



BSI Standards Publication

Refuse collection vehicles — General requirements and safety requirements

Part 5: Lifting devices for refuse collection vehicles

National foreword

This British Standard is the UK implementation of EN 1501-5:2021. It supersedes BS EN 1501-5:2011, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/183, 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 committee manager.

To address safety concerns with aspects of the standard, the UK national committee B/183 has developed additional provisions listed in informative National Annex NA. The Government may choose to include an informative note alongside any notice of designation of the standard on www.gov.uk. A revision is under drafting by the CEN committee CEN/TC 183.

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Amendments/corrigenda issued since publication

Date	Text affected
31 January 2025	Addition of National Annex NA and National Foreword updated

English Version

Refuse collection vehicles - General requirements and safety requirements - Part 5: Lifting devices for refuse collection vehicles

Bennes de collecte de déchets - Exigences générales et exigences de sécurité - Partie 5 : Lève-conteneurs pour véhicules de collecte de déchets

Abfallsammelfahrzeuge - Allgemeine Anforderungen und Sicherheitsanforderungen - Teil 5: Schüttungen für Abfallsammelfahrzeuge

This European Standard was approved by CEN on 15 February 2021.

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Contents

Page

European foreword.....	3
Introduction	5
1 Scope	7
2 Normative references	8
3 Terms and definitions	10
4 List of significant hazards	19
5 Safety requirements and/or protective measures	23
5.1 General	23
5.2 Requirements for lifting the designated refuse containers.....	26
5.3 Requirements for lifting devices mounted on rear loaded RCVs.....	30
5.4 Requirements for refuse container lifting devices mounted on side and front loaded RCV's	34
5.5 Requirements for loader cranes mounted on RCV's	35
5.6 Hydraulic system.....	36
5.7 Pneumatic system	36
5.8 Electric system	36
5.9 Operating symbols.....	36
5.10 Control systems	38
5.11 Requirement for field of vision	40
5.12 Electrical components	41
5.13 Noise	42
5.14 Maintenance.....	43
5.15 Lifting points.....	43
5.16 Signals and warning devices	44
6 Verification.....	44
7 Information for use	44
7.1 Signals and warning devices	44
7.2 Instruction handbook.....	44
7.3 Maintenance.....	46
7.4 Data sheet	46
7.5 Marking.....	46
Annex A (normative) Danger zones, dimensions and connections.....	47
Annex B (informative) Types of special containers and their pick-up systems	74
Annex C (normative) Requirements for pin connections and data sheets.....	82
Annex ZA (informative) Relationship between this Standard and the essential requirements of EU Directive 2006/42/EC aimed to be covered.....	88
Bibliography.....	94

European foreword

This document (EN 1501-5:2021) 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 September 2021 and conflicting national standards shall be withdrawn at the latest by March 2022.

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

This document supersedes EN 1501-5:2011.

This document has been prepared under a standardization request 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 main changes compared to the previous edition are listed below:

- document has been completely revised and partly restructured;
- European foreword and Introduction have been updated;
- Clause 2, Normative references, have been updated;
- In Clause 3, new terms and definitions have been added and others revised;
- Table 1 has been updated;
- Table 2 “Speed and acceleration” has been added;
- requirements on “lifting devices mounted on rear loaded RCV’s” (5.3), “lifting devices mounted on side and front loaded RCV’s” (5.4), “control systems” (5.10), “field of vision” (5.11), maintenance (5.14), “instruction handbook” (7.2) and many more have been revised;
- Annex A, B and C have been revised.
- Annex ZA has been updated.

EN 1501 consists of the following parts under the general title *Refuse collection vehicles — General requirements and safety requirements*:

- *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 (this part).*

This document will be enforced at the same time as EN 1501-1:2021, EN 1501-2:2021 and EN 1501-3:2021 and applied whenever the RCV is fitted with a lifting device.

According to the CEN-CENELEC Internal Regulations, the national standards organisations 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, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This document is a type-C standard as stated in EN ISO 12100:2010.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

- machine manufacturers (small, medium and large enterprises);
- health and safety bodies (regulators, accident prevention organizations, market surveillance etc.).

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

- machine users/employers (small, medium and large enterprises);
- machine users/employees (e.g. trade unions, organizations for people with special needs);
- service providers, e.g. for maintenance (small, medium and large enterprises);
- consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

The machinery concerned and the extent to which hazards, hazardous situations or hazardous events are covered are indicated in the Scope of this document.

When requirements of this type-C standard are different from those which are stated in type-A or type-B standards, the requirements 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 is intended for careful consideration by designers, manufacturers, suppliers and users of RCVs.

This European Standard should be read in conjunction with:

- the documents developed for refuse collection vehicles (EN 1501-1:2021, EN 1501-2:2021 and EN 1501-3:2021) which are compatible with the refuse container lifting devices specified in this standard;
- the documents developed for mobile refuse containers according to EN 840:2020 (all parts), for stationary refuse containers according to EN 12574:2017 (all parts) and for selective collection containers according to EN 13071:2019 (all parts) which are compatible with the lifting devices specified in this European Standard.

