

# Specification for recovery vehicles and vehicle recovery equipment

ICS 43.160; 53.020.20

## Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Subcommittee MHE/3/14, Vehicle recovery cranes and equipment, upon which the following bodies were represented:

Association of Vehicle Recovery Operators  
 Automobile Association  
 Central Motorway Police Group  
 Health and Safety Executive  
 Institute of Vehicle Recovery  
 Lifting Equipment Engineers Association  
 Metropolitan Police  
 Ministry of Defence  
 Recovery Equipment Manufacturers and Suppliers Association  
 Road Haulage Association Ltd.  
 Road Rescue Recovery Association  
 Royal Automobile Club  
 Safety Assessment Federation Ltd.

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# Contents

	Page
Committees responsible	Inside front cover
Foreword	ii
<hr/>	
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Stability	9
5 Mechanical components	9
6 Safe access	10
7 Stowage of equipment	10
8 Guarding	10
9 Controls	11
10 Wire rope sheaves	12
11 Snatchblocks	12
12 Load restraints and anchorages	13
13 Ropes	13
14 Winches	14
15 Electrical equipment	15
16 Hydraulic equipment	17
17 Pneumatic equipment	19
18 Passenger cabs added to the host chassis	19
19 Safety	23
20 Recovery equipment testing	24
21 Test certificates and documentation	24
22 Information for use	25
<hr/>	
Annex A (normative) Type test method for winches	28
Annex B (normative) Static test method for winches	29
Annex C (normative) Type test methods for recovery equipment	30
Annex D (normative) Production test methods for recovery equipment	32
<hr/>	
Figure 1 — Example of tipping line for four wheel chassis fitted with under lift boom	4
Figure 2 — Example of tipping line for six wheel chassis (balance type rear suspension) fitted with under lift boom	5
Figure 3 — Example of tipping line for six wheel chassis with rear stabilizers/stiff legs deployed and under lift boom	6
Figure 4 — Example of tipping line for winch fitted to six wheel chassis (balance type rear suspension) fitted with under lift boom	7
Figure 5 — Example of tipping line for vehicle fitted with rotating boom and four stabilizer legs	8
Figure 6 — Text and pictorial danger notices warning of cab tilting	20
Figure 7 — Dimensions of passenger cab door aperture	20
Figure 8 — Aperture for secondary means of escape from passenger cab	21
Figure 9 — Clearances for passenger seats	22
Figure 10 — Example of passenger cab step light	22
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## Foreword

This British Standard has been prepared under the direction of Technical Subcommittee MHE/3/14.

During the development of this standard there was no comparative subject in the work programmes of the relevant International and European technical committees (ISO/TC 96 and CEN/TC 147 respectively).

Attention is drawn to BS 7121-12 which covers the safe use of recovery vehicles and equipment.

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

**Compliance with a British Standard does not of itself confer immunity from legal obligations.**

### Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, pages 1 to 33 and a back cover.

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## 1 Scope

This British Standard specifies performance requirements for recovery equipment specifically for moving a casualty vehicle during breakdown or recovery activities. The standard includes winches used for the dragging or partial raising of the casualty vehicle.

Tow ropes and tow chains are not included in this standard.

## 2 Normative references

The 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.

BS 857, *Specification for safety glass for land transport*.

BS 7121-12:1999, *Safe use of cranes — Part 12: Recovery vehicles and equipment — Code of practice*.

BS EN 3 (all parts), *Portable fire extinguishers*.

BS EN 292-2:1991, *Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles and specifications*.

BS EN 294, *Safety of machinery — Safety distances to prevent danger zones being reached by the upper limbs*.

BS EN 418:1992, *Safety of machinery — Emergency stop equipment, functional aspects — Principles for design*.

BS EN 811, *Implementation of safety of machinery — Safety distances to prevent danger zones being reached by the lower limbs*.

BS EN 1012-1, *Compressors and vacuum pumps — Safety requirements — Part 1: Compressors*.

BS EN 12077-2:1999, *Cranes safety — Requirements for health and safety — Part 2: Limiting and indicating devices*.

BS EN 12385-1, *Steel wire ropes — Safety — Part 1: General requirements*.

BS EN 12385-4, *Steel wire ropes — Safety — Part 4: Stranded ropes for general lifting applications*.

BS EN 50081-1, *Electromagnetic compatibility — Generic emission standard — Part 1: Residential, commercial and light industry*.

BS EN 60204-32:1998, *Safety of machinery — Electrical equipment of machines — Part 32: Requirements for hoisting machines*.

BS EN 61000-6-2, *Electromagnetic compatibility (EMC) — Part 2: Generic standards — Immunity for industrial environments*.

BS EN 60529:1992, *Degrees of protection provided by enclosures (IP Code)*.

prEN 13557:2002, *Cranes, controls and control stations* (in preparation).

## 3 Terms and definitions

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

### 3.1

#### **boom**

lifting arm, used to impart a force upon the casualty vehicle

### 3.2

#### **casualty vehicle**

vehicle which is subject to recovery and/or subsequent movement by a recovery vehicle

### 3.3

#### **coefficient of utilization**

ratio between the minimum breaking load and the rated capacity

**3.4****competent person**

person who has such practical and theoretical knowledge and such experience of the recovery vehicle and equipment as is necessary to carry out the function to which the term relates in each particular context

**3.5****fully slewing boom**

lifting boom fixed to the recovery vehicle that can raise loads at any position within a slewing range of 360°

**3.6****lift and tow**

the act of conveying a casualty vehicle by partially raising one end of the casualty vehicle, by means of equipment mounted on the recovery vehicle, and using the effort of the recovery vehicle to tow the casualty vehicle, the remaining wheels of which stay in contact with the road or are mounted in a wheel dolly

**3.7****mean sheave diameter**

diameter to the bottom of the wire rope groove plus one nominal diameter of the wire rope for which the sheave was designed

**3.8****minimum breaking load**

specified load below which the item of equipment does not fail either by fracture or distortion to such an extent that the load is released

**3.9****nominal winch drum diameter**

diameter of the bare winch drum plus one wire rope diameter

**3.10****non-slewing boom**

lifting boom fixed to the recovery vehicle allowing loads to be raised only over the rear of the vehicle and in line with the longitudinal centre line of that vehicle

**3.11****over lift boom**

boom which imparts a force onto the casualty vehicle, usually from above the casualty vehicle

**3.12****partially slewing boom**

lifting boom fixed to the recovery vehicle that can raise loads at any position within a slewing range of less than 360°

**3.13****plated mass**

maximum mass given on a plate on the vehicle

**3.14****rated capacity**

maximum load (mass), as assessed by a competent person, which an item of lifting equipment may raise, lower or suspend under particular service conditions

NOTE This was previously known as Safe Working Load (SWL) and is often the same as the Working Load Limit or the Maximum Safe Working Load, which are other terms used, but it might be less.

**3.15****recovery**

act of retrieving a casualty vehicle from an accident or abnormal situation, including broken down vehicles and/or the subsequent movement of the casualty vehicle

**3.16****recovery equipment**

equipment specifically designed for moving a casualty vehicle during breakdown or recovery activities

**3.17****recovery vehicle**

vehicle fitted with recovery equipment

**3.18****snatchblock**

wire rope sheave and hook assembly comprising of one sheave only, that can be reeved onto a wire rope without disconnecting the wire rope ends

NOTE This is generally used for two fall working.

**3.19****transporter**

vehicle designed to carry a casualty vehicle entirely on its bed

**3.20****type test**

test of recovery equipment or components to show certain specifications are met

**3.21****under lift boom**

boom which imparts a force onto the casualty vehicle, usually from below the casualty vehicle

**3.22****wheel frames**

equipment used to lift and tow utilizing the wheels of the casualty vehicle

NOTE Wheel frames are also known as Wheel grids or Spectacle frames.

**3.23****winch design rating**

maximum allowable tensile force that may be applied to the wire rope by the winch

**3.24****fail safe**

arrangement of a control system such that a single fault does not lead to a dangerous operating condition and the fault does not remain undetected

**3.25****tipping line**

line about which the recovery vehicle can overturn due to the forces applied by the casualty vehicle or other external load

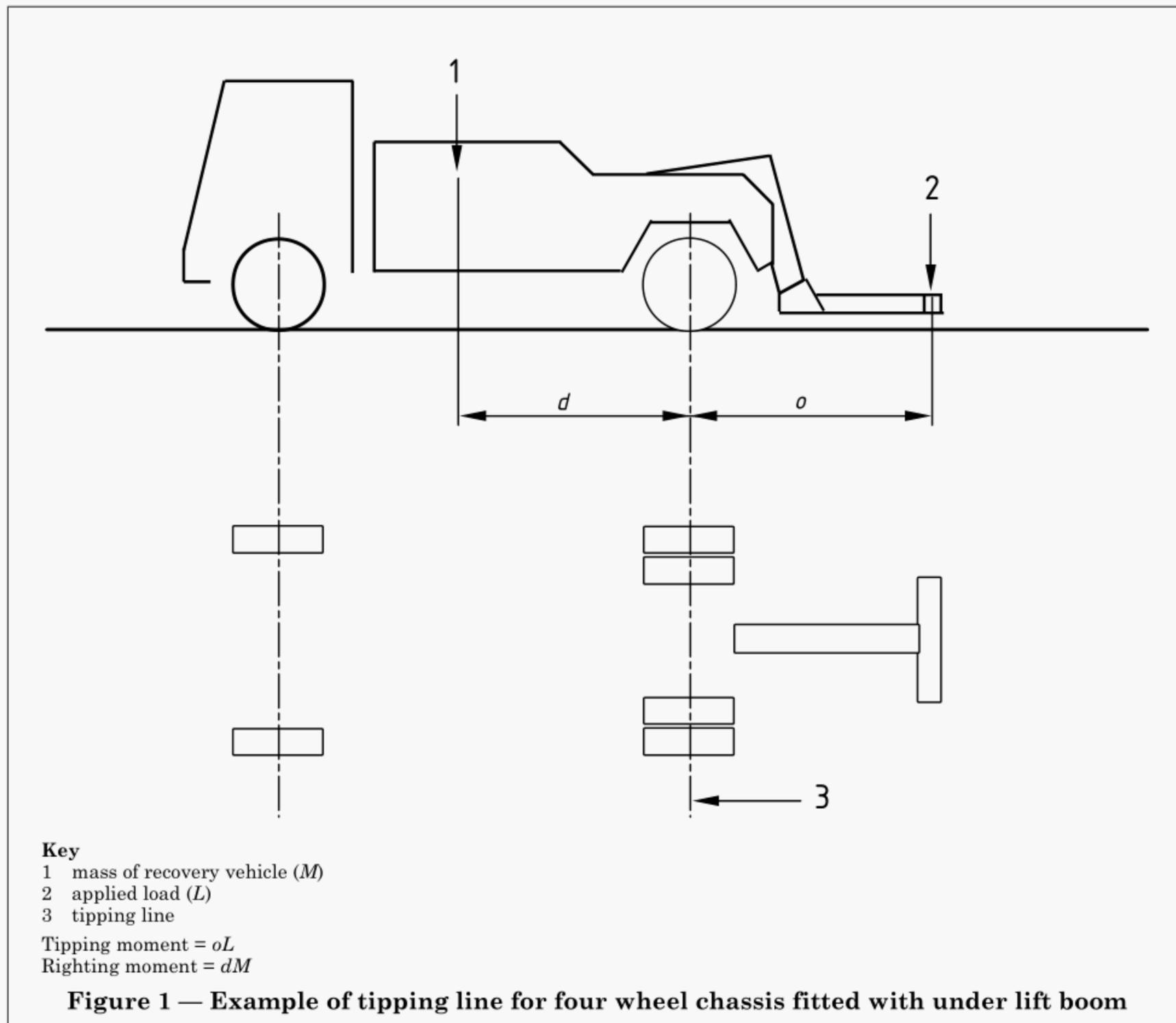
NOTE Examples of tipping lines are shown in Figure 1 to Figure 5.

