacity up to 1 700 l with flat lid(s), for wide trunnion or BG-and/or wide comb lifting device — Dimensions and design*

EN 840-5:2004, *Mobile waste containers — Part 5: Performance requirements and test methods*

EN 894-1:1997+A1:2008, *Safety of machinery — Ergonomic requirements for the design of displays and control actuators — Part 1: General principles for human interactions with displays and control actuators*

EN 894-2:1997+A1:2008, *Safety of machinery — Ergonomics requirements for the design of displays and control actuators — Part 2: Displays*

EN 894-3:2000+A1:2008, *Safety of machinery — Ergonomic requirements for the design of displays and control actuators — Part 3: Control actuators*

EN 953:1997+A1:2009, *Safety of machinery — Guards — General requirements for the design and construction of fixed and movable guards*

EN 1037:1995+A1:2008, *Safety of machinery — Prevention of unexpected start-up*

EN 1501-1:2011, *Refuse collection vehicles — General requirements and safety requirements — Part 1: Rear loaded refuse collection vehicles.*

EN 1501-2:2005+A1:2009, *Refuse collection vehicles and associated lifting devices — General requirements and safety requirements — Part 2: Side loaded refuse collection vehicles*

EN 1501-3:2008, *Refuse collection vehicles and their associated lifting devices — General requirements and safety requirements — Part 3: Front loaded refuse collection vehicles*

EN 1501-4:2007, *Refuse collection vehicles and their associated lifting devices — General requirements and safety requirements — Part 4: Noise test code for refuse collection vehicles*

EN 12574-1:2006, *Stationary waste containers — Part 1: Containers with a capacity up to 10 000 l with flat or dome lid(s), for trunnion, double trunnion or pocket lifting device — Dimensions and design*

EN 13071-1:2008, *Stationary waste containers up to 5 000 l, top lifted bottom emptied — Part 1: General requirements*

EN 13071-3:2011, *Stationary waste containers up to 5 000l, top lifted and bottom emptied — Part 3: Recommended lifting connections*

EN 13135-1:2003+A1:2010, *Cranes — Equipment — Part 1: Electrotechnical equipment*

EN 13135-2:2004+A1:2010, *Cranes — Equipment — Part 2: Non-electrotechnical equipment*

EN 13155:2003+A2:2009, *Cranes — Non-fixed load lifting attachments*

EN 13309:2010, *Construction machinery — Electromagnetic compatibility of machines with internal electrical power supply*

EN 13557:2003+A2:2008, *Cranes — Controls and control stations*

EN 14492-1:2006+A1:2009, *Cranes — Power driven winches and hoists — Part 1: Power driven winches*

EN 14803:2006, *Identification and/or determination of the quantity of waste*

EN 60204-1:2006, *Safety of machinery — Electrical equipment of machines — Part 1: General requirements (IEC 60204-1:2005, modified)*

EN 60529:1991, *Degrees of protection provided by enclosures (IP code) (IEC 60529:1989)*

EN 61131-2:2003, *Programmable controllers — Part 2: Equipment requirements and tests (IEC 61131-2:2007)*

EN 61984, *Connectors — Safety requirements and tests (IEC 61984:2008)*

EN ISO 4413:2010, *Hydraulic fluid power - General rules and safety requirements for systems and their components (ISO 4413:2010)*

EN ISO 4414:2010, *Pneumatic fluid power - General rules and safety requirements for systems and their components (ISO 4414:2010)*

EN ISO 6743-4:2001, *Lubricants, industrial oils and related products (class L) — Classification — Part 4: Family H (Hydraulic system) (ISO 6743-4:1999)*

EN ISO 12100:2010, *Safety of machinery - General principles for design - Risk assessment and risk reduction (ISO 12100:2010)*

EN ISO 13849-1:2008, *Safety of machinery — Safety-related parts of control systems — Part 1: General principles for design (ISO 13849-1:2006)*

EN ISO 13849-2:2008, *Safety of machinery — Safety-related parts of control systems — Part 2: Validation (ISO 13849-2:2003)*

EN ISO 13850:2008, *Safety of machinery — Emergency stop — Principles for design (ISO 13850:2006)*

EN ISO 13855, *Safety of machinery - Positioning of safeguards with respect to the approach speeds of parts of the human body (ISO 13855:2010)*

EN ISO 13857:2008, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2008)*

EN ISO 14121-1:2007, *Safety of machinery — Risk assessment — Part 1: Principles (ISO 14121-1:2007)*

ISO 3448:1992, Industrial liquid lubricants — *ISO viscosity classification*

ISO 4406:1999, *Hydraulic fluid power — Fluids — Method for coding the level of contamination by solid particles*

ISO 7000:2004, *Graphical symbols for use on equipment — Index and synopsis*

ISO 7241-1:1987, *Hydraulic fluid power — Quick-action couplings — Part 1: Dimensions and requirements*

ISO 11898-1:2003, *Road vehicles — Controller area network (CAN) — Part 1: Data link layer and physical signalling*

ISO 11898-2:2003, *Road vehicles — Controller area network (CAN) — Part 2: High-speed medium access unit*

ISO 11898-3:2006, *Road vehicles — Controller area network (CAN) — Part 3: Low-speed, fault tolerant, medium-dependent interface*

ISO 11898-4:2004, *Road vehicles — Controller area network (CAN) — Part 4: Time-triggered communication*

ISO 11898-5:2007, *Road vehicles — Controller area network (CAN) — Part 5: High-speed medium access unit with low power mode*

ISO 15817:2005, *Earth-moving machinery — Safety requirements for remote operator control*

IEC 60417-DB, *Graphical symbols for use on equipment*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100 and EN 1501-1 and the following apply.

3.1
refuse collection vehicle
RCV
vehicle used for the collection and transportation of refuse (e.g. household waste, bulky waste, recyclable materials) based on loading via waste containers or by hand. It consists of a chassis-cab onto which a bodywork is mounted

3.1.1
rear loaded RCV
RCV in which the waste is loaded into the body from the rear

NOTE See Figure A.1-1.

3.1.2
side loaded RCV
RCV in which the waste is loaded into the body from the sides

NOTE See Figure A.1-2.

3.1.3
front loaded RCV
RCV in which the waste is loaded into the body from the front

NOTE The trajectory of the waste container is over the top of the cab, parallel to the axis of the vehicle regardless of where the waste container is picked up (see Figure A.1-3).

3.1.4
travel movement
unrestricted motorised movement of the RCV

3.1.5
positioning movement
limited motorised movement of the RCV (e.g. when approaching and picking up a waste container)

3.2
lifting device
mechanism fitted onto the RCV for loading refuse into its body

3.3
waste container lifting device
mechanism fitted onto a RCV for emptying designated waste containers

3.3.1
split waste container lifting device
two or more adjacent waste container lifting devices with their own independent functional spaces

3.3.2
combined waste container lifting device
two or more waste container lifting devices which share a common functional space

3.3.3
integrated waste container lifting device
waste container lifting device designed to be permanently attached to the body of the RCV

3.3.4
demountable waste container lifting device
waste container lifting device designed to be detachable (e.g. bolted) from the body of the RCV

3.3.5
interchangeable waste container lifting device
waste container lifting device designed to be capable of being fitted on different designated RCVs provided with one standard interface (mechanical, hydraulic, electrical, dimensional and functional aspects)

3.4
mechanical interface
mechanical connections between the lifting device and the corresponding part of the RCV

3.5
hydraulic/pneumatic interface
hydraulic/pneumatic connections between the lifting device and the corresponding part of the RCV

3.6
electrical interface
electrical connections between the lifting device and the corresponding part of the RCV

3.7
mounting frame
framework used to fit the interchangeable or demountable waste container lifting device on the RCV

NOTE The mounting frame is provided as a fixed opening, a demountable frame, or a swivel hinged frame.

3.8
lifting carriage
sub-assembly onto which the pick-up system is normally fitted

3.9
guide system
component(s) to laterally locate the pick-up system of the designated waste container

3.10
locking system
mechanism which locks the pick-up system of the designated waste container to the waste container lifting device for emptying purpose

3.11
pushing pad
component of the lifting device onto which the front wall of the designated refuse container body rests when it is being lifted

3.12
container restraint device
system located towards the top of the loading opening of the RCV enabling the movement of the designated refuse container to be stopped progressively beyond the emptying angle of the lifting device

3.13
lid opener
device which opens the lid of the designated refuse container during the emptying cycle

3.14
pick-up system
part(s) of the lifting device intended to be in contact with the waste container for receiving its corresponding part with the purpose of holding, lifting and emptying it

3.14.1
comb pick-up system
horizontal row of upward facing teeth and locking system to retain the designated waste container according to frontal receivers forms A, B, and C of EN 840-1, EN 840-2, EN 840-3 and EN 840-4 during emptying

NOTE See Figure A.2.

3.14.2
trunnion pick-up system
pair of lateral arms with trunnion receiver and locking mechanism to retain the designated waste container according to lateral receivers type A of EN 840-2, EN 840-3, EN 840-4 and EN 12574-1 during emptying

NOTE See Figures A.4-1, A.4-2 and A.4-3.

3.14.3
double trunnion pick-up system
pair of lateral arms with two trunnion receivers and locking mechanism to retain the designated waste container according to lateral receivers type B of EN 12574-1 during emptying

NOTE See Figure A.4-4.

3.14.4
diamond pick-up system
triangular shaped element(s) with one corner of the triangle facing upwards and locking system to retain designated diamond waste container

NOTE See Figure A.5.

3.14.5
BG pick-up system
pair of lateral arms and locking mechanism to retain the designated BG waste container complying with lateral receivers type B of EN 840-4 during emptying

NOTE See Figure A.6.

3.14.6
pocket pick-up system
pair of lateral arms and locking mechanism to retain the designated waste container complying with lateral receivers type C of EN 12574-1 during emptying

NOTE See Figure A.7.

3.14.7
clamping system
mechanism which holds the designated waste container(s) by application of jaws

NOTE When these jaws overlap, it is called an overlapping clamp.

3.14.8
skip pick-up system
framework at the back end of the lifting device to catch and lock the trunnions/pivots or the trunnion bar of the skip container for lifting and or tipping it

NOTE See Figure A.1-4.

3.14.8.1
two chains skip pick-up system
lifting device with two chains to lift, tip and put back on the ground the skip container by tipping it over against a frontal trunnion

NOTE See Figure B.3-1.

3.14.8.2
four chains skip pick-up system
lifting device with four chains to lift, tip and put back on the ground the skip container which has to be tipped over against a fixed or moveable attachment on it

NOTE See Figure B.3-2.

3.14.8.3
skip container end position system
system to limit the final position of the tipped skip container

3.15
extending arm
part of the waste container lifting device which goes outside of the RCV designed to pick up the designated waste container

3.16
travel position
defined position(s) of the lifting device (e.g. clamps, arms, extending arm, etc) for the purpose of travel movement of the RCV (according to road traffic regulations)

3.17
rest position
defined stable position of the lifting device without further movement of the device

3.18
designated waste container
waste container compatible with the lifting device

3.18.1
paladin container
mobile cylindrical steel waste container with a capacity up to 1 m^3 designed for a clamping pick-up system

NOTE See Figure B.1-1.

3.18.2
diamond container
mobile waste container with a capacity from 60 l to 2,3 m^3 with a specific frontal receiver for a diamond pick-up system(s)

NOTE See Figure B.1-2.

3.18.3
skip container
stationary waste container not complying with EN 12574 larger than 2,5 m^3 designed to be handled either by a winch or specific skip lifting system

NOTE See Figure B.3.

3.19
waste container emptying cycle
succession of sequences to pick up, lift, hold and empty the designated waste container and put it back on the ground

3.20
emptying operating mode
mode of the waste container emptying cycle (e.g. manual, semi-automatic, automatic)

3.20.1
manual mode
mechanism achieving each movement by a single command

3.20.2
semi-automatic mode
mechanism achieving each sequence of movements (two or more movements in one sequence) by a single command

3.20.3
automatic mode
mechanism achieving a complete cycle of movements by a single command

3.21
container handling system
lifting accessory consisting of a mechanism to connect the loader crane and the designated waste container (and its opening mechanism)

3.22
container loading winch
power driven mechanism located on the bodywork used for pulling, tipping waste container(s) by means of ropes, chains or belts wound in one or more layers onto a drum

3.23
shaking
alternating movement of the lifting device designed to dislodge the waste from the waste container when tilted

3.24
operative
person trained to operate the RCV

3.25
working station
location outside of the functional space where the RCV is operated during normal use; inspection, cleaning and maintenance are excluded

NOTE See Figures A.1-1, A.1-2 and A.1-3.

3.26
visible space
space visible directly and/or indirectly by the operative from his working station, either in or outside of the cab

NOTE See Figure A.1.

3.27
functional space
space covered by the movements of the lifting device and of the designated waste container(s) when lifted by a lifting device as specified by the manufacturer

NOTE See Figure A.1.

3.28
loader crane
powered crane fitted on the RCV and designed for loading its designated waste container into the bodywork

4 List of significant hazards

This clause contains all the significant hazards, risk areas and hazardous situations and events as far as they are dealt with in this standard, identified by risk assessment performed according to EN ISO 14121-1 as significant for this type of machinery and which require action to eliminate or reduce the risk.

The verification methods to be used to demonstrate conformity include:

— *V*: visual inspection verifies the required features of the components;

— *T*: test / check verifies that the features provided perform their function in such a way that the requirement is met;

— *M*: measurement verifies that requirements are met to the specified limits;

— *D*: drawings and/or calculations verify that the design characteristics of the components provided meet the requirements. Documents and instructions for use are available.

Table 1 — List of significant hazards

N°	Hazard	Hazardous situation	Safety requirement measures	Reference	Verification
1	Crushing, trapping	Between waste container lifting device and body	Design	5.1.1.1.10, 5.3.3, 5.3.4, 5.10	*D*
2	Crushing, trapping	During operation in traffic	Comply with road regulation	5.1.1.1, 5.1.1.10, 5.10, 5.17, 7.1	
3	Crushing, shearing	During use of the lifting device	Guards	5.1.1.1	*V*
4	Crushing	Below the container	Level between bottom of container and ground	5.1.1.2	*T*
5	Impact	Impact with waste	Design of the waste container lifting device	5.1.1.3	*D*
6	Impact	Impact between container and compaction mechanism	Design of the RCV	5.1.1.4	*D, T*
7	Crushing, trapping	Overload of the container	Design of the waste container lifting device	5.1.1.4	*D*
8	Crushing, trapping	Largest working load	Design of the waste container lifting device	5.1.1.4	*D*
9	Crushing, trapping	Largest working load	Load of test for the waste container lifting device	5.1.1.5	*T*
10	Crushing, impact	Container falling when lifted	Guide system	5.1.1.6	*D, V*
11	Crushing, impact	Container falling when lifted	Container locked on the pick-up system	5.1.1.7	*D, T*
12	Crushing, impact	Container falling due to overload	Minimum emptying cycle time	5.1.1.8	*D, T*
13	Crushing, impact	Container falling due to overload	Maximum speed of the container	5.1.1.8	*D, T*
14	Crushing, impact	Container falling due to overload	Maximum acceleration of the container	5.1.1.8	*D, T*
15	Crushing, impact	Container falling when released on the ground	Stability of the container	5.1.1.9	*D,V*
16	All hazards	Hazardous control of the lifting device	Ergonomic control for the lifting device	5.1.2	*D, V*
17	All hazards	Hazardous control of the lifting device	Marking of controls	5.1.2	*D,V*
18	Crushing, trapping, shearing, impact	During maintenance, resetting, repair or restoring	Manual mode achieved by selector	5.1.2	*D,V*
19	Crushing, trapping, shearing, impact	Two or more lifting devices used simultaneously	Simultaneous use not possible	5.1.2	*D,V*
20	Crushing, trapping, shearing, impact	Split waste container lifting device	Control situated outside the functional space	5.1.2	*D,V*
21	Crushing, impact	Lifting of container	Guidance of container during lifting	5.2.1.1	*D, V*
22	Crushing, impact	Container falling from the comb	Design of the teeth of the comb	5.2.1.2	*D, T*
23	Crushing, trapping, shearing, impact	Container falling during lifting	Container locked on the waste container lifting device	5.2.1.3	*D, T*
24	Crushing	Container falling during lifting	Container supported at the right place during lifting	5.2.1.4	*D, T*

Table 1 *(continued)*

N°	Hazard	Hazardous situation	Safety requirement measures	Reference	Verification
25	Impact	Container falling during end of tipping motion	Damped tipping motion	5.2.1.4, 5.2.2.6	*D, T*
26	Crushing, trapping, shearing, impact	Containers falling during lifting or collision between container and RCV	Design of the arms of trunnion pick-up system for containers	5.2.2, 5.2.2.2, 5.2.2.3, 5.2.2.4, 5.2.2.5	*D, V*
27	Crushing, trapping, shearing, impact	Containers falling during lifting or collision between container and RCV	Design of the diamond pick-up system	5.2.3, 5.2.4	*D, V*
28	Impact	Opening of the lid during the lifting	Design of the lid opener	5.2.5	*D, V*
29	Crushing, trapping, shearing, impact	Emptying container with winch	Design of the winch	5.2.6.1	*D, V*
30	Crushing, trapping, shearing, impact	Pick-up container with a two chains pick-up system	Design of the pick-up system	5.2.6.2	*D, V*
31	Crushing, trapping, shearing, impact	Pick-up skip container by four chains pick-up system	Design of the connections for skip	5.2.6.3	*D, V*
32	Crushing, trapping, shearing, impact	Container falling due to absence of or bad end position system	Design of the end position system	5.2.6.5	*D, V*
33	Crushing, trapping, shearing, impact	Container falling during lifting	Slack control	5.2.6.6	*T*
34	Crushing, trapping, shearing, impact	Container falling during lifting	Catch for trunnion bar	5.2.6.4	*D,T*
35	Crushing, trapping, shearing, impact	Tipping of the RCV under too large a load	Design of stabilisation system	5.2.6.7	*D*
36	Crushing, trapping, shearing, impact	Lifting of paladin container	Design of clamping system	5.2.7	*D, V*
37	Impact	Waste falling during lifting of top lifted and bottom emptied container	Design of container handling system	5.2.8.1, 5.2.8.2	*D, T, V*
38	Crushing, trapping, shearing, impact	Waste container falls off caused by human error when using the crane	Fitting of crane or winch	5.2.8.1	*D,V*
39	Crushing, trapping, shearing, impact	Unexpected movement of crane with waste container	Follow the operation manual of the chassis-cab and crane	5.2.8.1	*V*
40	Crushing, trapping, shearing, impact	Operating the loader crane without observing the functional space	Fitting Illumination	5.2.8.1, 5.10, 5.12	*V*
41	Crushing, trapping, shearing, impact	Emptying BG container	Design of pick up arms	5.2.4	*D, T, V*

Table 1 *(continued)*

N°	Hazard	Hazardous situation	Safety requirement measures	Reference	Verification
42	Crushing, trapping, shearing, impact	Container falling during automatic or semi-automatic cycles on rear loaded RCV	Rear protection of functional space and design of locking system and motion control	5.3.1	*D, T, V*
43	Crushing, trapping, shearing, impact	Failure of mechanical interface	Design of mounting frame	5.3.3, 5.3.3.2, 5.3.3.3	*D, T*
44	Impact	Waste falling during lifting of container	Motion of the interchangeable waste container lifting device	5.3.2, 5.3.4	*D, V*
45	Impact, crushing	Operative falling on the lifting device, on the ground or in the compaction system	Safe footboard	5.3.5	*D*
46	Crushing, trapping, shearing, impact	Hazardous control of the lifting device	Design of hydraulic system	5.3.6, 5.3.6.2, 5.3.6.3, 5.3.6.4	*D*
47	Crushing, trapping, shearing, impact	Hazardous control of the lifting device	Hydraulic fluid	5.3.6.5	*D, T*
48	Crushing, trapping, shearing, impact	Hazardous control of the lifting device	Safe electrical interface	5.3.7	*D*
49	Impact, shearing	Part outside side loaded and front loaded RCV	Design of waste container lifting device	5.4, 5.5	*D, T*
50	Cutting, stabbing, puncture, burning	Impact from oil jet due to burst of hydraulic line	Design of hose and relief valves	5.5	*D, V*
51	Stabbing, puncture	Impact from air jet due to burst of pneumatic line	Design of hose	5.6	*D, V*
52	Electrical hazard	Electrocution	Design of electrical parts	5.7, 5.11.8, 5.11.10, 5.12	*D*
53	Electrical hazard	Electromagnetic compatibility	Design	5.13	*D, M*
54	All hazards	Misinterpretation of controls and lack of application of ergonomic principles	Pictograms for operating controls	5.8, 5.17	*V*
55	Crushing, trapping, shearing, impact	Failure/dysfunction of control system	Performance level of controls	5.9.1.1, 5.9.3.1	*D, T*
56	Crushing, trapping, shearing, impact	Unintentional starting	Design of controls	5.9.1.2	*D, T*
57	Crushing, trapping, shearing, impact	All mechanical hazardous situation	Emergency stop	5.9.2.1, 5.9.2.2, 5.9.2.3	*T*
58	Crushing, trapping, shearing, impact	During emptying	Selection of emptying mode	5.9.3.2	*T*

Table 1 *(continued)*

N°	Hazard	Hazardous situation	Safety requirement measures	Reference	Verification
59	Crushing, trapping, shearing, impact	During operation of lifting device	Visual control of functional space	5.10	*V*
60	Crushing, trapping, shearing, impact	Failure of position sensor	Safety position sensor	5.11.7	*V*
61	Crushing, trapping, shearing, impact	All mechanical hazardous situations	Design of remote and two-hand operating control	5.11.2, 5.11.4	*D, T*
62	Crushing, trapping, shearing, impact	Container falling during lifting	Safety related interlocks	5.11.3	*D, T*
63	Crushing, trapping, shearing, impact	Lifting device falling during maintenance	Mechanical restraint device	5.15	*V*
64	Crushing, trapping, shearing, impact	Lifting device falling due to loss of power supply	Design	5.11.6	*D*
65	Crushing, trapping, shearing, impact	Uncontrolled movement due to failure of control circuits	Design of control circuits	5.11.9	*D, V*
66	Crushing, trapping, shearing, impact	Lack of illumination	Design of lighting	5.12	*V*
67	Deafness	Noise	Design of the lifting device	5.14	*D, M*
68	Impact	Handling of the lifting device	Design of the lifting device	5.16	*V*
69	All hazards	Lack of signals and warning devices	Design of signals	7.1	*V*

5 Safety requirements and/or protective measures

5.1 General

Waste container lifting devices shall comply with the safety requirements and/or protective measures of this clause. In addition, the lifting devices shall be designed according to the principles of EN ISO 12100 for relevant but not significant hazards which are not dealt with by this standard.

All systems and components shall be specified and installed in accordance with their manufacturer's instructions.

5.1.1 Design

5.1.1.1 General

Any crushing and shearing hazards shall be avoided or minimized by design according to EN ISO 13857 and EN 349 or appropriate guard(s) according to EN 953 or protective equipment positioned according to EN ISO 13855.

