

มาตรฐานผลิตภัณฑ์อุตสาหกรรม

THAI INDUSTRIAL STANDARD

มอก. 60335 เล่ม 2(79)-2563

IEC 60335-2-79(2016-06)

ความปลอดภัยของเครื่องใช้ไฟฟ้าสำหรับใช้ใน ที่อยู่อาศัยและเครื่องใช้ไฟฟ้าอื่นที่คล้ายกัน

เล่ม 2(79) ข้อกำหนดเฉพาะสำหรับเครื่องทำความสะอาดใช้ความดันสูง
และเครื่องทำความสะอาดใช้น้ำ

HOUSEHOLD AND SIMILAR ELECTRICAL APPLIANCES – SAFETY –
PART 2-79: PARTICULAR REQUIREMENTS FOR HIGH PRESSURE CLEANERS AND STEAM
CLEANERS

สำนักงานมาตรฐานผลิตภัณฑ์อุตสาหกรรม

กระทรวงอุตสาหกรรม

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กระทรวงอุตสาหกรรม ถนนพระรามที่ 6 กรุงเทพฯ 10400
โทรศัพท์ 0 2202 3300

ประกาศในราชกิจจานุเบกษา ฉบับประกาศและงานทั่วไป เล่ม 138 ตอนพิเศษ 96 ง
วันที่ 5 พฤษภาคม พุทธศักราช 2564

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ผู้ทรงคุณวุฒิจากสำนักงานมาตรฐานผลิตภัณฑ์อุตสาหกรรม

มาตรฐานผลิตภัณฑ์อุตสาหกรรม ความปลอดภัยของเครื่องใช้ไฟฟ้าสำหรับใช้ในที่อยู่อาศัยและเครื่องใช้ไฟฟ้าอื่นที่คล้ายกัน เล่ม 2(79) ข้อกำหนดเฉพาะสำหรับเครื่องทำความสะอาดใช้ความดันสูงและเครื่องทำความสะอาดใช้ไอน้ำ ได้ประกาศใช้ครั้งแรกเป็นมาตรฐานผลิตภัณฑ์อุตสาหกรรม ความปลอดภัยของเครื่องใช้ไฟฟ้า สำหรับใช้ในที่อยู่อาศัย และงานที่มีลักษณะคล้ายกัน ข้อกำหนดเฉพาะสำหรับเครื่องทำความสะอาดชนิดความดันสูง และชนิดไอน้ำ สำหรับใช้ในอุตสาหกรรมและเชิงพาณิชย์ มาตรฐานเลขที่ มอก.1871-2542 ในราชกิจจานุเบกษา ฉบับประกาศทั่วไป เล่ม 117 ตอนที่ 90 ง วันที่ 9 พฤศจิกายน พุทธศักราช 2543 และได้ประกาศยกเลิกและกำหนดใหม่เป็นมาตรฐานผลิตภัณฑ์อุตสาหกรรม เครื่องทำความสะอาดใช้ความดันสูงและเครื่องทำความสะอาดใช้ไอน้ำ เฉพาะด้านความปลอดภัย มาตรฐานเลขที่ มอก.1871-2552 ในราชกิจจานุเบกษา ฉบับประกาศทั่วไป เล่ม 127 ตอนที่พิเศษ 91 ง วันที่ 29 กรกฎาคม พุทธศักราช 2553 ต่อมาได้พิจารณาเห็นสมควรแก้ไขปรับปรุง เพื่อให้ทันสมัยและเป็นไปตามเอกสารอ้างอิงฉบับล่าสุด จึงได้แก้ไขปรับปรุงโดยการยกเลิกมาตรฐานเดิมและกำหนดมาตรฐานฉบับนี้ขึ้นใหม่

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้ อาจใช้ร่วมกับข้อกำหนดในมาตรฐานผลิตภัณฑ์อุตสาหกรรมความปลอดภัยของเครื่องใช้ไฟฟ้าในบ้านและเครื่องใช้ไฟฟ้าอื่นที่คล้ายกัน ข้อกำหนดทั่วไป มาตรฐานเลขที่ มอก. 1375 โดยข้อกำหนดจะระบุ “Addition (เพิ่มเติมข้อความ)” “Modification (แก้ไขข้อความ)” และ “Replacement (แทนข้อความ)” เพื่อให้ข้อกำหนดต่าง ๆ สมบูรณ์มีความเหมาะสมที่จะใช้กับผลิตภัณฑ์อุตสาหกรรมเครื่องทำความสะอาดใช้ความดันสูงและเครื่องทำความสะอาดใช้ไอน้ำ

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้ กำหนดขึ้นโดยรับ IEC 60335-2-79 Edition 4.0 2016-06 Household and similar electrical appliances - Safety - Part 2-79: Particular requirements for high pressure cleaners and steam cleaners มาใช้โดยวิธีพิมพ์ซ้ำ (reprinting) ในระดับเหมือนกันทุกประการ (identical) โดยใช้ IEC ฉบับภาษาอังกฤษเป็นหลัก

คณะกรรมการมาตรฐานผลิตภัณฑ์อุตสาหกรรมได้พิจารณามาตรฐานนี้แล้ว เห็นสมควรเสนอรัฐมนตรีประกาศตาม มาตรา 15 แห่งพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม พ.ศ. 2511 ซึ่งแก้ไขเพิ่มเติมโดยพระราชบัญญัติ มาตรฐานผลิตภัณฑ์อุตสาหกรรม (ฉบับที่ 7) พ.ศ. 2558



ประกาศกระทรวงอุตสาหกรรม

ฉบับที่ ๖๑๖๘ (พ.ศ. ๒๕๖๔)

ออกตามความในพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม

พ.ศ. ๒๕๑๑

เรื่อง ยกเลิกมาตรฐานผลิตภัณฑ์อุตสาหกรรม

เครื่องทำความสะอาดใช้ความดันสูง

และเครื่องทำความสะอาดใช้ไอน้ำ เฉพาะด้านความปลอดภัย

และกำหนดมาตรฐานผลิตภัณฑ์อุตสาหกรรม

ความปลอดภัยของเครื่องใช้ไฟฟ้าสำหรับใช้ในที่อยู่อาศัย

และเครื่องใช้ไฟฟ้าอื่นที่คล้ายกัน เล่ม ๒(๗๙)

ข้อกำหนดเฉพาะสำหรับเครื่องทำความสะอาดใช้ความดันสูง

และเครื่องทำความสะอาดใช้ไอน้ำ

โดยที่เป็นการสมควรปรับปรุงมาตรฐานผลิตภัณฑ์อุตสาหกรรม เครื่องทำความสะอาดใช้ความดันสูง และเครื่องทำความสะอาดใช้ไอน้ำ เฉพาะด้านความปลอดภัย มาตรฐานเลขที่ มอก. 1871-2552

อาศัยอำนาจตามความในมาตรา ๑๕ แห่งพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม พ.ศ. ๒๕๑๑ ซึ่งแก้ไขเพิ่มเติมโดยพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม (ฉบับที่ ๗) พ.ศ. ๒๕๕๘ รัฐมนตรีว่าการกระทรวงอุตสาหกรรมออกประกาศยกเลิกประกาศกระทรวงอุตสาหกรรม ฉบับที่ ๔๒๐๐ (พ.ศ. ๒๕๕๓) ออกตามความในพระราชบัญญัติมาตรฐานผลิตภัณฑ์อุตสาหกรรม พ.ศ. ๒๕๑๑ เรื่อง ยกเลิกมาตรฐานผลิตภัณฑ์อุตสาหกรรม ความปลอดภัยของเครื่องใช้ไฟฟ้า สำหรับใช้ในที่อยู่อาศัยและงานที่มีลักษณะคล้ายกัน ข้อกำหนดเฉพาะสำหรับเครื่องทำความสะอาดชนิดความดันสูงและชนิดไอน้ำ สำหรับใช้ในอุตสาหกรรม และเชิงพาณิชย์ และกำหนดมาตรฐานผลิตภัณฑ์อุตสาหกรรม เครื่องทำความสะอาดใช้ความดันสูงและเครื่องทำความสะอาดใช้ไอน้ำ เฉพาะด้านความปลอดภัย ลงวันที่ ๒๖ มีนาคม พ.ศ. ๒๕๕๓ และออกประกาศกำหนดมาตรฐานผลิตภัณฑ์อุตสาหกรรม ความปลอดภัยของเครื่องใช้ไฟฟ้า สำหรับใช้ในที่อยู่อาศัยและเครื่องใช้ไฟฟ้าอื่นที่คล้ายกัน เล่ม ๒(๗๙) ข้อกำหนดเฉพาะสำหรับเครื่องทำความสะอาด ใช้ความดันสูงและเครื่องทำความสะอาดใช้ไอน้ำ มาตรฐานเลขที่ มอก. 60335 เล่ม 2(79)-2563 ขึ้นใหม่ ดังมีรายละเอียดต่อท้ายประกาศนี้

ทั้งนี้ ให้มีผลตั้งแต่กฎกระทรวงว่าด้วยการกำหนดให้ผลิตภัณฑ์อุตสาหกรรม ความปลอดภัย
ของเครื่องใช้ไฟฟ้าสำหรับใช้ในที่อยู่อาศัยและเครื่องใช้ไฟฟ้าอื่นที่คล้ายกัน เล่ม ๒(๗๙) ข้อกำหนดเฉพาะ
สำหรับเครื่องทำความสะอาดใช้ความดันสูง และเครื่องทำความสะอาดใช้ไอน้ำ ต้องเป็นไปตามมาตรฐานเลขที่
มอก. 60335 เล่ม 2(79)-2563 ใช้บังคับ เป็นต้นไป

ประกาศ ณ วันที่ ๑๐ กุมภาพันธ์ พ.ศ. ๒๕๖๔

สุริยะ จึงรุ่งเรืองกิจ

รัฐมนตรีว่าการกระทรวงอุตสาหกรรม



ห้ามทำซ้ำเพื่อการจำหน่ายแจก

มาตรฐานผลิตภัณฑ์อุตสาหกรรม

ความปลอดภัยของเครื่องใช้ไฟฟ้าสำหรับใช้ในที่อยู่อาศัยและ

เครื่องใช้ไฟฟ้าอื่นที่คล้ายกัน

เล่ม 2(79) ข้อกำหนดเฉพาะสำหรับเครื่องทำความสะอาดใช้

ความดันสูงและเครื่องทำความสะอาดใช้น้ำ

บททั่วไป

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้กำหนดขึ้นโดยรับ IEC 60335-2-79 Edition 4.0 2016-06 Household and similar electrical appliances - Safety - Part 2-79: Particular requirements for high pressure cleaners and steam cleaners มาใช้โดยวิธีพิมพ์ซ้ำ (reprinting) ในระดับเหมือนกันทุกประการ (identical) โดยใช้ IEC ฉบับภาษาอังกฤษเป็นหลัก

1 ขอบข่าย

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้เกี่ยวกับความปลอดภัยของเครื่องทำความสะอาดใช้ความดันสูง (high pressure cleaners) โดยไม่มีการขับเคลื่อนจุดลาก (traction drive) ที่มีเจตนาให้ใช้ในที่อยู่อาศัยและเชิงพาณิชย์ ภายในอาคารหรือภายนอกอาคาร มีความดันที่กำหนดไม่น้อยกว่า 2.5 MPa และไม่เกิน 35 MPa

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้ ยังครอบคลุมถึงเครื่องทำความสะอาดใช้น้ำ (steam cleaners) และส่วนต่าง ๆ ของเครื่องทำความสะอาดใช้น้ำร้อนความดันสูง (hot water high pressure cleaners) มีขั้นตอนทำไอน้ำ (steam stage) ซึ่งมีความจุไม่เกิน 100 l มีความดันที่กำหนดไม่เกิน 2.5 MPa และมีผลคูณของความจุกับความดันที่กำหนดไม่เกิน 5 MPa·l รวมอยู่ด้วย

เครื่องทำความสะอาดข้างต้น ต้องไม่ประกอบด้วยบริภัณฑ์หรืออุปกรณ์สำหรับการขับเคลื่อนจุดลาก ระบบกำลังของการขับเคลื่อนสำหรับเครื่องสูบน้ำความดันสูง (high pressure pump) ให้ครอบคลุมถึง

- มอเตอร์ที่ใช้ไฟฟ้ากำลังประธาน (mains powered motors) มีแรงดันไฟฟ้าที่กำหนดไม่เกิน 250 V สำหรับเครื่องจักร 1 เฟส และ 480 V สำหรับเครื่องจักรอื่น ๆ
- มอเตอร์ที่ทำงานด้วยแบตเตอรี่ (battery-operated motors)
- เครื่องยนต์เผาไหม้ภายใน (internal combustion engines)

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- มอเตอร์ไฮดรอลิก (hydraulic motors) หรือ มอเตอร์อัดลม (pneumatic motors)