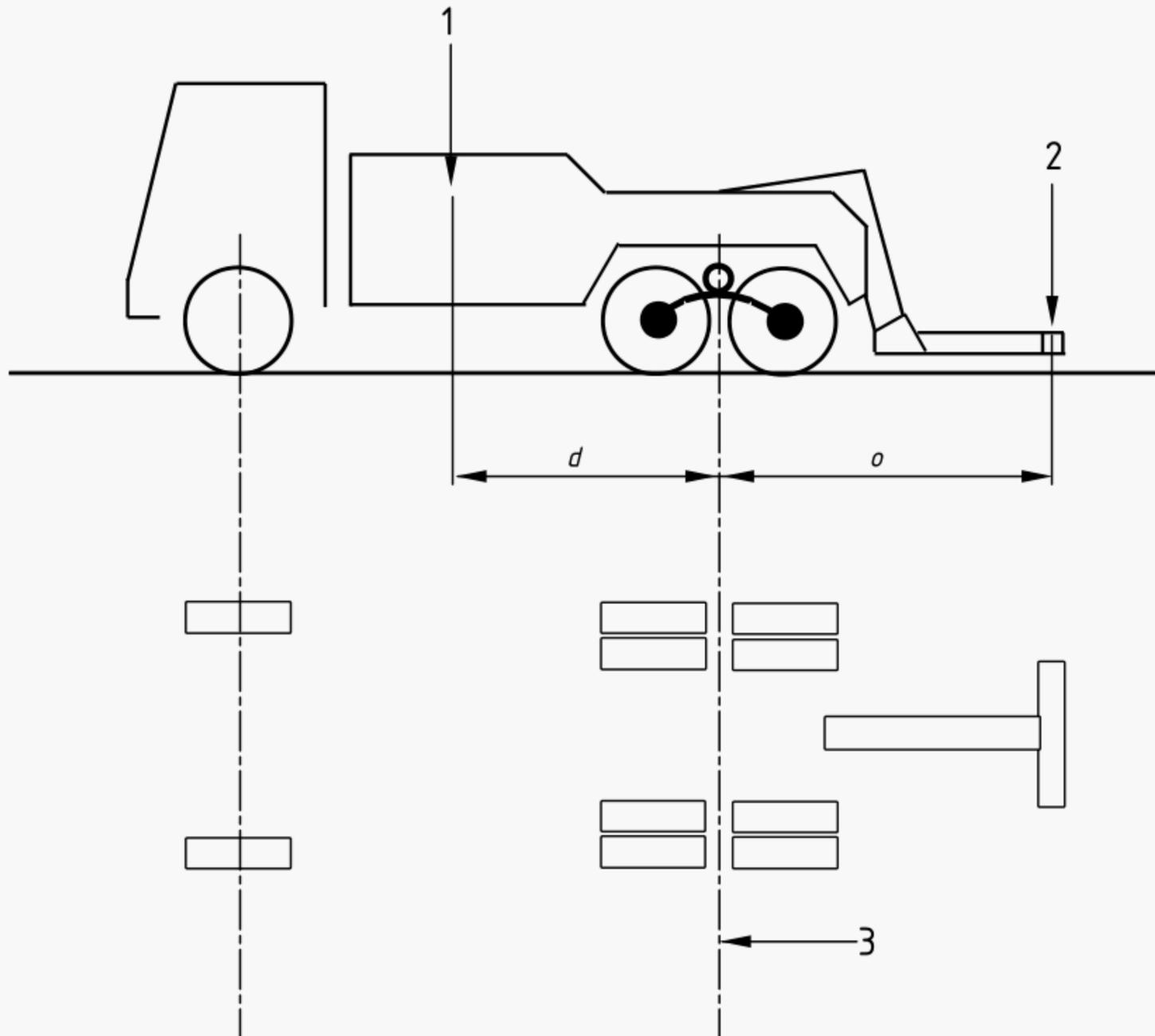
**3.26****tipping moment**

moment about the tipping line that can overturn the recovery vehicle, see Figure 1 to Figure 5

**3.27****righting moment**

moment about the tipping line that resists the overturn of the recovery vehicle, see Figure 1 to Figure 5



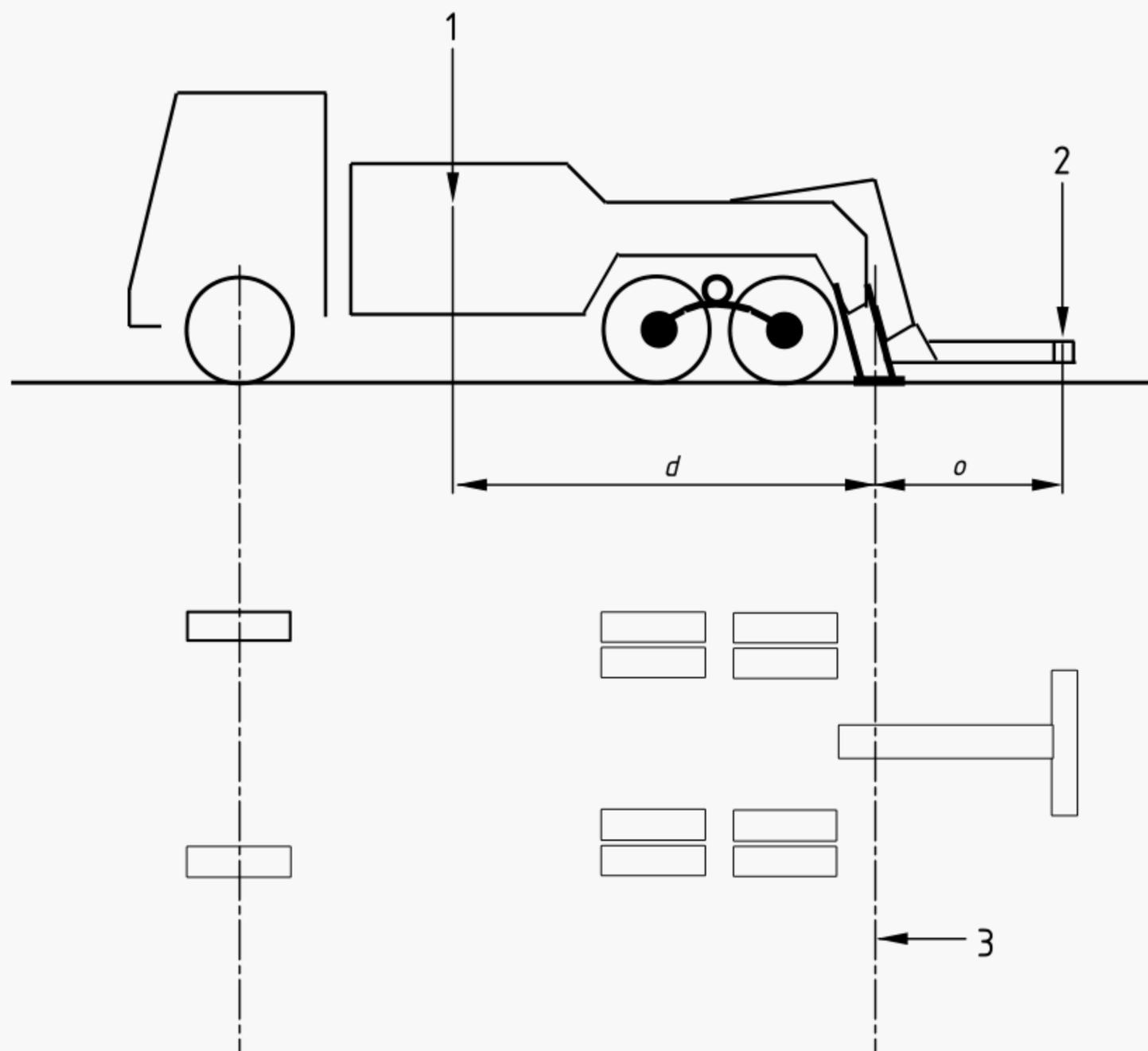
**Key**

- 1 mass of recovery vehicle ( $M$ )
- 2 applied load ( $L$ )
- 3 tipping line

Tipping moment =  $oL$

Righting moment =  $dM$

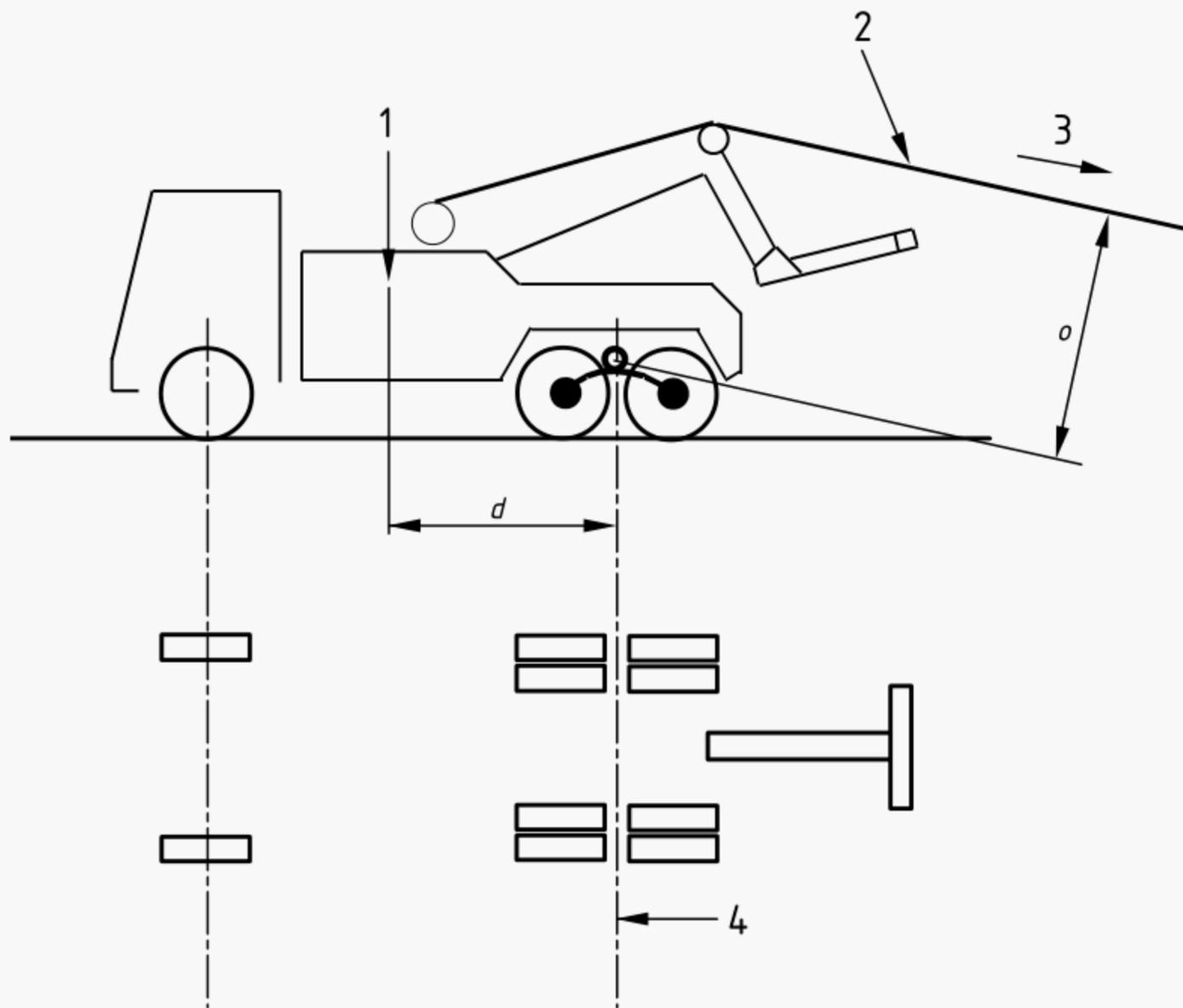
**Figure 2 — Example of tipping line for six wheel chassis (balance type rear suspension) fitted with under lift boom**

