
**Road vehicles — Fully automatic
coupling systems 24 V (FACS)
for heavy commercial vehicle
combinations —**

**Part 2:
50 mm fifth wheel couplings —
Electrical and pneumatic interface**

*Véhicules routiers — Dispositifs d'attelage entièrement automatiques
24 V (FACS) pour ensembles routiers lourds —*

*Partie 2: Sellettes d'attelage pour pivot de 50 mm — Interface
électrique et pneumatique*



STANDARDSISO.COM : Click to view the full PDF of ISO 13044-2:2013



COPYRIGHT PROTECTED DOCUMENT

© ISO 2013

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

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

Published in Switzerland

Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Requirements	2
4.1 General.....	2
4.2 Tractor and semi-trailer.....	3
4.3 Mechanical interface, Manual operation.....	3
4.4 EPI module.....	3
4.5 Mating of the two EPI parts.....	3
4.6 Guiding and alignment.....	4
4.7 Encapsulation and protection.....	6
4.8 Automation of landing legs.....	7
4.9 ISO 11992 Cable length.....	7
4.10 Mixed mode operation.....	7
5 Tests and specific requirements	7
5.1 General.....	7
5.2 Visual examination.....	8
5.3 Dimensional check.....	8
5.4 Connection and disconnection.....	8
5.5 Locking device operation.....	9
5.6 Current carrying capacity.....	9
5.7 Connection resistance (voltage drop), cable capacitance and pneumatics.....	9
5.8 Current cycling.....	11
5.9 Withstand voltage.....	11
5.10 Influence of water.....	11
5.11 Protection against dust.....	11
5.12 Endurance.....	11
5.13 Vibration.....	11
5.14 Shock resistance.....	11
5.15 Drop test.....	11
5.16 Temperature/humidity cycling.....	12
5.17 Salt spray.....	12
5.18 Chemical resistance.....	12
5.19 Leakage test of pneumatic connections.....	12
5.20 Functional test of protection covers.....	12
Annex A (normative) EPI module — Dimensional characteristics	13
Annex B (normative) EPI module — Contact allocation	21
Annex C (normative) Mixed mode operation	23
Bibliography	27

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2. www.iso.org/directives

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received. www.iso.org/patents

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

The committee responsible for this document is ISO/TC 22, *Road Vehicles*, Subcommittee SC 15, *Interchangeability of components of commercial vehicles and buses*.

ISO 13044 consists of the following parts, under the general title *Road vehicles — Fully automatic coupling systems 24 V (FACS) for heavy commercial vehicle combinations*:

- *Part 1: General requirements and definitions*
- *Part 2: 50 mm fifth wheel couplings — Electrical and pneumatic interface*

Introduction

This International Standard specifies the integrated electrical and pneumatic connections of an automated fifth wheel coupling system for articulated vehicles and related components.

Fully Automated Coupling Systems improve safety and comfort of vehicle combinations.

a) Higher safety standards

reduction of operational accidents,

less injured drivers because no need for driver to stay in the dangerous zone between the towing and the towed vehicle while uncoupling.

b) Higher comfort level

Fully Automated Coupling Systems eliminate necessity to access the coupling

higher comfort makes "Driver-Job" easier and safer,

new components create space for future extensions and potentials.

c) Cost reduction for end user

less inactive periods for the vehicle combination due to less damage and repair,

less repair and maintenance of cables and pipes.

STANDARDSISO.COM : Click to view the full PDF of ISO 13044-2:2013

Road vehicles — Fully automatic coupling systems 24 V (FACS) for heavy commercial vehicle combinations —

Part 2: 50 mm fifth wheel couplings — Electrical and pneumatic interface

1 Scope

This part of ISO 13044 specifies the mechanical, electrical/electronic and pneumatic characteristics of a fully automated fifth wheel coupling system to ensure interchangeability between a tractor vehicle and a coupled semi-trailer(s) with 24 V nominal supply voltage. The two vehicles together constitute an articulated vehicle.

This part of ISO 13044 also supports the smooth introduction of fully automated fifth wheel coupling systems in the market. It specifies features necessary for mixed mode operation; i.e. the combination of a fully automated coupling system (FACS) equipped tractor vehicle with a conventional semi-trailer, and vice versa, the combination of a conventional tractor vehicle with a FACS-equipped semi-trailer.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 337, *Road vehicles — 50 semi-trailer fifth wheel coupling pin — Basic and mounting/interchangeability dimensions*

ISO 1726-1, *Road vehicles — Mechanical coupling between tractors and semi-trailers — Part 1: Interchangeability between tractors and semi-trailers for general cargo*

ISO 1726-2, *Road vehicles — Mechanical couplings between tractors and semi-trailers — Part 2: Interchangeability between low-coupling tractors and high-volume semi-trailers*

ISO 3833, *Road vehicles — Types — Terms and definitions*

ISO 3842, *Road vehicles — Fifth wheels — Interchangeability*

ISO 4009, *Commercial vehicles — Location of electrical and pneumatic connections between towing vehicles and trailers*

ISO 4091:2003, *Road vehicles — Connectors for the electrical connection of towing and towed vehicles — Definitions, tests and requirements*

ISO 7638-1:2003, *Road vehicles — Connectors for the electrical connection of towing and towed vehicles — Part 1: Connectors for braking systems and running gear of vehicles with 24 V nominal supply voltage*

ISO 11992 (all parts), *Road vehicles — Interchange of digital information on electrical connections between towing and towed vehicles*

ISO 12098:2004, *Road vehicles — Connectors for the electrical connection of towing and towed vehicles — 15-pole connector for vehicles with 24 V nominal supply voltage*

ISO 16750-3:2012, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 3: Mechanical loads*

ISO 16750-5:2003, *Road vehicles — Environmental conditions and testing for electrical and electronic equipment — Part 5: Chemical loads*

ISO 6150:1988, *Pneumatic fluid power — Cylindrical quick-action couplings for maximum working pressures of 10 bar, 16 bar and 25 bar (1 MPa, 1,6 Mpa, and 2,5 MPa) — Plug connecting dimensions, specifications, application guidelines and testing*

3 Terms and definitions

For the purposes of this part of ISO 13044, the terms and definitions given in ISO 13044-1 and the following terms and definitions apply.

3.1

fully automated coupling system

FACS

coupling and uncoupling system where all operations, i.e. mechanical, electrical, pneumatic and applicable auxiliary functions, are performed automatically, enabling the coupling and uncoupling process to be completed without direct manual intervention

Note 1 to entry: As defined in ISO 13044-1:2012.

3.2

electrical/electronic-pneumatic interface module

EPI module

component, combining all electrical/electronic and pneumatic connections in one mating unit, consisting of two complementary parts, the EPI plug module and the EPI socket module

3.2.1

EPI plug module

part of the EPI module containing the electric male contacts, pneumatic male connections and the alignment pins. It is permanently attached to the kingpin side mounted on the semi-trailer

3.2.2

EPI socket module

part of the EPI module containing the electric female contacts, pneumatic female connections and the alignment sockets. It is permanently attached to the fifth wheel which is mounted to the tractor vehicle

3.2.3

semi-trailer

towed vehicle which is designed to be coupled to either a towing vehicle or to a dolly axle, and to impose a substantial vertical load either on the towing vehicle or on the dolly axle

3.2.4

alignment device

device placed on the trailer-side, which makes contact to the 5th wheel throat during the coupling process and centres the EPI plug relative to the EPI socket

4 Requirements

4.1 General

In order to guarantee best functionality, comfort and safety, the use of FACS is recommended in combination with spring-brake equipped semi-trailers only. FACS does not exonerate the driver from ensuring the semi-trailer is correctly parked before coupling or uncoupling.

In order to guarantee best functionality, comfort and safety, the use of FACS is recommended in combination with adjustable air-suspension on the rear axle equipped trucks only.

In the case of coupling systems that are not fully automatic, but utilize an automatic electro-pneumatic interface, this interface shall comply with the requirements specified within this International Standard.

4.2 Tractor and semi-trailer

In order to ensure interchangeability between tractor vehicles and semi-trailers, the requirements of ISO 3842 and ISO 1726-1 or ISO 1726-2 shall be met for vehicles to be equipped with FACS.

4.3 Mechanical interface, Manual operation

Fifth wheels installed on FACS-equipped tractor vehicles shall comply with the requirements of ISO 3842. Fifth wheel coupling pins (king pins) installed on FACS-equipped semi-trailers shall comply with the requirements of ISO 337. In the event of a failure of the remote control it shall be possible, in an emergency, to open the coupling in at least one other way. If this requires the use of a tool then this shall be included in the vehicle's tool kit. Any manual operation shall not lead to any damages or malfunction of the system components.

NOTE For fifth wheel versions with a throat angle other than 40° (e.g. 52°) optional versions would be allowed under the condition that the alignment device (Figure 2, key 2 or Figure 1, key 2) would use a corresponding angle. In this case the interchangeability will only be ensured within the individual version.