While producing this standard it was assumed that:

- for RCV the requirements of road traffic regulations apply. Where road traffic regulations are in conflict with the provisions of this standard, the road regulations have priority;
- due to the European regulations on the approval of vehicles for use on public roads, the requirements of UN/ECE R10:2019 for an RCV with regard to EMC applies. Therefore, EMC is not further considered in this standard;
- the guidelines issued by the chassis manufacturer have been taken into account;
- the guidelines of the lifting device manufacturer have been taken into account;

- that based on measurements on different types of RCVs hand-arm vibrations are in general lower than 2,5 m/s²;
- that based on measurements on different types of RCVs whole-body vibrations are lower than 0,5 m/s²;
- 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;
- components are kept in good repair and working order, so that the required characteristics remain despite wear and tear;
- harmful materials, such as asbestos, are not used as part of RCV's;
- only persons who have been appropriately trained will operate on RCV's.

1 Scope

This document deals with all significant hazards, hazardous situations and events relevant to lifting devices used for the emptying of designated refuse 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 document is applicable to the design and construction of the refuse 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 document describes and gives the safety requirements of the lifting devices for emptying refuse containers and their interfaces with the corresponding parts of the RCVs and will be used in conjunction with EN 1501-1:2021 for the rear, side and front loaded RCVs. It refers to EN 1501-4:2007 for the noise test code.

This document is not applicable to:

- operation in severe conditions e.g. extreme environmental conditions such as:
 - temperatures below -20°C and above $+40^{\circ}\text{C}$;
 - 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 refuse containers other than those manufactured according to EN 840:2020 (all parts), EN 12574:2017 (all parts), EN 13071:2019 (all parts), and those described as paladin, diamond, skip containers;
- loading bulky refuse by means of platform or forks;
- handling of loads the nature of which could lead to dangerous situations (e.g. hot refuses, acids and bases, radioactive materials, contaminated refuse, especially fragile loads, explosives);
- operation on ships;
- fitting and operation on stationary compactors.

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

2 Normative references

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

EN 818-1:1996+A1:2008, *Short link chain for lifting purposes - Safety - Part 1: General conditions of acceptance*

EN 840-1:2020, *Mobile waste and recycling containers - Part 1: Containers with 2 wheels with a capacity up to 400 l for comb lifting devices - Dimensions and design*

EN 840-2:2020, *Mobile waste and recycling 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 840-3:2020, *Mobile waste and recycling 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 840-4:2020, *Mobile waste and recycling 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 devices - Dimensions and design*

EN 840-5:2020, *Mobile waste and recycling containers - Part 5: Performance requirements and test methods*

EN 840-6:2020, *Mobile waste and recycling containers - Part 6: Safety and health requirements*

EN 894-1:1997+A1:2008, *Safety of machinery - Ergonomics 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 - Ergonomics requirements for the design of displays and control actuators - Part 3: Control actuators*

EN 894-4:2010, *Safety of machinery - Ergonomics requirements for the design of displays and control actuators - Part 4: Location and arrangement of displays and control actuators*

EN 1501-1:2021, *Refuse collection vehicles - General requirements and safety requirements - Part 1: Rear loaded refuse collection vehicles*

EN 1501-2:2021, *Refuse collection vehicles - General requirements and safety requirements - Part 2: Side loaded refuse collection vehicles*

EN 1501-3:2021, *Refuse collection vehicles - 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 1677-1:2000+A1:2008, *Components for slings - Safety - Part 1: Forged steel components, Grade 8*

EN 1677-6:2001+A1:2008, *Components for slings - Safety - Part 6: Links - Grade 4*

EN 12574-1:2017, *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 12574-2:2017, *Stationary waste containers - Part 2: Performance requirements and test methods*

EN 12574-3:2017, *Stationary waste containers - Part 3: Safety and health requirements*

EN 12999:2011+A2:2018, *Cranes - Loader cranes*

EN 13071-1:2019, *Stationary waste containers up to 5 000 l, top lifted and bottom emptied - Part 1: General requirements*

EN 13071-2:2019, *Stationary waste containers up to 5 000 l, top lifted and bottom emptied - Part 2: Additional requirements for underground or partly underground systems*

EN 13071-3:2019, *Stationary waste containers up to 5 000 l, top lifted and bottom emptied - Part 3: Recommended lifting connections*

EN 13135:2013+A1:2018, *Cranes - Safety - Design - Requirements for equipment*

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

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

EN 14803:2020, *Identification and/or determination of the quantity of waste*

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

EN 60204-1:2018, *Safety of machinery - Electrical equipment of machines - Part 1: General requirements (IEC 60204-1:2016, modified)*

EN 60529:1991¹⁾, *Degrees of protection provided by enclosures (IP Code) (IEC 60529:1989)*

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

EN 61984:2009, *Connectors - Safety requirements and tests (IEC 61984:2008)*

EN ISO 374-1:2016²⁾, *Protective gloves against dangerous chemicals and micro-organisms - Part 1: Terminology and performance requirements for chemical risks (ISO 374-1:2016)*

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 6743-4:2015, *Lubricants, industrial oils and related products (class L) - Classification - Part 4: Family H (Hydraulic systems) (ISO 6743-4:2015)*

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

1) As impacted by EN 60529:1991/A1:2000 and EN 60529:1991/A2:2013.