The design shall take into account the dynamic impact of the lifting device on the connection between the waste container lifting device and the body of the RCV.

NOTE The lifting device and its placement should meet the requirements of the road traffic regulations.

5.1.1.2 Distance to the ground

To prevent foot injuries, the distance between the lower edge of the waste container lifting device and the level on which the RCV is standing shall be at least 120 mm or 320 mm for waste container lifting device which can operate on the kerbside. If the movement of the waste container lifting device down to the ground level is necessary, the distance between 120 mm (320 mm) and the horizontal ground shall be controlled by a hold-to-run control situated in a position where the waste container lifting device is in full view of the operative.

5.1.1.3 Hopper

The loading edge of the waste container lifting device and/or the body shall be designed taking into consideration the volume of the largest designated waste container emptied by the waste container lifting device and the volume of the hopper, in order to avoid waste falling out of the hopper.

When the hopper is emptied by the compaction mechanism at the same time as the waste container lifting device is being operated, the design shall be such that the designated waste container shall not collide with it.

5.1.1.4 Load

The waste container lifting device shall be provided with a device preventing emptying in excess of the maximum permissible load of the largest designated waste container.

The maximum working load for the lifting device is the weight of the largest designated waste container plus 1,1 times its nominal load. This shall be applied at the centre of gravity of the largest fully loaded waste container.

The nominal load of the loaded waste container is determined assuming a density of waste as defined in the standards of the EN 840 series, EN 12574 series or EN 13071 series.

5.1.1.5 Tests

The functional dynamic test load shall be 1,1 times the maximum working load for lifting up and down in the nominal cycle time. The functional static test load shall be 1,25 times the maximum working load.

5.1.1.6 Guide system

The pick-up system shall be provided with a guide system to laterally position the designated waste container on the waste container lifting device.

5.1.1.7 Locking system

The waste container lifting device shall be provided with a device to automatically lock and keep locked the designated waste container in the lifting position before the tilt of the waste container reaches 30° from vertical or before the height of the designated waste container reaches 2 000 mm from the horizontal level on which the RCV is standing, even if electrical, hydraulic or pneumatic energy fails.

In the automatic or semi automatic lifting mode, the device shall also verify that the designated waste container is locked in position when the locking system is not mechanically actuated during the whole locking sequence. The device shall be at least required performance level PL_r d according to EN ISO 13849-1, as defined in 5.9.1.1.

5.1.1.8 Speed and acceleration

The minimum waste container emptying cycle time, excluding the horizontal extension movement and dwell time, shall be 6 s for designated waste containers with a capacity up to 400 l, 10 s for designated waste containers with a capacity up to 1 700 l and 20 s for other waste containers.

The maximum peripheral speed of any reachable part of the waste container lifting device or of the largest designated waste container fitted on the lifting device shall not exceed 2,5 m/s for waste containers with a capacity less than 2 500 l and 1,5 m/s for waste containers with a capacity larger than 2 500 l, during the emptying cycle. This applies up to a height of 2 500 mm from the level on which the RCV is standing. The sampling frequency during the measurement shall be at least 10 Hz. The waste container shall be loaded at the nominal load.

The maximum absolute acceleration of the designated waste container transmitted from the waste container lifting device pick-up system during the emptying cycle shall not exceed 30m/s^2 for containers with a capacity less than 2 500 l and 15 m/s^2 for containers with a capacity equal to or larger than 2 500 l. Testing shall be conducted with the container loaded with its nominal load. The sampling frequency during the measurement shall be 100 Hz.

5.1.1.9 Release of the container

When the designated waste container is lowered to the ground and released from the waste container lifting device, it shall not fall over and shall remain stable.

5.1.1.10 Locking of the waste container lifting device during travel movement of the RCV

During the travel movement the waste container lifting device shall not be capable of being operated. The waste container lifting device shall be positioned in its travel position and be automatically locked against any unintended movement, unless the travel position is different from the rest position. A hydraulic locking is accepted if a safety valve is fitted directly on the locking cylinder(s).

5.1.2 Emptying operating modes and controls of the lifting device

The operating movements of control devices shall be consistent with their effect and user-friendly, for example:

— For button operated waste container lifting device:

  Upper button = lift arm/lift carriage;

  Lower button = lower arm/lower carriage.

— For lever (one axis) operated waste container lifting device, the operating direction of the lever shall correspond to the stated movement:

  Pull or lift = lift arm/lift carriage;

  Push or down = lower arm/lower carriage.

— For joystick (two axis) operated waste container lifting device, the operation direction shall correspond to the stated movement:

  Pull = lift arm;

  Push = lower arm;

  Right = lift carriage;

  Left = lower carriage.

The direction of movement achieved by a button, lever or mode selector shall be marked on or close to the control device and be clearly identified by an arrow highlighting the direction.

The control devices shall be switched over to manual mode with a mode selector for maintenance, repair, resetting or restoring, following degraded working conditions. The changeover operation shall not initiate any lifting or tilting operation. In any case, operations that could release lifted containers shall only be possible in the lowest lift position. The selection switch shall be protected against unauthorized activation (e.g. special key or code card).

When more than one lifting device is fitted on the RCV, it shall not be possible for the same operative to simultaneously operate the waste container lifting devices if this can give rise to any hazardous situation in the functional space.

It shall be impossible to use simultaneously the mechanisms of a combined waste container lifting device.

If the waste container lifting device can be activated from both inside and outside the cab, a selector switch shall be provided in the cab and the selected control mode shall be indicated to ensure that only one control is operable at any time.

5.2 Requirements for lifting the designated waste containers

5.2.1 Comb pick-up system for waste containers according to EN 840 and EN 12574 series

5.2.1.1 Lifting carriage

The lifting carriage shall be so designed as specified and illustrated in Figure A.2-1 to Figure A.2-5 that the positioning of:

— the two-wheeled container is done by a guide system;

— the four-wheeled container is done by the centre of the comb.

5.2.1.2 Comb

The design of the comb shall meet the dimensions of Figure A.2-1 if it is intended to pick up containers complying with EN 840-1, EN 840-2 or EN 840-3.

If the comb is suitable for an identification system according to EN 14803 and the designated waste container complies with EN 840-1, EN 840-2 or EN 840-3, the comb shall meet the dimensions of Figure A.2-2.

If the designated waste container complies with EN 840-4, the comb shall meet the dimensions of Figure A.2-3.

If the comb is suitable for an identification system according to EN 14803, and the designated waste container complies with EN 840-4, the comb shall meet the dimensions of Figure A.2-4.

Figure B.4 gives examples of the dimensions of the teeth.

5.2.1.3 Comb locking system

The locking system shall meet the dimensions of Figure A.2-5a for EN 840 waste containers frontal receivers forms A and B and Figure A.2-5b for EN 840 waste containers frontal receivers form C.

Its width shall be at least 90 % of the used comb width.

The locking system shall not interfere with the lid of the designated waste container and shall allow it to open freely.

5.2.1.4 Container restraint device

The container restraint device shall be designed so as to damp the tipping motion of the container without catching or over stressing its frontal receiver.

During the entire emptying cycle and the shaking, the angle between any designated waste container and the pushing pad shall not exceed 25°.

The reaction forces of the restraint device shall not cause to the designated waste container any other wear than the normal superficial wear.

5.2.2 Trunnion pick-up system for containers of the EN 840 and EN 12574 series

5.2.2.1 General

The minimum width of the contact surface for each arm at the load bearing point for the trunnion shall be 15 mm.

The length of the lateral lifting arms shall be such that the designated waste container keeps clearance from structural parts of the waste container lifting device during the entire emptying cycle (see dimension r in Figure A.4-1).

The design of the trunnion lifting device shall be such that the designated waste container is centred on the pick-up system.

5.2.2.2 Trunnion pick-up system for containers according to EN 840-2 and EN 840-3

The shape of the trunnion receiver shall not protrude beyond the imaginary line by the radius of 145 mm centred on any possible container trunnion position while it is engaged in any position inside the slot.

The lid opening device for dome lid waste containers shall be designed and fitted in such a manner that the lid remains clear from the waste container's rear wall when the designated waste container is fully tipped.

The minimum opening of the lid shall be equal to ¾ of its total movement.

The lid opener: shall operate with the lid up to ¼ open of its total movement.

Dimensions and tolerances shall meet the requirements of Figure A.4-1.

5.2.2.3 Trunnion pick-up system for containers according to EN 840-4

The distance between the arms shall meet the dimension of Figure A.4-2.

5.2.2.4 Trunnion pick-up system for containers according to EN 12574-1

The pick-up system and the lid opener shall meet the dimensions of Figure A.4-3.

5.2.2.5 Double trunnion pick-up system for containers according to EN 12574-1

The lateral arms located on the lifting carriage shall meet the dimensions of Figure A.4-4.

5.2.2.6 Pushing pad

The pushing pad, central onto the axis of the lifting device, is composed of one or more part(s).

The pushing pad position in relation to the comb shall be according to Figure A.3-1 for designated waste container according to EN 840-1, EN 840-2 and EN 840-3 and Figure A.3-2 for designated waste container according to EN 840-4.

The contact surface area of the pushing pad onto the waste container shall be no less than 70 % of the projected area or the pressure exerted on the waste container with the nominal load by the pushing pad shall not exceed 80 kPa.

The pushing pad shall be designed so as to avoid that the waste container will be tipped over or slide away during the lifting sequence.

The surface of the pushing pad shall be made of a soft, flexible material.

5.2.2.7 Container restraint device

The container restraint device shall damp the tipping motion without any possibility for the container catching or over-stressing the trunnion.

During the entire emptying cycle and the shaking of the waste container complying with EN 840-2 and EN 840-4, the angle between the designated waste container and the lifting carriage shall not exceed 25°.

The reaction forces of the shock absorber shall not cause to the designated waste container any other wear than the normal superficial wear.

5.2.3 Diamond pick-up system

The diamond pick-up system shall be designed according to Figure A.5-1 for handling one two-wheeled container (Figure B.1-2).

The pick-up system shall be designed according to Figure A.5-1-1 and A.5-1-2 for handling two two-wheeled containers or one four-wheeled container (Figure B.1-2).

The designated waste container shall be locked onto its diamond pick-up system as described in 5.2.1.3.

The locking system shall meet the dimensions of Figure A.5-2. Its width shall be at least 90 % of the frontal receiver width. It shall not interfere with the lid of the waste container and shall allow it to open freely.

5.2.4 BG pick-up system

The pick up arms and the pick up range shall meet the dimensions of Figure A.6.

The length and configuration of the lateral lifting arms shall be such that the designated waste container keeps clearance from structural parts of the waste container lifting device during the entire emptying cycle and no waste falls beside the hopper (for small BG containers).

The design shall be such that the pick up points with BG adaptor of the designated waste container are centred by the waste container lifting device.

5.2.5 Pocket pick-up system for waste container according to EN 12574-1

For emptying dome lid containers, a lid opening device shall be provided. It shall be designed and fitted in such a manner that the lid remains clear from the rear wall of the container when the designated waste container is fully tipped.

The minimum opening of the lid shall be equal up to ¼ of its total movement.

Dimensions and tolerances for the pick-up system and the lid opener shall meet the requirements of Figure A.7.

5.2.6 Skip container pick-up system

NOTE Examples of skip waste container pick-up system are shown in Figure A.1-4 and Figures B.2 and B.3.

5.2.6.1 Loading skip container by container loading winch

The winch shall meet the requirements of EN 14492-1.

The hook(s) at the end of the cable(s) chain(s) or belt(s) shall be positively locked to the designated skip waste container according to the shape of the skip's attachment. The slings to be used for the connection to the designated waste skip container shall meet the requirements of the series of standards EN 1677.

5.2.6.2 Loading skip container by two chains pick-up system

The hooks on the chains which lock the two pivots of the designated skip waste container shall be designed according to the pivots/trunnions shape. The chains to be used for the connection to the designated waste skip container shall meet the requirements of EN 818.

5.2.6.3 Loading skip container by four chains lifting system

The hooks which lock the four pivots shall be designed according to the designated skip waste container. The chains to be used for the connection to the designated skip waste container shall meet the requirements of EN 818-1.

The attachment to tip over the designated waste skip container shall be so located on the pick-up device structure that the skip container cannot collide with the compaction mechanism. The width of the attachments shall be such that the designated skip waste container cannot slip out of the attachments.

Taking into consideration non-horizontal ground conditions, it shall be ensured that the container is aligned with the tailgate during its entire emptying cycle. This shall be achieved through lateral guides fitted on the lifting device or by a transversal levelling system of the RCV.

5.2.6.4 Catch for trunnion bar skip container

The catch shall be designed according to the trunnion bar's shape.

The catch-pivot shall be automatically locked when the designated skip waste container is lifted from the ground.

If a shaking mechanism is fitted,

— the catch-pivot of the trunnion bar shall be positively locked around it;

— shaking shall only be possible when the designated skip waste container position is 30° before its fully tipped position;

— shaking shall be possible only if the presence of the pivots/trunnions in the catch of the shaking mechanism is detected by the control system.

5.2.6.5 End position system

A skip container end position system shall be provided for stopping the movement of the skip container when it reaches its end position.

5.2.6.6 Slack control

A system shall be provided to prevent any slack chain, cable, or belt when the centre of gravity of the designated skip waste container pass over its equilibrium position during tipping.

5.2.6.7 Stabilization system

A stabilization system shall be provided if, during the lifting of the largest designated skip waste container, the equation of the calculation method of EN 1501-1:2011, 5.15.2 is not met or if the front axle(s) of the RCV support less than 10 % of its mass (see example in Figures B.3-1 and B.3-2).

If a stabilization system is fitted, the skip container lifting device shall be interlocked with it in such a way that it cannot operate unless the stabilizers are in place. The control system shall meet the requirements defined in 5.9.1 with at least required performance level PL_r c according to EN ISO 13849-1.

A visual warning as specified in EN 1501-1:2011, 7.1.1.2 shall indicate at the driver's position when the stabilizers are not fully retracted into their travel position.

5.2.7 Clamping system

The clamping system shall be so designed that the designated waste container such as a paladin container (see Figure B.1-1) is located and then clamped firmly during its entire emptying cycle.

The clamping movement shall be controlled by a hold-to-run control.

A hydraulic locking is accepted if a safety valve is fitted directly on the locking cylinder(s). The safety valve shall withstand a pressure of two times the operating pressure at the defined clamping force. In case of loss of power supply, the clamp shall not open and release the designated waste container.

A safety distance between the jaws, under the provisions as defined in EN 349, shall be kept during the lifting sequence of the designated waste container or when no container is held. If the full closure of the clamp is necessary (travelling position), a restart of the closure or clamping movement shall only be possible through the hold-to-run control by the operative.

The positioning force shall be minimal and only used to position the designated waste container into the clamp. Before lifting it, the jaws shall apply the maximum clamping force. The maximum clamping force shall be maintained during the entire emptying cycle. It shall be defined so as to avoid slipping out and damaging the designated waste container during the cycle and also during the dynamic and static tests as defined in 5.1.1.7.

The designated waste container shall remain positively clamped until it has been put back on the ground. Opening of the clamp shall only be possible when the designated waste container has been returned to a level not higher than 100 mm above that level when closing the clamp.

5.2.8 Loading of top lifted and bottom emptied waste container

5.2.8.1 General specifications for the loader crane

The design shall meet the relevant specifications and requirements of EN 12999, EN 13135-1 and 13135-2 and EN 13557.

The installation shall meet the specifications of the chassis and the crane manufacturers.

For the operation of the loader crane a good visibility of the functional space shall be provided.

If a stabilization system is fitted, the loader crane shall be interlocked with it in such a way that it cannot operate unless the stabilizers are in place. The control system shall meet at least required performance level PL_r c according to EN ISO 13849-1.

5.2.8.2 Loading operation

An example of a RCV with a loader crane for top lifted and bottom emptied waste containers is given in Figure A.1-5.

The waste container handling system shall be fully compatible with the connection system of the designated waste container as defined in EN 13071-3.

The waste container handling system shall meet the safety factors for the load lifting attachments. When fixed, it has to comply with the relevant requirements of EN 13135-1 for electro-technical equipment and/or EN 13135-2 for non-electro-technical equipment. When non-fixed load lifting attachments are used, they have to comply with EN 13155.

The designed maximum working load of the container handling system shall be at least two times the total permissible mass of the designated waste container as defined in EN 13071-1:2008, 4.6. The waste container handling system shall be provided with a device preventing a lift in excess of the maximum permissible mass.

The connection system of the designated waste container shall remain locked by the container handling system during the entire emptying cycle. It shall be impossible to unlock the designated waste container when it is lifted. The system shall comply with at least required performance level PL_rd according to EN ISO 13849-1.

The emptying of the designated waste container shall only be possible after an intended command of the operative and if collision of the designated waste container with the compaction mechanism is prevented.

The container handling system shall be provided with a device to accurately locate the lifting connection of the designated waste container on it.

5.3 Specific requirements for waste container lifting devices mounted on rear loaded RCVs

5.3.1 Automatic / Semi-automatic mode

When the bottom of the tallest EN 840 compliant waste container is lifted higher than 1 000 mm above the ground, access of the operative to the functional space of the waste container lifting device during the emptying cycle shall be protected by lateral and rear protective devices with the following requirements.

Opening of the protective devices shall be interlocked so as to immediately stop all movement within the functional space. The absence or failure of the protection device shall also immediately stop all movements.

The side protective device shall be designed according to C, F and G of Figure A.9.

The rear protective device of the waste container lifting device shall be designed according to Rl, Rc, D and E of Figure A.9, at a height above ground up to 1 000 mm. The functional space of the split waste container lifting device shall be divided and protected separately. The rear protection device shall cover the radius of the lifting device envelop Rl. The radius of the waste container envelop Rc shall not be more than 400 mm behind the rear protection.

Any stopping the waste container lifting device in the automatic and semi-automatic mode will require a new command to restart.

The command for the waste container lifting device shall be provided by a manual lift and lower control.

The manual mode of the waste container lifting device shall override the automatic mode.

The automatic and semi-automatic cycle shall be stopped when a person is detected on the footboard(s) if it (they) is (are) fitted.

The location of the designated waste container frontal receiver onto the comb teeth and its locking system shall be monitored by the control system during the locking sequence. The monitoring system shall meet at least required performance level PL_r b according to EN ISO 13849-1.

If the waste container lifting device can pick up different types (two-wheeled/four-wheeled) of designated waste containers according to EN 840-1, EN 840-2 and EN 840-3, the waste container type shall be identified in order to avoid misuse (e.g. the automatic cycle for two-wheeled containers is different from the automatic cycle for four-wheeled containers).

To prevent unintended movement (e.g. rolling back) of the designated four-wheeled waste container, the automatic cycle shall stop the container 100 mm above the ground level. A separate command is required to complete the cycle.

5.3.2 Dimensions for interchangeable waste container lifting device

The dimensions of the rear opening of the rear loaded RCV for interchangeable waste container lifting device(s) are given in Figures A.10-1 and A.10-2.

The volume necessary at the rear of the rear loaded RCV for the movement of the designated waste container shall follow the dimensions of Figure A.8.

5.3.3 Mechanical interface

5.3.3.1 General

The mechanical interface shall be designed to withstand the mechanical stresses induced by the waste container lifting device during its operation and the dynamic and static tests according to 5.1.1.5.

5.3.3.2 Mechanical interface for integrated and demountable waste container lifting device

The mechanical interface shall be compatible with its waste container lifting device.

5.3.3.3 Mechanical interface for interchangeable waste container lifting device

The mechanical interface shall be compatible with the waste container lifting device for which it is designed. The mounting frame shall comply with the dimensions of Figures A.11-1 and A.11-2.

5.3.3.4 Hinged adaptation frame

The hinged adaptation frame, if fitted, shall be mechanically locked to the tailgate or discharge door in closed position and mechanically restrained in the open position to avoid unintentional closure or excess opening.

5.3.4 Design for interchangeable waste container lifting device

The interchangeable waste container lifting device shall be so designed that it can be used on any RCV which is prepared to fit this type of waste container lifting device. The waste container lifting device shall ensure that only designated waste containers complying with EN 840-1, EN 840-2 and EN 840-3 or/and diamond waste containers can be emptied.

When (a) footboard(s) is (are) fitted on the RCV, the design of the interchangeable waste container lifting device shall ensure that the requirements for the volume(s) occupied by the operative(s), the footboard(s) and handle(s) dimensions according to EN 1501-1:2011, Figure B.4 are fulfilled.

5.3.5 Footboard(s)

When (a) footboard(s) is (are) fitted onto the waste container lifting device, it (they) shall meet the requirements of EN 1501-1.

5.3.6 Hydraulic interface for interchangeable waste container lifting device

5.3.6.1 General

The interchangeable waste container lifting device shall be fitted only on a RCV which supplies a pressure line and shall be fitted with a return line.

5.3.6.2 Pressure line

The tailgate or discharge door shall be equipped with a male QR coupling DN 25A according to ISO 7241-1 on a flexible hose. The waste container lifting device shall be equipped with a corresponding female QR coupling DN 25A according to ISO 7241-1.

The waste container lifting device shall be designed for a 40 l/min maximum flow with up to 200 bar operating pressure.

The waste container lifting device shall be fitted only on a RCV which supplies a flow between 40 l/min minimum to 46 l/min maximum measured between the pressured return line QR connectors, at a pressure between 210 bar to 230 bar.

To prevent oil contamination, the RCV shall ensure inlet oil contamination code 17/15/12 of ISO 4406 at maximum.

5.3.6.3 Return line

The return line on the tailgate or discharge door shall be equipped with a female QR coupling DN 25A according to ISO 7241-1. The lifting device shall be equipped with a flexible hose and at the end on a corresponding male QR coupling DN 25A according to ISO 7241-1.

The RCV shall be equipped with a return line in order to achieve less than 2 bar pressure at 70 l/min.

5.3.6.4 Position of hydraulic connections

The pressure and return lines shall be situated at the back of the tailgate or discharge door at its upper right side (in drive direction) following Figure A.12.

5.3.6.5 Hydraulic oil

The waste container lifting device shall be designed for the use of medium pressure hydraulic oil with HLP level according to EN ISO 6743-4, viscosity grade 32 of ISO 3448 with oil contamination code 17/15/12 of ISO 4406 at maximum.

5.3.7 Electrical interface for interchangeable waste container lifting device

The socket(s) shall be positioned at the back of the tailgate or discharge door at its upper right side (in drive direction) and on the waste container lifting device following Figure A.12.

The two 16 pin connectors according to EN 61984 shall comply with Figure A.13).

The pin connectors, circuits and loops with the four plugs and sockets are described in Figure A.14.

The connector of the 16 pin plugs and sockets shall be according to Tables C.1.

The socket of the RCV is defined in Table C.1a.

The floating plug of the waste container lifting device is defined in Table C.1b.

The socket of the waste container lifting device is defined in Table C.1c.

The floating plug of the RCV is defined in Table C.1d.