4.4 EPI module

4.4.1 EPI plug modules and EPI socket modules in accordance with this Standard shall provide the following electrical connections with 24 V nominal supply voltage:

- 7 poles for the electrical connection of the braking systems and running gear (incl. 2 poles for the CAN based communication compliant to ISO 11992-1 and -2);
- 23 poles for the electrical connection of equipment other than braking systems and running gear (incl. 2 poles for the CAN-based communication compliant to ISO 11992-1 and -3);

The dimensional characteristics and location of the EPI module shall be in accordance with the specifications of [Annex A](#). Number, location and functionality shall be in accordance with the specifications of [Annex B](#). Electrical contacts shall only be used as specified.

CAUTION — Using the electrical contacts for non-specified purposes (including ground) may cause damage to equipment. Any deviation from the contact allocation specified in Table 1 is not allowed. However, depending on legislation and customer demand, only some of the 30 electrical contacts may be required.

4.4.2 EPI plug modules and EPI socket modules in accordance with this International Standard shall provide connections for the following two pneumatic braking lines:

- one control line;
- one supply line;

The dimensional characteristics of the pneumatic connections shall be in accordance with the specifications of [Annex A](#).

4.5 Mating of the two EPI parts

The mating of the EPI plug module and the EPI socket module shall be connected automatically during the coupling process as illustrated in [Annex A](#), Figure A.1.

4.6 Guiding and alignment

4.6.1 General

The guiding and alignment of the EPI module shall be made by a rigid alignment pin in the middle plus two outer pins, which are preferably “self-aligning” designed to provide low forces during EPI mating; see [Annex A](#), Figure A.5. Each of the outer alignment pins shall have sufficient elasticity to permit a maximum of 2 mm deflection in any direction relative to the longitudinal axis of the central alignment pin. The deflection force shall be in the range from 50 N to 200 N.

The central alignment pin shall have the ability to align both EPI parts within a range ± 5 mm in both horizontal and vertical directions. The two outer pins shall ensure the parallel orientation of both EPI parts for connection alignment.

The positional tolerance between the contact surface of the alignment device and the fifth wheel shall be a maximum of ± 2 mm, according to Figure 1.

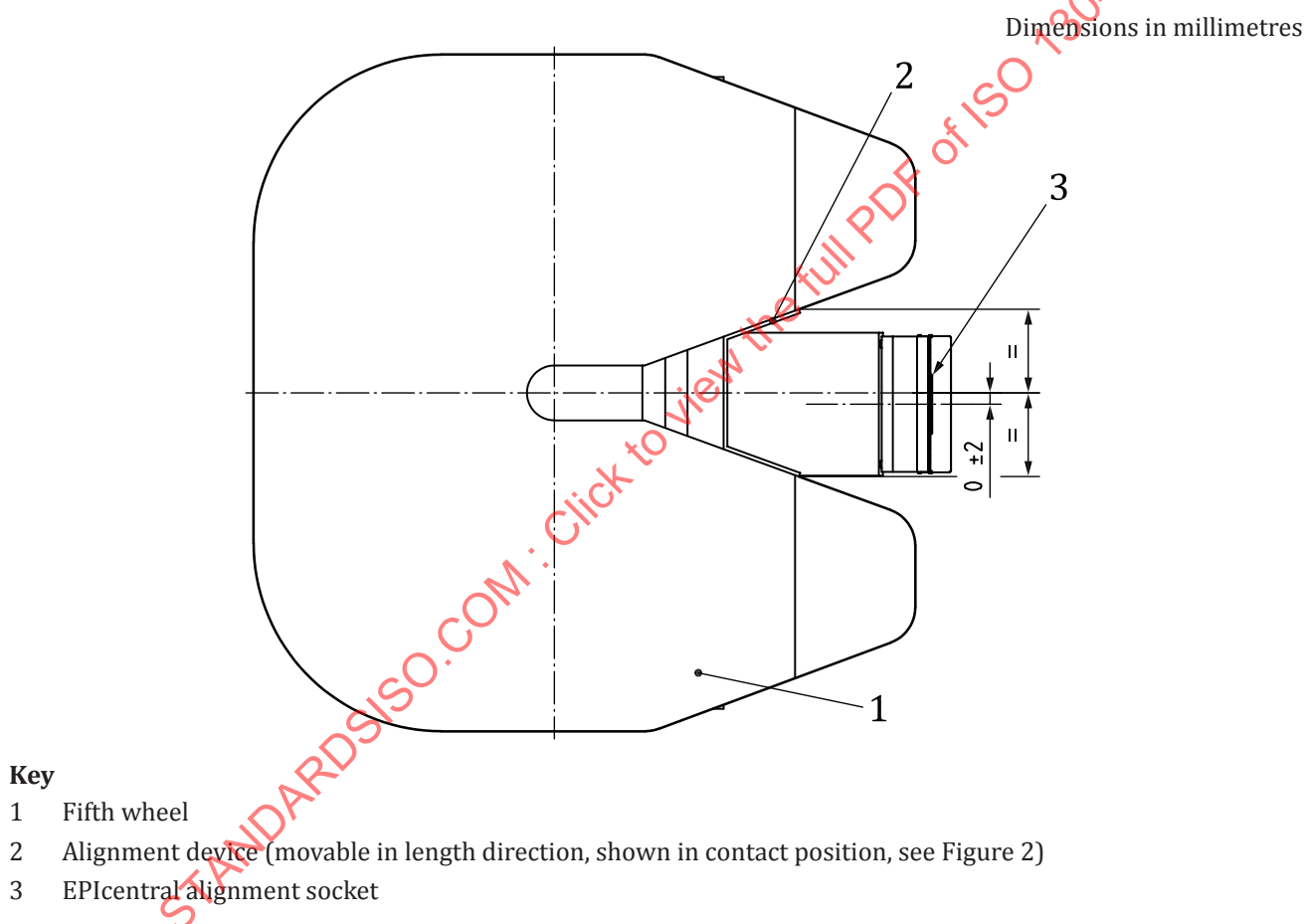


Figure 1 — EPI female module positioning tolerance (displaced shown)

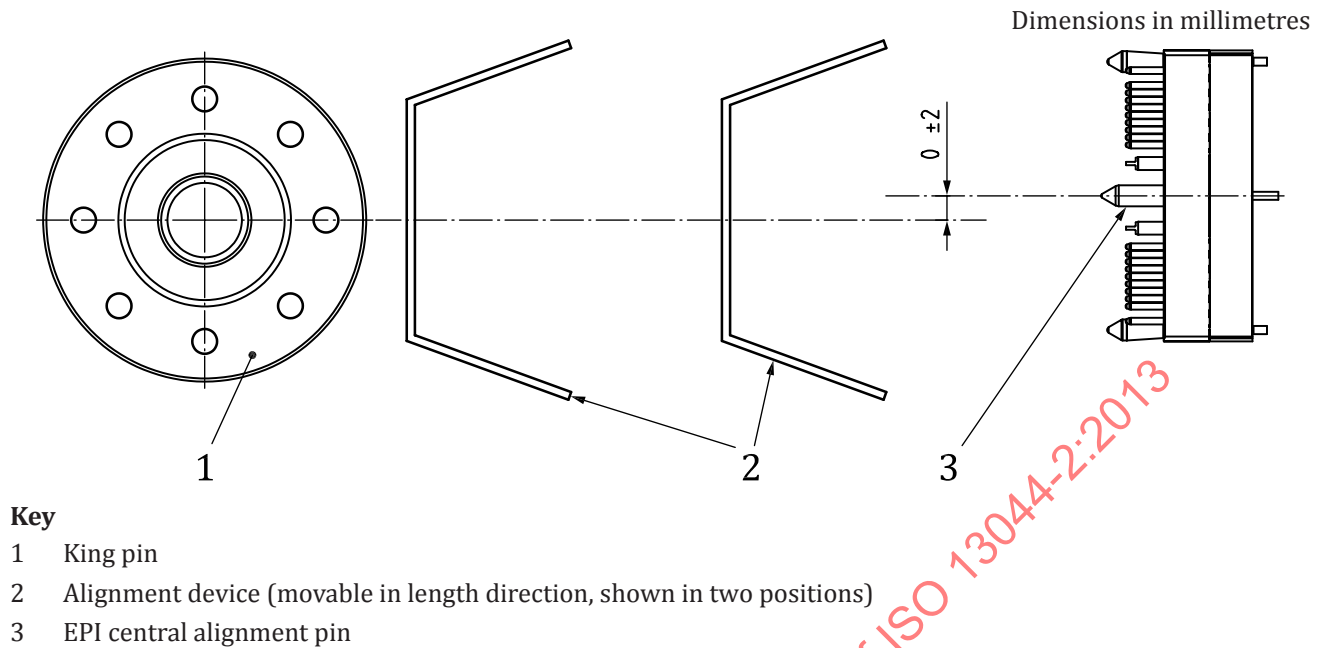


Figure 2 — EPI male module positioning tolerance (displaced shown)

4.6.2 Installation requirements of tractor-mounted EPI module

4.6.2.1 Linear degree of freedom in the longitudinal direction of alignment pin:

4.6.2.1.1 No actuator: Displaceable from 0 to a minimum of 30 mm [s2, as shown in Figure A.2 C)], preloaded with a force between 250 N to 500 N (as both pneumatic lines are under pressure) when uncoupled, achieved by means of either elastic elements or other stored energy. With the FACS coupled the EPI socket module will be pushed forward by $s_1 = 15$ mm [see Figure A.2 B)] which is the nominal position. In the coupled position, a movement as described above shall be possible, without the EPI modules being disconnected or damaged.

