Manufacturing Summit

Manufacturing Summit

- CETA Technical Committee Activities for 2014
  - Received Pressure Washer Exemption for San Joaquin Valley Air Pollution Control District under **Rule 4308**
  - Applied for exemption status for Yolo-Solano Air Management District under **Rule 2.37 Natural Gas-Fired Water Heaters and Small Boilers**
  - Completed a new CETA Performance Standard with signature approval
  - Completed a CETA Efficiency Standard final draft for final approval
  - Started a CETA Ergonomic High Pressure Spray gun standard
  - Completed a draft of a CETA High Pressure Hose Standard
  - Contacted the DOE to start lobbying for our CETA Efficiency Standard

CETA Technical Committee Report

Good Afternoon Dr. Dean,

- I was the project lead for the November 2013 amendment to District Rule 4308 so I can answer your question below.

- As proposed in the draft staff report you attached, our Governing Board did adopt an exemption for all hot water pressure washers during this recent rule amendment. Attached is the final rule, which can also be found on our District webpage here: http://www.valleyair.org/rules/currntrules/03-4308_CleanRule.pdf. In addition, attached is the final draft staff report with analyses that we took to our Governing Board for adoption. That can also be found on our webpage here: http://www.valleyair.org/Board_meetings/GB/agenda_minutes/Agenda/2013/November/8-FinalGBItem_Rule4308_11.14.13.pdf

- Let me know if you have any additional questions. Thank you.

- **Chelsea Gonzales**
- *Air Quality Specialist*
- San Joaquin Valley Air Pollution Control District

HEALTHY AIR LIVING
www.healthyairliving.com
Make one change for clean air!

CETA Technical Committee Report

Reason for having an industry standard

- **Performance Standard CPC 100**
  There has been reported tort claims against companies which advertise specifications which are not delivered when tested by the customer. This is false advertisement.

- A class action lawsuit in California involving small engine manufactures several years ago forced the engine industry to examine the various engine J standards and the difficulty of not having a single performance standard which is recognized by the industry.

- CETA is attempting to raise the bar for manufacturers giving the pressure washer industry a performance standard which was developed by the industry.

- This standard uses the same procedures as the old standard for testing and measuring gpm and psi with the biggest change in calculating engine performance. Engines are measured by acceptable loading on the engine and is defined by using no more than 85% of maximum available engine power. By solving for the difference in “loaded” and “wide open throttle” speeds, using a typical loaded speed of 3200 rpm and 85% load, about 175 rpm difference is determined.

- The engine manufacturers are performing this test to verify excessive loading on their engines which could void engine warranties

Market Efficiency Labeling

- **Efficiency Label**
  Recent studies show that consumers continue to support companies and brands that demonstrate social and environmental responsibility and are increasingly looking for certification marks or labels on products to validate environmental credentials. What's more, manufacturers and retail brands are under greater pressure to ensure products meet standards and have accurate test and analysis data to back up their claims.

- Intertek's new Green Leaf Mark is proof that a product has been independently tested and found to conform to multiple existing environmental regulations, such as RoHS laws, REACH and Eco Design requirements through one mark rather than multiple marks. The Green Leaf Mark is used on product packaging, in point of purchase displays, product advertising and literature to explain a product’s environmental credentials.

Efficiency Standard CETA-ES01

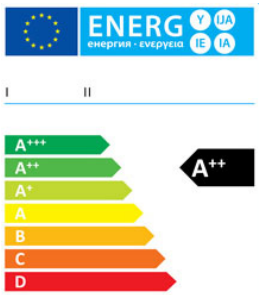
- This standard was written to address the requirement by the DOE standard 10 CFR Part 430
- The plan is to use this standard for the application and use of the Green Leaf label, verified label or creation of a CETA efficiency label.
- The present industry average using this standard is 70% efficiency.
- It is proposed that the target will be 68% efficiency which meets the requirement of only 25% able to comply with this standard giving importance to the use of an efficiency label. We still need feedback from the various pressure washer manufacturers to determine their averages following this standard before establishing a final number. This is the same requirement for use of the ENERGY STAR label. The use of these labels are limited to only 25% of the products that can achieve targeted efficiency.

Current Laws & Standards

Efficiencies & Regulations:

- Federal Level: 78% (AFUE Standard)
- CO in flue gas <400ppm
- Smoke test #3 on the smoke spot
- The EUnited Cleaning Machines Association requires on a voluntary bases any machine greater then 50KW (170,800 Btu's) can not have a thermal loss of greater then 9% as measured using the carbon dioxide content or oxygen measurement in the exhaust.

Future Laws & Regulations



WASHINGTON, DC - The U.S. Department of Energy (DOE) recently announced it has increased the energy efficiency standards for process heaters and boilers. The Department amended these standards, which become effective in 2015.

