



BSI Standards Publication

Rough-terrain trucks — Safety requirements and verification

Part 6: Application of EN ISO 13849-1 to slewing and non-slewing variable-reach rough-terrain truck

National foreword

This Published Document is the UK implementation of CEN/TR 1459-6:2015.

The UK participation in its preparation was entrusted to Technical Committee MHE/7, Industrial trucks.

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

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

© The British Standards Institution 2015. Published by BSI Standards Limited 2015

ISBN 978 0 580 83396 0

ICS 53.060

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

This Published Document was published under the authority of the Standards Policy and Strategy Committee on 30 September 2015.

Amendments issued since publication

Date	Text affected
------	---------------

ICS 53.060

English Version

**Rough-terrain trucks - Safety requirements and verification –
Part 6: Application of EN ISO 13849-1 to slewing and non-
slewing variable-reach rough-terrain truck**

This Technical Report was approved by CEN on 6 July 2015. It has been drawn up by the Technical Committee CEN/TC 150.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

Contents

	Page
European foreword.....	5
Introduction.....	6
1 Scope.....	7
2 Normative references.....	7
3 Terms and definitions.....	7
4 General.....	8
5 Description of the procedure followed to determine PL _r for SRP/CS of trucks.....	11
6 Risk assessment methodology.....	11
7 Risk Assessment Process.....	12
7.1 Determination of Machine limits.....	12
7.2 Hazard identification (5.4 annex B of EN ISO 12100).....	14
7.3 Risk evaluation.....	15
8 Required performance level for SRP/CS of trucks.....	16
8.1 prEN 1459-1.....	16
8.2 prEN 1459-2.....	17
8.3 prEN 1459-3.....	18
Annex A (informative) Hazard identification.....	19
A.1 prEN 1459-1.....	19
A.2 EN 1459-2.....	26
A.3 EN 1459-3.....	30
Annex B (informative) Numerical weighting of Risk Priority Number (RPN).....	32
Annex C (informative) Risk priority number and corresponding performance level.....	33
Annex D (informative) Comparison of risks prEN 1459-1 and EN 1459-2.....	34
Annex E (informative) Risk Estimation and Evaluation.....	38
E.1 Hazard Identification Risk Estimation and Evaluation from 1.1. to 1.7 Operator.....	38
E.2 Hazard Identification Risk Estimation and Evaluation from 1.1. to 1.7 Co-worker.....	42
E.3 Hazard Identification Risk Estimation and Evaluation from 1.1. to 1.7 Bystander.....	45
E.4 Hazard Identification Risk Estimation and Evaluation from 2.1. to 2.8 Operator.....	48
E.5 Hazard Identification Risk Estimation and Evaluation from 2.1. to 2.8 Co-worker.....	51
E.6 Hazard Identification Risk Estimation and Evaluation from 2.1. to 2.8 Bystander.....	54
E.7 Hazard Identification Risk Estimation and Evaluation from 3.1. to 3.5 Operator.....	57
E.8 Hazard Identification Risk Estimation and Evaluation from 3.1. to 3.5 Co-worker.....	60
E.9 Hazard Identification Risk Estimation and Evaluation from 3.1. to 3.5 Bystander.....	63
E.10 Hazard Identification Risk Estimation and Evaluation from 3.6. to 3.9 Operator.....	66
E.11 Hazard Identification Risk Estimation and Evaluation from 3.6. to 3.9 Co-worker.....	69
E.12 Hazard Identification Risk Estimation and Evaluation from 3.6. to 3.13 Bystander.....	72
E.13 Hazard Identification Risk Estimation and Evaluation from 3.10. to 3.13 Operator.....	76
E.14 Hazard Identification Risk Estimation and Evaluation from 3.10. to 3.13 Co-worker.....	79
E.15 Hazard Identification Risk Estimation and Evaluation from 4.1. to 4.3 Operator.....	82
E.16 Hazard Identification Risk Estimation and Evaluation from 4.1. to 4.3 Co-worker.....	85
E.17 Hazard Identification Risk Estimation and Evaluation from 4.1. to 4.3 Bystander.....	88
E.18 Hazard Identification Risk Estimation and Evaluation from 4.4. to 4.9 Operator.....	90
E.19 Hazard Identification Risk Estimation and Evaluation from 4.4. to 4.9 Co-worker.....	93
E.20 Hazard Identification Risk Estimation and Evaluation from 4.4. to 4.9 bystander.....	96
E.21 Hazard Identification Risk Estimation and Evaluation from 4.10. to 4.15 Operator.....	99
E.22 Hazard Identification Risk Estimation and Evaluation from 4.12. to 4.16 Co-worker.....	102
E.23 Hazard Identification Risk Estimation and Evaluation from 4.12. Bystander.....	105
E.24 Hazard Identification Risk Estimation and Evaluation from 6.1. to 6.5 Operator.....	107