**Key**

- 1 mass of recovery vehicle ( $M$ )
- 2 applied load ( $L$ )
- 3 tipping line

Tipping moment =  $oL$   
 Righting moment =  $dM$

**Figure 3 — Example of tipping line for six wheel chassis with rear stabilizers/stiff legs deployed and under lift boom**

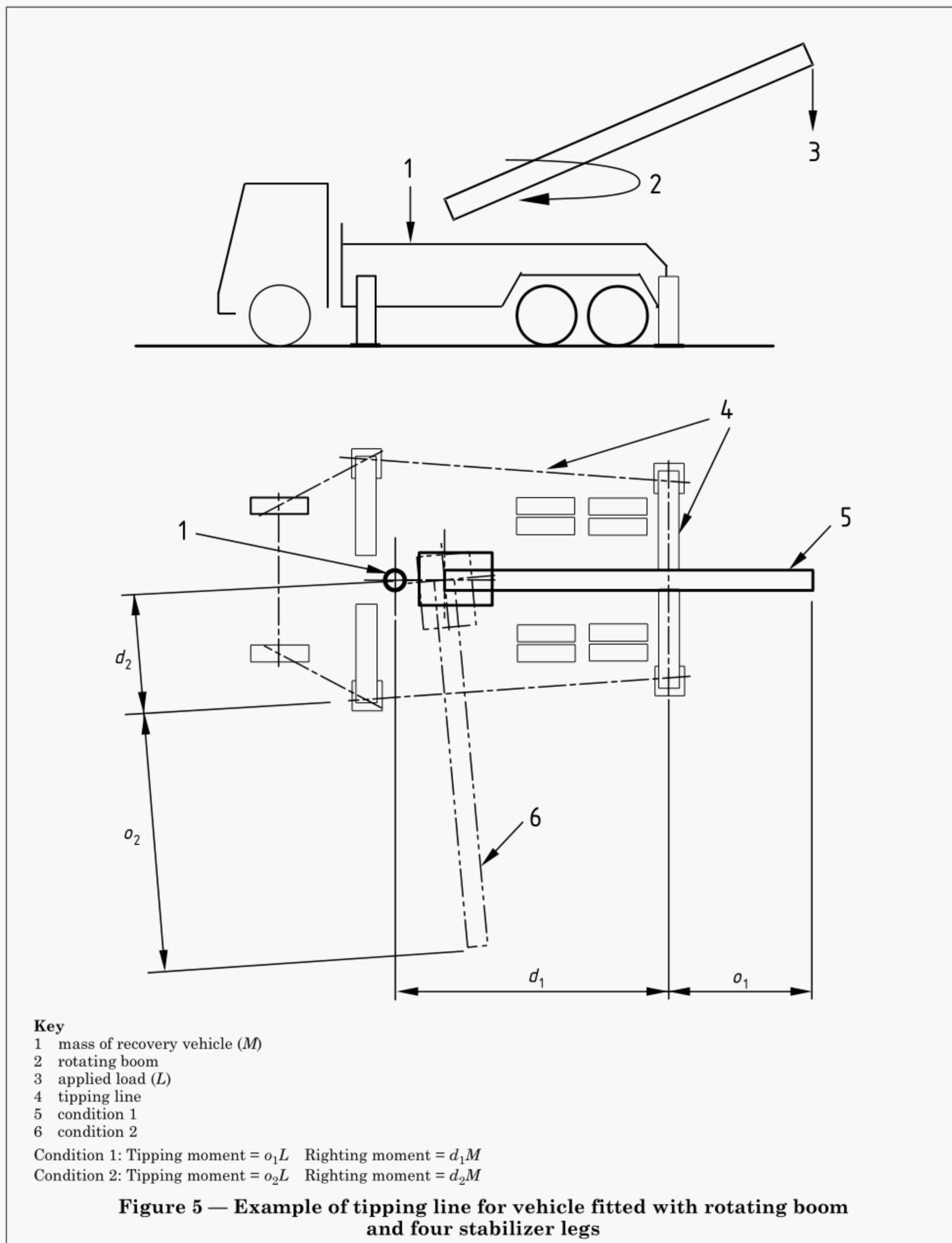
**Key**

- 1 mass of recovery vehicle ( $M$ )
- 2 winch rope
- 3 applied load ( $L$ )
- 4 tipping line

Tipping moment =  $oL$

Righting moment =  $dM$

**Figure 4 — Example of tipping line for winch fitted to six wheel chassis (balance type rear suspension) fitted with under lift boom**



## 4 Stability

### 4.1 General

The recovery vehicle shall be stable when casualty vehicle loads are imposed upon it in accordance with 4.2.1 and 4.2.2.

### 4.2 Static stability (stationary recovery vehicle)

#### 4.2.1 Non-slewing booms

Under all configurations of the recovery vehicle, as stated by the manufacturer in the rated capacity chart, the tipping moment calculated for a load corresponding to the rated capacity of the recovery equipment shall not exceed 75 % of the value of the recovery vehicle righting moment.

#### 4.2.2 Partially slewing booms and fully slewing booms

Under all configurations of the recovery vehicle, as stated by the manufacturer in the rated capacity chart, the tipping moment calculated for a load corresponding to the rated capacity of the recovery equipment shall not exceed 60 % of the value of the recovery vehicle righting moment.

NOTE Partially or fully slewing booms that are lockable in the position as defined for non-slewing booms may be considered as a non-slewing boom when so locked.

The tipping line that moments used in the calculations are taken from shall be clearly identified. In the case of partially and fully slewing booms, the various tipping lines affecting stability as the boom slews within its full range of movement shall be clearly identified.

Where tipping moment for the recovery vehicle is variable, e.g. free on wheels or stiff legs deployed, the stability requirements shall be calculated for all configurations. These calculations shall form part of the vehicle test certificate (see 21.1).

For stability calculations the mass of the recovery vehicle shall be taken as its operational mass without any additional mass e.g. that of a casualty vehicle or ancillary equipment used for a lifting operation.

All stability calculations shall assume firm level ground. This shall be stated on the test certificate (see 21.1).

### 4.3 Dynamic stability (moving recovery vehicles, lift and tow condition)

NOTE The speed limitation is an operational matter but manufacturers of recovery equipment should take this into account.

The resultant front axle mass calculated for the application of a casualty vehicle load corresponding to the rated capacity of the recovery equipment shall be not less than 40 % of the plated mass of that axle.

The recovery vehicle speed used for the calculations shall be either:

- a) a value,  $s$ , in km/h given by the following equation:

$$s = \frac{160}{x - 2}$$

where  $x$  is the rear axle mass divided by front axle mass; or

- b) 80 km/h;

whichever is the lesser.

## 5 Mechanical components

### 5.1 General

All exposed components shall be made of corrosion resistant material or have a corrosion resistant finish e.g. paint or plating.

Components that could be affected by road dirt e.g. bearings, controls and cylinder rods shall be sealed.

Components that are intended to be handled during recovery operations or are accessible to the operator shall not have sharp edges or rough surfaces.

NOTE Components which are intended to be fitted to other components during a recovery operation should be easy to assemble under adverse working conditions.

### **5.2 Rotating shafts, housings and slideways**

Any rotating, or partially rotating shafts, housings and slideways shall either:

- a) be of a non-lubrication material or self-lubricating material; or
- b) be provided with a means of lubrication.

Any lubrication nipples shall be of a similar size and type and shall be readily accessible.

### **5.3 Containment of motion**

The motion of the recovery equipment shall be contained within its design limits by means of limiters conforming to BS EN 12077-2.

Manually extending booms shall be fitted with a pull out limit stop and mechanical locking means for their retracted and incremental positions.

### **5.4 Partially slewing booms and fully slewing booms**

**NOTE** In the case of proprietary slewing rings, it is particularly important that the manufacturer is consulted and given details of the rated loads to be applied so that the correct components can be selected.

Provision shall be made to enable the boom to be mechanically locked to prevent inadvertent movement.

A slewing check device shall be fitted to prevent booms slewing uncontrollably whilst in use.

### **5.5 Lift and tow equipment**

Lift and tow equipment shall incorporate a means to prevent accidental disconnection of the casualty vehicle during use.

**NOTE** Lift and tow equipment should allow safe and easy connection to and disconnection from the casualty vehicle under adverse working conditions.

## **6 Safe access**

Safe means of access shall be provided to the control station(s) and to the recovery equipment for the operator. Controls shall be so positioned as not to present a "hand hold" to the operator whilst gaining access to the control station or equipment.

**NOTE** The means of access should be safe in wet and slippery conditions, for example by the use of slip resistant surfaces.

Where the fitting of lift and tow equipment to a casualty vehicle involves the operator being positioned partially beneath a raised casualty vehicle, then means shall be provided with the recovery equipment to solidly support the casualty vehicle from the ground (e.g. wheel blocks).

## **7 Stowage of equipment**

Provision shall be made for the secure stowage of equipment on the recovery vehicle. As far as practicable, the provision for stowage of lift and tow equipment shall be on the nearside of the recovery vehicle.

**NOTE** Attention should be given to the provision for stowage of equipment on the recovery vehicle so that excessive noise, for example from loose equipment, is not transmitted through the vehicle body.

## **8 Guarding**

All gear wheels, pinions and chain drives shall be guarded unless such parts are so situated in relation to the structure of the equipment as to be as safe as if a guard were provided.

Guards conforming to BS EN 811 shall be used for protection of lower limbs and guards conforming to BS EN 294 shall be used for protection of upper limbs.

Guards shall be provided for revolving shafts and couplings unless every set screw, bolt or key on any revolving shaft is sunk, shrouded, or otherwise guarded.

## 9 Controls

### 9.1 General

All controls shall be identified by a marking adjacent to the control. Details of control functions shall be included in the operator's manual (see 22.2.3).

Controls shall be so placed as to prevent accidental operation.

A stop control shall be located adjacent to all control stations and all remote and/or wander lead controls. The stop control shall be coloured red.

The direction of movement of control levers shall, wherever possible, be consistent with the consequential motion of the machine. Markings shall provide a clear and unambiguous indication of the relationship between the movement of the control lever at the control station and the corresponding direction of motion.

Spacing of controls shall be in accordance with prEN 13557:2002, 5.2.3.1.2.

Controls shall be spring loaded to stop except for controls which have float functions.

NOTE Controls with float functions may be held in position by a detent or similar device, providing no powered movement of the equipment takes place when the control is so held.

The control shall not activate equipment movement when disengaging from the float position.

The control arrangement shall be such that no combination of control selections by the operator can cause a movement of the equipment not intended by the operator.

### 9.2 Control stations mounted upon the equipment

If one control station is provided it shall be mounted on the nearside of the recovery vehicle. Where more than one control station is provided, at least one shall be mounted on the nearside of the recovery vehicle. The order in which the controls are placed shall be the same for all stations viewed from the operator's position.

The control station shall be situated such that the operator has a clear view of the recovery operation.

All control stations shall be such that they can be rendered inoperative by the operator.

Control stations shall not be positioned adjacent to an engine exhaust outlet.

### 9.3 Wander lead remote controls

Where one wander lead control is permanently connected to the recovery equipment it shall be located on the nearside of the vehicle. A stowage position shall be provided to prevent accidental operation of the controls.