5.4 Specific requirements for waste container lifting devices mounted on side and front loaded RCVs

If the waste container lifting device is in a position where some parts of it protrude beyond the dimensions of the RCV, there shall be a visual warning (orange warning light) and/or an audible warning in the cabin when the vehicle starts driving and the RCV shall not be able to be driven faster than 6 km/h (positioning movement).

If an extending waste container lifting device is fitted, it shall not be capable of being operated during the travel movement. It shall be automatically locked in its travel position and prevented from any unintentional movement. A hydraulic locking is accepted if a safety valve is fitted directly on the locking cylinder(s). The lock shall withstand a load of 1,25 times the maximum load for the extending arm.

5.5 Hydraulic system

The hydraulic system shall comply with the requirements of EN ISO 4413.

All hydraulic lines shall be designed for a burst pressure limit of at least 4 times the maximum working pressure.

Hoses located within 500 mm of persons standing or passing by shall be shielded to prevent oil jets resulting from sudden hose failure. The protection shall be sufficiently sturdy to divert fluids away from the persons.

The hydraulic waste container lifting device shall be equipped with safety devices for hose burst protection (e.g. hydraulic restraint valves mounted directly on the lifting cylinders) or with other devices to prevent unintended lowering. They shall be rigidly hydraulically connected onto the lifting cylinder(s) and, if fitted, onto the lifting carriage cylinder(s).

5.6 Pneumatic system

The pneumatic system shall comply with the requirements of EN ISO 4414.

All pneumatic hoses, tubes and fittings shall be designed for a burst pressure limit of at least two times the working pressure.

5.7 Electrical powered system

The electrical powered system shall comply with the relevant requirements of EN 60204-1.

5.8 Operating symbols

5.8.1 The following operating controls shall be provided with pictograms (graphical symbols) according to their function and direction of movement. Examples are shown in Table 2. All the other operating controls shall be provided with a pictogram according to EN 1501-1 to EN 1501-3 and/or a proper description.

Table 2 — Graphical symbols

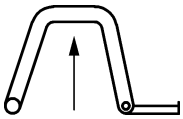
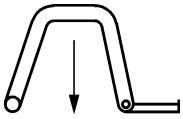
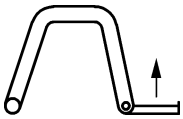
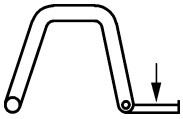
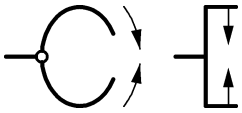
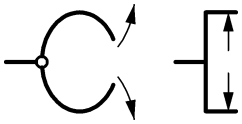
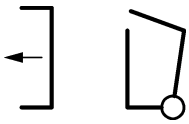
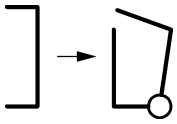
No	Symbol	Meaning	No of symbol according to ISO 7000/IEC 60417-DB[a]
1		Lift arms raise	
2		Lift arms lower	
3		Forks/ lateral arms raise	
4		Forks / lateral arms lower	
5		Close clamp/Close arms	
6		Open clamp/Open arm	
7		Retract arm	
8		Extend arm	

Table 2 (*continued*)

No	Symbol	Meaning	No of symbol according to ISO 7000/IEC 60417-DB[a]
9		Waste container lifting device up	
10		Waste container lifting device down	
11		Automatic cycle of waste container lifting device	
12		Working light(s)	
13		Right rotation	0004
14		Left rotation	0004

[a] The numbers below 5 000 are according to the pictograms of ISO 7000 and the numbers above 5 000 to the pictograms of IEC 60417-DB.

5.8.2 The pictograms/descriptions may be engraved, or applied via stickers. Both designs shall be durable and durably attached at the appropriate working station(s).

5.8.3 Colours for pictograms: black or white, on a contrasting background.

5.8.4 The following colours are exclusively to be used for controls (see EN 60204-1:2006, 10.2) except levers and joysticks:

— red: stop;

— red on yellow background (red mushroom-head button): emergency stop (see EN 60204-1:2006, 10.7.3 and EN ISO 13850);

— orange: selected emptying cycle mode: automatic, semi-automatic, manual (see NOTE);

— dark blue: down movement;

— light blue: up movement;

— black: two-wheeled / four-wheeled waste container selection;

— dark green: start of semi-automatic emptying cycle.

Colours shall be permanent.

NOTE If an orange light is used to indicate the emptying cycle mode: with continuous light: automatic, with flashing light: semi-automatic and without light: manual.

5.9 Control systems

5.9.1 General requirements for safety circuits

5.9.1.1 Safety related parts of control systems shall comply with EN ISO 13849-1 and EN ISO 13849-2, for example:

— at least required performance level PL_r d according to EN ISO 13849-1 for hazardous movements of semi-automatic / automatic lifting, of extending/retracting part(s) of the lifting device, clamping system, locking devices and emergency stop devices as described in 5.9.2.2;

— at least required performance level PL_r b according to EN ISO 13849-1 for all hazardous movements in manual mode of the waste container lifting device, for lifting up, down;

— at least required performance level PL_r a according to EN ISO 13849-1 for all other movements.

5.9.1.2 If for any uncontrolled reason a cycle stops, the system shall go in a safe state and shall not restart automatically (see for example EN 60204-1:2006, 7.5).

5.9.2 Emergency stop devices

5.9.2.1 Emergency stop devices shall have a stop function of category 0 according to EN 60204-1:2006, 9.2.2 and EN ISO 13850.

5.9.2.2 Emergency stop devices shall:

— stop all movement of any element of the lifting device and the bodywork and overrule all the operating controls except the rescue control if provided;

— be provided at all working station(s) and on both sides of the waste container lifting device(s), outside of the functional space (see Figure A.1);

— be located within easy reach of the operative(s);

— be fitted in a position with a clear view of the functional space;

— be designed according to EN 60204-1:2006, 10.7;

— in the case of an interchangeable waste container lifting device, be prepared to receive an emergency stop system with two dedicated lines according to Annex C.

5.9.2.3 The emergency stop device of the lifting device shall be connected with the emergency stop device of the RCV.

5.9.3 Control circuits and devices

5.9.3.1 General

All control devices shall be:

— adapted to the ergonomic requirements of the operatives according to EN 894-1 to EN 894-3;

— located, positioned and marked such that they can be clearly and permanently identified;

— located in a position with a clear view for the operative to the functional space;

— safeguarded against unintentional use to avoid any uncontrolled movement of any part of the lifting device (e.g. shrouded buttons);

— with a neutral position and the movement to activate the function corresponding to the intended effect;

— operable when wearing working gloves according to EN 374-1 (for out of the cab controls only), e.g. a minimum diameter of 20 mm for push buttons.

When more than one control station can be used, interlocked controls according to EN 60204-1:2006 shall be used.

Marking shall be done by graphic symbols according to Table 2 (see also EN 60204-1:2006, 10.2.2).

5.9.3.2 Operating mode selection

A manual control for the selection of emptying operating modes shall be fitted. The selected modes shall be indicated and a visual indication shall be provided at each relevant working station. The mode selector shall be protected against unintentional activation.

It shall not be possible to select the automatic mode when the waste container lifting device is operated from the cab.

Choosing another emptying operating mode (e.g. from semi-automatic to automatic) shall not initiate any movement of the waste container lifting device without an intentional command.

Mode selection shall fulfil the requirements of EN 60204-1:2006, 9.2.3.

5.10 Visual control

The operative shall have a direct view of the lifting device(s) functional space(s) during its (their) operation as a minimum up to 2 500 mm above ground level, from the outside working station (see for example Figure A.1-1).

If the lifting device is capable of being operated from the cab, the operative shall have a view of the functional space (for example through direct view, mirror view or closed circuit television system (CCTV) as shown in Figure A.1-2).

The survey of the functional zone above 2 500 mm and of the hopper can be done through direct view, mirror view or closed circuit television system (CCTV) as shown in Figures A.1-2 and A.1-3.

NOTE The view of the functional space is observed with the biggest designated waste container picked up by the lifting device.

If a CCTV is provided, it shall be switched on automatically when the speed of the RCV is less than 6 km/h and the main switch is on. It cannot be switched off manually. The minimum size of the monitor shall be 12,7 cm. The installation of the monitor shall restrict to a minimum the forward visibility.

If mirror(s) and monitor(s) are used to view the functional space, then they shall be placed in the same view direction as the traffic mirror(s).

5.11 Electrical components

5.11.1 General

Boxes for controls, switches and terminals fitted outside of the cab shall meet the requirement of EN 60204-1:2006, 11.4 and be designed for at least the protection grade IP65 according to EN 60529 (see also of EN 60204-1:2006, 10.1.3). Arduous conditions including cleaning with hot water pressure jets shall be taken into consideration in the design.

It shall not be possible to bypass or render non operational safety switches or similar devices by the use of simple means. This applies also to the hold-to-run characteristics of the control device for starting the waste container lifting device.

5.11.2 Remote controls

Remote controls may be available only for waste container lifting device with a lift capacity higher than 1000 kg.

Remote controls shall comply with the requirements of ISO 15817.

Remote controls, including the stopping device, shall meet the requirements of EN 60204-1:2006, 9.2.7.

No more than one remote control adapted operating control shall be designed for each controlled movement, so that EN 60204-1:2006, 9.2.7.4 does not apply.

Wireless controls shall be capable of operating the lifting device after switching on the receiver outside of the RCV by the operative. It shall be switched off automatically during travel movement. The wireless controls shall not be able to be operated from the cab.

If a controlled movement can be operated from a working station or by a wireless control a selector switch shall be provided at the working station to ensure that only one control is operable at the same time.

All movements shall be stopped automatically at:

— distance between the RCV and the remote control exceeding 10 m;

— interruption of the remote control by more than 1 s;

— loss of power supply of the remote control.

Wireless controls shall be capable of operating only when the operative is within the visible space and has a direct view relating to the functional space of the controlled movement(s).

5.11.3 Safety related interlocks

Safety related interlocks shall meet the requirements of EN 60204-1:2006, 9.3.

5.11.4 Two-hand operating controls

Two-hand operating controls shall comply with type II of EN 60204-1:2006, 9.2.6.2 or with EN 574.

5.11.5 Overload protection

All electrical circuits shall be protected against overload and short circuit according to EN 60204-1:2006, 7.2 and 7.3.

5.11.6 Power supply

In case of a loss of power supply no dangerous situation shall occur.

In case of energy interruption, the requirements of EN 60204-1:2006, 9.4.3.2 shall be met.

5.11.7 Position sensors

Safety related position sensors such as limit switches, proximity switches or positioning switches shall meet the requirements of EN 60204-1:2006, 10.1.4.

5.11.8 Terminals and wire connections

5.11.8.1 Wire connections to terminals and components shall be capable of resisting shocks and vibrations occurring during the use of the lifting device(s) and shall comply with EN 60204-1:2006, 13.1.1.

5.11.8.2 Wiring terminals shall be fixed in boxes or purpose designed multi-pin plugs with an IP 65 rating. No more than one wire shall be connected to one connection point unless the connection point is designed to accommodate several wires. Terminals shall be permanently marked according to the wiring documents.

5.11.8.3 For screwed connections, the ends of flexible wires shall be in accordance with EN 60204-1:2006, 13.1.1.

5.11.9 Wiring

5.11.9.1 The wiring shall be installed according to EN 60204-1:2006, 13.1.2, 13.2.1, 13.2.4, 13.3 and 13.4.

5.11.9.2 Wires connected on the 0 volt level of the chassis-cab shall be marked in a different colour, pictogram or numbering to the current supply wires.

5.11.10 Cables

All cables shall be suitable for the operating conditions and external influences and conform to EN 60204-1:2006, 12.1 to 12.6. Only flexible cables shall be used.

5.12 Working light(s)

For the safety of operations the lifting device(s) shall be provided with a minimum illumination of 75 lux available in the entire functional zone when measured one meter above ground level.

NOTE Lighting has to conform with road traffic regulations.

5.13 Electromagnetic compatibility (EMC)

The waste container lifting device shall comply with the requirements of EN 13309.

5.14 Noise

The waste container lifting device shall be designed to minimise the noise at the operative’s positions.

The noise test code of EN 1501-4 shall apply to the whole machine (RCV with its waste container lifting device fitted).

The noise control is described in EN 1501-1, EN 1501-2 or EN 1501-3 for the complete rear, side and front loaded RCVs because the lifting device cannot be considered separately.

5.15 Maintenance

Unexpected start-up shall be prevented according to EN 1037.

Maintenance instructions shall include clear guidelines for securing the lifting device when repositioning is required for maintenance.

If a person has to enter the hazardous areas during cleaning or maintaining, a supporting device shall prevent the waste container lifting device from falling unintentionally by means of at least one specific mechanical restraint device. It shall be permanently attached and shall be capable of supporting 1,25 times the full weight of the mobile part of the waste container lifting device.

5.16 Lifting points

The interchangeable or demountable waste container lifting device shall be equipped with lifting points for safe handling.

5.17 Signals and warning devices

Warning signals shall be operational as long as the ignition key of the RCV is switched on.

Electrical signal(s) shall be provided to the RCV to activate the warning system(s).

6 Verification

Safety requirements and measures in Clause 5 shall be verified according to Table 1 in Clause 4 (sixth / last column).

The verification regime covers the following basic verification:

1) type verification, including unique machines, the result of which is to ensure that the type of machine complies with the requirements of the standard;

2) individual verification of each machine put on the market, the result of which is to prove that before dispatch, each machine satisfies all the safety requirements.

The quality control procedures determine the applicable verification regime.

7 Information for use

7.1 Signals and warning devices

The following warnings shall be provided:

Warning label(s)

— (a) warning label(s) instructing the operative of the dangerous zone(s), according to Figures B.5-1 and B.5-2;

Warning sign

— a warning sign according to Figure B.6, fixed at the rear of the RCV, instructing the road user(s) that part(s) of the lifting device protrude beyond the lateral dimensions when operating.

7.2 Operation manual

The manual shall be supplied with the lifting device. The format and content shall be in accordance with EN ISO 12100, 6.5.

The lifting device shall be delivered with operating instructions and shall, as a minimum, include the following information:

— description of the lifting device;

— information on the intended use;

— type(s) of RCV onto which the interchangeable waste container lifting device can be fitted;

— prohibition of the foreseeable misuse including lifting of persons;

— advice on the competence of the operating personnel;

— advice that lifting devices shall only be operated by trained personnel;

— information about operatives not using any part of the waste container lifting device for riding purposes;

— information about the use of the footboard(s) in relation with the waste container lifting device (if fitted);

— information on the safety for the use of the lifting device;

— information on the weight and location of the centre of gravity of the demountable or interchangeable waste container lifting device;

— information on attachment points and positioning points for the lifting device;

— description of the controls;

— operating position of the operative when using a remote control e.g. need for a full view of the functional space;

— safety information on the use of wireless controls if fitted;

— description of the interfaces with the RCV (mechanical, hydraulic/pneumatic, electrical);

— information on risks which cannot be ruled out despite safety measures incorporated by the designer (e.g. change in stability through raised bodywork with lifting device);

— description of the stow position for the element(s) which can be out of the dimensions of the RCV e.g. waste container handling system, stabilizer(s), extending arm, etc.;

— when personal protective equipment (PPE) is required;

— safety information about operation when a CCTV system is mounted;

— advice that the lifting devices shall not be used when safety devices are not effective;

— advice for cleaning with a hot water pressure jet;

— checks to be carried out in normal use and their timescale;

— checks to be carried out after major repair;

— advice that maintenance work on safety related parts is only to be carried out by trained personnel;

— tests for the warning signals;

— emergency procedure for any energy failure;

— list of the designated waste containers to be handled;

— schematic drawing with the safety relevant dimensions of the designated skip containers to be handled;

— advice for avoiding the lifting of damaged, overloaded or overfilled waste container;

— environmental air conditions (especially range of temperature) of the geographic area for which the lifting device is designed and to be operated;

— if footboard(s) is (are) fitted on the waste container lifting device, description of the detection system;

— information on the performances of the use of the comb lifting system instead of the trunnion lifting system when the waste container lifting device is equipped for both.

The information of airborne sound power level and emission sound pressure levels at working stations are given in the operation manual of the RCV onto which this lifting device is fitted.

7.3 Maintenance

The information for use manual shall cover the preventive maintenance and the maintenance schedule and give detailed information related to the pre-use, after-use and periodic maintenance procedures. A specific clause “safety information” covers the safety precautions, general warnings and safe practices for maintenance.

It shall cover also information for minimum training requirements for maintenance personnel including the following items:

— checking of the safety devices;

— information on components requiring servicing to maintain a safe lifting device and the intervals at which servicing is required;

— instruction for maintaining the waste container lifting device in its elevated position when it is required;

— information giving safety precautions;

— instruction for demountable or interchangeable waste container lifting device about separation of energy sources when demounting.

7.4 Data sheet

Each demountable and interchangeable waste container lifting device shall be supplied with a data sheet with the contents as specified in Table C.3.

7.5 Marking

Demountable and interchangeable waste container lifting device(s) shall, as a minimum, be identified by the following durable marking:

— name and address of the manufacturer and, where applicable, the authorized representative;

— designation of the machinery;

— mandatory marking [1)];

— year of construction;

— designation of series or type;

— serial or identification number;

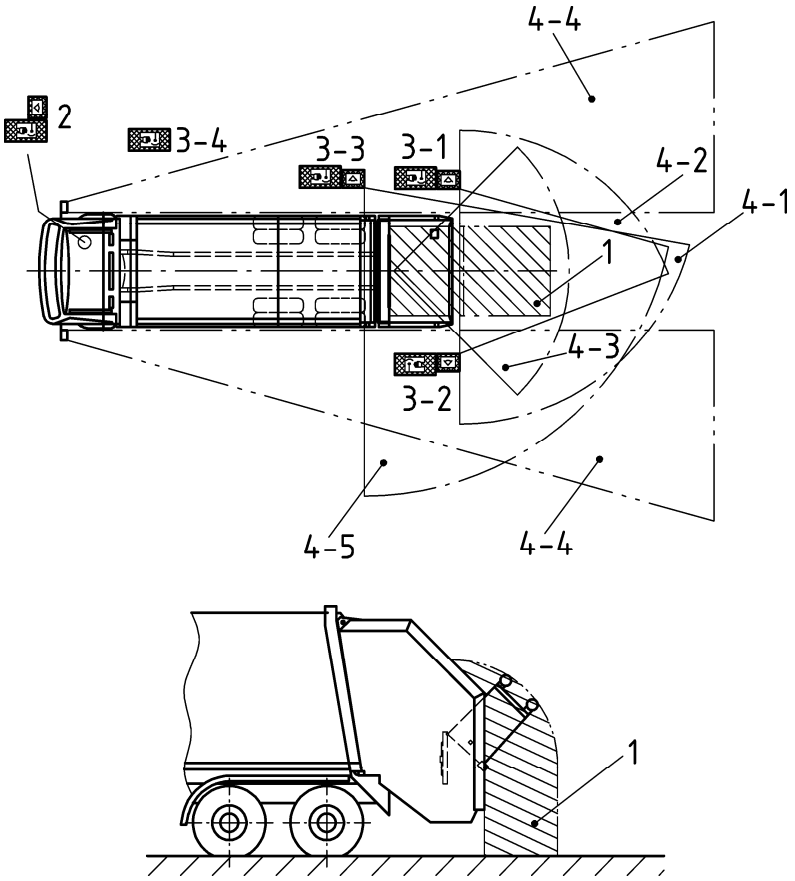
— type(s) of RCV onto which it can be fitted.

The maximum permissible lifting mass(es) shall be marked durable.

NOTE For machines and their related products intended to be put on the market in the EEA, CE marking as defined in the applicable European Directive(s), e.g. Machinery, Outdoor noise, Pressure equipment.

