UL 60335-2-79

STANDARD FOR SAFETY

Household and Similar Electrical Appliances – Safety – Part 2-79: Particular Requirements for High Pressure Cleaners and Steam Cleaners

UL Standard for Safety for Household and Similar Electrical Appliances – Safety – Part 2-79: Particular Requirements for High Pressure Cleaners and Steam Cleaners, UL 60335-2-79

First Edition, Dated January 14, 2016

Summary of Topics

Adoption of IEC 60335-2-79, Household and Similar Electrical Appliances, Part 2-79: Particular Requirements for High Pressure Cleaners and Steam Cleaners (Edition 2.2 issued July 2007) as a new IEC-based UL standard, UL 60335-2-79, with National Differences.

The new requirements are substantially in accordance with Proposal(s) on this subject dated September 4, 2015 and December 4, 2015.

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Household and Similar Electrical Appliances – Safety – Part 2-79:

Particular Requirements for High Pressure Cleaners and Steam Cleaners

First Edition

January 14, 2016

This ANSI/UL Standard for Safety consists of the First Edition.

The most recent designation of ANSI/UL 60335-2-79 as an American National Standard (ANSI) occurred on January 14, 2016. ANSI approval for a standard does not include the Cover Page, Transmittal Pages, Title Page or Preface. The National Difference Page and IEC Foreword are also excluded from the ANSI approval of IEC-based standards.

Comments or proposals for revisions on any part of the Standard may be submitted to UL at any time. Proposals should be submitted via a Proposal Request in UL's On-Line Collaborative Standards Development System (CSDS) at http://csds.ul.com.

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Preface

This UL Standard is based on IEC Publication 60335-2-79: Edition 2.2 Safety of Household and Similar Electrical Appliances, Part 2-79: Particular Requirements for High Pressure Cleaners and Steam Cleaners. IEC publication 60335-2-79 is copyrighted by the IEC.

This UL Standard 60335-2-79 Standard for Safety for Household and Similar Electrical Appliances, Part 2-79: Particular Requirements for High Pressure Cleaners and Steam Cleaners, is to be used in conjunction with the fifth edition of UL 60335-1. The requirements for High Pressure Cleaners and Steam Cleaners are contained in this Part 2 Standard and UL 60335-2-79.

Requirements of this Part 2 Standard, where stated, amend the requirements of UL 60335-1.

Where a particular subclause of UL 60335-1 is not mentioned in UL 60335-2-79, the UL 60335-1 subclause applies.

The text, figures and tables of IEC Publication Safety of Household and Similar Electrical Appliances, Part 2-79: Particular Requirements for High Pressure Cleaners and Steam Cleaners, IEC 60335-2-79, copyright July, 2007 are used in this Standard with the consent of the IEC and the American National Standards Institute (ANSI). The IEC copyrighted material has been reproduced with permission from ANSI. ANSI should be contacted regarding the reproduction of any portion of the IEC material. The IEC Foreword and Introduction are not a part of the requirements of this Standard but are included for information purposes only. Copies of IEC Publication 60335-2-79 may be purchased from ANSI, 11 West 42nd Street, New York, New York, 10036, (212) 642-4900.

Note – Although the intended primary application of this Standard is stated in its Scope, it is important to note that it remains the responsibility of the users of the Standard to judge its suitability for their particular purpose.

NATIONAL DIFFERENCES

General

National Differences from the text of International Electrotechnical Commission (IEC) Publication 60335-2-79, Household and Similar Electrical Appliances – Safety – Part 2-79: Particular Requirements for High Pressure Cleaners and Steam Cleaners copyright 2007, are indicated by notations (differences) and are presented in bold text.

There are five types of National Differences as noted below. The difference type is noted on the first line of the National Difference in the standard. The standard may not include all types of these National Differences.

DR – These are National Differences based on the **national regulatory requirements**.

D1 – These are National Differences which are based on **basic safety principles and requirements**, elimination of which would compromise safety for consumers and users of products.

D2 – These are national differences from IEC requirements based on existing **safety practices**. These requirements reflect national safety practices, where empirical substantiation (for the IEC or national requirement) is not available or the text has not been included in the IEC standard.

DC – These are National Differences based on the **component standards** and will not be deleted until a particular component standard is harmonized with the IEC component standard.

DE – These are National Differences based on **editorial comments or corrections**.

Each national difference contains a description of what the national difference entails. Typically one of the following words is used to explain how the text of the national difference is to be applied to the base IEC text:

Addition / Add - An addition entails adding a complete new numbered clause, subclause, table, figure, or annex. Addition is not meant to include adding select words to the base IEC text.

Modification / Modify - A modification is an altering of the existing base IEC text such as the addition, replacement or deletion of certain words or the replacement of an entire clause, subclause, table, figure, or annex of the base IEC text.

Deletion / Delete - A deletion entails complete deletion of an entire numbered clause, subclause, table, figure, or annex without any replacement text.

INTERNATIONAL ELECTROTECHNICAL COMMISSION

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY – Part 2-79: Particular requirements for high pressure cleaners and steam cleaners

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.

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5) IEC provides no marking procedure to indicate its approval and cannot be rendered responsible for any equipment declared to be in conformity with an IEC Publication.

6) All users should ensure that they have the latest edition of this publication.

7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.

8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

This part of International Standard IEC 60335 has been prepared by sub-committee 61J: Electrical motor-operated cleaning appliances for industrial use, of IEC technical committee 61: Safety of household and similar electrical appliances.

This consolidated version of IEC 60335-2-79 consists of the second edition (2002) [documents 61J/128/FDIS and 61J/133/RVD], its amendment 1 (2004) [documents 61J/165/FDIS and 61J/171/RVD] and its amendment 2 (2007) [documents 61J/252/FDIS and 61J/258/RVD].

The technical content is therefore identical to the base edition and its amendment and has been prepared for user convenience.

It bears the edition number 2.2.

A vertical line in the margin shows where the base publication has been modified by amendments 1 and 2.

This part 2 is to be used in conjunction with the latest edition of IEC 60335-1 and its amendments. It was established on the basis of the fourth edition (2001) of that standard.

NOTE When “Part 1” is mentioned in this standard, it refers to IEC 60335-1.

This part 2 supplements or modifies the corresponding clauses in IEC 60335-1, so as to convert that publication into the IEC standard: Safety requirements for electric high pressure cleaners and steam cleaners.

101DV DE ***Modification: Replace the preceding two paragraphs and Note 1 with the following:***

This part 2 standard is to be used in conjunction with UL 60335-1 Ed. 5: 2011-10 and its amendments.

NOTE When “Part 1” is mentioned in this standard, it refers to UL 60335-1 Ed. 5: 2011-10. When ″Part 2″ is mentioned in this standard, it refers to this document.

This Part 2 supplements or modifies the corresponding clauses in UL 60335-1 Ed. 5: 2011-10, so as to convert that publication into the UL standard: Safety requirements for high pressure cleaners and steam cleaners.

When a particular subclause of Part 1 is not mentioned in this part 2, that subclause applies as far as is reasonable. When this standard states “addition”, “modification” or “replacement”, the relevant text in Part 1 is to be adapted accordingly.

NOTE 2 The following numbering system is used:

– subclauses, tables and figures that are numbered starting from 101 are additional to those in Part 1;

– unless notes are in a new subclause or involve notes in Part 1, they are numbered starting from 101, including those in a replaced clause or subclause;

– additional annexes are lettered AA, BB, etc.

102DV DE ***Modification: Add the following after NOTE 2:***

The numbering system in this standard uses a space instead of a comma to indicate thousands and uses a comma instead of a period to indicate a decimal point. For example, 1 000 means 1,000 and 1,01 means 1.01.

NOTE 3 The following print types are used:

– requirements: in roman type;

– test specifications: in italic type;

– notes: in small roman type.

Words in **bold** in the text are defined in Clause 3. When a definition concerns an adjective, the adjective and the associated noun are also in bold.

103DV DE ***Modification: Replace the last sentence of NOTE 3 with the following:***

Words in SMALL ROMAN CAPS in the text are defined in Clause 3. When a definition concerns an adjective, the adjective and the associated noun are also in SMALL ROMAN CAPS.

The committee has decided that the contents of the base publication and its amendments will remain unchanged until the maintenance result date indicated on the IEC web site under ″http://webstore.iec.ch″ in the data related to the specific publication. At this date, the publication will be

• reconfirmed,

• withdrawn,

• replaced by a revised edition, or

• amended.

104DV DE ***Modification: Replace the “in some countries” paragraph and dashed items below with the following:***

The USA differences have been reviewed and developed into UL national differences in this Part 2 standard.

The following differences exist in the countries indicated below.

– Clause 1: Different pressure limitations apply (USA).

– 6.1: Ground fault current interrupters are required for appliances rated 250 V or less, single phase (USA).

– 7.12: No requirements for sound and vibration markings exist (USA).

– 11.101: The losses of burners are subject to regulations (Germany). Smoke spot requirements are different (USA).

– 20.103: The fuel tank capacity is limited (USA).

– 21.101, 21.101.2 and 21.102: Different burner tests are required (USA).

– 25.7: Different power supply cord lengths are required (Canada, USA).

– Clause 32: The connection with the water mains is subject to regulations (Canada).

A bilingual version of this publication may be issued at a later date.

105DV DE ***Modification: Delete the preceding paragraph.***

This paragraph does not apply.

INTRODUCTION

It has been assumed in the drafting of this International Standard that the execution of its provisions is entrusted to appropriately qualified and experienced persons.

This standard recognizes the internationally accepted level of protection against hazards such as electrical, mechanical, thermal, fire and radiation of appliances when operated as in normal use taking into account the manufacturer's instructions. It also covers abnormal situations that can be expected in practice.

This standard takes into account the requirements of IEC 60364 as far as possible so that there is compatibility with the wiring rules when the appliance is connected to the supply mains. However, national wiring rules may differ.

If an appliance within the scope of this standard also incorporates functions that are covered by another part 2 of IEC 60335, the relevant part 2 is applied to each function separately, as far as is reasonable. If applicable, the influence of one function on the other is taken into account.

This standard is a product family standard dealing with the safety of appliances and takes precedence over horizontal and generic standards covering the same subject.

An appliance that complies with the text of this standard will not necessarily be considered to comply with the safety principles of the standard if, when examined and tested, it is found to have other features that impair the level of safety covered by these requirements.

An appliance employing materials or having forms of construction differing from those detailed in the requirements of this standard may be examined and tested according to the intent of the requirements and, if found to be substantially equivalent, may be considered to comply with the standard.

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY – Part 2-79: Particular requirements for high pressure cleaners and steam cleaners

1 Scope

This clause of Part 1 is replaced by the following.

This International Standard deals with the safety of high pressure cleaners for household, industrial and commercial use, in which the discharge line is hand supported and manipulated, having a pressure not less than 2,5 MPa and not more than 25 MPa and with an input to the drive for the high pressure pump not exceeding 10 kW, their RATED VOLTAGE being not more than 250 V for single-phase appliances and 480 V for other appliances.

It also applies to industrial and commercial steam cleaners having a water container with a capacity not exceeding 1 000 l, a RATED PRESSURE not exceeding 3,2 MPa and a product of capacity and RATED PRESSURE not exceeding 300.

It is also applicable to appliances making use of other forms of energy for the motor, but it is necessary that their influence is taken into consideration.

As far as it is practicable, this standard deals with the common hazards presented by appliances that are encountered by all persons in and around the home. However, in general, it does not take into account

– the use of appliances by young children or infirm persons without supervision,

– playing with the appliance by young children.

NOTE 101 Attention is drawn to the fact that

– for appliances intended to be used in vehicles or on board ships or aircraft, additional requirements may be necessary;

– in many countries additional requirements are specified by the national health authorities, the national authorities responsible for the protection of labour, the national water supply authorities and similar authorities.

NOTE 102 This standard does not apply to

– appliances that are incorporated in process equipment;

– appliances intended to be used in locations where special conditions prevail, such as the presence of corrosive or explosive atmosphere (vapour or gas);

– audio, video and similar electronic apparatus (IEC 60065);

– appliances for medical purposes (IEC 60601);

– hand-held motor-operated electric tools (IEC 60745);

– personal computers and similar equipment (IEC 60950);

– transportable motor-operated electric tools (IEC 61029);

– steam cleaners for household use only (IEC 60335-2-54).

1DV.1 D2 *Modification: Replace the second paragraph of Clause 1 of the Part 2 with the following:*

1DV.1.1 This International Standard deals with the safety of high pressure cleaners for household, industrial and commercial use having a pressure not more than 38 MPa at the point of maximum system pressure and a pressure at the pump outlet while spraying of not less than 2,5 MPa and not more than 35 MPa and with an input to the drive for the high pressure pump not exceeding 20 kW, their RATED VOLTAGE being not more than 250 V for single-phase appliances and 600 V for other appliances.

1DV.1.2 A coin-operated product is investigated under these requirements and under such additional requirements as are applicable to the product under consideration.

1DV.2 D2 *Modification: add the following to Clause 1 of the Part 2:*

1DV.2.1 These requirements do not cover liquid sand blasters or other products using cleaning solutions containing insoluble particulates.

1DV.2.2 These requirements do not cover products that develop steam within a closed heated vessel or are connected to an external source of steam.

1DV.2.3 These requirements do not cover burners with input ratings greater than 733 kW.

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

IEC 60364-1, *Electrical installations of buildings – Part 1: Fundamental principles, assessment of general characteristics, definitions*

IEC 60704-1, *Household and similar electrical appliances – Test code for the determination of airborne acoustical noise – Part 1: General requirements*

IEC 61558-2-3, *Safety of power transformers, power supply units and similar – Part 2-3: Particular requirements for ignition transformers for gas and oil burners*

ISO 5349 (all parts), *Mechanical vibration – Measurement and evaluation of human exposure to hand-transmitted vibration*

2DV D2 *Modification: Add the following to Clause 2 of the Part 2:*

ANSI/OPEI B71.10-2013,
Off-Road Ground-Supported Outdoor Power Equipment – Gasoline Fuel Systems – Performance Specifications and Test Procedures

ANSI/NEMA Z535.3,
Criteria for Safety Symbols

ANSI/NEMA Z535.4,
Product Safety Signs and Labels

UL 94
Tests for Flammability of Plastic Materials for Parts in Devices and Appliances

UL 295
Commercial-Industrial Gas Burners

UL 296
Oil Burners

UL 331
Strainers for Flammable Fluids and Anhydrous Ammonia

UL 514A
Metallic Outlet Boxes

UL 723
Test for Surface Burning Characteristics of Building Materials

UL 746B
Polymeric Materials – Long Term Property Evaluations

UL 943
Ground-Fault Circuit-Interrupters

UL 969
Marking and Labeling Systems

UL 1439
Test for Sharpness of Edges on Equipment

UL 2111
Overheating Protection for Motors

ASTM B858-2006,
Standard Test Method for Ammonia Vapor Test for Determining Susceptibility to Stress Corrosion Cracking in Copper Alloys

ASTM D256-1981,
Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics

ASTM D396 REV A,
Standard Specifications for Fuel Oils

ASTM D471 REV A,
Standard Test Method for Rubber Property, Effect of Liquids

ASTM D664 REV A,
Standard Test Method for Acid Number of Petroleum Products by Potentiometric Titration

ASTM D1822,
Standard Test Method for Tensile-Impact Energy to Break Plastics and Electrical Insulating Material

ASTM D6751,
Standard Specification for Biodiesel Fuel Blend Stock (B100) for Middle Distillate Fuels

SAE J30,
Fuel and Oil Hose

SAE J1681,
Recommended Practice for Gasoline, Alcohol, and Diesel Fuel Surrogates for Material Testing

NFPA 69-2002,
Explosion Prevention Systems

NFPA 70,
National Electrical Code

ASME B1.20.1,
Pipe Threads, General Purpose (Inch)

3 Definitions

This clause of Part 1 is applicable except as follows.

3.1.9 Replacement:

NORMAL OPERATION operation of the appliance under the following conditions

The appliance is supplied at RATED VOLTAGE and operated at RATED FLOW and RATED PRESSURE with the nozzle and hose specified by the manufacturer fitted to it; all strainers and filters are in a clean operating condition and the UNLOADER VALVE is set to the RATED PRESSURE. The WATER HEATER, if fitted, is operated at maximum power.

Power outlets for accessories are loaded with a resistive load in accordance with the marking.

3.1.9DV D2 *Modification: Add the following to Subclause 3.1.9 of the Part 2:*

The product is to be operated with the omission of all recommended maintenance and cleaning operations, except that combustion engines are to be maintained in accordance with the instructions.

3.5.1DV D2 *Modification: Replace Subclause 3.5.1 of the Part 1 with the following:*

PORTABLE PRODUCT **an appliance that is intended to be carried or conveyed while in use, or that is mounted on wheels and can be readily moved**

3.101 UNLOADER VALVE pressure operated valve which, when the pump pressure exceeds the preset value, returns the excess fluid to the inlet system. In addition it bypasses the total pump flow at reduced pressure when its outlet flow is cut off

3.102 SAFETY VALVE pressure operated valve which, when the pump or steam cleaner pressure exceeds the preset value, returns the excess fluid or steam to the inlet system or into the atmosphere

3.103 RATED PRESSURE maximum pressure at the pump or at the steam cleaner assigned to the appliance by the manufacturer

3.103DV DE *Modification: replace 3.103 as follows:*

RATED PRESSURE maximum pressure at the pump outlet or at the steam cleaner assigned to the appliance by the manufacturer

3.104 PERMISSIBLE PRESSURE limiting pressure up to which an appliance and/or parts of the appliance can be operated without impairing its integrity

3.105 RATED FLOW flow at RATED PRESSURE at the nozzle assigned to the appliance by the manufacturer

3.106 WATER HEATER means of heating water or CLEANING AGENT by electricity, gas, liquid fuel or heat exchanger

3.107 CLEANING AGENT water with or without the addition of a soluble or miscible chemical

3.108 PRESSURE SWITCH device which, in response to varying fluid pressure, provides a controlling function at a pre-set value

3.109 FLOW SWITCH device which, in response to a varying rate of fluid flow, provides a controlling function at a pre-set value

3.110 PRIMARY SAFETY CONTROL control device that responds directly to flame properties sensing the presence of flame and, in event of ignition failure or unintentional flame extinguishment, causes safety shut down

NOTE PRIMARY SAFETY CONTROLS are also known as flame failure devices.

3.111 TRIGGER GUN device that shuts off the supply of fluid through its outlet if the trigger is not held in its operating position

3.112 CONTINUOUS IGNITION ignition by an energy source that is continuously maintained throughout the time the burner is in service, whether the burner is firing or not

3.113 RATED TEMPERATURE maximum temperature of the CLEANING AGENT assigned by the manufacturer

3.114 PENCIL JET NOZZLE nozzle that gives a concentrated, parallel water jet; also called needle jet nozzle, solid jet nozzle or 0 degree jet nozzle

3.115 WATER JETTER high-pressure pipe-cleaning device, consisting of a nozzle at the end of a high-pressure hose

3.116 MOTORIZED CLEANING HEAD accessory containing a motor that is supplied from the appliance and which is attached to the end of a hand-held hose or tube

NOTE The main cleaning head permanently attached is not regarded as a MOTORIZED CLEANING HEAD.

3.117 LOW PRESSURE ACCESSORY accessories to be connected to a high pressure cleaner equipped with one or more nozzles with an equivalent diameter exceeding 2 mm

NOTE 101 Nozzles with an equivalent diameter exceeding 2 mm used in a high pressure cleaner system are not considered to become clogged.

NOTE 102 Typical examples of LOW PRESSURE ACCESSORIES are washing brushes, foam nozzles, washing sponges.

3.118 HAND-GUIDED APPLIANCE appliance to be moved on the floor while in operation, guided by a mechanically coupled handle

3.119DV D2 *Modification: Add the following to Clause 3 of the Part 2:*

3.119DV.1 AIR SHUTTER – a manual or automatic adjustable device that varies the size of the air inlet, or inlets, regulating primary or secondary air

3.119DV.2 ALUMINUM COATED STEEL – aluminum coated steel in which the bond between the steel and the aluminum is an iron-aluminum alloy

3.119DV.3 COMBUSTIBLE MATERIAL – material made of or surfaced with wood, compressed paper, plant fibers, or other material that will ignite and burn Such material shall be considered as combustible even though flameproofed, fire-retardant treated, or plastered.

3.119DV.4 COMPLETE COMBUSTION – combustion evidenced by

a) absence of excessive smoke in the flue gases;

b) absence of excessive concentrations of carbon monoxide;

c) absence of noticeable quantities of aldehydes; and

d) lack of evidence of unburned fuel

3.119DV.5 FLUE COLLAR – the portion of a product that is constructed for attachment of the chimney or vent connector

3.119DV.6 FUEL OIL – any hydrocarbon oil as defined by ASTM D396

3.119DV.7 GAS BURNER MANIFOLD – the conduit of a product that supplies gas to the individual burner

3.119DV.8 GUIDING HANDLE – the handle by which the operator supports the least percentage of product weight when the product is in use, transported, or both

This includes the handle of a hand-supported nozzle, lance, or wand.

3.119DV.9 HEATING SURFACES – all surfaces that transmit heat directly from flame or flue gases to the medium to be heated

3.119DV.10 HOT WATER PRESSURE WASHER – (also known as “hot pressure washer,” “hot water high-pressure cleaning machine,” “hot high-pressure cleaning machine,” “hot water power washer,” or “hot power washer”)

a pressure washer incorporating a heat source and a heat exchanger (usually a pipe or tubing coil) to heat the flowing water during operation of the machine

The heat may be derived from natural or LP gas, liquid fuel, or electricity. The heat source operates only when water is flowing through the open-ended heat exchanger. Water is not heated in a closed vessel.

3.119DV.11 HYDRAULIC POWER, KW – a measure of hydraulic power developed by a product and calculated by multiplying the flow rate (l/min) by the fluid pressure (MPa) as measured at the discharge nozzle and dividing by the constant 60

3.119DV.12 INTERLOCK – a switch or control intended to monitor the physical state of a required condition and to furnish an indication of that state to a safety-control circuit by means of a switch contact closure

3.119DV.13 INTERMITTENT IGNITION – ignition by an energy source that is continuously maintained throughout the time the burner is firing

3.119DV.14 INTERMITTENT PILOT – a pilot that is automatically lighted each time there is a call for heat

The pilot burns during the entire period that the main burner is firing.

3.119DV.15 INTERRUPTED IGNITION – ignition by an energy source that is automatically energized each time the main burner is fired and subsequently is automatically shut off during the firing cycle

3.119DV.16 INTERRUPTED PILOT – a pilot that is automatically lighted each time there is a call for heat

The pilot fuel is cut off automatically at the end of the main burner flame-establishing period.

3.119DV.17 LIMIT CONTROL – a safety control responsive to changes in liquid level, pressure, or temperature, normally set beyond the intended operating range of the product to limit its operation

3.119DV.18 LOW-VOLTAGE CIRCUIT – a circuit involving a potential of not more than 30 volts alternating current (42.4 peak) or direct current and supplied by a primary battery or by a standard Class 2 transformer or by a combination of a transformer and a fixed impedance having output characteristics in compliance with what is required for a Class 2 transformer A circuit derived from a source of supply classified as a circuit involving a potential of not more than 600 volts and having characteristics in excess of those of a low-voltage circuit, by connecting resistance in series with the supply circuit as a means of limiting the voltage and current, is not considered to be a low-voltage circuit.