4.6.2.1.2 With actuator: The actuator shall move the EPI socket by at least the range described in [4.6.2.1.1](#).

4.6.2.2 Linear degree of freedom in the lateral direction: essentially fixed.

4.6.2.3 Linear degree of freedom in the vertical direction: essentially fixed.

4.6.2.4 Rotational degree of freedom around the longitudinal axis of EPI tractor alignment socket: essentially fixed.

4.6.2.5 Rotational degree of freedom around the lateral articulation axis: from horizontal to a minimum of 12° [EPI module upwards, see Figure A.2 b)].

4.6.2.6 Rotational degree of freedom around the vertical axis: essentially fixed.

4.6.3 Installation requirements of semi-trailer-mounted EPI module

4.6.3.1 Linear degree of freedom in the longitudinal direction of the alignment pin: fixed.

4.6.3.2 Linear degree of freedom in the lateral direction: essentially fixed.

4.6.3.3 Linear degree of freedom in the vertical direction: essentially fixed.

4.6.3.4 Rotational degree of freedom around the longitudinal axis of the truck alignment pin: $\pm 2^\circ$.

4.6.3.5 Rotational degree of freedom around the lateral axis: $\pm 2^\circ$.

4.6.3.6 Rotational degree of freedom around the vertical axis: $\pm 100^\circ$ around king pin axis, $\pm 2^\circ$ around vertical axis through EPI-Module.

4.6.4 Perpendicular degree of freedom of contacts

Each electric male contact shall be floating and shall align to the datum position when EPI plug and socket are engaged according to ISO 12098:2004, 4.1 and ISO 7638-1:2003, 4.1.

Each pneumatic male contact shall be floating to allow a degree of freedom of a minimum of 0,5 mm perpendicular to the main alignment pin axis and with a minimum of $\pm 0,5^\circ$ axis deviation.

4.6.5 Pneumatic valves in EPI socket module

Both pneumatic sockets have to be airtight when disconnected. These sockets shall be opened by the pneumatic plugs [see A.5 a)]. The sockets shall be fully open a minimum of 3 mm before EPI modules are mated. To compensate tolerances, the sockets shall stay fully open a minimum of 3 mm after the EPI modules are mated.

The minimum flow diameter of the pneumatic socket when fully open shall not be less than the internal diameter of the EPI pneumatic plug, which is strongly recommended to have a minimum inner diameter equivalent to 6 mm (see NOTE below).

NOTE Reductions in the internal diameter may increase the response time when tested in accordance with the procedure defined in regulations like e.g. Annex 6 to ECE Regulation 13.

4.7 Encapsulation and protection

4.7.1 General

In order to guarantee interchangeability, protection covers of the EPI modules shall be located in defined positions having devices and activation points which are determined as follows.

4.7.1.1 Protection cover on the EPI socket module

See [Annex A](#), Figures A.6 – A.8.

4.7.1.2 Protection cover on the EPI plug module

See [Annex A](#), Figures A.9.

4.7.2 EPI plug module protection cover actuation

The protection cover on the EPI plug module:

- Shall open early enough to lift the EPI socket module during the coupling process;
- Shall try to close before the kingpin reaches the coupled position;
- Shall not cause damage to any part while trying to close;
- Shall close completely in case there is no EPI socket module.

4.7.3 Gasket between plug and socket

In order to ensure a correct seal when connected, a gasket shall be installed between plug and socket on the contact surface of the EPI socket module.

See [Annex A](#), Figure A.1.

4.8 Automation of landing legs

Automated landing legs shall be power driven without necessarily being able to lift the semi-trailer.

The following parameters shall be applied when using electrical operation:

Nominal voltage: 24V;

Current limitation: 15A;

Polarity: contact L12 in Table B.1 is positive while running landing gear up;

Contact L13 in Table B.1 is positive while running landing gear down;

Operating time: minimum 20s, maximum 90s;

As the landing legs reach the end position, the current shall be cut off on the truck side within 2 s as long as 18 A are exceeded.

4.9 ISO 11992 Cable length

Part 1 of ISO 11992 specifies the respective maximum lengths of the cables allocated to the towing vehicle, trailer and interface connection. In the case of a FACS equipped towing vehicle or trailer the length associated with the interface cable is not appropriate therefore the length 7m specified for this interface may be allocated to the FACS elements of the towing vehicle and trailer as described in this paragraph. [Figure 3](#) below defines the electrical installation associated with data communications for braking and is specified as follows:

- Towing vehicle: The combined length of a + b shall be a maximum of 21 m;
- Semi-trailer: The combined length of c + d shall be a maximum of 19 m.

IMPORTANT — Using the above cable lengths ensures that the overall length of cable available to connect from the tractors ABS/EBS ECU to the trailer ABS/EBS ECU as specified in Part 1 of ISO 11992 is not exceeded.

NOTE For parameters a, b, c and d see [Figure 3](#).

4.10 Mixed mode operation

For example provisions, see [Annex C](#).

The design of this electrical circuit shall be configured in a way that a point- to-point connection is ensured as required by ISO 11992.

5 Tests and specific requirements

5.1 General

Tests and requirements for EPI modules in accordance with this Standard are specified in the following clauses. The test sequence to be followed shall be as given in Table 1. The test sequence shall be carried out in the order of the running numbers listed in Table 1 under the particular sample group. A test sequence shall be continued only if the sample meets the applicable requirements.

Table 1 — Test sequence

Item	Test title	Sample group					
		A	B	C	D	E	F
5.2	Visual examination	1, 5, 9	1, 11	1, 7, 12	1, 6	1, 7, 9	1, 8
5.3	Dimensional check	2					
5.4	Connection and disconnection	3	2	2		2	
5.5	Locking device operating test	4, 8	3, 10	3, 10			
5.6	Current carrying capacity				3		
5.7	Connection resistance		4, 7	4, 9	2, 5	6	2, 6
5.8	Current cycling				4		
5.9	Withstand voltage		5, 9	8			3, 7
5.10	Influence of water		8	11			
5.11	Protection against dust					5	
5.12	Endurance					4	
5.13	Vibration					3	4
5.14	Shock resistance	6					
5.15	Drop test	7					5
5.16	Temperature/humidity cycling		6				
5.17	Salt spray			5			
5.18	Chemical resistance			6			
5.19	Pneumatic connection leakage test					8	
5.20	Protection cover test	see 5.12					

5.2 Visual examination

Testing and requirements shall be in compliance with ISO 4091:2003, 5.1.

5.3 Dimensional check

Testing and requirements shall be in compliance with ISO 4091:2003, 5.2.

5.4 Connection and disconnection

All load-bearing mechanical components shall be able to withstand a minimum force of 1 500 N in the connecting direction.

All load-bearing mechanical components shall be able to withstand a minimum force of 1 500 N in the disconnecting direction.

In case the connector is assisted by an actuator, the force which acts on the connector shall be between 250 N and 500 N.

The peak force of the electrical female contact connecting with the corresponding electrical male contact in MMC (Maximum Material Condition) [see A.5 d)] shall be less than 5 N.

The peak force of the pneumatic female contact connecting with the corresponding pneumatic male contact in MMC (Maximum Material Condition) [see A.5 b)] shall be less than 20 N, the sliding force shall be less than 5N. These measurements shall be done without pneumatic pressure.

5.5 Locking device operation

5.5.1 Application

The following applies to connectors not equipped with a distinct locking device, but secured by means of the interlock between the 5th wheel and king pin.

5.5.2 Requirements

In order to compensate for play and tolerances, the sum of the forces acting to hold the plug and socket together shall not be less than the sum of the maximum forces defined in 5.4 throughout the connector's entire range of motion and, if forces are created by air pressure, entire ranges of pressure.

Pressure ranges in operation are:

- supply line from 6 bar to 12 bar;
- control line from 0 bar to 12 bar.

5.6 Current carrying capacity

Testing and requirements shall be in compliance with ISO 4091:2003, 5.8.

5.7 Connection resistance (voltage drop), cable capacitance and pneumatics

Testing and requirements shall be in compliance with ISO 4091:2003, 5.9.

The total cable capacitance of the data lines (b + c) 7 m shall be a maximum of 350 pF, corresponding to an average capacitance of 50 pF/m (in compliance with ISO 4141-1:2005, 6.3), for the additional FACS harness.

NOTE The example in Figure 4 for the pneumatic tubing is provided to illustrate the complete system configuration.