มาตรฐานผลิตภัณฑ์อุตสาหกรรมนี้ ไม่ครอบคลุมถึง

- เครื่องจักรฉีดน้ำความดันสูง (high pressure water jet machines) มีความดันที่กำหนดเกิน 35 MPa

หมายเหตุ 101 ในยุโรปเครื่องจักรฉีดน้ำเช่นนี้อยู่ในขอบข่าย EN 1829-1

- เครื่องทำความสะอาดใช้ไอน้ำที่มีเจตนาให้ใช้งานครัวเรือน (steam cleaners intended for domestic use) (IEC 60335-2-54)

- เครื่องมือมือถือ เครื่องมือขนได้ ทำงานด้วยมอเตอร์ไฟฟ้า (hand-held and transportable motor-operated electric tools) (อนุกรม IEC 60745, อนุกรม IEC 61029, อนุกรม IEC 62841)

- เครื่องใช้ไฟฟ้าที่มีจุดประสงค์ทางการแพทย์ (appliances for medical purposes) (IEC 60601)

- เครื่องพ่นทางการเกษตร (agricultural sprayers) (ISO 4254-6)

- เครื่องทำความสะอาดใช้สารขัดของแข็งที่ไม่มีของเหลว (non-liquid, solid abrasive cleaners)

- เครื่องจักรที่ออกแบบให้เป็นส่วนหนึ่งของกระบวนการผลิต (machines designed to be part of a production process)

- เครื่องจักรที่ออกแบบให้ใช้ในสิ่งแวดล้อมกัดกร่อนหรือสิ่งแวดล้อมระเบิด (machines designed for use in corrosive or explosive environments) (ฝุ่น ไอระเหย หรือก๊าซ)

- เครื่องจักรที่ออกแบบให้ใช้ในยานพาหนะ หรือบนเรือหรือเครื่องบิน (machines designed for use in vehicles or on board of ships or aircraft)

หมายเหตุ 102 ข้อควรคำนึง คือ ในหลายประเทศมีข้อกำหนดเกี่ยวกับความปลอดภัยเพิ่มเติมในการใช้ โดยกระทรวงสาธารณสุข กระทรวงแรงงาน การประปา และองค์กรสาธารณสุขภูมิภาคที่คล้ายกัน

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รายละเอียดให้เป็นไปตาม IEC 60335-2-79:2016 ภาคผนวก

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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.
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- 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.

International Standard IEC 60335-2-79 has been prepared by subcommittee 61J: Electrical motor-operated cleaning appliances for commercial use, of IEC technical committee 61: Safety of household and similar electrical appliances.

This fourth edition cancels and replaces the third edition published in 2012. It constitutes a technical revision.

The principal changes in this edition as compared with the third edition of IEC 60335-2-79 are as follows (minor changes are not listed):

- the standard has been revised editorially to avoid misunderstandings;
- the document has been revised for the consistent use of definitions throughout the text;
- correct references were added in the foreword;

- Annex B has been revised and updated;
- Clause 15 has been revised and updated; clarification of relevant liquid tanks has been added;
- in Clause 20 the revised temperature has been inserted;
- the text in 29.1 was modified in order to remove any misunderstandings and is in line with IEC 60335-2-102.

The text of this standard is based on the following documents:

FDIS	Report on voting
61J/635/FDIS	61J/645/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 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 fifth edition (2010) of that standard.

NOTE 1 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 high pressure cleaners and steam cleaners.

When a particular sub clause of Part 1 is not mentioned in this part 2, that sub clause 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:

- sub clauses, tables and figures that are numbered starting from 101 are additional to those in Part 1;
- unless notes are in a new sub clause or involve notes in Part 1, they are numbered starting from 101, including those in a replaced clause or sub clause;
- additional annexes are lettered AA, BB, etc.

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.

NOTE 4 The attention of National Committees is drawn to the fact that equipment manufacturers and testing organizations may need a transitional period following publication of a new, amended or revised IEC publication in which to make products in accordance with the new requirements and to equip themselves for conducting new or revised tests.

It is the recommendation of the committee that the content of this publication be adopted for implementation nationally not earlier than 12 months or later than 36 months from the date of publication.

A list of all parts of the IEC 60335 series, under the general title: *Household and similar electrical appliances – Safety* can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.



ห้ามทำซ้ำเพื่อการจำหน่าย
TISI

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 and takes into account the way in which electromagnetic phenomena can affect the safe operation of appliances.

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.

When a part 2 standard does not include additional requirements to cover hazards dealt with in Part 1, Part 1 applies.

NOTE 1 This means that the technical committees responsible for the part 2 standards have determined that it is not necessary to specify particular requirements for the appliance in question over and above the general requirements.

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.

NOTE 2 Horizontal and generic standards covering a hazard are not applicable since they have been taken into consideration when developing the general and particular requirements for the IEC 60335 series of standards. For example, in the case of temperature requirements for surfaces on many appliances, generic standards, such as ISO 13732-1 for hot surfaces, are not applicable in addition to Part 1 or part 2 standards.

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 part of IEC 60335 deals with the safety of high-pressure cleaners without traction drive, intended for household and commercial indoor or outdoor use, having a **rated pressure** not less than 2,5 MPa and not exceeding 35 MPa.

It also applies to steam cleaners and those parts of hot water high pressure cleaners incorporating a steam stage which have a capacity not exceeding 100 l, a **rated pressure** not exceeding 2,5 MPa and a product of capacity and **rated pressure** not exceeding 5 MPa·l.

They are not equipped with a traction drive. The following power systems of the drive for the high pressure pump are covered:

- mains powered motors up to a **rated voltage** of 250 V for single-phase machines and 480 V for other machines,
- battery-operated motors,
- internal combustion engines,
- hydraulic or pneumatic motors.

This standard does not apply to

- high pressure water jet machines having a **rated pressure** exceeding 35 MPa;

NOTE 101 In Europe, those machines are covered by EN 1829-1.

- steam cleaners intended for domestic use (IEC 60335-2-54);
- hand-held and transportable motor-operated electric tools (IEC 60745 series, IEC 61029 series, IEC 62841 series);
- appliances for medical purposes (IEC 60601);
- agricultural sprayers (ISO 4254-6);
- non-liquid, solid abrasive cleaners;
- machines designed to be part of a production process;
- machines designed for use in corrosive or explosive environments (dust, vapour or gas);
- machines designed for use in vehicles or on board of ships or aircraft.

NOTE 102 Attention is drawn to the fact that in many countries additional requirements on the safe use of the equipment covered can be specified by the national health authorities, the national authorities responsible for the protection of labour, the national water supply authorities and similar authorities.

2 Normative references

This clause of Part 1 is applicable except as follows.

Addition:

IEC 60364-1, *Low-voltage electrical installations – Part 1: Fundamental principles, assessment of general characteristics, definitions*

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

Replacement:

IEC 61770:2008, *Electric appliances connected to the water mains – Avoidance of backsiphonage and failure of hose-sets*

3 Terms and definitions

This clause of Part 1 is applicable except as follows.

3.1.9 Replacement:**normal operation**

conditions under which the machine is operated in normal use

It denotes the operation at **rated flow** and **rated pressure** with the appropriate nozzle and **hose line** fitted, all strainers and filters in a clean operating condition and the **unloader valve** set to the **rated pressure**. The **water heater**, if fitted, is operated at maximum power. Electric motor driven machines are supplied at **rated voltage**.

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

The burner is operated at rated power. Machines designed for operation at more than one rated power setting are additionally tested at the most disadvantageous power.

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

The draught is adjusted as recommended in the instructions.

3.1.12 Addition:

Functions not controlling the starting and stopping of the high pressure jet exiting the nozzle are not regarded as remote operation. Functions for other purposes e.g. detergent or water flow control are not considered to be remote operation.

3.101**unloader valve**

pressure operated device which, when the pump pressure exceeds a preset value, releases the pressure and leads the excess fluid into 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 device which, when the pump or steam cleaner pressure exceeds a preset value, releases the pressure and which may return the excess fluid or steam either to the inlet system or into the atmosphere

3.103**rated pressure**

maximum working pressure at the pressure generator during **normal operation**

3.104

allowable pressure

maximum pressure up to which a machine and/or parts of the machine may be subjected without impairing its safety

3.105

rated flow

maximum flow at **rated pressure** at the nozzle during **normal operation**

3.106

maximum flow rate

highest possible flow rate at the nozzle

Note 1 to entry: Typically, the **maximum flow rate** occurs at working pressures lower than **rated pressure** and with a nozzle designed for spraying of **cleaning agents**.

3.107

rated temperature

maximum temperature of the **cleaning agent** during **normal operation**

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

trigger gun

hand-held spraying device where the flow of the **cleaning agent** is regulated by an integrated manually operated control device

3.111

pencil jet nozzle

nozzle that gives a concentrated, parallel water jet

Note 1 to entry: **Pencil jet nozzles** are also known as needle jet nozzles, solid jet nozzles or 0 degree jet nozzles.

3.112

water jetter

pipe-cleaning device, connected to and controlled by a **trigger gun**, consisting of a high pressure hose and a cleaning head with nozzles

3.113

cleaning agent

water with or without the addition of gaseous, soluble or miscible detergent or solid abrasive

3.114

water heater

device for heating the **cleaning agent** by means of electricity, gas, liquid fuel or heat exchange

3.115**continuous ignition**

ignition of an oil or gas fired burner that is continuously maintained throughout the time the burner is operational, whether the burner is firing or not

3.116**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 1 to entry: **Primary safety controls** are also known as flame failure devices or flame safety controls.

3.117**motorized cleaning head**

hand-held or hand-guided cleaning device connected to the machine, with an integrated electrical motor

3.118**low pressure accessory**

device, connected to and controlled by a **trigger gun**, with large nozzle openings generating a pressure below **rated pressure**

Note 1 to entry: Typical examples of **low pressure accessories** are washing brushes, foam nozzles, washing sponges.

3.119**hand-guided machine**

machine that needs to be moved on the floor

3.120**hose line**

assembly of high pressure hoses mounted with appropriate fittings

3.121**guard**

part of the machine specifically designed to provide protection by means of a physical barrier, such as a casing, a shield, a cover, a screen, a door, an enclosure or a fence; other parts of the machine that fulfil a primarily operational function, such as, for example, the frame of the machine, may also fulfil a protective function but are not referred to as **guards**

Note 1 to entry: Three main kinds of **guards** can be distinguished: fixed **guards**, interlocking moveable **guards** and adjustable **guards**. Interlocking movable **guards** are required where frequent access is envisaged, while fixed **guards** can be used where frequent access is not envisaged.

3.122**operator**

person installing, operating, adjusting, cleaning, moving, or performing **user maintenance** on the machine

3.123**test solution**

a solution which 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

Note 1 to entry: The chemical designation of dodecyl sodium sulphate is $C_{12}H_{25}NaSO_4$.

3.124**reaction force**

force which reacts on the spraying device (and thereby on the **operator**) as a result of the action force by the water jet leaving the nozzle

Note 1 to entry: The **reaction force** can also be called recoil force. For other standards with regard to hand-arm-vibration, the technical term is feed force (e.g. ISO 28927 series) or push force (e.g. ISO 15230) what describes another force. For high-pressure cleaners, the **reaction force** is the relevant physical dimension.

3.125

commercial use

intended use of machines covered by this standard, i.e. not intended for normal housekeeping purposes by private persons but which may be a source of danger to the public

i.e. in particular that

- the machines may be used by cleaning contractors, cleaning staff, etc.;
- they are used in commercial or public premises (i.e. offices, shops, hotels, hospitals, schools, etc.) or in industrial (plants, etc.) and light industrial (workshops, etc.) environments.

Note 1 to entry: **Commercial use** is also called professional use.

4 General requirement

This clause of Part 1 is applicable except as follows.

Replacement of the first paragraph by the following:

Machines shall be constructed so that they function safely so as to cause no danger to persons or surroundings during normal use, even in the event of carelessness, and during installation, adjusting, maintenance, cleaning, repairing or transportation.

Addition:

For the purposes of this standard, the term 'appliance' as used in Part 1 is to be read as 'machine'.

5 General conditions for the tests

This clause of Part 1 is applicable except as follows.

5.101 *The **test solution** shall be stored in a sealed container, in an ambient between 3 °C and 8 °C and used within seven days after its preparation.*

5.102 ***Protective devices** and **safety valves** shall remain fully functional but shall not operate under **normal operation**.*

6 Classification

This clause of Part 1 is applicable except as follows.

6.1 *Replacement:*

Machines shall be one of the following classes with respect to the protection against electric shock:

- **class I**,
- **class II**, or
- **class III**.