3.119DV.19 MAIN BURNER FLAME-ESTABLISHING PERIOD – the interval of time the main burner fuel safety-shutoff valves are permitted to be open before the primary-safety control is required to supervise the main burner flame

3.119DV.20 NOZZLE – a device with one or more openings for discharge of the fluid from the system. A nozzle restricts the fluid flow in order to obtain the desired pressure, velocity, spray patterns, and the resulting volume of flow.

3.119DV.21 PILOT FLAME-ESTABLISHING PERIOD – the length of time fuel is permitted to be delivered to a proved pilot before the flame-sensing device is required to detect pilot flame

3.119DV.22 PRESSURE WASHER – (also known as “high-pressure cleaning machine” or “power washer” or “high pressure cleaner”)

a machine incorporating a water inlet, a high pressure pump to increase the pressure of the incoming water, and a manually controlled water outlet nozzle

Such a machine is intended for cleaning by means of water pressure and flow. Pressure washers are divided into three types according to 3.119DV.33 and 3.119DV.34.

3.119DV.23 PROVED PILOT – a pilot flame supervised by a primary-safety control that senses the presence of the pilot flame prior to permitting the main burner fuel to be delivered for combustion

3.119DV.24 RADIATION SHIELD – a separate panel or panels interposed between heating surfaces and adjacent objects to reduce heat transmission by radiation

3.119DV.25 REGULATING (OPERATING) CONTROL – a control, which may or may not be a safety control or interlock

3.119DV.26 SAFETY CONTROL – automatic controls, including relays, switches, and other auxiliary devices used in conjunction therewith to form a safety control system, that will reduce the risk of fire, electric shock, or injury to persons during operation of the product

3.119DV.27 SAFETY SHUTDOWN – the action of shutting off all fuel and ignition energy to the product by means of a safety control or other controls such that restart cannot be accomplished without manual reset

3.119DV.28 SAFETY SHUTOFF VALVE – a valve that is automatically closed by the safety control system or by an emergency device

Such valve may be of the automatic or manually opened type.

3.119DV.29 STEAM CLEANER – identical to a hot water pressure washer, except that water flowing through the heat exchanger is heated to a temperature greater than the atmospheric boiling point

No steam is generated within the product. Temperature and pressure of the flowing water are maintained by combination of the water pump, the heat source, and the discharge nozzle. Water is not heated in a closed vessel. Whereas a hot water pressure washer discharges hot water, the water flow of a steam cleaner, upon exiting the discharge nozzle, immediately vaporizes to saturated steam. The temperature of the saturated steam at the exit side of the discharge nozzle is given by the ASME Steam Tables; for example it is 164 °C for a water pressure of 0,7 MPa absolute.

3.119DV.30 STABLE COMBUSTION – combustion evidenced by

a) constancy of fuel consumption; and

b) constancy of products in flue-gas analysis

3.119DV.31 SUPPORT HANDLE – the handle by which the operator supports the greatest percentage of product weight when the product is in use, transported, or both

This includes the handle of a pushcart mounted product, or any handle used to transport the product.

3.119DV.32 TRIAL-FOR-IGNITION PERIOD – that period of time the main burner fuel is permitted to be delivered into the ignition zone before the main flame-sensing device is required to detect main flame

3.119DV.33 TYPE 2 PRESSURE CLEANING MACHINE – a cleaning machine developing hydraulic power not greater than 6 kW and fluid pressure greater than 0,7 MPa, but not greater than 22 MPa, as measured at the discharge nozzle

3.119DV.34 TYPE 3 PRESSURE CLEANING MACHINE – a cleaning machine developing hydraulic power greater than 6 kW or fluid pressure greater than 22 MPa as measured at the discharge nozzle

However, the cleaning machine shall not develop hydraulic power greater than 17 kW or fluid pressure greater than 35 MPa in any case.

3.119DV.35 WAND – tubing or piping used to extend the nozzle

Also known as a lance.

4 General requirement

This clause of Part 1 is applicable.

5 General conditions for the tests

This clause of Part 1 is applicable except as follows.

5.1 *Addition:*

The burner is operated at rated power. Appliances intended for operation at more than one rated power are additionally tested at the most disadvantageous power.

The burner-air adjustment, where provided, is regulated to establish the air/fuel ratio to produce the combustion characteristics recommended in the user instructions. The combustion characteristics may be specified by the appearance of the flame, the percentage of carbon dioxide (CO_2) in the flue gases, or by other characteristics.

On appliances designed for use with a flue pipe, a section of flue pipe is attached to the appliance. Flue gas determinations are taken in this flue pipe.

The draught is adjusted to that recommended in the instructions for use.

5.4DV D2 *Modification: Add the following to Subclause 5.4 of the Part 1:*

A product with a fuel-fired water-heating system shall comply with the applicable performance requirements when tested with each grade or type of fuel recommended by the manufacturer of the product.

5.5DV D2 *Modification: Add the following to Subclause 5.5 of the Part 1:*

Adjustable levelling features of the product are to be set such that the base of the product is at the minimum distance from the floor.

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 *Replacement:*

Appliances shall be CLASS I, CLASS II or CLASS III with respect to the protection against electric shock. However, HAND-HELD APPLIANCES and hand-held parts of steam cleaners and high pressure cleaners shall be CLASS II or CLASS III.

Compliance is checked by inspection and by the relevant tests.

6.2 *Replacement:*

The appliances shall have a degree of protection against harmful ingress of water according to Table 101:

Table 101 – Degree of protection against harmful ingress of water

		Protection class (electric shock)	Protection degree (IEC 60529)
STEAM CLEANERS	for indoor use only	I – II	IPX4
		III	IPX3
	for outdoor use	I-II-III	IP X5
	HAND-HELD PARTS	II	IPX7
		III	IP X3
HIGH PRESSURE CLEANERS	HAND-HELD APPLIANCES	II-III	IP X7
	Other types of appliances	I-II-III	IP X5
	HAND-HELD PARTS	II-III	IP X7

However, FIXED APPLIANCES that are specified for installation in an independent room, where they will not be subject to spillage or splashing of water, shall be at least IPX0.

Compliance is checked by inspection and by the relevant tests.

7 Marking and instructions

This clause of Part 1 is applicable except as follows.

7DV D2 *Modification: Add the following to Clause 7 of the Part 2:*

7DV.1 Markings and instructions may be communicated in accordance with the provisions of the ANSI Z535 series of standards or equivalent.

7DV.2 Appliances having provision for connection to potable water supply as required by Clause 22.48DV.3 shall be marked with the following or equivalent wording:

WARNING: IF CONNECTION IS MADE TO A POTABLE WATER SYSTEM, THE SYSTEM SHALL BE PROTECTED AGAINST BACKFLOW.

7.1 *Addition:*

– RATED PRESSURE in Pascal;

– PERMISSIBLE PRESSURE in Pascal;

– maximum RATED FLOW in litre per minute;

– maximum RATED TEMPERATURE where this is above 50 °C;

– serial number;

– year of production. The year of production may be indicated by the last two digits of the year;

– maximum inlet water pressure in Pascal if not given in the instruction manual;

– maximum power of the water heater in kW.

NOTE 101 For electric heaters the input power is specified.

For gas-fired or oil-fired heaters the output power is specified.

7.1DV D2 *Modify Clause 7.1 of Part 2 by adding the following:*

7.1DV.1 Delete the 7th dashed item of Clause 7.1 of the Part 1. A product shall be marked in accordance with Table 7.1DV.1 or equivalent, as applicable.

Table 7.1DV.1
Indoor/outdoor markings

Intended use of product	Required marking
outdoor use only	For outdoor use only.
indoor use only	For indoor use only.
either indoor or outdoor use	For either indoor or outdoor use.
stationary or fixed product for indoor installation	For indoor installation only.
portable product for use outdoors, but intended to be stored indoors	Store indoors.

7.1DV.2 D2 ***Modification: Replace the sentence following note 101 of the Part 2 with the following:***

Maximum power of the water heater (burner) may be stated as the burner energy input rate in kW under maximum firing conditions using the highest heat-content fuel intended for the product.

7.1DV.101 ***Addition: Add the following Subclauses 7.1DV.101.1 – 7.1DV.101.4 to Subclause 7.1 of the Part 2:***

7.1DV.101.1 Each essential individual assembly not packaged with the product shall include on the assembly the manufacturer's or vendor's identification and part number. In addition, if parts or sections of a product are separately shipped from the factory, the primary nameplate for the product shall be marked in a manner which will relate the proper sections to one another when they are installed in the field. These requirements apply to any essential element that is not packaged with the section bearing the primary nameplate for the product.

7.1DV.101.2 A product, other than a fuel-fired product, that is intended for permanent installation in a garage or similar location and that incorporates arcing or sparking parts shall be permanently marked with the following statement or equivalent: "This equipment incorporates parts that tend to produce arcs or sparks and, therefore, when located in a garage, it should be in a room or enclosure provided for the purpose, or should be 45 cm or more above the floor."

7.1DV.101.3 The following information shall be provided on a product in a location that is visible to the user:

a) For a gas-fired product:

1) The kW input rate or rates;

2) The type of gas or gases for which the product is rated;

3) The designed manifold pressure or pressures; and

4) The designed inlet pressure range.

b) For an oil-fired product:

1) The firing rate or rate or range expressed to the nearest 0,4 L/hr; and

2) The grade(s) of fuel.

c) For a fuel-fired product:

The type of flooring, combustible or noncombustible, and the minimum clearances to adjacent construction.

7.1DV.101.4 A detachable fuel tank as described in 22DV.110.29.1.3 shall be marked on the outside surface with the following or equivalent statement: ″Do not use this container for transporting or storage of oil or any other flammable liquids. This container is intended to permit outdoor filling without moving the machine.″

Exception: A tank investigated and found acceptable for use as a safety can need not be so marked.

7.1DV.3 DR *Modification to Clause 7.1 to add the following text:*

A marking shall be provided on a portable cord-connected product if the product has a marked ampere rating which exceeds 80 percent of the rating of the branch circuit to which it may be connected, in accordance with the National Electrical Code. This marking shall read "Connect to Individual Branch Circuit Only."

A yellow label with black lines showing the substance of the warning symbols in accordance with Figure 101 shall be permanently fixed to the appliance.

7.1DV.4 D2 *Modification: Delete from Subclause 7.1 of the Part 2:*

Delete the paragraph starting with ″A yellow label with black lines...″

All pressure hoses shall be marked with a pressure of at least the PERMISSIBLE PRESSURE in megapascals and the maximum temperature in degrees Celsius and shall be marked with the name of the manufacturer and the date of production. These data may be coded.

NOTE 102 For low pressure accessories, no marking of the PERMISSIBLE PRESSURE is necessary.

The TRIGGER GUN and the spray lance shall be marked with the PERMISSIBLE PRESSURE in megapascals and the maximum temperature in degrees Celsius and with a mark giving the manufacturer of the TRIGGER GUN.

7.1DV.5 D2 *Modification: The underlined words are added to the sentence following note 102 as follows:*

7.1DV.5.1 The TRIGGER GUN and the spray lance shall be marked with the permissible pressure <u>of each</u> in megapascals and the maximum temperature <u>of each</u> in degrees Celsius, and <u>the TRIGGER GUN</u> with a mark giving the manufacturer of the trigger gun.

NOTE 103 It is recommended that the safety valve should be marked with an identification.

7.1DV.6 DE *Deletion:*

Delete NOTE 103.

When the surface of a flue or duct for exhaust gases from the heater exceeds a temperature rise of 60 K, a warning notice shall be fitted near to the hot surface stating

WARNING: Hot. Do not touch.

or displaying symbol No. 5041 of IEC 60417-1.

The height of the lettering shall be not less than 4 mm.

Steam cleaners shall be marked with symbol IEC 60417-5597.

Appliances not intended to be connected to the potable water mains shall be marked with the symbol according to Figure 104. It is acceptable to show this symbol in monochrome colour.

7.1DV.7 D2 *Modification: Delete the paragraph starting with ″Appliances not intended to be connected...″*

Appliances that can be used indoors and are powered by internal combustion engines, except LPG-powered engines, shall be marked with the symbol according to Figure 105. It is acceptable to show this symbol in monochrome colour.

7.1DV.8 D1 *Modification: Modify the first sentence of the last paragraph of Subclause 7.1 of the Part 2 as follows:*

Replace ″that can″ with ″intended to″.

7.1DV.102 D2 *Addition: Add Subclauses 7.1DV.102 - 7.1DV.102 to Subclause 7.1 of the Part 2 as follows:*

7.1DV.102.1 Cautionary and warning markings

7.1DV.102.2 General requirements

7.1DV.102.2.1 In all cases, wording for the marking following the word “CAUTION” or “WARNING” may vary from that shown but shall be equivalent. Markings may be grouped under the appropriate signal word “CAUTION” or “WARNING”.

7.1DV.102.2.2 The instructions shall contain at least the meaning of the symbols used on the cleaning machine and in the instructions.

7.1DV.102.2.3 The following markings, as applicable, shall be provided on each product. Warnings may be communicated in accordance with the provisions of the ANSI Z535 series of standards or equivalent. Signal words may vary in compliance with ANSI Z535.4, but shall not be of lesser significance than indicated here.

Always wear properly rated eye protection such as safety goggles or face shield while spraying. (Safety glasses do not provide full protection.)

“CAUTION – Gun Kicks Back – Hold With Both Hands.”

“WARNING – Risk Of Explosion – Do Not Spray Flammable Liquids.”

“CAUTION – To Reduce the Risk of Injury, Read Operating Instructions Carefully Before Using.”

7.1DV.102.2.4 If part of the lance, wand, gun or adjacent surfaces subject to contact during normal use exceeds the maximum surface temperature rise on a handle or knob grasped for lifting, carrying, or holding as specified in Table 3 and Table 11.8DV, the product shall be provided with a permanent marking with the following wording or the equivalent:

"CAUTION – Hot Surfaces – Use Only Designated Gripping Areas Of Lance (Wand Or Gun)." The marking shall be in a location that is visible to the operator during normal use.

7.1DV.102.2.5 A removable guard, panel or cover providing protection from contact with hot parts shall be permanently marked with the following or equivalent:

"CAUTION – Hot Surfaces are Contained Within This Compartment."

Exception: Individual parts may be marked "Caution– Hot."

7.1DV.102.3 *Gas- and oil-fired products*

7.1DV.102.3.1 The following marking or equivalent shall be provided on all portable gas- and oil-fired products.

"WARNING" and the following or equivalent wording, "Risk of Asphyxiation. Use This Product Only In A Well Ventilated Area."

"WARNING" and the following or equivalent statement, "Risk Of Explosion. Operate Only Where Open Flame Or Torch Is Permitted."

7.1DV.102.3.2 An oil-fired product with a tank shall be marked "CAUTION" and the following or equivalent statement:

"Risk of Fire. Do Not Add Fuel When The Product Is Operating Or Still Hot."

7.1DV.102.4 *Engine-driven products*

7.1DV.102.4.1 An engine-driven product equipped with a recoil starter shall be marked with the following or equivalent:

"WARNING – Starter cord kickback (rapid retraction) can result in bodily injury. Kickback will pull hand and arm toward engine faster than you can let go. ALWAYS relieve spray gun pressure before pulling starter cord. Pull starter cord slowly until resistance is felt, then pull rapidly."

7.1DV.102.4.2 The radiator cap on a water-cooled engine shall be marked with the following or equivalent:

"CAUTION – Do not remove when hot."

7.1DV.102.4.3 A gasoline-fueled engine shall be marked with the following or equivalent:

"CAUTION – Risk of fire. Do not add fuel when the product is operating or still hot."

7.1DV.102.4.4 An engine-driven product shall be marked with the following or equivalent:

″Running this product indoors can result in death due to carbon monoxide, a poison gas you cannot see or smell. Never operate indoors, even if windows and doors are open. Only use outdoor and far away from windows, doors, and openings or vents.″

7.1DV.102.5 *Electrically operated products*

7.1DV.102.5.1 A portable electrically operated product shall be provided with a tag attached to the power-supply cord. The tag shall be plainly and permanently marked with the following wording, or the equivalent, in the format shown. No substitute other than DANGER shall be used for "WARNING." The words "WARNING – RISK OF ELECTROCUTION" and "DO NOT REMOVE THIS TAG" shall be in block lettering. See 7.14DV.2.6.

a) For a grounded product:

″WARNING

RISK OF ELECTROCUTION

1. Connect Only To Properly Grounded Outlet. Do Not Remove Ground Pin

2. Inspect Cord Before Using – Do Not Use If Cord Is Damaged

3. Keep All Connections Dry And Off The Ground

4. Do Not Touch Plug With Wet Hands"

5. For a product rated either

- **250 volts or less, single phase; or**
- **3-phase, 208Y/120 volts and 60 A or less:**

"This pressure washer is provided with a Ground Fault Circuit Interrupter (GFCI) built into the plug or the power-supply cord. This device provides additional protection from the risk of electric shock. Should replacement of the ground-fault circuit-interrupter or cord become necessary, use only identical replacement parts."

6. For a product rated more than 250 volts, single phase, or more than 3-phase, 208Y/120 volts and 60 A or less:

"To provide additional protection from the risk of electric shock, this pressure washer should be protected by a ground fault circuit interrupter (GFCI)."

7. “Read instruction manual before using.

DO NOT REMOVE THIS TAG”

b) For a double-insulated product:

“WARNING

RISK OF ELECTROCUTION

1. Inspect cord before using – do not use if cord is damaged

2. Keep all connections dry and off the ground

3. Do not touch plug with wet hands

4. Double Insulated – when servicing use only identical replacement parts”

5. For a product rated either

- **250 volts or less, single phase; or**

- **3-phase, 208Y/120 volts and 60 A or less:**

“This pressure washer Is provided with a Ground Fault Circuit Interrupter (GFCI) built into the plug or the power-supply cord. This device provides additional protection from the risk of electric shock. Should replacement of the ground-fault circuit-interrupter or cord become necessary, use only identical replacement parts.”

6. For a product rated more than 250 volts, single phase, or more than 3-phase, 208Y/120 volts and 60 A or less:

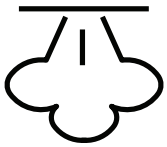
“To provide additional protection from the risk of electric shock, this pressure washer should be protected by a ground fault circuit interrupter (GFCI).”

7. “Read Instruction Manual Before Using

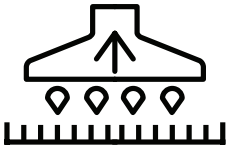
DO NOT REMOVE THIS TAG”

Add the following subclause:

7.6 Addition:



[symbol IEC 60417-5597 (DB:2002-10)] steam



[symbol IEC 60417-5935 (DB:2002-10)] motorized cleaning head for water-suction cleaning

su0945

7.7DV.1 D2 *Addition: Add the following at the end of subclause 7.7 of the Part 1:*

7.7DV.1.1 A permanently connected product shall be provided with an abbreviated or complete wiring diagram or chart of the product to provide information necessary for the proper selection of power-supply conductors, overcurrent protection, and disconnecting means. The diagram or chart shall show the location of each connection that must be made in the field. A label attached to an accessible cover is considered to comply with this requirement.

7.7DV.2 DR *Addition to subclause 7.7 of the Part 1 as follows:*

7.7DV.2.1 If any point within a terminal box or wiring compartment of a permanently connected product in which the power-supply conductors are intended to be connected, including such conductors themselves, attains a temperature of more than 60°C during the normal-temperature test, the product shall be permanently marked ″For supply connection, use wires acceptable for at least ...C,″ or with an equivalent statement, and the temperature value shall be in accordance with Table 7.7DV.1. This statement shall be located at or near the point where the supply connections are to be made, and shall be clearly visible both during and after installation of the product.

Table 7.7DV.1
Temperature marking (based on 25°C ambient)

Temperature attained during test at points within terminal box or compartment, or on wires intended for supply connections, °C	Temperature marking
61 – 75	75
76 – 90	90

7.7DV2.2 Terminals for field wiring shall be prominently marked ″USE COPPER CONDUCTORS ONLY,″ ″FOR USE WITH ALUMINUM OR COPPER CONDUCTORS,″ or with an equivalent statement, as appropriate.

7.7DV2.3 A permanently connected product having one motor and other loads or more than one motor with or without other loads shall be permanently marked, in a location that will be visible when connections to the power-supply circuit are made and inspected, with:

a) The minimum supply-circuit conductor ampacity in accordance with 25.2DV.1, and the maximum rating and type - for example, non-time delay fuse, and dual-element-time delay fuse, or similar rating and type - of supply-circuit overcurrent-protective device in accordance with 25.2DV.1; or

b) The abbreviated wiring diagram or chart required by 7.7DV.1.1 if it is of a permanent type and in a location that is visible when connection to the power-supply circuit are made and inspected.

c) If a product is intended for use on two or more circuits, the nameplate shall include the above information for each circuit.

7.10DV D2 ***Modification to IEC Clause 7.10 of the part 1 by deleting part of the IEC wording as follows:***

Delete from the first paragraph the words, “on STATIONARY APPLIANCES.”

7.12 Addition:

The cover of the instruction sheet shall carry the following:

WARNING: Do not use the appliance without reading the instruction sheet.

This warning may be replaced by symbol 0434 and symbol 1641 of ISO 7000. In this case the meaning of these symbols shall be explained.

If symbol No. 5041 of IEC 60417-1 is marked on the appliance, its meaning shall be explained.

The instructions shall contain the substance of the following.

– The electric supply connection shall be made by a qualified electrician and comply with IEC 60364-1.

NOTE 101 It is recommended that the electric supply to this appliance should include either a residual current device that will interrupt the supply if the leakage current to earth exceeds 30 mA for 30 ms or a device that will prove the earth circuit.

– WARNING: This appliance has been designed for use with the **cleaning agent** supplied or recommended by the manufacturer. The use of other **cleaning agents** or chemicals may adversely affect the safety of the appliance.

– WARNING: Do not use the appliance within range of persons unless they wear protective clothing.

– WARNING: High pressure jets can be dangerous if subject to misuse. The jet must not be directed at persons, live electrical equipment or the appliance itself.

– Do not direct the jet against yourself or others in order to clean clothes or foot-wear.

– Disconnect from the electrical power supply before carrying out **user maintenance**.

– High pressure cleaners shall not be used by children or untrained personnel.

– To ensure appliance safety, use only original spare parts from the manufacturer or approved by the manufacturer.

– WARNING: High pressure hoses, fittings and couplings are important for the safety of the appliance. Use only hoses, fittings and couplings recommended by the manufacturer.

– Do not use the appliance if a **supply cord** or important parts of the appliance are damaged, e.g. safety devices, high pressure hoses, **trigger gun**.

– If an extension cord is used, the plug and socket must be of watertight construction.

– WARNING: Inadequate extension cords can be dangerous.

– Where gas or liquid fuel are used the specification of the correct fuel and the following warning:

- WARNING: Incorrect fuels shall not be used as they may prove hazardous.

– For oil fired appliances without a **primary safety control**, the statement:

- This appliance must be attended during operation.

– The intended use of the appliance.

– For gas or oil-heated appliances it is important to provide adequate ventilation and make sure that the flue gases are properly discharged.

– Adequate information about the starting/stopping of the appliance and storage.

