

საქართველოს სტანდარტი

კომპრესორები და ვაკუუმ-ტუმბოები- უსაფრთხოების მოთხოვნები -ნაწილი 3:
პროცესის კომპრესორები

საინფორმაციო ნაწილი. სრული ტექსტის სანახავად შეიძინეთ სტანდარტი.

საქართველოს სტანდარტებისა და მეტროლოგიის
ეროვნული სააგენტო
თბილისი

სსტ ენ 1012-3:2013/2018

საინფორმაციო მონაცემები

1 დამტკიცებულია და შემოღებულია სამოქმედოდ საქართველოს სტანდარტებისა და მეტროლოგიის ეროვნული სააგენტოს 2018 წლის 02 ოქტომბრის № 98 და 2018 წლის 06 ივლისის № 75 განკარგულებებით

2 მიღებულია თავფურცლის თარგმნის მეთოდით სტანდარტიზაციის ევროპული კომიტეტის სტანდარტი ენ 1012-3:2013 „ კომპრესორები და ვაკუუმ-ტუმბოები-უსაფრთხოების მოთხოვნები -ნაწილი 3: პროცესის კომპრესორები”

3 პირველად

4 რეგისტრირებულია საქართველოს სტანდარტებისა და მეტროლოგიის ეროვნული სააგენტოს რეესტრში: 2018 წლის 02 ოქტომბერი №268-1.3-014049

აკრძალულია ამ სტანდარტის გადაცემა მესამე პირებისათვის ან/და მისი სხვა ფორმით გავრცელება

საინფორმაციო ნაწილი. სრული ტექსტის საანახავად შეიძინეთ სტანდარტი.

ICS 23.140; 23.160

English Version

Compressors and vacuum pumps - Safety requirements - Part 3: Process compressors

Compresseurs et pompes à vide - Prescriptions de sécurité
- Partie 3: Compresseurs de procédé

Kompressoren und Vakuumpumpen -
Sicherheitsanforderungen - Teil 3: Prozesskompressoren

This European Standard was approved by CEN on 8 September 2013.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

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

Foreword.....5

Introduction6

1 Scope7

2 Normative references7

3 Terms and definitions 10

4 List of significant hazards – Hazard analysis and risk assessment 16

5 Safety requirements and/or protective measures 22

5.1 General..... 22

5.2 Mechanical safety 23

5.2.1 General..... 23

5.2.2 Guards 23

5.2.3 Fluid injection..... 24

5.2.4 Loss of stability..... 25

5.2.5 Lifting and transportation of compressor units and parts 25

5.2.6 *Slip, trip and fall*..... 30

5.2.7 Speed 30

5.2.8 Loss of main energy supply or short term power interruption..... 31

5.2.9 Reverse running of the compressor 31

5.3 Electrical safety..... 32

5.3.1 Generally applicable 32

5.3.2 Protection from overload 32

5.3.3 Protection from live parts 32

5.3.4 Protection from lightning..... 32

5.3.5 *Portable and skid-mounted compressor units* 32

5.4 Control systems..... 33

5.4.1 General..... 33

5.4.2 Failure of safety related control system energy supply 33

5.4.3 Start/restart..... 33

5.4.4 Manual suspension of safety functions 34

5.4.5 Electrical control systems 35

5.4.6 Pneumatic and/or hydraulic control systems 36

5.5 Thermal safety..... 36

5.6 Noise 37

5.7 Materials and substances processed, used or exhausted 37

5.7.1 General..... 37

5.7.2 Reactive gases 38

5.7.3 Oxygen compressors 38

5.7.4 Acetylene compressors 40

5.7.5 Compressors for H2S containing gases 41

5.7.6 Nitrogen and other inert gases..... 41

5.7.7 Access closures to process gas containing parts..... 41

5.7.8 Compressor shaft seal systems..... 42

5.7.9 Static seals (Gaskets) for piping 42

5.7.10 Micro-organisms, biological and microbiological substances 43

5.7.11 *Compressor units driven by internal combustion engines*..... 44

5.8 Fire and explosion 44

5.8.1 General..... 44

5.8.2 Electrostatic phenomena 45

5.8.3 *Oil-flooded rotary compressor units* 45

საინფორმაციო ნაწილი. სრული ტექსტის სახსრავად შეიძინეთ სტანდარტი.