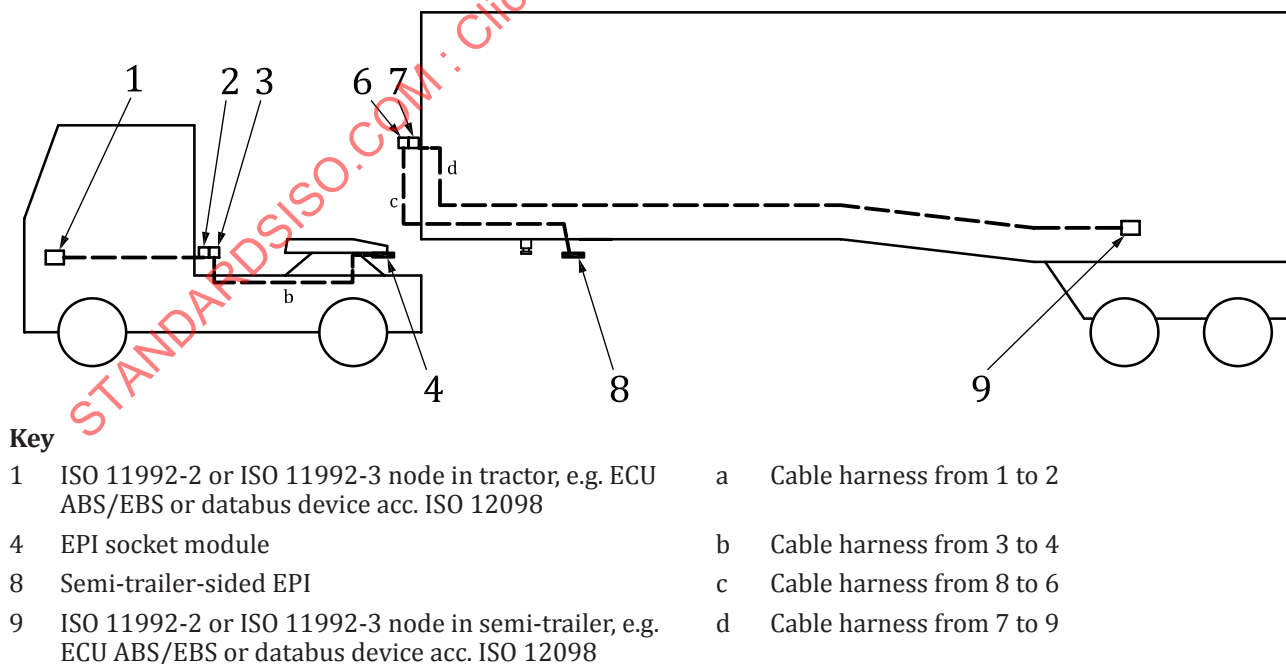


Figure 3 — Example of an electrical wiring diagram of FACS equipped tractor and semi-trailer

NOTE Connectors 2, 3, 6 and 7 enable either mixed mode or emergency operations.

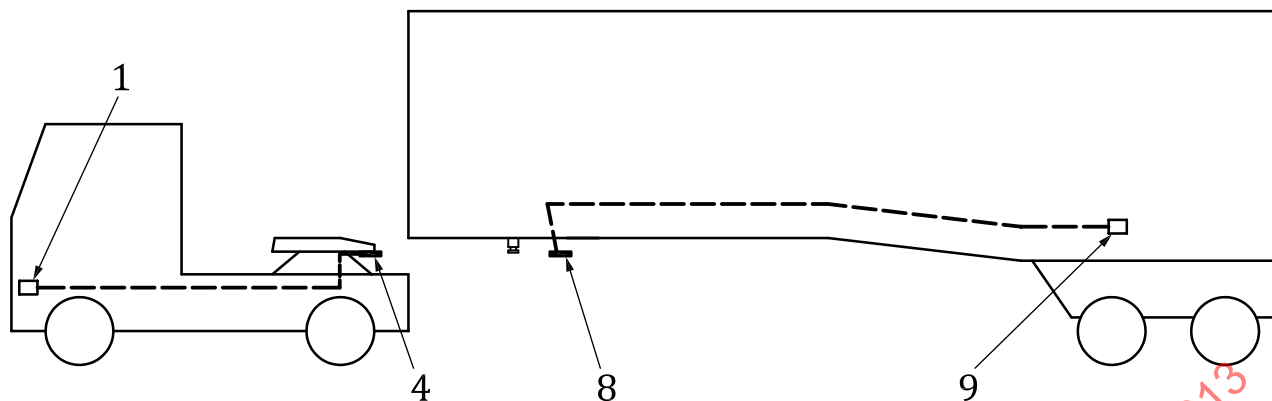
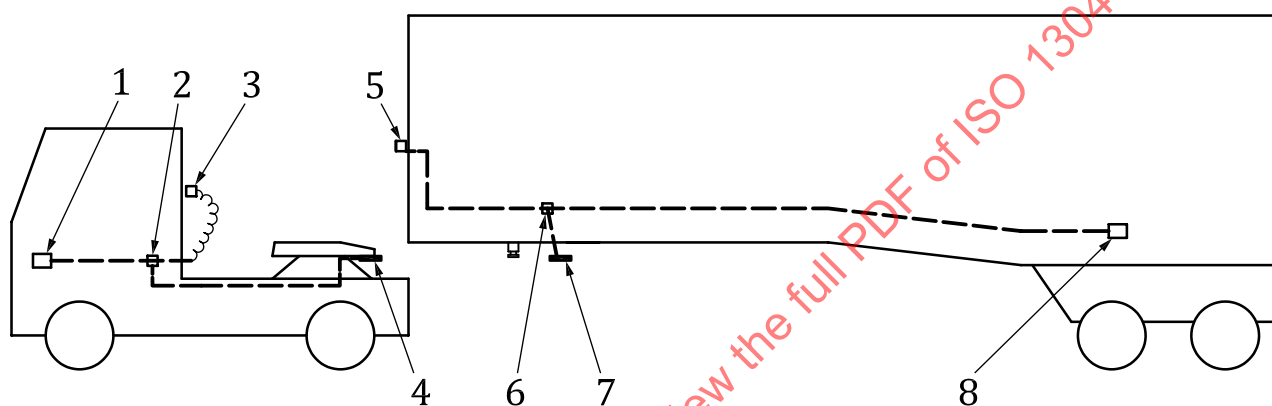


Figure 3 — a — Example of electrical wiring diagram in non-mixed mode



Key

- 1 Semi-trailer control valve mounted on tractor
- 4 Tractor-sided EPI
- 8 Semi-trailer-sided EPI
- 9 Semi-trailer regulating valve(s)

Figure 4 — Example of pneumatic tubing diagram of FACS equipped tractor and semi-trailer

NOTE Connectors 2, 3, 6 and 7 enable either mixed mode or emergency operations.

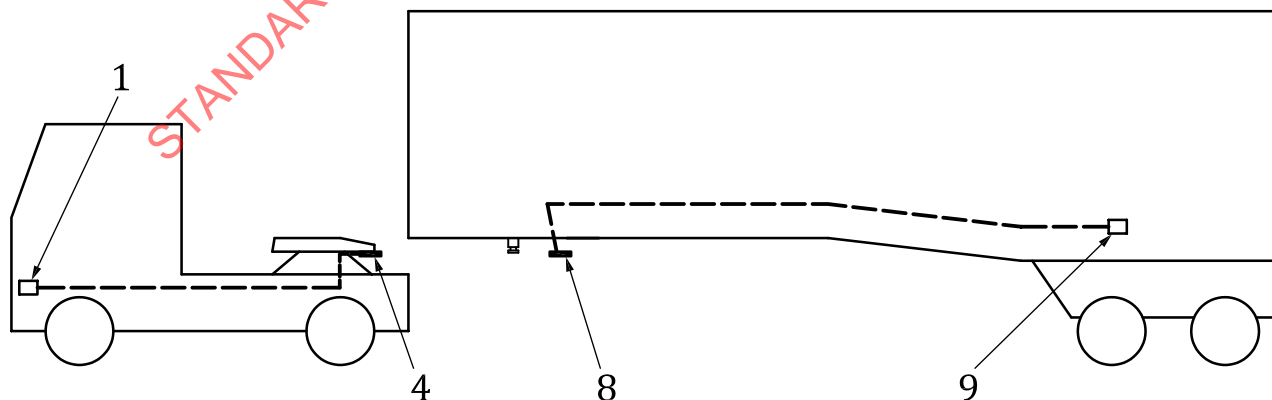


Figure 4 — a — Example of pneumatic tubing diagram in non-mixed mode

5.8 Current cycling

Testing and requirements shall be in compliance with ISO 4091:2003, 5.10.

5.9 Withstand voltage

Testing and requirements shall be in compliance with ISO 4091:2003, 5.11.

5.10 Influence of water

Testing and requirements shall be in compliance with ISO 4091:2003, 5.12.

5.11 Protection against dust

Testing and requirements shall be in compliance with ISO 4091:2003, 5.14.

5.12 Endurance

EPI modules shall conform to the endurance test conditions specified in ISO 4091, except that for the number of test cycles the following 3-step approach shall be applied:

- 9 000 cycles at a speed of 0,2 m/s (± 10 %);
- cycles at a speed of 0,2 m/s (± 10 %) under 80 % of the max allowed misalignment;
- 500 cycles at a speed of 0,6 m/s (± 10 %). The test shall include the encapsulation and protection devices described in [4.6](#).