– For **fixed appliances** intended to be used in a dry independent room, and for steam cleaners intended for indoor use only, the installation instructions shall carry the following notice:

- Do not splash or wash down.

– Adequate information about the nozzles to be used, the danger of the kickback force and the sudden torque on the spray assembly when opening the **trigger gun**.

– The kickback forces have to be given in the manual if they exceed 20 N.

– The functioning of the safety devices, e.g. **safety valves, flow switches, pressure switches**.

– Adequate information about **user maintenance**.

– Adequate information about malfunction.

– Where provision is made for remote signalling, reference must be made to the wiring installation requirements of the country.

– Adequate information about the connection with the water mains, including the maximum inlet pressure, if not given on the rating plate.

– The A-weighted sound pressure level L_{pA} in dB(A), emitted by the appliance. If the A weighted sound pressure level exceeds 85 dB(A), it shall also state the sound power level L_{WA} in dB(A) and that appropriate ear protection has to be used. The sound level is measured in accordance with IEC 60704-1.

– The weighted r.m.s. acceleration value to which the operators' arms are subjected in m/s^2, separately for each arm (if applicable). The weighted r.m.s. acceleration value is measured in accordance with ISO 5349 for arm vibrations, the appliance being supplied at **rated voltage** or at the maximum **rated voltage** for machines with a range of voltages.

Instructions for use for **water jetters** (if applicable) shall be given, such as "Insert hose to red mark before turning on the appliance".

The instructions for appliances having a current-carrying hose operating at other than **safety extra-low voltage** shall include the substance of the following:

CAUTION: This hose contains electrical connections:

– do not use to collect water;

– do not immerse in water for cleaning;

– the hose should be checked regularly and must not be used if damaged.

If the symbol IEC 60417-5935 is used, its meaning shall be explained.

The instructions shall contain the substance of the following, if applicable.

– WARNING: Do not use combustion engine powered appliances indoors unless adequate ventilation is assessed by national labour authorities.

– WARNING: Ensure that any exhaust emissions are not in the vicinity of air intakes.

For appliances intended to be connected to the potable water mains, the instruction shall contain the substance of the following, if applicable:

– adequate information for the correct connection to the potable water mains;

– necessary length and quality of the water supply hose;

– necessary measures for conversion of the connection from water mains supply to supply from other water sources.

For appliances not intended to be connected to the water mains, the instruction shall contain the substance of the following, if applicable:

– adequate information for the correct connection to the water supply;

– adequate information about suction operation;

– necessary length and quality of the water supply hose;

– necessary measures for conversion of the connection from supply from other water sources to supply from the potable water mains (if applicable).

For all appliances, the instruction shall contain the substance of the following:

– water that has flown through backflow preventers is considered to be non-potable.

7.12DV.1 D2 ***Modification: Replace the third paragraph of Subclause 7.12 of the Part 2 with the following:***

This warning may be replaced by symbol 0434 and symbol 1641 or 0790 of ISO 7000.

The instructions shall contain at least the meaning of the symbols used on the cleaning machine and in the instructions.

7.12DV.2 D2 ***Modification: delete the eleventh dash item of Subclause 7.12 of the Part 2.***

7.12DV.3 D2 ***Modification: add the following note after the twelfth dash item of Subclause 7.12 of the Part 2:***

NOTE 1 See 7.12DV.13.3 d)

7.12DV.4 D2 *Modification: add the following note after the sixteenth dash item of Subclause 7.12 of the Part 2:*

NOTE 2 See 7.1DV.102.2.1

7.12DV.5 D2 *Modification: add the following note after the twenty-second dash item of Subclause 7.12 of the Part 2:*

NOTE 3 An example of special precautions is protection against freezing.

7.12DV.6 D2 *Modification: add the following to the twenty-sixth dash item of Subclause 7.12 of the Part 2:*

Statement of sound pressure and power levels is optional.

7.12DV.7 D2 *Modification: add the following to the twenty-seventh dash item of Subclause 7.12 of the Part 2:*

Statement of vibration level is optional.

7.12DV.8 D2 *Modification: in Subclause 7.12 of the Part 2, delete "for cleaning" from the second dash item under "CAUTION."*

7.12DV.9 DE *Modification: delete:*

"If the symbol IEC 60417-5935 is used, its meaning shall be explained." (All symbols must be explained.)

7.12DV.10 D2 *Modification: addition of the following to Subclause 7.12 of the Part 2:*

For an engine driven product employing a battery starter, the following caution shall be provided:

"CAUTION – Risk of injury: Disconnect battery ground terminal before servicing."

7.12DV.11 D2 *Modification: addition of the following to Subclause 7.12 of the Part 2:*

General requirements for instructions

7.12DV.11.1 The product instructions may be combined in one or more manuals provided the instructions pertaining to a risk of fire, electric shock, or injury to persons are separated in format and emphasized to distinguish them from the rest of the text.

7.12DV.11.2 The following items shall be entirely in upper case letters or shall be emphasized to distinguish them from the rest of the text:

a) The headings for the installation, operation, user-maintenance, and moving and storage instructions;

b) The heading for the instructions pertaining to a risk of fire, electric shock, or injury to persons; and

c) The opening and closing statements of the instructions specified in 7.12DV.13.2– “IMPORTANT SAFETY INSTRUCTIONS” and “SAVE THESE INSTRUCTIONS,” or the equivalent.

7.12DV.11.3 An illustration may be used with a required instruction to clarify the intent but shall not replace the written instructions.

7.12DV.12 D2 *Modification: addition of the following to Subclause 7.12 of the Part 2:*

Moving and storage instructions

If moving or storage of a product could result in damage to the product that could result in a risk of fire, electric shock, or injury to persons during subsequent use, the instructions shall describe the proper moving and storage procedure, and shall be preceded by the heading “MOVING AND STORAGE INSTRUCTIONS” or the equivalent.

7.12DV.13 D2 *Modification: addition of the following to Subclause 7.12 of the Part 2:*

Instructions pertaining to a risk of fire, electric shock, or injury to persons

7.12DV.13.1 The instructions pertaining to a risk of fire, electric shock, or injury to persons shall include those items in the list in 7.12DV.13.2 that are applicable to the product. The statement “IMPORTANT SAFETY INSTRUCTIONS” or the equivalent shall precede the list, and the statement “SAVE THESE INSTRUCTIONS” or the equivalent shall either precede or follow the list. The signal words “WARNING” or “CAUTION” shall be entirely in upper case letters or shall be emphasized to distinguish them from the rest of the text.

NOTE See also 7.12DV.5

7.12DV.13.2 The items in the following list (or equivalent) may be numbered, and other instructions pertaining to a risk of fire, electric shock, or injury to persons that the manufacturer believes are needed may be included.

IMPORTANT SAFETY INSTRUCTIONS

WARNING – When using this product basic precautions should always be followed, including the following:

1. Read all the instructions before using the product.

2. To reduce the risk of injury, close supervision is necessary when a product is used near children.

3. Know how to stop the product and bleed pressures quickly. Be thoroughly familiar with the controls.

4. Stay alert – watch what you are doing.

5. Do not operate the product when fatigued or under the influence of alcohol or drugs.

6. Keep operating area clear of all persons.

7. Do not overreach or stand on unstable support. Keep good footing and balance at all times.

8. Follow the maintenance instructions specified in the manual.

9. For a grounded or double-insulated product rated either

– 250 volts or less, single phase; or

– 3-phase, 208Y/120 volts and 60 A or less:

"This Product Is Provided With A Ground Fault Circuit Interrupter Built Into The Power Cord or Plug. If Replacement Of The Ground Fault Circuit Interrupter Or Cord Is Needed, Use Only Identical Replacement Parts."

10. For a grounded or double insulated product rated more than 250 volts, single phase, or more than 3-phase, 208Y/120 volts and 60 A or less:

"This Product Shall Only Be Connected To A Power Supply Protected By A Ground Fault Circuit Interrupter."

11. WARNING – Risk of eye injury. Spray can splash back or propel objects. Always wear properly rated eye protection such as safety goggles or face shield while spraying. (Safety glasses do not provide full protection.)

12. For an engine-driven product equipped with a recoil starter:

"WARNING – Starter cord kickback (rapid retraction) can result in bodily injury. Kickback will pull hand and arm toward engine faster than you can let go. ALWAYS relieve spray gun pressure before pulling starter cord. Pull starter cord slowly until resistance is felt, then pull rapidly."

A cleaning machine that uses a gas burner with a manually lighted pilot shall include the following or equivalent statements for lighting the pilot, preceded by the specified signal word:

1. "WARNING: If you do not follow these instructions exactly, a fire or explosion may result causing property damage, personal injury or loss of life."

2. "In the event of pilot outage, wait at least five minutes to clear out any gas before relighting."

3. "Use only your hand to push in or turn the gas control knob. Never use a tool. If the knob will not push in or turn by hand, don't try to repair it; call a qualified service technician."

SAVE THESE INSTRUCTIONS

7.12DV.13.3 The instructions pertaining to a risk of fire, electric shock, or injury to persons, or the installation instructions shall include (a) – (d), as applicable in the format shown. If the applicable instructions in (a) – (d) are included in the installation instructions, a reference to these instructions shall be included in the list mentioned in 7.12DV.13.1 as a separate item. The headings "GROUNDING INSTRUCTIONS," "EXTENSION CORDS," "SERVICING OF A DOUBLE INSULATED PRODUCT," "GROUND FAULT CIRCUIT INTERRUPTION PROTECTION", and the signal words "DANGER" and "WARNING" shall be entirely in upper case letters or shall be emphasized to distinguish them from the rest of the text.

a) Cord connected, grounded products:

GROUNDING INSTRUCTIONS

This product must be grounded. If it should malfunction or break down, grounding provides a path of least resistance for electric current to reduce the risk of electric shock. This product is equipped with a cord having an equipment-grounding conductor and a ground pin. The plug must be plugged into an appropriate outlet that is properly installed and grounded in accordance with all local codes and ordinances.

WARNING – Improper connection of the equipment-grounding conductor can result in a risk of electrocution. Check with a qualified electrician or service personnel if you are in doubt as to whether the outlet is properly grounded. Do not modify the plug provided with the product – if it will not fit the outlet, have a proper outlet installed by a qualified electrician. Do not use any type of adapter with this product.

1. For a product rated either

– 250 volts or less, single phase; or

– 3-phase, 208Y/120 volts and 60 A or less:

GROUND FAULT CIRCUIT INTERRUPTER PROTECTION

This pressure washer is provided with a ground-fault circuit-interrupter (GFCI) built into the plug or the power-supply cord. This device provides additional protection from the risk of electric shock. Should replacement of the ground-fault circuit-interrupter or cord become necessary, use only identical replacement parts.

2. For a product rated more than 250 volts, single phase, or more than 3-phase, 208Y/120 volts and 60 A or less:

GROUND FAULT CIRCUIT INTERRUPTER PROTECTION

To comply with the National Electrical Code (NFPA 70) and to provide additional protection from the risk of electric shock, this pressure washer should be protected by a ground fault circuit interrupter (GFCI).

b) Cord connected, double insulated products:

1. For a product rated 250 volts or less, single phase:

GROUND FAULT CIRCUIT INTERRUPTER PROTECTION

This pressure washer is provided with a ground-fault circuit-interrupter (GFCI) built into the plug or the power-supply cord. This device provides additional protection from the risk of electric shock. Should replacement of the ground-fault circuit-interrupter or cord become necessary, use only identical replacement parts.

2. For a product rated more than single phase, or more than 250 volts:

GROUND FAULT CIRCUIT INTERRUPTER PROTECTION

To comply with the National Electrical Code (NFPA 70) and to provide additional protection from the risk of electric shock, this pressure washer should be protected by a ground fault circuit interrupter (GFCI).

SERVICING OF A DOUBLE-INSULATED APPLIANCE

In a double-insulated product, two systems of insulation are provided instead of grounding. No grounding means is provided on a double-insulated product, nor should a means for grounding be added to the product. Servicing a double-insulated product requires extreme care and knowledge of the system, and should be done only by qualified service personnel. Replacement parts for a double-insulated product must be identical to the parts they replace. A double-insulated product is marked with the words "DOUBLE INSULATION" or "DOUBLE INSULATED." The following symbol may also be marked on the product.

M3

c) Permanently connected products:

GROUNDING INSTRUCTIONS

This product must be connected to a grounded, metal, permanent wiring system; or an equipment-grounding conductor must be run with the circuit conductors and connected to the equipment-grounding terminal or lead on the product.

d) Extension cords, all products

EXTENSION CORDS

If the appliance cord is equipped with a GFCI, do not use extension cords. If the appliance cord is not equipped with a GFCI, the appliance and any extension cord used should be connected only to a GFCI-protected power source.

1. Use only extension cords that have grounding-type plugs and female cord connectors that accept the plug from the product.

2. Use only extension cords that are intended for outdoor use. These extension cords are identified on the packaging or on the cord by a marking “Acceptable for use with outdoor appliances; store indoors while not in use.”

3. Use only extension cords having an electrical rating not less than the rating of the product.

4. Do not use a damaged extension cord. Examine extension cord before using and replace if damaged.

5. Do not abuse extension cord and do not yank on a cord to disconnect.

6. Keep cord away from heat and sharp edges.

7. Always disconnect the extension cord from the receptacle before disconnecting the product from the extension cord.

WARNING – To reduce the risk of electrocution, use only a GFCI-protected extension cord or plug into GFCI outlet. Keep all connections dry and off the ground. Do not touch plug with wet hands.

7.14 Addition:

The height of symbol IEC 60417-5935 shall be at least 15 mm.

Compliance is checked by measurement.

7.14DV D2 *Modification: add the following to Subclause 7.14 of the Part 2:*

Permanence of Markings

7.14DV.1 General

7.14DV.1.1 Representative samples of a tag or label (other than decorative) are to be subjected to exposure conditions for indoor use (standard atmosphere, water immersion, and oven aging) or, if applicable, to exposure conditions for outdoor use (indoor use plus low temperature and ultraviolet light and water exposure), to determine compliance with requirements for permanence and legibility in UL 969.

7.14DV.1.2 If a tag or label is exposed to unusual conditions in service such as oils, detergents, or other conditions, representative samples are to be subjected to an additional immersion test. This test is to be conducted in the same manner as the immersion test described in UL 969 except that the samples are to be immersed in a representative solution of service use, instead of in demineralized water. Following the test, the labels shall comply with the requirements for permanence and legibility in UL 969.

7.14DV.2 Tags

7.14DV.2.1 A cord tag used for the cautionary marking described in 7.12DV.13.1 and a tag other than a cord tag that is used for cautionary or warning marking shall comply with the requirements:

a) In 7.14DV.2.2 – 7.14DV.2.5; and

b) For permanence and legibility in UL 969, when tested as specified in 7.14DV.1.

7.14DV.2.2 Three as-received samples and six samples of the tag that have been subjected to the conditioning specified in 7.14DV.2.4, three for each condition, are to be subjected to the test described in 7.14DV.2.5. After testing, the samples shall comply with the following requirements:

a) The tag shall not tear for more than 1,6 mm at any point;

b) The tag shall not separate from its point of attachment;

c) The tag shall not slip or move along the length of a cord or a tubular-type mounting surface more than 15 mm.

d) There shall be no permanent shrinkage, deformation, cracking, or any other condition that will render the marking on the tag illegible; and

e) Overlamination shall remain in place and not be torn or otherwise damaged. The printing shall remain legible.

7.14DV.2.3 Each sample is to consist of a length of cord or tubular-type mounting surface, or if the surface is flat, a section of the surface having dimensions larger than the tag. The tag is to be affixed to the cord or surface in the intended manner. If tags are applied by an adhesive, tests are to be conducted no sooner than 24 h after application of the tag.

7.14DV.2.4 The conditioning required by 7.14DV.2.2 is to consist of the following:

a) The samples are to be conditioned for 24 h in an air-circulating oven maintained at a uniform temperature of 87,0 ±1,0 C. Following removal from the oven, the samples are to remain at a temperature of 23,0 ±2,0 C and a relative humidity of 50 ±5 percent for 30 min before testing.

b) The samples are to be conditioned for 72 h in a humidity of 85 ±5 percent at 32,0 ±2,0 C. The samples are to be tested within 1 min after the conditioning.

7.14DV.2.5 A cord or tubular-type mounting surface is to be held rigidly in a vertical orientation. A flat mounting surface is to be held rigidly in a vertical plane. A force of 22,3 N is to be applied to the uppermost corner of the tag farthest from the point of attachment, within 7 mm of the vertical edge of the tag. The force is to be applied vertically downward and maintained for 1 min. In determining compliance with 7.14DV.2.2(d), manipulation such as straightening of the tag by hand is permitted.

7.14DV.2.6 The cord tag specified in 7.12DV.13.1 shall:

a) Be permanently affixed to the power-supply cord, and

b) Be located not more than 152,4 mm from the attachment plug.

7.14DV.3 The literature for accessories shall indicate what accessories are intended for use with the product if use of such accessories may expose the user to a risk of injury.

7.101 Motorized cleaning heads shall be marked with

– **rated voltage** or **rated voltage range** in volts;

– **rated power input** in watts;

– name, trade mark or identification mark of the manufacturer or responsible vendor;

– model or type reference.

Motorized cleaning heads, except those of **class III construction** having a **working voltage** up to 24 V shall be marked with symbol IEC 60417-5935.

NOTE This symbol is an information sign and, except for the colours, the rules of ISO 3864-1 apply.

7.101DV D2 *Modification: deletion from Subclause 7.101 of the Part 2:*

Delete the sentence “Motorized cleaning heads. 5935” and the note following it.

Compliance is checked by inspection.

7.102 Power outlets for accessories shall be marked with the maximum load in watts.

7.102DV D2 *Modification: addition to Subclause 7.101 of the Part 2:*

Add "or amperes" following "watts."

NOTE This marking may be on the appliance close to the appliance outlet.

Compliance is checked by inspection.

8 Protection against access to live parts

This clause of Part 1 is applicable except as follows.

8.1 *Addition:*

NOTE 101 Water and water-borne **cleaning agents** are considered as being conductive.

8.1.4 *Addition:*

Isolated battery systems of 18 to 24 cells of either acid or alkaline electrochemistry, including gel batteries, shall be regarded as **class III** provided that

– the maximum voltage per cell on charge does not exceed 2,7 V;

– there are no earthed parts;

– conductive parts cannot fall on to and thereby bridge live parts of opposite polarity.

9 Starting of motor-operated appliances

This clause of Part 1 is not applicable.

9DV D2 *Modification: Replace Clause 9 of the part 2 with the following:*

This Clause of Part 1 is applicable except as follows. Add the underlined words to Subclause 9DV.2 of the part 1:

The use of time delay fuses is acceptable for stationary <u>or portable</u> appliances marked as indicated in clause 7.17DV.

10 Power input and current

This clause of Part 1 is applicable except as follows.

10.1 *Addition:*

The power input of **motorized cleaning heads** is measured separately.

10.101 At **normal operation** the pressure shall not deviate more than ± 10 % from the **rated pressure**, and the **permissible pressure** shall not be exceeded.

NOTE The burner performance is adjusted in accordance with the manufacturer's instructions.

Compliance is checked by measurement.

The **permissible pressure** shall not exceed 1,5 times the **rated pressure**.

11 Heating

This clause of Part 1 is applicable except as follows.

11.4 *Modification:*

Replace *"**Heating appliances**"* by *"Electric **heating appliances**"*.

11.7 *Addition:*

Appliances are operated until steady conditions are established.

11.7DV D2 *Modification: add the following to Subclause 11.7 of the Part 2:*

A temperature is considered to be constant when three successive readings taken at intervals of 10 percent of the previously elapsed duration of the test, but not less than 5-min intervals, indicate no change.

11.8DV DC *Modification:*

Table 3 of Part 1 is modified according to Table 11.8DV.

Table 11.8DV
Maximum normal temperatures

Part	Temperature (C)
11.8DV.8 Sealing compound	melting point – 40 K
11.8DV.9 Engine electrical systems (12 V)	175
11.8DV.10 Flame spreaders and combustion heads	
– gray iron	542
– Cr alloy cast iron (0.5–1.0% Cr, 0.2–0.5% Ni or Cu)	708
– ductile iron	708
– type 430 Fe-Cr steel	819
– types 442, 446 Fe-Cr steel	892
– types 501, 502 Fe-Cr steel	708
– type 309 Fe-Cr-Ni steel	986
11.8DV.11 Flue baffles	
– aluminum coated steel	597
– ceramic coated steel (A19 or equivalent)	597
– low carbon steel	597
– gray iron	542
– ductile iron	542
– Cr alloy cast iron (0.5–1.0% Cr, 0.2–0.5% Ni or Cu)	708

Table 11.8DV Continued on Next Page

Table 11.8DV Continued

Part	Temperature (C)
– types 501, 502 Fe-Cr steel	708
– type 430 Fe-Cr steel	708
– types 442 Fe-Cr steel	819
– types 446 Fe-Cr steel	892
– type 309 Fe-Cr-Ni steel	986
11.8DV.12 Heating surfaces	
– aluminum coated steel	597
– ceramic coated steel (A19 or equivalent)	597
– low carbon steel	486
– gray iron	486
– Cr alloy cast iron (0.5–1.0% Cr, 0.2–0.5% Ni or Cu)	586
– type 410 Fe-Cr steel	625
– type 430 Fe-Cr steel	673
– types 442, 446 Fe-Cr steel	892
– type 321 Fe-Cr-Ni steel	769
– type 347 Fe-Cr-Ni steel	789
– type 316 Fe-Cr-Ni steel	825
– type 309 Fe-Cr-Ni steel	772
– aluminum coated steel liners and radiation shields[aa]	486
– galvanized steel[bb]	292
11.8DV.13 Fuel tubing and fittings	
– aluminum	372
– copper and copper alloys	233
– tinned copper	178
– steel, AISI Type C1010	428
– steel, AISI Type 410	539
– steel, AISI Type 430	672
– steel, AISI Type 446	872
11.8DV.14 LP-gas in a fuel tank[cc]	[cc]
11.8DV.15 Flue gases, permanently installed products	
– gas-fired, equipped with draft hood	247
– gas-fired, other	497
– oil-fired	542
11.8DV.16 Flue gases, portable products	no limit
11.8DV.17 Rubber, other than synthetic, used for gaskets or other parts, the deterioration of which could affect safety	
– when used as supplementary insulation or as reinforced insulation[dd]	65
– in other cases[dd]	75
11.8DV.19 Surface subject to casual contact	
– metallic	70
–nonmetallic	95
NOTE: The values in the table are based on an ambient temperature of 25 °C.	
[aa] The specified maximum temperature applies if the reflectivity of aluminum-coated steel is utilized to reduce risk of fire; otherwise the allowable temperature rise is as given under Heating Surfaces.	
[bb] The specified maximum temperature applies if the galvanizing is required as a protective coating or the reflectivity of the surface serves to reduce risk of fire.	

Table 11.8DV Continued on Next Page

Table 11.8DV Continued

Part	Temperature (C)
[cc] **Temperature shall not exceed that which would raise the pressure within an LP-gas container to more than 80 percent of the design working pressure of an ASME container or 120 percent of the minimum service pressure of a DOT fuel container.**	
[dd] **Note that such components must also comply with the Tests on Gaskets, Seals, and Parts, clause 21DV.1062.**	

11.101 The maximum temperature of the flue gases shall not exceed 400 °C.

The required test observations shall be recorded for any test input for the appliance. After 15 min of operation, samples of the flue gas shall be taken at a point between the flue outlet and the draught hood. Operation is considered to be stable when three consecutive samples taken at 15 min intervals show consistent analysis values.