Annex A
(normative)

Functional spaces, dimensions and connections

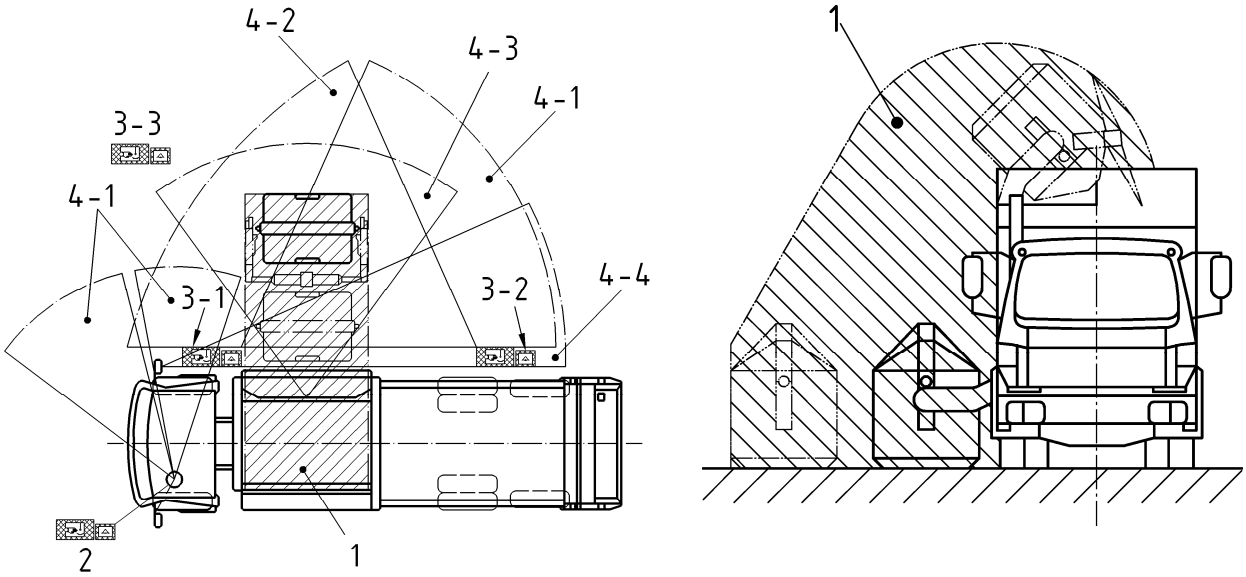


Key

1 functional space
2 in cab working station including CCTV monitor
3 outside of the rear loaded RCV working stations
3-1 right hand working station
3-2 left hand working station
3-3 discharge working station
3-4 remote working station
4 visible spaces for working stations
4-1 direct visible space from right working station
4-2 direct visible space from left working station
4-3 indirect visible space by CCTV from in cab working station
4-4 indirect visible space by mirrors for in cab working station
4-5 direct visible space from discharge working station

NOTE Working stations 2, 3-3 and 3-4 can be located on the left hand or right hand side of the rear loaded RCV

Figure A.1-1 — Rear mounted waste container lifting device



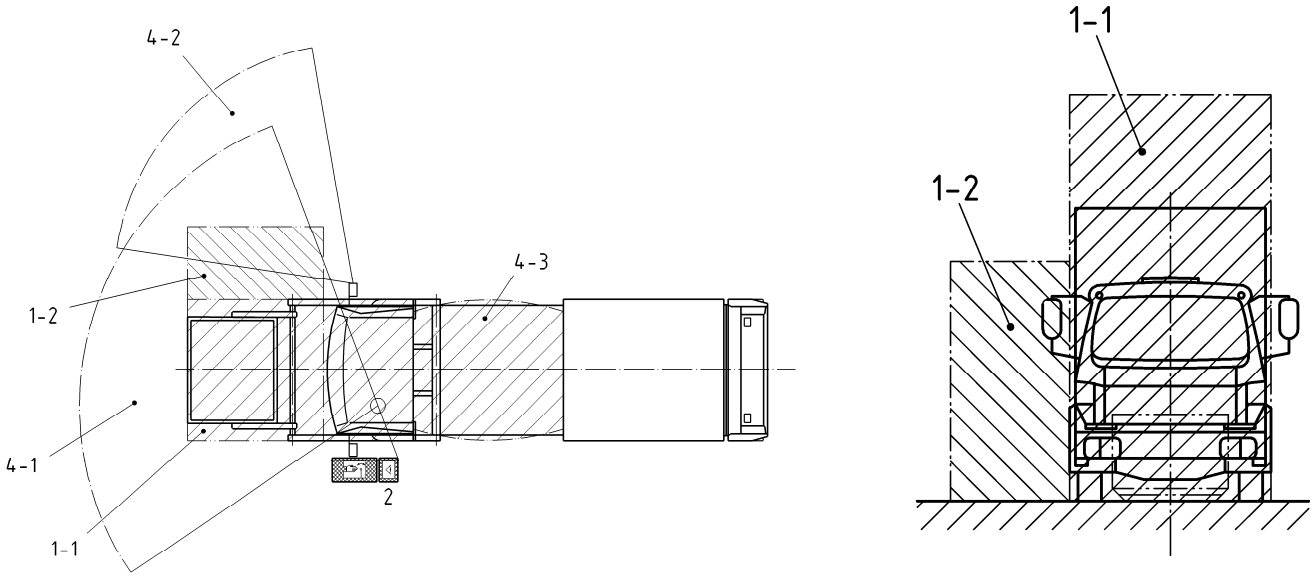
Top view Front view

Key

1 functional space
2 in cab working station
3 outside of the side loaded RCV working stations
3-1 right hand working station
3-2 left hand working station
3-3 remote working station
4 visible spaces
4-1 direct visible space for in cab working station
4-2 direct visible space from left working station
4-3 indirect visible space by CCTV from in cab working station
4-4 indirect visible space by mirror for in cab working station

NOTE Working stations 2, 3-1, 3-2 and 3-3 can be located on the left hand or right hand side of the rear loaded RCV

Figure A.1-2 — Side mounted waste container lifting device



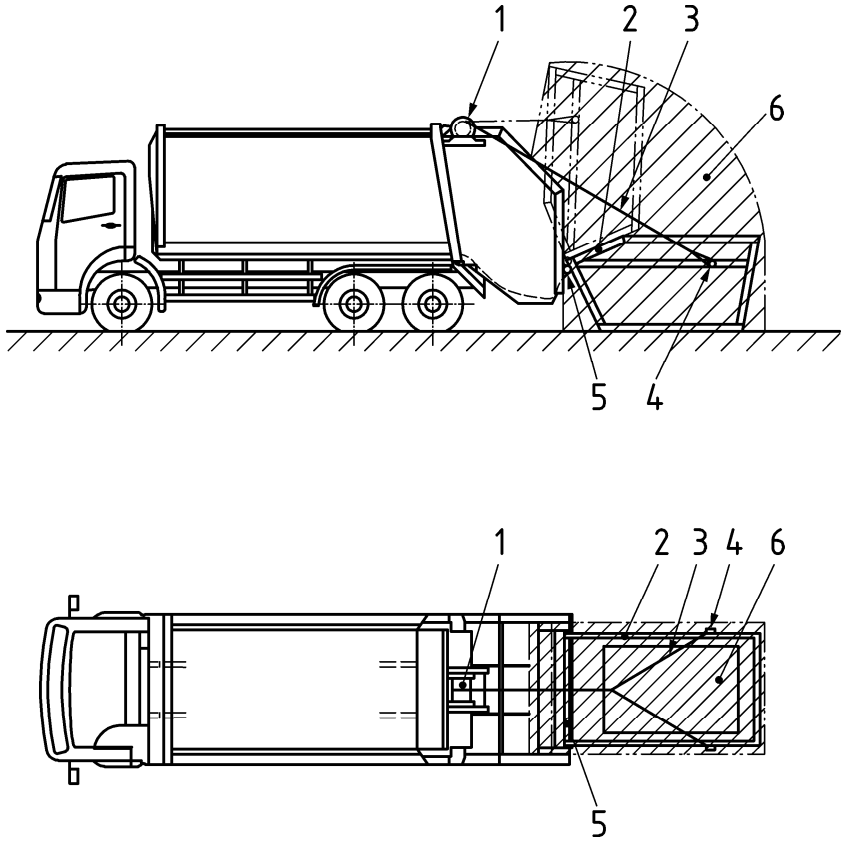
Top view Front view

Key

1-1 functional space for front waste container lifting device
1-2 functional space for front-side waste container lifting device
2 in cab working station of the front loaded RCV
4 visible spaces for in cab working station
4-1 direct view
4-2 indirect view with mirrors (forwards: pick up/lift waste container)
4-3 indirect view by CCTV (rearwards: empty waste container)

NOTE Working station 2 can be located on the left hand or right hand side of the rear loaded RCV

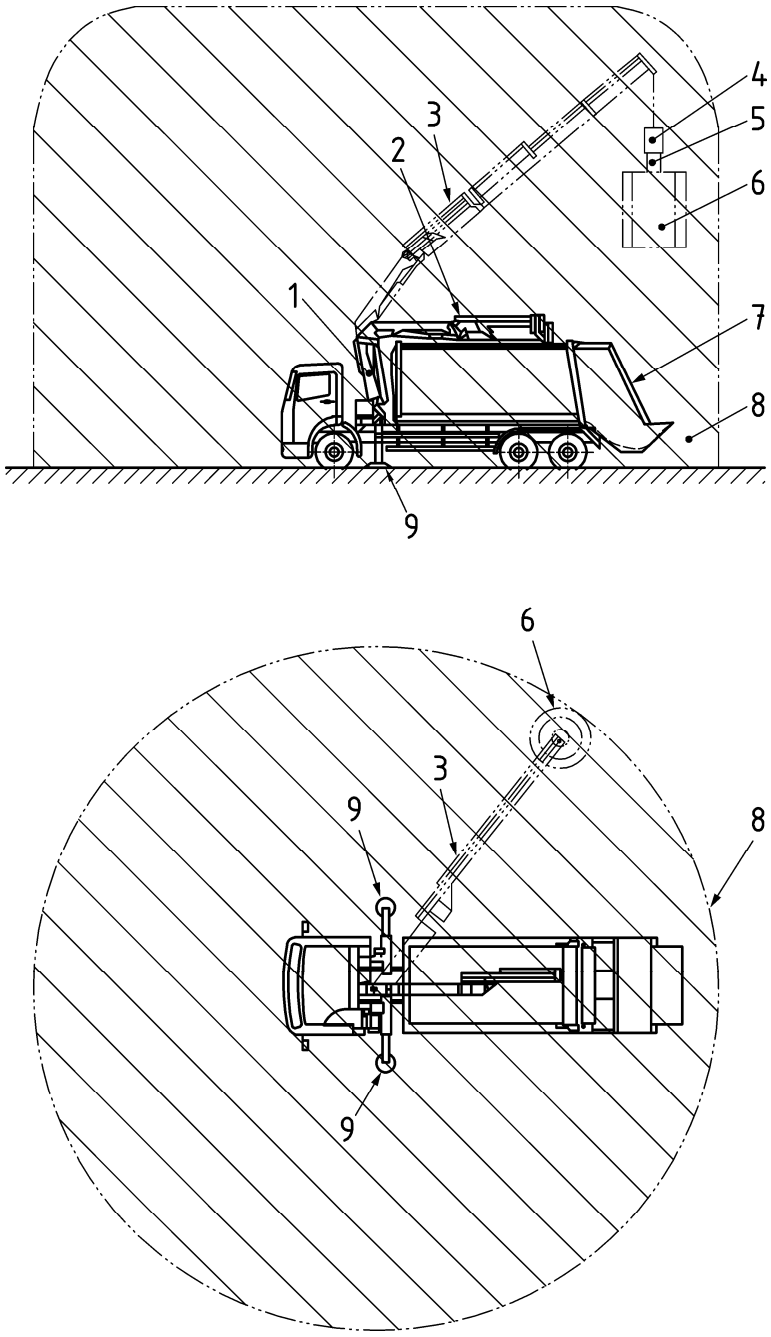
Figure A.1-3 — Front mounted waste container lifting device



Key

1 winch
2 skip container
3 cable or chain
4 pivot/trunnion
5 trunnion bar
6 functional space

Figure A.1-4 — Rear loaded RCV with winch and skip container

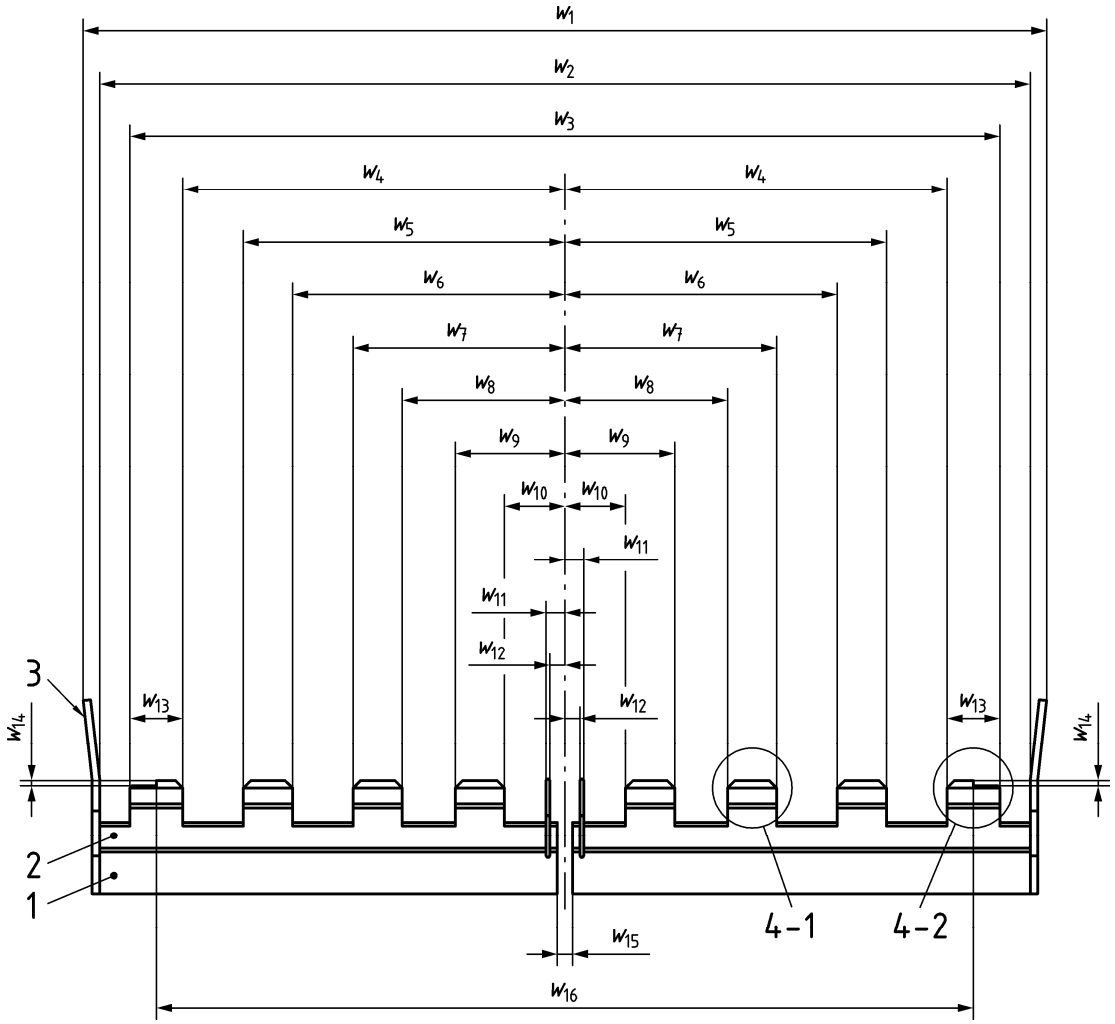


Key

1 slewing column
2 stored boom
3 extended/working boom
4 lifting attachment
5 connection device
6 waste container
7 loading edge
8 functional space
9 stabilizer

Figure A.1-5 — RCV with loader crane and top lifted and bottom emptied container

Figure A.1 — Types of RCVs, working stations, functional and visible spaces

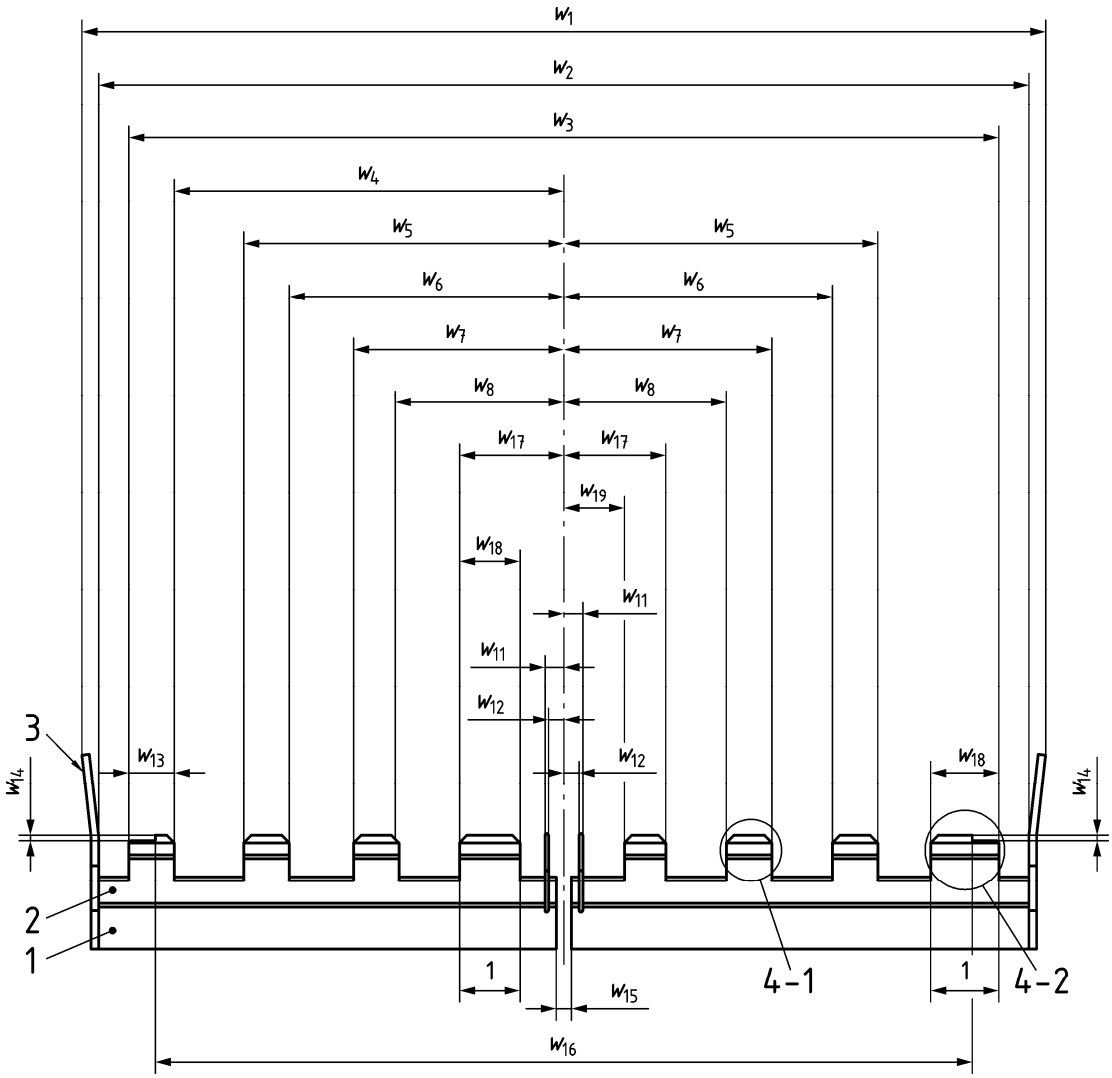


Pick up range related to the ground:

830 mm to 1 030 mm for containers according to EN 840-1,

830 mm to 1 290 mm for containers according to EN 840-2 and EN 840-3.

Figure A.2-1 — Standard comb and guide system for waste containers according to EN 840-1 to EN 840-3

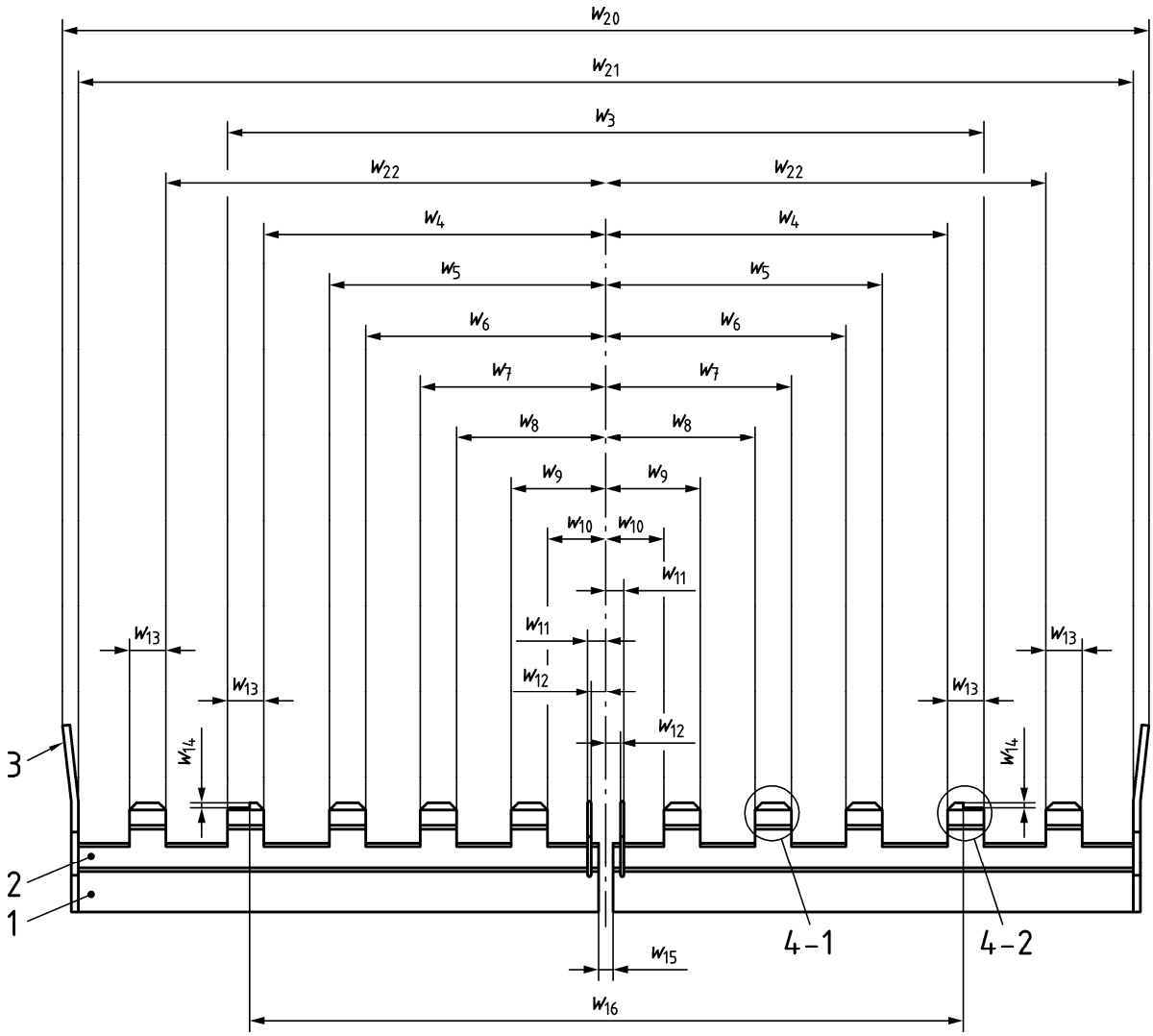


Pick up range related to the ground:

830 mm to 1 030 mm for containers according to EN 840-1,

830 mm to 1 290 mm for containers according to EN 840-2 and EN 840-3.