The minimum AFUE rating requirements vary based on the type of fuel used and the heating medium. The minimum AFUE rating for a gas-fired hot water process heaters and boilers is 82%; the minimum AFUE rating for an oil-fired hot water process heater and boiler is 84%. In addition, gas-fired process heaters and boilers are not permitted to have a constant burning pilot.In 2020 the ENERG is going to make mandatory EU-wide 9% thermal energy loss in exhaust gas on machines over 170,800 btu’s

ENERGY STAR Program

The EPA developed a program of selected products which they feel have a significant potential for energy savings and greenhouse gas reductions.

Presently there is a category for boilers which does not fit our industry. We need to lobby to establish a category.

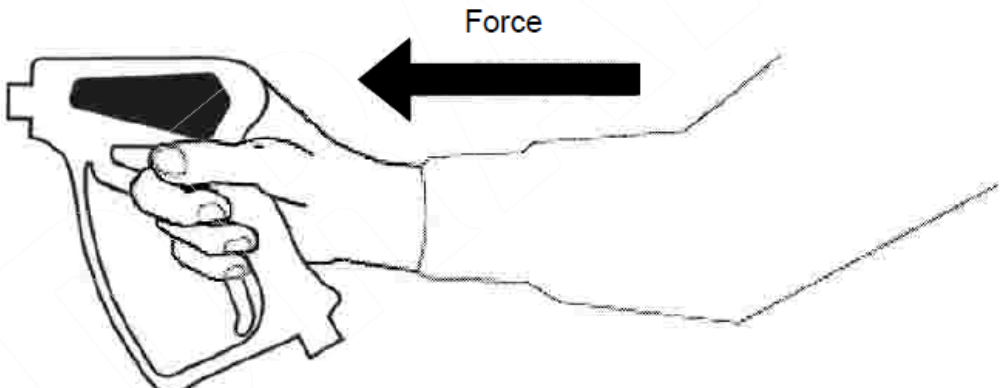
- The ENERGY STAR mark can convey a marketing advantage which requires the following during the selection process:
  - Significant potential energy savings and greenhouse gas reductions
  - Product must be fully commercialized and available to the public
  - Manufactures have the ability to produce similar products that qualify for ENERGY STAR
  - Clear method of distinction between products that are more efficient and those that are less efficient

Ergonomic Spray Gun Standard

We have received several requests from different insurance companies develop an industry ergonomic high pressure spray gun standard.

This will require detailed research to determine fatigue and stress related injury data while using pressure washer equipment.