The amount of smoke in the flue gases shall not exceed,

– for atomising and wall burners, that corresponding to a No. 2 Shell-Bacharach smoke spot;

– for vaporising burners, that corresponding to a No. 2 Shell-Bacharach smoke spot.

The amount of carbon monoxide (CO) in the flue gases shall not exceed 0,04 % (volume) on an air-free and dry basis.

Compliance is checked by measurements under the conditions specified in 11.2 to 11.7.

11.101DV DE *Modification: add the following after the first sentence of Subclause 11.101 of the Part 2:*

See 11.8dv.15 in Table 11.8DV regarding flue gas temperatures.

11.101DV.1 D2 *Modification: replace both dash items with the following:*

Flames at any allowable firing rate shall not produce smoke in excess of 1 as indicated on the Shell-Bacharach scale.

11.102 Hoses, spray lances and fittings containing the **cleaning agent** shall not exceed the **rated temperature**.

Compliance is checked by measurement under the conditions specified in 11.2 to 11.7.

11.103 The temperature rise of external enclosures that form part of exhausts or ducts from a combustion chamber and the temperature rise of flue gases have no limit.

Adequate protection against unintentional contact with hot metal parts by the user shall be ensured.

The temperature rise of the protection means shall not exceed 60 K.

Compliance is checked by inspection and by measurement under the conditions specified in 11.2 to 11.7.

11.103DV.2 D2 *For fixed fuel-fired products where a chimney connector passes through the test enclosure, enclosure inside surface temperatures are to be measured not less than 5 cm from the annulus, and not farther than 15 cm for a gas-fired product, and 23 cm for an oil-fired product from the chimney connector.*

11.104 Where liquid fuel is used the temperature of the fuel in the tank shall be at a maximum of 10 °C below the flash-point temperature, if there is a source of ignition in contact with the air/fuel mixture.

Compliance is checked by measurement under the conditions specified in 11.2 to 11.7.

11.105DV D2 *Addition of Subclauses 11DV.105.1 – 11DV.105.2 to Clause 11 of the Part 2:*

11DV.105.1 Gas-fired products

The performance of the burner shall be such that:

a) Ignition of the main burner flame occurs without backfire, flash, or puff during five ignition trials;

b) Flame does not flash outside the representative product or otherwise damage the representative product;

c) Combustion is complete and stable in the space provided by the product over the full operating range of the burner assembly or during any sudden change in the gas firing rate between maximum and minimum rates;

d) The concentration of carbon monoxide in an air free sample of the flue gas taken at the high-fire rate does not exceed 0,04 percent; and

e) The burner operates without interruption.

f) Gas-fired products having a burner input rating greater than 117 kW shall comply with the requirements of UL 295.

11DV.105.2 Oil-fired products

During this test:

a) The oil-temperature control for a burner intended to burn preheated oil is to be set for the minimum temperature recommended in the manufacturer's instructions for the grade of fuel oil being used;

b) Each spark gap is to be adjusted to the maximum recommended by the manufacturer, but not less than 3,2 mm, if the burner is to employ an interchangeable transformer;

c) The temperature of the oil as supplied to any parts of the burner, except those located downstream from the preheater, is to be 1,7±3 C; and

d) If a burner is equipped with a preheater, the temperature of the oil at the inlet to the preheater is to be not less than 11 K above the pour point of the test fuel.

The performance of the burner shall be such that:

a) Ignition of the main burner flame occurs without backfire, flash, or puff during five ignition trials;

b) Combustion is complete and stable at all firing rates over the operating range of the product;

c) Flames at any allowable firing rate do not produce smoke in excess of 1 as indicated on the Shell-Bacharach scale; and

d) The burner operates without interruption.

11.2DV D2 *Modification: add the following to Subclause 11.2 of the Part 1:*

11.2DV.1 Fixed products – corner installation. A ceiling of equivalent construction is to be placed above the product and in contact with the enclosure walls. All joints in the test enclosure are to be tight or sealed. The walls and ceiling of the enclosure are to:

a) Extend 0,9 m beyond the ends of the product, and

b) Be located at the minimum clearances, to the nearest cm, as specified by the manufacturer, from the sides and top of the product.

11.2DV.2 Fixed products – alcove or closet installation.

11.2DV.2.1 The ceiling height of the enclosure is to be that required to obtain the clearance from the top of the product to the ceiling specified by the manufacturer; but in no case is the ceiling height to be more than 2,3 m. See Figure 11.2DV.2.1.

11.2DV.2.2 The walls and ceiling of the enclosure are to be made of plywood approximately 20 mm thick. The walls are to be vertical and at right angles to each other. The interior surface of the walls and ceiling are to be finished in flat black paint. All joints of the enclosure are to be sealed. The floor is to be of combustible or noncombustible material as selected by the manufacturer for testing purposes and as specified on the product nameplate. Combustible floors are to be made of plywood approximately 20 mm thick, finished in flat black paint. Adjustable leveling features of the product are to be set such that the base of the product is at the minimum distance from the floor.

11.2DV.2.3 For the alcove installation test, the enclosure is to be open opposite the front of the product. The side walls and ceiling are to extend 46 cm beyond the front of the product, and a wall is to be placed opposite the open side of the enclosure at a distance of 1,2, 0,9, or 0,6 m as specified by the manufacturer for testing purposes.

11.2DV.2.4 For closet installation test, a simulated door is to be provided for the enclosure.

11.2DV.3 Fuel-fired fixed products

11.2DV.3.1 If the chimney connector passes through the enclosure, an opening 20 cm larger than the chimney connector is to be cut in the enclosure and the annulus thus formed is to be sealed on the exterior surface with a fire and heat resistive barrier at least 3 mm thick. See Figure 11.2DV.3.1.

11.2DV.3.2 The flue-gas temperature shall be measured in a plane perpendicular to the axis of the flue outlet immediately before the inlet to a draft hood or draft regulator. Two lines intersecting at right angles shall be established in the plane of measurement. They shall be oriented so that they will divide the flue collar internal area into quadrants. One temperature shall be taken at the intersection of the two lines. Eight temperatures shall be taken in sets of four along each line at points one-third and two-thirds of the distance from the intersection to the periphery. The flue-gas temperature shall be the average of these nine individual readings. When the flue outlets are nonsymmetrical or of unusual shape, the location of points at which the temperature of the flue gases is measured shall be at the discretion of the testing agency.

11.2DV.3.3 For the closet installation test, the door is to have two openings located so that the lower edge of the lower opening is 15 cm above the floor level of the enclosure and the other being located so that its upper edge is 15 cm below the ceiling of the enclosure. The height of each opening is to be one-half the width. The free area of each of the two openings is to be at least 6,5 cm^2 per 300 W of the heater input rating, but not more than an area equivalent to 20 percent of the total area of the simulated door. Both openings are to be centered on the vertical centreline of the enclosure.

11.2DV.4 Gas-fired products

A draft hood, if used, is to be in place.

11.2DV.5 Oil-fired products with mechanical atomising burners

A representative product is to be fired at its rated (W) input, ±5 percent, with a grade of fuel for which the burner is rated. The draft at the flue collar is to be as recommended by the manufacturer but not more than 1,5 mm water column for burners fired at 18,9 L per hour or less and not more than 2,3 mm for burners fired at rates from 18,9 to 60,6 L per hour.

12 Void

13 Leakage current and electric strength at operating temperature

This clause of Part 1 is applicable.

14 Transient overvoltages

This clause of Part 1 is applicable.

15 Moisture resistance

This clause of Part 1 is applicable except as follows.

15.1DV D2 *Modification: replacement: Clause 15.1 of the Part 1 is replaced by the following:*

15.1DV.1 Water spray test

As a result of each condition described in 15.1DV, there shall be no wetting of live parts, film-coated wire, or insulation likely to be adversely affected by the liquid involved, and no liquid shall enter a compartment housing field-installed wiring. For a cord-connected product rated 250 V or less, the leakage current is to be monitored during and after each test for compliance with Clause 13 of the Part 1. Following each test, the product shall comply with the requirements in a repeated Dielectric Voltage-Withstand Test, Clause 16 of the Part 1, and is then to be examined for presence of liquid.

A portable product or a product intended to be located in a wash area is to be subjected to a solid stream of water. The water spray test is to be conducted by means of the product's own high pressure discharge for 5 min from a nozzle-to-cleaning machine distance of 1,5 m. The discharge shall be made using the nozzle or nozzles supplied with the product that produces the worst case pressure and flow test criteria. Unless there are other possible operational positions of the product as stated in the manufacturer's instruction manual, the unit is to be placed on a flat horizontal surface for the duration of the test. The water stream is to be directed in a uniform manner (constant rate of movement over the product) over the entire surface of the product, at several angles, including the indirect splashing described below, with the trigger depressed in the full flow (full open) position.

Indirect splashing: the product is to be subjected to casual splashing caused by the hose stream directed at the supporting surface of the product to indirectly spray the underside of the cleaning machine.

15.2 Replacement:

Appliances shall be constructed so that spillage of liquid due to **normal operation**, overfilling or overturning of unstable, **hand-guided appliances** and **hand-held appliances** does not affect their electrical insulation.

NOTE 101 An appliance is considered to be unstable if it overturns when a force of 180 N is applied to the top of the appliance in the most unfavourable horizontal direction. The appliance is placed on a support inclined at an angle of 10° to the horizontal, the liquid container being filled to half the level indicated in the instructions for use.

Compliance is checked by the following test.

*Appliances with **type X attachment**, except those having a specially prepared cord, are fitted with the lightest permissible type of flexible cord of the smallest cross-sectional area specified in Table 11.*

***Hand-guided appliances** and **hand-held appliances** and appliances that are unstable are then, with the containers completely filled for the float tank, if any, and with the most conductive detergent recommended by the manufacturer for the detergent tank, if any, and with the cover lid in place, overturned from the most unfavourable of the normal positions of use, and are left in that position for 5 min, unless the appliance returns automatically to its normal position of use.*

Liquid containers that are filled by hand are completely filled with water containing approximately 1% NaCl and a further quantity, equal to 15% of the capacity of the container or 0,25 l, whichever is the greater, is poured in steadily over a period of 1 min.

***Hand-held appliances** and appliances that are unstable are then, with the containers completely filled for the float tank, if any, and with the most conductive detergent recommended by the manufacturer for the detergent tank, if any, and with the cover lid in place, overturned from the most unfavourable of the normal positions of use, and are left in that position for 5 min, unless the appliance returns automatically to its normal position of use.*

***Motorized cleaning heads** are placed in a container, the base of which is level with the surface supporting the appliance. The container is filled with a detergent solution to a level of 5 mm above its base, this level being maintained throughout the test. The solution consists of 20 g of NaCl and 1 ml of a solution of 28 % by mass of dodecyl sodium sulphate in each 8 l of water.*

The appliance is operated until its liquid container is completely full and for a further 5 min.

NOTE 102 The solution is to be stored in a cool atmosphere and used within seven days of its preparation.

NOTE 103 The chemical designation of dodecyl sodium sulphate is $C_{12}H_{25}NaSO_4$.

After each of these tests, the appliance shall withstand the electric strength test of 16.3.

*Inspection shall show that there is no trace of liquid on insulation that could result in a reduction of **clearances** or **creepage distances** below the values specified in Clause 29.*

15.3 Modification:

The relative humidity shall be 93 % ± 6 %.

15.101 **Motorized cleaning heads** of shall be resistant to liquids that may come into contact with them.

Compliance is checked by the following tests.

*The **motorized cleaning head** is subjected to an impact test as described in IEC 60068-2-75, the value of the impact being 2 J. The **motorized cleaning head** is rigidly supported and three blows are applied to every point of the enclosure that is likely to be weak.*

It is then subjected to the free fall test procedure 1 of IEC 60068-2-32. It is dropped 4 000 times from a height of 100 mm onto a steel plate having a thickness of not less than 15 mm. It is dropped

– 1000 times on its right side;

– 1000 times on its left side;

– 1000 times on its front face;

– 1000 times on its cleaning surface.

*The **motorized cleaning head** is then subjected to the test described in 14.2.7 of IEC 60529, the water containing approximately 1% NaCl.*

*The **motorized cleaning head** shall then withstand the electric strength test of 16.3 the voltage being applied between the **live parts** and the solution and inspection shall show that there is no trace of saline solution on insulation which could result in a reduction of **clearances** and **creepage distance**s below the values specified in Clause 29.*

NOTE The test is not carried out on **motorized cleaning heads** of **class III construction** having a **working voltage** up to 24V.

16 Leakage current and electric strength

This clause of Part 1 is applicable except as follows.

16.3 Addition:

Current-carrying hoses, except for their electrical connections, are immersed for 1 h in water containing approximately 1% NaCl, at a temperature of 20 °C ± 5 °C. While the hose is still immersed, a voltage of 2 000 V is applied for 5 min between each conductor and all the other conductors connected together. A voltage of 3 000 V is then applied for 1 min between all the conductors and the saline solution.

17 Overload protection of transformers and associated circuits

This clause of Part 1 is applicable.

17DV.1 D2 *Addition: add the following to Clause 17 of the Part 1:*

Alternatively, a transformer shall be protected by overcurrent protection:

a) Rated 20 amperes or less,

b) Set at not more than 125 percent of the primary current when the primary only is protected, or

c) Set at not more than 250 percent of the primary current and 125 percent of the secondary current when both primary and secondary circuits are protected.

Exception: The overcurrent protection need not be provided as part of a pressure washer if the overcurrent protection of the branch circuit to which the product will be connected will provide equal or better protection.

18 Endurance

This clause of Part 1 is applicable except as follows.

18DV D2 *Deletion:*

Delete Clause 18 of the Parts 1 and 2.

18.101 Appliances shall be constructed so that, in normal use, there will be no electrical or mechanical failure that could impair compliance with this standard. The insulation shall not be damaged and contacts and connections shall not work loose as result of heating, vibration, etc.

Moreover, **overload protective devices** and **safety valves** shall not operate under **normal operation**.

*For **motor-operated appliances**, compliance is checked by the tests of 18.102 and 18.106, and by such of the additional tests of 18.103 to 18.105 as applicable.*

*18.102 The appliance is operated under **normal operation** and at **rated voltage** for 96 h, reduced by the running time necessary for the tests of Clauses 11 and 13.*

Appliances are operated continuously, or for a corresponding number of periods, each period being not less than 8 h.

The specified operating time is the actual running time.

If the appliance incorporates more than one motor, the operating times specified apply to each motor separately.

*The test shall be carried out with a **cleaning agent** that has not been heated.*

All hoses are coiled on concrete during this test.

*18.103 Appliances are started under **normal operation**, 50 times at a voltage equal to 1,1 times **rated voltage** and 50 times at a voltage equal to 0,85 times **rated voltage**, the duration of each period of supply being at least equal to ten times the time necessary from start of full speed, but not less than 10 s.*

An interval sufficient to prevent overheating and at least equal to three times the period of supply is introduced after each running period.

*18.104 Appliances provided with a centrifugal or other automatic starting switch are started 10 000 times under **normal operation** and at a voltage equal to 0,9 times **rated voltage**, the operating cycle being that specified in 18.103.*

Forced cooling may be used, if necessary.

*18.105 Appliances provided with **self-resetting thermal cut-outs** are supplied at a voltage equal to 1,1 times **rated voltage**, under such a load as will cause the **thermal cut-out** to operate within a few minutes until the **thermal cut-out** has performed 200 cycles of operation.*

*18.106 During the tests of 18.102 and 18.103, overload **protective devices** and **safety valves** shall not operate.*

After the tests of 18.102 to 18.105, the appliance shall withstand the tests of Clause 16.

Connections, handles, guards, brush-caps and other fittings or components shall not have worked loose, and there shall be no deterioration impairing safety in normal use.

19 Abnormal operation

This clause of Part 1 is applicable except as follows.

19.1 Addition:

The test of 19.7 is not carried out on the pump motor of three-phase appliances.

19.1DV D2 *Modification: add the following to Subclause 19.1 of the Part 1:*

19.1DV.1 Add between notes 2 and 3: All non-protective devices are to be failed in the most adverse way, one at a time; also see 19.4 of the Part 1.

19.1DV.2 A product with a fuel-fired water-heating system, shall be tested under conditions of restricted inlet water flow, as specified in 19.1DV.3 and 19.1DV.4.

19.1DV.3 A limit control is to be adjusted in accordance with 22DV.110.31.4. An auxiliary limit control, if adjustable, is to be set to the minimum allowable setting. A modulating type operating control provided to regulate the fuel input between high and low fire value is to be bypassed to permit the product to operate on high fire. The on-off type operating control, set to cut out at a value below the set point of the limit control, is also to be bypassed during this test.

19.1DV.4 A valve is to be placed in the water inlet line and the product is to be operated at maximum rated input while the inlet water valve is completely closed.

19.2DV D2 *Modification: add the following to Subclause 19.2 of the Part 1: Electrically heated products*

For a product with a liquid heater operated without liquid, the liquid container is to be filled with water following the abnormal operation test and the product operated as intended following operation, the product shall comply with the requirements in the Electric Strength Test, Clause 16.

19.7 Addition:

Motorized cleaning heads *are tested with the rotating brush or similar device locked for 30 s.*

19.7DV D2 *Modification: add the following to Subclause 19.7 of the Part 1:*

19.7DV.1 Following the reference to table 8, add the statement, A "steady conditions" state may relate to parameters other than winding temperatures.

19.7DV.2 A switch or other device that controls a motor is to be tested with the rotor locked. For this test the product is to be connected to a supply circuit of rated frequency and voltage as specified in 5.8 of the Part 1.

19.11.2 Addition:

Contactors complying with the relevant IEC standard are not open-circuited or short-circuited, provided the appropriate standard covers the conditions that occur with the appliance. However, locking in the ON-position of the main contacts of a contactor intended for switching on and off the electrical heating element(s) in normal use is considered to be a fault condition, unless the appliance is provided with at least two sets of contacts connected in series. This condition is, for example, achieved by providing two contactors operating independently of each other or by providing one contactor having two independent armatures operating two independent sets of main contacts.

19.13DV D2 *Modification to subclause 19.3 of the part 1:*

Add the underlined words at the beginning of the third paragraph as follows:

<u>After the tests and</u> when the insulation, other than that of CLASS III APPLIANCES, has cooled down to approximately room temperature, it shall withstand the electric strength test of 16.3, the test voltage, however, being as specified in table 4.

19.101 For oil-fired and fan-assisted gas-fired appliances the following applies.

When the combustion air supply to an appliance having fan-assisted draught is restricted, the appliance shall continue to operate so as not to create a hazardous condition, shut off the fuel supply or extinguish the flame.

Compliance is checked by applying 11.101 under the test conditions specified in 19.101.1 and 19.101.2.

19.101DV D2 *Modification: add the following to Subclause 19.101 of the Part 2:*

19.101DV.1 If the main burner flame is extinguished following interruption of the air supply, fuel to the main burner shall be shut off by the burner or by action of a safety control within the safety control time period specified in Table 22DV.110.31.6.2. When the combustion air is restored the burner assembly shall require manual restart, or an automatically-lighted burner shall reignite the fuel introduced into the ignition zone.

19.101DV.2 If combustion continues following interruption of the air supply, burner operation is to be continued for at least 48 h. At the end of that period, the combustion air supply is to be restored and the burner ignited if the flame has been extinguished. The performance of the burner shall not create a hazardous condition.

19.101.1 The exhaust flue is blocked with a flat metal plate of sufficient area to cover the entire aperture. It is placed in the most disadvantageous way on top of the flue.

19.101.2 With the appliance under normal operation, the combustion air intake is restricted. The air intake to the burner assembly is blocked by means of an adequately sized terry-towel introduced with no force whatsoever.

19.102 For atmospheric gas-fired appliances the following applies.

19.102.1 With the outlet of the draught hood blocked, the concentration of carbon monoxide in an air-free sample of the flue gases shall not exceed 0,04 % when the appliance is tested in an atmosphere having a normal oxygen supply.

The appliance is operated for at least 15 min at normal test pressure. The outlet of the draught hood is then blocked and a sample of the flue gases is secured and analysed.

The concentration of carbon monoxide is measured as specified in 11.101.

19.102.2 Total downdraught pressures ranging from 0 Pa to 13 Pa imposed at the outlet of the draught hood shall not extinguish the main burner flames nor cause them to flash back, lift, float or burn outside the appliance, nor produce a concentration of carbon monoxide in an air-free sample of the flue gases in excess of 0,04 % when the appliance is tested in an atmosphere having a normal oxygen supply.

Compliance is checked by inspection and by the following test.

The appliance is operated for at least 15 min at normal test pressure. A straight section of flue pipe of suitable diameter and of a length at least equal to ten pipe diameters is attached directly to the outlet of the draught hood and connected to the outlet of a blower. The total draught pressure is measured with a resolution of 1 Pa in the straight section of the flue pipe at a point midway between its ends so that the measuring head is coincident with the axis of the flue pipe.

The draught in the flue pipe is varied from the minimum total pressure to the maximum value specified and the effect noted. A sample of the flue gases is secured and analysed.

The amount of CO in the flue gases shall not exceed 0,04 % (volume) on an air-free and dry basis.

19.102.2DV D2 *Modification: add the following to Subclause 19.102.2 of the Part 2:*

The pilot or pilots of a gas-fired product that may be used outdoors shall ignite while the representative product is exposed to a wind having a velocity of 16 km/h.

19.102.3 Downdraughts imposed as stated for the main burner shall not extinguish the pilot burner flames nor cause them to flash back when they are operated separately from the main burner(s).

The construction of an appliance equipped with a power burner or operating under forced or induced draught shall be such that its performance is not impaired by chimney draughts or chimney stoppage. This requirement shall be deemed met when the appliance meets the following conditions:

With the flue outlet or outlet of the draught diverting device, if one is provided, blocked to any degree up to and including complete closure, the concentration of carbon monoxide in an air-free sample of the flue gases shall not exceed 0,04 % when the appliance is tested in an atmosphere having a normal oxygen supply.

Should outage occur, raw gas shall not be forced into the combustion chamber on reopening of the flue outlet.

Compliance is checked by inspection and by the following test.

The appliance is operated for at least 15 min at normal test pressure. When the appliance incorporates a control to automatically shut off the main gas supply under blocked flue conditions, the area of the flue outlet is gradually decreased to the lowest point at which the control will remain in its open position. A sample of the flue gases is then taken and analysed.

The amount of CO in the flue gases shall not exceed 0,04 % (volume) on an air-free and dry basis.

19.102.4 Total downdraught pressures ranging from 0 Pa to 13 Pa imposed at the flue outlet or outlet of the draught diverting device, if provided, shall not extinguish the main burner flames nor cause them to flash back, lift, float, burn outside the appliance, nor produce a concentration of carbon monoxide in an air-free sample of the flue gases in excess of 0,04 % when the appliance is tested in an atmosphere having a normal oxygen supply.

A straight section of flue pipe of suitable diameter and of a length at least equal to 10 pipe diameters is attached directly to the flue outlet or the outlet of the draught diverting device and connected to the outlet of a blower. The total draught pressure is measured with a resolution of 1 Pa in the straight section of flue pipe at a point midway between its ends so that the head of the measuring device is coincident with the axis of the flue pipe.