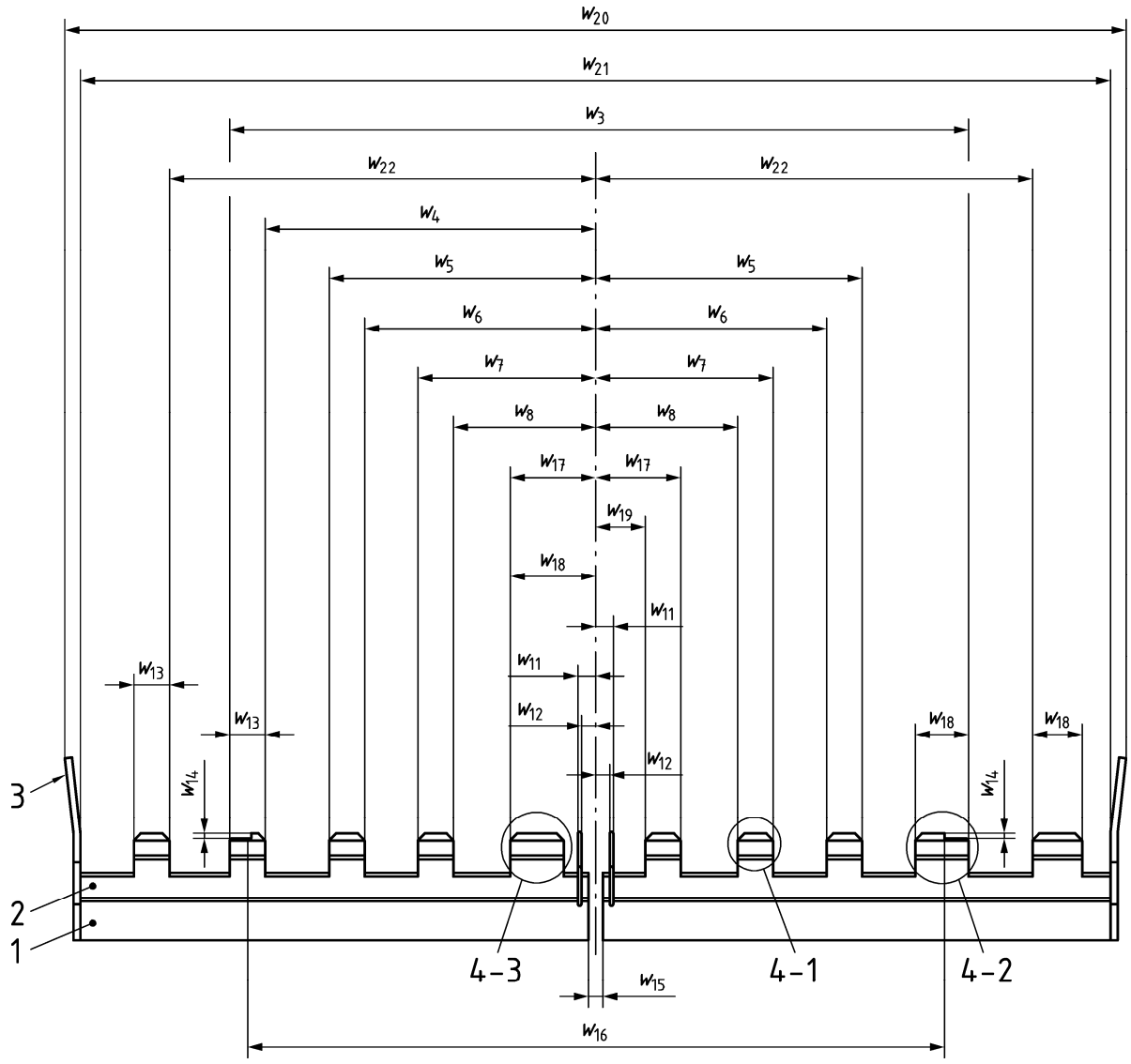
Figure A.2-2 — Standard comb and guide system for waste containers according to EN 840-1 to EN 840-3, when identification systems according to EN 14803 are used



Pick up range related to the ground:

830 mm to 1 290 mm

Figure A.2-3 — Standard wide comb and guide system for containers according to EN 840-4



Pick up range related to the ground:

830 mm to 1 290 mm

Figure A.2-4 — Standard wide comb and guide system for containers according to EN 840-4, when identification systems according to EN 14803 are used

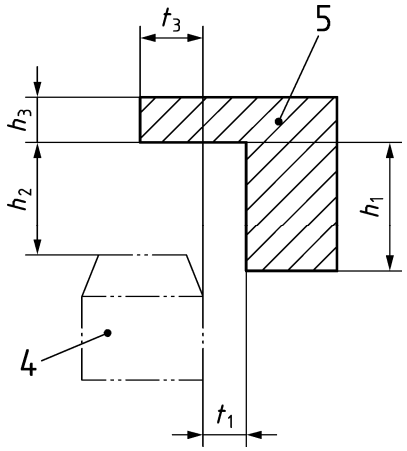


Figure A.2-5a — Locking system for EN 840 forms A and B

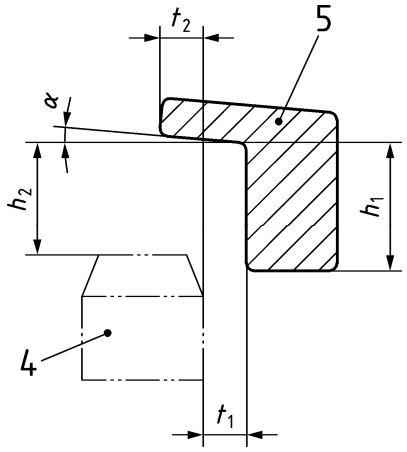


Figure A.2-5b — Locking system for EN 840 form C

Key to Figures A.2-1 to A.2-5

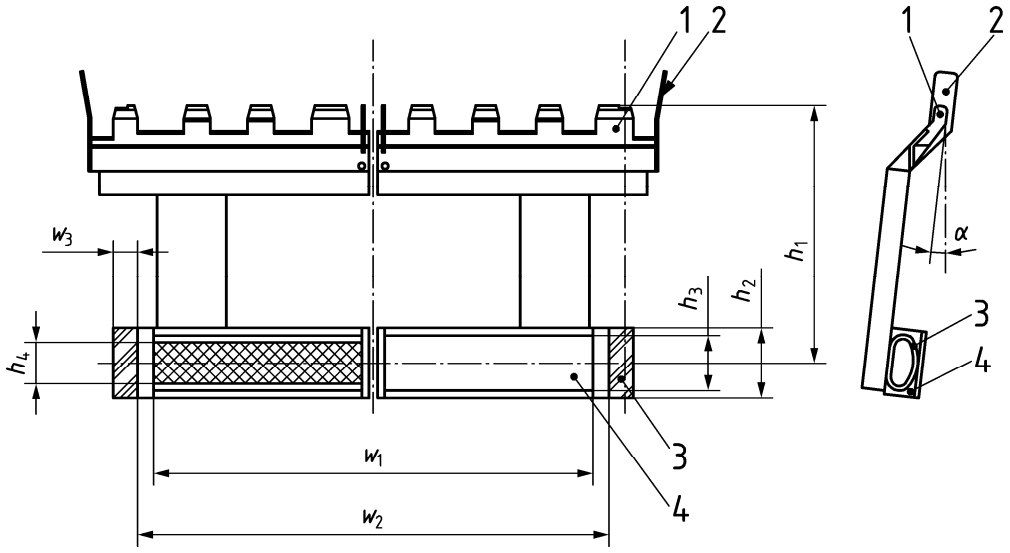
1 lifting carriage
2 comb
3 guide system
external guide system
internal guide system
4 comb tooth
4.1 universal tooth
4.2 tooth for EN 840-2 and 3
4.3 antenna
5 locking system

Figure A.2-5 — Locking system for comb pick-up system

Table Figure A.2

Dimension term	mm	Designation
		Figures A.2-1 and -2
w_1	1330^{+20}_{0}	Total width of comb with guide system
w_2	1280^{+10}_{-5}	Total width of comb without guide system
w_3	1180^{+0}_{-2}	Distance between the external faces of the outermost teeth
		Figures A.2-1 to -4
w_4	535^{+0}_{-20}	Distance from axis to internal face of the last tooth
w_5	430^{+5}_{-5}	Distance from axis to external face of the last but one tooth
w_6	370^{+5}_{-5}	Distance from axis to internal face of the last but one tooth
w_7	285^{+5}_{-5}	Distance from axis to external face of the second tooth
w_8	225^{+5}_{-5}	Distance from axis to internal face of the second tooth
		Figures A.2-1 and -3
w_9	135^{+5}_{-5}	Distance from axis to external face of the first tooth
w_{10}	75^{+5}_{-5}	Distance from axis to internal face of the first tooth
w_{11}	26^{+0}_{-1}	Distance from axis to external face of the central guide
w_{12}	20^{+0}_{-2}	Distance from axis to internal face of the central guide
		Figures A.2-1 to -4
w_{13}	50^{+5}_{-5}	Width/length of tooth for EN 840-2 and -3
w_{14}	6^{+3}_{-0}	Height void of flat spot
w_{15}	10	Minimum distance between the two halves of a split LD
w_{16}	1 115	Distance to the centres of the outermost teeth
		Figures A.2-2 and -4
w_{17}	140^{+1}_{-0}	Distance from axis to external face of the first tooth
w_{18}	85^{+2}_{-0}	Width/length of tooth with antenna
w_{19}	80^{+5}_{-0}	Distance from axis to internal face of the first tooth
		Figures A.2-3 and -4
w_3	1180^{+0}_{-2}	Distance between the external faces of the last but one tooth
w_{20}	1690^{+20}_{-0}	Total width of comb with guide system
w_{21}	1640^{+5}_{-0}	Total width of comb without guide system
w_{22}	685	Distance from axis to internal face of the last tooth
		Figure A.2.5
h_1	25^{+0}_{-5}	Locking device height
h_2	23^{+1}_{-0}	Free vertical space between locking device and tooth
h_3	8^{+4}_{-0}	Thickness
t_1	$8{,}5^{+0}_{-0{,}5}$	Free horizontal space between locking device and tooth
t_2	16^{+0}_{-3}	Overlap for containers with frontal receiver form C
t_3	$10^{+0}_{-0{,}5}$	Overlap for containers with frontal receiver forms A and B
α	0°-18°	Attack angle of locking system

Figure A.2 — Standard combs and guide systems



Key

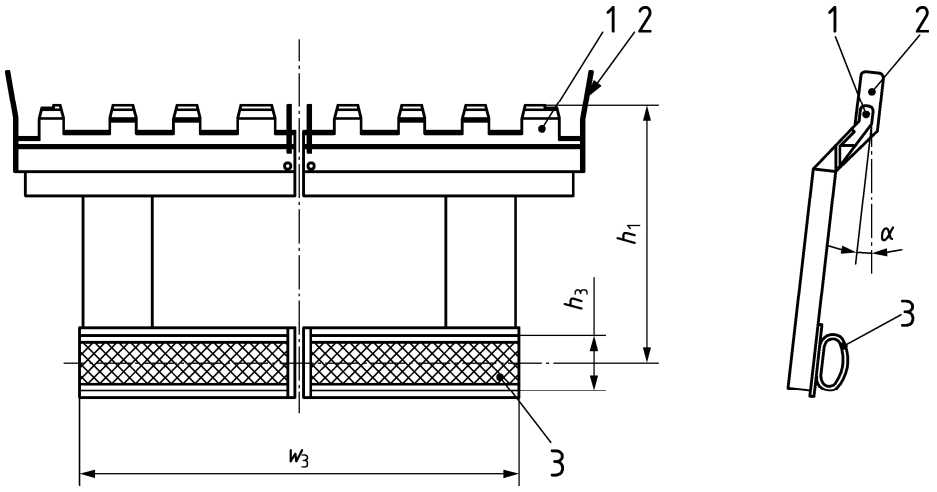
1 comb
2 guide system
3 pushing pad
4 additional pushing pads (for steel containers only)

Table Figure A.3-1

Dimension term	mm	Designation
normative		
h_1	450	Minimum distance between comb and pushing pad
informative		
h_2	160	Minimum vertical dimension of support part for 1,1 m^3 steel container
h_3	120	Minimum dimension of flexible pushing pad
h_4	> 100	Vertical dimension of pushing pad in contact with container
w_1	> 1 000	Width of pushing pad
w_2	1085^{+25}_{-5}	Inside distance between supports for 1,1 m^3 steel container
w_3	> 30	Width of additional pushing pads for steel container according to EN 840-3
α	> 5°	Attack angle of lifting carriage to container

NOTE Measurements taken with waste container lifting devices lifted 90° from normal and container filled with test load according to EN 840-5.

Figure A.3-1 — Pushing pad for containers according to EN 840-1, EN 840-2 and EN 840-3



Key

1 comb
2 guide system
3 pushing pad

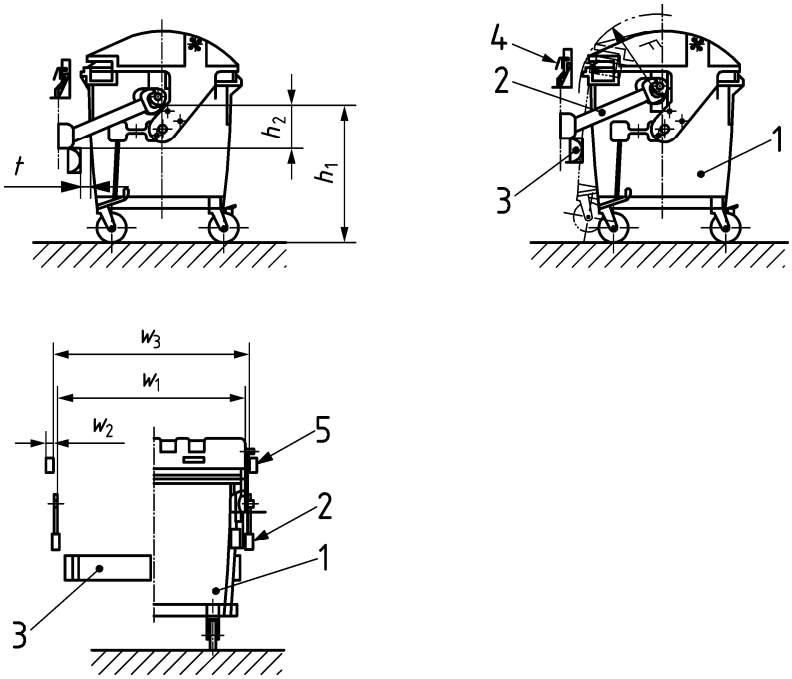
Table Figure A.3-2

Dimension term	mm	Designation
normative		
h_1	450	Minimum distance between comb and pushing pad
informative		
$h_{3\ (note)}$	120	Minimum height of flexible part of pushing pad
w_3	1450	Minimum width of specific pushing pads for steel container only
α	>5°	Attack angle of lifting carriage to container

NOTE Measurements taken with waste container lifting device lifted 90° from normal and container filled with test load according to EN 840-5.

Figure A.3-2 — Pushing pad for containers according to EN 840-4

Figure A.3 — Pushing pads for comb pick-up system



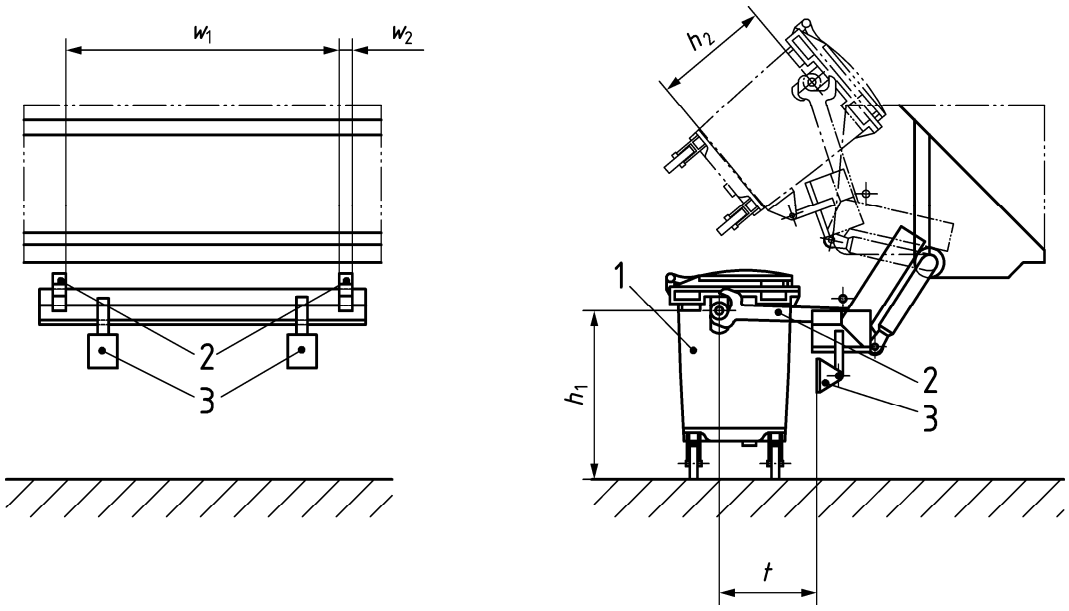
Key

1 waste container
2 trunnion pick-up system
3 pushing pad
4 comb and guide system
5 lid opener

Table Figure A.4-1

Dimension term	mm	Designation
normative		
w_1	1270^{+10}_{-0}	Inside width of pick-up system (trunnion lifting arms)
w_2	30	Minimum thickness of lid opener
w_3	$1\,290+-5\ ^{+5}_{-5}$	Inside distance of the lid opener
informative		
h_1	800 to 1 150	Pick up range
h_2	> 310	Vertical distance between trunnion receiver and top of pushing pad
r	635^{+10}_{-15}	Radius of free space required for the container movement
t	> 50	Free space to the pushing pad for picking up the trunnion

Figure A.4-1 — Trunnion pick-up system for containers according to EN 840-2 and EN 840-3



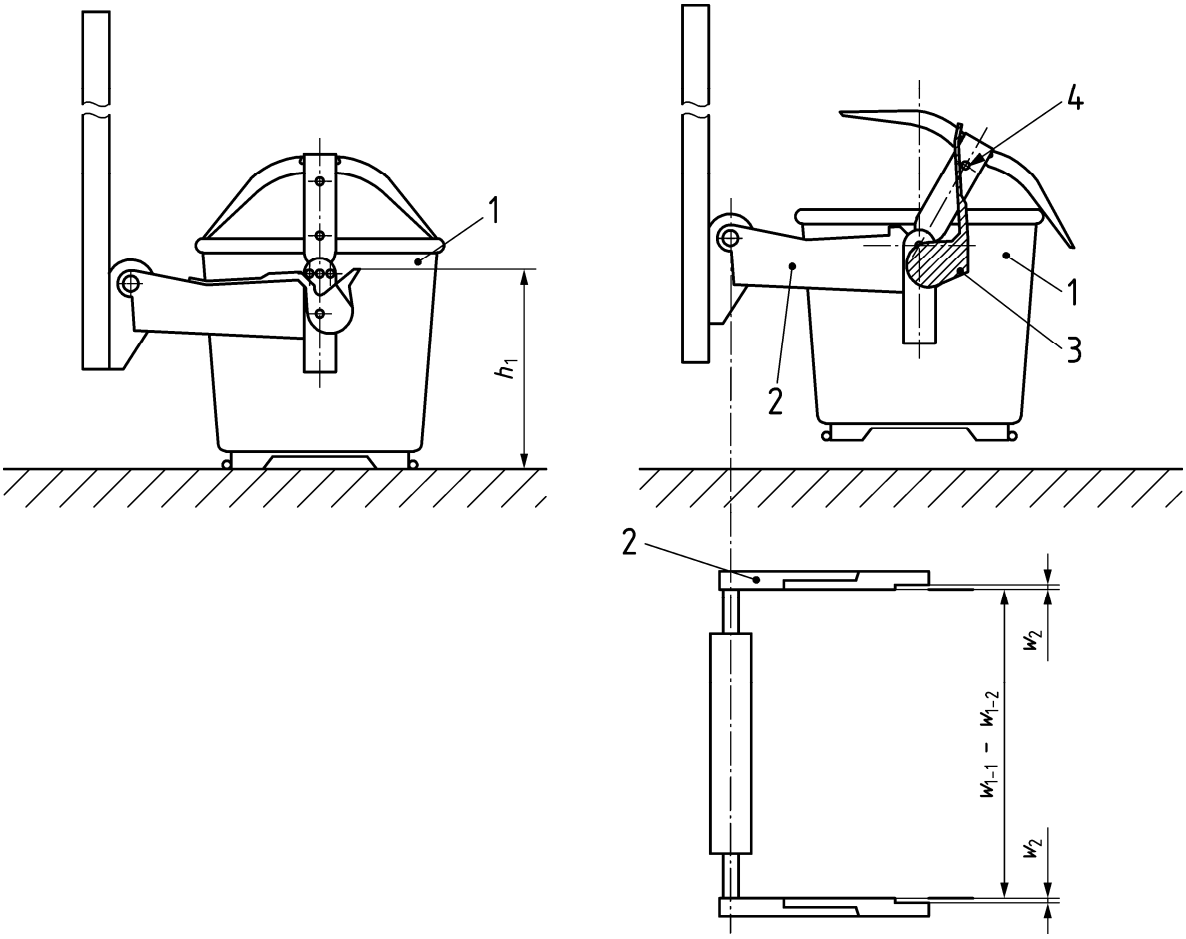
Key

1 waste container
2 trunnion pick-up system
3 pushing pad

Table Figure A.4-2

Dimension term	mm	Designation
normative		
w_1	1670^{+10}_{-0}	Inside width of pick-up system
w_2	> 50	Minimum thickness of trunnion receiver
informative		
h_1	800 - 1150	Pick up range
h_2	> 310	Vertical distance between trunnion receiver and pushing pad
t	500 - 560	Maximum free horizontal distance between trunnion and pushing pad

Figure A.4-2 — Trunnion pick-up system for containers according to EN 840-4



Key

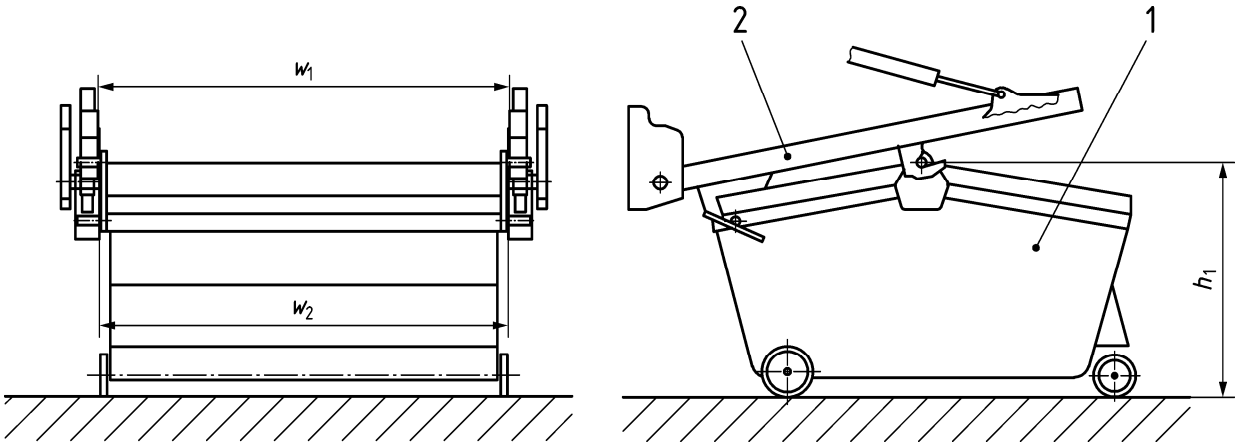
1 waste container
2 pick-up system
3 lid opener
4 lid trunnion

Table Figure A.4-3

Dimension term	mm	Designation
h_1	850 to 1 250	Pick up range
w_{1-1}	1 270	Inside width of the pick-up system for type F container
w_{1-2}	1 770	Inside width of the pick-up system for type A container
w_2	> 20	Thickness of lid opener

NOTE Nominal dimension of container type F: 1 260 mm (narrow interface), type A: 1 760 mm (wide interface) (see EN 12574-1: 2006, Table 1, item 13).