However, **hand-held appliances** and hand-held parts containing electrical components 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 machines 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	IPX5
	Hand-held parts	II	IPX7
III		IPX3	
High pressure cleaners	Hand-held appliances	II-III	IPX7
	Other types of machines	I-II-III	IPX5
	Hand-held parts	II-III	IPX7

However, **fixed appliances** that are specified for installation in a separate 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.

7.1 Modification:

Replace the 4th dashed item as follows:

- the business name and address of the manufacturer and, if applicable, his authorized representative; any address shall be sufficient to ensure postal contact;

Addition:

Machines shall be marked in addition with the following:

- serial number, if any;
- designation of the machine and series or type, allowing the technical identification of the product. This may be achieved by a combination of letters and/or numbers;

NOTE 101 Designation of machine, series or type includes the model or type reference as required in Part 1.

- year of construction, i.e. the year in which the manufacturing process is completed;
- **rated pressure** in Pascal;
- **allowable pressure** in Pascal;
- **rated flow** in litre per minute;

- **maximum flow rate** in litre per minute, if necessary. The number of flow rate markings is limited to two;
- maximum **rated temperature** where this is above 50 °C;
- maximum power of the **water heater** in kW, if applicable (for electric heaters, the input power, for gas-fired or oil-fired heaters the output power).

Machines equipped with wheels and other mobile machinery shall be marked with the mass of the most usual configuration in kg.

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

Machines shall be marked in addition with the following, if applicable:

- 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.

The height of the lettering shall be not less than 4 mm. This wording may be replaced by symbol IEC 60417-5041 (2002-10).

- Steam cleaners shall be marked with symbol IEC 60417-5597 (2014-06).
- Machines not intended to be connected to the potable water mains shall be marked with the symbol according to Figure 104, coloured as shown or in monochrome colour.
- Machines intended to be used indoors and 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.

7.1.101 All high pressure hoses shall be marked with the following:

- with a pressure of at least the **allowable pressure** in Pascal;
- maximum temperature in degrees Celsius;
- business name of the manufacturer of the hose and the date of production. These data may be coded.

Compliance is checked by inspection.

7.1.102 All high pressure accessories (e.g. **trigger gun**, spray lance) shall be marked with the following:

- a pressure of at least the **allowable pressure** in Pascal;
- maximum temperature in degrees Celsius.

Compliance is checked by inspection.

7.1.103 **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;
- year of construction, i.e. the year in which the manufacturing process is completed;
- mass of the most usual configuration in kg.

Motorized cleaning heads for water-suction cleaning appliances, except those of **class III construction** having a **working voltage** up to 24 V shall be marked with symbol IEC 60417-5935 (2012-09).

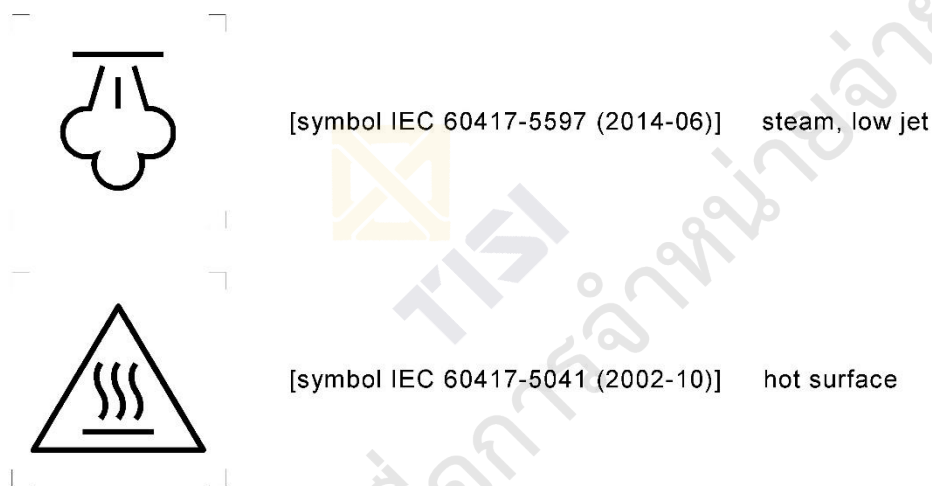
NOTE This symbol is an information sign and, except for the colours, the rules of ISO 3864-1 apply.

Compliance is checked by inspection.

7.1.104 Socket-outlets for accessories shall be marked with the maximum load in watts on the socket-outlet or close to it.

Compliance is checked by inspection.

7.6 Addition:



7.12 Modification:

Replace the 4th paragraph by the following text.

This machine is not intended for use by persons (including children) with reduced physical, sensory or mental capabilities, or lack of experience and knowledge.

Addition:

The front cover of the instructions shall include the substance of the following warning:

CAUTION Read the instructions before using the machine.

This wording may be replaced by symbols ISO 7000-0434A (2004-01) and ISO 7000-0790 (2004-01).

The instructions shall contain at least the following:

- the business name and full address of the manufacturer and, if applicable, his authorized representative;
- designation of the machine and series or type, except for the serial number, allowing the technical identification of the product. This may be achieved by a combination of letters and/or numbers;

NOTE 101 The designation of series or type can be abstracted, as long as the identification of the product is ensured.

- the general description of the machine;
- the intended use of the machine and the auxiliary equipment as covered by the scope of this standard;

NOTE 102 Examples of auxiliary equipment are lights and powered brushes.

- the meaning of the symbols used on the machine and in the instructions;
- drawings, diagrams, descriptions and explanations necessary for the safe use, maintenance and repair of the machine and for checking its correct functioning;
- technical data including the markings on the machine and the maximum inlet water pressure in Pascal;
- information regarding putting into service, safe operation, handling, transportation, and storage of the machine taking into account its weight;
- instructions to enable adjustment and maintenance to be carried out safely, including the protective measures that should be taken during these operations;
- the conditions in which the machine meets the requirement of stability during use, transportation, assembly, dismantling when out of service, testing or foreseeable breakdowns;
- the procedure to be followed to prevent unsafe situations in the event of accident (e.g. contact with or spillage of detergents, battery acid, fuel or oil) or equipment breakdown (such as flat tire or component failure).

The instructions shall indicate the type and frequency of inspections and maintenance required for safe operation including the preventive maintenance measures. They shall, if applicable, give the specifications of the spare parts if they affect the health and safety of the **operator**.

In addition, the instructions shall give the following information, if applicable:

- information about appropriate personnel protection equipment (PPE) for high pressure cleaners in operation, e.g. safety boots, safety gloves, safety helmets with visors, hearing protection etc. which shall be worn while operating the equipment;
- instructions for **water jetters** shall be given, such as “Insert hose to red mark before turning on the machine”;
- adequate information about the connection with the water mains, including the maximum inlet pressure, if not given on the rating plate;
- adequate information about the nozzles to be used, the danger of the reaction force and the sudden torque on the spray assembly when opening the **trigger gun**;
- the reaction forces if they exceed 20 N;
- the functioning of the safety devices, e.g. **safety valves, flow switches, pressure switches**;
- for battery-operated machines, the precautions to be taken for safe charging;
- information regarding safe disposal of batteries;
- if split rims are used for pneumatic tyres, instructions shall be given for the safe change of tyres;
- for mains operated machines, the substance of the following:
The electric supply connection shall be made by a qualified electrician and comply with IEC 60364-1. It is recommended that the electric supply to this machine 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.
- For oil fired machines without a **primary safety control**, the substance of the following:
This machine must be attended during operation.

- For **fixed appliances** intended to be used in a dry independent room, and for steam cleaners intended for indoor use only, the substance of the following:

Do not splash or wash down.

For machines intended to be connected to the potable water mains, the instructions shall give the following information, 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 supply from the potable water mains to supply from other water sources.

For machines not intended to be connected to the potable water mains, the instructions shall give the following information, 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.

7.12.101 The instructions shall include warnings concerning ways in which the machine shall not be used, which in the experience of the manufacturer are likely to occur. At least, they shall include the substance of the following warnings, if applicable.

- **WARNING** This machine 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 machine.
- **WARNING** During use of high pressure cleaners, aerosols may be formed. Inhalation of aerosols can be hazardous to health.
- **WARNING** High pressure jets can be dangerous if subject to misuse. The jet must not be directed at persons, live electrical equipment or the machine itself.
- **WARNING** Do not use the machine within range of persons unless they wear protective clothing.
- **WARNING** Do not direct the jet against yourself or others in order to clean clothes or foot-wear.
- **WARNING** Risk of explosion – Do not spray flammable liquids.
- **WARNING** High pressure cleaners shall not be used by children or untrained personnel.
- **WARNING** High pressure hoses, fittings and couplings are important for the safety of the machine. Use only hoses, fittings and couplings recommended by the manufacturer.
- **WARNING** To ensure machine safety, use only original spare parts from the manufacturer or approved by the manufacturer.
- **WARNING** Water that has flowed through backflow preventers is considered to be non-potable.
- A warning that the machine shall be disconnected from its power source during cleaning or maintenance and when replacing parts or converting the machine to another function:
 - for mains operated machines, by removing the plug from the socket-outlet;
 - for battery-operated machines, by safely disconnecting at least the positive or negative terminal of the battery or by an equivalent method (disconnecting device; for non-SELV both terminals must be disconnected);
 - for internal combustion engine powered machines, by removing the ignition key and by disconnecting the battery.

NOTE Where no ignition key and no battery exist, the disconnection can be achieved by equivalent means.

- WARNING Do not use the machine if a supply cord or important parts of the machine are damaged, e.g. safety devices, high pressure hoses, trigger gun.
- WARNING Inadequate extension cords can be dangerous. If an extension cord is used, it shall be suitable for outdoor use, and the connection has to be kept dry and off the ground. It is recommended that this is accomplished by means of a cord reel which keeps the socket at least 60 mm above the ground.
- WARNING Do not use combustion engine powered machines indoors unless adequate ventilation is assessed by national labour authorities.
- WARNING Ensure that any exhaust emissions are not in the vicinity of air intakes.
- WARNING For gas or oil-heated machines it is important to provide adequate ventilation and make sure that the flue gases are properly discharged.
- WARNING Always switch off the mains disconnecting switch when leaving the machine unattended.

Instructions for machines where gas or liquid fuel are used shall also include the specification of the correct fuel and the substance of the following:

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

Instructions for machines having a current-carrying hose, operating at other than **safety extra-low voltage**, shall also include the substance of the following:

- WARNING This hose contains electrical connections: do not use it to collect water and do not immerse in water for cleaning.

The instructions for machines not intended for commercial use shall include the substance of the following:

- WARNING Depending on the application, shielded nozzles can be used for high pressure cleaning, which will reduce the emission of hydrous aerosols dramatically. However, not all applications allow the use of such a device. If shielded nozzles are not applicable for the protection against aerosols, a respiratory mask of class FFP 2 or equivalent may be needed, depending on the cleaning environment.

The instructions for machines intended for commercial use shall include the substance of the following:

- WARNING The employer shall perform a risk assessment in order to specify the necessary protective measures regarding aerosols, depending on the surface to be cleaned and its environment. Respiratory masks of class FFP 2, an equivalent or higher are suitable for the protection against hydrous aerosols.

7.12.102 Information on noise

NOTE The instructions can include information on airborne noise emission as indicated in CC.2.7.

7.12.103 Information on vibration

NOTE The instructions can include information on vibration emission as indicated in Clause DD.2.

7.13 Addition:

The words "Original instructions" shall appear on the language version(s) verified by the manufacturer.

7.14 Addition:

The height of symbol IEC 60417-5935 (2012-09) shall be at least 15 mm.

Compliance is checked by measurement.

8 Protection against access to live parts

This clause of Part 1 is applicable except as follows.

8.1 Addition:

Water and water-borne **cleaning agents** are considered conductive.

9 Starting of motor-operated appliances

This clause of Part 1 is replaced by the following.

It shall only be possible to start the machine by intended actuation of a control device provided for the purpose. The same requirement applies when restarting the machine after a stoppage, whatever the cause.

Compliance is checked by inspection and test.

10 Power input and current

This clause of Part 1 is applicable except as follows.

10.101 At normal operation, the pressure shall not deviate more than $\pm 10\%$ from the **rated pressure**.

Compliance is checked by measurement. During measurement, the heat exchanger is adjusted to the highest water temperature during high pressure cleaning mode.

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:

Machines are operated until steady conditions are established.

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

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, taking into account the following:

The required test observations are recorded for any test input for the machine. After 15 min of operation, samples of the flue gas are 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.

11.102 Hoses, spray lances and fittings containing the **cleaning agent** shall withstand at least the **rated temperature**.

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

11.103 Adequate protection against unintentional contact with hot metal parts by the user shall be ensured. The protection means shall be considered as an external enclosure.

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

11.104 Where liquid fuel is used, the temperature of the fuel in the tank shall not exceed a temperature 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.

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.

15.2 Replacement:

All machines shall be constructed so that

- spillage of liquid due to **normal operation**,
- filling including overfilling, and
- overturning of **hand-guided machines, hand-held appliances** and unstable machines

does not affect their electrical insulation.