E.25	Hazard Identification Risk Estimation and Evaluation from 6.1. to 6.5 Co-worker.....	110
E.26	Hazard Identification Risk Estimation and Evaluation from 6.4. to 6.9 Bystander	113
E.27	Hazard Identification Risk Estimation and Evaluation from 6.6. to 6.10 Operator	116
E.28	Hazard Identification Risk Estimation and Evaluation from 6.6. to 6.10 Co-worker.....	119
E.29	Hazard Identification Risk Estimation and Evaluation from 6.10. to 6.15 Bystander	122
E.30	Hazard Identification Risk Estimation and Evaluation from 6.11. to 6.14 Operator	125
E.31	Hazard Identification Risk Estimation and Evaluation from 6.11. to 6.14 Co-worker.....	128
E.32	Hazard Identification Risk Estimation and Evaluation from 6.15. to 6.18 Operator	131
E.33	Hazard Identification Risk Estimation and Evaluation from 6.15. to 6.18 Co-worker.....	134
E.34	Hazard Identification Risk Estimation and Evaluation from 7.1. to 7.10 Operator	137
E.35	Hazard Identification Risk Estimation and Evaluation from 7.1. to 7.5 Co-worker.....	140
E.36	Hazard Identification Risk Estimation and Evaluation from 7.1. to 7.8 Bystander	143
E.37	Hazard Identification Risk Estimation and Evaluation from 7.6. to 7.10 Co-worker.....	146
E.38	Hazard Identification Risk Estimation and Evaluation from 8.1. to 8.7 Operator	149
E.39	Hazard Identification Risk Estimation and Evaluation from 8.1. to 8.4 Co-worker.....	152
E.40	Hazard Identification Risk Estimation and Evaluation from 8.2. to 8.5 Bystander	155
E.41	Hazard Identification Risk Estimation and Evaluation from 8.8 to 8.12 Operator	158
E.42	Hazard Identification Risk Estimation and Evaluation from 8.5. to 8.8 Co-worker.....	161
E.43	Hazard Identification Risk Estimation and Evaluation from 8.9. to 8.12 Co-worker.....	164
E.44	Hazard Identification Risk Estimation and Evaluation from 9.1. to 9.5 Co-worker.....	167
E.45	Hazard Identification Risk Estimation and Evaluation from 9.1. to 9.4 Bystander.....	170
E.46	Hazard Identification Risk Estimation and Evaluation 10.2 Operator	173
E.47	Hazard Identification Risk Estimation and Evaluation from 10.1 to 10.2 Co-worker.....	174
E.48	Hazard Identification Risk Estimation and Evaluation 10.2 Bystander	177
E.49	Hazard Identification Risk Estimation and Evaluation from 18.1 to 18.4 Operator	180
E.50	Hazard Identification Risk Estimation and Evaluation from 18.13 to 18.17 Co-worker.....	183
E.51	Hazard Identification Risk Estimation and Evaluation from 18.13 to 18.21 Bystander	186
E.52	Hazard Identification Risk Estimation and Evaluation from 18.4 to 18.8 Operator	189
E.53	Hazard Identification Risk Estimation and Evaluation from 18.18 to 18.22 Co-worker.....	192
E.54	Hazard Identification Risk Estimation and Evaluation from 18.9 to 18.12 Operator	195
E.55	Hazard Identification Risk Estimation and Evaluation from 18.13 to 18.16 Operator	198
E.56	Hazard Identification Risk Estimation and Evaluation from 19.1 to 19.4 Operator	201
E.57	Hazard Identification Risk Estimation and Evaluation from 19.9 to 19.13 Co-worker.....	204
E.58	Hazard Identification Risk Estimation and Evaluation from 19.10 to 19.13 Bystander	207
E.59	Hazard Identification Risk Estimation and Evaluation from 19.5 to 19.16 Operator	210
E.60	Hazard Identification Risk Estimation and Evaluation from 19.17 to 19.20 Operator	213
E.61	Hazard Identification Risk Estimation and Evaluation from 20.1 to 20.5 Operator	216
E.62	Hazard Identification Risk Estimation and Evaluation from 20.1 to 20.5 Co-worker.....	219
E.63	Hazard Identification Risk Estimation and Evaluation from 20.1 to 20.5 Bystander.....	222
E.64	Hazard Identification Risk Estimation and Evaluation from 20.6 to 20.10 Operator	225
E.65	Hazard Identification Risk Estimation and Evaluation from 20.6 to 20.10 Co-worker.....	228
E.66	Hazard Identification Risk Estimation and Evaluation from 20.6 to 20.10 Bystander	231
E.67	Hazard Identification Risk Estimation and Evaluation from 20.11 to 20.15 Operator	234
E.68	Hazard Identification Risk Estimation and Evaluation from 20.11 to 20.15 Co-worker.....	237
E.69	Hazard Identification Risk Estimation and Evaluation from 20.11 to 20.15 Bystander	240
E.70	Hazard Identification Risk Estimation and Evaluation from 21.1 to 21.5 Operator	243
E.71	Hazard Identification Risk Estimation and Evaluation from 21.1 to 21.4 Co-worker.....	246
E.72	Hazard Identification Risk Estimation and Evaluation from 21.1 to 21.3 Bystander	249
E.73	Hazard Identification Risk Estimation and Evaluation from 21.6 to 21.9 Operator	252
E.74	Hazard Identification Risk Estimation and Evaluation from 21.5 to 21.9 Co-worker.....	255
E.75	Hazard Identification Risk Estimation and Evaluation from 21.4 to 21.6 Bystander	258
E.76	Hazard Identification Risk Estimation and Evaluation from 22a.1 to 22a.5 Operator	261
E.77	Hazard Identification Risk Estimation and Evaluation from 22a.1 to 22a.5 Co-worker.....	264
E.78	Hazard Identification Risk Estimation and Evaluation from 22a.1 to 22a.4 Bystander	267
E.79	Hazard Identification Risk Estimation and Evaluation from 22a.6 to 22a.10 Operator	270
E.80	Hazard Identification Risk Estimation and Evaluation from 22a.6 to 22a.10 Co-worker.....	273
E.81	Hazard Identification Risk Estimation and Evaluation from 22a.7 to 22a.10 Bystander	276
E.82	Hazard Identification Risk Estimation and Evaluation from 22b.1 to 22b.4 Operator	279
E.83	Hazard Identification Risk Estimation and Evaluation from 22b.1 to 22b.4 Co-worker	282
E.84	Hazard Identification Risk Estimation and Evaluation from 22b.7 to 22b.9 Bystander	285
E.85	Hazard Identification Risk Estimation and Evaluation from 22b.5 to 22b.8 Operator	288