2) As impacted by EN ISO 374-1:2016/A1:2018.

EN ISO 13849-1:2015, *Safety of machinery - Safety-related parts of control systems - Part 1: General principles for design (ISO 13849-1:2015)*

EN ISO 13849-2:2012, *Safety of machinery - Safety-related parts of control systems - Part 2: Validation (ISO 13849-2:2012)*

EN ISO 13850:2015, *Safety of machinery - Emergency stop function - Principles for design (ISO 13850:2015)*

EN ISO 13854:2019, *Safety of machinery - Minimum gaps to avoid crushing of parts of the human body (ISO 13854:2017)*

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

EN ISO 13857:2019, *Safety of machinery - Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2019)*

EN ISO 14118:2018, *Safety of machinery - Prevention of unexpected start-up (ISO 14118:2017)*

EN ISO 14120:2015, *Safety of machinery - Guards - General requirements for the design and construction of fixed and movable guards (ISO 14120:2015)*

IEC 60417:2002, [online database], *Graphical symbols for use on equipment*

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

ISO 4406:2017, *Hydraulic fluid power - Fluids - Method for coding the level of contamination by solid particles*

ISO 7000:2019, *Graphical symbols for use on equipment - Registered symbols*

ISO 7241:2014, *Hydraulic fluid power - Dimensions and requirements of quick-action couplings*

ISO 11898-1:2015, *Road vehicles - Controller area network (CAN) - Part 1: Data link layer and physical signalling*

ISO 11898-2:2016, *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*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100:2010 and EN 1501-1:2021 and the following apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1**refuse collection vehicle****RCV**

vehicle used for the collection and transportation of refuse (e.g. household refuse, bulky refuse, recyclable materials) based on loading via refuse containers or by hand

Note 1 to entry: Most of the time it consists of a chassis or rigid chassis onto which a bodywork is mounted. Sometimes it can also be a truck and trailer combination.

Note 2 to entry: An RCV is a special purpose vehicle according to 2007/46/EC Annex II, Part A, 5.8.

[SOURCE: EN 1501-1:2021, 3.1]

3.1.1**rear loaded RCV**

RCV, in which refuse is loaded into the body from the rear

Note 1 to entry: In rear loaded RCVs refuse is transferred manually or mechanically from the rear rake rail into a hopper. A compaction mechanism, if fitted, then transfers and compacts the refuse from the hopper into a fixed or interchangeable body of the rear loaded RCV. To discharge, either the body is tilted, rotated or an ejection device is used.

[SOURCE: EN 1501-1:2021, 3.2]

3.1.2**side loaded RCV**

RCV into which the refuse materials are loaded from the sides

Note 1 to entry: In side loaded RCVs refuse is transferred manually or mechanically from the side over the rake rail into a hopper. A compaction mechanism, if fitted, then transfers and compacts the refuse from the hopper into a fixed or interchangeable body of the side loaded RCV. To discharge, either the body is tilted, rotated or an ejection device is used.

[SOURCE: EN 1501-2:2021, 3.2]

3.1.3**front loaded RCV**

RCV into which the refuse materials are loaded from the front

Note 1 to entry: In front loaded RCVs refuse is transferred manually or mechanically from the front over the rake rail into a hopper. A compaction mechanism, if fitted, then transfers and compacts the refuse from the hopper into a fixed or interchangeable body of the front loaded RCV. To discharge, either the body is tilted, rotated or an ejection device is used. The trajectory of the refuse container is over the top of the cab or the front axle, regardless where the refuse container is picked up.

[SOURCE: EN 1501-3:2021, 3.2]

3.1.4**travel movement**

unrestricted motorised movement of the RCV

[SOURCE: EN 1501-1:2021, 3.28]

3.1.5**positioning movement**

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

3.2

lifting device

mechanism fitted onto the RCV for loading refuse into its body

3.2.1

refuse container lifting device

mechanism fitted onto an RCV for emptying designated refuse containers

Note 1 to entry: Refuse container lifting devices other than specified in EN 12999:2011+A2:2018.

3.2.1.1

split refuse container lifting device(s)

two or more adjacent devices with their own independent danger zone

3.2.1.2

combined refuse container lifting device(s)

two or more devices which share a common danger zone

3.2.1.3

integrated refuse container lifting device

designed to be permanently attached to the RCV

3.2.1.4

demountable refuse container lifting device

designed to be detachable from the RCV

Note 1 to entry: Detachable means for example bolted.