Tanks for the following liquids are excluded from the tests:

- hydraulic oil,
- coolant,

- fuel (diesel, gasoline, LPG).

Compliance is checked by the following test.

The machine 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. A machine is considered to be unstable if it overturns when a force of 180 N is applied to the top of the machine in the most unfavourable horizontal direction.

Machines 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 machines and hand-held appliances and machines that are unstable are then, with the containers completely filled for the float tank, if any, and with the most conductive detergent for the detergent tank, if any, and with the cover lid in place, tilted from the most unfavourable of the normal positions of use, and are left in that position for 5 min, unless the machine returns automatically to its normal position of use.

Liquid containers that are filled by hand are completely filled with a saline solution of water containing approximately 1 % NaCl and 0,6 % rinsing agent 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.

Any commercially available rinsing agent may be used, but if there is any doubt with regards to the test results, the rinsing agent shall have the following properties:

- viscosity, 17 mPa·s;
- pH, 2,2 (1 % in water).

and its composition shall be

Substance	Parts by mass
	%
Plurafac ® LF 221 ¹	15,0
Cumene sulfonate (40 % solution)	11,5
Citric acid (anhydrous)	3,0
Deionized water	70,5

¹ Plurafac ® LF 221 is the trade name of a product supplied by BASF. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of this product.

Hand-held appliances and machines that are unstable are then, with the containers completely filled for the float tank, if any, and with the most conductive detergent 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 machine returns automatically to its normal position of use.

Motorized cleaning heads are placed in a tray, the base of which is level with the surface supporting the machine. The tray is filled with the **test solution** to a level of 5 mm above its base, this level being maintained throughout the test. The machine including the **motorized cleaning head** is operated until its liquid container is completely full and afterwards for a further 5 min.

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

*There shall be no trace of liquid on insulation that reduces the **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 shall be resistant to liquids that may come into contact with them during normal use.

The following test is not applicable to **motorized cleaning heads** of **class III construction** having a **working voltage** up to 24 V.

Compliance is checked by the following four 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 60068-2-31. 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

- 1 000 times on its right side;*
- 1 000 times on its left side;*
- 1 000 times on its front face;*
- 1 000 times on its cleaning surface.*

*The **motorized cleaning head** is then subjected to the test described in 14.2.4 of IEC 60529:199, using the **test solution**.*

*The **motorized cleaning head** shall be operated in a flat-bottomed vessel filled with a saline solution of water containing approximately 1 % NaCl so that a depth of 3,0 mm of water is maintained. The vessel is to be a size such that the **motorized cleaning head** moves about freely; and is to be operated with or without connection to the high pressure cleaner for 15 min whichever applicable. The **motorized cleaning head** shall then withstand the electric strength test of 16.3, the voltage being applied between the **live parts** and the **test solution**. There shall be no trace of saline solution on insulation that reduces **clearances** or **creepage distances** below the values specified in Clause 29.*

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 a saline solution of water containing approximately 1 % NaCl, at a temperature of $20 \text{ }^{\circ}\text{C} \pm 5 \text{ }^{\circ}\text{C}$. 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.

18 Endurance

This clause of Part 1 is applicable except as follows.

18.101 The insulation, contacts and connections shall not be damaged and shall not work loose, as result of heating, vibration, etc.

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

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

18.102 The machine 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.

The machine is 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 machine 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 **hose lines** are coiled on concrete during this test.*

18.103 Machines 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 Machines 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 the **rated voltage**, the operating cycle being that specified in 18.103.

If the temperature rise of any part of the machine exceeds the temperature rise determined during the test of 11.8, forced cooling or rest periods may be applied, the rest periods being excluded from the specified operating time. If forced cooling is applied, it shall not alter the air flow of the machine or redistribute carbon deposits.

18.105 Machines provided with **self-resetting thermal cut-outs** shall work reliably under overvoltage conditions.

Compliance is checked by the following test.

*The machine is supplied at a voltage equal to 1,1 times the **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 After the tests of 18.102 to 18.105, the machine 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 applicable to the pump motor of three-phase machines.

19.7 Addition:

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

19.11.2 Addition:

Contactors complying with the relevant IEC standard shall not be open-circuited or short-circuited, provided the appropriate standard covers the conditions that occur with the machine. 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 machine 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.

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

When the combustion air supply to a machine having fan-assisted draught is partially or completely blocked, the machine shall either continue to operate safely or the fuel supply shall be shut off.

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

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 machine 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 a force not exceeding 1 N.*

19.102 For atmospheric gas-fired machines, 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 %.

Compliance is checked by inspection and by the following test.

The machine is tested in an atmosphere having a normal oxygen supply. The machine 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 amount of CO in the flue gases shall not exceed 0,04 % (volume) on an air-free and dry basis.

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 machine, nor produce a concentration of carbon monoxide in an air-free sample of the flue gases in excess of 0,04 %.

Compliance is checked by inspection and by the following test.

The machine is tested in an atmosphere having a normal oxygen supply. The machine 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.

19.102.3 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 a machine 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.

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 %.

Compliance is checked by inspection and by the following test.

The machine is tested in an atmosphere having a normal oxygen supply.

The machine is operated for at least 15 min at normal test pressure. When the machine 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.

In case outage occurs, raw gas shall not be forced into the combustion chamber on reopening of the flue outlet.

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 machine, nor produce a concentration of carbon monoxide in an air-free sample of the flue gases in excess of 0,04 %.

Compliance is checked by inspection and by the following test.

The machine 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 machine 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.

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

19.103 The machine shall be able to start with a successful ignition even under undervoltage condition, if applicable.

Compliance is checked by the following test.

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

20 Stability and mechanical hazards

This clause of Part 1 is applicable except as follows.

20.1 *Replacement of the first sentence by the following:*

Machines, other than **fixed appliances**, **hand-held appliances** and **hand-guided machines** without a fixed upright parking position of the handle, intended to be used on a surface such as the floor or a table, shall have adequate stability.

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 by the following tests.

*Hoses, when tested at 45 °C for 7 days with the normally diluted **cleaning agent**, shall not be damaged. Seals used in the construction of the machine shall not differ from untested seals when immersed in the normally diluted cleaning liquid at 45 °C for 7 days and then rinsed in water.*

Metal used in the construction of the parts of the machine 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 × 200 mm × 2 mm) shall have its surface area recorded as dm² 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 45 °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/dm². There shall be no significant signs of corrosion present on the test piece and the mass change shall be within 40 mg/dm².

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

Compliance is checked by inspection and by measurement.

20.103 Oil-heated or gas-heated machines 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 The unintentional closing and lowering of doors, lids, covers etc., which could cause injury, shall be prevented.

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

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

21 Mechanical strength

This clause of Part 1 is applicable except as follows.

21.1 *Replacement of the first paragraph by the following:*

The machine and its components and fittings shall have adequate mechanical strength and be constructed to withstand such rough handling that may be expected in normal use, during transportation, assembly, dismantling, scrapping and any other action involving the machine.

Modification in the third paragraph:

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

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

Compliance is checked by the following tests in 21.101.1, 21.101.2, and 21.101.3.

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 used externally outside of the high pressure cleaner to connect the trigger gun with the high pressure cleaner 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 s 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.

During this test, there shall be no rupture.

21.102 Pressure safety devices shall operate reliably.

Compliance is checked by the following test.

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

21.103 Hand-held appliances, hand-guided machines and machines 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 machine 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 machine 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 machine or spray gun is then dropped five times, with its major axis vertical, and with the nozzle pointing downwards.

After this test, the machine 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.

21.104 During **normal operation**, the **allowable pressure** shall not be exceeded.

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

Equipped with the nozzle for highest flow assigned by the manufacturer, the flow rate shall not deviate more than ± 10 % from the maximum **rated flow**.

Compliance is checked by measurement.

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.

22.12 *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.

22.35 *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 $70\text{ °C} \pm 2\text{ °C}$ 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 $-10\text{ °C} \pm 2\text{ °C}$.

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 during **normal operation**, 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 Not applicable.

22.48 *Replacement of the compliance paragraph by the following:*

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

22.101 The machine shall be constructed so as to prevent the penetration of objects from the floor, which may impair the safety of the machine.

The machine shall have no opening less than 60 mm from the floor that could admit liquid to **live parts**. If applicable, for portable products stable vertical and horizontal positions have to be considered, also taking into account that external hoses are connected or not.

Compliance is checked by inspection and 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^2 , the width not being less than 3 mm.

Compliance is checked by measurement.

22.103 The machine 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. It shall not be possible to supply the nozzle with high pressure fluid without having the **trigger gun** or equivalent means in the high pressure system.

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 jettors 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 is locked in the non-operating condition. The pressure in the fluid system is adjusted to 2,5 MPa. The actuator of the operating means is then 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.

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

22.104 Machines, 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.

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

Water jettors 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 The machine and their parts shall not have uncontrolled movement to a hazardous degree when used in accordance with the manufacturer's instructions.

Portable appliances with wheels and 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**. Except for stationary appliances, circuits not controlling the motor driving the high pressure pump are acceptable to be directly connected to the supply mains without this switch.

Compliance is checked by inspection.

22.110 The equivalent nozzle diameter of low pressure accessories shall not be less than 2 mm.

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

Compliance is checked by inspection and measurement.

22.111 Guards

Fixed **guards** shall be secured by systems that can be opened or removed only with **tools**, and shall be incapable of remaining in place without their fixings, if applicable.

Their fixing systems shall remain attached to the **guards** or to the machine when the **guards** are removed, with the exception of fixing systems that can remain detachable without impairing safety. This does also not apply if, after removal of the fixing systems, or if the component is incorrectly repositioned, the machine becomes inoperative or is obviously incomplete.

NOTE This requirement does not necessarily apply to fixed **guards** that are only liable to be removed, for example, when the machine is completely overhauled, is subject to major repairs or is dismantled for transfer to another site. For the same reason, it is not necessary to apply the requirement to the casings of machinery intended for use by laymen, where the manufacturer's instructions specify that the repairs requiring removal of these casings are only to be carried out in a specialist repair workshop. In that case, fixing systems can be used that are not easy to remove.

If movable **guards** are interlocked, the interlocking devices shall prevent the start of hazardous machine functions until the **guards** are fixed in their position, and give a stop command whenever they are no longer closed.

Interlocking movable **guards** shall, as far as possible, remain attached to the appliance when open and they shall be designed and constructed in such a way that they can be adjusted only by means of an intentional action.

Interlocking movable **guards** shall be designed in such a way that the absence or failure of one of their components prevents starting or stops the hazardous functions of the appliance.

Adjustable **guards** may be used only to restrict access to those areas of the moving parts strictly necessary for the work. They shall be manually or automatically adjustable based on the type of work involved and shall be adjustable without use of **tools**.

Compliance is checked by inspection.

22.112 The machine shall be designed in such a way as to avoid incorrect mounting, if this can lead to an unsafe situation. If this is not possible, information on the correct mounting shall be given directly on the part and/or the enclosure.

Compliance is checked by inspection.

22.113 For machines where the **operator** is required to use personal protective equipment (PPE), controls shall be designed in such a way that they can be operated safely.

Compliance is checked by inspection and by functional test.

23 Internal wiring

This clause of Part 1 is applicable.

24 Components

This clause of Part 1 is applicable except as follows:

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 cycles of operations.

*Switches and mechanical devices operated by the trigger of the **trigger gun** shall be tested for 50 000 cycles of operations.*

After the test, the device should stop the liquid flow to the nozzle immediately. Small leakages are allowed (e.g. for frost protection purposes).

24.7 Not applicable.

25 Supply connection and external flexible cords

This clause of Part 1 is applicable except as follows:

25.1 Addition:

Three-phase machines are not required to be provided with a plug.

Machines classified as IPX7 shall not be provided with an appliance inlet.

Machines 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 machine 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 machine when coupled.

Machines provided with appliance inlets shall also be provided with an appropriate cord set.

25.7 Addition:

Supply cords of non-fixed machines shall not be less than 5 m in length.

However, for **hand-held appliances** and machines 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 machine 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.

25.15 Modification:

Replacement of Table 12 by the following:

Table 12 – Pull force and torque

Mass of machine 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 machines 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.

26 Terminals for external conductors

This clause of Part 1 is applicable.

27 Provision for earthing

This clause of Part 1 is applicable.

28 Screws and connections

This clause of Part 1 is applicable.

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. The requirement is not applicable to the distance between high voltage spark electrodes and PE for appliances using galvanic isolated sparking transformers with common earth for generating the sparking voltage.

This requirement is not applicable to the air gap between the 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 machine.

30 Resistance to heat and fire

This clause of Part 1 is applicable except as follows.