Where wander lead controls are connected by plugs and sockets, then the socket shall be located on the nearside of the recovery vehicle. Where more than one socket is provided, at least one socket shall be located on the nearside of the recovery vehicle.

Each socket shall either:

- a) be located in a protected location, e.g. in a locker; or
- b) be protected by a cover to prevent the ingress of moisture and foreign particles.

NOTE A spring loaded or screw on cover is suitable.

Protection against electric shock for direct or indirect contact shall be as provided in BS EN 60204-32:1998, Clause 6.

Plug/socket combinations shall conform to BS EN 60204-32:1998, 14.4.5.

When the wander lead control is placed face down it shall not activate the controls.

### 9.4 Cordless remote controls

When the control is placed face down or in the operator's pocket it shall not activate the controls.

A stowage position shall be provided to prevent accidental operation of the controls or damage to the control unit.

### 9.5 Emergency stop control

Recovery equipment shall be fitted with one or more stop category "O" emergency stop controls conforming to BS EN 418:1992.

The activation of an emergency stop control shall stop all mechanical functions of the recovery equipment. The emergency stop control shall require positive re-activation before any control can restart the recovery equipment.

An emergency stop control shall be located adjacent to all control stations mounted on the recovery equipment. It shall be coloured red and labelled "EMERGENCY STOP".

## 10 Wire rope sheaves

### 10.1 General

If wire rope sheaves are fitted they shall be of the following types.

- a) Type 1. Permanently reeved sheaves, where the wire rope is not normally removed from the sheave engagement.
- b) Type 2. Non-permanently reeved sheaves, where the wire rope is reeved into the sheave to perform a particular recovery function.

### 10.2 Mean sheave diameter

The mean sheave diameter for type 1 shall be not less than 10 times the wire rope diameter reeved into the sheave.

The mean sheave diameter for type 2 shall be not less than 7.5 times the wire rope diameter reeved into the sheave.

### 10.3 Sheave rope grooves

#### 10.3.1 Type 1

For type 1 the wire rope sheave shall be grooved to a depth not less than 1.25 times the diameter of the wire rope. The grooves shall be finished smoothly and shall be free from defects liable to damage the wire rope. The edges shall be rounded. The contour at the bottom of the groove shall be circular over an angle of not less than 120°. The diameter shall be compatible with the wire rope and give support throughout this angle.

#### 10.3.2 Type 2

For type 2 the wire rope shall be supported within the groove such that, when subjected to a test load of 110 % of the winch rating there is no permanent deformation of the wire rope.

The wire rope with which the vehicle equipment is to be fitted shall not be used for this test.

## 11 Snatchblocks

The cheek plates shall be such that the wire rope is securely held within the snatchblock and its sheave groove at all times during operation.

The cheek plate closing device shall securely lock the cheek plates to prevent accidental opening, especially when the snatchblock is being drawn along a rough surface.

For dragging application the minimum coefficient of utilization of the snatchblock shall be 2.

Snatchblock hooks shall conform to 14.5.

## 12 Load restraints and anchorages

### 12.1 General

The recovery vehicle shall be fitted with primary and secondary load restraints and anchorages to secure the casualty vehicle in all planes during normal recovery operations.

### 12.2 Load restraints for casualty vehicles transported wholly upon the recovery vehicle

#### 12.2.1 Primary load restraints

The primary load restraints shall be positioned such that they can secure the casualty vehicle in all planes.

The minimum breaking load of the primary load restraints shall be equal to at least 125 % of the calculated load that would be imposed on them by the maximum casualty vehicle mass under all configurations of the equipment during transportation, as given in the operator's manual.

#### 12.2.2 Secondary load restraints

The secondary load restraint(s) shall comprise one or more devices securely attached to the recovery equipment to prevent the casualty vehicle from rolling into the cab of the recovery vehicle in the event of failure of the primary restraints.

### 12.3 Load restraints for casualty vehicles transported by lift and tow

#### 12.3.1 Primary load restraints

The primary load restraints shall be positioned such that they can secure the casualty vehicle in all planes.

The minimum breaking load of the primary load restraints shall be equal to at least 125 % of the calculated load that would be imposed on them by the maximum casualty vehicle mass under all configurations of the equipment during lifting and transportation, as given in the operator's manual.

NOTE More than one form of restraint may be used. The restraint may form part of the recovery equipment deployed in raising the casualty vehicle.

#### 12.3.2 Secondary load restraints

The secondary load restraint(s) shall comprise one or more devices to contain the casualty vehicle in close proximity to the recovery vehicle in the event of failure of the primary restraint.

The secondary load restraint(s) shall be anchored to the recovery equipment subframe. They shall not be anchored to a moving part of the equipment.

The calculated value of the total minimum breaking load of the secondary load restraints shall be equal to 50 % of the casualty vehicle mass.

### 12.4 Restraint anchorages

The minimum breaking load of each restraint anchorage shall be 125 % of the minimum breaking load of the restraints.

## 13 Ropes

### 13.1 General

Wire ropes conforming to BS EN 12385-1 and BS EN 12385-4 shall be used. This standard specifies winches using wire winch ropes.

### 13.2 Wire rope selection

The diameter of the rope selected shall be such that the ratio of the rope diameter to the nominal winch drum diameter is not less than 10.

The minimum breaking load of the rope selected shall be as given by the following formula:

$$f > rs$$

where:

- $f$  is the wire rope manufacturer's quoted value of minimum breaking load in kilonewtons (kN)
- $r$  is the winch design rating, in kilonewtons
- $s$  is the coefficient of utilization (a value of  $\geq 2$  shall be used).

### 13.3 Wire rope construction

The construction of the wire ropes used shall be as specified for the winch by the winch manufacturer in the winch handbook.

### 13.4 Wire rope terminations

#### 13.4.1 Free end wire rope termination

The free end wire rope termination, including any fittings, shall have a minimum breaking load of at least 90 % of the wire rope minimum breaking load as quoted by the manufacturer.

#### 13.4.2 Drum end termination

A sufficient length of wire rope shall be fitted that five wraps of wire rope around the drum can be maintained at all times. The wire rope shall be marked in a conspicuous manner, in a position such that when the mark exits the recovery equipment it indicates to the operator that only five wraps remain on the drum.

## 14 Winches

### 14.1 Actual winch rating

The actual winch rating,  $a$ , in kilonewtons (kN) shall be no greater than that calculated in accordance with the following formula:

$$a = f/s$$

where:

- $f$  is the minimum breaking load of the wire rope as given by the manufacturer in kilonewtons (kN)
- $r$  is the coefficient of utilization (a value of 2 shall be used).

The actual winch rating shall be stated in the recovery vehicle documentation (see Clause 21) and the nominal wire rope diameter and minimum breaking load of the wire rope to be used shall also be stated.

### 14.2 Type testing of winches

The first production unit of each winch model shall be tested in accordance with Annex A and the winch shall be deemed to have passed the test if it conforms to the following criteria.

- a) All the steps in the procedure given in Annex A have been completed.
- b) The winch components show no cracking or permanent deformation.
- c) There has been no rotational movement of the drum measured during the 15 min steady state period (A.4.8).

### 14.3 Production testing of winches

All winches and winch installations shall be tested in accordance with Annex B prior to first being put into service. The winch shall be deemed to have passed the test if it conforms to the following criteria.

- a) All the steps in Annex B have been completed.
- b) The winch and the vehicle installation components show no cracking or permanent deformation.

#### 14.4 Wire rope drums

Means shall be provided to prevent the wire rope running off the sides of the drum. If drum flanges are fitted they shall project above the outermost wire rope layer by a distance of 1.5 times the wire rope diameter.

#### 14.5 Hooks

Hooks shall incorporate a device to prevent the inadvertent displacement of the load from the hook. The device shall completely close the hook throat and require positive action to open it.

Hooks attached to wire ropes or forming an integral part of a snatchblock shall have a minimum coefficient of utilization of 2.

#### 14.6 Winch brakes

The winch brake system shall be fail safe.

#### 14.7 Overload protection devices

Winches with a winch design rating equal to or greater than 10 kN or causing a tipping moment equal to or greater than 40 000 N·m shall be fitted with an overload protection device.

Overload protection devices shall be adjusted to operate at the actual winch rating within a tolerance of -25 % +10 % of winch design rating for electric winches and  $\pm 10$  % of winch design rating for hydraulic winches.

The means of adjustment of the overload protection device shall be sealed with a tamper proof seal.

#### 14.8 Controls

##### 14.8.1 *Electric winch controls*

A battery isolation switch shall be incorporated in the main power cable of electric winches to protect against unintentional operation.

##### 14.8.2 *Freespool controls*

Freespool controls shall have a visible indication of the engaged and disengaged positions. The operation of these controls shall require two deliberate actions to maintain the freespool position.

### 15 Electrical equipment

NOTE This section only applies to the electrical equipment fitted to the recovery equipment. It therefore excludes such equipment as radios, radio telephones, additional front or rear driving lamps etc.

#### 15.1 General

All electrical components and cables and their terminals shall be clearly identified and this shall be shown on a wiring diagram given in the maintenance manual (see 22.2.4).

Each separate function shall have overload protection.

#### 15.2 Power source

The total power demand of the recovery equipment electrical system shall be recorded by the recovery equipment manufacturer and provided in writing to the purchaser. Any modifications necessary to the chassis electrical power source such that it is capable of supplying both the original chassis electrical equipment and the additional recovery vehicle electrical system shall be agreed between the manufacturer and the purchaser.

NOTE The power source is normally the vehicle alternator and battery which are not covered by this standard.

When the recovery equipment is operated, essential vehicle systems (e.g. lights, beacons) shall remain operative.

### 15.3 Power supply

The power supply cables from the chassis power source, or modified power source, supplying recovery equipment functions under 50 A shall be fed to a main distribution point. This main distribution point and all overload protection and electrical power equipment for the recovery equipment shall be housed in one or more enclosures. Where the enclosure housing the main distribution point is external to the cab or passenger cab of the recovery vehicle then the enclosure shall provide a degree of protection, IP65, as specified in BS EN 60529:1992. The enclosure shall be securely mounted in a position which is easily accessible. Power shall be distributed from the main distribution point to the various electrical functions of the recovery equipment except for functions for which provision has been made by the chassis manufacturer.

Power supplies to recovery equipment functions requiring 50 A or more shall be provided with an easily accessible isolator switch as close to the power source as possible.

The isolation switch shall be connected in such a way that its operation only shuts down the power supply to the recovery equipment.

Power supply cables over 50 A shall be as short as practical and shall be fitted with overload protection.

The power supply cables selected shall have an electrical rating sufficient to supply the maximum demand of all the recovery equipment functions. Where additional, optional functions are available from the distribution point the power supply cables from the power source to the distribution point shall have an electrical rating sufficient to supply the maximum demand assuming all these functions are in use.

### 15.4 Earthing

A main earth return cable from the distribution point shall be fitted to the power source.

The earth return cable shall be as short as practical. The earth return cable selected shall have an electrical rating sufficient to supply the maximum demand of all the recovery equipment functions, with allowance for any voltage drop. Where additional, optional functions are available from the distribution point the earth return cable from the power source shall have an electrical rating sufficient to supply the maximum demand assuming all these functions are in use.

### 15.5 Fitting

Electrical equipment shall be fitted in accordance with the electrical equipment manufacturer's instructions. Where recovery equipment electrical components are fitted to the chassis, they shall be fitted in accordance with the chassis manufacturer's instructions.

All cable entries/exits shall be via protective fittings e.g. grommets, cable glands.

All cables shall be fitted to the recovery equipment using insulated mechanical fasteners. These fasteners shall support the cables to prevent chaffing and strain. Where cables are routed on the vehicle chassis they shall not be secured to chassis pipes or cables, or in close proximity to exhaust systems or moving parts.