3.2.1.5

interchangeable refuse container lifting device

designed to be capable of being fitted on different designated RCVs provided with a common interface

Note 1 to entry: Interfaces can have mechanical, pneumatic, hydraulic, electrical, dimensional and functional aspects.

3.2.2

loader crane

power driven crane, designed for being attached to a chassis, comprising a column, which slews about a base, and a boom system which is attached onto the top of the column, designed to be fitted on a commercial vehicle (including trailer) with a significant residual load carrying capability, and being designed for loading and unloading the vehicle as well as for other duties as specified by the manufacturer in the operator's manual

Note 1 to entry: Loader cranes are considered as sub categories of lifting device in this standard. EN 1501-5 gives additional requirements applicable to those kinds of lifting device.

[SOURCE: EN 12999:2011+A2:2018; 3.1.1—lexically modified]

3.3

interface

connections between two parts and/or systems of the RCV

[SOURCE: EN 1501-1:2021, 3.23]

3.3.1**mechanical interface**

mechanical connection(s) between the lifting device and the corresponding part of the RCV

3.3.2**hydraulic interface**

hydraulic connection(s) between the lifting device and the corresponding part of the RCV

3.3.3**pneumatic interface**

pneumatic connection(s) between the lifting device and the corresponding part of the RCV

3.3.4**electrical interface**

electrical connection(s) between the lifting device and the corresponding part of the RCV

3.4**mounting frame**

framework used to fit the interchangeable or demountable refuse container lifting device on the RCV

Note 1 to entry: The mounting frame is provided as a fixed opening, a demountable frame, or a swivel hinged frame.

3.5**lifting carriage**

sub-assembly of the lifting device onto which the pick-up system is normally fitted

3.6**guide system**

component(s) to laterally locate the pick-up system of the designated refuse container

3.7**locking system**

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

3.8**pushing pad**

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

3.9**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

3.10**lid opener**

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

3.11**pick-up system**

part(s) of the lifting device intended to be in contact with the refuse container for receiving its corresponding part with the purpose of holding, lifting and emptying it

3.11.1

comb pick-up system

horizontal row of upward facing teeth and locking system to retain the designated refuse container during emptying

Note 1 to Entry: According to frontal receivers forms A or B of EN 840-1:2020, EN 840-2:2020, EN 840-3:2020 and EN 840-4:2020 or form C of EN 840-1:2004, EN 840-2:2004, EN 840-3:2004 and EN 840-4:2004

Note 2 to entry: See Figures A.2 to A.5.

3.11.2

trunnion pick-up system

pair of lateral arms with trunnion receiver and locking mechanism to retain the designated refuse container during emptying

Note 1 to entry: According to lateral receivers type A of EN 840-2:2020, EN 840-3:2020, EN 840-4:2020 and EN 12574-1:2017

Note 2 to entry: See Figures A.7 to A.9.

3.11.3

double trunnion pick-up system

pair of lateral arms with two trunnion receivers and locking mechanism to retain the designated refuse container according to lateral receivers type B of EN 12574-1:2017 during emptying

Note 1 to entry: See Figure A.10.

3.11.4

diamond pick-up system

triangular shaped element(s) with one corner of the triangle facing upwards and locking system to retain designated diamond refuse container

Note 1 to entry: See Figures A.11 and A.12.

3.11.5

BG pick-up system

pair of lateral arms and locking mechanism to retain the designated BG refuse container during emptying

Note 1 to entry: Complying with lateral receivers type B of EN 840-4:2020.

Note 2 to entry: See Figure A.13.

3.11.6

pocket pick-up system

pair of lateral arms and locking mechanism to retain the designated refuse container during emptying

Note 1 to entry: Complying with lateral receivers type-C of EN 12574-1:2017.

Note 2 to entry: See Figures A.14 and A.15.

3.11.7

clamping system

mechanism which holds the designated refuse container(s) by application of jaws

Note 1 to entry: When these jaws overlap, it is called an overlapping clamp.

3.11.8**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 1 to entry: See Figure B.3.

3.11.8.1**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 1 to entry: See Figure B.4 a).

3.11.8.2**four chains skip pick-up system**

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

Note 1 to entry: See Figure B.4 b).

3.11.8.3**skip container end position system**

system to limit the final position of the tipped skip container

3.12**extending arm**

part of the refuse container lifting device which goes outside of the RCV designed to pick up the designated refuse container

3.13**transport position**

designated position of the equipment during travel movement and all elements of the vehicle are in a position as defined by the manufacturer

[SOURCE: EN 1501-1:2021, 3.31]

3.14**clearance position**

defined position(s) of the lifting device to maintain adequate ground clearance during operation to avoid damaging the lifter

3.15**designated refuse container**

refuse container compatible with the lifting device

3.15.1**paladin container**

mobile cylindrical steel refuse container with a capacity up to 1 m³ designed for a clamping pick-up system

Note 1 to entry: See Figure B.1.