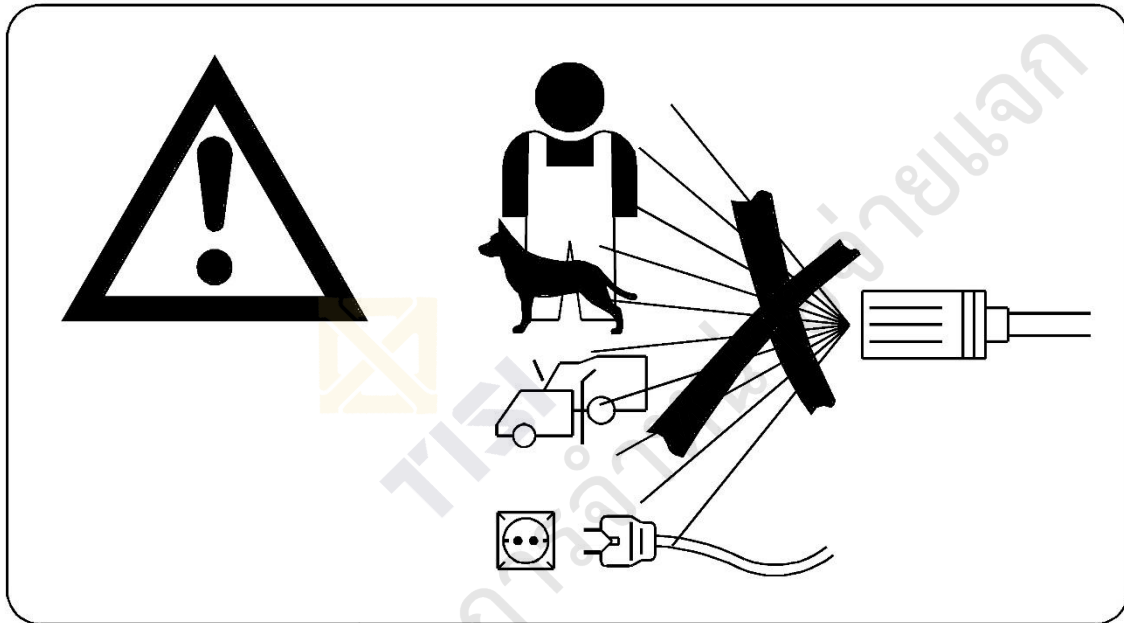
30.2.3 Not applicable.

31 Resistance to rusting

This clause of Part 1 is applicable.

32 Radiation, toxicity and similar hazards

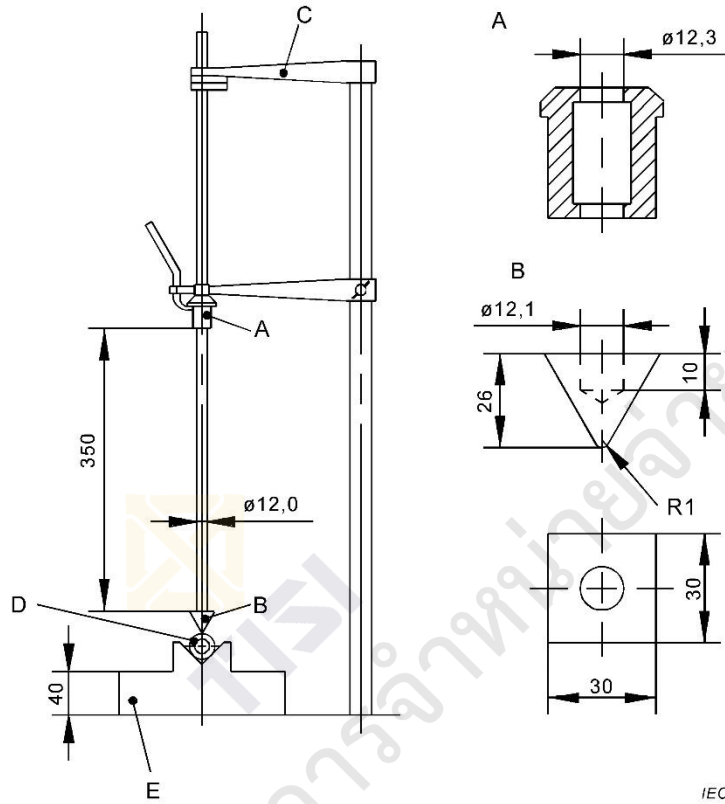
This clause of Part 1 is applicable.



IEC

Figure 101 – Warning symbol

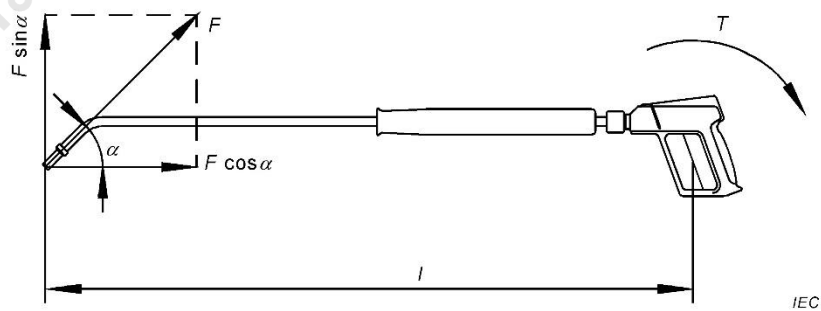
Dimensions in millimetres



Key

- A weight
- B chisel
- C fixing arm
- D sample
- E base having a mass of 10 kg

Figure 102 – Impact test apparatus



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

Figure 103 – Reactions on handle



Figure 104 – Warning symbol: Machine not suitable for connection to the potable water mains



Figure 105 – Warning symbol: Do not inhale fumes

Annexes

The annexes of Part 1 are applicable, except as follows.



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Annex B
(normative)

Appliances powered by rechargeable batteries that are recharged in the appliance

Annex B of Part 1 is applicable except as follows.

7 Marking and instructions

7.1 *Delete the last paragraph.*

7.12 *Replace the last two paragraphs by:*

For machines intending to be supplied from a **detachable supply unit** or a battery charger for the purposes of recharging the battery, the type reference of the **detachable supply unit** or battery charger shall be stated.

7.15 *Delete the last paragraph.*

Annex S
(normative)

Battery-operated appliances powered by batteries that are non-rechargeable or not recharged in the appliance

Annex S of Part 1 is applicable except as follows.

7 Marking and instructions

7.1 *Add to the last sentence at the beginning: "If relevant and".*

Delete, after the last sentence, Note 1.

Renumber "Note 2" to "Note".

Delete Figure S.1.



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Annex AA (normative)

Requirements to avoid backsiphonage

The requirements of IEC 61770 are applicable except as follows:

1 Scope

Replace the text of this clause by:

This standard specifies requirements for the connection of high pressure cleaners and steam cleaners to water mains having a water pressure not exceeding 1,2 MPa. These requirements are intended to prevent the backsiphonage of non-potable water into the potable water mains.

The connection of the machine to the water mains may be temporary or permanent.

3 Terms and definitions

3.3 *Replace the Note by:*

NOTE Examples are air gaps and backflow preventers with reduced pressure zone.

3.4 *Add, after “feed pipe and”, the following:*

“the maximum or”

3.9 *Add the following Note:*

NOTE For three-phase machines 5 s and for single phase machines, 2 s can be appropriate.

Add the following new definitions:

3.12

backflow preventer with reduced pressure zone

safety device which artificially provides disconnection by the action or the reaction of one or more hydromechanical closing and venting devices activated by pressure differences

3.13

protection point

location in a hydraulic circuit where a safety device is installed

4 General requirements

4.2 *Replace the existing text by:*

Backflow prevention devices shall be incorporated in, or fixed to, the machine or the water supply system and constructed so that

- their functional characteristics cannot be changed, even intentionally,
- their selection of the necessary safety level is in compliance with Annex BB.

4.3 Not applicable.

4.4 Not applicable.

5 General conditions for the tests

5.4 *Replace the text by:*

Tests, except the functional and endurance tests on airgaps and backflow preventers with reduced pressure zone, are made on the machine, unless this is impracticable. The compliance is then checked by the tests according to Annex A of IEC 61770:2008.

NOTE During the functional and endurance tests, additional samples can be required.

7 Pipe interrupters

This clause of IEC 61770 is not applicable.

8 Dynamic backflow preventers

This clause of IEC 61770 is not applicable.

9 Hose-sets

This clause of IEC 61770 is not applicable.

Add the following new clause:

10 Backflow preventer with reduced pressure zone

10.1 General requirements

The settings of the action and difference pressure of the device shall be fixed and not adjustable.

Only the pressure of the water of the supply network can operate the control of the internal components of the device.

Possible additional control devices (electric, pneumatic) shall not adversely affect the backflow protection function.

When installed according to the instructions for use, the drain of the **backflow preventer with reduced pressure zone** shall point downwards.

The design of the relief valve operation shall be such that when the differential pressure over the upstream check valve is less than 14 kPa (140 mbar), the relief valve shall be open to ensure positive safety.

Any water retention shall not be possible within the reduced pressure zone.

The cross-sections of the passage orifices and of the pilot tube for operation of the relief device shall be equal to or greater than 12,5 mm², no dimension for the calculation of the cross-section shall be less than 4 mm.

An air break to drain shall exist between any waste drain and any means of collecting the discharged water.

The **backflow preventer with reduced pressure zone**, with an air break to drain fitted, shall evacuate the full relief flow rate without spilling to the outside.

This air break to drain shall be directly incorporated into the **backflow preventer with reduced pressure zone**.

The relief orifice of the device shall permit neither the fitting of a standardized threaded pipe nor the connection of a standardized pipe or shape, be it by glue, welding or interlocking.

10.2 Verification of the pressure difference between the upstream and the reduced pressure zones

For the following tests, the manufacturer has to provide a special sample having the necessary test ports to verify the function of the **backflow preventer with reduced pressure zone**.

Test ports have to be provided on the type test sample:

- upstream of the first anti-pollution check valve;
- in the reduced pressure zone;
- downstream of the second anti-pollution check valve.

Compliance is checked as follows (static test):

Record the pressure difference between upstream and reduced pressure zone over the upstream pressure from 0,1 MPa to 1 MPa (1 bar to 10 bar).

The pressure difference between the upstream zone and the reduced pressure zone shall be greater than 14 kPa (140 mbar).

10.3 Verification of the tightness of the downstream check valve (in the closing direction)

Compliance is checked as follows:

*Downstream of the **backflow preventer with reduced pressure zone**, apply a pressure of 1,6 MPa (16 bar) with water at 20 °C, the upstream zone being at atmospheric pressure. The pressure is to be applied in increments of 0,1 MPa (1 bar) per 5 s.*

Hold the pressure for 2 min.

*Isolate the **backflow preventer with reduced pressure zone** from the supply system for 10 min.*

There shall be no leakage, no permanent deformation or deterioration of the downstream anti-pollution check valve after the test.

10.4 Verification of the tightness of the upstream check valve at low pressure

Compliance is checked as follows:

Fill the **backflow preventer with reduced pressure zone** with water so that the water column has a height of (200 ± 50) mm in the tube (diameter inside 10_{-2}^0) mm.

Isolate for $5 \text{ min} \pm 30 \text{ s}$.

Raise the level in the tube to $(1\ 000 \pm 50)$ mm.

Isolate for $5 \text{ min} \pm 30 \text{ s}$.

Raise the level in the tube to $(2\ 000 \pm 50)$ mm.

Isolate for $5 \text{ min} \pm 30 \text{ s}$.

The tightness of the upstream anti-pollution check valve shall be verified by the water level in the tube which shall be constant at each test stage.

No sagging of the water level in the tube is allowed at any of the stages.

10.5 Verification of opening start of the relief valve and of its closing

Compliance is checked as follows:

The following pressures are applied upstream of the device:

0,175 MPa; 0,3 MPa; 0,6 MPa and 1 MPa (1,75 bar; 3 bar; 6 bar and 10 bar).

Each of these pressure values is reduced slowly.

The value of the pressure when the relief valve opens has to be checked.

In each case, the pressure difference between upstream and reduced pressure zone shall be greater than 14 kPa.

After this test, the pressure is increased to its initial value.

The device shall then close again in an absolutely tight manner.

10.6 Durability test

The complete device is conditioned for 72 h in an environment at a temperature of (65 ± 5) °C, and at a relative humidity of (50 ± 5) %.

There shall be no distortion of any part of the device to such an extent that compliance with the standard is impaired.

Without replacement of any component, the device shall be capable of fulfilling the requirements of 10.2 to 10.5.

Compliance is checked as follows:

A test arrangement has to be provided according to Figure AA.1. The device is submitted to $5\ 000_{-0}^{+50}$ cycles at a temperature of (65 ± 5) °C.