Figure A.4-3 — Trunnion pick-up system for container according to EN 12574-1 with dome lid



Key

1 waste container
2 double trunnion pick-up system

Table Figure A.4-4

Dimension term	mm	Designation
informative		
h_1	1 400 to 1 450	Pick up range
w_1	According to container	Inside width of main trunnion
w_2	According to container	Inside width of trunnion pick-up system

Figure A.4-4 — Double trunnion lifting system for containers according to EN 12574-1

Figure A.4 — Trunnion pick-up system

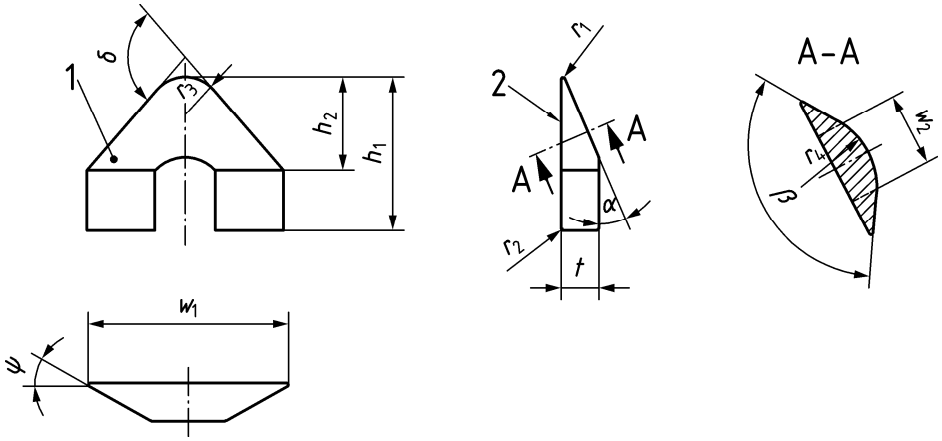


Figure A.5.1a — All views of single version

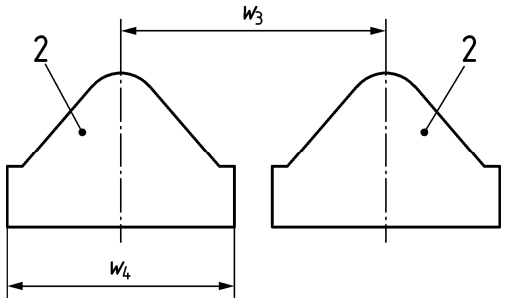


Figure A.5.1b — Rear view of double version

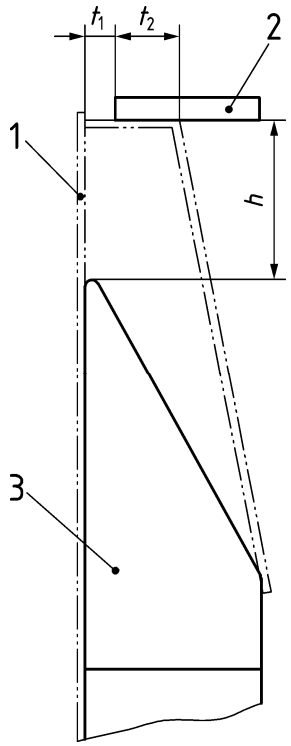
Key

1 centring surface
2 vertical contact surface

Table Figure A.5-1

Dimension term	mm	Designation
h_1	390	Minimum height of receiver
h_2	$230^{+0,5}_{-0}$	Height of centring (curved) surface
w_1	513	Width of diamond receiver
w_2	165	Dimension to tangent points
w_3	680^{+1}_{-1}	Distance of diamonds for double version
w_4	580	Maximum width of diamond
t	102	Maximum depth
r_1	6	Radius curved section
r_2	15	Radius contact surface
r_3	111^{+0}_{-1}	Radius of top surface
r_4	197	Radius of the outside surface
α	$28°^{+0}_{-0,5}$	Angle
β	125°	Angle
□	31°	Angle
δ	96°	Angle

Figure A.5-1 — Diamond pick-up system



Key

1 diamond pick-up system
2 locking system
3 diamond receiver of the container

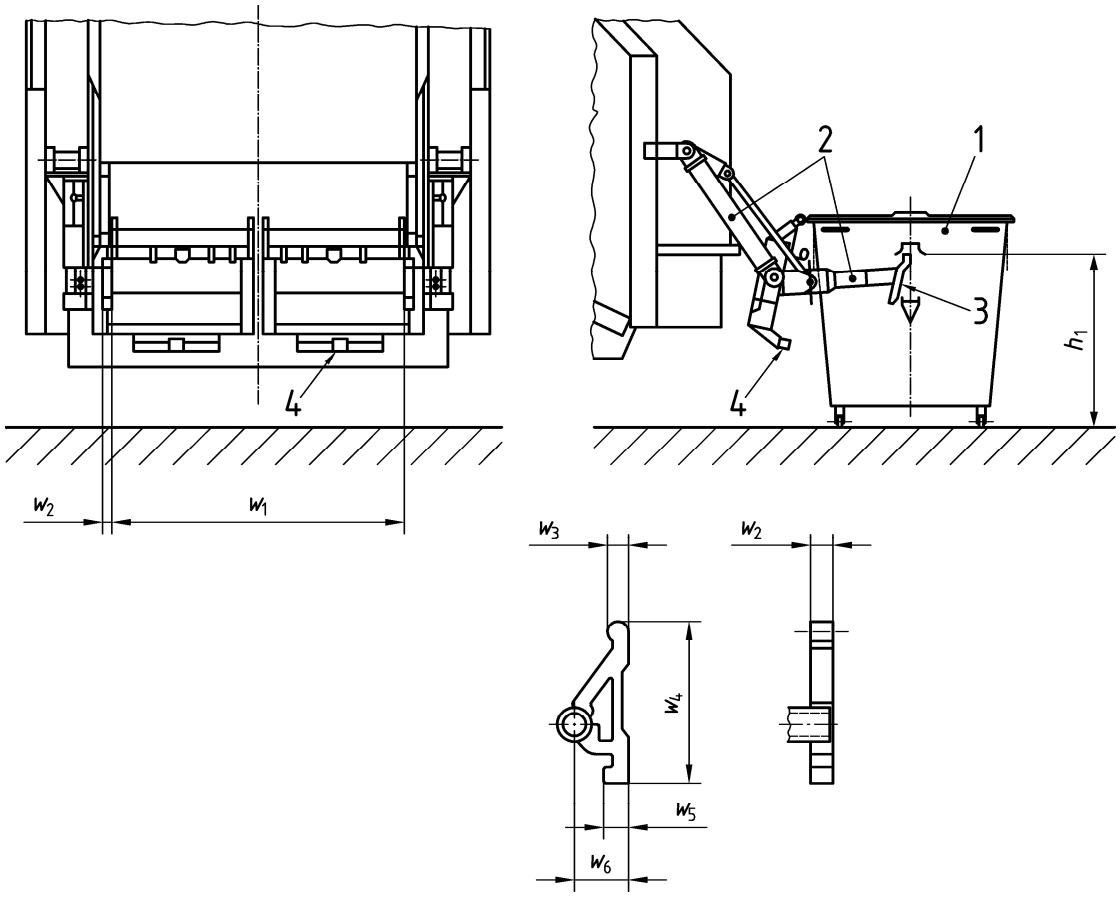
Table Figure A.5-2

Dimension term	mm	Designation
h	92^{+1}_{-1}	Free vertical distance for locking system
t_1	20^{+15}_{-0}	Free horizontal distance for locking system
t_2	> 20	Overlap

Minimum pick up height: 670 mm

Figure A.5-2 — Diamond locking system

Figure A.5 — Diamond pick-up system



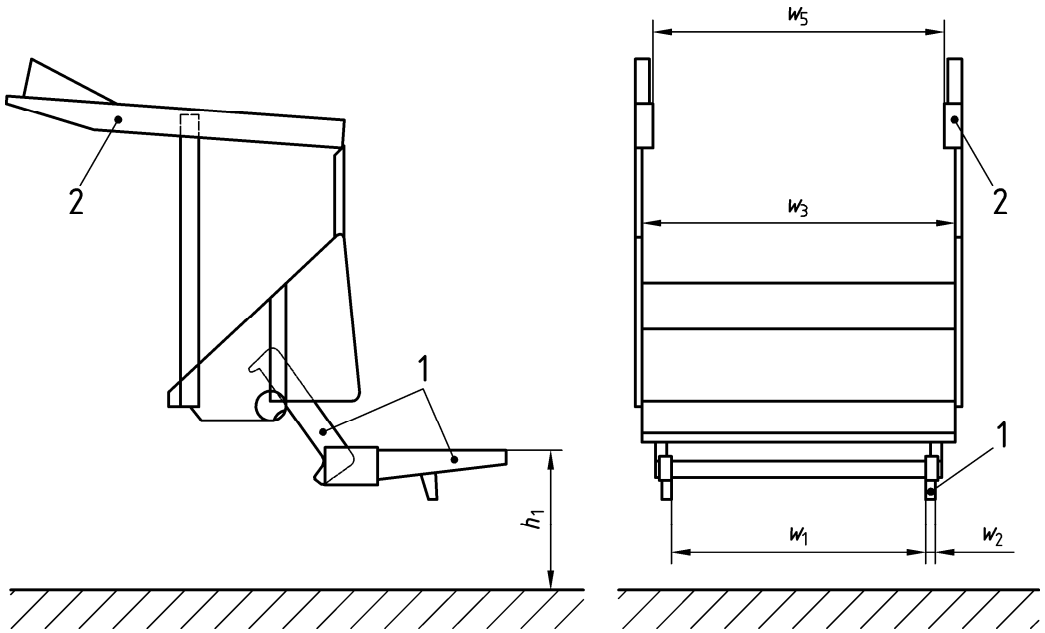
Key

1 waste container
2 BG pick-up system
3 BG adaptor
4 pushing pad

Table Figure A.6

Dimension term	mm	Designation
normative		
w_1	1544^{+0}_{-4}	Internal width of pick up arms
w_2	40	Thickness of pick up arm (“BG adaptor”)
w_3	40^{+0}_{-1}	Top diameter of pick up arm (“BG adaptor”)
w_4	293^{+0}_{-1}	Height of pick up arm (“BG adaptor”)
w_5	30^{+0}_{-1}	Depth of pick up arm (“BG adaptor”)
w_6	110^{+0}_{-1}	Depth to axis (“BG adaptor”)
informative		
h_1	640 to 1 200	Pick up range

Figure A.6 — BG pick-up system for containers according to EN 840-4



Key

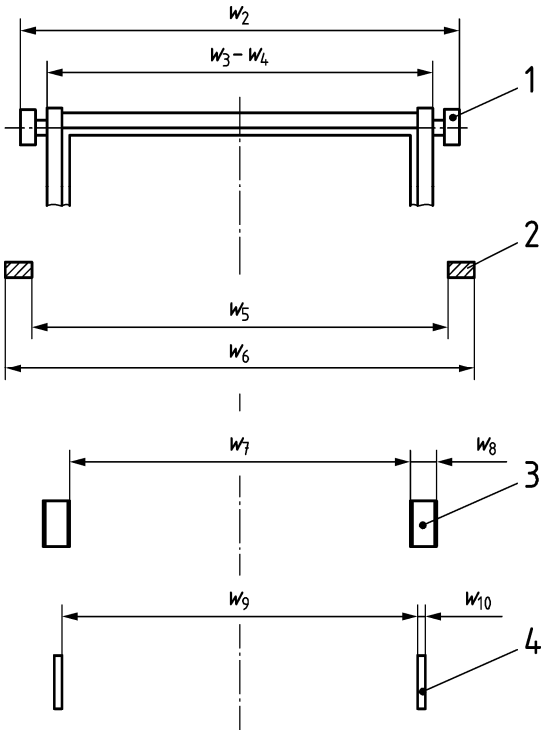
1 pocket pick-up system
2 lid opener

Table Figure A.7-1

Dimension term	mm	Designation
normative		
w_1	1605^{+10}_{-10}	Inside width of pick-up system
w_2	20-40	Thickness of pocket receiver arm
informative		
h_1	500 to 1 040	Pick up range
w_3	1900	Minimum free space for container movement
w_5	1920^{+5}_{-5}	Minimum width of the lid opener guide

NOTE Does not apply to type C waste container (with flat lid).

Figure A.7-1 — Pocket pick-up system and lid opener



Key

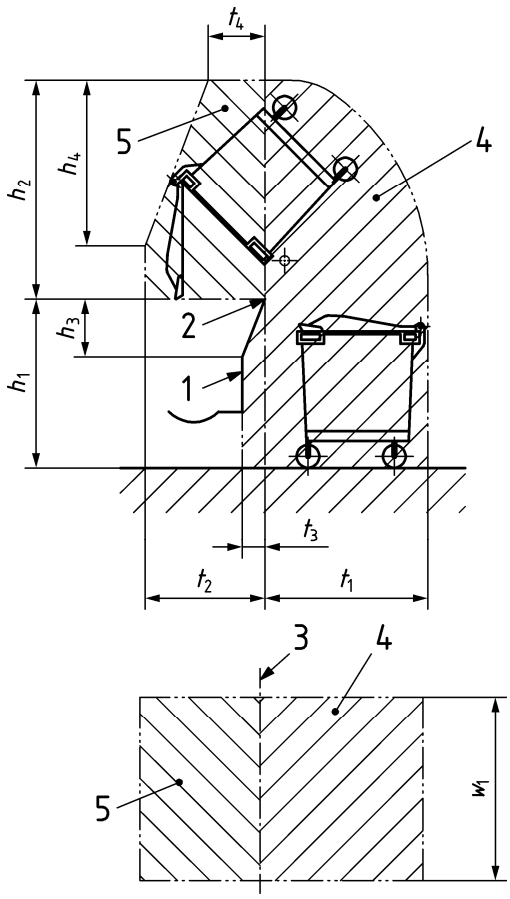
1 container opening roll
2 lid opener
3 container pocket
4 fork

Table Figure A.7-2

Dimension term	mm	Designation
w_2	2040^{+20}_{-20}	Outside dimension of roll
w_3	1780^{+50}_{-50}	Dimension for 2,5 m^3 containers
w_4	1845^{+10}_{-10}	Dimension for 4,5 m^3 containers
w_5	1920^{+5}_{-5}	Inside dimension of lid opener
w_6	2010^{+40}_{-0}	Outside dimension of lid opener
w_7	1600^{+15}_{-15}	Internal distance between pocket pick-up system
w_8	120^{+7}_{-5}	Width of container pocket
w_9	1650^{+10}_{-10}	Internal width of fork
w_{10}	40	Thickness of fork

Figure A.7-2 — Pocket pick-up system and lid opener for EN 12574-1 pocket containers (Type 3)

Figure A.7 — Pocket pick-up systems



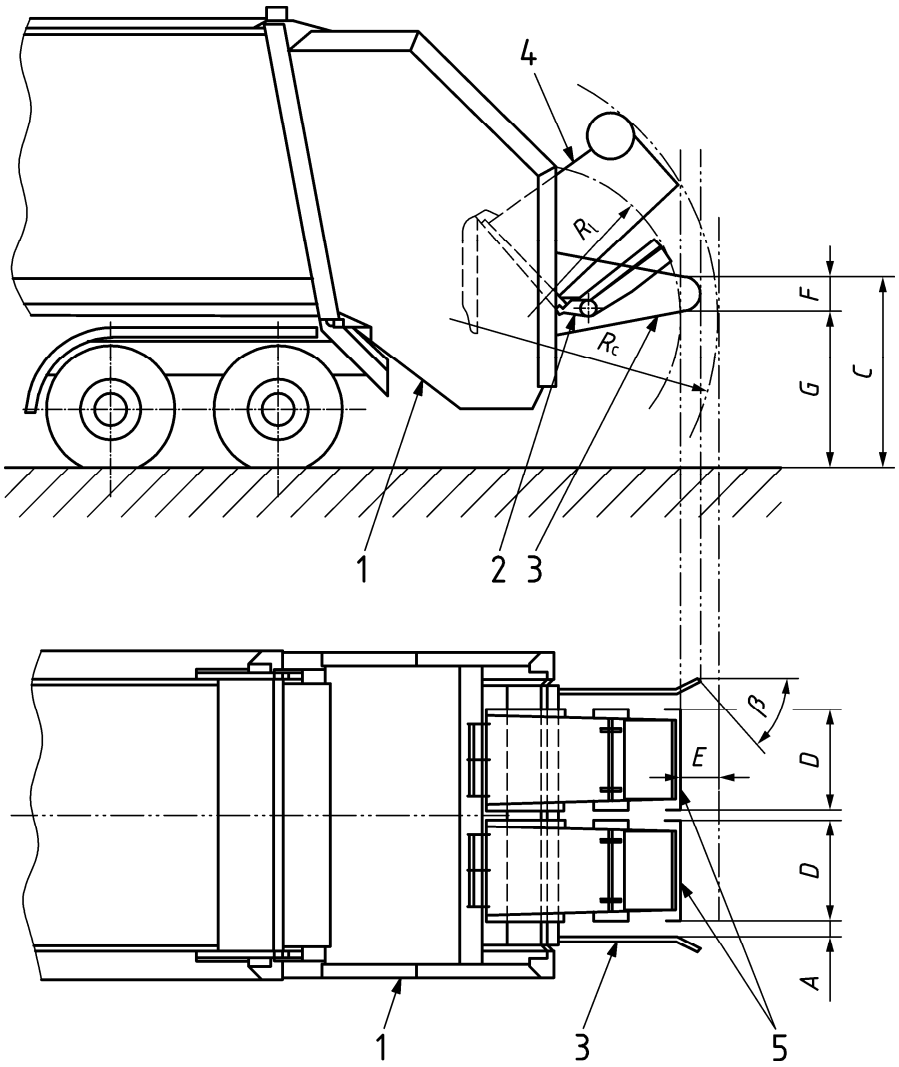
Key

1 interface line including the mounting frame according to Figures A.10 and A.11
2 rave rail/Support strip
3 splitting line between the outside and inside functional volumes
4 functional volume outside the RCV
5 functional volume inside the RCV

Table Figure A.8

Dimension term	mm	notes
h_1	1 200 to 1 600	Height of support strip
h_2	1775^{+15}_{-15}	Height of loading opening
h_3	495^{+20}_{-20}	Height of free space for lifting device mechanism
h_4	1320^{+20}_{-20}	Height of free space for lid
t_1		Functional space
t_2	1000^{+50}_{-50}	Maximum internal distance for the lid
t_3	160^{+50}_{-0}	Free space for lifting device mechanism
t_4	530^{+30}_{-30}	Maximum internal distance for the container
w_1	1400^{+10}_{-0}	Width of the functional space

Figure A.8 — Limit of the functional space of the interchangeable waste container lifting device in rear loaded RCV's tailgate for lifting EN 840-1, EN 840-2, EN 840-3 or diamond containers

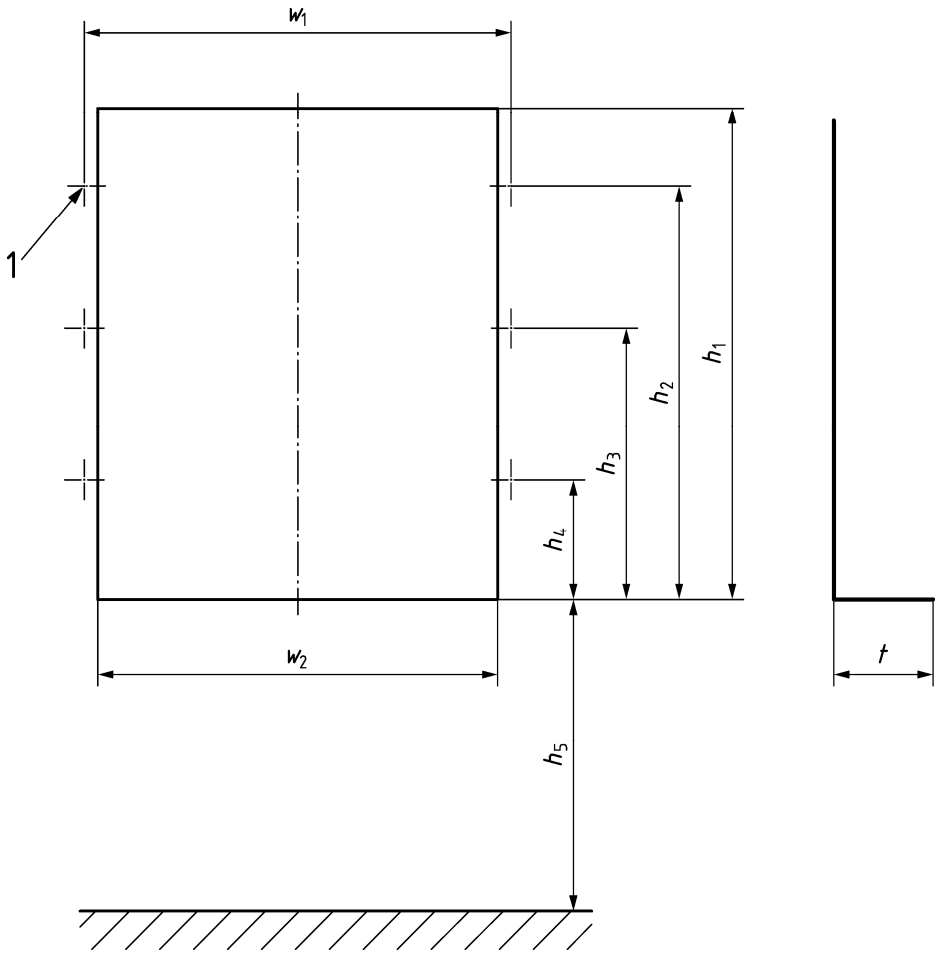


Key

A safety distance of the functional space to the side protective device according to EN ISO 13857
β angle between the lateral protective device and the container envelope ≥ 45°
F height of the lateral protective device: minimum 100 mm
D width of the rear guard ≥ 600 mm
E distance of the rear protective device to the Rc: 400 mm maximum
C upper edge of the lateral protective device: 1 000 mm minimum
G lower edge of the lateral protective device: 1 000 mm maximum; 400 mm minimum
Rc radius of the envelop of the largest designated waste container for the automatic or semi-auto modes
Rl radius of the waste container lifting device envelop
1 rear loaded RCV's tailgate or discharge door
2 waste container lifting device
3 lateral guards (side protective device)
4 tipping end position of the container
5 rear guards (rear entrance protective device)

NOTE Rc generate the length of the lateral guard.
Rl generate the position of the rear guard(s).