5.13 Vibration

Testing and requirements shall be in compliance with ISO 16750-3:2012, 4.1.2.7.

Vibrational tests shall be achieved in orientation of use. If not actuator-equipped pre-load according [4.6.2.1.1](#) shall be reduced to achieve ≤ 5 mm; all other dimensions shall be nominal. The EPIs shall be tested while being mounted in their suspension assemblies. These suspensions shall include all the parts from tractor EPI to the elastic elements and axles needed to fulfil 4.6.2 respectively semi-trailer EPI and elastic elements and axles to fulfil 4.6.3.

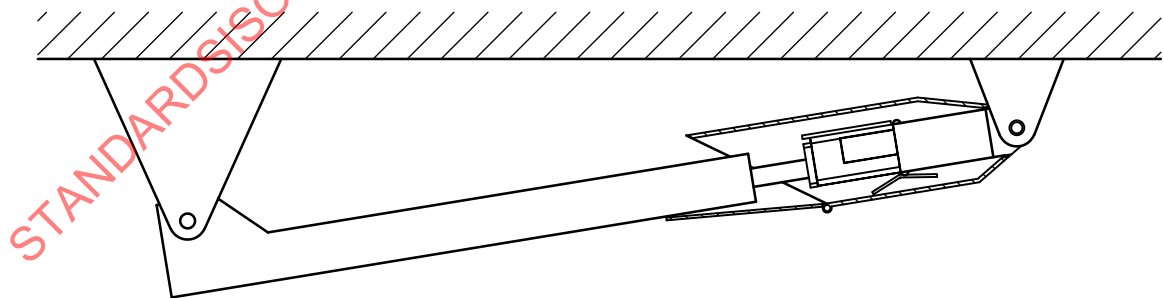


Figure 5 — Vibrational test

5.14 Shock resistance

Testing and requirements shall be in compliance with ISO 16750-3:2012, 4.2.2.

5.15 Drop test

Testing and requirements shall be in compliance with ISO 16750-3:2012, 4.3.

5.16 Temperature/humidity cycling

Testing and requirements shall be in compliance with ISO 4091:2003, 5.18.

5.17 Salt spray

The following specifications shall be taken into account:

- a) EPI modules disconnected, with flaps protection covers closed: Test conditions according to ISO 4091 with 96 h test time.
- b) EPI plug and socket module coupled: Test conditions according to ISO 4091, however, with 300 h test time.

5.18 Chemical resistance

The following chemical agents shall be selected for testing:

- lubricating oil;
- diesel fuel;
- grease;
- alkaline cleaning agent;
- neutral cleaning agent;
- white spirit;
- acid cleaning agent.

For the composition of these chemical agents, see ISO 16750-5. Testing conditions, particularly the test temperatures and test duration, shall be in compliance with ISO 16750-5.

5.19 Leakage test of pneumatic connections

Testing shall be in compliance with ISO 6150:1988 series A. However, the number of test cycles shall be 10.000.

Leakage rates shall be determined after 5 000 and 10 000 cycles with performance according to ISO 6150, 6.10.

5.20 Functional test of protection covers

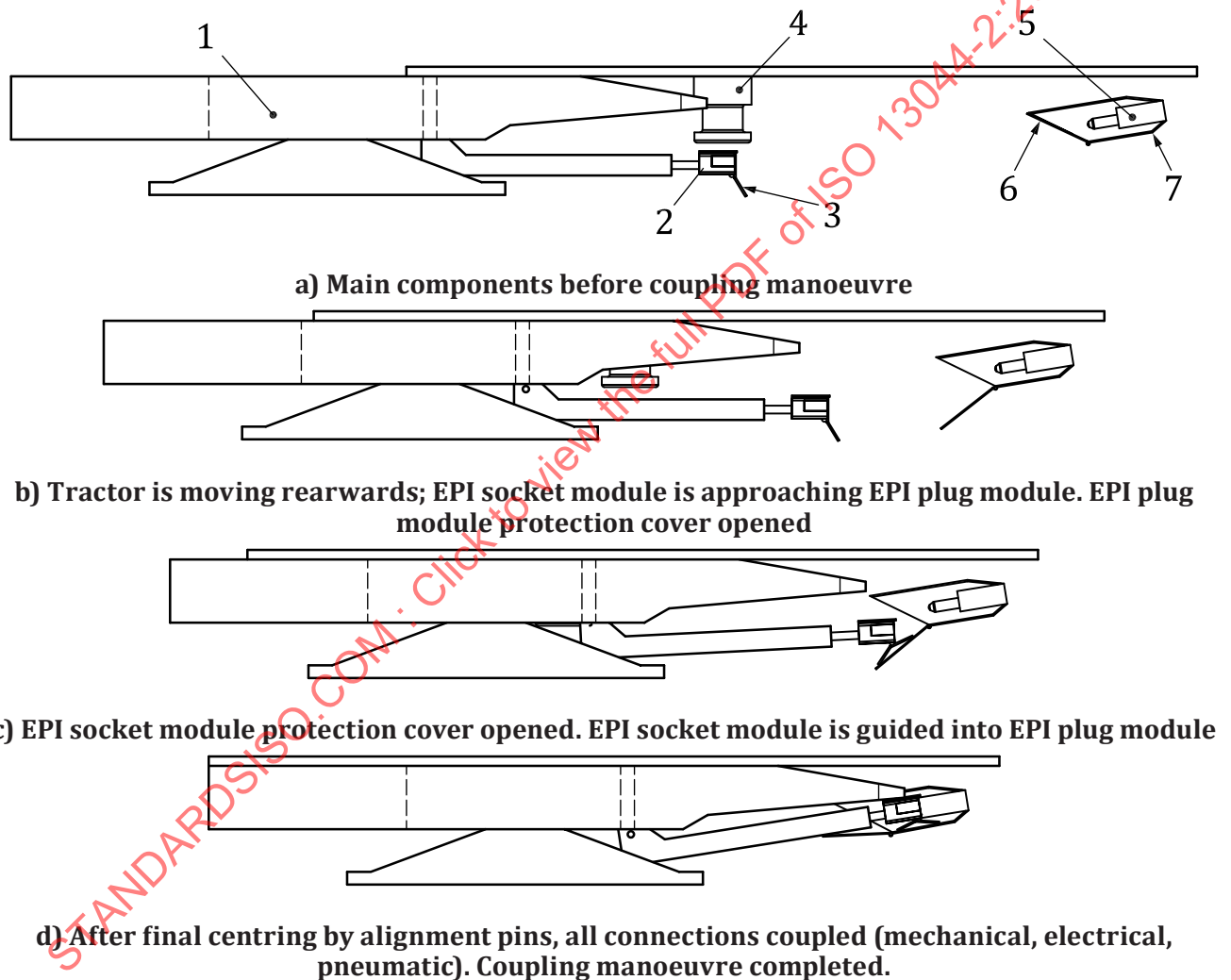
The testing of the protection cover functionality shall be included in the endurance test according to [5.12](#).

Annex A (normative)

EPI module — Dimensional characteristics

A.1 Operation sequence

The operation sequence in FACS mode shall be as specified in Figure A.1



Key

- | | |
|--------------------------------------|------------------------------------|
| 1 Fifth wheel | 5 EPI plug module |
| 2 EPI socket module | 6 EPI plug module protection cover |
| 3 EPI socket module protection cover | 7 EPI plug module housing |
| 4 King pin | |