The total downdraught pressure is adjusted to 13 Pa. The appliance is then operated for at least 15 min. A sample of the flue gases is taken and analysed. The total downdraught pressure is then varied from 0 Pa to 13 Pa and the effect on the main burner flames noted.

Compliance is checked by observation of the flame and the concentration of carbon monoxide is measured as specified in 11.101.

19.103 The appliance shall be able to start with a successful ignition, as far as applicable.

Compliance is checked by the following test.

The appliance is supplied with 0,75 times its ***rated voltage****. Starting the appliance shall not lead to a hazardous condition.*

19DV.104 D2 *Addition: add the following to Clause 19 of the Part 1: Power interruption test*

19DV.104.1 An electrically operated burner shall, upon interruption and restoration of the electrical power supply, require manual restart or shall resume intended operation automatically without increasing the risk of fire or injury to persons. Interruption of power shall be for an agreed-upon period of time.

19DV.104.2 Gas-fired products

When the electrical power is interrupted, the gas safety valves shall be de-energized and fuel to the main burner shut off within the time period specified in Table 22DV.31.5.2.

19DV.104.3 Oil-fired products

When the electrical power is interrupted, fuel to the main burner shall be shut off by the burner or by action of a safety control within the time period specified in Table 22DV.31.6.2.

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.1DV D2 *Modification: add the following to Subclause 20.1 of the Part 1, following the penultimate paragraph:*

When tested to a 15° inclination, fuel-fired appliances shall not leak fuel or overturn.

20.2DV D1 *Modification: add the following to Subclause 20.2 of the Part 1*

Non-electrical enclosures and guards

20.2DV.1 In addition, an enclosure or guard of polymeric material shall comply with the ball impact and mould stress-relief distortion tests described in 21DV.101.1 and 21DV.101.2.

20.2DV.2 A nonmetallic enclosure or guard that is a component of a cleaning machine intended for permanent installation outdoors or a portable cleaning machine intended for outdoor use (not marked to store indoors) and where the component is exposed to weathering shall comply with the light and water exposure test described in 21DV.101.3.

20.101 Pumps, pipes, hoses, hose connectors, couplers, seals, valves and other components that are likely to carry **cleaning agent**, either directly or in solution shall be designed to withstand any mechanical, chemical or thermal stress that may occur during use at their maximum **rated operating temperatures** under **normal operation**.

Compliance is checked either by the following tests or by furnishing evidence to the testing organisation.

*Hoses, when tested at 85 °C for 7 days with the normally diluted **cleaning agent**, shall not be damaged. Seals used in the construction of the appliance shall not differ from untested seals when immersed in the normally diluted cleaning liquid at 85 °C for 7 days and then rinsed in water.*

Metal used in the construction of the parts of the appliance subjected to the pressure shall not be etched, pitted or corroded when immersed in the normally diluted cleaning liquid.

A convenient specimen of metal (e.g. 200 mm x 200 mm x 2 mm) shall have its surface area recorded as dm^2 then degreased in a solvent such as acetone or toluene, dried and weighed to the nearest 0,1 mg. This specimen shall be immersed in the cleaning solution at 85 °C for 7 days. At the end of this time it shall be removed, rinsed in water, allowed to dry and the mass change calculated as mg/dm^2. There shall be no significant signs of corrosion present on the test piece and the mass change shall be within 40 mg/dm^2.

When testing for the suitability of hoses, seals and metals with the cleaning solution as above, duplicate tests shall be carried out using local potable water only as the test liquid. The results using water only shall be well within the allowed tolerances and will serve as a guide to the corrosiveness, etc. of the cleaning solution used in the test.

20.102 Appliances with **water heaters** shall be protected against overpressure occurring as a result of heat applied to the water or water-borne **cleaning agents**. The appliance shall be equipped with safety devices that do not allow the temperature to exceed the **rated temperature** + 20 K or the **permissible pressure** to be exceeded.

Compliance is checked by inspection and appropriate tests.

20.103 Oil-heated or gas-heated appliances shall not cause uncontrolled combustion of gas or liquid fuel. They shall have a **primary safety control** unless they are oil-fired, **portable** and unless there is re-ignition during operation by a **continuous ignition** device.

Compliance is checked by inspection.

20.104 Injury due to unintentional closing or slamming of parts, such as movable side walls and covers, shall be prevented.

Wheels or rollers for the transport of appliances heavier than 20 kg shall be located or protected so that injury to the feet of the operator is prevented.

20.104DV D2 ***Modification: delete the second paragraph of Subclause 20.104 of the Part 2.***

Compliance is checked by inspection, by measurement and by manual test.

21 Mechanical strength

This clause of Part 1 is applicable except as follows.

The impact value is increased to 1,0 J ± 0,04 J.

21DV D2 *Addition to Clause 21 of the Part 1:*

21DV.101 Tests on nonmetallic enclosures and guards, including electrical enclosures

21DV.101.1 Ball-impact

21DV.101.1.1 The component, when installed as intended shall not crack to the extent that moving or hot parts that may result in a risk of injury to persons are exposed to unintentional contact when struck with a smooth steel sphere having a diameter of 51 mm and weighing 0,53 kg.

21DV.101.1.2 If the component being tested can be struck from above, the sphere is to be allowed to fall vertically from rest to strike the component. Otherwise, the sphere is to be suspended by a cord and is to be allowed to fall from rest as a pendulum to strike the component. In either case, the vertical travel of the sphere is to be 1,30 m.

21DV.101.1.3 If the component is intended for outdoor use, it shall also be struck with the sphere specified in 21DV.101.1.1 immediately after being conditioned at −35,0 +2,0°C for 3 h.

Exception: For an appliance marked "Store Indoors" (or equivalent) in accordance with 7.1DV.3, the conditioning temperature shall be 0,0 +2,0°C.

21DV.101.2 Mold stress-relief distortion

21DV.101.2.1 A polymeric enclosure or guard shall withstand the conditioning described in 21DV.101.2.2 without:

a) Cracking, shrinkage, warpage, or other distortion that affects the functional strength of the part; and

b) Being affected to the extent that moving or hot parts would be exposed to unintentional contact.

21DV.101.2.2 A representative mechanical guard or enclosure is to be conditioned in an air-oven for 7 h at a uniform temperature not less than 10 C higher than the maximum operating temperature of the material during the Normal Temperature Test, clause 11, measured under normal operating conditions, but not less than 70 C.

21DV.101.3 Light and water exposure

21DV.101.3.1 For a nonmetallic enclosure or guard that is exposed to sunlight during intended operation, the Izod impact strength (21DV.101.4) and tensile impact strength (21DV.101.5) of specimens conditioned in accordance with 21DV.101.3.2 shall not be less than 70 percent of that obtained on unconditioned specimens.

21DV.101.3.2 1000-h Xenon exposure test

21DV.101.3.2.1 This test only applies to tanks exposed to sunlight while mounted in the normal configuration inside the product.

NOTE Products for outdoor use, but indoor storage do not need to comply with this test.

21DV.101.3.2.2 Five specimens of the fuel tank and fuel cap are to be tested in accordance with Procedure B in ASTM D2565, and are to retain a minimum of 70% of original tensile yield strength (as-received samples) after 1000 h of Xenon exposure.

21DV.101.3.2.3 The test apparatus is to be as specified Type B or Type BH in ASTM D2565. The temperature within the apparatus is to be 60 ±2°C.

21DV.101.3.2.4 During each operating cycle of 120 min, the specimens are to be exposed to light alone for 102 min and to light and water for 18 min. This conditioning is to last for 1000 h.

21DV.101.3.2.5 The specimens are then to be subjected to the tensile strength test in accordance with the Standard Test Method for Tensile Properties of Plastics, ASTM D638, using a crosshead speed of 50.8 mm/min.

21DV.101.4 Izod impact

The Izod impact strength is to be determined in accordance with the procedures specified in Tests for Impact Resistance of Plastics and Electrical Insulating Materials, ASTM D256-1981, on ten specimens obtained from the finished part, five specimens in the as-received condition, and five specimens conditioned in accordance with 21DV.101.3.2. For materials less than 3.2 mm thick and on materials that tend to flex (twist) in the test, the tensile impact test in 21DV.101.5 is generally conducted in lieu of the Izod impact test.

21DV.101.5 Tensile impact

The tensile impact strength is to be determined in accordance with the procedures specified in ASTM D1822-1979, on specimens obtained from the finished part, five specimens in the as-received condition, and five specimens conditioned in accordance with 21DV.101.3.

21DV.102 Test for strength of support handles

21DV.102.1 A support handle or similar means provided to support or carry a product shall withstand a load of four times the weight of the product without damage to the support handle, its securing means, or that portion of the enclosure to which the support handle is attached.

21DV.102.2 The load is to be uniformly applied over a 76-mm width at the center of the support handle, without clamping. The load is to be started at zero and gradually increased so that the test value is attained in 5 to 10 s; the test value is to be maintained for 1 min. If a product has more than one support handle and cannot be carried by one support handle, the load is to be distributed between the support handles. The distribution of the load is to be determined by measuring the percentage of the product weight sustained by each support handle with the product in the normal carrying position. If a product is furnished with more than one support handle and can be carried by only one support handle, each support handle shall withstand the total load.

21DV.102.3 Support handles constructed of, or that rely upon, polymeric materials are to be subjected to the test of 21DV.102.2 before and after the mold stress test of 21DV.101.2.

21DV.103 LP-gas container securement test

21DV.103.1 The means for securing an LP-Gas fuel container shall withstand loadings in any direction equal to four times the filled weight of the container.

21DV.103.2 For this test, the container is to be empty of fuel and is to be secured in accordance with manufacturer's instructions. Loadings are to be applied in any convenient manner capable of being measured by gauges or weights.

21DV.104 Tests on LP-gas fuel lines and fittings

These tests are not applicable to low-pressure portions of fuel systems and are only applicable to components incorporated into or supplied with the product.

21DV.104.1 Routine pressure test

Routine pressure testing shall be performed in accordance with DVA.3.1.4.

21DV.105 Tests on fuel oil and gasoline fuel lines and fittings

21DV.105.1 Pull test

Nonmetallic tubing or hose shall comply with the requirements for the pull test in 4.4 and 5.4 (Fuel Line Assembly Tensile Test) of ANSI/OPEI B71.10.

21DV.106 Tests on gaskets, seals, and parts

These requirements cover products fueled by flammable and combustible liquids such as gasoline and diesel fuel, including gasoline with small amounts of additives such as detergents, solvents for detergents and anti-icing chemicals, and gasoline with up to 10% ethanol.

21DV.106.1 Fluid handling parts

A synthetic rubber gasket, seal, or part, in contact with any of the fluids indicated in Table 21DV.106.1, when considered on the basis of its intended function, shall comply with the requirements in 21DV.106.2.1 – 21DV.106.4.2 relative to the fluids contacted.

Exception: If the limits for volume change or weight loss are exceeded, a complete product assembly shall be filled with the appropriate test liquid for 70 hours. Following the exposure, the product shall comply with the requirements in the Hydrostatic Pressure and Strength Test, Clause 21.101..

Table 21DV.106.1
Test fluids for synthetic rubber materials

Liquid/vapor in contact with part	Test fluid[a]
Manufactured and natural fuel gases	IRM 903 oil and n-hexane
LP-gas	n-hexane
Fuel oils or diesel fuels	IRM 903 oil
Gasoline	Reference fuels C and H
[a]According to ASTM D471. NOTE The weight loss test of 21DV.106.4 is not conducted with IRM 903 oil.	

21DV.106.2 Aging test

21DV.106.2.1 Neoprene or rubber compounds, except foamed materials, used for gaskets to seal a fuel-confining part or electrical enclosure shall have physical properties as specified in Table 21DV.106.2.1.1 before and after accelerated aging under the conditions specified in Table 21DV.106.2.1.2

Table 21DV.106.2.1.1
Physical properties of gaskets

Materials	Neoprene or rubber compound		Polyvinyl-chloride	
	Before test	After test	Before test	After test
Elongation – Minimum increase in distance between 25.4 mm gage marks at break	Not specified	50 percent of original	Not specified	50 percent of original
Tensile strength – Minimum force at breaking point	5.86 MPa	50 percent of original	8.27 MPa	50 percent of original

Table 21DV.106.2.1.2
Accelerated aging conditions

Measured temperature[a] (C)	Test program	
	Rubber or neoprene	Thermoplastic
60	Air oven aging for 70 h at 100 ±2 C	7 days in an air-circulating oven at 87 C
75	Air oven aging for 168 h at 100 ±2 C	10 days in an air-circulating oven at 100 C
80	7 days in an air-circulating oven at 113 C	7 days in an air-circulating oven at 113 C
90	10 days in an air-circulating oven at 121 C	7 days at 121 C or 60 days at 97 C in an air-circulating oven
105	7 days in an air-circulating oven at 136 C	7 days in an air-circulating oven at 136 C

[a]The temperatures specified correspond to the maximum temperature measured on the gasket during the Heating test, Clause 11.

21DV.106.2.2 Foamed neoprene or rubber compounds forming gaskets to seal a fuel-confining part or an electrical enclosure are to be subjected to accelerated aging under the conditions specified in Table 21DV.106.2.1.2. The compounds shall not harden or otherwise deteriorate to a degree that will impair their sealing properties.

21DV.106.2.3 Thermoplastic materials forming gaskets to seal a fuel-confining part or electrical enclosure are to be subjected to accelerated aging under the conditions specified in Table 21DV.106.2.1.2 Thermoplastic material shall not deform or melt, or otherwise deteriorate to a degree that will impair its sealing properties. Solid polyvinyl-chloride gasket material shall have physical properties as specified in Table 21DV.106.2.1.1 before and after the accelerated aging.

21DV.106.2.4 Gaskets of materials other than those mentioned in 21DV.106.2.1 – 21DV.106.2.3 shall be made of material that does not absorb moisture and shall provide equivalent resistance to aging and temperatures.

21DV.106.3 Volume change

21DV.106.3.1 The volume change of a synthetic rubber gasket, seal, or part, shall be not more than 25 percent swelling or 1 percent shrinkage when tested in accordance with ASTM D471 REV A; except as specified in 21DV.106.3.2.

Exception: The swelling shall be not more than 40 percent for a gasket or seal tested in ASTM Reference Fuel C.

21DV.106.3.2 The tests using ASTM Reference Fuels C and H, n-hexane, and IRM 903 Oil are to be conducted at a temperature of 23 ±2 C . Three specimens are to be used in each test. Each specimen is to be placed on a small diameter wire hook. Its volume is then to be determined by weighing first in air (M1) and then in water (M2). The specimens are then to be wiped dry and placed in the test liquid. After 70 h, the specimens are to be removed from the liquid one at a time, immediately wiped dry, and weighed in air while on the same hook (M3). The weight is to be obtained within 30 s after removal from the test liquid. The final weight in water (M4) is to be determined immediately thereafter. Before obtaining the weights in water (M2 and M4), each specimen is to be dipped in ethyl alcohol, then dipped in water, in order to eliminate surface air bubbles. The change in volume is to be calculated

as follows, with the results reported as the average of the three specimens tested:

$$Volume\ Change\ (\%) = \frac{[(M_3 - M_4) - (M_1 - M_2)] \times 100}{(M_1 - M_2)}$$

21DV.106.4 Weight loss

21DV.106.4.1 The weight loss (extraction) of a synthetic rubber gasket, seal, or part, shall not be more than 10 percent when determined in accordance with ASTM D471-95, except as specified in 21DV.106.4.2.

21DV.106.4.2 The test is to be conducted at the same time and using the same specimens as for the volume change test described in 21DV.106.3.1 and 21DV.106.3.2. For this test, each specimen is to be weighed on a balance pan, in air, to the nearest milligram (M1) prior to immersion in the test liquid. After 70 h immersion and following the weight determinations needed for the volume change calculation, the specimens are to be allowed to reach constant weight by conditioning in air at a temperature of 23 ±2 C for at least 70 h. The specimens are then to be weighed in air (M2). The loss in weight is to be calculated as follows, and the results reported as the average of the three specimens tested:

$$Weight\ Loss\ (\%) = \frac{(M_1 - M_2) \times 100}{M_1}$$

21DV.106.5 Gaskets and seals for metal fuel tank joints

21DV.106.5.1 In addition to complying with the requirements specified in 21DV.106.2.1 – 21DV.106.2.4, gaskets or sealing compounds used to prevent leakage through metal fuel tank joints and located below the intended fuel level in the tank or below the maximum fuel level in a sump shall also not leak after test when subjected to the tests specified in 21DV.106.5.2 – 21DV.106.5.6.

21DV.106.5.2 Three representative fuel tanks under test are to be placed in an air oven maintained at a temperature of 100 C for 168 h.

21DV.106.5.3 Three representative fuel tanks under test are to be filled with the intended fuel and placed in a room ambient of 23 ±2 C for 720 h.

21DV.106.5.4 Three representative fuel tanks under test are to be filled with a 50 percent water and 50 percent fuel mixture and placed in a room ambient of 23 ±2 C for 30 days.

21DV.106.5.5 Each representative fuel tank is to be subjected to an aerostatic leakage test before and after aging, fuel exposure, and fuel and water exposure and after the drop test described in 21DV.106.5.6. Each representative gravity tank shall withstand a pressure of 6.9 kPa for 1 min.

21DV.106.5.6 Each representative fuel tank that is intended to be removed for filling is then to be drop tested. The fuel tank is to be half filled with water and dropped 0.8 m, so that impact will be on the bottom of the tank. Each representative fuel tank is then to be subjected to the leakage test specified in 21DV.106.5.5.

21DV.107 During the tests, a flexible polymeric or elastomeric boot that covers a switch and that is flexed when the switch is operated is to be removed, and a part that can be opened or removed without the use of a tool is to be removed or placed in the most adverse position for the test being conducted.

Exception: A boot that is momentarily flexed and not held in the flexed position when the switch is operated and that meets the following conditions is not required to be removed:

a) The boot shall be mechanically secured by fastening means, such as screws;

b) The boot shall not be able to be removed by hand, or depend upon friction for securement; and

c) The boot shall comply with the Aging Test described in 21DV.106.2.

d) For portable equipment for use outdoors, but intended to be stored indoors, and marked in accordance with 7.1DV.1 and for stationary and fixed equipment intended for indoor installation and marked in accordance with 7.1DV.1, the boot shall be cold-conditioned at 0,0 +2,0°C for 3 h. For equipment not marked for storage in accordance with 7.1DV.1, the boot shall be cold-conditioned at −35,0 +2,0°C for 3 h. Immediately after the conditioning, and with the temperature maintained, the boot shall be hand-flexed, with gloves worn to inhibit heat transfer to the boot. The boot shall not harden or otherwise deteriorate to a degree that will impair its sealing properties.

21.101 Parts subjected to the **rated pressure** of the appliance shall be of sufficient mechanical strength.

Compliance is checked by the following tests in 21.101.1 and 21.101.2.

*21.101.1 The high pressure system is subjected to a static pressure test of two times the **rated pressure** for 5 min at room temperature.*

*The high pressure hose shall be subjected to a static pressure test of four times the **rated pressure** at room temperature, whereby the test pressure shall be reached between 15 and 30 s after starting at zero pressure.*

NOTE It will be necessary to render the pressure relief valve and/or alternative sensing device inoperative.

During this test there shall be no rupture.

21.101.2 A supply hose, if any, is subjected to a static pressure test of two times the maximum inlet pressure for 5 min at room temperature.

During this test there shall be no rupture.

21.101.3 A **low pressure accessory** is subjected to a static pressure test of two times the measured pressure in the system, when connected to the most severe high pressure cleaner it is intended to be used with, for 5 min at room temperature.

21.102 Pressure safety devices shall operate reliably.

Compliance is checked by the following test.

The pressure is increased to 110 % of the permissible pressure, or by 1,5 MPa for unheated appliances, and the device shall operate.

21.103 **Hand-held appliances**, hand-guided appliances and appliances carried on the operator's body in normal use and spray guns shall be resistant to dropping.

Compliance is checked by the following test.

The appliance and/or the spray gun is dropped from a height of 1 m onto a surface of hydraulically pressed concrete paving slabs.

The test is made five times, the appliance and/or spray gun being in a position such that its major axis is horizontal and so that a different part of the device is exposed to the impact each time.

The appliance or spray gun is then dropped five times, with its major axis vertical, and with the nozzle pointing downwards.

*After this test, the appliance or spray gun shall show no damage to such an extent that compliance with this standard is impaired; in particular, **live parts** shall not have become accessible.*

22 Construction

This clause of Part 1 is applicable except as follows.

22.7 Addition:

Any safety device shall be either inaccessible to the user or it shall be evident that the setting of the **safety valve** is sealed and there is no provision for rendering the device inoperative.

Cleaning agent ejected from the **safety valve** shall be directed safely.

22.7DV D2 ***Modification: add the following to Subclause 22.7 of the Part 1:***

Overpressure protection

22.7DV.1 A pressure-relief device which inhibits a pressure increase that occurs as a result of the closing of a trigger gun, or malfunction of a bypass or dump valve, shall be set and have a flow capacity such that pressure does not continue to increase after the discharge of the relief device.

Exception: A pressure-relief device is not required in an application when the construction of the appliance is such that it does not pose a potential risk of injury to users under abnormal pressure conditions. The integrity of the construction is to be determined by the test described in clause 21.

22.7DV.1.1 Compliance is checked by determining the start-to-discharge pressure described in 22.7DV.2. Each of three representative devices is to be subjected to a gradually increasing hydraulic pressure, and the pressure at which the device begins to open is to be recorded.

22.7DV.1.2 For a rupture-disc type relief device, these values shall be within 5 percent of each other and their average identified as the setting for the rupture-disc type relief device to be used. For a relief valve, the pressure setting of each representative device is considered to be the average of the three opening-pressure values obtained for that representative device. The three average values shall be within 10 percent of each other and their average identified as the start-to-discharge pressure setting for the relief valve to be used.

22.7DV.2 A pressure-relief device is considered to be a pressure-actuated valve or rupture member intended to relieve excessive pressures automatically. The start-to-discharge pressure settings of these devices shall be within 10 percent of each other when determined in accordance with clause 22.7DV.1.1. The manufacturer of the product pressure system shall calibrate 100 percent of relief devices.

Exception: Three rupture discs tested in accordance with 22.7DV.1.1, and subjected to the Burst disk overpressure protection test, Annex A, DVA.3.1.5, meet the intent of the requirement.

22.7DV.3 There shall be no shutoff valve between the pressure-relief means and the parts that it is intended to protect.

22.7DV.4 A pressure relief device shall be installed so that it is readily accessible for inspection and repair.

22.7DV.5 Compliance is checked by operating the relief device, such as during the hydrostatic pressure test.

22.7DV.6 A pressure-relief device having an adjustable setting is judged on the basis of the maximum setting unless the adjusting means is reliably sealed at a lower setting.

22.10DV D2 *Modification: add the following to Subclause 22.10 of the Part 1:*

A protective device that permits resetting or replacement by the user after it opens shall be accessible for inspection and repair.

22.12 Addition:

It shall not be possible to disconnect parts of the high pressure system without **tools** if this results in impairing the safety within the meaning of this standard.