3.15.2

diamond container

mobile refuse container with a capacity from 60 l to 2,3 m³ with a specific frontal receiver for a diamond pick-up system(s)

Note 1 to entry: See Figure B.2.

3.15.3

skip container

stationary refuse container not complying with the EN 12574:2017 series larger than 2,5 m³ designed to be handled either by a winch or specific skip lifting system

Note 1 to entry: See Figure B.4.

3.16

emptying cycle

succession of sequences to pick up from the ground, lift, hold and empty the designated refuse container and put it back on the ground

3.17

emptying operating mode

mode of the refuse container emptying cycle

EXAMPLE Manual mode, semi-automatic mode, automatic mode.

3.18

manual mode

mechanism achieving either each movement or each sequence of movements by a hold-to-run command

Note 1 to entry: Each sequence of movements means two or more movements in one sequence.

[SOURCE: EN 1501-1:2021, 3.14]

3.19

semi-automatic mode

mechanism achieving either each movement or each sequence of movements by a manual pulse start command

Note 1 to entry: A sequence of movements means two or more movements in one sequence.

[SOURCE: EN 1501-1:2021, 3.15]

3.20

automatic mode

mechanism achieving a sequence of movements by a pulse start command

[SOURCE: EN 1501-1:2021, 3.16]

3.21

container handling system

lifting accessory assembled to the loader crane consisting of a mechanism to connect the loader crane with the designated refuse container and its opening mechanism if applicable

3.22**container loading winch**

power driven mechanism located on the bodywork used for pulling, tipping refuse 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 refuse from the refuse container when tilted

3.24**operator**

person trained to operate the RCV

[SOURCE: EN 1501-1:2021, 3.25]

3.25**working station**

location where the RCV is operated during normal use

Note 1 to entry: Inspection, cleaning and maintenance are excluded.

3.26**danger zone**

zone within and/or around machinery in which a person may be exposed to a potential risk to their health or safety

[SOURCE: EN 1501-1:2021, 3.24]

3.27**footboard**

platform situated at the rear of the rear loaded RCV on which the operator(s) can stand for riding

[SOURCE: EN 1501-1:2021, 3.27]

3.28**raise rail**

lowest fixed limit of the loading edge or nearest edge in relation to position of the operator

[SOURCE: EN 1501-1:2021, 3.12]

3.29**closed system**

configuration where the operator cannot reach the hazardous area of the compaction mechanism from the level on which the operator is standing

[SOURCE: EN 1501-1:2021, 3.18.2]

3.30**hold-to-run control device**

control device which initiates and maintains machine functions only as long as the manual control (actuator) is actuated

[SOURCE: EN ISO 12100:2010, 3.28.3]

3.31

adaptation frame

framework onto which the refuse container lifting device is fitted

Note 1 to entry: It can be hinged or fixed to the tailgate or to the discharge door.

[SOURCE: EN 1501-1:2021, 3.30]

3.32

cab

enclosure mounted on the chassis in front of the bodywork where the operator drives and controls the RCV and where other potential operator(s) can sit

[SOURCE: EN 1501-1:2021, 3.3]

3.33

bodywork

assembly of all components fitted on the chassis of the RCV including the body itself

Note 1 to entry: The bodywork can be fixed or interchangeable. The bodywork also includes either a compaction mechanism, a lifting device or (a) footboard(s) or any combination of the three.

[SOURCE: EN 1501-1:2021, 3.4]

3.34

body

part of the bodywork in which the collected refuse is transported

Note 1 to entry: It may be fixed or interchangeable or rotate as part of the compaction mechanism.

Note 2 to entry: To discharge the collected refuse, the body is either tilted or rotated or an ejection system is used.

[SOURCE: EN 1501-1:2021, 3.5]

3.35

discharge door

part of the bodywork, connected to the body without compaction mechanism

Note 1 to entry: It is designed to be opened to discharge the collected refuse or recyclable materials.

[SOURCE: EN 1501-1:2021, 3.8]

3.36

hopper

part of the bodywork into which the refuse is loaded either manually or mechanically

[SOURCE: EN 1501-1:2021, 3.9]

3.37

loading edge

perimeter of the loading opening

[SOURCE: EN 1501-1:2021, 3.11]

3.38**compaction mechanism**

mechanism used to compact and/or transfer refuse and recyclable materials from the hopper into the body

[SOURCE: EN 1501-1:2021, 3.17]

3.39**tipping**

means of emptying of the body by tilting the body after opening the tailgate or the discharge door if needed

[SOURCE: EN 1501-1:2021, 3.19.3]

3.40**general safe stop****GSS**

safety related stop function to stop hazardous movements of the controlled machines in order to reach an off-state

Note 1 to entry: A GSS is not an emergency stop.