Figure A.1 — Operation sequence in FACS mode

A.2 EPI characteristics — Positions

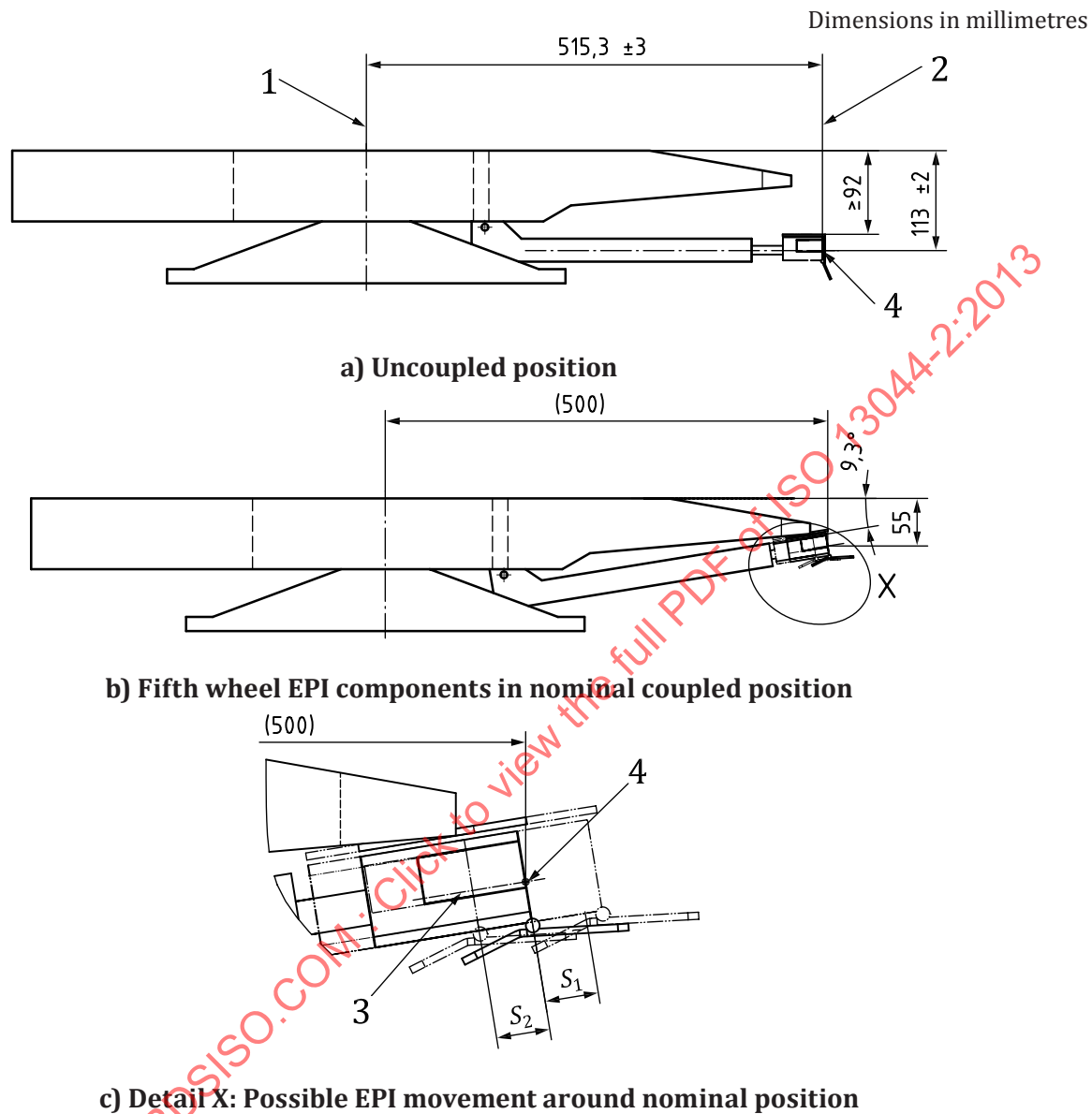
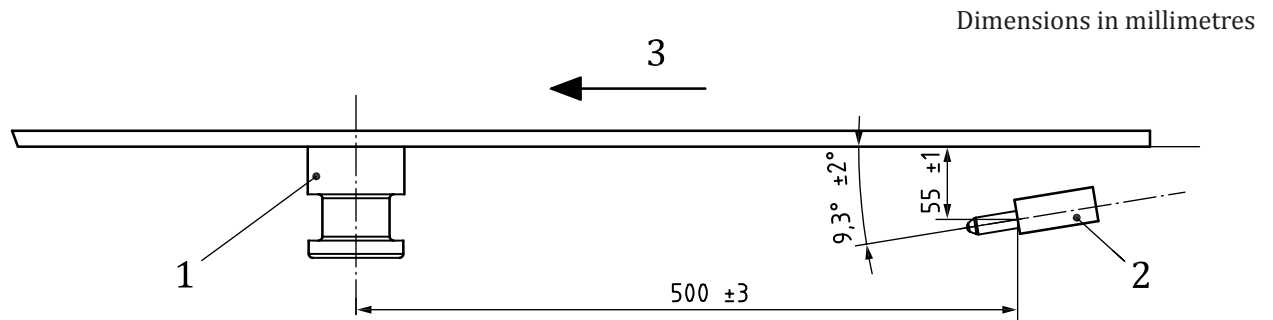


Figure A.2 — Position of the EPI socket module on the fifth wheel



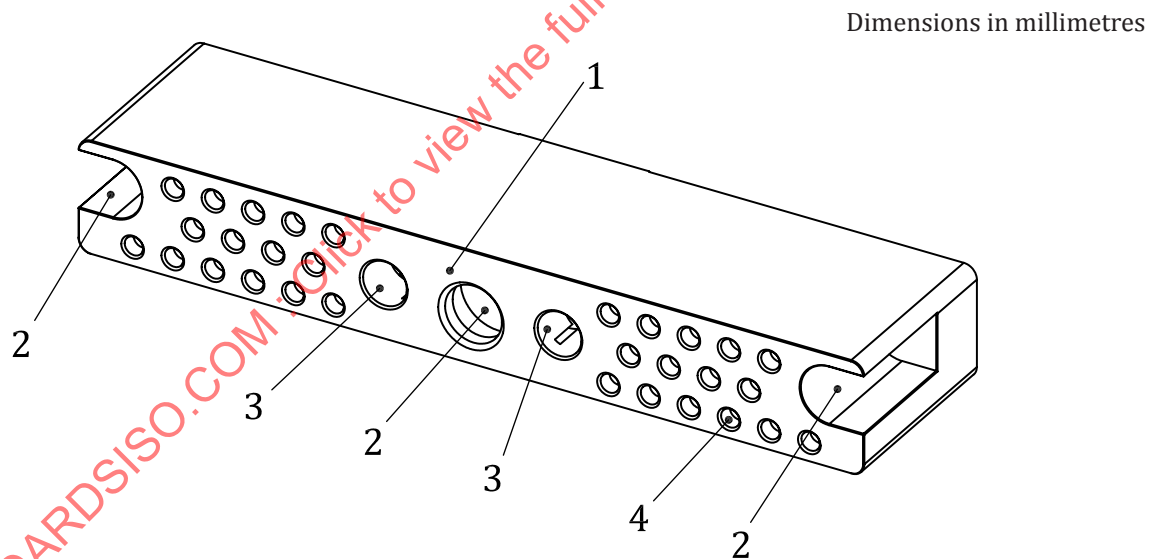
Key

- 1 Kingpin
- 2 EPI semi-trailer
- 3 Forward direction

Figure A.3 — Position of the EPI plug module

A.3 EPI characteristics — Dimensions

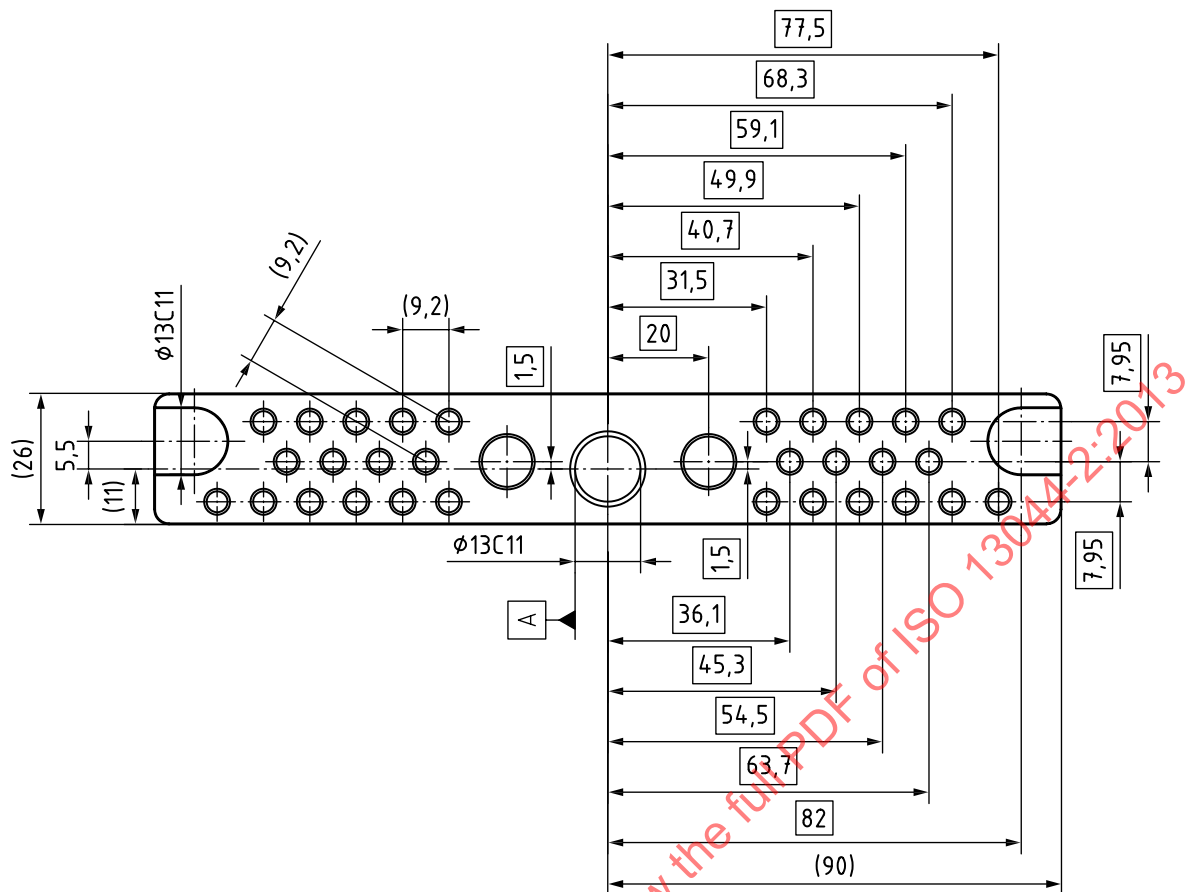
A.3.1 EPI socket module



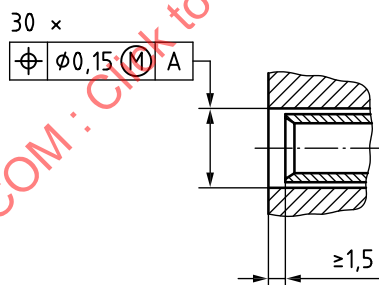
a) — Isometric view

Key

- 1 Gasket
- 2 Alignment socket
- 3 Pneumatic socket
- 4 Electric sockets (30x)



