

Rubber and plastics machines — Extruders and extrusion lines

Part 1. Safety requirements for extruders

The European Standard EN 1114-1 : 1996 has the status of a
British Standard

ICS 83.200

NO COPYING WITHOUT BSI PERMISSION EXCEPT AS PERMITTED BY COPYRIGHT LAW

BSI
Documents



Document Sharing Hub

Committees responsible for this British Standard

The preparation of this British Standard was entrusted by Technical Committee MCE/3, Safeguarding of machinery, to Subcommittee MCE/3/2, Rubber and plastics machines — Safety, upon which the following bodies were represented:

- British Plastics Federation
- British Rubber Manufacturers' Association Ltd.
- Engineering Employers' Federation
- Institute of Occupational Safety and Health
- Plastics Machinery Distribution
- Trades Union Congress
- Health and Safety Executive
- Co-opted members

This British Standard, having been prepared under the direction of the Engineering Sector Board, was published under the authority of the Standards Board and comes into effect on 15 April 1997

© BSI 1997

Amendments issued since publication

Amd. No.	Date	Text affected

The following BSI references relate to the work on this standard:
Committee reference MCE/3/2
Draft for comment 93/710604

ISBN 0 580 27068 8

Contents

	Page
Committees responsible	Inside front cover
National foreword	ii
Foreword	2
Text of EN 1114-1	3

National foreword

This British Standard has been prepared by Technical Committee MCE/3/2, Rubber and plastics machines — Safety, and is the English language version of EN 1114-1 : 1996, *Rubber and plastics machines — Extruders and extrusion machines — Safety requirements for extruders*, published by the European Committee for Standardization (CEN).

EN 1114-1 was produced as a result of international discussions in which the United Kingdom took an active part.

Cross-references

Publication referred to	Corresponding British Standard
	BS EN 292 <i>Safety of machinery. Basic concepts, general principles for design</i>
EN 292-1 : 1991	Part 1 : 1991 <i>Basic terminology, methodology</i>
EN 292-2 : 1991	Part 2 : 1991 <i>Technical principles and specifications</i>
EN 294 : 1992	BS EN 294 : 1992 <i>Safety of machinery. Safety distances to prevent danger zones being reached by the upper limbs</i>
EN 349 : 1993	BS EN 349 : 1993 <i>Safety of machinery. Minimum gaps to avoid crushing of parts of the human body</i>
EN 418 : 1992	BS EN 418 : 1992 <i>Safety of machinery. Emergency stop equipment, functional aspects. Principles for design</i>
EN 563 : 1994	BS EN 563 : 1994 <i>Safety of machinery. Temperatures of touchables surfaces. Ergonomics data to establish temperature limit values for hot surfaces</i>
EN 626-1 : 1994	BS EN 626-1 : 1995 <i>Principles and specifications for machinery manufacturers</i>
EN 60204-1 : 1992	BS EN 60204-1 : 1993 <i>Safety of machinery. Electrical equipment of machines. Specification for general requirements</i>
EN 60529 : 1991	BS EN 60529 : 1992 <i>Specification for degrees of protection provided by enclosures (IP code)</i>
ISO 9614-1 : 1993	BS EN ISO 9614-1 : 1995 <i>Acoustics. Determination of sound power levels of noise sources using sound intensity. Measurement at discrete points</i>

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, the EN title page, pages 2 to 30, an inside back cover and a back cover.

ICS 83.200

Descriptors: Safety of machines, plastic-working machines, rubber-working machines, extruding equipment, dangerous machines, accident prevention, hazards, hazardous areas, safety measures, information, utilization

English version

Rubber and plastics machines — Extruders and extrusion lines — Part 1: Safety requirements for extruders

Machines pour le caoutchouc et les matières
plastiques — Extrudeuses et lignes d'extrusion —
Partie 1: Exigences de sécurité pour les extrudeuses

Gummi- und Kunststoffmaschinen — Extruder und
Extrusionsanlagen —
Teil 1: Sicherheitsanforderungen für Extruder

This European Standard was approved by CEN on 1996-08-11. 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 Central Secretariat 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 Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and United Kingdom.

CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

© 1996 Copyright reserved to CEN members.

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 145, Rubber and plastics machines — Safety, of which the Secretariat is held by UNI.

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 April 1997, and conflicting national standards shall be withdrawn at the latest by April 1997.

This European Standard 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 Directives(s).

This is the first in a series of standards on the safety of extruders and extrusion lines.

Part 2 deals with die face pelletizers.

Part 3 deals with caterpillar, roller and belt take-offs.

Further parts are under discussion.

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

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Contents

	Page
Foreword	
0 Introduction	
1 Scope	
2 Normative references	
3 Definitions	
4 Hazards and areas of danger	
4.1 List of hazards	
4.2 Areas of danger	
5 Safety requirements and/or measures	
5.1 Mechanical hazards	
5.2 Electrical energy	
5.3 Hot machine parts and hot plasticized material	
5.4 Noise	
5.5 Materials and substances processed used and/or exhausted by the machinery	
5.6 Fire	
5.7 Temperature control for heated areas	
5.8 Emergency stop devices	
5.9 Machine control systems	
6 Verification of compliance with the safety requirements and/or measures	
7 Information for users	
7.1 Minimum marking on the machine	
7.2 Instruction manual	
Annex ZA (informative) Clauses of this European Standard addressing essential requirements or other provisions of EU Directives	

0 Introduction

This European Standard is a type C Standard as defined in EN 292.

The extent to which hazards are covered is indicated in the scope of this standard. In addition, machinery should conform as appropriate to EN 292 for hazards which are not covered by this standard.

1 Scope

In respect of the hazards listed in 4.1 and dealt with in clause 5, this standard specifies the safety requirements for the design and construction of the following kinds of screw type extruders for plastics and rubber:

- single screw extruders;
- twin screw extruders;
- multi/multiple screw extruders;
- hot feed extruders;
- cold feed extruders;
- vacuum extruders;
- pin extruders.

This standard also covers the following feeding systems:

- hoppers;
- single roller feeding systems;
- double roller feeding systems;
- crammer feeding systems:

and the following ancillary equipment which form part of or are attached to the extruder:

- screen changers;
- melt/gear pumps;
- melt ducts;
- static mixers;
- degassing equipment;
- shear head devices;
- extruder head.

This standard only applies to extruder heads that give initial shape to the plasticized material.

This standard does not apply to extruders without screws, e.g.:

- piston extruders;
- disc extruders;
- roller extruders.

This standard applies primarily to machines which are manufactured after the date of approval of this European Standard.

2 Normative references

This European Standard incorporates by dated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

- | | |
|------------------------------|--|
| EN 292-1 : 1991 | <i>Safety of machinery — Basic concepts, general principles for design — Part 1: Basic terminology, methodology</i> |
| EN 292-2 : 1991
+A1: 1995 | <i>Safety of machinery — Basic concepts, general principles for design — Part 2: Technical principles and specifications</i> |
| EN 294 : 1992 | <i>Safety of machinery — Safety distances to prevent danger zones being reached by the upper limbs</i> |
| EN 349 : 1993 | <i>Safety of machinery — Minimum gaps to avoid crushing to parts of the human body</i> |
| EN 418 : 1992 | <i>Safety of machinery — Emergency stop equipment, functional aspects — Principles for design</i> |
| EN 563 : 1994 | <i>Safety of machinery — Temperatures of touchable surfaces — Ergonomics data to establish temperature limit values for hot surfaces</i> |
| prEN 574 : 1991 | <i>Safety of machinery — Two-hand control devices</i> |
| EN 626-1 : 1994 | <i>Safety of machinery — Reduction of risks to health from hazardous substances emitted by machinery — Part 1: Principles and specifications for machine manufacturers</i> |
| prEN 811 : 1992 | <i>Safety of machinery — Safety distances to prevent danger zones being reached by the lower limbs</i> |
| prEN 953 : 1992 | <i>Safety of machinery — General requirements for the design and construction of guards (fixed, movable)</i> |
| prEN 954-1 : 1994 | <i>Safety of machinery — Safety related parts of control systems — Part 1: General principles for design</i> |