### 15.6 Slave starting take off sockets and leads

Slave starting take off sockets shall be provided with an isolator switch which is readily accessible by the operator.

These sockets shall be clearly labelled 12 V or 24 V as appropriate.

Take off sockets shall be such that it is not possible to locate a negative lead in a positive take off socket, and vice versa.

Slave starting take off leads ("jump leads") shall not be permanently wired into the electrical system.

### 15.7 Lamps

#### 15.7.1 Hazard warning lightbars and beacons

Control switches for hazard warning lightbars and beacons shall be accessible from the recovery vehicle's driving position.

For lightbars and beacons the control switch shall be identified by the colour orange or yellow and shall be illuminated in the "on" position.

### 15.7.2 *Work lamps*

The main isolator switch for work lamps shall be accessible from the recovery vehicle's driving position. The switch shall be identified by the colour white and shall be illuminated in the "on" position.

### 15.7.3 *Internal illumination lamps (e.g. for lockers or control stations)*

The master control switch for internal illumination lamps shall be accessible from the recovery vehicle's driving position.

The switch shall be identified by the colour green and shall be illuminated in the "on" position.

### 15.8 **Power take off controls**

Power take off control switches shall be accessible from the recovery vehicle's driving position.

The control switch shall be clearly identified by either a label and an audible warning when the power take off is engaged, or by a warning lamp coloured red, which shall be illuminated when the power take off is engaged. Audible warnings shall be loud enough to be heard from the drivers' position; warning lamps shall be visible from the drivers' position.

### 15.9 **Electromagnetic compatibility (EMC)**

#### 15.9.1 *Immunity*

The electrical system shall either:

- a) conform to BS EN 61000-6-2; or
- b) conform to the following requirements:
  - 1) all components of the equipment shall conform to BS EN 61000-6-2;
  - 2) the application of the components shall be in accordance with the component manufacturer's instructions;
  - 3) the electrical equipment shall be installed according to the electrical equipment manufacturer's instructions.

#### 15.9.2 *Emission*

The electrical system shall either:

- a) conform to BS EN 50081-1; or
- b) conform to the following requirements:
  - 1) all components of the equipment shall conform to BS EN 50081-1;
  - 2) the application of the components shall be in accordance with the component manufacturer's instructions;
  - 3) the electrical equipment shall be installed according to the electrical equipment manufacturer's instructions.

## 16 **Hydraulic equipment**

**NOTE** It is the object of the following requirements to protect the operator and others in the vicinity of the recovery equipment against failures in the hydraulic or other system, caused by excessive loads on the recovery equipment and components.

### 16.1 **Safe hydraulic pressure**

One or more pressure relief valves shall be fitted to ensure that the hydraulic pressure never exceeds the working pressure of any component within the hydraulic system.

Devices shall be fitted to prevent back pressures that can affect the safety of the recovery equipment.

**16.2 Safety of the recovery equipment and casualty vehicle**

The hydraulic system shall be fitted with devices to prevent the following:

- a) a gravity fall of the casualty vehicle in the event of hydraulic failure;
- b) hydraulic shock, caused by the sudden closure of any control valve, leading to over running of the associated motion;
- c) uncontrolled movement or release of the casualty vehicle in the event of loss of oil supply pressure or flow;
- d) uncontrolled movement or release of the casualty vehicle in the event of a hose burst;
- e) runaway of the casualty vehicle in the event of a load reversal;
- f) the overloading of any stabilizers or stiff legs.

**16.3 Motion drives**

Devices shall be fitted to prevent forces imposed by the casualty vehicle from driving hydraulic motors and hydraulic cylinders beyond their limits as specified by the manufacturer of the motor or cylinder.

**16.4 Hydraulic fluid**

The manufacturer shall state the hydraulic fluid to be used, which should be appropriate for the components of the hydraulic equipment and the ambient temperature in which it is to be operated.

The fluid system shall be fitted with a filter which gives the maximum level of filtration specified by the manufacturer of the components.

**16.5 Hydraulic fluid reservoir(s)**

The hydraulic fluid reservoir(s) shall have a sufficient capacity to ensure an uninterrupted flow of hydraulic fluid to all actuators when all hydraulic cylinders are operating at full stroke.

Provision shall be made for checking the fluid level, and the minimum and maximum levels shall be clearly marked.

**16.6 Venting**

Any venting of fluid or pressure relief of fluid shall be within the system. No venting system shall open into the atmosphere.

**16.7 Hydraulic hoses**

Hydraulic hoses shall be shielded to prevent hydraulic fluid spraying onto operators or other people near the recovery vehicle in the case of a hose failure.

**16.8 Sink rate of booms**

When the boom is in the lift and tow configuration, the sink rate shall be no greater than a loss of vertical height of 5 mm/h when subjected to the maximum working load. The measurement shall be taken between the ground and the point of lift on the boom in its normal working position.

In all other configurations the sink rate shall not exceed 10 % of the boom radius measured over a minimum period of 1 h with the boom subjected to the maximum working load.

**16.9 Protection of hydraulic components**

Hydraulic components shall be protected against physical damage by locating them in areas which are free from stowed equipment and where they cannot be hit by the casualty vehicle, or by the use of guards.

NOTE This could be achieved by use of an enclosure.

Hydraulic components shall be protected from road dirt where this would have a detrimental effect upon the component.

## 17 Pneumatic equipment

### 17.1 Pneumatic supply

The rate of the pneumatic supply shall be sufficient to ensure an uninterrupted flow to the pneumatic system when all functions are in operation.

Where the pneumatic supply to the recovery equipment is from a host chassis pneumatic system, then this supply shall be connected in accordance with the vehicle manufacturer's recommendations.

Where the pneumatic supply is from a compressor forming part of the recovery equipment, then the compressor, receiver and overload valves shall conform to BS EN 1012-1.

### 17.2 Safe pneumatic pressure

One or more pressure relief valves shall be fitted to ensure that the pneumatic pressure never exceeds the working pressure of any component within the pneumatic system.

### 17.3 Air filtration

The pneumatic system shall be fitted with a filter which gives the maximum level of filtration specified by the manufacturer of the components.

### 17.4 Protection of pneumatic components

Pneumatic components shall be protected against physical damage by locating them in areas which are free from stowed equipment and where they cannot be hit by the casualty vehicle, or by the use of guards.

NOTE This could be achieved by use of an enclosure.

Pneumatic components shall be protected from road dirt where this would have a detrimental effect upon the component.

### 17.5 Pressure relief valves and pneumatic exhausts

Pressure relief valves and pneumatic exhausts shall be vented to areas where the exhausted air cannot come into direct contact with the operator or other persons during operation of the recovery equipment or during driving of the recovery vehicle.

## 18 Passenger cabs added to the host chassis

NOTE The purpose of the passenger cab is to transport the occupants of the casualty vehicle in a safe and comfortable manner.

### 18.1 General

A notice shall be affixed to the passenger cab stating the number of persons the cab is designed to accommodate.

If a cab extension is fitted to a non-tilting cab structure then reinforced mountings shall be fitted to carry the additional weight.

An extension to a tilting cab structure shall be provided with a cab tilting system and shall be fitted with a mechanical lock or prop of the non-automatic type to support the cab structure in the raised position in the event of the failure of the cab tilting system.

Danger notices shall be provided in the driver's door area and adjacent to the cab lock or prop release mechanism as shown in Figure 6a. At least one additional pictorial reminder of danger of the cab tilting operation shall be placed adjacent to the lock or prop as shown in Figure 6b.

### 18.2 Access to passenger cab

Where an additional side door is provided, this shall be on the vehicle's nearside, with access steps to gain a convenient entry.

If any door is fitted with locks which can be locked from outside, the locks shall be such that they can be opened from inside the vehicle.

A side door which opens outwards shall be hinged at the edge nearest the front of the vehicle and shall be provided with a slam lock of the two stage type.

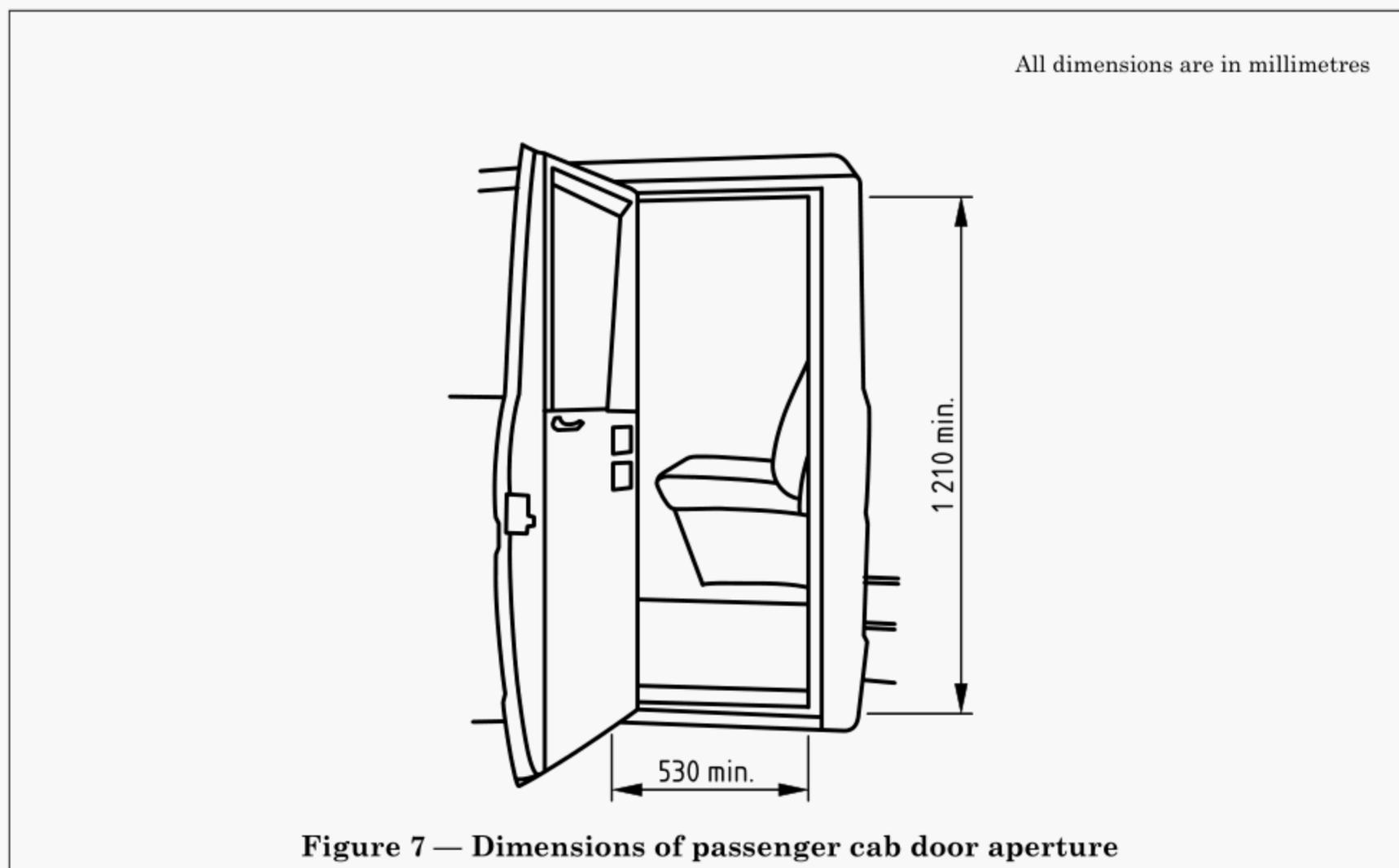
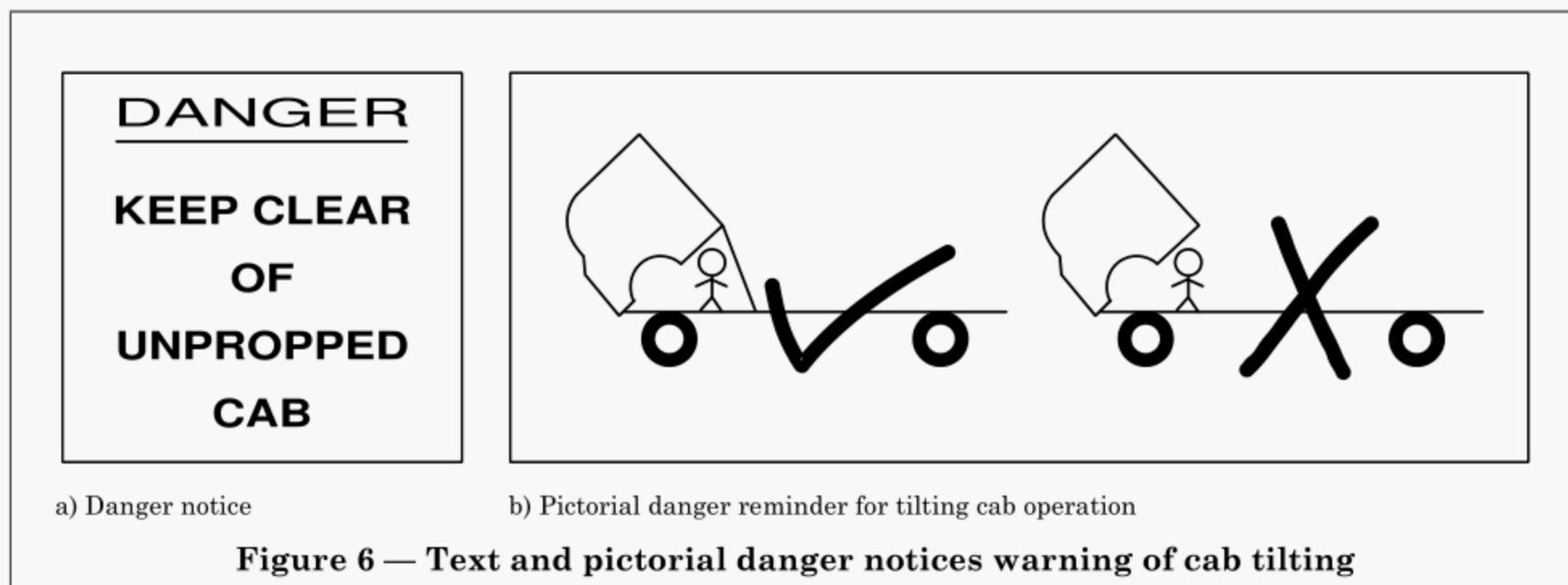
When the passenger door is fully open there shall be an opening in the passenger cab body which is not less than 1 210 mm high and not less than 530 mm wide (see Figure 7).