b) Dimensions — Socket front view



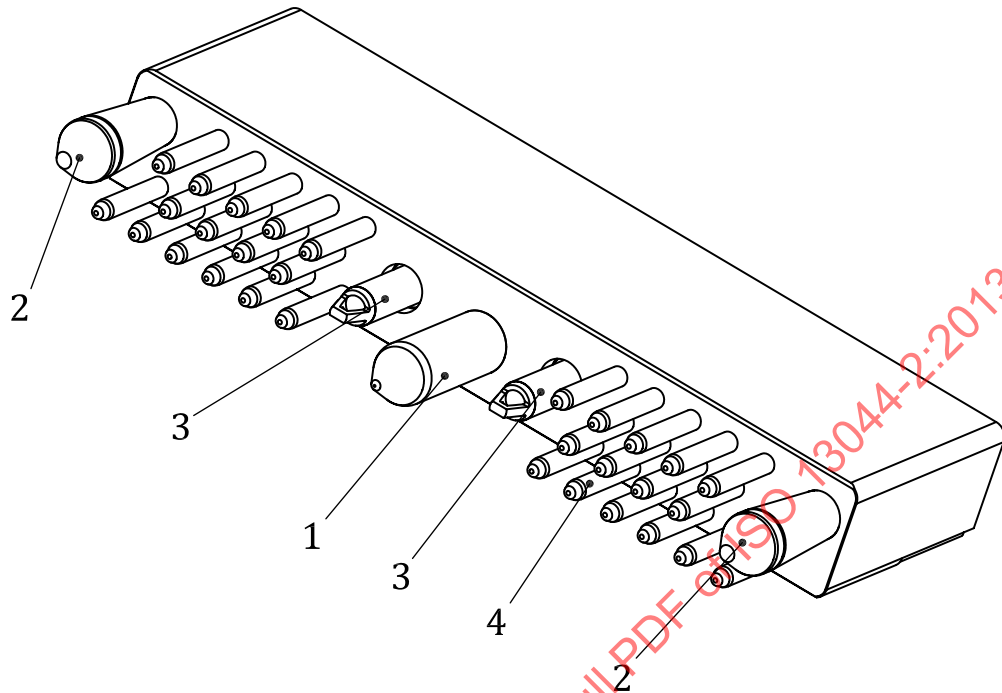
c) Dimensions of female contacts (taken from ISO 7638-1)

Figure A.4 — EPI socket module

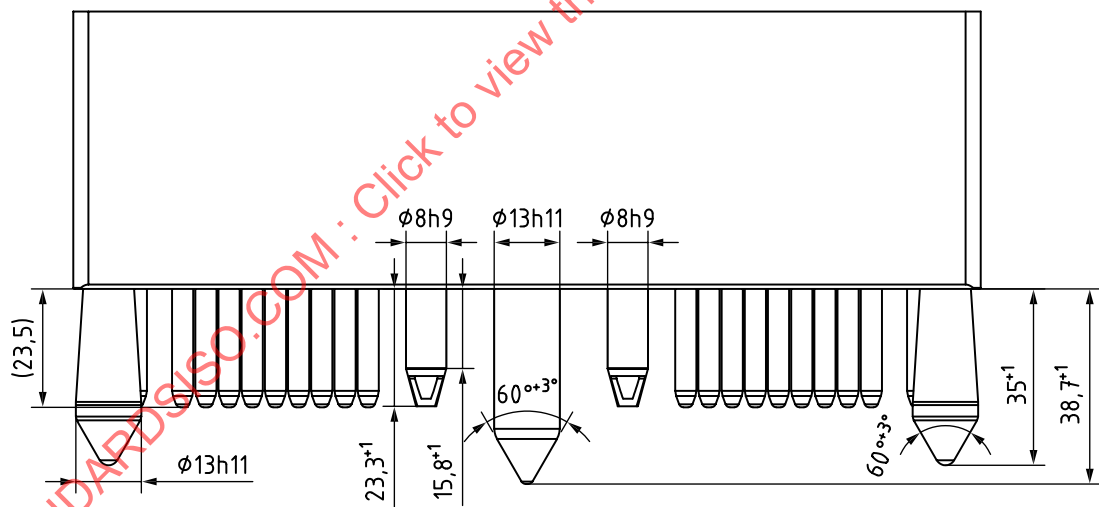
Dimensions and tolerances shall be valid for all 30 electric and 2 pneumatic female contacts.

A.3.2 EPI plug module

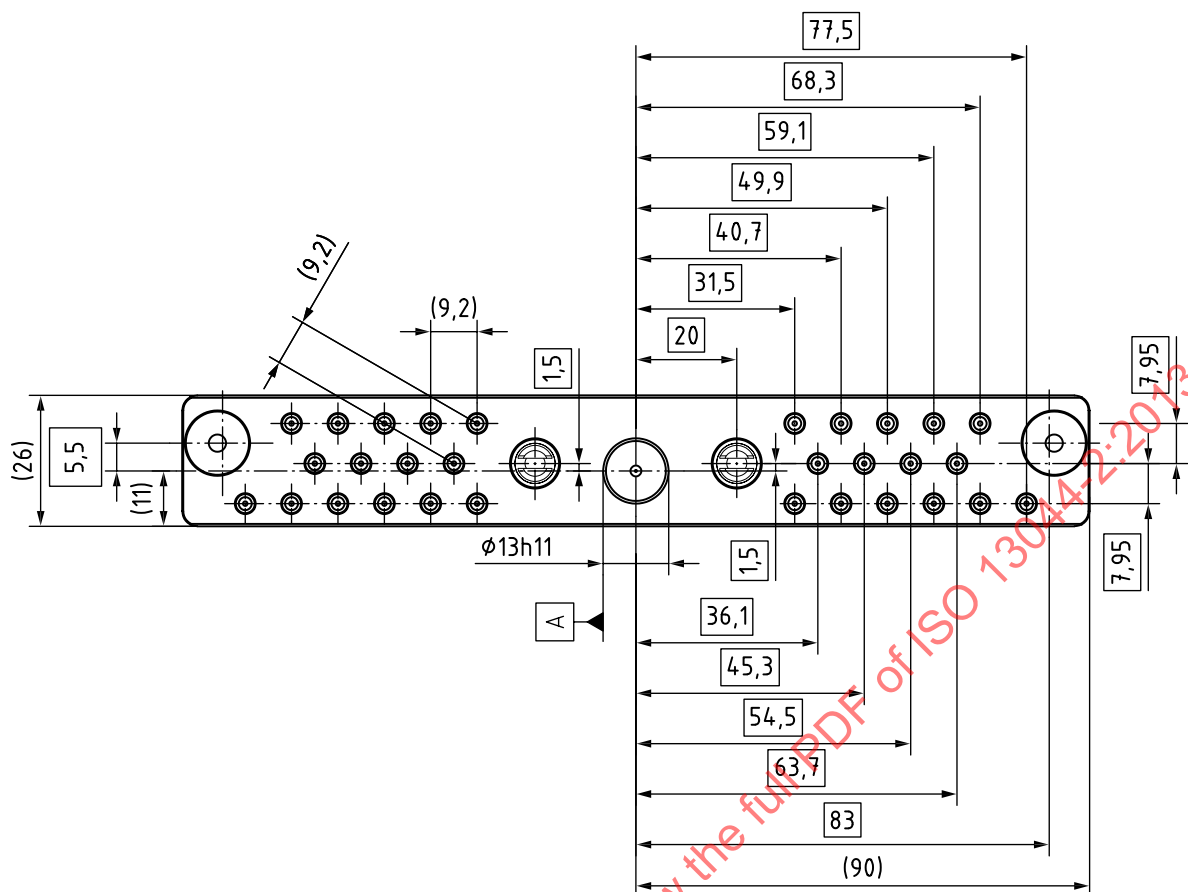
Dimensions in millimetres



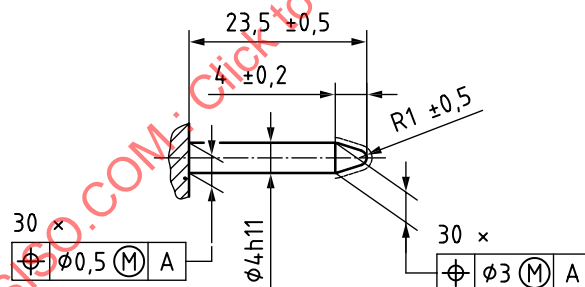
a) Isometric view



b) Dimensions — Top view



c) Dimensions — Front view



d) Dimensions of male contacts (taken from ISO 7638-1)

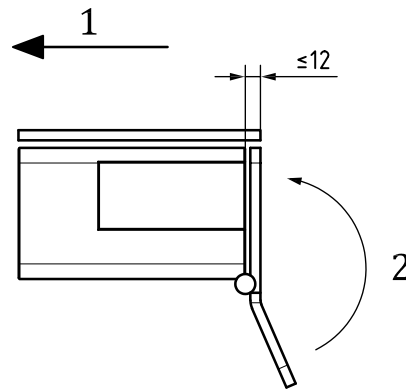
Key

- 1 Central alignment pin, rigid
- 2 Flexible outer alignment pins (2x)
- 3 Pneumatic male connections (2x)
- 4 Electric male contacts (30x)

Figure A.5 — EPI plug module

Dimensions and tolerances shall be valid for all 30 electric and 2 pneumatic male contacts.