EN 1037 : 1995	<i>Safety of machinery — Prevention of unexpected start-up</i>
EN 1088 : 1995	<i>Safety of machinery — Interlocking devices associated with guards — Principles for design and selection</i>
EN ISO 11201 : 1995	<i>Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Engineering method in an essentially free field over a reflecting plane</i>
EN ISO 11204 : 1993	<i>Acoustics — Noise emitted by machinery and equipment — Measurement of emission sound pressure levels at a work station and at other specified positions — Method requiring environmental corrections</i>
EN 60204-1 : 1992	<i>Safety of machinery — Electrical equipment of machines — Part 1: General requirements</i>
EN 60529 : 1991	<i>Degrees of protection provided by enclosures</i>
EN ISO 3744 : 1995	<i>Acoustics — Determination of sound power levels of noise sources using sound pressure — Engineering method in an essentially free field over a reflecting plane</i>
prEN ISO/DIS : 4871 : 1995	<i>Acoustics — Declaration and verification of noise emission values of machinery and equipment</i>
EN ISO 9614-1 : 1995	<i>Acoustics — Determination of sound power levels of noise sources using sound intensity — Part 1: measurement at discrete points</i>

3 Definitions

For the purposes of this standard the following definitions apply.

3.1 extruder

The extruder is a machine which conveys solid or liquid material by means of one or more screws rotating within a barrel and discharges it continuously through the extrusion head. In doing so the material can be heated, cooled, consolidated, mixed, plasticized, can undergo chemical reactions, and may be degassed or gas injected. Viewed in the direction of flow of the material the extruder itself ends with the tip of the screw or screws.

Screen changers, melt pumps, shear head devices, static mixers and degassing equipment, etc., may be arranged between the extruder and the extruder head or along the barrel.

3.2 plasticized material

A liquid, paste or solid product which is ready to be processed into semi-finished products or finished products.

3.3 feeding system

Any equipment which feeds the material into the screw(s).

3.4 crammer feeding system

A system which has a dedicated drive which assists the flow of materials from the hopper feed into the extruder by means of screws or other devices. It is also used to densify bulk low density materials.

3.5 double roller feeding device

A device used for constant feeding of the extruder with rubber, e.g. rubber strips. The feeding device consists of two rolls arranged in parallel positioned at the feed opening of the extruder above the open screw. The rolls are driven in contra-rotating direction under constant power so that the material is transported into the extruder under constant pressure. The rolls are water cooled to prevent heating and vulcanizing of the product.

3.6 single roller feeding device

A roller, which has an axis parallel to that of the screw. The screw and the roller counter-rotate and form an in-running nip and thereby improve the regularity of feeding. It may be driven by the screw or by an independent device.

3.7 main feed opening

An opening in the barrel through which, for example, the granulate, sheets, strips, powder or plasticized material passes.

3.8 secondary feed opening

A subsidiary opening in the barrel through which, for example, granulate, powder, liquid or paste (e.g. colour, stabilizers, plasticizers) passes.

3.9 barrel

A housing which surrounds one or more screws.

3.10 degassing equipment

A device which is arranged in certain sections of the screw barrel and is intended to remove volatile components of the plasticized material during preparation of plastic material and rubber.

3.11 pins

These are components fixed into the extruder barrel and which protrude into the inside of the barrel to allow a better mix of the material.

3.12 accessories attached to openings in the extruder barrel

Accessories are parts of measuring devices; for example, temperature or pressure gauges with a maximum connection diameter of 30 mm.

3.13 melt/gear pump

A pump which has a dedicated drive conveying continuously plasticized material. Its purpose is to ensure equalization of pressure; in particular, to increase it downstream of the screw leading to an improvement in the regularity of delivery.

3.14 melt ducts

Melt ducts are heated pipes connecting accessories (for example, screen changers, melt pumps and static mixers), and carry plasticized material.