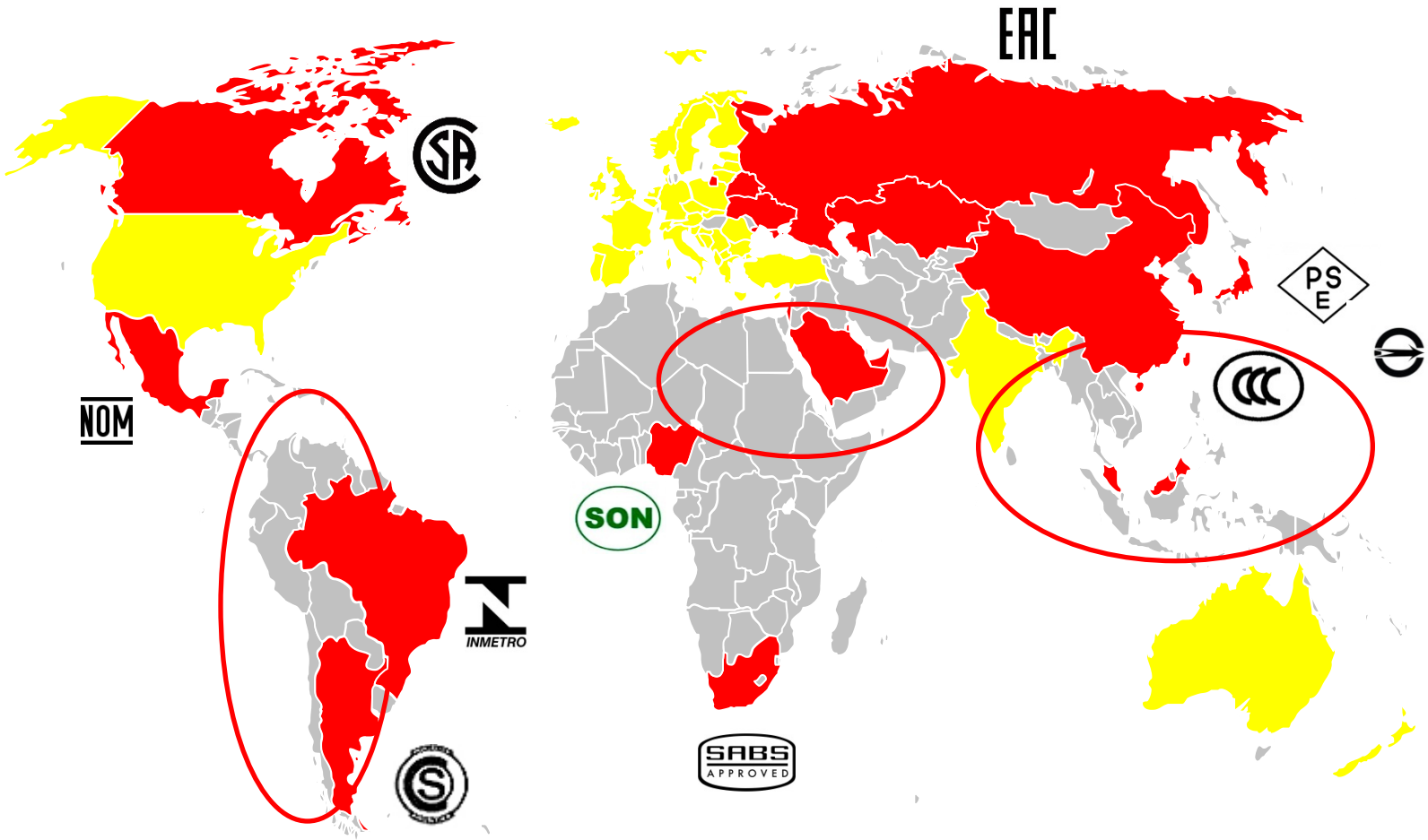
- The Ergonomic standard can convey a bench mark for spray gun manufacturers:
  - Significant reduction in workman compensation claims
  - Specify time of use from force measured
  - Manufactures have the ability to produce better quality spray guns using different design changes to reduce fatigue
- Should incorporate tension, balance and weight distribution.
- The force to open the trigger gun is 105N (24 lb), at a pressure of 240 bar (3500 psi). Force to hold the trigger gun in the open position is 30N (8 lb), at a pressure of 150 bar (2200 psi).
  - N= Newton



General – Why do we need safety standards?

- To avoid accidents with unsafe products!
- Compliance with standard requirements helps to reduce litigation of products placed on the market
- Application of standards is also relevant for the liability insurance in a company
- Knowledge of the content of important standards is a must-have for all persons involved in the engineering process of a product (designers, lab technicians…)
- Product safety is vital for any company with the testing and certification of one their products – it has to be implemented as a company policy
- Product certification is partly mandatory or a marketing advantage

Certification worldwide (el. products)



Mandatory

Recommended

Regions w/ increasing mandatory certification

IEC vs. CENELEC standards

- IEC publishes standards on a worldwide basis
- IEC standards form the basis for european standards published by CENELEC
- Only if a EU directive (Machinery, EMC, Low Voltage…) require additional or different requirements, CENELEC will amend or modify the IEC content in so-called “Common modifications”.
- Additional modifications are based on national laws. Typical requirement: Plugs are different in nearly all countries.
- US: UL has its own standard (like UL 1776) but is starting to adopt IEC standards
- Canada: CSA has its own standards (C22.2 No. 68 & B140.11) but has in parallel a hug variety of IEC standards already adopted

IEC

CENELEC

UL Underwriters Laboratories

CANADIAN STANDARDS ASSOCIATION

General – IEC / EN 60335

- IEC / EN 60335-Family is a standard family dealing with safety
- Performance or environmental requirements are not dealt within IEC / EN 60335

  But there are some overlaps; oil fired high pressure cleaners – safety standard specifies max. soot and CO emissions due to safety relevance)
- product safety has to be ensured during
  - normal operation (intended use, described in user instructions)
  - typically forseeable misuse
  - single failure cases (safe when one failure occurs, functionality and or product may be damaged)
- product safety standards will not give protection against
  - multiple failures
  - misuse
- High Pressure Cleaners
  - typically forseeable misuse: cleaning the enclosure with high pressure water spray
  - misuse: spraying paint instead of water

Relation IEC / EN 60335 part 1 and Part 2-x

- Part 1 has to be seen as a library, as a collection of safety standards and test procedures
- Part 2-x specifies specific requirements by referencing on certain contents of part 1 or by specifying new requirements

Relation IEC / EN 60335 Part 1 and Part 2-x

- Part 2-x is always the starting point for research on requirements, not part 1!
- Part 1 can not be used independently!
- Part 1 and Part 2-x have the same structure (numbering of clauses etc).
- Part 2-x specifies the application of part 1 clause by clause:
  - *“This clause of Part 1 is replaced by the following”*
    => The relevant content of part 1 is not needed, everything is specified in part 2-x
  - *“This clause of Part 1 is applicable”*
    => The relevant content of part 1 is completely to be used, no additions or deletions necessary
  - *“This clause of Part 1 is applicable except as follows” “Modification”, ”Addition”,”Replacement”,*
    => The relevant content of part 1 is completely to be used, however, the content has to be modified as specified
  - *“This clause of Part 1 is not applicable”*
    => This clause of part 1 is not needed.