Each cycle has to be performed in the following order:

- Stage 1: open valve 5, then valve 1, circulation at a flow rate as given in Table AA.1 at the value $\pm 5\%$ for (6 ± 2) s;
- Stage 2: close valve 5, then immediately close valve 1;
- Stage 3: open valve 3, static pressure at 0,3 MPa (3 bar) for (6 ± 2) s;
- Stage 4: close valve 3, open valve 4. Upstream drain for (6 ± 2) s (opening of the relief valve);
- Stage 5: close valve 4;
- Stage 6: open valve 5, then immediately open valve 1, circulation at a flow rate as specified in Table AA.1 at the value $\pm 5\%$ for (6 ± 2) s;
- Stage 7: Close valve 5, then immediately close valve 1;
- Stage 8: Open valve 2, static pressure at 1 MPa (10 bar) for (6 ± 2) s;
- Stage 9: Close valve 2, open valve 4. Upstream drain (opening of the relief valve) for (6 ± 2) s;
- Stage 10: Close valve 4.

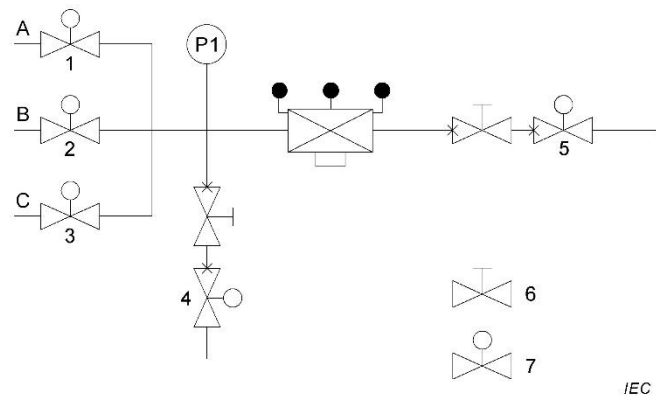
The complete series of test cycles is divided into the following test cycles:

- 1 250 cycles;
- the device is at rest for 14 h at ambient temperature;
- 1 250 cycles;
- after this test cycle, the device is stored under a static pressure of 1 MPa (10 bar) for 14 h at room temperature;
- 1 250 cycles;
- after this test cycle, the device is submitted for 14 h to an upstream pressure of 0,3 MPa (3 bar) and to a downstream pressure of 1 MPa (10 bar) at room temperature;
- 1 250 cycles.

Table AA.1 – Nominal size versus durability test flow rate

Nominal size of check valve DN mm	8	10	15	20	25
Flow rate m ³ /h	0,4	0,6	1,3	2,2	3,5

At the end of the test, the device shall be fit for further use. Compliance is checked by the tests of 10.2 to 10.5.



Key

- A flow rate: maximum pressure 0,3 MPa (3 bar) at zero-flow rate
- B static pressure: 1 MPa \pm 0,05 MPa (10 bar \pm 0,5 bar)
- C static pressure: 0,3 MPa \pm 0,03 MPa (3 bar \pm 0,3 bar)
- P1 pressure gauge
- 6 regulating valve
- 7 valve with time control of opening and closing

Figure AA.1 – Arrangement for the durability test on backflow preventers with reduced pressure zone

Annex BB (normative)

Analysis method for determining the necessary safety device to prevent backsiphonage

BB.1 Overview

The method for determining the necessary safety device to prevent backsiphonage consists of the following steps.

- Ascertain which fluid categories are used in the machine in accordance with Clause BB.2.
- Ascertain which are the installation characteristics for the safety device to be taken into account in accordance with Clause BB.3.
- Determine the maximum water level.
The result determines if the situation at the point of protection is $p = atm$ or $p > atm$.
- Consider which are the safety devices to be used, by referring to the protection matrix according to Clause BB.4.
- Verify if the drainage systems are fitted with an air break to drain in accordance with Clause BB.5.

BB.2 Determination of fluid categories which are or might be in contact with potable water

BB.2.1 In normal use, fluids which are or may be in contact with potable water are classified in five categories as defined below.

In cases where insignificant concentrations or substantial amounts of substances are present, it may be appropriate to redefine the safety measurement.

High pressure cleaners and steam cleaners according to IEC 60335-2-79 are classified as fluid category 4.

BB.2.2 Category 1

Water to be used for human consumption coming directly from a potable water distribution system.

BB.2.3 Category 2

Fluid presenting no human health hazard.

Fluid recognised as being fit for human consumption, including water taken from a potable water distribution system, which may have undergone a change in taste, odour, colour or a temperature change (heating or cooling).

BB.2.4 Category 3

Fluid representing some human health hazard due to the presence of one or more harmful substances.

NOTE The border between category 3 and category 4 is in principle $LD_{50} = 200$ mg/kg body weight. LD_{50} is the quantity of substances or the mixture which, given in one intake through oral and parenteral path, brings about

within 15 days (the required time to take into account potential delayed effect) the death of 50 out of 100 treated animals.

BB.2.5 Category 4

Fluid presenting a human health hazard due to the presence of one or more toxic or very toxic substances or one or more radioactive, mutagenic or carcinogenic substances.

BB.2.6 Category 5

Fluid presenting a human health hazard due to the presence of microbiological or viral elements.

BB.3 Determination of installation characteristics – Pressure

For each hydraulic circuit present in the machine, locate the desired or **existing protection point(s)** to be protected, or, failing this, the point of connection of the machine to the potable water main.

Determine the maximum water level.

Define whether the **protection point** or, failing this, the point of connection of the machine to the potable water mains is subjected to atmospheric pressure ($p = atm$) or to a pressure exceeding atmospheric pressure ($p > atm$).

- $p = atm$ applies if the **protection point** or, failing this point, the point of connection of the machine to the potable water main is located above the maximum water level;
- $p > atm$ applies if the **protection point** or, failing this point, the point of connection of the machine to the potable water main is located below this maximum water level.

BB.4 Matrix of the safety devices appropriate to fluid categories

The suitability of each safety device is indicated in Table BB.1.

Table BB.1 – Matrix of the safety devices appropriate to fluid categories

Safety device to prevent backsiphonage	Category of fluids				
	1	2	3	4	5
Air gap	-	●	●	●	●
Backflow preventer with reduced pressure zone	-	●	●	●	
Key ● Covers the risk - Protection not required					

BB.5 Air break to drain

All machines connected to a potable water mains and including a water draining device have to be provided with an air-break before their discharge to the drainage system.

This air gap shall comply with the above described requirements. Otherwise, the fluid in the apparatus has to be considered as fluid category 5.

The air breaks to drain shall be realized by a full disconnection or by air inlets.

Requirements on air breaks to drain:

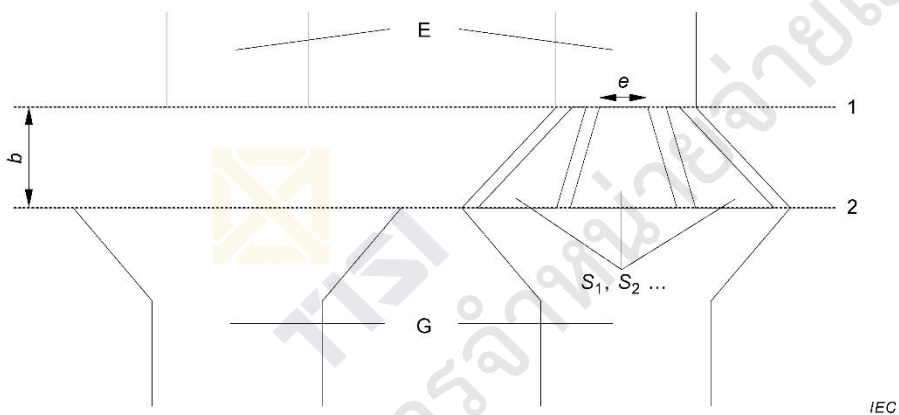
$$b \geq G;$$

$$b \geq 20 \text{ mm};$$

$$G \geq E \text{ and drain shall be capable of taking the full flow of the discharge } S_1 + S_2 + \dots \geq \frac{b \times 2\pi G}{3}$$

$$e \geq 4 \text{ mm}.$$

An example of an air break to drain is shown in Figure BB.1.



Key

1	outlet evacuation
2	spillover level
Evacuation E:	bore E
Drain G:	bore G
Air inlets:	S1, S2, cross-sections for air passage
e	smallest dimension for calculation of a cross-section
b	air gap height

Figure BB.1 – Example for an air break to drain

Annex CC (informative)

Emission of acoustical noise

CC.1 Noise reduction

Noise reduction at high pressure cleaners is an integral part of the design process and shall be achieved by applying measures at source to control noise, see for example ISO/TR 11688-1. The success of the applied noise reduction measures is assessed on the basis of the actual noise emission values in relation to other machines of the same type with comparable non-acoustical technical data. The major sound sources of high pressure cleaners are pumps and burners.

CC.2 Noise test code

CC.2.1 Emission sound pressure level determination

The emission sound pressure level is determined in accordance with ISO 11203, using the method with Q calculated for machines without a specified work station, with the measurement distance $d = 1$ m.

NOTE In this case, the emission sound pressure level is equal to the surface sound pressure level used for calculating the sound power level according to ISO 3744 when applying a rectangular parallelepiped measurement surface at a distance of 1 m from the reference box.

CC.2.2 Sound power level determination

The sound power level is measured in accordance with ISO 3744, or with ISO 3743-1 if a suitable hard-walled test room is available.

CC.2.3 Operating and mounting conditions

The operating conditions shall be identical for the determination for both sound power and emission sound pressure level at the specified positions.

In addition to **normal operation** in accordance with 3.1.9, the following requirements shall be taken into account.

The high pressure cleaner shall be installed on the reflecting plane; skid-mounted machines shall be placed on a support 0,40 m high, unless otherwise required by the manufacturer's conditions of installation.

The high pressure cleaner is operated under **normal operation**. Immediately before each series of measurement, the machine shall be operated for at least 10 min. The noise emitted by the nozzle and the emission of the water jet hitting any surfaces shall be excluded from measurement.

The period of observation shall be at least 15 s.

CC.2.4 Measurement uncertainties

A standard deviation of reproducibility σ_{RO} of less than 1,5 dB is expected for both the A-weighted emission sound pressure level according to ISO 11203 and the A-weighted sound power level determined according to ISO 3744 or ISO 3743-1.

CC.2.5 Information to be recorded

The information to be recorded covers all of the technical requirements of this noise test code. Any deviations from this noise test code or from the basic standards upon which it is based are to be recorded together with the technical justification for such deviations.

CC.2.6 Information to be reported

The information to be included in the test report is at least that which the manufacturer requires for a noise emission declaration or the user requires to verify the declared values.

CC.2.7 Declaration and verification of noise emission values

The declaration of the emission sound pressure level shall be made as a dual-number noise emission declaration according to ISO 4871, where it exceeds 70 dB(A). Where the emission sound pressure level does not exceed 70 dB(A), this fact may be stated in place of the emission value and uncertainty, e.g. by declaring $L_{pA} \leq 70$ dB(A).

It shall declare the noise emission value L_{pA} and separately the respective uncertainty K_{pA} .

The sound power level shall be given as a single value declaration according to ISO 4871 declaring the sum of L_{WA} and the respective uncertainty K_{WA} , where the emission sound pressure level exceeds 80 dB(A).

NOTE K_{pA} and K_{WA} are expected to be 3 dB.

The noise declaration shall state that the noise emission values have been obtained according to this noise test code. If this statement is not applicable, the noise declaration shall indicate clearly what the deviations from this standard, and from the basic standards, are.

If undertaken, verification shall be conducted according to ISO 4871 by using the same mounting, installation and operating conditions as those used for the initial determination of the noise emission values.

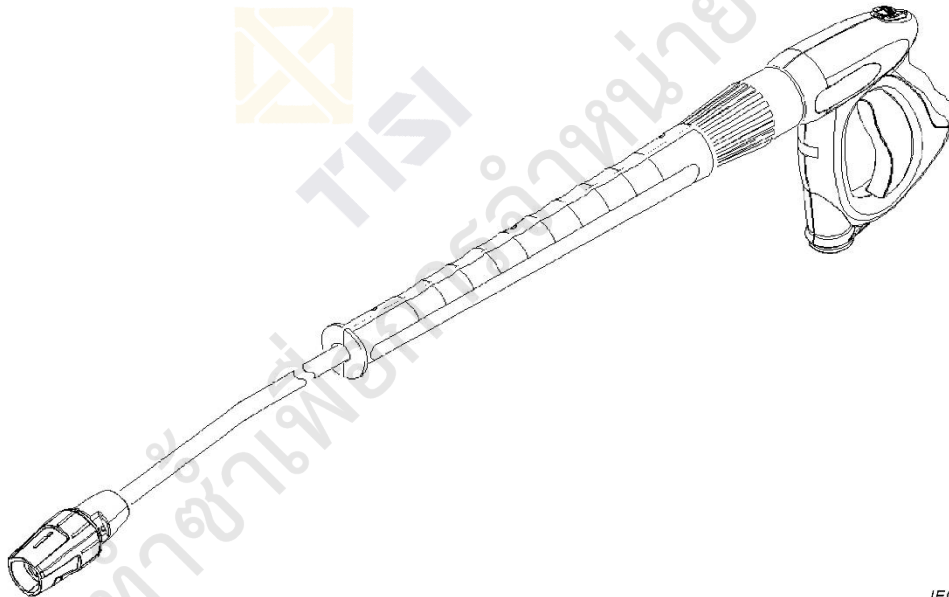
Annex DD
(informative)

Emission of vibration

DD.1 General

Annex DD specifies a laboratory method for measuring hand-transmitted vibration emission at the handles of high-pressure cleaners. It is a type-test procedure for establishing the magnitude of vibration in the gripping areas of a machine run under specified test conditions. It is intended that the results be used to compare different models of the same type of machine.