3.15 static mixer

A device positioned at the outlet of the screw of an extruder which contains fixed obstacles. When the screw pushes the material it cuts and kneads it to improve homogeneity.

3.16 screen changer

A device containing one or more screens through which plasticized material flows to remove foreign particles. The screen or screens are fixed on a carrier and can be moved from an on-line operating position to an off-line or non-operating position and vice versa.

3.17 shear head device

An item of ancillary equipment which has its own motive power and temperature control system, fitted between the screw of the extruder and the extrusion head. It serves to raise the plasticized material discharged from the extrusion head to the correct temperature for continuous vulcanization.

3.18 extruder head

A device that gives shape to the plasticized material.

3.19 extrudate

The plasticized material which comes out of the extrusion head during extrusion. If there is no extrusion head, the extruded product is the plasticized material which leaves the extruder.

4 Hazards and areas of danger

4.1 List of hazards

4.1.1 Mechanical hazards

- crushing;
- shearing;
- cutting and severing;
- drawing in or trapping;
- ejection of parts of machinery;
- discharge of plasticized material under pressure or by other causes.

These hazards are principally due to:

- the rotating parts of the drive and power transmission machinery;
- the moving parts in the extrusion barrel;
- the rotating screw or screws of the extruder at any opening;
- the moving parts of the feeding systems;
- the accessible moving parts during purging, cleaning and pre-heating;
- the accessible moving parts of the cooling air fans;
- over pressure in the barrel;
- over pressure in melt ducts;
- the accessible moving parts of the screen changer;
- the extruder itself when moved;
- any dangerous movement of the extruder head and/or its parts;
- gravity fall of any parts.

4.1.2 Hazards from electrical energy

4.1.2.1 Electrical shock or burns due, for example, to direct or indirect contact with live parts.

4.1.2.2 Electrical shock due to electrostatic phenomena.

4.1.3 Thermal hazards

- burns;
- scalds;

due to contact with hot machine parts or hot extruded product.

4.1.4 Hazards generated by noise

- hearing loss;
- interference with speech communication;
- interference with the perception of acoustic signals, due to high noise levels.

4.1.5 Hazards resulting from materials and substances processed, used and/or exhausted by the machinery

Health effects due, for example, to contact with, or inhalation of, harmful fluids, gases, mists, fumes and dusts.

4.1.6 Fire hazards

Ignition due to:

- contact with flammable materials and hot surfaces;
- faulty electrical equipment;
- leaks from hydraulic lines on to hot surfaces.