E.86	Hazard Identification Risk Estimation and Evaluation from 22b.5 to 22b.8 Co-worker.....	291
E.87	Hazard Identification Risk Estimation and Evaluation from 22b.10 to 22b.12 Bystander.....	294
E.88	Hazard Identification Risk Estimation and Evaluation from 22b.9 to 22b.12 Operator	297
E.89	Hazard Identification Risk Estimation and Evaluation from 22b.9 to 22b.13 Co-worker.....	300
E.90	Hazard Identification Risk Estimation and Evaluation from 22b.13 to 22b.15 Operator	303
E.91	Hazard Identification Risk Estimation and Evaluation from 22b.14 to 22b.18 Co-worker	306
E.92	Hazard Identification Risk Estimation and Evaluation from 22b.16 to 22b.18 Operator	309
E.93	Hazard Identification Risk Estimation and Evaluation from 22c.1 to 22c.3 Operator.....	312
E.94	Hazard Identification Risk Estimation and Evaluation from 22c.1 to 22c.3 Co-worker.....	315
E.95	Hazard Identification Risk Estimation and Evaluation from 22c.3 to 22c.4 Bystander	318
E.96	Hazard Identification Risk Estimation and Evaluation from 22c.4 to 22c.6 Operator.....	321
E.97	Hazard Identification Risk Estimation and Evaluation from 22c.4 to 22c.6 Co-worker.....	324
E.98	Hazard Identification Risk Estimation and Evaluation from 22d.1 to 22d.6 Operator	327
E.99	Hazard Identification Risk Estimation and Evaluation from 22d.1 to 22d.6 Co-worker.....	330
E.100	Hazard Identification Risk Estimation and Evaluation from 22d.3 to 22d.4 Bystander.....	333
	Bibliography	342