[SOURCE: EN 62745:2017, 4.7.3.3]

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 12100:2010 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°	Significant hazard	Hazardous situation	Reference in this European Standard	Verification
1	Crushing, trapping	Between refuse container lifting device and body	5.1.2.1, 5.3.3, 5.3.4, 5.10	<i>D</i>
2	Crushing, trapping	During operation in traffic	5.1.2.1, 5.1.2.10, 5.10, 7.1	<i>V, D</i>
3	Crushing, shearing	During use of the lifting device	5.1.2.1	<i>V</i>
4	Crushing	Below the container	5.1.2.2	<i>T</i>
5	Impact	Impact with refuse	5.1.2.3	<i>D</i>
6	Impact	Impact between container and compaction mechanism	5.1.2.4	<i>D, T</i>
7	Crushing, trapping	Overload of the container	5.1.2.4	<i>D</i>
8	Crushing, trapping	Largest working load	5.1.2.4	<i>D</i>
9	Crushing, trapping	Largest working load	5.1.2.5	<i>T</i>
10	Crushing, impact	Container falling when lifted	5.1.2.6	<i>D, V</i>
11	Crushing, impact	Container falling when lifted	5.1.2.7	<i>D, T</i>
12	Crushing, impact	Container falling due to overload	5.1.2.8	<i>D, T</i>
13	Crushing, impact	Container falling when released on the ground	5.1.2.9	<i>D, V</i>
14	All hazards	Hazardous control of the lifting device	5.1.3	<i>D, V</i>
15	Crushing, trapping, shearing, impact	During maintenance, resetting, repair or restoring	5.10.3.3	<i>D, V</i>
16	Crushing, trapping, shearing, impact	Two or more lifting devices used simultaneously	5.1.3	<i>D, V</i>
17	Crushing, trapping, shearing, impact	Split refuse container lifting device	5.1.3	<i>D, V</i>
18	Crushing, impact	Lifting of container	5.2.1.1	<i>D, V</i>
19	Crushing, impact	Container falling from the comb	5.2.1.2	<i>D, T</i>
20	Crushing, trapping, shearing, impact	Container falling during lifting	5.2.1.3, 5.2.1.4	<i>D, T</i>
21	Impact	Container falling during end of tipping motion	5.2.1.4, 5.2.2.6	<i>D, T</i>
22	Crushing, trapping, shearing, impact	Containers falling during lifting or collision between container and RCV	5.2.2, 5.2.2.5, 5.2.3, 5.2.4	<i>D, V</i>
23	Impact	Opening of the lid during the lifting	5.2.5	<i>D, V</i>
24	Crushing, trapping, shearing, impact	Emptying container with winch	5.2.6.1	<i>D, V</i>
25	Crushing, trapping, shearing, impact	Pick-up container with a two chains pick-up system	5.2.6.2, 5.2.6.3	<i>D, V</i>

N°	Significant hazard	Hazardous situation	Reference in this European Standard	Verification
26	Crushing, trapping, shearing, impact	Container falling due to absence of or bad end position system	5.2.6.5	<i>D, V</i>
27	Crushing, trapping, shearing, impact	Container falling during lifting	5.2.6.6	<i>T</i>
28	Crushing, trapping, shearing, impact	Container falling during lifting	5.2.6.4	<i>D, T</i>
29	Crushing, trapping, shearing, impact	Tipping of the RCV under too large a load	5.2.6.7	<i>D</i>
30	Crushing, trapping, shearing, impact	Lifting of paladin container	5.2.7	<i>D, V</i>
31	Impact	Refuse falling during lifting of top lifted and bottom emptied container	5.5.2	<i>D, T, V</i>
32	Crushing, trapping, shearing, impact	Refuse container falls off caused by human error when using the crane	5.5.1	<i>D, V</i>
33	Crushing, trapping, shearing, impact	Unexpected movement of crane with refuse container	5.5.1	<i>V</i>
34	Crushing, trapping, shearing, impact	Operating the loader crane without observing the danger zone	5.5.2	<i>V</i>
35	Crushing, trapping, shearing, impact	Emptying BG container	5.2.4	<i>D, T, V</i>
36	Crushing, trapping, shearing, impact	Container falling during automatic or semi-automatic cycles on rear loaded RCV	5.3.1	<i>D, T, V</i>
37	Crushing, trapping, shearing, impact	Failure of mechanical interface	5.3.3.1, 5.3.3.2, 5.3.3.3	<i>D, T</i>
38	Impact	Refuse falling during lifting of container	5.3.2, 5.3.4	<i>D, V</i>
39	Impact, crushing	Operator falling on the lifting device, on the ground or in the compaction mechanism	5.3.5	<i>D</i>
40	Crushing, trapping, shearing, impact	Hazardous control of the lifting device	5.3.6.1, 5.3.6.2, 5.3.6.3, 5.3.6.4, 5.3.7	<i>D</i>
41	Crushing, trapping, shearing, impact	Hazardous control of the lifting device	5.3.6.5, 5.3.6.6	<i>D, T</i>
42	Impact, shearing	Part outside side loaded and front loaded RCV	5.4, 5.5	<i>D, T</i>
43	Cutting, stabbing, puncture, burning	Impact from oil jet due to burst of hydraulic line	5.6	<i>D, V</i>
44	Stabbing, puncture	Impact from air jet due to burst of pneumatic line	5.7	<i>D, V</i>
45	Electrical hazard	Electrocution	5.8, 5.12	<i>D</i>
46	Electrical hazard	Electromagnetic compatibility	Introduction	<i>D, M</i>