22.14DV D2 ***Modification: add the following to Subclause 22.14 of the Part 1:***

Whenever referee measurements are necessary to determine that a part such as an enclosure, a frame, a guard, a handle, or similar feature is not sufficiently sharp to constitute a risk of injury to persons, the method described in UL 1439 is to be employed.

22.17DV D2 ***Modification: add the following to Subclause 22.17 of the Part 1:***

For a cord-connected or fixed product that is intended to be wall-mounted, means shall be provided to reduce the likelihood that an appliance is dislodged from the wall, regardless of whether the product is mounted directly or via brackets or other means.

Compliance is checked by inspection. To determine whether a product complies with the requirement, any part of the enclosure or barrier that can be removed without the use of tools to gain access to the hanging means is to be removed.

22.30DV D2 ***Modification: add the following to Subclause 22.30 of the Part 1:***

Parts of class I construction which serve as part of the protective earthing arrangement shall be constructed or assembled such that during servicing they:

- **are unlikely to be disturbed; or**

- **are unlikely to be reassembled incorrectly if they are disturbed.**

22.35 Modification:

Delete the note.

Addition:

These parts are subject to the hammer test of Clause 21. If this insulation does not meet the requirement of 29.3, these are subject to the following impact test.

A sample of the covered part is conditioned at a temperature of 70 °C ± 2 °C for 7 days (168 h). After conditioning, the sample is allowed to attain approximately room temperature.

Inspection shall show that the covering has not shrunk to such an extent that the required insulation is no longer given or that the covering has not peeled off, so that it may move longitudinally.

After this, the sample is maintained for 4 h at a temperature of – 10 °C ± 2 °C.

While still at this temperature, the sample is then subjected to impact by means of the apparatus shown in Figure 102. The weight "A", having a mass of 0,3 kg, falls from a height of 350 mm onto the chisel "B" of hardened steel, the edge of which is placed on the sample.

One impact is applied to each place where the insulation is likely to be weak or damaged in normal use, the distance between the points of impact being at least 10 mm.

After this test, it shall show that the insulation has not peeled off and an electric strength test as specified in 16.3 is made between metal parts and metal foil wrapped round the insulation in the required area.

22.47 This clause of Part 1 is not applicable.

22.48 This clause of Part 1 is applicable except as follows:

Replace the existing text of the test by:

Compliance is checked by the relevant tests of IEC 61770, as modified in Annex AA of this standard.

22.48DV D2 *Modification: replace Clause 22.48 of the Parts 1 and 2 by the following:*

Backflow prevention

22.48DV.1 Appliances having provision for connection to a potable water supply shall be in compliance with Clause 22.48DV.2 or 22.48DV.3 as applicable.

22.48DV.2 Appliances incorporating a liquid storage tank which may be supplied from a potable water supply shall be in compliance with one of the following design types:

a) an air-gap shall be provided between the water inlet and the maximum water level in the storage tank. The height of the air-gap shall be at least three times the diameter of the water supply pipe to the tank and shall not be less than 25 mm. All appliances except those intended for stationary installation shall comply with the indicated test.

Compliance is checked by inspection and the following test. The air-gap required by 22.48DV.2(a) shall be maintained when the tank is filled to the maximum water level condition that may occur and the cleaning machine is

1) tilted up to 15° in any direction; and

2) tipped over and the air-gap is measured 60 s later.

b) a vacuum breaker in compliance with ASSE 1001 shall be provided; or

c) a backflow preventer, in compliance with ASSE 1019, ASSE 1052, or ASSE 1057 shall be provided.

22.48DV.3 Appliances not incorporating a liquid storage tank shall be marked as specified in 7DV.2 D2 or shall be in compliance with the above Clause 22.48DV.2.

22.101 Appliances shall have no opening less than 60 mm from the floor that could admit liquid to **live parts**.

Compliance is checked by measurement.

22.102 A drain hole for condensed water or spillage of any liquid shall have a diameter of not less than 5 mm or an area of not less than 30 mm, the width not being less than 3 mm.

Compliance is checked by measurement.

22.102DV D2 *Modification: add the following to Subclause 22.102 of the Part 2:*

An enclosure for electrical components shall have provision for drainage if the enclosure employs knockouts or unthreaded openings.

22.103 The appliance or the **trigger gun** shall be provided with a device for stopping the liquid flow to the nozzle. For hand-held washing devices, steam cleaners and **trigger guns** this device shall operate automatically without hydraulic pressure when its operating means is not actuated by the user.

The operating means of hand-held washing devices, steam cleaners and **trigger guns** shall have a device by means of which it can be locked when the device is in the non-operating condition.

Hand-held washing devices, steam cleaners and **trigger guns** shall not have any locking means in the operating condition.

The operating means shall be positioned so that there is no risk of inadvertent actuation when put down on a flat surface.

Water jetters shall not be operated by a valve lever that projects out from the apparatus in the off-position in such a way that accidental contact would cause inadvertent actuation.

Compliance is checked by inspection and the following test:

*The operating means of the **trigger gun** of a high pressure cleaner or of a hand-held washing device shall be locked in the non-operating condition. The pressure in the fluid system is adjusted to 2,5 MPa. The actuator of the operating means shall then be stressed for 1 min at room temperature with a force of 150 N, applied in the middle of the actuator in the normal direction of operation.*

During and after the test, there shall be no leakage of water. After the test, the locking device shall still be functional.

NOTE 101 Drainage of water from the nozzle is permissible during the test of the first requirement.

22.104 Appliances, except steam cleaners, provided with a fixed or adjustable **pencil jet nozzle** facility shall have a distance from the trigger to the nozzle greater than 750 mm.

Compliance is checked by measurement.

22.104DV D2 *Modification: add the following to Subclause 22.104 of the Part 2:*

22.104DV.1 A TYPE 2 CLEANING MACHINE shall be provided with a lance or wand having a trigger mechanism located at least 750 mm from the discharge nozzle.

22.104DV.2 If the lance or wand is of a type that can be detached from the trigger mechanism, a high pressure cleaner shall not be capable of discharging cleaning fluid at a discharge pressure greater than 690 kPa with the part removed.

22.104DV.3 A TYPE 3 CLEANING MACHINE shall comply with the requirements for a Type 2, except that the trigger mechanism on the lance or wand shall be located at least 1,22 m from the discharge nozzle.

22.104DV.4 Nonmetallic hose used to connect the lance to a TYPE 3 CLEANING MACHINE shall be shrouded by a protective device for a distance of at least 610 mm from the nearest grasping area of the lance. The shroud shall interrupt and disperse the fluid flow in the event of hose rupture so as to prevent operator injury.

22.105 Fitments on the high-pressure hoses shall only be accomplished by the manufacturer or his agent using specialist tools.

Water jetters shall have a clearly visible red marking around the high-pressure hose at a distance of 50 cm from the rigid part of the nozzle.

Compliance is checked by inspection and measurement.

22.106 Appliances and their parts shall not have uncontrolled movement to a hazardous degree when used in accordance with the manufacturers' instructions.

Portable appliances having a mass exceeding 100 kg shall have a parking brake or equivalent means.

Compliance is checked by inspection.

22.107 The component of the reaction force of the nozzle in the direction of the spray gun, F_r, shall be limited to 150 N.

F_r is calculated as follows:

$$W = \sqrt{(200 \times \Delta p)}$$

where

W is the water exit velocity, in m/s;

Δp is the rated pressure, in bar.

$$F = \frac{W \times Q}{60}$$

where

F is the reaction force in the direction of the nozzle, in newtons;

Q is the rated flow, in l/min.

$F_r = F \times \cos(\alpha)$

where

α is the angle between the nozzle and the spray lance, see Figure 103.

If the reaction force in the direction of the handle exceeds 150 N, the trigger gun shall be equipped with a support by which the reaction force is completely or partially transferred to the operator's body. Instead of a support, trigger guns can also be equipped with a two-hand activation mechanism that can only be operated when both operating elements are activated at the same time.

Considering the middle of the finger grip as a pivot point, the torque reaction T on the handle shall not be more than 20 Nm in any direction. T is calculated as follows:

$T = F \times l \times \sin(\alpha)$

where

l is the distance between nozzle and trigger, in m. See figure 103.

Compliance is checked by calculation and inspection.

22.108 The **trigger gun** and lance shall be provided with two handles. One of the handles could be a suitable shape of the spraying pipe.

Compliance is checked by inspection.

22.109 High pressure cleaners shall be fitted with a switch or contactor in their supply circuit that ensures **all-pole disconnection**.

22.109DV DR *Modification: add the following to Subclause 22.109 of the Part 2:*

A single-phase product rated 125 volts or less is permitted to be fitted with a single-pole, current-interrupting device located in the ungrounded conductor of the supply circuit.

22DV.110 D2 *Addition: add the following to Clause 22 of the Part 2:*

22DV.110.1 A product, if not assembled by the manufacturer as a unit, shall be arranged in major subassemblies. Incorporation of a subassembly into the final assembly shall not require alteration, cutting, drilling, threading, welding, or similar tasks by the installer. Two or more subassemblies that must bear a definite relationship to each other for the intended installation or operation of the product shall be arranged and constructed so that they may

be incorporated into the complete assembly only in the correct relationship with each other and without need for alteration or alignment, or such subassemblies shall be assembled, tested, and shipped from the factory as one unit.

22DV.110.2 With reference to 22DV.110.1, portions of a product considered to constitute major subassemblies are:

a) Heat exchanger, including its base, heating chamber, casing, and safety controls;

b) Burner or heating element;

c) Pump; and

d) Engine or motor not included as part of the pump.

22DV.110.3 D2 *Thermal Insulating Material*

22DV.110.3.1 Thermal insulation shall be of such nature, and so located and mounted or supported, that it will not be adversely affected by the normal operation of the product.

22DV.110.3.2 Thermal insulation that is not rigid shall be mounted or supported so that it will not sag if sagging may introduce a risk of fire, electric shock, or injury to persons.

22DV.110.3.3 Adhesive material employed for mounting thermal insulation shall be acceptable for use at the temperature the adhesive may attain when the product is tested in accordance with these requirements and additionally for products not marked with ″store indoors″ at minus 17,8 C. Determination of the acceptability of an adhesive may be omitted if the thermal insulation is mechanically supported by at least one rivet, or the equivalent, per 929 cm^2 of material.

22DV.110.3.4 Combustible or electrically conductive thermal insulation shall be spaced from uninsulated live parts of the product in accordance with the requirements for unearthed accessible metal parts specified in clause 29.

22DV.110.4 DR *If the current rating of a product is more than 40 A, and there are subdivided circuits within the product feeding two or more power-consuming components—motors, motor control circuits, electric heating elements—connected in parallel with each other across any pair of main supply terminals or leads, overcurrent protection shall be provided as a part of the product for the conductors of each terminal circuit.*

Exception: Additional overcurrent protection is not required as a part of the product for the conductors of the subdivided circuits described below:

a) For each separate motor or heating element circuit supplied by insulated conductors having an ampacity at least one-third that of the protective device in the branch circuit to which the product will properly be connected.

b) For each separate motor control circuit supplied by insulated conductors having an ampacity at least one-fifth that of the protective device in the branch circuit to which the product will properly be connected.

22DV.110.5 D2 ***A product that employs resistance-type heating elements rated more than 48 A shall have the heating elements subdivided. Each subdivided load shall not exceed 48 A and shall be protected at not more than 60 A. The overcurrent protective devices shall be provided as an integral part of the product.***

22DV.110.6 D2 ***A protective device shall be wholly inaccessible from outside the product without opening a door or cover.***

Exception: The operating handle of a circuit breaker, the operating button of a manually operable motor protector, and similar parts may project outside the product enclosure.

22DV.110.7 D2 ***Receptacles***

22DV.110.7.1 A portable product shall not be provided with a general-use receptacle.

22DV.110.7.2 A general-use (convenience) receptacle shall be of the grounding type.

22DV.110.7.3 Each circuit having a receptacle intended for general use shall have overcurrent protection of not more than 20 A provided as a part of the product if the overcurrent protection of the branch circuit to which the product will properly be connected exceeds that acceptable for the receptacles. The overcurrent protection provided shall be of the time-delay type.

22DV.110.7.4 A 120 V single-phase, 15 A or 20 A receptacle installed in a product shall have ground-fault circuit protection.

22DV.110.7.5 The face of a receptacle shall:

a) Be flush with or project beyond a nonconductive surrounding surface, or

b) Project at least 0,4 mm beyond a conductive surrounding surface.

22DV.110.8 D2 ***Batteries***

22DV.110.8.1 If a battery is intended to be provided, means shall be provided to secure it in a position to prevent contact with conducting materials in the area and it shall be located to permit servicing.

22DV.110.8.2 At atmospheric pressure, the flammable range for hydrogen is 4–75% by volume in air. NFPA 69 establishes requirements to ensure safety with flammable mixtures. The provisions of §6.3, Design and Operating Requirements, of NFPA 69-2002 require that combustible gas concentrations be restricted to 25% of the lower flammable limit (i.e. 1%, 10,000 ppm). This design criterion provides a safety margin.

22DV.110.8.2.1 The enclosure or compartment housing a vented battery where gassing is possible during heavy discharge, overcharging, or similar type of usages shall be vented. The means of venting shall provide air flow through the compartment such as to reduce the risk of accumulation of a hydrogen-air gas mixture.

Since a hydrogen-air gas mixture is lighter than air, location of some of the ventilation openings in the uppermost portions of the battery compartment is necessary.

The venting means shall prevent hydrogen concentrations in excess of 1 percent by volume. If the adequacy of the ventilation is not obvious, a determination shall be made by measurement of gas concentration in accordance with the Battery Compartment Ventilation Test.

Exception: The battery compartment ventilation test does not apply to a battery compartment housing a battery in a product provided with a regulating circuit that prevents excessive battery charging current.

22DV.110.8.2.2 Battery compartment ventilation test

With the engine alternator output voltage at its maximum value, such as maximum engine operating rpm and no other electrical loads, a fully charged battery is to be subjected to 0.5 h of overcharging. Any user adjustable controls associated with the charger or charging circuit are to be adjusted for the most severe charging rate. The most severe charging rate is the maximum charging rate that does not cause a thermal or overcurrent protective device to open.

During and at the conclusion of the test, the battery compartment shall not be opened, and the maximum hydrogen gas concentration shall not be more than 1% by volume. Hydrogen measurements are to be made by sampling the atmosphere inside the battery compartment at the end of the overcharging period. Samples of the atmosphere within the battery compartment are to be taken at the location where the greatest concentration of hydrogen gas is likely.

Instead of the hydrogen concentration measurement, the ventilation conditions may be calculated according to the Safety requirements for secondary batteries and battery installations – Part 3: Traction batteries, IEC 62485-3.

Note A lead-acid battery at full charge, when most of the charging energy goes into gas, generates approximately 28 liters of hydrogen gas per cell for each 63 A-h of input.

22DV.110.8.3 There shall be no sparking or arc producing devices (switches, relays, and similar devices) located within the battery compartment or closer than 300 mm to the battery when in an open or unshielded product.

22DV.110.8.4 The interior of a metal compartment housing a lead-acid battery shall be protected against corrosion by two coats of acid resistant paint, two coats of enamel individually baked on, or the equivalent.

22DV.110.9 D2 ***The igniter, pilot burner, and pilot flame-sensing device shall be constructed and supported so that each will be fixed in its proper position.***

22DV.110.10 D2 ***The means for ignition shall be located so as to reduce the possibility of the collection of carbon and other material, or the dislocation, distortion, or burning of parts.***

22DV.110.11 D2 ***The construction of a burner assembly shall be such that the igniter assembly may be readily withdrawn from and replaced in the burner assembly during servicing of the igniter assembly and burner assembly without resulting in:***

a) Reduction of the clearances between bare current-carrying parts, electrodes, and grounded metal parts.

b) Changes in the air gap at electrode tips.

c) Reduction of the spacings between the high-potential cables and grounded metal parts.

d) Changes in the position of the igniter or pilot relative to the area at which ignition is to be initiated.

22DV.110.12 D2 ***A gas-fired product provided with an electric-ignition system shall, for each individual combustion chamber, ignite the pilot of a gas burner assembly having an input of more than 117 kW per individual combustion chamber, or the pilot or main burner of a gas burner having an input of 117 kW or less.***

22DV.110.13 ***Regarding 22DV.110.12 D2, the ignition system shall be activated before the delivery of fuel to the ignition zone and shall remain active during the main burner flame-establishing period. If means for ignition is cut off at the termination of the main burner flame-establishing period, the ignition (igniter, pilot, and any pilot igniter) shall remain off for the duration of that firing cycle and for the purge period required upon attempting the next firing cycle.***

22DV.110.14 D2 ***The ignition system of an automatically-lighted oil burner shall be activated before or simultaneously with the delivery of fuel to the ignition zone and shall remain active during the trial-for-ignition period. If ignition is cut off at the termination of the trial-for-ignition period, the ignition shall remain off for the duration of that firing cycle unless the ignition is fully restored within 0,8 s upon unintentional extinguishment of the main burner flame.***

22DV.110.15 D2 ***Burner piping components such as the main automatic gas-shutoff valve, main manual gas-shutoff valve, pressure regulator, and similar components, may be furnished as separate parts provided that they can be joined in the field with standard piping. The standard piping may be furnished, cut, and threaded by the field installer.***

22DV.110.16 D2 ***The means for regulating the supply of air and fuel shall be arranged so that the adjustments may be fixed or restricted in a manner to reduce the possibility of unintentional changes in settings. An adjustable or movable part shall be provided with a locking device to reduce the possibility of unintentional shifting.***

NOTE Securing lacquer or similar compound is not acceptable as a locking device.

22DV.110.17 D2 *Each burner assembly part, control, and safety device requiring service shall be accessible.*

22DV.110.18 D2 *Addition: Gas-fired assemblies*

22DV.110.18.1 Bolt holes in a gas-fired burner assembly shall not intersect gasways unless provision is made to provide gas tightness.

22DV.110.18.2 Burner heads, mixer heads, and mixer tubes shall be of metals having a melting point (solidus temperature) greater than 788°C.

22DV.110.18.3 The burner orifice and orifice holder shall be made of a material having a melting point of not less than 788°C for use with manufactured and mixed gases and not less than 593°C for natural gas, LP-Gas, and LP-Gas-air mixtures.

22DV.110.18.4 Main burner gas orifice spuds shall be threaded into their holders with at least 3-1/2 full threads.

22DV.110.18.5 Flame spreaders and flame-spreader supports used with upshot-type burners shall be constructed so that they cannot be incorrectly fitted together, or they shall be marked to indicate the correct method of assembly if it is necessary to remove the flame spreader for service or assembly. A flame spreader shall not be threaded to its support unless the support is readily removable.

22DV.110.18.6 Flame-spreader supports used with upshot-type burners shall be constructed so that the flame spreader can be supported only at the correct distance above the burner.

22DV.110.18.7 Burners shall be provided with means to prevent disintegrated ceramic flame-spreader material from falling into the burner ports. They shall also be constructed so that disintegration of the ceramic will not cause an adverse change in the operating characteristics of the burner.

22DV.110.18.8 Joints in the burner assembly shall be gastight. Joints shall not depend on cement or other sealing material for mechanical strength, except for joints forming part of the orifice area.

22DV.19 D2 *Oil-fired assemblies*

22DV.110.19.1 Fuel-confining parts or operating parts of an oil-fired burner assembly shall not sag, distort, melt, oxidize, show leakage of fuel, or prevent a safety device from functioning during any of the tests specified in clause 11.

22DV.110.19.2 A firing assembly, atomizer and nozzle assembly, and similar assemblies, intended to be removed and replaced for servicing shall be constructed so that, upon replacement, the assembly will self-restore the atomizer or nozzle to its correct position.

22DV.110.19.3 A small orifice or other opening in an oil supply system shall be protected by a strainer or filter appropriate for the downstream fuel path.

22DV.110.19.4 A fan housing in which oil leaking from any oil-handling part of the assembly may accumulate (for example, an inverted fan housing on a gun-type burner) shall be provided with an open drain.

22DV.110.19.5 An outer shell of a blast tube or firing head, if made of sheet metal, shall have the necessary strength, rigidity, durability, resistance to corrosion, and other physical properties equivalent to sheet steel not less than 1,35 mm thick or Type 309 stainless steel not less than 0,66 mm thick.

22DV.110.19.6 A material shall have melting point of not less than 510 °C and a tensile strength not less than 69 MPa at 200 °C.

22DV.110.19.7 Fuel-confining parts not complying with 22DV.110.19.1 and 22DV.110.19.6 may be employed if a fusible-link valve or the equivalent is included in the burner system so as to shut off the fuel supply in the event of excessive temperature or fire in the vicinity of such parts.

22DV.110.19.8 A burner part intended for the handling of fuel under pressure shall withstand, without rupture, a hydrostatic pressure equivalent to five times the maximum working pressure of the fuel system.

22DV.110.19.9 Each strainer shall comply with the requirements in UL 331.

22DV.110.20 D2 *Combination gas-oil burner assemblies*

A combination burner shall comply with requirements relevant to each type of fuel employed. A combination burner assembly intended to burn only one fuel at a time shall be arranged so that the fuel not being fired will be shut off automatically when the burner assembly for that fuel is not in firing position or is not intended to be fired. If the burner is equipped to change automatically from one fuel to the other, the burner shall be arranged so that the fuel being fired is shut off before the other fuel is delivered to the ignition zone.

22DV.110.21 D2 *Electric high-tension ignition system*

22DV.110.21.1 Assembly

An electric high-tension ignition system shall comply with the applicable requirements of UL 296.

22DV.110.21.2 Insulators

22DV.110.21.2.1 The construction shall be such that an insulator is not likely to be damaged when tightening the securing means.

22DV.110.21.2.2 An insulator shall be:

a) Made of ceramic insulating material or the equivalent,

b) Impervious to oil and moisture, and

c) Cleanable by wiping.

22DV.110.21.2.3 An insulator shall be located so that no detrimental accumulations of carbon will form on its surfaces when the burner is tested in accordance with the requirements in clause 11.

22DV.110.22 Gas pilots

22DV.110.22.1 Clearance shall be provided for removal and replacement of the pilot burner without kinking the pilot gas tubing.

22DV.110.22.2 Tips of continuous-burning aerated pilot burners shall have heat and corrosion resistant characteristics at least equivalent to AISI Type 416 stainless steel or material. Nickel alloys of greater than 1,0 percent nickel shall not be used due to the possibility of catalytic cracking effect.

22DV.110.22.3 A pilot provided for ignition of a main burner unit shall be proved.

22DV.110.22.4 The gas-supply pressure to the pilot or a group of pilots shall be regulated separately of the main burner-gas regulator. The pilot-supply line shall be connected, or arranged to permit connection, upstream from all main burner valves and the main burner regulator.

Exception: A gas burner having an input rate of 117 kW or less to any individual combustion chamber may be provided with a single gas-appliance pressure-regulator to control the pressure of both pilot and main-burner gas, provided it is of the type acceptable for pilot and main burner load application.

22DV.110.22.5 The pilot-supply line shall be connected upstream of all main burner valves and regulators.

22DV.110.23 Burner valves

22DV.110.23.1 Automatic safety shutoff valves – gas-fired burners

Each main burner supply line and each pilot supply line shall be equipped with at least one safety-shutoff valve that will close, independent of external force and with sufficient closing force to provide tight shutoff under intended operating conditions.