European foreword

This document (CEN/TR 1459-6:2015) has been prepared by Technical Committee CEN/TC 150 “Industrial Trucks - Safety”, the secretariat of which is held by BSI.

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

EN 1459 consists of the following parts, under the general title *Rough-terrain trucks — Safety requirements and verification*:

- *Part 1: Variable-reach trucks*
- *Part 2: Slewing variable-reach trucks*
- *Part 3: Interface between the variable-reach truck and the work platform*
- *Part 4: Additional requirements for variable reach trucks handling freely suspended loads*
- *Part 5: Additional requirements for attachments and attachment interfaces*
- *Part 6: Application of EN ISO 13849-1 to slewing and non-slewing variable-reach rough-terrain trucks*

Introduction

This Technical Report has been prepared to explain the rationale used to determine the minimum required Performance Levels for rough terrain variable reach trucks as listed in EN 1459 series.

It is intended to provide solid basis to the Performance Level Required (PL_r) required for the Safety Related Part of Control System (SRP/CS) referred to in prEN 1459-1, EN 1459-2 and EN 1459-3. The PL_r have been defined by using approaches from appropriate standards for safety of machinery and proven general principles for design.

The methodology described in this Technical Report may be used by other Technical Committees to assess the risk and determine PL_r for machines covered by other type C-standards.

1 Scope

This Technical Report describes the risk assessment methodology followed to determine the Performance Level required (PL_r), as defined in EN ISO 13849-1:2008, for specific safety related parts of control system (SRP/CS) of rough-terrain variable-reach trucks covered by prEN 1459-1, EN 1459-2 and EN 1459-3.

This Technical Report does not apply to SRP/CS that includes no electrical/electronic components.

NOTE It is the intention of CEN TC150 WG2 to use the same methodology to develop future standards (e.g. further parts of EN 1459).

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.

prEN 1459-1:2015, *Rough-terrain trucks — Safety requirements and verification — Part 1: Variable-reach trucks*

EN 1459-2:2015 *Rough-terrain trucks — Safety requirements and verification — Part 2: Slewing variable-reach trucks*

EN 1459-3:2015 *Rough-terrain trucks — Safety requirements and verification — Part 3: Interface between the variable-reach truck and the work platform*

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

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

ISO/TR 14121-2:2012 *Safety of machinery — Risk assessment — Part 2: Practical guidance and examples of methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in EN ISO 12100, prEN 1459-1:2015, EN 1459-2:2015 and EN 1459-3:2015 and the following apply.

3.1

operator

competent person who controls the operation of the truck

3.2

co-worker

trained person who is working in the vicinity of the truck but not in control of the truck

3.3

by-stander

untrained person who is in the vicinity of the truck and not involved in the job site activity