N°	Significant hazard	Hazardous situation	Reference in this European Standard	Verification
47	All hazards	Misinterpretation of controls and lack of application of ergonomic principles	5.9, 5.16	<i>V</i>
48	Crushing, trapping, shearing, impact	Failure/dysfunction of control system	5.10.1	<i>D, T</i>
49	Crushing, trapping, shearing, impact	Unintentional starting	5.10.1, 5.10.3.1	<i>D, T</i>
50	Crushing, trapping, shearing, impact	All mechanical hazardous situation	5.10.2	<i>T</i>
51	Crushing, trapping, shearing, impact	During emptying	5.10.3.2	<i>T</i>
52	Crushing, trapping, shearing, impact	During operation of lifting device	5.11	<i>V</i>
53	Crushing, trapping, shearing, impact	Failure of position sensor	5.12.6	<i>V</i>
54	Crushing, trapping, shearing, impact	All mechanical hazardous situations	5.12.2, 5.12.4	<i>D, T</i>
55	Crushing, trapping, shearing, impact	Container falling during lifting	5.12.4	<i>D, T</i>
56	Crushing, trapping, shearing, impact	Lifting device falling during maintenance	5.14	<i>V</i>
57	Crushing, trapping, shearing, impact	Lifting device falling due to loss of power supply	5.12.5	<i>D</i>
58	Crushing, trapping, shearing, impact	Uncontrolled movement due to failure of control circuits	5.10	<i>D, V</i>
59	Crushing, trapping, shearing, impact	Lack of illumination	5.12.9	<i>V</i>
60	Noise	Hazards to health: deafness, physiological disorders such as loss of awareness, tinnitus Hazards causing accidents due to interference with speech communication and non-perception of acoustic signals	5.13	<i>D, M</i>
61	Impact	Handling of the lifting device	5.15	<i>V</i>
62	All hazards	Lack of signals and warning devices	5.16	<i>V</i>

5 Safety requirements and/or protective measures

5.1 General

5.1.1 Introduction

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 12100:2010 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.

Intercompatibility between RCV and interchangeable refuse container lifting device shall be ensured. All mechanical, electrical, pneumatic and hydraulic interfaces shall be available.

If different lifter systems are combined, the requirements specific for these systems shall be considered.

5.1.2 Design

5.1.2.1 General

Any crushing and shearing hazards shall be avoided or minimized by design according to EN ISO 13857:2019 and EN ISO 13854:2019 or appropriate guard(s) according to EN ISO 14120:2015 or safeguards according to EN ISO 13855:2010.

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

5.1.2.2 Distance to the ground

To prevent foot injuries, automatic or semi-automatic downwards movements shall be stopped automatically when the distance between the lower edge of the lifting carriage and the level on which the RCV is standing shall be at least 120 mm or 320 mm for lifting carriage which can operate on the kerbside.

If movement of the lifting carriage 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 device situated in a position where the lifting carriage is in full view of the operator.

The control of the movement of the lifting carriage to the clearance position is allowed from the driver's position under the following conditions:

- max. lifting movement is limited to 400 mm from the lowest possible position of the lifting carriage;
- any crushing and shearing risk is prevented;
- automatic lifting is possible only after the RCV has started moving.

5.1.2.3 Hopper

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

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

5.1.2.4 Load

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

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

The nominal load of the loaded refuse container is determined assuming a density of refuse as defined in the standards of EN 840:2020 (all parts), EN 12574:2017 (all parts) or EN 13071:2019 (all parts).

5.1.2.5 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.

5.1.2.6 Guide system

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

5.1.2.7 Locking system

The designated refuse container shall be kept locked during the emptying cycle of the lifting device above a tilt angle of 45° from the vertical or 2 000 mm above the ground, even if electric, hydraulic or pneumatic energy fails.

In the automatic or semi-automatic lifting mode, it shall be detected that the designated refuse container is locked in position. Detection is only required for locking systems directly actuated by electric, hydraulic and/or pneumatic energy. The detection device shall fulfil required performance level PL_r d according to EN ISO 13849-1:2015, as defined in 5.10.1.

5.1.2.8 Speed and acceleration

The minimum emptying cycle time, the maximum peripheral speed and the maximum acceleration of the lifting device shall comply with the requirements in the following table depending on the type of lifting device and the designated refuse container capacity.