Figure A.9 — Entrance protection in automatic mode



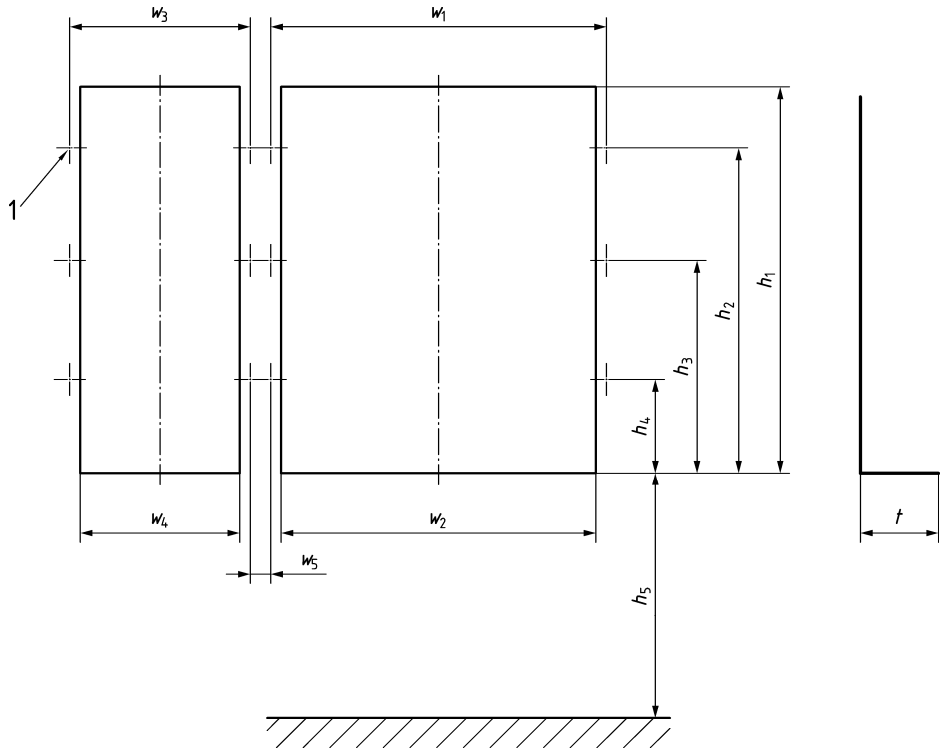
Key

1 fixing points: 6 holes for M 16 bolts

Table Figure A.10-1

Dimension term	mm	Designation
h_1	1685^{+15}_{-0}	Internal height of the opening
h_2	$1457^{+0,5}_{-0,5}$	Height of fixing points 1
h_3	$955^{+0,5}_{-0,5}$	Height of fixing points 2
h_4	$420^{+0,5}_{-0,5}$	Height of fixing points 3
h_5	1200 to 1600	Height of support strip
t	35^{+5}_{-5}	Depth of support strip
w_1	1536^{+2}_{-0}	Distance between fixing points
w_2	1410^{+2}_{-0}	Internal width of the opening

Figure A.10-1 — Opening of single-chamber rear loaded RCV for interchangeable waste container lifting device



Key

1 rixing points: 12 holes for M 16 bolts

Table Figure A.10-2

Dimension term	mm	Designation
h_1	1685^{+15}_{-0}	Internal height
h_2	$1457^{+0,5}_{-0,5}$	Height of fixing points 1
h_3	$955^{+0,5}_{-0,5}$	Height of fixing points 2
h_4	$420^{+0,5}_{-0,5}$	Height of fixing points 3
h_5	1200 to 1600	Height of support strip
t	35^{+5}_{-5}	Depth of support strip
w_1	1536^{+2}_{-0}	Distance between fixing points
w_2	1410^{+2}_{-0}	Internal width of large opening
w_3	772^{+2}_{-0}	Centreline distance of fixing points
w_4	714^{+2}_{-0}	Internal width of small opening
w_5	60 to 80	Centreline distance of fixing points between the 2 openings

NOTE Large opening can be on the left side.

Figure A.10-2 — Opening of multi-chamber rear loaded RCV for interchangeable waste container lifting device

Figure A.10 — Openings of rear loaded RCVs for interchangeable waste container lifting device

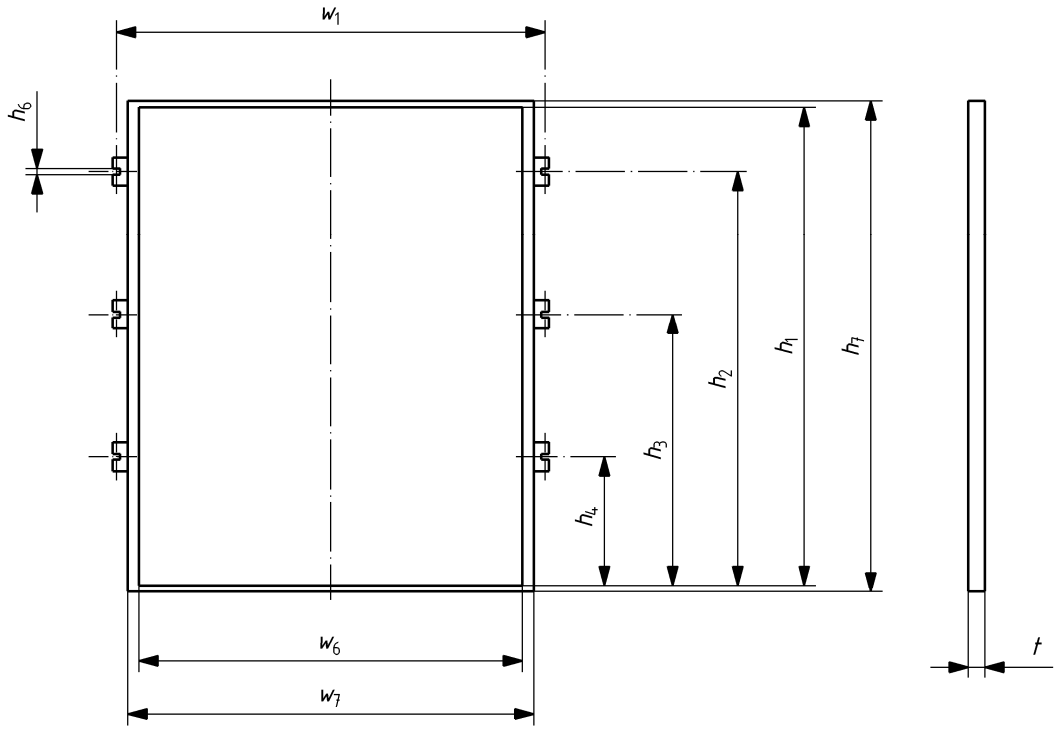


Table Figure A.11-1

Dimension term	mm	Designation
h_1	1685^{+15}_{-0}	Internal height
h_2	$1457^{+0,5}_{-0,5}$	Height of fixing points 1
h_3	$955^{+0,5}_{-0,5}$	Height of fixing points 2
h_4	$420^{+0,5}_{-0,5}$	Height of fixing points 3
h_6	18	Link opening
h_7	1730^{+15}_{-15}	Total height
t	35^{+5}_{-5}	Thickness of mounting frame
w_1	1536^{+2}_{-0}	Distance between fixing points
w_6	1400^{+5}_{-5}	Internal width of frame
w_7	1480^{+5}_{-5}	Outside dimension of frame

Figure A.11-1 — Mounting frames of interchangeable waste container lifting device for single-chamber rear loaded RCV

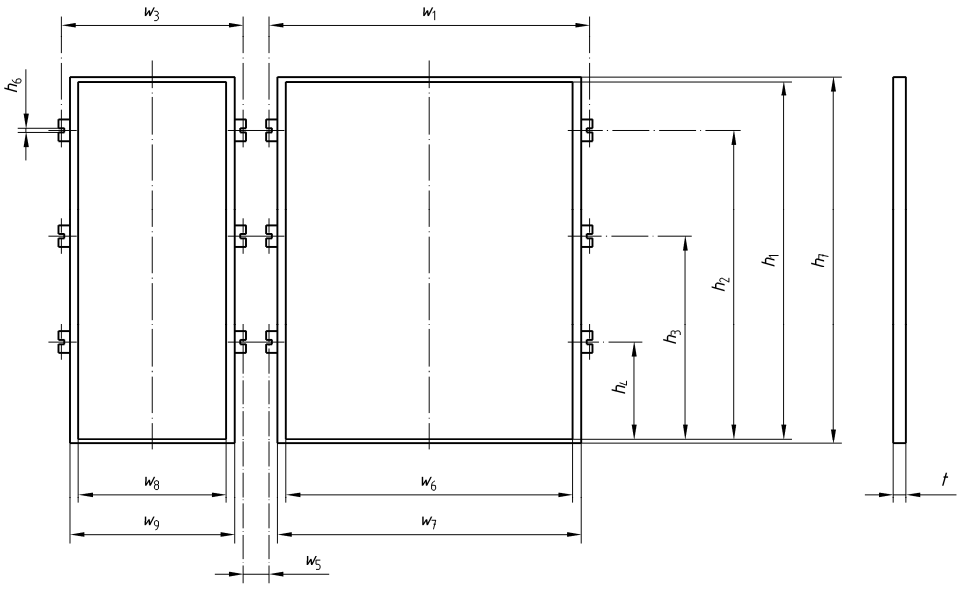


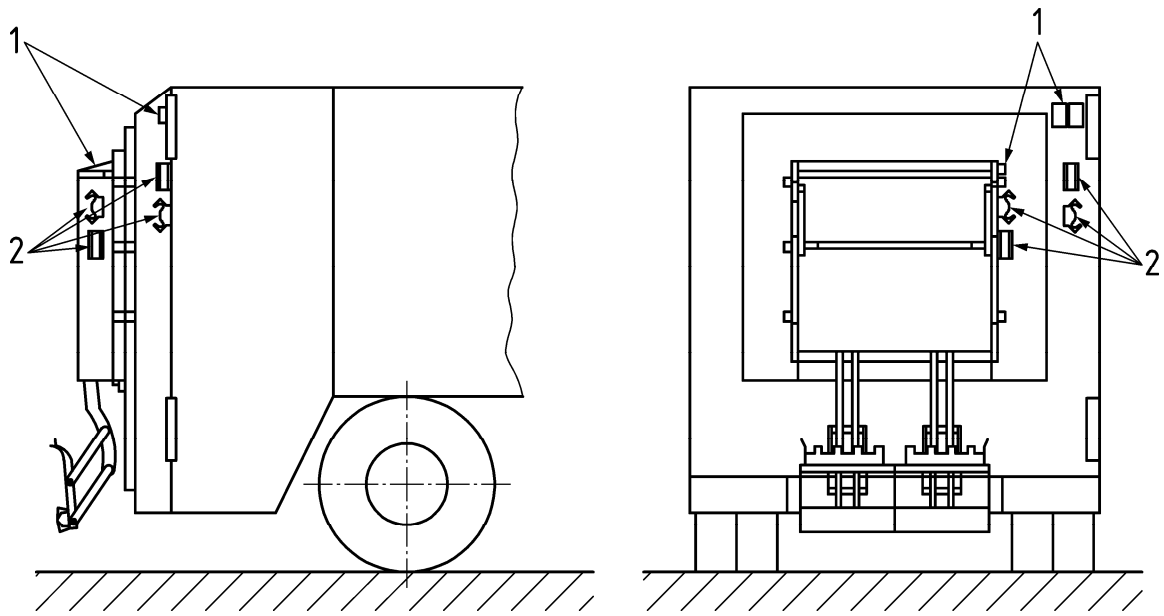
Table Figure A.11-2

Dimension term	mm	Designation
h_1	1685^{+15}_{-0}	Internal height
h_2	$1457^{+0,5}_{-0,5}$	Height of fixing points 1
h_3	$955^{+0,5}_{-0,5}$	Height of fixing points 2
h_4	$420^{+0,5}_{-0,5}$	Height of fixing points 3
h_6	18	Link opening
h_7	1730^{+15}_{-15}	Total height
w_1	1536^{+2}_{-0}	Distance between fixing points for large frame
w_3	772^{+2}_{-0}	Distance between fixing points for small frame
w_5	60 to 80	Centreline distance of fixing points between the 2 openings
w_6	1400^{+5}_{-5}	Inside dimension of frame
w_7	1480^{+5}_{-5}	Outside dimension of frame
w_8	714^{+2}_{-2}	Internal width of frame
w_9	794^{+5}_{-5}	Outside dimension of frame

NOTE Large chamber can be on the left side.

Figure A.11-2 — Mounting frames of interchangeable waste container lifting devices for multi-chamber rear loaded RCV

Figure A.11 — Mounting frames of interchangeable waste container lifting devices for rear loaded RCV



Key

1 hydraulic interface (Length of hydraulic hoses: 1 250 mm ± 100 mm)

2 socket and plug of electric connector (Length of cables: 1 500 mm ± 100 mm)

NOTE For multi-chamber RCV the hydraulic interfaces should be located close to the top right hand side of the right opening and top left hand of the left opening of the tailgate.

Figure A.12 — Positions of hydraulic and electric connectors for interchangeable waste container lifting device

Dimensions in millimetres

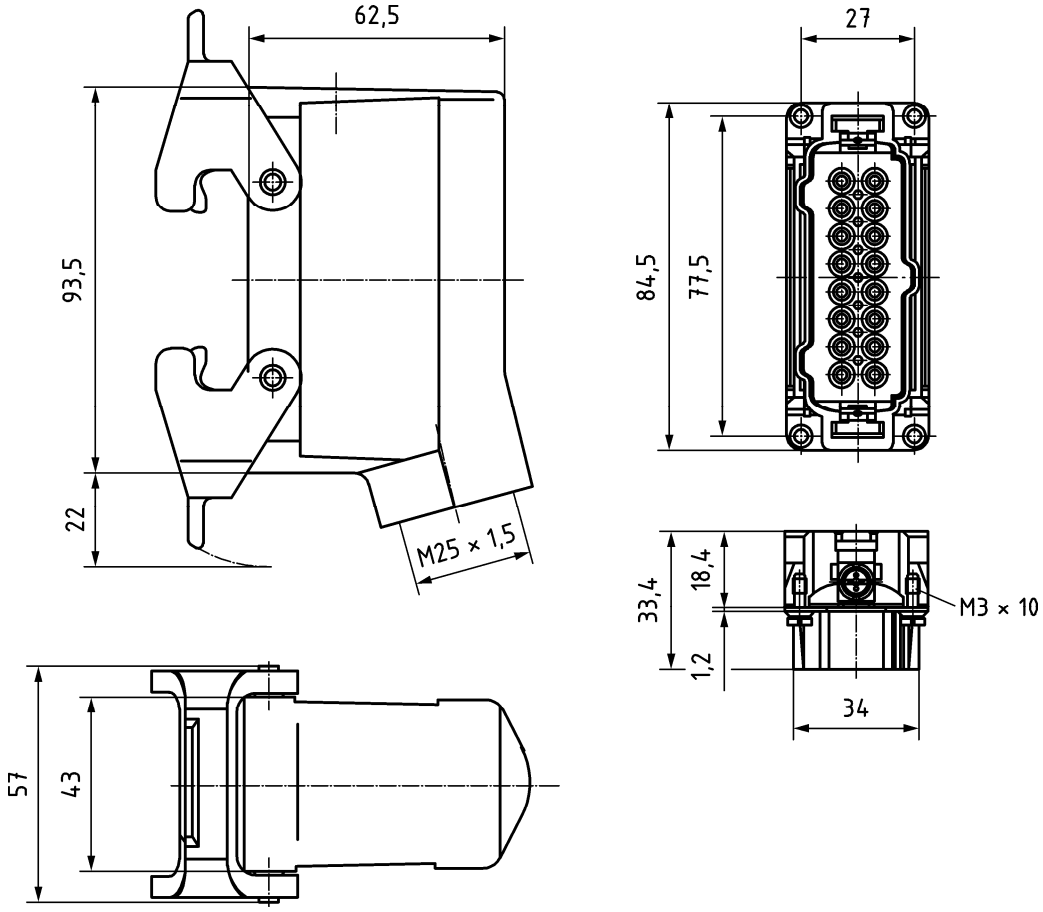


Figure A.13-1 — 16-pole floating plug (location 2 on Figure A.12)

Dimensions in millimetres

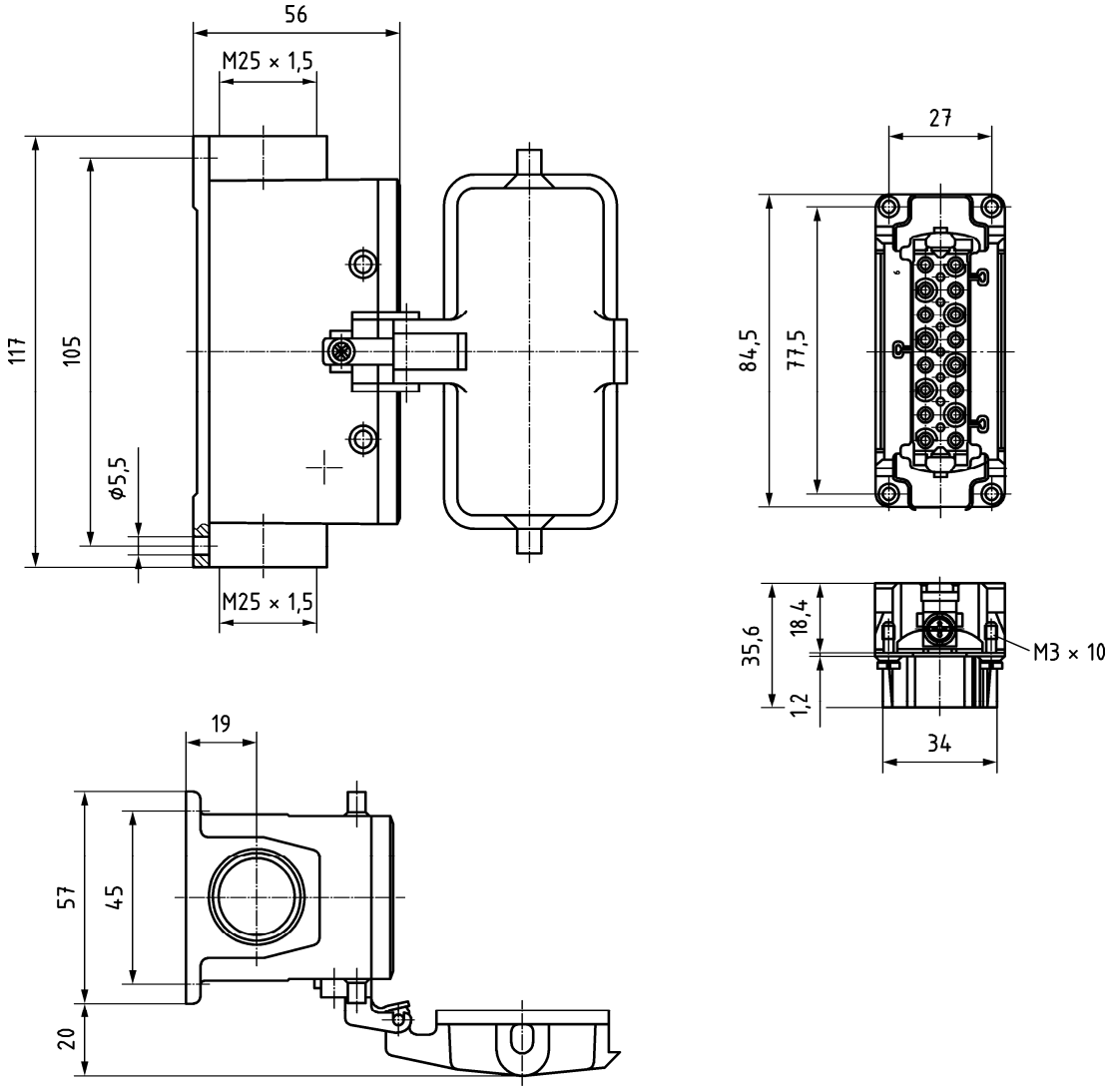
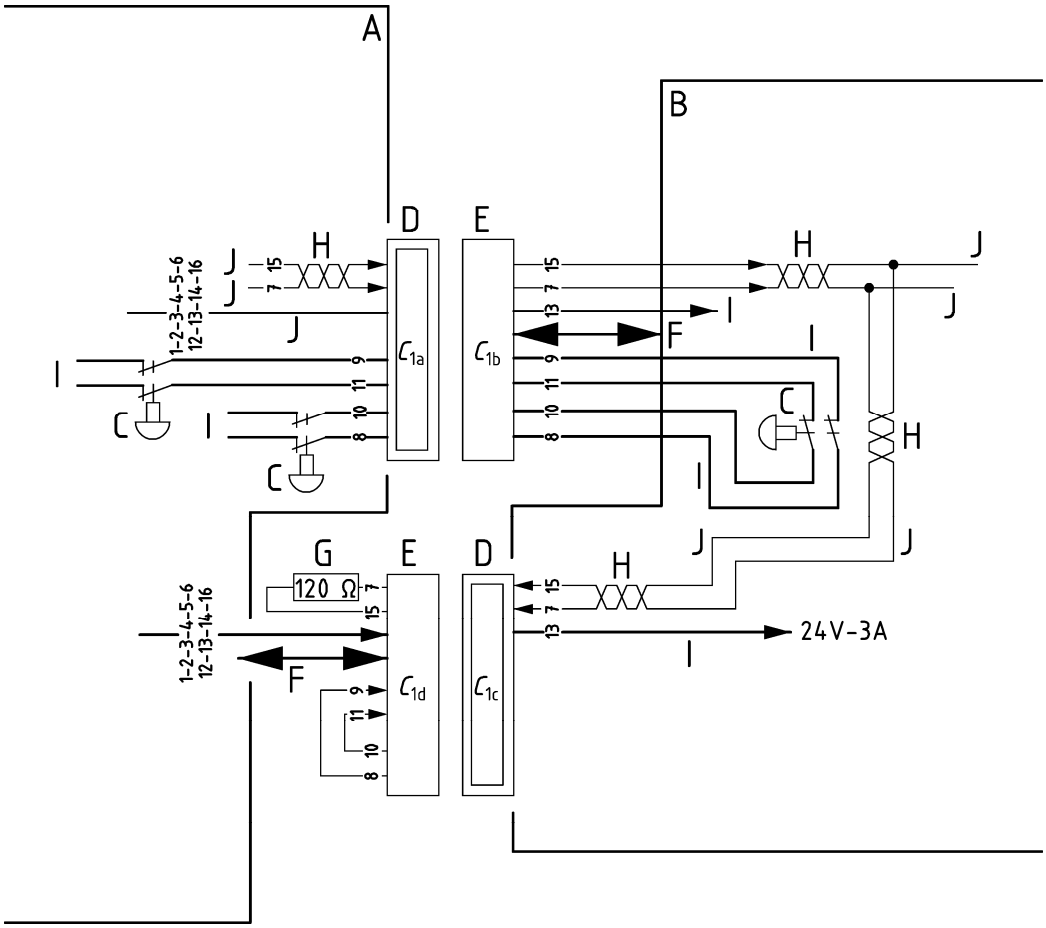


Figure A.13-2 — 16-pole socket (location 2 on Figure A.12)

Figure A.13 — Electric 16-pole connectors for interchangeable waste container lifting device



Key

A tailgate or discharge door
B interchangeable waste container lifting device
C Emergency stop device
D socket (fixed)
E floating plug (free)
F cable
G resistor: CleAN OPEN termination
H twisted cable
I emergency loop with pin numbers
J other circuit with pin numbers

C1 a, b, c d = reference to Annex C, Table C.1

Figure A.14 — Pin connections between interchangeable waste container lifting device and RCV — Emergency and CleAN OPEN loops

Annex B
(informative)