A grab handle or handrail shall be fitted to assist passengers' exit and entry.

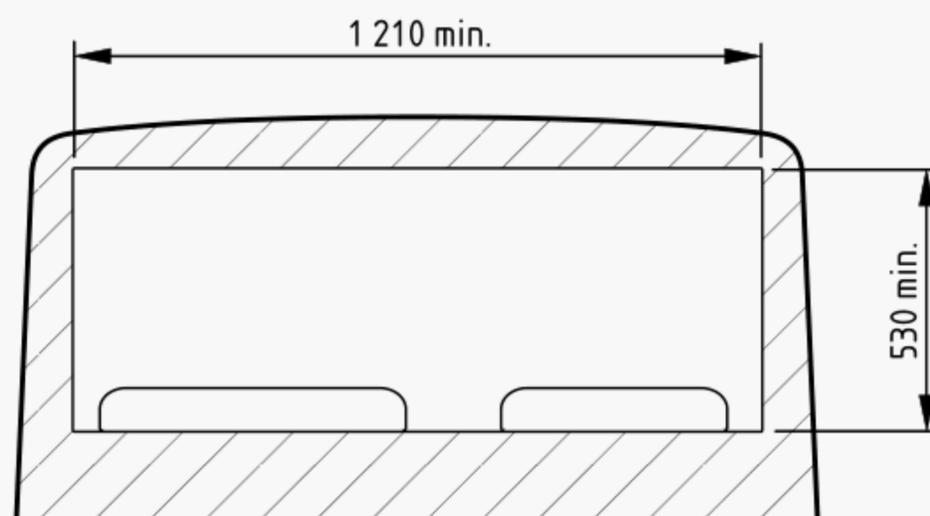
In the case of vehicles where no access door is provided to the rear portion of the passenger cab, and entry and exit is restricted to the front nearside door, a clear area of passage shall be provided of not less than 1 210 mm × 530 mm (see NOTE). Provision shall be made for a second means of escape in emergency through either break glass hammers or kick-out glazing. A notice indicating the means of escape shall be clearly displayed.

NOTE The fact that a front seat can be folded forward may be taken into account when measuring the dimensions of the clear area.

In the case of vehicles with rear access doors, if the second means of escape is through to the cab front area over any dividing bulkhead, the clear opening shall be not less than 1 210 mm × 530 mm not taking into account the front seats (see Figure 8).



All dimensions are in millimetres



**Figure 8 — Aperture for secondary means of escape from passenger cab**

### 18.3 Windows

All windows shall be of safety glass conforming to BS 857.

### 18.4 Passenger seats

Passenger seats shall incorporate an upholstered type squab and an upholstered back.

Every seat shall be securely fixed to the vehicle.

If a locker is provided beneath the rear passenger seat, the squab shall be detachable for access to the locker and provided with a means of holding it securely in place.

Every seat shall be at least 400 mm wide, not including any arm rests (whether folded back or not).

The minimum clearance from the foremost point of any seat squab to any obstruction forward of it at that height shall be 200 mm. In the case of a row of three or more seats, this dimension shall be a minimum of 305 mm (see Figure 9).

The minimum clearance from the centre line of the rear seat back rest to any obstruction forward of it at that height shall be 610 mm (see Figure 9).

The minimum height clearance, measuring vertically from the centre line of the seat squab, shall be 965 mm (see Figure 9).

### 18.5 Passenger restraints

Passenger restraints shall be fitted to all passenger seats.

### 18.6 Heating and ventilation

Heating and ventilation shall be provided.

### 18.7 Interior lighting

At least one interior light shall be provided in the passenger cab controlled by the driver, with a switch available to the passenger. This light shall be positioned so that it does not reflect directly onto the windscreen.

One or more step lights shall be provided for passenger cabs with more than one fixed entry step (see Figure 10).

All dimensions are in millimetres

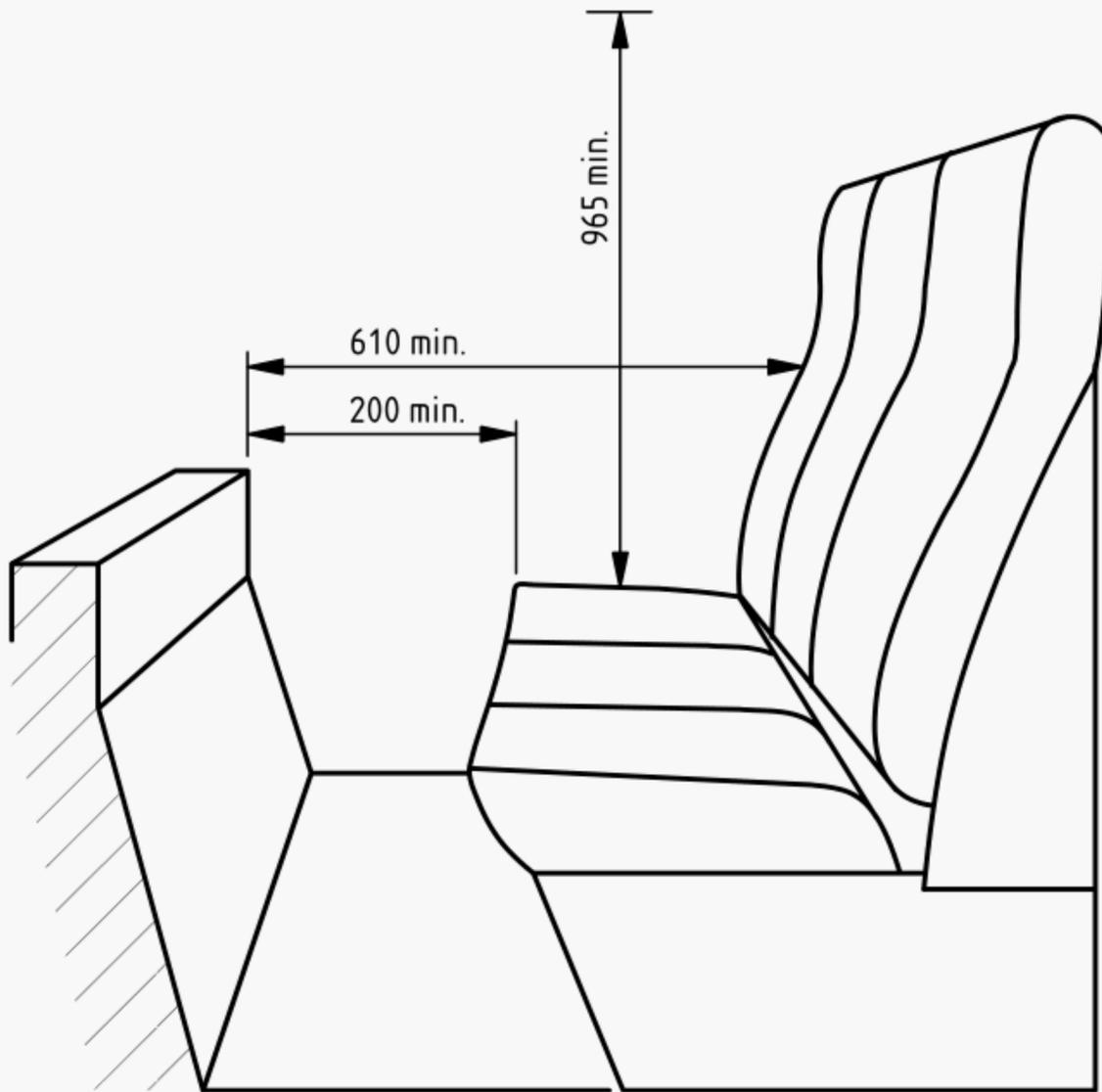


Figure 9 — Clearances for passenger seats

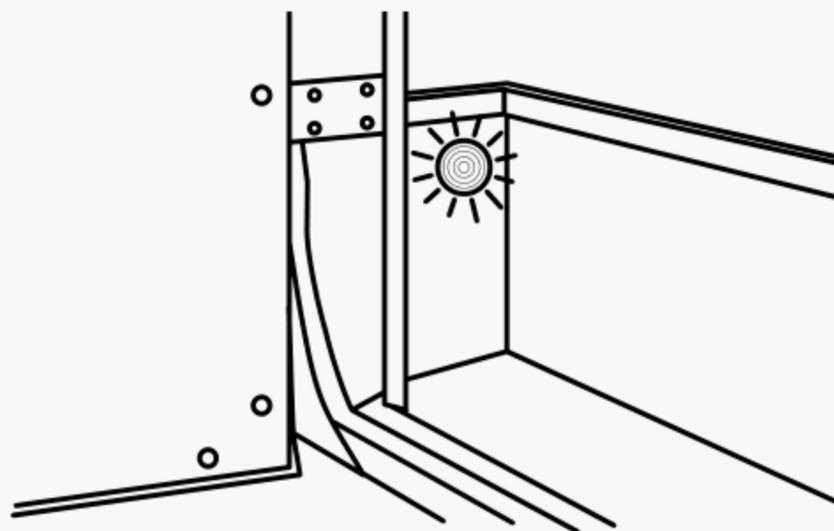


Figure 10 — Example of passenger cab step light

## 19 Safety

### 19.1 Overload protection devices

Powered recovery equipment shall be fitted with one or more overload protection devices to warn the operator of overloading and prevent dangerous movement of the equipment.