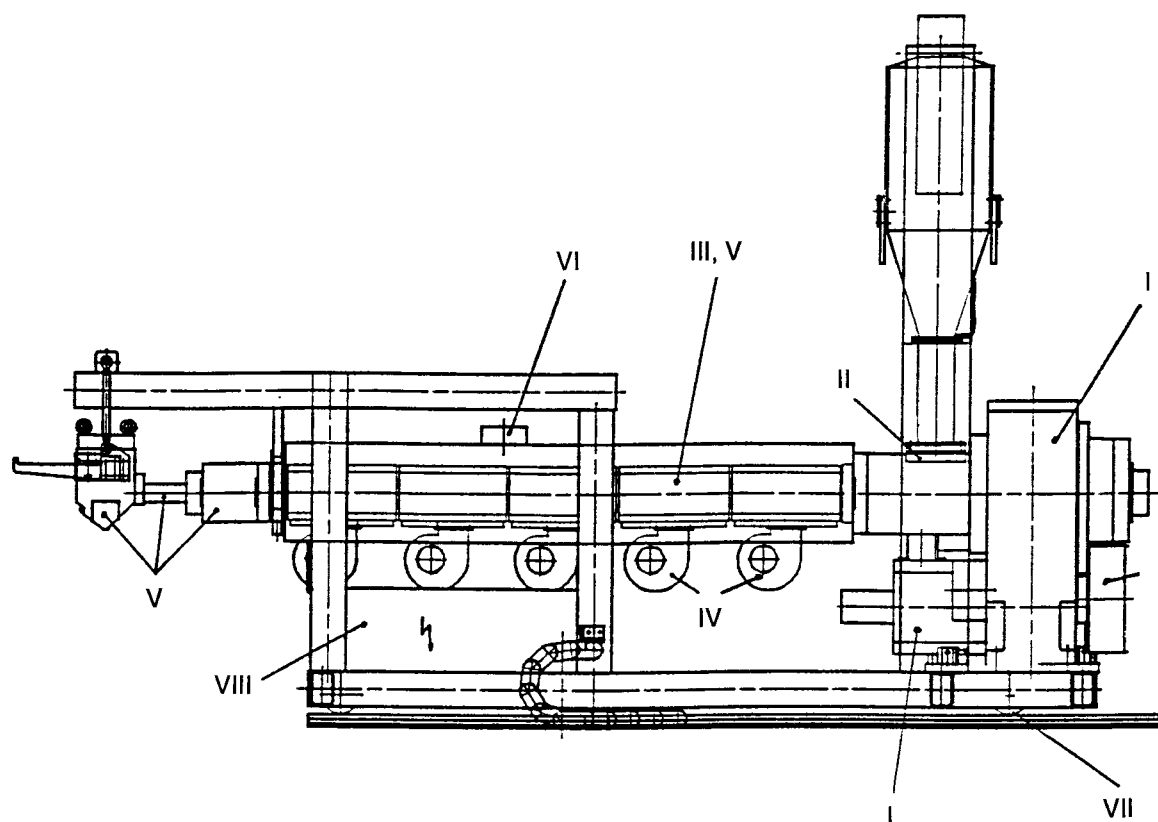
4.1.7 Hazards of falling from height

Injury due to falling from high level working places.

4.2 Areas of danger

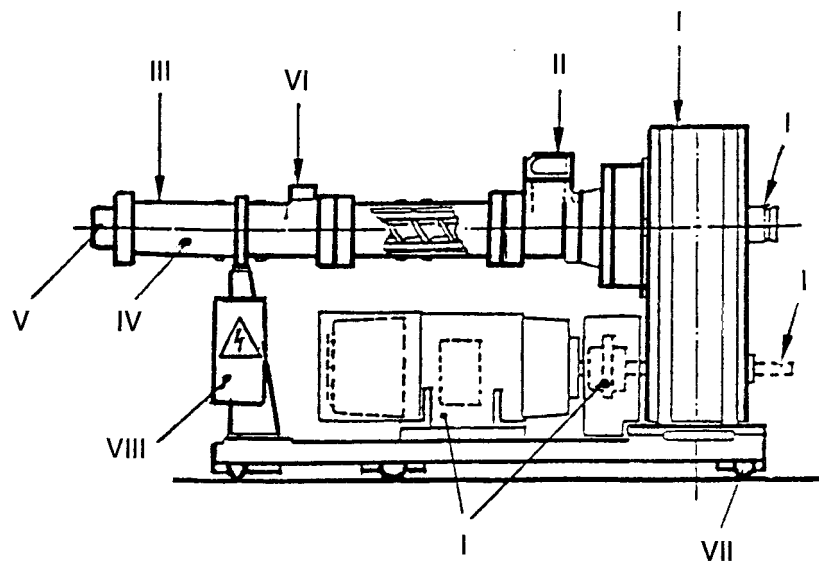
The areas of danger described below are examples.

4.2.1 Principal areas of danger of an extruder



- I Drive and power transmission to the screw
- II Feed opening
- III Barrel heaters
- IV Barrel cooling
- V Hot surfaces
- VI Degassing
- VII Wheels for horizontal movement
- VIII Electrical junction box

Figure 1. Example of a plastic extruder



- I Drive and power transmission to the screw
- II Feed opening
- III Barrel heaters
- IV Barrel cooling
- V Extruder head
- VI Degassing
- VII Wheels for horizontal movement
- VIII Electrical junction box

Figure 2. Example of a rubber extruder