Table 2 — Speed and acceleration

Lifting device	designated refuse container capacity	Minimum refuse container emptying cycle time ^a	Maximum peripheral speed ^b	Maximum acceleration ^c
Refuse container lifting device	≤ 400 l	6 s	2,5 m/s	30 m/s ²
	≤ 1700 l	10 s	2,5 m/s	30 m/s ²
	≤ 2500 l	20 s	2,5 m/s	30 m/s ²
	> 2500 l	20 s	1,5 m/s	15 m/s ²
Loader crane	All	<i>Not applicable</i>	1,5 m/s	15 m/s ²
^a Minimum refuse container emptying cycle, excluding all horizontal extension, retraction movement(s) and dwell time. ^b Maximum peripheral speed of any reachable part of the refuse container lifting device or the largest designated refuse container fitted on the lifting device. 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 refuse container shall be loaded at the nominal load. ^c Maximum absolute acceleration of the designated refuse container transmitted from the refuse container lifting device pick-up system during emptying cycle. Testing shall be conducted with the container loaded with its nominal load. The sampling frequency during the measurement shall be at least 100 Hz.				

5.1.2.9 Release of the container

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

5.1.2.10 Locking of the refuse container lifting device during travel movement of the RCV

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

5.1.3 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 refuse container lifting device:

Upper button	=	lift arm/lift carriage;
Lower button	=	lower arm/lower carriage.
- For lever (one axis) operated refuse 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 refuse 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.

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

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

If the refuse container lifting device can be activated from both inside and outside the cab, a work station selector device shall be provided in the cab and the selected work station shall be indicated (e.g. by key position, indicator lamp) and it shall be ensured that only the indicated work station is operable at any time.

5.2 Requirements for lifting the designated refuse containers

5.2.1 Comb pick-up system for refuse containers according to the EN 840:2020 series and EN 12574:2017 series

5.2.1.1 Lifting carriage

The lifting carriage shall be designed as specified and illustrated in Figures A.2 to A.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 if it is intended to pick up containers complying with EN 840-1:2020, EN 840-2:2020 or EN 840-3:2020.

If the comb is suitable for an identification system according to EN 14803:2020 and the designated refuse container complies with EN 840-1:2020, EN 840-2:2020 or EN 840-3:2020, the comb shall meet the dimensions of Figure A.2.

If the designated refuse container complies with EN 840-4:2020, the comb shall meet the dimensions of Figure A.3.

If the comb is suitable for an identification system according to EN 14803:2020, and the designated refuse container complies with EN 840-4:2020, the comb shall meet the dimensions of Figure A.3.

If it is intended to pick up containers not complying with EN 840-1:2020, EN 840-2:2020 or EN 840-3:2020 then modifications of the comb dimensions are allowed to ensure compatibility and safe handling of these containers.

Figures A.2 to A.5 give examples of the dimensions of the teeth.

5.2.1.3 Comb locking system

The locking system shall meet the dimensions of Figure A.5 a) for EN 840:2020 refuse containers frontal receivers forms A and B.

In case of refuse containers frontal receivers form C (see EN 840:2004) the locking systems should meet the dimensions of Figure A.5 b).

NOTE The frontal receiver Form C was deleted already in the 2012 version of EN 840-1. Nevertheless there are still several containers with Form C used in the European market. This is why the compatibility has to be ensured and why the informative reference to EN 840-1:2004 is still made.

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

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

If assisted automatic pick-up system is provided, the locking system shall be activated after the pick-up movement is finished.

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 refuse container and the pushing pad shall not exceed 25°.

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

5.2.1.5 Pushing pad

The pushing pad position in relation to the comb shall be according to Figure A.6 a) for designated refuse container according to EN 840-1:2020, EN 840-2:2020 and EN 840-3:2020 and Figure A.6 b) for designated refuse container according to EN 840-4:2020.

5.2.2 Trunnion pick-up system for containers of the EN 840:2020 series and EN 12574:2017 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 refuse container keeps clearance from structural parts of the refuse container lifting device during the entire emptying cycle (see dimension r in Figure A.7).

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

5.2.2.2 Trunnion pick-up system for containers according to EN 840-2:2020 and EN 840-3:2020

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 refuse containers shall be designed and fitted in such a manner that the lid remains clear from the refuse container's rear wall when the designated refuse container is fully tipped.

The minimum opening of the lid shall be equal to 3/4 of its total movement.

The lid opener shall operate with the lid up to 1/4 open of its total movement.

Dimensions and tolerances shall meet the requirements of Figure A.7.

5.2.2.3 Trunnion pick-up system for containers according to EN 840-4:2020

The distance between the arms shall meet the dimension of Figure A.8.

5.2.2.4 Trunnion pick-up system for containers according to EN 12574-1:2017

The pick-up system and the lid opener shall meet the dimensions of Figure A.9.