The device shall be such that if it is not functioning it is not possible to start or continue the operation that the device is intended to protect.

Where these devices are adjustable at the time of manufacture, after adjustment they shall be locked and sealed by the manufacturer of the recovery equipment.

### 19.2 Rated capacity charts and markings

#### 19.2.1 General

The recovery equipment shall be marked with the maximum casualty vehicle mass.

#### 19.2.2 Non-slewing booms: vertical loads

For non-slewing booms which have four or more rated capacities, or where any rated capacity can change (e.g. due to the effect of boom angle, stabilizers/stiff legs or number of falls from a winch rope) a chart shall be provided by the equipment manufacturer. The chart shall show, without ambiguity, the rated capacity for each condition including any lift and tow conditions. The chart shall be displayed on the vehicle such that it is clearly visible from the control stations mounted on the recovery equipment.

NOTE Where there are no more than three rated capacities for a boom, unaffected by boom angle and stabilizers/stiff legs, the rated capacities may be simply marked on the boom at the relevant positions.

#### 19.2.3 Partially and fully slewing booms: vertical loads

The rated capacity chart or markings shall be in accordance with 19.2.2. In addition the chart shall show the rated capacities throughout the slewing range.

#### 19.2.4 Ancillary equipment

Ancillary recovery equipment shall be clearly marked with its rated capacity.

### 19.3 Reflectors on stabilizers

Stabilizers that extend beyond the sides of the recovery vehicle shall be fitted with reflectors. The forward face of the stabilizer shall be fitted with a white reflector. The rearward face shall be fitted with a red reflector. These reflectors shall be within 100 mm of a vertical line drawn through the extreme outside part of the stabilizer. They shall be a minimum of 350 mm and a maximum of 900 mm from the ground. The minimum reflective area of each reflector shall be 22.2 cm<sup>2</sup>.

### 19.4 Level indicators

Recovery equipment fitted with a slewing boom shall incorporate one or more level indicators to indicate to the operator when the vehicle is level within the tolerances specified by the manufacturer for the safe slewing of the boom.

### 19.5 Vehicle warning beacon

The recovery vehicle shall be fitted with one or more amber warning beacons.

If the recovery vehicle is intended to be used for recovery of casualty vehicles which might obscure the vehicle warning beacon, a switched socket shall be provided at the rear of the vehicle for the connection of an additional warning beacon.

### 19.6 Fire extinguishers

A fire extinguisher conforming to BS EN 3, shall be fitted on the recovery vehicle.

## **20 Recovery equipment testing**

### **20.1 Type testing of recovery equipment**

The first production unit of each model of recovery equipment shall be tested in accordance with Annex C and the recovery equipment shall be deemed to have passed the test if it conforms to the following criteria.

- a) All the steps in the procedure given in Annex C have been completed.
- b) The components of the recovery equipment, mountings to the host chassis and the host chassis show no cracking or permanent deformation.
- c) All controls function as intended.

### **20.2 Production testing of recovery equipment**

All recovery equipment and recovery equipment installations shall be tested in accordance with Annex D prior to first being put into service. The recovery equipment shall be deemed to have passed the test if it conforms to the following criteria.

- a) All the steps in the procedure given in Annex D have been completed.
- b) The components of the recovery equipment, mountings to the host chassis and the host chassis show no cracking or permanent deformation.
- c) All controls function as intended.

## **21 Test certificates and documentation**

### **21.1 Recovery equipment test certificate**

A recovery equipment test certificate shall be issued on completion of a successful production test. This shall record at least the following information.

- a) The make, model and serial number of the recovery equipment.
- b) The rated capacity of the recovery equipment.
- c) The test load applied.
- d) The test equipment used together with serial numbers and calibration dates.
- e) The stability calculations for all recovery vehicle configurations.

The test certificate shall state that stability calculations assume firm level ground.

### **21.2 Winch test certificate**

A winch test certificate shall be issued on completion of a successful winch static test. The certificate shall contain the following in addition to the information given on the test report.

- a) For electric winches:
  - 1) date of manufacture;
  - 2) model;
  - 3) serial number;
  - 4) voltage and current at test load;
  - 5) rated line pull bottom layer, in kN;
  - 6) minimum wire rope diameter, in mm;
  - 7) minimum wire rope breaking load, in kN.

b) For hydraulic winches:

- 1) date of manufacture;
- 2) model;
- 3) serial number;
- 4) maximum operating pressure, in bar<sup>1)</sup> at rated load;
- 5) maximum oil flow, in l/min;
- 6) rated line pull bottom layer, in kN;
- 7) minimum wire rope diameter, in mm;
- 8) minimum wire rope breaking load, in kN.

## 22 Information for use

### 22.1 General

All information for use shall be in accordance with BS EN 292-2:1991, Clause 5.

### 22.2 Manuals

#### 22.2.1 Provision of manuals

Manuals (instructions) shall be provided with the recovery equipment by the manufacturer for the installer, the operator and the maintenance of the recovery equipment.

#### 22.2.2 Instructions for the installer

The manufacturer shall provide instructions for the correct installation of the recovery equipment.

Installation instructions shall include:

- a) details of bolts and fastenings required for mounting the recovery equipment;
- b) masses, centres of gravity and all information required for:
  - calculation and test of stability for all recovery vehicle configurations;
  - calculation of axle loadings;
- c) hydraulic system specifications which include:
  - pressure and flow requirements;
  - system oil capacity;
  - system oil specification;
  - minimum reservoir capacity recommendations;
  - recommended filtration;
- d) electrical system requirements which shall include the total power demand of the recovery equipment electrical system;
- e) pneumatic system specification;
- f) winch wire rope specification which shall include:
  - actual winch rating;
  - nominal wire rope diameter;
  - minimum breaking load of the wire rope.

The installation manual shall include a list of checks, inspections and operations and shall state that they should be carried out before the recovery equipment is put into service for the first time and for its subsequent use.

<sup>1)</sup> 1 mbar = 100 N/m<sup>2</sup> = 100 Pa.

### 22.2.3 Operator's manual

The operator's manual shall identify the level of competence required by an operator or detailed training instructions required to be given to the operator.

The operator's manual shall give technical data and information about the following.

- a) A description of the control systems, including diagrams and descriptions of the symbols used with the control levers.
- b) A description of the limiting and indicating devices.
- c) A drawing showing all the warning signs and the positions at which they are affixed to the recovery equipment.
- d) The service conditions for intended use and service conditions for which the recovery equipment should not be used.

The operator's manual shall include a warning about working in the proximity of electric overhead and underground power lines and utilities.

Information about the rated capacity of the recovery equipment for all configurations and positions shall be included in the operator's manual and a copy of the rated capacity load plate (see 22.3.4) shall be provided.

The operator's manual shall state that should the secondary restraint become operative it shall be replaced.

The operator's manual shall include instructions for all pre-start and post operational checks and shall state that these checks should be carried out before setting up for work, operating and stowing the machine after use.

Post operational check instructions shall include the maximum heights and widths for the recovery and casualty vehicle in travelling mode.

The operator's manual shall include instructions regarding the need to ascertain that ground, support and anchorage conditions are adequate for the maximum loadings imposed by the recovery equipment. The operator's manual shall state the maximum load that the stabilizers should impose on the ground and the need of the operator to ensure that the ground can support the load.

The operator's manual shall detail the method of fitting attachments and any other likely equipment to be fitted or removed during, before or after use.

The operator's manual shall specify safety requirements that should be considered by the operator when planning a recovery operation. These shall include at least the following.

- 1) Evaluation of the load and its characteristics.
- 2) Selection of recovery equipment.
- 3) Instructions to explain the correct setting of load limiting selectors.
- 4) The position of the recovery equipment, the load and clearances before, during and after the recovery operation.
- 5) The site conditions including the space and clearances for the operation.
- 6) Environmental conditions existing and considerations when the operation might have to be stopped if conditions become unfavourable.
- 7) Advice and procedures given in the code of practice BS 7121-12.

The operator's manual shall include information on the normal temperature range for operation of the recovery equipment. The operator's manual shall state that at temperatures outside the normal temperature range the manufacturer should be contacted for advice before operation of the recovery equipment.

#### **22.2.4 Maintenance manual**

The maintenance manual shall contain information and instructions to ensure that maintenance can be carried out safely, and foreseeable hazards which might occur are identified. Information and drawings for the identification of parts which might need replacement during maintenance shall be included.

The maintenance manual shall include information for the in-service inspections and tests that should be carried out by a competent person to ensure that the equipment is safe to use.

The maintenance manual shall contain instructions on examinations and tests to be carried out after allowable repairs to the equipment. The manual shall state that the examinations and tests shall be carried out before putting the recovery equipment back into use.

The manufacturer shall provide advice on how to disconnect tubing and lines when pressure might be retained in hydraulic or pneumatic systems when the power supply has been switched off.

The power isolation procedure shall be detailed within the maintenance manual.

Circuit diagrams, where applicable, shall be included for hydraulic, pneumatic and electrical circuits.

The maintenance manual shall include information on materials and parts that require specialized repair techniques (e.g. welding at low temperature).

### **22.3 Marking**

#### **22.3.1 General**

All plates affixed permanently to the recovery equipment shall be manufactured from weatherproof material.

#### **22.3.2 Manufacturer's plate**

Recovery equipment shall be identified by a manufacturer's plate affixed to the equipment.

The manufacturer's plate shall be fixed permanently on the recovery equipment. It shall contain the following information.

- a) Manufacturer's name and address and, if applicable, the supplier.
- b) Year of manufacture.
- c) Serial number.
- d) Type, if there is a type designation.

#### **22.3.3 Installer's plate**

The installer of the recovery equipment shall affix a plate to the host chassis or the supporting item. It shall include the following information.

- a) Installer's name and address.
- b) Year of installation.
- c) Equipment serial number, chassis or registration number of vehicle (if applicable).

#### **22.3.4 Rated capacity charts and markings**

The following information shall as a minimum be provided.

- a) A rated capacity load plate (see **19.2**), with the capacity stated at various configurations of the recovery equipment, shall be displayed on the equipment such that it is clearly visible from all fixed control stations mounted on the recovery vehicle. It shall also be provided in the operator's manual.
- b) A rated capacity load chart for all equipment configurations (see **19.2**) shall be provided in the operator's manual. It may also be displayed on the recovery equipment in addition to the load plate according to a).
- c) The maximum casualty vehicle mass shall be marked on the recovery vehicle.

## Annex A (normative)

### Type test method for winches

#### A.1 Principle

This test assesses the structural integrity of the winch and its load holding performance.

#### A.2 Apparatus

**A.2.1 Test mounting**, only utilizes the recommended fixing points on the winch as specified in the winch fitting instructions.

**A.2.2 Test rope**, comprising a wire rope of the diameter and construction recommended by the winch manufacturer for use with the winch.

**A.2.3 Means of applying a constant load to the test rope while it is wound in and out by the winch under test.**

**A.2.4 Calibrated means of measuring the load applied to the test rope.**

**A.2.5 Calibrated means of measuring movement of the winch drum.**

**A.2.6 Calibrated means of measuring movement of the test rope**, capable of measuring at least 5 m of movement.

#### A.3 Preparation for test

If the winch is fitted with an overload protection device, disable it. After the test, reinstall the overload protection device.

Secure the winch to the test mounting in accordance with the winch manufacturer's fitting instructions.

Fit the test rope to the winch with a minimum number of five wraps on the winch drum.