Figure DD.1 and Figure DD.2 show an example of a typical **trigger gun** (spraying device) covered by this document.



IEC

Figure DD.1 – Trigger gun

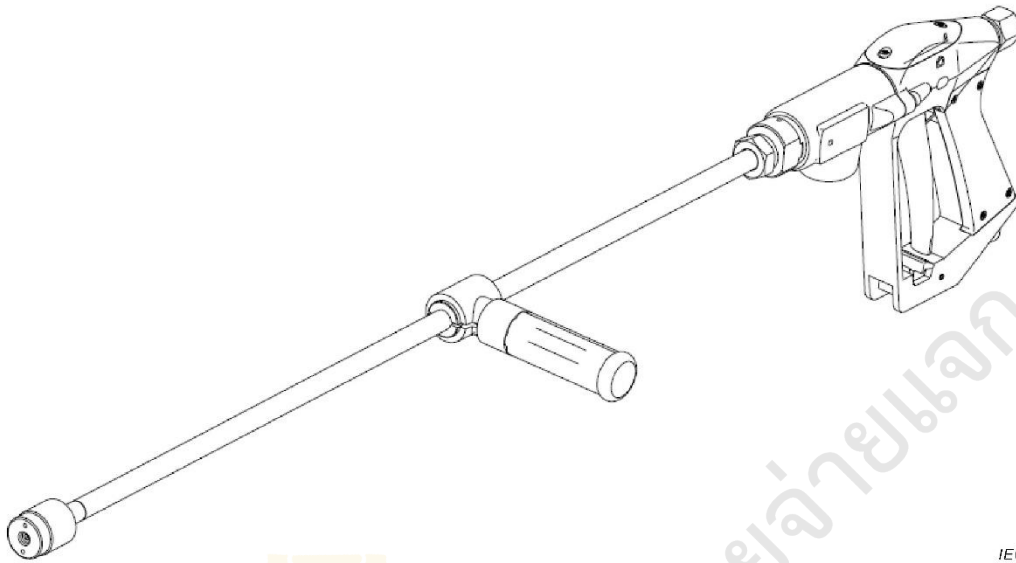


Figure DD.2 – Trigger gun with additional side handle

DD.2 Reduction of vibration

The machine shall be designed and constructed in such a way that risks resulting from vibrations produced by the machine are reduced to the lowest level, taking account of technical progress and the availability of means of reducing vibration, in particular at source.

The handles shall be designed and constructed in such a way as to reduce the vibrations transmitted to the upper limbs of the **operator** to the lowest level that is reasonably possible.

DD.3 Terms, definitions and symbols

For the purposes of this document, the terms and definitions given in ISO 20643 and the symbols given in Table DD.1 apply.

Table DD.1 – Description and units of the symbols used

Symbol	Description	Unit
a_{hw}	root-mean-square (r.m.s.) single-axis acceleration value of the frequency-weighted hand-transmitted vibration	m/s^2
a_{hv}	vibration total value of frequency-weighted r.m.s. acceleration; root sum of squares of a_{hw} values for the three measured axes of vibration	m/s^2
$\overline{a_{hv}}$	arithmetic mean value of a_{hv} values of runs for single operator using one hand position	m/s^2
a_h	arithmetic mean value of $\overline{a_{hv}}$ values for all operators for one hand position	m/s^2
$\overline{a_h}$	arithmetic mean value of a_h values for one hand position on several machines	m/s^2
a_{hd}	declared vibration emission value	m/s^2
s_{n-1}	standard deviation for a test series (for a sample, s)	m/s^2
σ_R	standard deviation of reproducibility (for a population, σ)	m/s^2
C_v	coefficient of variation for a test series	
K	uncertainty	m/s^2

DD.4 Information on vibration emission

The instructions shall give the following information:

- the vibration total value to which the hand-arm system is subjected, measured in accordance with this document, if the vibration total value exceeds $2,5 m/s^2$. Where this value does not exceed $2,5 m/s^2$, this fact may be stated in place of the emission value and uncertainty, e.g. by declaring $a_h \leq 2,5 m/s^2$;
- the uncertainty surrounding this value in accordance with this document.

These values shall be either those actually measured for the machine in question or those established on the basis of measurements taken for a technically comparable machine which is representative of the machine being produced.

Regarding operating conditions during measurement and the methods used for measurement, the reference of the standard applied (IEC 60335-2-79) shall be specified.

DD.5 Characterization of vibration

DD.5.1 Direction of measurement

The vibration transmitted to the hand shall be measured for three directions of an orthogonal coordinate system. The resulting value of the three axes shall be reported. At each hand position, the vibration shall be measured simultaneously in the three directions shown in Figure DD.3 and Figure DD.4.

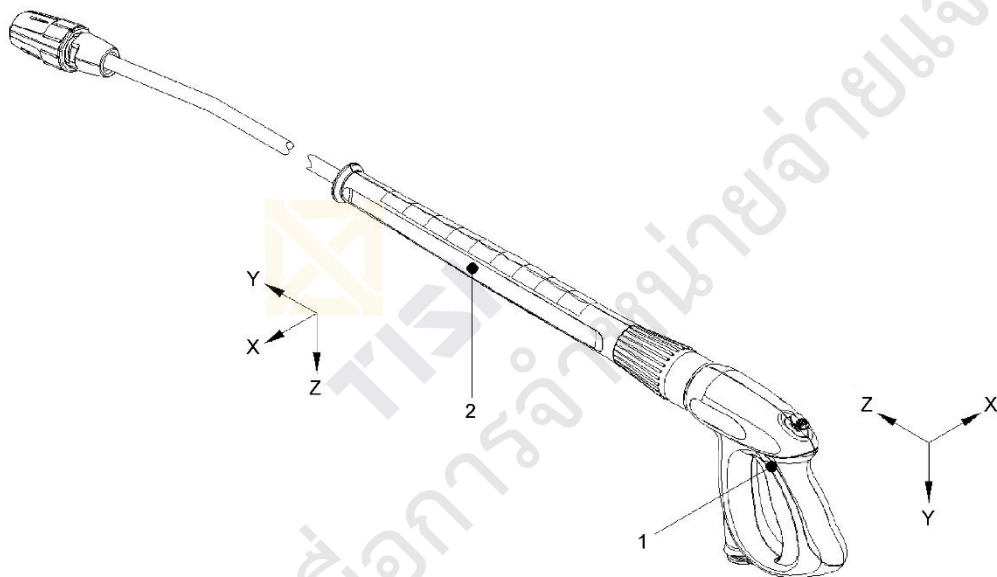
DD.5.2 Location of measurements

Measurements shall be made at the gripping zones, where the **operator** normally holds the machine and applies the **reaction force**.

The prescribed transducer location for the main measuring point shall be as close as possible to the hand between the thumb and index finger, with the **trigger gun** held as in **normal**

operation. Figure DD.3 shows this main measuring point for a **trigger gun** at the left side, which may be located also at the right side of the handle. Alternatively, the transducer may be located at the end of the handle, between the thumb and index finger. The transducer shall be attached to the lance with a maximum distance from the gripping area of 10 mm.

A secondary measuring point is defined as being on the second handle, in the middle of the gripping area, see Figure DD.3. For adjustable second handles (see Figure DD.4), or for **trigger guns** without a certain second handle, the distance between the main measuring point and the second measuring point shall be $l = 50 \text{ cm} \pm 5 \text{ cm}$, if applicable. Where not applicable, the maximum distance between transducer one and transducer two has to be chosen.

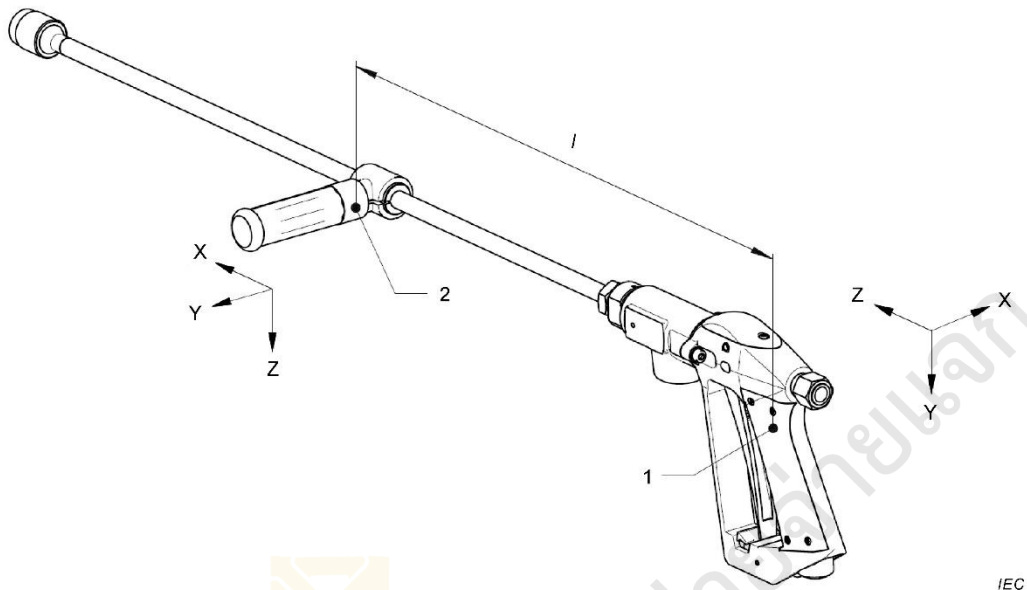


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Key

- 1 main measuring point
- 2 secondary measuring point

**Figure DD.3 – Measurement locations:
Trigger gun, main and secondary measuring point**



Key

- 1 main measuring point
- 2 secondary measuring point

**Figure DD.4 – Measurement locations:
Trigger gun with additional side handle, main and secondary measuring point**

DD.5.3 Magnitude of vibration

The definitions for the magnitude of vibration given in 6.3 of ISO 20643:2005 apply.

DD.5.4 Combination of vibration directions

The vibration total value as defined in 6.4 of ISO 20643:2005 shall be reported for both hand positions. It is acceptable to report on and carry out tests on the hand position having the highest reading. The vibration total value at that hand position shall be at least 30 % higher than the other. This result may be obtained during a preliminary test carried out by a single operator during five test runs. This result may also be obtained due to experience with comparable machines and nozzles. For machines with rotary nozzles, the test shall be carried out for both hand positions.

NOTE Experience has shown that the vibration value at the main measuring point is typically higher than at the secondary measuring point.

To obtain the vibration total value, a_{hv} , for each test run, the results in each direction shall be combined using Formula (D.1):

$$a_{hv} = \sqrt{a_{hwx}^2 + a_{hwy}^2 + a_{hwz}^2} \tag{D.1}$$

DD.6 Instrumentation requirements

DD.6.1 General

The instrumentation shall be in accordance with 7.1 of ISO 20643:2005.

DD.6.2 Mounting of transducers**DD.6.2.1 Specification of transducer**

The specification of the transducer given in 7.2.1 of ISO 20643:2005 applies. Triaxial transducers shall be used for measurement as far as possible.

DD.6.2.2 Fastening of transducers

The transducer or the mounting block used shall be rigidly attached to the surface of the handle, if applicable.

For the two axes aligned parallel to the vibrating surface, the measurement axes of the two transducer elements in a triaxial transducer shall be at a maximum of 10 mm from the surface.

DD.6.3 Frequency weighting filter

Frequency-weighting shall be in accordance with ISO 5349-1.

DD.6.4 Integration time

The integration time shall be in accordance with 7.4 of ISO 20643:2005. The integration time for each test run shall be at least 16 s, initiating after the starting period.

NOTE The starting period itself is considered to be negligible due to the relation of the duration of the starting and working period.

DD.6.5 Calibration

The specifications for calibration given in 7.6 of ISO 20643:2005 apply.