5.8.4	Oil-lubricated reciprocating process compressor units	46
5.8.5	Compressor units driven by internal combustion engines	46
5.9	Ergonomic principles	46
5.9.1	General	46
5.9.2	Manual handling of compressor units and parts	47
5.9.3	Portable and skid-mounted compressor units	47
5.10	Integrity of machinery parts and other functional requirements	47
5.10.1	Generally applicable	47
5.10.2	Snow, wind and seismic loads	47
5.10.3	Break-up during operation	48
5.10.4	Low temperature operation	48
5.10.5	Liquid shock	49
5.10.6	Coolant system	49
5.10.7	Process gas temperature rise	49
5.10.8	Turbo compressor	49
5.11	Pressure limiting devices	50
5.11.1	General	50
5.11.2	Installation of pressure limiting devices	50
5.11.3	Design specifications of pressure relief devices	51
5.11.4	Multi stage compressor units	51
5.11.5	Single and multi stage turbo compressors	51
5.12	Information and warning devices	51
6	Verification of safety requirements and/or protective measures	52
6.1	Pressure testing	52
6.1.1	General	52
6.1.2	Acetylene compressors	52
6.2	Leak tightness test for hazardous gases	53
6.3	Test of electrical loops	53
6.4	Test of control systems	53
6.5	Noise	53
6.5.1	General	53
6.5.2	Sound power level of compressors used outdoors	54
6.6	Stability of portable compressor units	54
6.7	Structure of verification	54
7	Information for use	59
7.1	General requirements	59
7.2	Accompanying documents	60
7.2.1	Instruction handbook (Operating Manual)	60
7.2.2	Service instructions	66
7.2.3	Dismantling	68
7.2.4	Qualification	68
7.3	Markings, signs and written warnings	68
7.3.1	Generally applicable	68
7.3.2	Compressor unit enclosures	69
7.3.3	Portable and skid-mounted compressor units	69
7.3.4	Markings (in particular, data plate)	69
Annex A	(informative) Graphical symbols	71
Annex B	(informative) Measure to ensure a safety function while testing a safety device (example)	78
B.1	Shutdown Override Switches	78
B.2	Monitoring	78
Annex C	(informative) Guide to the application of current standards to the functional safety on safety related control of process compressors or compressor units	79
C.1	Introduction	79
C.2	Scope	79
C.3	Standard and code references	79
C.4	Standard abbreviations	80
C.5	Risk reduction process and functional safety	81

C.6	Relationship between EN 1012-3 and the standards for functional safety.....	82
C.7	Process of functional safety.....	84
C.7.1	General.....	84
C.7.2	Risk Assessment	85
C.7.3	Allocation of safety function to protection layers	90
C.7.4	Safety Requirements Specification.....	91
C.7.5	Design and engineering	91
C.7.6	Installation commissioning and validation	93
C.7.7	Verification	93
C.7.8	Assessment of functional safety.....	93
C.8	Risk assessment of compressor and auxiliary system	94
C.9	Responsibilities	95
C.9.1	End user and manufacturer	95
C.9.2	Compressor or compressor unit manufacturer.....	95
C.9.3	Example 1, using EN 61508, EN 61511	97
C.9.4	Example 2, using EN 61508, EN 61511	99
Annex ZA	(informative) Relationship between this European Standard and the Essential Requirements of EU Directive 2006/42/EC	101
Bibliography	102

საინფორმაციო ნაწილი. სრული ტექსტის სანახავად შეიძინეთ სტანდარტი.

Foreword

This document (EN 1012-3:2013) has been prepared by Technical Committee CEN/TC 232 "Compressors, vacuum pumps and their systems", the secretariat of which is held by SIS.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2014, and conflicting national standards shall be withdrawn at the latest by May 2014.

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

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

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

EN 1012, *Compressors and vacuum pumps*, is composed of the following parts:

- *Part 1: Air compressors*;
- *Part 2: Vacuum pumps*;
- *Part 3: Process compressors* (the present document).

The responsibility of CEN/TC 232 includes coordination of safety standards with CEN/TC 182, Refrigerating systems, safety and environmental requirements, and CEN/TC 234, Gas infrastructure.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, 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 the United Kingdom.

Introduction

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

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

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

When published in 1996, Part 1 of EN 1012 applied to all types of compressor. The standard is now divided into 3 parts with Part 1 addressing compressors for compressed air, nitrogen and inert gases and Part 3 addressing compressors for process gases. Part 2 continues to address vacuum pumps.

Separating requirements for process gas compressors from those for compressors for air, nitrogen and other inert gases was considered a practical move so that the requirements for one type of compressor could be changed without affecting the complete standard.

Where texts parts of EN 1012-3 are identical with EN 1012-1:2010, these are identified and formatted in italics.

If common requirements for functional safety would be applied to all process compressors, the variety in the application of process compressors may cause significantly different levels of residual risk. Therefore, in addition to the requirements of this standard, the application of risk assessment may be required for safety related control systems in the case of particular applications to specify performance levels and/or safety integrity levels for related aspects of functional safety.

Informative Annex C has been included to provide guidance on risk assessment for related aspects of functional safety, including the determination of safety integrity levels and/or performance levels. The manufacturer of the compressor is responsible for carrying out such a risk assessment and applying appropriate preventive measures. These tasks are outside the scope of this standard.

საინფორმაციო ნაწილი. სრული ტექსტის სანახავად შეიძინეთ სტანდარტი.