Types of special containers and their pick-up systems

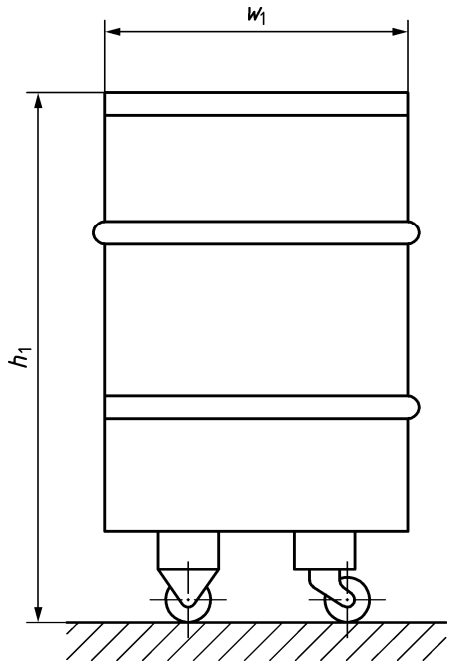
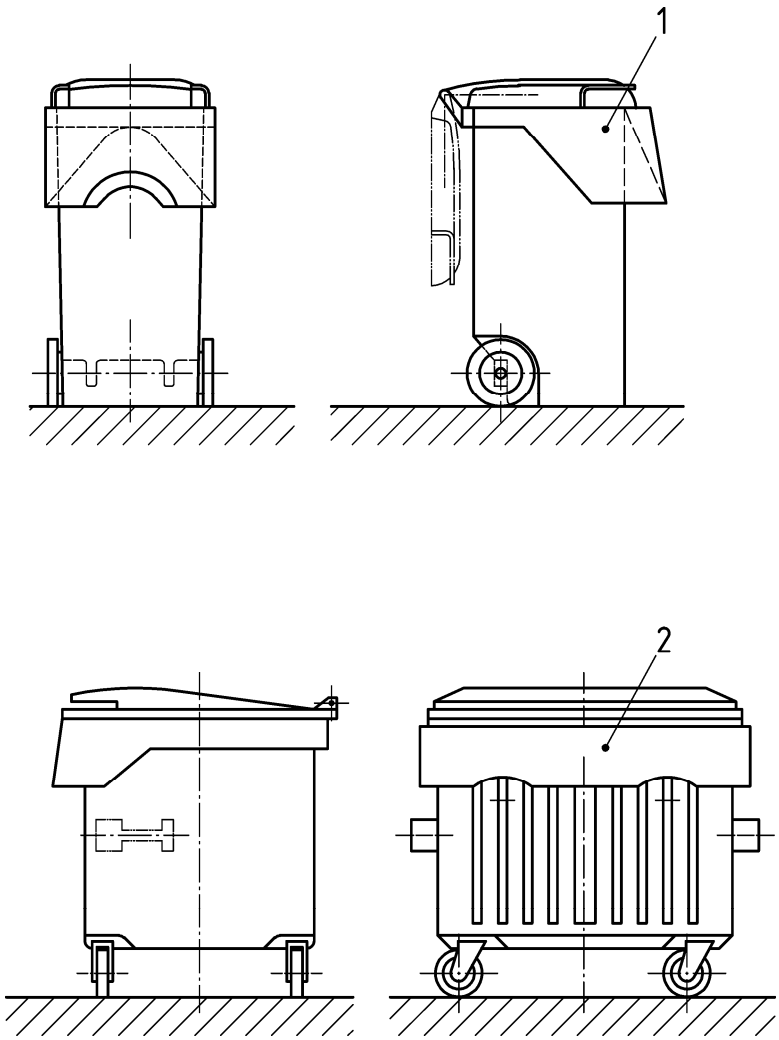


Table Figure B.1-1

Dimension term	mm	Designation
w_1	914 ± 10	Outside diameter
h_1	1 560 ± 10	Height from ground to top of container

Figure B.1-1 — Paladin container

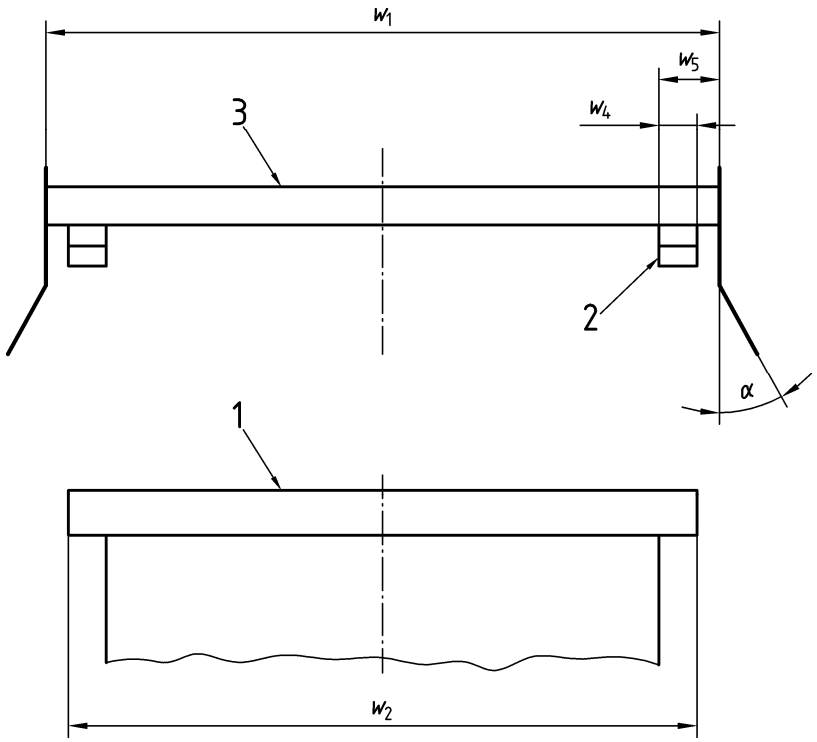


Key

1 two-wheeled container
2 four-wheeled container

Figure B.1-2 — Diamond containers

Figure B.1 — Non-European standardized containers



Key

1 skip container trunnion bar
2 catch (to the tailgate or arm)
3 rave rail

Table Figure B.2

Dimension term informative	mm	Designation
w_1	w2 + 40/+20	Width of rave rail (Internal distance between guide system)
w_2	1 900 mm	Preferred width of the trunnion bar of the designated skip container
w_4		Preferred width of catch for skip trunnion (depends on the dimensions of the container)
w_5		Preferred position of catch onto the tailgate or lifting arms (depends on the dimensions of the container)
α	> 5°	Attack angle of guide system

Figure B.2 — Example of catch for skip container lifted by a winch or a two chains skip pick-up system

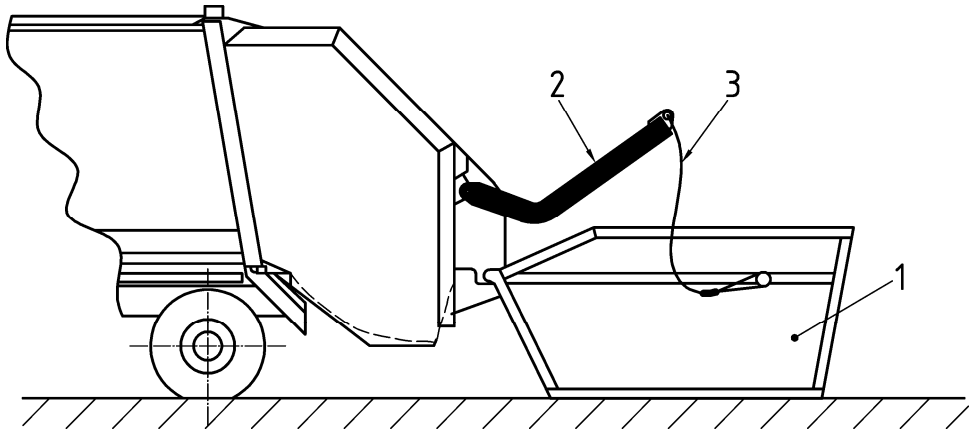


Figure B.3-1 — Two chains skip container pick-up system

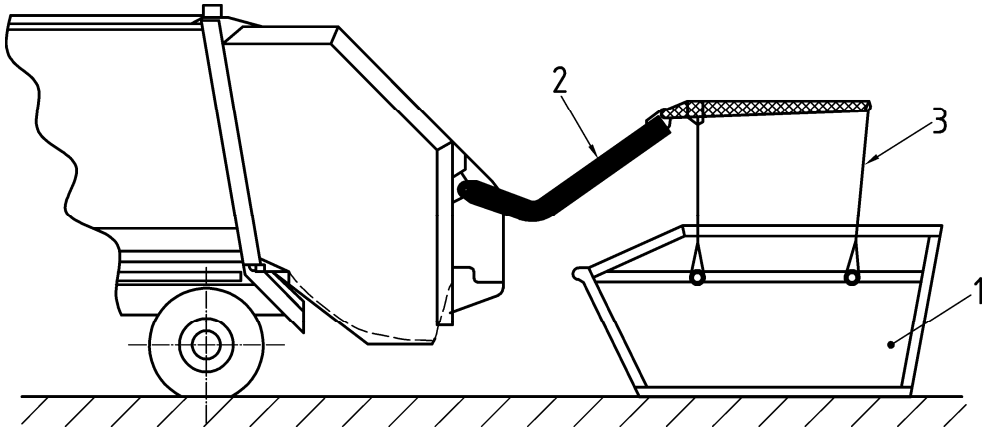


Figure B.3-2 — Four chains skip container pick-up system

Key

1 container
2 pick-up system
3 chain

Figure B.3 — Chains skip container pick-up system

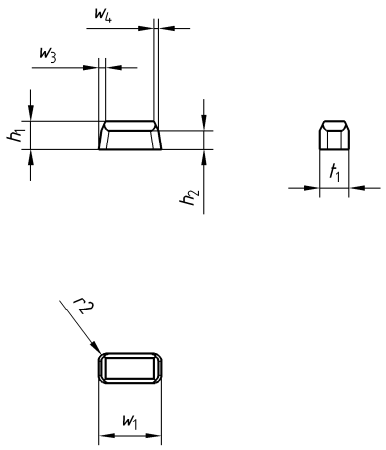


Figure B.4-1 — Detail tooth 4.1 (universal teeth)

NOTE see also Figures A.2-1 to -4

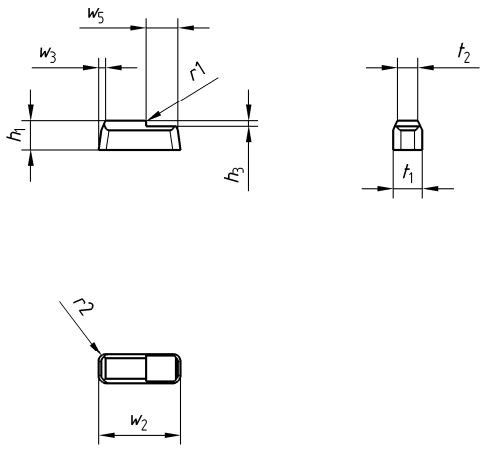


Figure B.4-2 — Detail tooth 4.2 (specific teeth for container EN 840-2 and –3)

NOTE see also Figures A.2-1 to -4

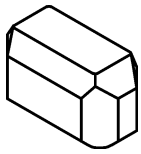


Figure B.4-3 — Perspective with rounded borders and corners

Key

r_1 angle flat spot minimum

r_2 angle corner minimum

Table Figure B.4

Dimension term	mm	Designation
w_1	50^{+5}_{-5}	Total length of 4-1 tooth (w_{13} of A.2)
w_2	85^{+2}_{-0}	Total length of 4-2 tooth (w_{18} of A.2)
w_3	7,5	Length of lower chamfered edge
w_4	4,5	Length of upper chamfered edge
w_5	32,5	Length of flat spot for 4-2 tooth
h_1	30 ± 0,5	Total height
h_2	20 ± 0,5	Height lower slant
h_3	6^{+3}_{-0}	Height void of flat spot (w_{14} of A.2)
t_1	30^{+2}_{-0}	Total thickness
t_2	20 minimum	Thickness at top of slant
r_1	2	Angle flat spot minimum
r_2	8	Angle corner minimum
r_3	1	Rounded border minimum
r_4	2	Rounded corner minimum

Figure B.4 — Profiles of comb teeth

Figure B.5-1 — Warning label: Do not reach into moving parts

Figure B.5-2 — Warning label: Do not stand under any moving part

Figure B.5 — Safety labels

Figure B.6 — Warning sign: Falling container or object

Annex C
(normative)

Requirements for pin connections and data sheets

Tables C.1 — Pin connections for the connectors defined in A.13

Table C.1 a — List of signals from RCV: 16-pin socket (fixed on RCV)			
PIN Nr.	**SIGNAL TYPE**	**SIGNAL DESCRIPTION**	**OBSERVATION**
1	Supply	Power supply type 1	24 V nominal direct from chassis 5 A maximum
2	Supply	Power supply type 1	24 V nominal direct from chassis 5 A maximum
3	Gnd	Ground	mass chassis,5 A maximum
4	Gnd	Ground	mass chassis,5 A maximum
5	O	Reverse gear from gearbox engaged: + 24V	EN 61131-2, 16 V to 34 V
6	I	LD down position (out of travel position):+ 24 V	EN 61131-2, 3.3.1 (type 2)
7	Bus	CleAN OPEN CAN L	ISO 11898-1 to ISO 11898-5, CleAN OPEN
8	O	Emergency stop circuit 1	loop 1 in for the LD(out for the RCV), max. 300 mA and 50 V maximum
9	I	Emergency stop circuit 1	loop 1 out for the LD(in for the RCV), max. 300 mA and 50 V maximum
10	O	Emergency stop circuit 2	loop 2 in for the LD(out for the RCV), max. 300mA and 50 V maximum
11	I	Emergency stop circuit 2	loop 2 out for the LD(in for the RCV), max. 300 mA and 50 V maximum
12	I	Container count pulse (one pulse per container, no matter if 2 or 4 wheeled): + 24 V	pulse 300 ms minimum, 1 s maximum, EN 61131-2
13	O	Info. to LD that it can request hydraulic fluid flow as PTO is in motion (bypass or electromagnetic clutch can be used) and emergency stop in working state: + 24V = RCV ready	EN 61131-2, 16 V to 34 V to say to the LD that it can be used in safe condition (first information)
14	I	Hydraulic supply request from LD to RCV (e.g. bypass or electromagnetic clutch + engine working speed): + 24V = oil and engine speed request	EN 61131-2, 3.3.1, type 2. For any request, the RCV has to check if it is not in positioning movement or reverse gear, to send only the hydraulic oil flow without the engine working speed. Maximum 3 A
15	Bus	CleAN OPEN CAN H	ISO 11898-1 to ISO 11898-5, CleAN OPEN
16	I	Start compaction cycle request from LD: + 24V	EN 61131-2, 3.3.1, type 2 pulse 300 ms minimum, 1 s maximum

Tables C.1 (*Continued*)

Table C.1 b — List of signals from waste container lifting device: 16-pin plug (with cable from lifting device)

PIN Nr.	SIGNAL TYPE	SIGNAL DESCRIPTION	OBSERVATION
1	(Supply)	Power supply in	24 V direct from the chassis 5 A maximum
2	(Supply)	Power supply in	24 V direct from the chassis 5 A maximum linked with pin 1
3	Gnd	Ground	Mass chassis, 3 A maximum
4	Gnd	Ground	Mass chassis, 3 A maximum link to pin 3
5	I	Info. to LD: Reverse gear engaged: + 24 V	EN 61131-2, 3.3.1, type 2
6	O	LD down position (out of travel movement): + 24V	EN 61131-2
7		CleAN OPEN CAN L	
8	I	Emergency stop circuit 1	loop 1 in for the LD from the RCV, maximum 300 mA and 50 V
9	O	Emergency stop circuit 1	loop 1 out for the LD to the RCV, maximum300 mA and 50 V
10	I	Emergency stop circuit 2	loop 2 in for the LD from the RCV, maximum 300 mA and 50 V
11	O	Emergency stop circuit 2	loop 2 out for the LD(in for the RCV), max. 300 mA and 50 V maximum
12	O	Container count pulse (one pulse per container, no matter if 2 or 4 wheeled)	EN 61131-2, pulse 300 ms min, 1 s maximum
13	I	Info. to LD that it can request hydraulic fluid flow as PTO is in motion (bypass or electromagnetic clutch can be used) and emergency stop in working state: + 24V = RCV ready	EN 61131-2, 3.3.1, type 2
14	O	Hydraulic supply request from LD to RCV (e.g. bypass or electromagnetic clutch + engine working speed): + 24V = oil and engine speed request	EN 61131-2
15		CleAN OPEN CAN H	ISO 11898-1 to ISO 11898-5, CleAN OPEN
16	O	Start compaction cycle request from LD: + 24V	EN 61131-2, pulse 300 ms minimum, 1 s maximum
For RCV and LD with CleAN OPEN the following signals can be omitted: Pins 5, 6, 12, 14, 16.			

Tables C.1 (*Continued*)

Table C.1 c — List of signals from waste container lifting device: 16-pin socket (fixed on lifting device)

PIN Nr.	SIGNAL TYPE	SIGNAL DESCRIPTION	OBSERVATION
1	I	Info. from RCV : + 24V =neutral gear	EN 61131-2, 16 to 34 V
2	N. c.	Do not connect	
3	O	Safety distance is OK to get a compaction closed system from footboard level: + 24V	EN 61131-2, type 2, Table 2
4	O	Safety distance is OK to get a compaction closed system from footboard level: + 24V	EN 61131-2, type 2, Table 2
5	I	Footboard(s) is (are) occupied: 0 V	EN 61131-2
6	O	Info to the compaction mechanism that LD is going up in order to control its down movement (anti-collision compaction /container): + 24V = stop compaction	EN 61131-2
7	Bus	CleAN OPEN CAN L	ISO 11898-1 to ISO 11898-5, CleAN OPEN
8	N. c.	Do not connect	
9	N. c.	Do not connect	
10	N. c.	Do not connect	
11	N. c.	Do not connect	
12	I	Emergency stop control: in “normal” operating state should be permanent: + 24 V	EN 61131-2, 3 A maximum
13	O	OK for automatic compaction cycle. Closed system from ground level (safety distance OK): + 24V	EN 61131-2, Table 2
14	I	Info. to LD that the compaction mechanism is going down in order to control the LD 'up' movement (anti-collision compaction /container): + 24V : compaction in a possible clash situation	EN 61131-2, 3.3.1, type 2
15	Bus	CleAN OPEN CAN H	ISO 11898-1 to ISO 11898-5, CleAN OPEN
16	O	OK for automatic compaction cycle. Closed system from ground level (safety distance 0K): + 24V	EN 61131-2, 3.3.1, type 2

NOTE In order to use an old type of LD, i.e. according to DIN 30731:2001 (withdrawn), a dummy socket can be used for defining either a "closed" or an "open" LD from the footboard level. This dummy socket can use the power supply on pin 1 to declare the LD configuration.

For RCV and LD with CleAN OPEN the following signals can be omitted: Pins 1, 5, 6, 14

Tables C.1 (*Continued*)

Table C.1 d — List of signals from RCV: 16-pin plug (with cable from RCV)

PIN Nr.	SIGNAL TYPE	SIGNAL DESCRIPTION	OBSERVATION
1	Supply	Info. to LD: RCV in neutral gear: + 24V	EN 61131-2, 16 to 34 V
2	I	Info. for RCV itself that no interchangeable LD is fitted: + 24V	Required when the two RCV plugs are connected together
3	I	Safety distance is OK to get a compaction closed system from the footboard level: + 24V	EN 61131-2, 3.3.1 type 2, Table 2 [a]
4	I	Safety distance is OK to get a compaction closed system from the footboard level: + 24V	EN 61131-2, 3.3.1 type 2, Table 2 [a]
5	O	Info. to LD: footboards occupied: 0 V	EN 61131-2
6	I	Info. to compaction mechanism that LD is going up in order to control its down movement (anti-collision compaction /container): + 24V	EN 61131-2, 3.3.1, type 2
7	Bus	CAN Bus termination (resistor 120 Ω to pin 15)	ISO 11898-1 to ISO 11898-5, CleAN OPEN
8	I	Link emergency stop circuit 1	bridge to 9
9	O	Link emergency stop circuit 1	bridge to 8
10	I	Link emergency stop circuit 2	bridge to 11
11	O	Link emergency stop circuit 2	bridge to 10
12	O	Emergency stop control system: in “normal” operating state should be permanent: + 24 V	EN 61131-2, maximum 3 A
13	I	OK for automatic compaction cycle. Closed system from ground level (safety distance OK): + 24 V	EN 61131-2, 3.3.1,type 2, Table 2
14	O	Info. to LD that compaction mechanism is going down in order to control the TD "up" movement (anti-collision compaction /container): + 24V = compaction in a possible clash situation	EN 61131-2, type 2
15	Bus	CAN Bus termination (resistor 120 Ω to pin 7)	ISO 11898-1 to ISO 11898-5, CleAN OPEN
16	I	OK for automatic compaction cycle. Closed system from ground level (safety distance OK): + 24V	EN 61131-2, 3.3.1, type 2, Table 2

[a] + 24 V = closed system (see signal processing chronogram in Table C.2)

Table C.2 — Signal processing chronogram footstep(s). Pins 13, 16, 3 and 4 of Tables C.1c and C.1d

Signals on pins 13 and 16 24 V	Signals on pins 3 and 4 24 V	Footboard status	Compaction mechanism	Compaction mode
Closed system from ground level	Closed system from footboard level			
No	No	Occupied	Open	Movements are only possible after the shear trap has been passed and when the distance from the compaction mechanism to the shear trap is increasing
No	No	Not occupied	Open	Semi-automatic and hold-to-run operation allowed
Yes	No	Occupied	Open	Semi-automatic and hold-to-run operation allowed
Yes	No	Not occupied	Closed	Automatic mode allowed
Yes	Yes	Occupied or not	Closed	Automatic mode allowed

Table C.3 — Data sheet: Waste container lifting device data

Business name and full address of the manufacturer	
Waste container lifting device designation	
RCVs onto which it can be mounted	
Mandatory marking (for EU/EEC countries: CE marking)	
Own weight of the waste container lifting device	
Explanation of series or type codes	
Mounting height of the waste container lifting device	
Centre of gravity of the waste container lifting device	
Maximum permissible lifting mass	
Designated waste containers to be handled	
Required oil flow	
Maximum return line pressure	
Electrical consumption	

Annex ZA
(informative)

Relationship between this Standard and the Essential Requirements of EU Directive 2006/42/EC

This European standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association to provide one means of conformity to Essential Requirements of the New Approach Directive 2006/42/EC.

Once this European Standard is cited in the Official Journal of the European Union under that Directive and has been implemented as a national standard in at least one Member State, compliance with the normative clauses of this European Standard, within the limits of the scope of this standard, a presumption of conformity with the relevant Essential Requirements of that Directive and associated EFTA regulations.

WARNING — Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

Bibliography

[1] CEN Guide 414, *Safety of machinery — Rules for the drafting and presentation of safety standards*

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