Fit the means of measuring the test load to the free end of the test rope.

Fit the means of measuring the movement of the winch drum to the winch.

Set up the means of measuring the movement of the test rope.

Fit the means of applying the test load to the free end of the test rope.

#### A.4 Procedure

NOTE The winch and its power unit may be cycled to obtain optimum operating temperatures and correct distribution of lubricants before the test is started.

**A.4.1** Apply a load of  $1.25^{+0.1}_0$  times the winch design rating to the test rope.

**A.4.2** Operate the winch under test until a length of 5 m, or a length that fills the winch drum bottom layer, whichever is the lesser, of the test rope is wound onto the drum.

**A.4.3** Operate the winch until the length of test rope wound on as described in **A.4.2** is wound out.

NOTE Where the input drive unit supplied with the winch (e.g. hydraulic motor, electric motor or manual handle) is not capable of producing the power required to achieve the test load then a substitute drive unit may be fitted for the purpose of this test only.

**A.4.4** Apply a load of  $1.1^{+0.1}_0$  times the winch design rating to the test rope.

**A.4.5** Repeat steps **A.4.2** and **A.4.3**.

**A.4.6** Stop the motion of the winch and maintain the load on the test rope.

**A.4.7** After the load has stopped moving maintain this steady state for a minimum period of 15 min.

**A.4.8** Measure and record any rotational movement of the winch drum during this period.

**A.4.9** Where the winch fitting instructions give various options for exit of the rope from the winch, repeat steps **A.4.1** to **A.4.8** for each option.

### A.5 Test report

The test report shall include the following information.

- a) The winch make, model and serial number.
- b) The winch design rating.
- c) The test equipment used together with serial numbers and calibration dates.
- d) Diameter and construction of the test rope.
- e) The test load applied.
- f) The length of test rope wound on and off the winch drum.

## Annex B (normative) Static test method for winches

### B.1 Principle

This test assesses the structural integrity of the winch and its installation.

### B.2 Apparatus

**B.2.1** *Test mounting*, secures the recovery vehicle so that the test loads may be applied to the winch and its installation.

**B.2.2** *Test rope*, comprising a wire rope of the diameter and construction recommended by the winch manufacturer for use with the winch.

**B.2.3** *Means of applying a load to the test rope*.

**B.2.4** *Calibrated means of measuring the loads applied to the test rope*.

### B.3 Preparation for test

Anchor the recovery vehicle to withstand the test load to be applied.

Fit the test rope to the winch with the minimum number of five wraps on the winch drum.

Fit the means of measuring the test load to the free end of the test rope.

Fit the means of applying the test load to the free end of the test rope.

### B.4 Procedure

NOTE The winch and its power unit may be cycled to obtain optimum operating temperatures and correct distribution of lubricants before the test is started.

**B.4.1** Apply a load of  $1.1^{+0.1}_0$  times the winch design rating to the test rope.

**B.4.2** Maintain this steady state for a minimum period of 60 s.

**B.4.3** Operate the winch under test until a length of the test rope that fills the winch drum bottom layer is wound onto the drum.

**B.4.4** Repeat steps **B.4.1** and **B.4.2**.

**B.4.5** Where the winch fitting instructions give various options for exit of the rope from the winch, repeat steps **B.4.1** to **B.4.4** for each option.

## B.5 Test report

The test report shall include the following information.

- a) The winch make, model and serial numbers.
- b) The winch design rating.
- c) The make, model and chassis number of the recovery equipment.
- d) The test equipment used together with serial numbers and calibration dates.
- e) Diameter and construction of the test rope.
- f) The test load applied.

## Annex C (normative)

### Type test methods for recovery equipment

#### C.1 Over lift and under lift booms recovery equipment

##### C.1.1 Principle

This test assesses the structural integrity of the recovery equipment.

##### C.1.2 Apparatus

**C.1.2.1 Recovery equipment and host chassis model**, comprises recovery equipment fitted to the host chassis in accordance with the manufacturer's fitting instructions.

**C.1.2.2 Means of applying a load to the recovery equipment in the manner a casualty load would be applied.**

**C.1.2.3 Calibrated means of measuring the load applied to the recovery equipment.**

##### C.1.3 Preparation for test

If the recovery equipment is fitted with an overload protection device, disable it. After the test, reinstall the overload protection device.

Ensure that the recovery equipment is fitted to the host chassis in accordance with the recovery equipment manufacturer's fitting instructions.

Identify and record all the positions and conditions throughout the working range of the recovery equipment, as shown on the rated capacity charts, that are subject to the test load. Where the rated capacity of the recovery equipment changes due to boom angle, identify the test positions at increments of boom angle not exceeding 30°.

Fit the means of measuring the test load.

Fit the means of applying the test load.

##### C.1.4 Procedure

**C.1.4.1** Operate the recovery equipment under test, with no load applied, throughout its full working range observing the equipment motion in relation to the intended control operation.

**C.1.4.2** For each identified equipment position and condition as recorded in **C.1.3**, apply a load of 1.25 times the rated capacity of the recovery equipment.

##### C.1.5 Test report

The test report shall include the following information.

- a) The recovery equipment make, model and serial number.
- b) The host chassis make, model and chassis/registration number.
- c) The test equipment used together with serial numbers and calibration dates.
- d) A chart showing each identified equipment position and condition.
- e) The rated capacity for each identified equipment position and condition.
- f) The test load applied for each identified equipment position and condition.

## C.2 Slidebed or moving body recovery equipment

### C.2.1 Principle

This test assesses the structural integrity of the recovery equipment.

### C.2.2 Apparatus

**C.2.2.1 Recovery equipment and host chassis**, comprises recovery equipment fitted to the host chassis in accordance with the manufacturer's fitting instructions.

**C.2.2.2 Means of applying a load to the recovery equipment in the manner a casualty load would be applied.**

This shall take the form of a "rolling load" two axle wheeled device. The device shall have the proportions of wheelbase, track, tyre "footprint", commensurate with the type of casualty the equipment is designed to handle as detailed in the manufacturer's operating instructions. The sum of the axle loads of the device shall be equal to the test load. The axle loadings of the device shall be 66 % of the test load on one axle and 34 % on the remaining axle.

The test load shall be a mass of 1.25 times the rated capacity of the equipment for equipment rated at 5 000 kg and below, and a mass of 1.1 times the rated capacity of the equipment for equipment rated above 5 000 kg.

### C.2.3 Preparation for test

If the recovery equipment is fitted with an overload protection device, disable it. After the test, reinstall the overload protection device.

Ensure that the recovery equipment is fitted to the host chassis in accordance with the manufacturer's fitting instructions.

Identify and record all the positions and conditions throughout the working range of the recovery equipment, as shown on the rated capacity charts, that are subject to the test load.

### C.2.4 Procedure

**C.2.4.1** Operate the recovery equipment, with no load applied, throughout its full working range observing the equipment motion relative to the intended control operation.

**C.2.4.2** For each identified equipment position and condition as recorded in **C.2.3** load the rolling load onto the body, with the 66 % loaded axle contacting the body first.

**C.2.4.3** Position the rolling load on the body in the position designed for casualty carrying.

**C.2.4.4** Cycle the body through its loading and unloading procedure.

**C.2.4.5** Unload the rolling load from the body.

**C.2.4.6** Repeat steps **C.2.4.2** to **C.2.4.5** with the 34 % loaded axle of the rolling load contacting the body first.

### C.2.5 Test report

The test report shall include the following information.

- a) The recovery equipment make, model and serial number.
- b) The host chassis make, model and chassis/registration number.
- c) A chart showing each identified equipment position and condition.
- d) The rated capacity for each identified equipment position and condition.
- e) The test load applied for each identified equipment position and condition.

## Annex D (normative)

### Production test methods for recovery equipment

#### D.1 Over lift and under lift booms recovery equipment

##### D.1.1 Principle

This test assesses the structural integrity of the recovery equipment.

##### D.1.2 Apparatus

**D.1.2.1 Recovery equipment and host chassis model**, comprises recovery equipment fitted to the host chassis in accordance with the manufacturer's fitting instructions.

**D.1.2.2 Means of applying a load to the recovery equipment in the manner a casualty load would be applied.**

**D.1.2.3 Calibrated means of measuring the load applied to the recovery equipment.**

##### D.1.3 Preparation for test

If the recovery equipment is fitted with an overload protection device, disable it. After the test, reinstall the overload protection device.

Ensure that the recovery equipment is fitted to the host chassis in accordance with the manufacturer's fitting instructions.

Identify and record all the positions and conditions throughout the working range of the recovery equipment, as shown on the rated capacity charts, that are subject to the test load. Where the rated capacity of the recovery equipment changes due to boom angle, identify the test positions at increments of boom angle not exceeding 30°.

Fit the means of measuring the test load.

Fit the means of applying the test load.

##### D.1.4 Procedure

**D.1.4.1** Operate the recovery equipment under test, with no load applied, throughout its full working range observing the equipment motion in relation to the intended control operation.

**D.1.4.2** For each identified equipment position and condition as recorded in **D.1.3** apply a load of 1.1 times the rated capacity of the recovery equipment.

##### D.1.5 Test report

The test report shall include the following information.

- a) The recovery equipment make, model and serial number.
- b) The host chassis make, model and chassis/registration number.
- c) The test equipment used together with serial numbers and calibration dates.
- d) A chart showing each identified equipment position and condition.
- e) The rated capacity for each identified equipment position and condition.
- f) The test load applied for each identified equipment position and condition.

#### D.2 Slidebed or moving body recovery equipment

##### D.2.1 Principle

This test assesses the structural integrity of the recovery equipment.

##### D.2.2 Apparatus

**D.2.2.1 Recovery equipment and host chassis model**, comprises recovery equipment fitted to the host chassis in accordance with the manufacturer's fitting instructions.

**D.2.2.2 Means of applying a load to the recovery equipment in the manner a casualty load would be applied.**

This shall take the form of a “rolling load” two axle wheeled device. The device shall have the proportions of wheelbase, track, tyre “footprint”, commensurate with the type of casualty the equipment is designed to handle as detailed in the manufacturer’s operating instructions. The sum of the axle loads of the device shall be equal to the test load. The axle loadings of the device shall be 66 % of the test load on one axle and 34 % on the remaining axle.

The test load shall be a mass of 1.1 times the rated capacity of the equipment for equipment rated at 5 000 kg and below, and a mass of 1.1 times the rated capacity of the equipment for equipment rated above 5 000 kg.

**D.2.3 Preparation for test**

If the recovery equipment is fitted with an overload protection device, disable it. After the test, reinstall the overload protection device.

Ensure that the recovery equipment is fitted to the host chassis in accordance with the manufacturer’s fitting instructions.

Identify and record all the positions and conditions throughout the working range of the recovery equipment, as shown on the rated capacity charts, that are subject to the test load.

**D.2.4 Procedure**

**D.2.4.1** Operate the recovery equipment, with no load applied, throughout its full working range observing the equipment motion in relation to the intended control operation.

**D.2.4.2** For each identified equipment position and condition as recorded in **D.2.3** load the rolling load onto the body, with the 66 % loaded axle contacting the body first.

**D.2.4.3** Position the rolling load on the body in the position as designed for casualty carrying.

**D.2.4.4** Cycle the body through its loading and unloading procedure.

**D.2.4.5** Unload the rolling load from the body.

**D.2.4.6** Repeat steps **D.2.4.2** to **D.2.4.5** with the 34 % loaded axle of the rolling load contacting the body first.

**D.2.5 Test report**

The test report shall include the following information.

- a) The recovery equipment make, model and serial number.
- b) The host chassis make, model and chassis/registration number.
- c) A chart showing each identified equipment position and condition.
- d) The rated capacity for each identified equipment position and condition.
- e) The test load applied for each identified equipment position and condition.