DD.7 Testing and operating conditions of the machinery**DD.7.1 General**

During testing, the machine shall be equipped and held in a manner similar to that when performing a normal work task. A reasonable warming-up period shall be undertaken prior to the start of the test.

DD.7.2 Operating conditions

During testing, the machine shall be operated at **rated voltage**, and shall be used in accordance with **normal operation** as defined in this standard and with the manufacturer's specifications, as far as not otherwise specified in DD.7.2. The operation shall be stable and smooth. In particular, the following conditions shall apply:

NOTE 1 Further requirements are given in DD.8.1 (3 test persons, five test runs), and DD.6.4 (16 s test duration).

- The tests shall be carried out at **normal operation**.
- The trigger gun shall be held without tension, with a downwards angle of $45^\circ \pm 5^\circ$, spraying the water jet to the atmosphere without working towards any barrier (see Figure DD.5). Gloves shall not be used unless required as PPE due to manufacturer's instructions.
- The hand position of the second hand (support hand) shall be as shown in Figure DD.5. The hand shall be placed as close as possible next to the transducer. The second hand shall support the trigger gun from underneath. If the gripping area is too small to place the transducer in the middle of the gripping area and simultaneously between the thumb and index finger, the transducer shall be placed in the middle of the gripping area, whilst the second hand shall be shifted towards the nozzle. A removable pulsation dampener, if any, shall not be used. If a pulsation dampener is permanently fixed to the machine, this fact

shall be reported. The length of the **hose line** shall be not more than 10 m. If the standard length according to the manufacturer's instructions is more than 10 m, the standard hose may be used; in this case the length shall be reported. The type of the **hose line** shall be reported.

- The nominal diameter shall be not more than DN 12. If the standard nominal diameter according to the manufacturer's instructions is more than DN 12, the standard hose may be used; in this case the nominal diameter shall be reported.

NOTE 2 DN 12 is the inner diameter nominal expressed in mm.

- During measurement, the **hose line** shall lie without interference and in particular without touching the **operator**.



Figure DD.5 – Operating conditions – Position of spraying device

DD.7.3 Operators

Three different **operators** shall operate the machine during testing. The vibration measurements are influenced by the **operator**. They should therefore be skilled and able to operate the machine properly i.e. the **operator** shall be experienced in the use of the machine. The gripping force shall be as under long term working conditions and not be excessive.

The **hose line** shall hang loose from the lance with minimum bending forces transferred into the lance.

DD.8 Measurement procedure and validity

DD.8.1 Reported vibration values

Three series of five consecutive tests shall be carried out on each machine tested, using a different **operator** for each series. The values should be reported as in Annex EE.

The test shall be carried out for the machine as described in Clause DD.7 and reported for a standard nozzle. If it is necessary to report alternative vibration values, the tests shall be carried out as described in DD.8.2. For nozzles which cause significantly higher vibration

values (e.g. rotary nozzles with a single water jet), these values shall be reported also. If only one value is to be reported, this shall be the higher one.

The coefficient of variation, C_v , and the standard deviation, s_{n-1} , shall be calculated for each hand position for each of the three **operators**. The C_v of a test series is defined as the ratio of s_{n-1} to the mean value of the series:

$$C_v = \frac{s_{n-1}}{a_{hv}} \quad (D.2)$$

with s_{n-1} identical to s_{rec} (see Clause DD.10) and where the standard deviation of the i th value, a_{hvi} , is:

$$s_{n-1} = \sqrt{\frac{1}{n-1} \sum_{i=1}^n (a_{hvi} - \overline{a_{hv}})^2} \quad (D.3)$$

where

$\overline{a_{hv}}$ is the mean value of the series in m/s^2 ;

n is equal to 5, the number of measured values.

If C_v is greater than 0,15 or s_{n-1} is greater than 0,3 m/s^2 , then the measurements shall be checked for error before data are accepted.

DD.8.2 Declaration and verification of the vibration emission value

The $\overline{a_{hv}}$ value for each **operator** shall be calculated as the arithmetic mean of a_{hv} values for the five test runs. For each hand position, the result from the three **operators** shall be combined into one value, a_h , using the arithmetic mean of the three $\overline{a_{hv}}$ values.

For tests using only one machine, the declared value, a_{hd} , is the highest of the a_h values reported for the two hand positions.

For tests using three or more machines, $\overline{a_h}$ values for each hand position shall be calculated as the arithmetic mean of the a_h values for the different machines on that hand position. The declared value, a_{hd} , is the highest of the $\overline{a_h}$ values reported for the two hand positions.

Both a_{hd} and the uncertainty, K , shall be presented with a precision determined in accordance with EN 12096. The value of a_{hd} is to be given in m/s^2 and presented by using two and a half significant digits for numbers starting with 1 (e.g. 1,20 m/s^2 , 14,5 m/s^2); otherwise, two significant digits are sufficient (e.g. 0,93 m/s^2 , 8,9 m/s^2). The value of K shall be presented with the same number of decimals as a_{hd} .

K shall be determined in accordance with EN 12096, based on the standard deviation of reproducibility, σ_R . The value of K shall be calculated in accordance with Clause DD.10.

DD.9 Determination of uncertainty

DD.9.1 General

The uncertainty value, K , represents the uncertainty of the declared vibration emission value, a_{hd} , and, in the case of batches, production variations of machinery. It is expressed in m/s^2 . The sum of a_{hd} and K indicates the limit below which the vibration emission value of a single machine, and/or a specified large proportion of the vibration emission values of a batch of machines, are stated to lie when the machines are new.

DD.9.2 Tests on single machines

For tests made on only a single machine, K shall be given as

$$K = 1,65\sigma_R$$

where σ_R is the standard deviation of reproducibility, estimated by the value s_R , given by

$$a) \quad s_R = \sqrt{s_{rec}^2 + s_{op}^2}$$

or

$$b) \quad s_R = 0,06 a_{hd} + 0,3,$$

whichever is the greater.

NOTE 1 The uncertainty is expected to be at least $0,5 m/s^2$.

NOTE 2 Formula b) is empirical, based on experience giving a lower limit for s_R .

The calculations are performed on the hand position giving the highest value of a_h where

s_{rec}^2 is the arithmetic mean value of the standard deviation from the results of five tests, s_{reci} , for **operator** j , identical to s_{n-1} according to DD.8.1, and with the s_{rec}^2 value for each **operator** calculated using

$$s_{recj}^2 = \frac{1}{n-1} \sum_{i=1}^n (a_{hvij} - \overline{a_{hvj}})^2$$

where

n is 5, the number of measured values;

a_{hvij} is the vibration total value for the i^{th} test with the j^{th} **operator**;

$\overline{a_{hvj}}$ is the average vibration total value of measurements on the j^{th} **operator**;

s_{op} is the standard deviation of the results from the three **operators**, i.e.

$$s_{op}^2 = \frac{1}{m-1} \sum_{j=1}^m (\overline{a_{hvj}} - a_h)^2$$

where

m is three (i.e. the number of **operators**);

$\overline{a_{hvj}}$ is the average vibration value from the j^{th} **operator** (average of five tests);

a_h is the average vibration value from all three operators.

NOTE 3 The value of s_R is an estimate of the standard deviation of reproducibility of testing performed at different test centres. Since there is currently no information on reproducibility for the tests defined in this document, the value for s_R is based on the repeatability of the test for individual test subjects and across the different test subjects, according to EN 12096.

DD.9.3 Tests on batches of machines

For tests on three or more machines, the K value shall be given as

$$K = 1,5\sigma_t$$

where σ_t is estimated by the value s_t , given by

$$s_t = \sqrt{s_R^2 + s_b^2}$$

or

$$s_t = 0,06a_{hd} + 0,3,$$

whichever is the greater.

The calculations are performed on the hand position giving the highest value of $\overline{a_h}$ and where:

$\overline{s_R^2}$ is the mean value of s_R^2 for the different machines in the batch, where the s_R value for each machine is calculated using DD.9.2 a), above;

s_b is the standard deviation of the test results for individual machines, i.e.

$$s_b^2 = \frac{1}{p-1} \sum_{l=1}^p (a_{hl} - \overline{a_h})^2$$

where

a_{hl} is the single-machine emission for one hand position on the l th machine;

$\overline{a_h}$ is the mean value of the single-machine emissions for one hand position;

a_{hd} is the highest of the $\overline{a_h}$ values reported for the two hand positions;

p is the number of machines tested (W 3).

DD.10 Measurement report

The following information shall be given in the test report:

- reference to this document;
- name of the measuring laboratory;
- date of measurement and name of the person responsible for the test;
- specification of the machine (manufacturer, type, serial number, etc.);
- declared emission value a_{hd} and uncertainty K ;
- type of nozzle, **trigger gun**, hose;
- energy supply (input voltage etc., as applicable);

- instrumentation (accelerometer, recording system, hardware, software, etc.);
- position and fastening of transducers, measuring directions and individual vibration values;
- operating conditions, and other quantities to be specified according to Clause DD.7;
- detailed results of the test (see Annex EE).

If transducer positions or measurements other than those specified in this document are used, they shall be clearly defined and an explanation of the reason for the change in the position of the transducer shall be inserted in the test report.



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Annex EE
(informative)

**Model test report for vibration emission at handles
of high-pressure cleaners**

See Tables EE.1 and EE.2.

Table EE.1 – General information and reported results

The test has been carried out in accordance with ...	
Tester:	
Measured by (company/laboratory):	Tested by: Reported by: Date:
Test object and declared value:	
Machine tested (power supply and machine type, type of material used, manufacturer, machine model and name, the type, length and nominal bore diameter of the hose line):	Declared vibration emission value a_{hd} and uncertainty K :
Measuring equipment:	
Transducers (manufacturer, type, positioning, fastening method, photos, mechanical filters if used):	
Vibration instrumentation:	Auxiliary equipment:
Operating and test conditions and results:	
Test conditions (test method used, material used for test, type of inserted tool used, operator posture, hand position, photos):	
Power supply (air pressure, hydraulic flow, voltage):	Measured feed force:
Any other quantities to report:	

Table EE.2 – Measurement results for one machine

Date:			Machine type:				Serial number:			
			Main handle (hand position 1)			Support handle (hand position 2)				
Test	Operator	Test run	a_{hV}	Statistics for operator			a_{hV}	Statistics for operator		
				$\overline{a_{hV}}$	s_{n-1}	C_v		$\overline{a_{hV}}$	s_{n-1}	C_v
1	1	1								
2	1	2								
3	1	3								
4	1	4								
5	1	5								
6	2	1								
7	2	2								
8	2	3								
9	2	4								
10	2	5								
11	3	1								
12	3	2								
13	3	3								
14	3	4								
15	3	5								
			a_h for hand position 1:			a_h for hand position 2:				
			s_R for hand position 1:			s_R for hand position 2:				

NOTE The $\overline{a_{hV}}$ and a_{hV} values are calculated according to DD.5.4 and DD.8.2, s_{n-1} and C_v are calculated according to DD.8.1, and s_R is calculated according to Clause DD.9.

Bibliography

The bibliography of Part 1 is applicable except as follows.

Addition:

IEC 62841 (all parts), *Electric motor-operated hand-held, transportable tools and lawn and garden machinery – Safety*

IEC 60335-2-54, *Household and similar electrical appliances – Safety – Part 2-54: Particular requirements for surface-cleaning appliances for household use employing liquids or steam*

ISO 3743-1, *Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for small movable sources in reverberant fields – Part 1: Comparison method for hard-walled test rooms*

ISO 3744, *Acoustics – Determination of sound power levels and sound energy levels of noise sources using sound pressure – Engineering methods for an essentially free field over a reflecting plane*

ISO 3864-1, *Graphical symbols – Safety colours and safety signs – Part 1: Design principles for safety signs and safety markings*

ISO 4871, *Acoustics – Declaration and verification of noise emission values of machinery and equipment*

ISO 5349-1, *Mechanical vibration – Measurement and evaluation of human exposure to hand-transmitted vibration – Part 1: General requirements*

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

ISO 11203, *Acoustics – Noise emitted by machinery and equipment – Determination of emission sound pressure levels at a work station and at other specified positions from the sound power level*

ISO/TR 11688-1, *Acoustics – Recommended practice for the design of low-noise machinery and equipment – Part 1: Planning*

ISO 15230, *Mechanical vibration and shock – Coupling forces at the man-machine interface for hand-transmitted vibration*

ISO 20643:2005, *Mechanical vibration – Hand-held or hand-guided machinery – Principles for evaluation of vibration emission*

ISO 28927 (all parts), *Hand-held portable power tools – Test methods for evaluation of vibration emission*

ISO 4254-6, *Agricultural machinery – Safety – Part 6: Sprayers and liquid fertilizer distributors*

EN 1829-1, *High pressure water jet machines – Safety requirements – Part 1: Machines*

EN 12096:1997, *Mechanical vibration – Declaration and verification of vibration emission values*