Dimensions in millimetres



Key

- 1 Driving direction
- 2 Shutting torque min. 0,05 Nm, max. 0,2 Nm as cover is closed

Figure A.6 — EPI socket module protection — Closed position (left side view)

Dimensions in millimetres

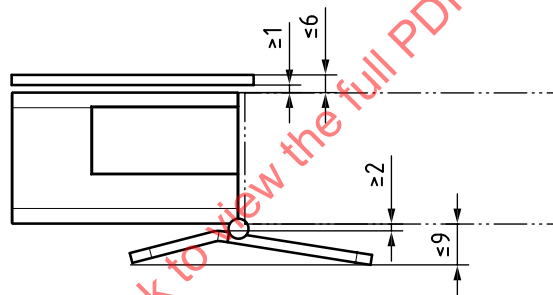


Figure A.7 — EPI socket module protection — Opened position

Dimensions in millimetres

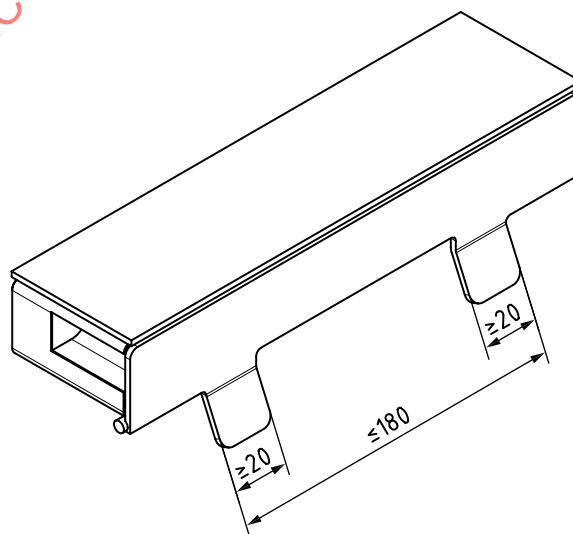
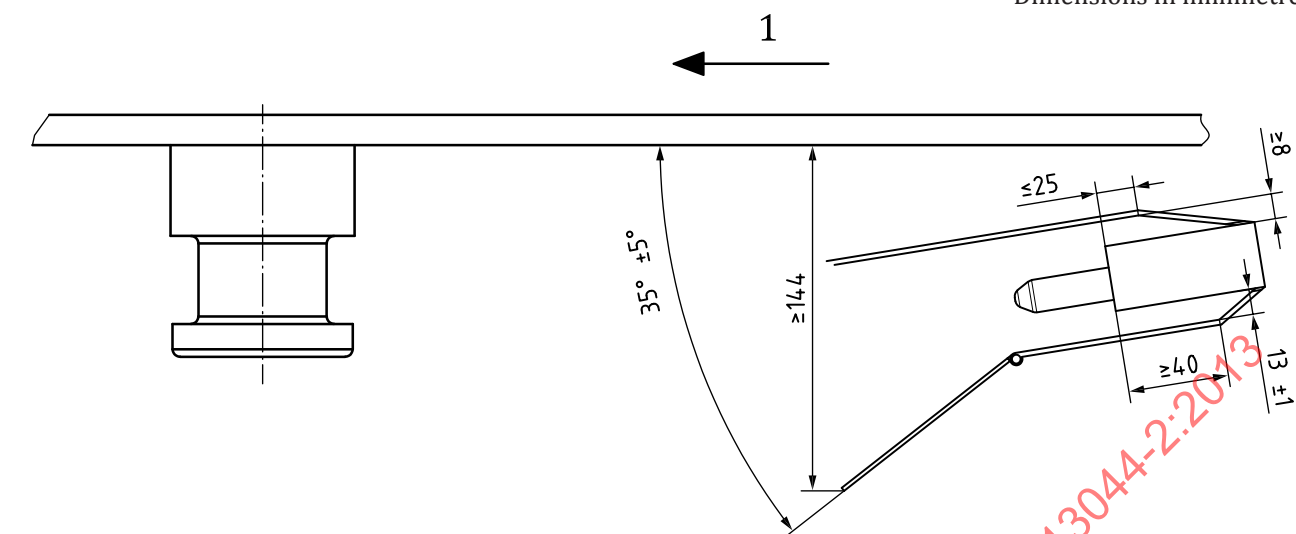


Figure A.8 — EPI socket module protection activation tabs - Socket front view

Dimensions in millimetres



Key

1 Driving direction

Figure A.9 — EPI module protection - Opened position, dimensions

Annex B (normative)

EPI module — Contact allocation

The electric and pneumatic contacts shall be allocated as specified in Table B.1.

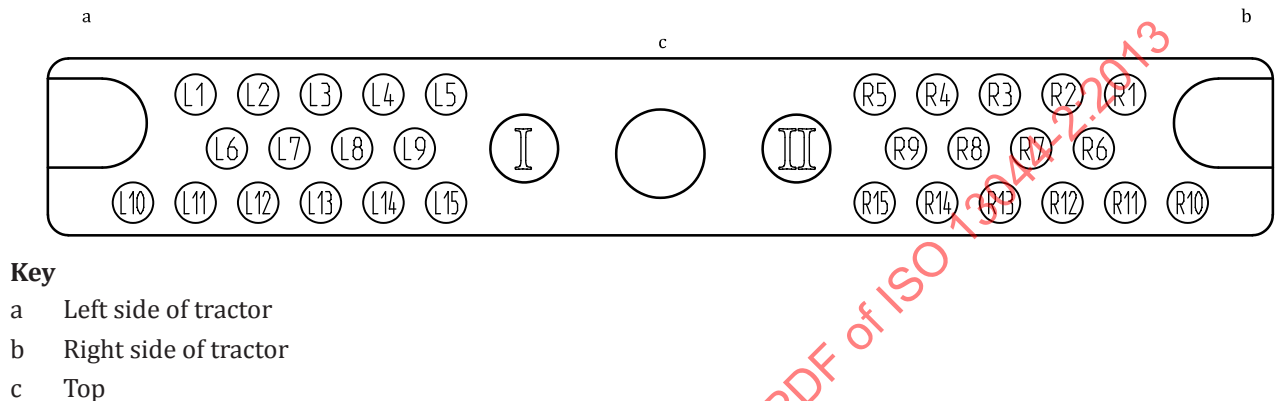


Figure B.1 — Contact allocation — Rear view of socket, tractor side

NOTE For detailed allocation see Table B.1.

Table B.1 — Electric and pneumatic contact allocation

Contact No.	^a min mm ²	Reference	Function
L 1	4	ISO 7638-1 Pin 1	ABS/EBS plus electrovalve
L 2	1,5	ISO 7638-1 Pin 2	ABS/EBS plus electronics
L 3	1,5	ISO 7638-1 Pin 3	ABS/EBS minus electronics
L 4	4	ISO 7638-1 Pin 4	ABS/EBS minus electrovalve
L 5	1,5	ISO 7638-1 Pin 5	ABS/EBS warning device
L 6	1,5	ISO 7638-1 Pin 6	ABS/EBS CAN High according to ISO 11992-1 and 11992-2, for data interchange of braking systems and running gear
L 7	1,5	ISO 7638-1 Pin 7	ABS/EBS CAN Low according to ISO 11992-1 and 11992-2, for data interchange of braking systems and running gear
L 8	6	New	Return for pin L 10
L 9	6	New	Return for pin L 11
L 10	6	New	Permanent power supply for additional equipment 1
L 11	6	New	Permanent power supply for additional equipment 2
L 12	2,5	New	Electric landing gear 1
L 13	2,5	New	Electric landing gear 2
L 14	1,5	New	Multi media
L 15	1,5	New	Multi media
R 1	1,5	ISO 12098 Pin 1	Left-hand direction indicator light
R 2	1,5	ISO 12098 Pin 2	Right-hand direction indicator light

^a Nominal cross-sectional area of the conductor connected at the rear terminal of the pin and tube