22DV.110.23.2 Manual valves – gas-fired burners

22DV.110.23.2.1 Manually operated main-shutoff and pilot-shutoff valves shall be of the lubricated plug or ball type, with stops. Manually operated valves shall have the handle attached parallel to the gas flow when in the open position, shall be accessible, and shall be marked to indicate the on and off positions.

22DV.110.23.2.2 A manually operated main-burner-shutoff valve shall be installed in the line supplying all main burners of each gas device and shall be located upstream of main-burner-gas control and automatic safety-shutoff valves.

22DV.110.23.2.3 A manually operated pilot-shutoff valve shall be located in the gas supply line to a pilot burner or burners. A pilot-shutoff valve internal to a combination gas control valve is considered to comply with this requirement.

22DV.110.23.3 Manual valves – oil-fired burners

22DV.110.23.3.1 A plug or rotating-disc type valve, employing the bearing surface of the plug or disc as the liquid seal to the exterior of the valve body, shall not be used in a fuel-oil line.

22DV.110.23.3.2 An air-bleeder valve provided in the oil supply line shall be self closing.

22DV.110.24 Gas pressure regulators

22DV.110.24.1 A gas-pressure regulator shall be furnished on a gas-fired burner. The regulator shall be located up-stream of all automatically operating valves and pressure detecting devices. This regulator may be an integral part of a gas valve assembly or a separate unit.

22DV.110.24.2 The diaphragm housing of a gas-pressure regulator shall be constructed so that a vent pipe may be connected.

22DV.110.25 Combustion chamber lining

Combustion-chamber (fire box) lining, if used, shall be durable, securely held in place, and accessible for replacement.

22DV.110.26 Baffles

22DV.110.26.1 A baffle in a flue-gas passage or otherwise exposed to combustion products shall be fixed in position. A flue baffle shall be made of material having resistance to corrosion equivalent to AISI Type C1010 sheet steel not less than 1,07 mm thick, unless its deterioration will not cause excessive temperatures when the product is tested in accordance with clause 11.

22DV.110.26.2 Each flue baffle shall be removable for cleaning or shall be constructed so that it cannot be dislodged or distorted during cleaning. Flue baffles that are removable for cleaning shall be constructed so as to reduce the possibility that they may be replaced in an incorrect position.

22DV.110.27 Draft control

An automatically operated damper, if provided, shall maintain the intended damper opening at all times and be arranged to prevent starting of the burner unless the damper is in the intended position for starting.

22DV.110.28 Flue collars

A flue collar or a flue-collector part, if provided, shall have the rigidity, heat, and corrosion resistance at least equivalent to that of AISI (American Iron and Steel Institute) Type 1010 steel having a thickness as specified for heating surfaces as follows:

a) For a gas-fired burner, not less than 1,30 mm think.

b) For an oil-fired burner, not less than 1,07 mm thick.

The collar shall extend externally through the casing a sufficient distance to permit secure attachment of the vent connector.

22DV.110.29 D2 *Fuel oil supply system*

22DV.110.29.1 Fuel oil tanks

22DV.110.29.1.1 A tank not of full-drain construction, and not so designed, shall allow the ready removal of any accumulation of water or sludge. For a tank not over 45 cm deep, this may be accomplished by providing an accessible fill opening large enough to permit entrance of the average adult hand.

22DV.110.29.1.2 A tank shall be provided with means to determine or observe the fuel level as the tank is filled. A filling opening allowing supervision while filling the tank is sufficient.

22DV.110.29.1.3 A tank that employs a gauge glass or any other fuel-level indicator that, when damaged, may allow flooding at the burner or escape of fuel from the tank either when the tank is installed on the product as intended, or is in a position in which it may be stored or carried, shall be marked as specified in 7.1DV.101.4. If the indicator employs thermoplastic, gasket, or other seal materials, the tank shall be subjected to the Tests on Gaskets, Seals, and Parts, 21DV.106.

22DV.110.29.1.4 Fuel oil tanks – metal

22DV.110.29.1.4.1 Each joint of a metallic tank shall be lock-seamed, brazed, welded, or otherwise made mechanically secure. A joint not continuously brazed or welded shall be thoroughly sweated with solder or equivalent. All connections shall be made through solid threaded bosses or fittings mechanically secured to the tank.

22DV.110.29.1.4.2 A metal fuel tank shall comply with one of the following:

- be constructed of painted mild steel having a minimum thickness of 0,76 mm, or;

- pass the impact test of 21DV.101.1.

22DV.110.29.1.4.3 Joints in metal fuel tanks shall be welded, brazed, soldered, or bonded. If soldered or bonded, the joints shall be of a construction that will retain the heads if the solder or bonding melts. Fittings and fill pipe, if soldered or bonded, shall be mechanically secured to the tank in addition to soldering or bonding.

22DV.110.29.2 Fuel oil lines and piping

22DV.110.29.2.1 An opening threaded for pipe connection shall be threaded in accordance with ANSI/ASME B1.20.1.

22DV.110.29.2.2 A fitting, other than one complying with the appropriate American National Standard, shall comply with the applicable torque requirements specified in Table 22DV.110.29.2.2.

Table 22DV.110.29.2.2
Torque requirements for pipe connections

Pipe size ANSI B36.10 (Nominal inches)	Outside diameter (mm)	Torque (N•m)
1/8	10,29	17
1/4	13,72	28
3/8	17,15	51
1/2	21,34	90
3/4	26,67	113
1	33,40	137
1-1/4	42,16	164
1-1/2	48,26	175
2	60,33	186

22DV.110.29.2.3 Iron or steel supply pipe employed on a product shall comply with the Standard for Wrought Steel and Wrought Iron Pipe, ANSI B36.10, Schedule 40. If brass or copper pipe is employed, it shall be dimensionally equivalent to iron pipe. Substantial malleable iron, steel, brass, or copper pipe fittings shall be used with pipe.

22DV.110.29.2.4 The tubing and fittings shall not be exposed to temperatures greater than those specified in Table 11.8DV. Tubing shall be arranged to reduce the likelihood of mechanical damage, such as by closely following the contour of the product. Tubing connections for gas shall be made by means of compression or flare type fittings with steel or brass nuts; only flare-type fittings shall be used for fuel oil.

22DV.110.29.2.5 Aluminum tubing shall not be exposed to condensate; pass through insulating material of other than neutral reaction, unless the tubing is protected from the insulation; or be used in combination with dissimilar metals.

22DV.110.30 Gas-fired products

22DV.110.30.1 Tapped holes for gas valves, pilots, or other branch supply lines shall have at least 3-1/2 pipe threads.

22DV.110.30.2 Compounds used on threaded joints of gas piping shall be resistant to the action of liquefied petroleum gases.

22DV.110.30.3 A vertical section of piping supplied on the upstream side of the gas controls shall include a trap ("drip leg"). Otherwise, the installation instructions shall require installation of a trap at the inlet of the gas connection of the product.

22DV.110.30.4 A 1/8-in. (3,2 mm) iron pipe size or larger plugged tapping, accessible for test gauge connection, shall be furnished downstream from the last mainline gas control for measuring gas pressure at the burner.

22DV.110.31 D2 *Controls*

22DV.110.31.1 General

22DV.110.31.1.1 A safety-control circuit shall be two-wire, one side grounded, having a nominal voltage of 120 volts or less. A safety control or protective device shall interrupt the ungrounded conductor.

Exception: This requirement does not apply to a supervised circuit within a safety control or to the extension of such circuit to a separate element of the control, such as a flame-sensing device.

22DV.110.31.1.2 All safety controls shall be accessible. Partial disassembly with ordinary hand tools, such as a screwdriver, is acceptable.

22DV.110.31.1.3 A safety control shall be supported in such a manner that it and its sensing element will remain in the intended position. It shall be possible to determine by observation or test whether or not each control is in its intended location.

22DV.110.31.1.4 A product shall not provide means to render any safety control ineffective or to allow firing of the burner without the protection of each of the required safety controls.

22DV.110.31.1.5 The control circuit of a burner intended for use with a limit control, that functions to interrupt or reduce the delivery of fuel for combustion by opening an electrical circuit, shall be arranged to permit the limit control to be wired into the circuit so as to effect the direct opening of that circuit, whether the switching mechanism is integral with or remote from the sensing element.

22DV.110.31.1.6 The requirement in 22DV.110.31.1.5 is intended to prevent interposing in the limit-control circuit other controls, the failure of which may result in a condition the limit control is intended to prevent. For this purpose, a limit control may interrupt the pilot circuit of a magnetic-type motor controller that, in turn, directly opens the desired circuit when it is necessary to interrupt a single-phase circuit carrying a load greater than the capacity of available limit controls, or to interrupt a multiphase circuit.

22DV.110.31.1.7 A burner circuit shall be arranged to prevent feedback by a motor, capacitor, or similar device from energizing a fuel valve or ignition device.

22DV.110.31.1.8 Cabinet compartments housing gas piping and controls for a gas-fired burner shall be ventilated.

22DV.110.31.2 Combustion air controls

22DV.110.31.2.1 An air shutter shall be adjustable to any intended setting and be provided with means that will require use of a tool to change the setting.

22DV.110.31.2.2 An air shutter shall be guided to prevent its movement from its intended path during adjustment, and the means for adjusting the part shall be accessible for servicing.

22DV.110.31.2.3 A gas-burner assembly equipped with a forced or induced draft fan, or both, shall be constructed to obtain the intended combustion level or it shall shut off the fuel supply immediately upon failure of the air supply.

22DV.110.31.2.4 A gas burner shall be equipped to provide preignition purging in accordance with 22DV.110.31.2.5.

Exception: Preignition purging is not required if the burner is equipped with a continuous pilot and the assembly is arranged so that any and all gas from the burner ports will be lighted and burned without increasing the risk of fire or injury to persons.

22DV.110.31.2.5 A forced- or induced-draft gas burner assembly shall provide preignition purging for the combustion chamber, heat exchanger, and flue passages of the product to which the burner assembly is to be applied, immediately before ignition of an interrupted or intermittent pilot. Purging shall continue for a sufficient time to permit at least four air changes of this volume. Purging shall be at an air-flow rate not less than the equivalent of that provided for combustion at one-third rated high-fire input.

22DV.110.31.2.6 The following are considered to provide purging in accordance with 22DV.110.31.2.5.

a) A purge period of 30 s, during which time air flow at a rate equivalent to that provided for combustion at rated high-fire input of the burner assembly or product is obtained.

b) A purge period of 60 s, during which time air flow at a rate equivalent to that provided for combustion at one-half rated high-fire input of the burner assembly or product is obtained.

c) A purge period of 90 s, during which time air flow at a rate equivalent to that provided for combustion at one-third rated high-fire input of the burner assembly or product is obtained.

22DV.110.31.2.7 Purge periods less than those indicated in 22DV.110.31.2.6 for a product's burner assembly may be considered as providing purging in accordance with 22DV.110.31.2.5 if the quantity of purge air flow is found to be sufficient to provide at least four air changes of the product's combustion chamber, heat exchanger, and flue-passage volume.

22DV.110.31.3 Operating controls

Heating system operating controls shall be based upon water temperature and pressure or flow.

22DV.110.31.4 Limit controls

If the product is equipped with an operating control that only regulates the fuel input between high and low values, an additional operating-control set to shut off the fuel at a value below the set point of the limit control shall be provided.

22DV.110.31.5 Primary-safety controls – gas-fired burners

22DV.110.31.5.1 Each burner assembly shall be provided with a primary-safety control that will de-energize the main burner safety-shutoff valve upon loss of flame at point of supervision.

22DV.110.31.5.2 The time interval between loss of flame and de-energizing of the safety-shutoff valves shall be as specified in Table 22DV.110.31.5.2.

Table 22DV.110.31.5.2
Rated timings for gas-fired products

Program	Timing (s) for indicated maximum firing rate per combustion chamber	
	117 kW or less	Over 117 kW but not over 733 kW
Continuous ignition		
–Flame-establishing period	120	120[f]
–Flame-failure response time	180	4
–Flame-failure reignition time	0,8	0,8
–Valve closing time	a	5
Intermittent ignition		
–Flame-establishing period	90	15
–Flame-failure response time	180	4
–Flame-failure reignition time	0,8	0,8
–Valve closing time	a	5
Interrupted ignition		
–Ignition means flame-establishing period	90	15
–Main burner flame-establishing period	90[b]	15[c]
–Flame failure response time[d]	180	4
–Flame failure reignition time[e]	0,8	0,8
–Valve closing time	a	5

Table 22DV.110.31.5.2 Continued on Next Page

Table 22DV.110.31.5.2 Continued

Program	Timing (s) for indicated maximum firing rate per combustion chamber	
	117 kW or less	Over 117 kW but not over 733 kW
Direct ignition		Not permitted
–Flame-establishing period	60	
–Flame-failure response time	90	
–Flame-failure reignition time	0,8	
–Valve closing time	a	
[a]Included in flame failure response time. (Flame failure response time is the interval between the occurrence of flame extinguishment and de-energizing the safety shutoff means.)		
[b]Includes main gas valve opening time from initiation of gas flow.		
[c]May be 30 s for burners, other than power burners, with a safety shutoff valve having a full opening time of not less than 25 s.		
[d]Applicable to both pilot and main burner flame failure.		
[e]Applicable to pilot flame-failure reignition only.		
[f]Not acceptable on mechanical draft burners.		

22DV.110.31.5.3 A burner assembly shall be equipped with an automatic gas-ignition system. This system shall be constructed to provide for ignition by means of one of the following:

a) For a product having an input of 117 kW or less for each combustion chamber, a direct ignition device; or

b) A proved igniter or pilot.

22DV.110.31.5.4 An ignition system as described in 22DV.110.31.5.3(a) shall provide for automatic shutoff of main burner gas if the presence of the main burner flame is not proved. An ignition system as described in 22DV.110.31.5.3(b) shall provide for automatic shutoff of all gas if the presence of the ignition source is not proved.

22DV.110.31.5.5 An ignition system shall provide for automatic shutoff of the main burner gas without reenergizing the direct ignition device in the event of main burner flame outage during an operating cycle.

22DV.110.31.5.6 Pilot supervision by the primary-safety control shall be only at the point where the pilot flame will effectively ignite the gas at the main burner or burner group. The supervision shall be effective with the pilot burning with any flame capable of actuating the safety control.

22DV.110.31.5.7 If a pilot flame is not proved, the gas to the pilot shall be automatically shut off and safety shutdown established. In the event of pilot extinguishment the gas to such pilots shall be shut off within the time interval specified in Table 22DV.110.31.5.2.

22DV.110.31.5.8 If burner assemblies are constructed for multiple installation in single devices, the automatic safety-control mechanism of each burner assembly shall operate independently of the other, or equivalent features shall be provided so that in no case can any one burner operate so as to increase the risk of fire or injury to persons.

22DV.110.31.5.9 Supervision of the main burner flame only shall begin at the end of the main burner flame establishing period if the burner assembly is provided with interrupted pilot.

22DV.110.31.6 Primary-safety controls – oil-fired burners

22DV.110.31.6.1 An oil burner shall be equipped by the burner manufacturer or the product manufacturer with a primary-safety control.

Exception: An oil burner need not be equipped with a primary-safety control provided all of the following conditions are met:

a) The cleaning machine is portable.

b) The fuel input does not exceed 15,1 L/h.

c) The burner employs continuous spark ignition.

d) The cleaning machine is provided with an integral fuel tank having a capacity of not more than 37,9 L.

e) No unsafe condition is created by a lack of ignition. The product is acceptable if either of the following are met.

(1) The combustion chamber is constructed so that it can accept the entire capacity of the tank without spillage to the outside.

Compliance is checked by inspection and test.

(2) The product is shown to remain safe in the event of a lack of ignition.

Compliance with (2) is checked by the following test.

Method A

1. Fill a container with 25 percent of the product fuel tank capacity using a fuel oil recommended by the product manufacturer.

2. Operate the oil burner for 5 min. to allow stabilization.

3. Turn off the oil burner and immediately pour the fuel from the container directly into the combustion chamber.

4. Operate the product and the oil burner. The product is compliant if explosion or fire hazards are not created.

5. 5. Repeat steps 1 through 4 for quantities of fuel equal to 50, 75, and 100 percent of the product fuel tank capacity.

Method B

1. Operate the oil burner for 5 min. to allow stabilization.

2. Disable the burner ignition source.

3. Operate the oil burner until an amount of fuel equal to 25 percent of the product's fuel tank capacity has been sprayed into the combustion chamber.

4. Re-enable the burner ignition source, and operate the product and the oil burner. The product is compliant if explosion or fire hazards are not created.

5. Repeat steps 1 through 4 for quantities of fuel equal to 50, 75, and 100 percent of the product fuel tank capacity.

f) The discharge hose length does not exceed 18.3 m.

22DV.110.31.6.2 A primary-safety control shall comply with the requirements in Table 22DV.110.31.6.2.

Table 22DV.110.31.6.2
Safety control timing for oil-fired products

Maximum main flame hourly input (L)	Ignition	Main flame establishing period (s)[a,b]	Flame-failure reaction time (s)[c]
11,4 (approximately 117 kW) or less	Unproved igniter or pilot	90	90
76 (approximately 879 kW) or less	Unproved igniter or pilot	15	4[d]
NOTE—The normal timing is the designed duration of the period determined at rated voltage of the control in a room temperature of 21,1°C. Allowable factory tolerance may be in addition thereto.			
[a]The maximum input for determining the main-flame establishing period for a burner not equipped as indicated in (3) is to be the maximum input of the burner.			
[b]The maximum input for determining the main-flame establishing period and for determining if a proved pilot or igniter is required for a burner equipped to start on low fire only is to be the input to the largest fire that can be initially ignited, provided the input to that fire cannot be increased until ignition of the low fire is established and proved.			
[c]The flame-failure reaction timing is to be based on the burner's maximum input. The flame-failure reaction time is the interval between the occurrence of flame extinguishment and the time the safety shutoff device is de-energized. For burners having an hourly input of 117 kW or less, the timing may be the interval measured from the time the sending device first detects loss of flame to the time the safety shutoff device is de-energized.			
[d]A flame-failure reaction time of more than 4 s, but not more than 15 s, is acceptable if intermittent ignition is employed, or if the ignition system is reenergized in not more than 0.8 s after flame extinguishment occurs.			

22DV.110.31.7 Gas-fired products – pilot supervision

22DV.110.31.7.1 The automatic pilot shall effect ignition of the gas at the main burner(s) when the gas supply to the pilot is reduced to the point where the flame is just sufficient to keep the valve of the shutoff device open, or just above the point of flame extinction, whichever represents the higher gas rate. A pilot that becomes extinguished after having completed the main burner ignition is considered as complying with this requirement.

22DV.110.31.7.2 The combustion detector of a primary safety control that detects the presence of ignition spark is to be positioned so that the combustion detector responds to flame properties only. At the rated voltage, the signal strength due to an ignition spark shall be not more than 50 percent of the signal strength required to hold in the flame relay at 110 percent of rated voltage.

22DV.110.31.7.3 Compliance with 22DV.110.31.7.2 is to be determined in conjunction with the Combustion Tests of clause 11.

22DV.110.31.8 D2 *Automatic temperature controls*

22DV.110.31.8.1 An auxiliary control device in a product shall disconnect all heating elements that it controls from all ungrounded conductors of the supply circuit.

22DV.110.31.8.2 An auxiliary control is considered to be one that is intended primarily for time, temperature, pressure regulation, or similar functions under the conditions of intended operation, and not to reduce the risk of overload or excess-temperature conditions resulting from abnormal operation.

22DV.110.32 D2 *Electrical frame and enclosure*

22DV.110.32.1 A switch, relay, solenoid, or similar parts shall be individually and completely enclosed, except for terminals, unless it can be shown that malfunction of the component would not result in a risk of fire, or there are no openings in the bottom of the product enclosure. It will also necessitate the use of a barrier of noncombustible material:

a) Under a motor unless:

1) The structural parts of the motor or of the product provide the equivalent of such a barrier;

2) The protection provided with the motor is such that no burning insulation or molten material falls to the surface that supports the product when the motor is energized under any of the following applicable fault conditions:

i) Open main winding;

ii) Open starting winding;

iii) Starting switch short-circuited; and

iv) Capacitor of permanently-split capacitor motor short circuited – the shortcircuit is to be applied before the motor is energized, and the rotor is to be locked;

3) The motor is provided with a thermal motor protector – a protective device that is sensitive to temperature and current – that will prevent the temperature of the motor windings from exceeding 125°C under the maximum load under which the motor will run without causing the protector to cycle and from exceeding 150°C with the rotor of the motor locked; or

4) The motor complies with the requirements for impedance-protected motors, and the temperature of the motor winding will not exceed 150°C during the first 72 hours of operation with the rotor of the motor locked.

b) Under wiring, unless it is marked VW-1 (FR-1).

22DV.110.32.2 The barrier specified in 22DV.110.32.1 shall be horizontal, shall be located as illustrated in Figure 22DV.110.32.2, and shall not have an area less than that described in that illustration. Openings for drainage, ventilation, and similar functions may be employed in the barrier, provided such openings would not permit molten metal, burning insulation, or similar objects to fall on combustible material.

22DV.110.32.3 A product exposed to the effects of weathering shall be provided with threaded openings complying with the applicable requirements in UL 514A, unless the locations of the openings:

a) Are wholly below the lowest uninsulated live part within the enclosure, or

b) Prevent drainage into the enclosure along the outside surface of a field-supplied wireway when subjected to the tests specified in 15dv.3 and 15dv.4, as applicable.

22DV.110.33 D2 *Strength of mounting*

22DV.110.33.1 A product intended to be mounted on a wall or ceiling shall withstand a force of four times the weight of the product without malfunction of or damage to the mounting bracket, its securing means, or that portion of the product to which it is attached. Provision shall be included to accommodate any excessive vibration of the product.

22DV.110.33.2 To determine whether a product complies with the requirement in 22DV.110.33.1, it is to be mounted in accordance with the installation instructions provided by the manufacturer—on a surface of the construction specified using the parts provided. An adjustable product is to be adjusted to the position that will give the maximum projection from the wall. The force is to be applied through a 7,5-cm wide strap at the dimensional center of the product and is to be increased during a 5- to 10-s interval, until a load equal to the weight of the product plus a force of three times the weight of the product, is applied to the mounting system. The load is to be maintained for 1 min.

22DV.110.33.3 Nonmetallic mounting means shall comply with the tests specified in 21DV.101.

22DV.110.34 D2 *Internal combustion engines*

22DV.110.34.1 Backfire deflector

A backfire deflector shall be provided for equipment employing mechanical ignition systems (ignition systems having adjustable dwell and/or timing) on each combustion air intake.

22DV.110.34.2 Fuel systems – gasoline or diesel

22DV.110.34.2.1 General

A fuel confining part having internal threads made of drawn brass or machined from brass rod shall be capable of withstanding, without cracking, the 10-Day Moist Ammonia-Air Stress Cracking Test specified in 24DV.2.

22DV.110.34.2.2 Fuel tanks

22DV.110.34.2.2.1 Overfill test

The tank location and the facilities for filling shall be such that when an overfill condition occurs, the liquid is to be held captive or drain to the ground. The tank and any arrangements related to filling shall comply with 5.5 (Fuel Tank Overfill Test) of ANSI/OPEI B71.10. The engine shall not be operating during evaluation of a product to these requirements.

22DV.110.34.2.2.2 Construction – metal tanks

22DV.110.34.2.2.2A The construction of a metallic tank shall provide sufficient strength and rigidity to resist damage by impact.

Compliance is checked by the test of 22DV.110.34.2.2.2B

22DV.110.34.2.2.2B A metallic tank shall not leak or exhibit hazardous deformation after receiving an impact at the most adverse location from a smooth steel sphere of diameter 51 mm and weight 0.53 kg dropped, or swung as a pendulum, from a height of 1.3 m.

22DV.110.34.2.3 Fuel pump

External fuel-confining parts of a fuel pump shall be of metal or shall be subjected to the exposure tests of Clause 21DV.106. Failure of operating parts shall not result in external leakage of fuel.

22DV.110.34.2.4 Fuel lines and fittings

22DV.110.34.2.4.1 A flexible fuel line shall comply with the requirements in ANSI/SAE J30.

Exception: The burst pressure of a fuel line need not be more than 689 kPa if used in a pressure system, or 69 kPa if used in a gravity or suction system.

22DV.110.34.2.4.2 Nonmetallic tubing or hose shall comply with the requirements for the pull test in 21DV.105.1.

22DV.110.34.2.4.3 Nonmetallic fuel-confining parts, except a gasket or seal, shall comply with requirements in 22DV.110.35.2. Glass filter bowls may be used where they are located within the framework of the product.

22DV.110.34.2.4.4 Fuel lines shall be supported to minimize chafing and to maintain at least a 13 mm clearance from bare exhaust components.

22DV.110.35 Tests on fuel oil and gasoline fuel tanks. The tests specified in this subclause are applicable only to tanks not provided by the engine manufacturer.

22DV.110.35.1 All tanks

The tank location and the facilities for filling on products shall comply with the overfill test of 22DV.110.34.2.2.1.

22DV.110.35.2 Nonmetallic tanks

22DV.110.35.2.1 Fuel exposure test

22DV.110.35.2.1.1 A nonmetallic material used to form a fuel tank not provided by the engine manufacturer shall show no evidence of softening or other deterioration when tested in accordance with 22DV.110.35.2.1.2, 22DV.110.35.2.1.3 or 22DV.110.35.2.1.4 as appropriate.

22DV.110.35.2.1.2 A representative tank intended for use with gasoline is to be filled to capacity with ASTM Reference Fuel C and maintained at a temperature of 21,0°C or higher for 30 days.

22DV.110.35.2.1.3 A representative tank intended for use with fuel oil is to be filled to capacity with IRM 903 Oil and maintained at a temperature of 21,0°C or higher for 30 days.

22DV.110.35.2.1.4 A representative tank intended for use with gasoline-ethanol blends or biodiesel blends is to be filled to capacity with the appropriate test liquid specified in Annex DVC and maintained at a temperature of 21,0°C or higher for 30 days.

22DV.110.35.2.2 Heat aging test

22DV.110.35.2.2.1 A fuel tank shall show no signs of cracking or deterioration of any kind when tested in accordance with 22DV.110.35.2.2.2 – 22DV.110.35.2.2.3.

22DV.110.35.2.2.2 The fuel tank with the fuel cap shall be conditioned in an air oven for 168 h at 100 ±2°C and then in an ambient of 23 ±2°C and 50% relative humidity for at least 24 h.

22DV.110.35.2.2.3 Following the conditioning of 22DV.110.35.2.2.2, the fuel tank shall be checked under water for signs of cracking or deterioration while pressurized with air to a differential pressure of 35 kPa.

22DV.110.35.2.3 Low temperature test

22DV.110.35.2.3.1 When a nonmetallic fuel tank, and a fuel tank constructed of nonmetallic and metallic materials in combination, is tested as described in 22DV.110.35.2.3.2, the tank shall not leak, and the mountings for the tank shall not break or deform.

22DV.110.35.2.3.2 A representative fuel tank is to be filled to capacity with 75% glycol and 25% water by volume, and placed in a cold chamber maintained at –30 ±3°C for 24 h with the fill cap secured in position. The tank is then to be removed from the cold chamber, and subjected to the ball-impact described in 21DV.101.1.1–21DV.101.1.2.

22DV.110.35.2.4 Light and water exposure test

Tanks shall be tested in accordance with 21DV.101.3.2.

22DV.110.35.2.5 Leakage test

Each fuel tank-fuel indicator that is integrally mounted on a tank is to be subjected to an aerostatic pressure of 20.7 kPa for 1 min while submerged in water. The tank shall not leak.

23 Internal wiring

This clause of Part 1 is applicable.

23DV DE *Modification of Clause 23 of the Part 2 as follows:*

Add the underlined words:

This clause of Part 1 is applicable <u>except as follows</u>.

23.3DV Addition: add 23.3DV.1 – 23.3DV.4 to Subclause 23.3 of the Part 1 as follows:

23.3DV.1 D2 *Internal wiring and components shall be protected from damage when field connections such as wiring, water, drains, and similar field connections, are made to the product.*

23.3DV.2 DR *Type MTW, RHW, RHW-2, TW, THW, THW-2, THHW, THHW-2, THWN, THWN-2, XHHW, XHHW-2, or ZW wires having equivalent moisture-resistant properties of those wires specified in Annex DVA of Part 1 are acceptable for the wiring between electrical component enclosures when they are enclosed in a conduit or raceway listed in Part 1 Table DVD.1.2, or in moisture-resistant cable.*

23.3DV.3 D2 *All wires not rated for use in wet location, and all cords, shall be routed and supported so that they will not be immersed in water.*

23.3DV.4 D1 *A splice shall be provided with insulation equivalent to that of the wires involved.*

24 Components

This clause of Part 1 is applicable except as follows.

24.1DV D2 ***Addition: add the following and 24.1DV.1 – 24.1DV.4 and Table 24.1DV.4 to Subclause 24.1 of the Part 1:***

A product shall incorporate thermal or overload protection in accordance with 24.1DV.1 unless it complies with Clause 19 of Part 1.

24.1DV.1 D2 ***Motor-overload protection required for a product shall consist of one of the following:***

a) Thermal protection complying with the applicable requirements in UL 2111.

Exception No. 1: A motor intended to move air only by means of an air-moving fan that is integrally attached, keyed, or otherwise fixed to the motor shaft is not required to have running overload protection.

Exception No. 2: A shaded-pole motor with a 2:1 or smaller ratio between locked rotor and no-load currents and a 1 A or smaller difference between no-load and locked rotor currents is considered to have acceptable overload protection if it is protected against locked rotor conditions only.

b) Impedance protection complying with the requirements in UL 2111, when the motor is tested as used in the product under stalled rotor conditions.

c) Other protection that is shown by test to be equivalent to the product mentioned in (a).

24.1DV.2 DR ***If a requirement in this standard refers to the horsepower rating of a motor and the motor is not rated in horsepower, use is to be made of the appropriate table of NFPA 70, that gives the relationship between horsepower and full-load currents for motors. For a universal motor, the table applying to a single-phase, ac motor is to be used if the product is marked for use on ac only; otherwise the table applying to dc motors is to be used.***

24.1DV.3 D2 ***The motor of a product with load characteristics likely to result in an overload or stalled condition that will not be evident to the user shall incorporate thermal or overload protection in accordance with the requirements in 24.1DV.1. The loss of high pressure water supply to the trigger gun is an example of an overload or stalled condition evident to the user.***

24.1DV.4 DR ***With reference to 24.1DV.1(c), an overload-protective device complying with the National Electrical Code, NFPA 70, is considered to be an overload device that is responsive to motor current and is rated or set as specified in column A of Table 24.1DV.4. If the rating of the motor running overload protection determined in accordance with the foregoing does not correspond to a standard size or rating of a fuse, nonadjustable circuit breaker, thermal cutout, thermal relay, or heating element of a thermal-trip motor switch, the next higher size, rating, or setting may be used, but may not be more than that specified in column B of Table 24.1DV.4. For a multispeed motor, each winding connection is to be considered.***

Table 24.1DV.4
Maximum rating or setting of overload-protective device

Type of motor	Ampere rating of device as a percentage of motor full-load current rating[a]	
	A	B
Motor with marked service factor of 1,15 or more	125	140
Motor with marked temperature rise of 40°C or less	125	140
Any other motor	115	130
[a]See 24.1DV.4		

24.1.1DV D2 ***Addition: add 24.1.1DV.1 – 24.1.1DV.2 to Subclause 24.1.1 of the Part 1:***

24.1.1DV.1 A capacitor provided as a part of a capacitor motor and a capacitor connected across the line, such as a capacitor for radio-interference elimination or power-factor correction, shall be housed within an enclosure or container that will protect the plates against mechanical damage and that will prevent the emission of flame or molten material resulting from malfunction or breakdown of the capacitor. The container shall be of metal providing strength and protection not less than that of uncoated steel 0,51 mm thick. Sheet metal shall not be less than 0,66 mm thick.

Exception No. 1: The individual container of a capacitor may be of sheet metal less than 0.51 mm thick or may be of material other than metal if the capacitor is mounted in an enclosure that houses other parts of the product or provided that such housing is acceptable for the enclosure of live parts.

Exception No. 2: Capacitors rated P2 according to UL 810.

24.1.1DV.2 A capacitor connected from one side of the line to the frame or enclosure of a product shall have a capacitance rating of not more than 0,10 µF.

24.1.2 Addition:

The relevant standard for ignition transformers is IEC 61558-2-3.

24.1.3 Addition:

The mains disconnecting switch shall be suitable for at least 10 000 operations.

Switches and mechanical devices operated by the trigger of the ***trigger gun*** *shall be tested for 50 000 operations.*

NOTE 101 After the test, the device should stop the liquid flow to the nozzle immediately. Small leakages are allowed.

24.1.4DV D2 ***Modification: add the following to Subclause 24.1.4 of the Part 1:***

A contactor or other device controlled by a temperature control shall comply with the endurance requirements applicable to the temperature control.

24.3DV D2 *Modification: add the following to Subclause 24.3 of the Part 1:*

The current rating of a switch that controls an inductive load other than a motor, such as a transformer or an electric-discharge-lamp ballast, shall not be less than twice the rated full-load current of the transformer or ballast unless the switch has been investigated and found acceptable for the application.

24.7 Not applicable.

24DV DC *Additions: add 24DV.1 – 24DV.2.4 to Subclause 24.7 of the Part 1 as follows:*

24DV.1 In this standard all IEC component standard requirements are replaced by the relevant requirements of UL component standards, examples of which are given in annex DVC of UL 60335-1. Compliance is checked by the evaluation of the construction and the test requirements of the applicable UL component standard.

24DV.2 Moist Ammonia-Air Stress Cracking Test

24DV.2.1 A fuel confining brass part containing more than 15 percent zinc and having internal threads shall be capable of withstanding, without cracking, the moist ammonia-air stress cracking test.

Compliance is checked by the tests of 24DV.2.2 – 24DV.2.5, as applicable. After being subjected to the conditions described, a fuel confining brass part shall:

a) Show no evidence of cracking, delamination, or degradation or

b) If a pressure confining part, also comply with 24DV.2.5.

24DV.2.2 One test sample of each size is to be subjected to the physical stresses normally imposed on or within a part as the result of assembly with other components. Samples with female tapered pipe threads, intended to be used for installing the product in the field are to have the threads engaged and tightened to the torque specified in Table 22DV.110.29.2.2. Samples with female threads other than tapered pipe threads shall be torqued as specified by the manufacturer. Teflon tape or pipe compound is not to be used on any threads. Samples with male threads are evaluated in ″as received″ condition.

24DV.2.3 The samples are then to be tested in accordance with Apparatus (Section 6), Reagents and Materials (Section 7), Test Media (Section 8), Test Sample Preparation (9.3 - 9.4), and Test Procedure (10.1 - 10.4) of ASTM B858-06, with the test solution pH level High 10.5 ±0.1; exposure temperature of 25 ±1°C; and with the examination in accordance with 24DV.2.4.

24DV.2.4 After the exposure period, the samples are to be examined for cracks or other signs of stress corrosion using a microscope having a magnification of 25X.

24DV.2.5 Pressure-confining brass parts exhibiting evidence of cracking, delamination, or degradation, as a result of the test exposure shall withstand the hydrostatic strength test of 21.101.

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows.

25DV DR *Addition: add 25DV.1 – 25DV.2 to Clause 25 of the Part 1 as follows:*

25DV.1 A grounded or double-insulated product that is rated either

- **250 volts or less, single phase; or**

- **3-phase, 208Y/120 volts and 60 A or less:**

shall be provided with a ground-fault circuit-interrupter (GFCI) as an integral part of the power-supply cord attachment plug; or power-supply cord within 300 mm of the attachment plug face. The GFCI shall be marked "Rainproof" or "Suitable for Wet Locations" and investigated in accordance with UL 943.

25DV.2 A three- to two-wire, grounding-type adapter shall not be provided with the product.

25.1 Addition:

NOTE 101 Three-phase appliances are not required to be provided with a plug.

Appliances classified as IPX7 shall not be provided with an appliance inlet.

Appliances classified as IPX4, IPX5 or IPX6 shall not be provided with an appliance inlet, unless both inlet and connector have the same classification as the appliance when coupled or separated, or unless inlet and connector can only be separated by the use of a **tool** and have the same classification as the appliance when coupled.

Appliances provided with appliance inlets shall also be provided with an appropriate cord set.

25.1DV.1 DR *Modification: Delete all of Subclause 25.1 of the Part 2 except note 101.*

25.1DV.2 DR *Modification: Delete second and third dashed items 25.1 of the part 1.*

25.1DV.3 D2 *Modification: Add the following to Subclause 25.1 of the Part 1:*

The flexible cord shall be attached to the product.

25.2DV DR *Modification: Add the following at the end of subclause 25.2 of the Part 1:*

25.2DV.1 With reference to the requirement in 7.7DV2.3(a):

a) The rating of the supply-circuit overcurrent-protective device shall not exceed the rating of the fuse employed in the short-circuit test conducted on the motor protector; and

b) The minimum supply-circuit conductor ampacity for a product shall not be less than the sum of the following three items:

1) One hundred and twenty-five percent of the full-load current rating of the highest rated motor.

2) The full-load currents of all other motors; and

3) The currents of all other loads.

25.3DV D2 ***Modification: add 25.3DV.1 – 25.3DV.3 to Subclause 25.3 of the Part 1 as follows:***

25.3DV.1 Wiring terminals for the supply conductors shall be provided with a pressure wire connector securely fastened in place—for example, firmly bolted or held by a screw.

Exception: A wire binding screw or stud-and-nut combination may be employed at a wiring terminal intended to accommodate a 5,3 mm^2 or smaller conductor if upturned lugs or the equivalent are provided to hold the wire in place.

25.3DV.2 A wire-binding screw or stud-and-nut combination as mentioned in the exception to 25.3DV.1 shall not be smaller than M5 (U.S. No. 10).

Exception No. 1: An M4 (U.S. No. 8) screw or stud-and-nut combination may be used at a terminal intended only for the connection of a 2,1 mm^2 conductor.

Exception No. 2: An M3.5 (U.S. No. 6) screw may be used for the connection of a 1,3 or 0,8 mm^2 conductor in a low-voltage circuit.

25.3DV.3 A wiring box or compartment in which power-supply connections to a permanently connected product are to be made shall be located so that the connections may be readily inspected after the product is installed as intended.

25.7 Addition:

Supply cords of non-fixed appliances shall not be less than 5 m in length.

However, for **hand-held appliances** and appliances carried on the operator's body the supply cord shall be not less than 15 m.

Ordinary tough rubber sheathed flexible cord shall not be used for this type of appliance due to attack by cleaning agents, hence PVC or polychloroprene-sheathed flexible cords are acceptable for use at temperatures at or above 0 °C.

Only polychloroprene sheathed flexible cords (code designation 60245 IEC 57 or higher) are allowed for use at temperatures below 0 °C. For industrial and commercial use, heavy polychloroprene sheathed flexible cord (code designation 60245 IEC 66 or higher specification) is required.

25.7DV D2 *Modification: replace the first, third, and fourth paragraphs of Subclause 25.7 of the Part 2 with 25.7DV.1 – 25.7DV.4 as follows:*

25.7DV.1 For a portable product employing a motor rated 1.5 kW or less, the flexible cord shall be either Type SJ, SJE, SJO, SJT, SJTO, SJO, SJOO, SJEO, SJEOO, or SJTOO, or Type S, ST, STO, SOO, or STOO. Portable products employing a motor rated more than 1.5 kW and stationary products shall employ Type S, ST, STO, SOO, SO, SE, SEO, SEOO, or STOO flexible cord.

25.7DV.2 The flexible cord employed on a product that may be used outdoors shall be marked "W" (for example, SJOW). The flexible cord shall not be prohibited from being additionally marked "Water Resistant".

25.7DV.3 For a portable product, the flexible cord shall be at least 10,7 m long. For stationary products, the flexible cord shall be at least 0,9 m long and not longer than 1,2 m. The measurement of the length of the flexible cord is to include the attachment plug.

25.7DV.4 The attachment plug and cord shall have an ampere rating not less than the rated current of the product, or the input current under maximum normal load conditions, whichever is greater, and a nominal voltage rating not less than to the rated voltage of the product.

25.15 Modification:

Replace table 12 by the following:

Table 12 – Pull force and torque

Mass of appliance *kg*	*Pull force* *N*	*Torque* *Nm*
≤ 1	*30*	*0,1*
>1 and ≤ 4	*60*	*0,25*
> 4	*125*	*0,40*

Addition:

The test is also applied to the cord in the cord set for appliances classified as IPX4 or higher that are provided with an appliance inlet. The cord set is fitted to the appliance inlet prior to the commencement of the test.

25.23 Addition:

NOTE 101 There is no limitation on the length of conductors in flexible hoses.

26 Terminals for external conductors

This clause of Part 1 is applicable.

26DV DE *Modification: add the underlined words to Clause 26 of the Part 2 as follows:*

This clause of Part 1 is applicable except as follows.

26.3DV D1 *Modification: add the underlined words to Subclause 26.3, note 1 of the Part 1:*

Terminals and wiring compartments may be prevented from loosening.

27 Provision for earthing

This clause of Part 1 is applicable.

27DV DE *Modification: add the underlined words to Clause 27 of the Part 2 as follows:*

This clause of Part 1 is applicable except as follows.

27DV.101 D2 *Addition: add Subclauses 27DV.101.1 – 27DV.101.5.2 and Table 27DV.101.4.1 to Clause 27 of the Part 1 as follows:*

27DV.101.1 The secondary circuit supplied by a transformer with a primary operating at more than 150 volts to earth, including Class 1, 2, and 3 circuits, shall be earthed.

27DV.101.2 Bonding shall be by a positive means, such as by clamping, riveting, brazing, welding, or making a bolted or screwed connection. The bonding connection shall penetrate nonconductive coatings, such as paint.

27DV.101.3 A bolted or screwed connection that incorporates a star washer or serrations under a screw head is acceptable for penetrating nonconductive coatings.

27DV.101.4 Bonding conductor tests

27DV.101.4.1 A conductor smaller than the conductor supplying power to the component, or smaller than the conductor size in column B of Part 1 Table 27.7DV.1.2.1 may be used if, using a separate representative product for each test, neither the bonding conductor nor the connection opens under either of the following conditions:

a) When carrying a current equal to twice the rating or setting of the intended branch-circuit overcurrent-protective device for the time specified in Table 27DV.101.4.1.

b) When subjected to the limited-short-circuit test described in Part 1 27.7DV.1.4 – 27.7DV.1.8.

27DV.101.4.2 The circuit for the test described in 27DV.4.1(b) is to have a power factor of 0,9–1,0 and is to be limited to the current specified in Table 27DV.101.4.1, at the rated voltage. The open-circuit voltage of the test circuit is to be 100–105 percent of the specified voltage. The circuit is to be connected through a nonrenewable time delay type fuse. The rating of the fuse is to be equal to that of the intended branch circuit overcurrent device.

Table 27DV.101.4.1
Duration of current flow, bonding conductor test

Overcurrent device rating (A)	Minimum duration current flow (min)
30 or less	2
31 – 60	4
61 – 100	6
101 – 200	8
201 – 400	10
401 – 600	12

27DV.101.5 An earthing lead shall be connected to the product such that it is not likely to be removed during any servicing of the product.

28 Screws and connections

This clause of Part 1 is applicable.

28DV D2 *Modification: replacement. For oil burners or gas burners, Table 14 of the Part 1 is replaced by the following:*

Screws or bolts used to attach parts that are detached for servicing of the burner shall withstand the torques specified in Table 28DV after one removal and replacement.

Table 28DV
Torque requirements for screws or bolts

American standard screw size		Torque (N•m)	ISO screw size (mm)	Torque (N•m)
–	–	–	4	1,6
No. 8	4,2 mm	2,0	4,5	2,6
No. 10	4,8 mm	3,4	5	4,2
1/4 in.	6,4	11,3	6	8,7
–	–	–	7	15,0
5/16 in.	7,9	22,6	8	23,5
–	–	–	9	33,6
3/8 in.	9,5	39,6	10	45,2
7/16 in.	11,1	65,0	12	81,0
1/2 in.	12,7	96,0	14	128,0

29 Clearances, creepage distances and solid insulation

This clause of Part 1 is applicable except as follows.

29.1 Addition:

The requirement is not applicable to the air gap between the spark electrodes.

29.2 Addition:

The microenvironment is pollution degree 3 unless the insulation is enclosed or located so that it is unlikely to be exposed to pollution due to normal use of the appliance.

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

30.2.3 Not applicable

31 Resistance to rusting

This clause of Part 1 is applicable.

32 Radiation, toxicity and similar hazards

This clause of Part 1 is applicable.

Addition:

NOTE 101 For appliances intended to be connected to the water mains, requirements and test methods are under consideration to check that the appliance is so constructed or provided with a device to prevent backflow of contaminated water from the appliance, should the pressure of the water mains become lower than atmospheric pressure.

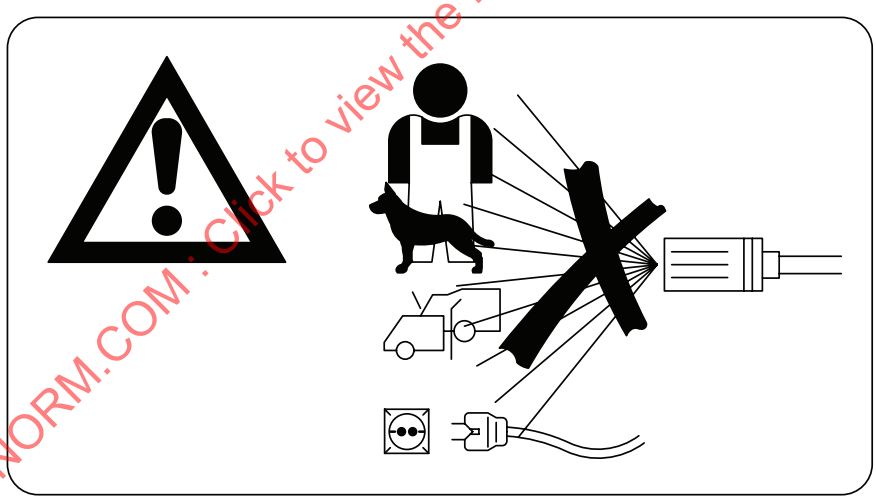


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Figure 101 – Warning symbol

101DV DE *Figure 101DV DE Deletion:*

Delete Figure 101.