Normative vs. informative Content / Structure

- The content of a standard is **mandatory**, except for
  - "NOTE": This text contains no requirements, only explanations or examples

    A lot of former "NOTES" have been made normative during the last revisions of the standards
  - informative Annex (= a very long NOTE)

- Each Clauses is divided in two resp. three parts
  - Requirement ("What has to be ensured?")
  - Test ("How to measure/ inspect?") – *always in Italics*
  - maybe acceptance criteria at the end: Requirement fulfilled yes/no ("what is acceptable during or after the test, what's not?") – *always in Italics*

IEC / EN 60335-Family / Overview

- **IEC / EN 60335-1 General Requirements**

- IEC / EN 60335-2-2 Vacuum Cleaners
- IEC / EN 60335-2-10 Sweepers
- IEC / EN 60335-2-29 Battery chargers
- IEC / EN 60335-2-41 Garden pumps / submersible pumps
- IEC / EN 60335-2-54 steam cleaners

- IEC / EN 60335-2-67 Single-Disc-Machines Professional
- IEC / EN 60335-2-68 Spray Extractors Professional
- IEC / EN 60335-2-69 Vacuum Cleaners Professional
- IEC / EN 60335-2-72 Scrubber driers / sweepers Professional
- IEC / EN 60335-2-75 vending machines (water dispensers)
- IEC / EN 60335-2-80 Fans / Blowers(AB84)
- **IEC / EN 60335-2-79 High Pressure Cleaners**
- **IEC / EN 60335-2-102 Additional requirements for oil- and gas fired products like water heaters and boilers**
- **IEC / EN 60335-1 contains general and basic requirements**
- **IEC / EN 60335-2-x contains product specific requirements**

Structure of 60335 - standards (part 1)

1 Scope	*- is this standard applicable?*
2 Normative references	
3 Terms and Definitions	*- Definition of important terms,* ***bold print***
4 General Requirement	
5 General Conditions for the test	
6 Classification	*- protection classes, IP-classification*
7 Marking and instructions	*- rating plate, symbols, content of user manual*
8 Protection against access to live parts	*- test probes, access to electrical components*
9 Starting of motor operated appliances	
10 Power input and current	*- Tolerances for power values (real <=> rating plate)*
11 Heating	*- Temperature rise measurement for components and surfaces*
12 Void	
13 Leakage Current and electric strength at operating temperature	
14 Transient overvoltages	
15 Moisture resistance	*- IP-Test, overflow test, climate chamber*

Structure of 60335 - standards (part 2)

16 Leakage current and electric strength	*- dielectric strength test etc.*
17 Overload protection of transformers and associated circuits	
18 Endurance	*- 96h Test*
19 Abnormal operation	*- locked rotor tests, functional safety, protection components*
20 Stability and mech. hazards	*- tilt tests, test probes for mech. components*
21 Mechanical strength	*- hammer tests of enclosures*
22 Construction	*- various mech. and el. requirements*
23 Internal wiring	*- Quality of internal cables and wires*
24 Components	*- Requirements for el. components*
25 Supply connection and ext. flexible cords	*- Supply Cord: Length, Quality, strain relief*
26 Terminals for external conductors	
27 Provisions for earthing	
28 Screws and connections	*- Endurance of screw connections*
29 Clearances, creepage distances and solid insulation	*- Min. distances of electrical parts through air or over surface*
30 Resistance to heat and fire	*- Ball pressure test and glow wire tests. Classify attended vs. unattended appliances*
31 Resistance to rusting	
32 Radiation, toxicity and similar hazards	*- Reference to EMF tests*

Important Content – Scope

- Pressure range: 360 psi (25 bar) to 5000 psi (350 bar)
  - Upper pressure limit harmonized with north american standard UL 1776 (Type III)
  - In Europe, high pressure cleaners exceeding 5000 psi (350 bar) are covered by EN 1829-1
- Energy system
  - Electrical
  - battery driven
  - internal combustion engine driven

Cl. 6 Classification

Cl. 6.1 Protection class

Defined in (IEC / EN 60335-2-x).

- Class I grounded 
- Class ll double insulated 
- Class III low voltage  (marking not yet mandatory)

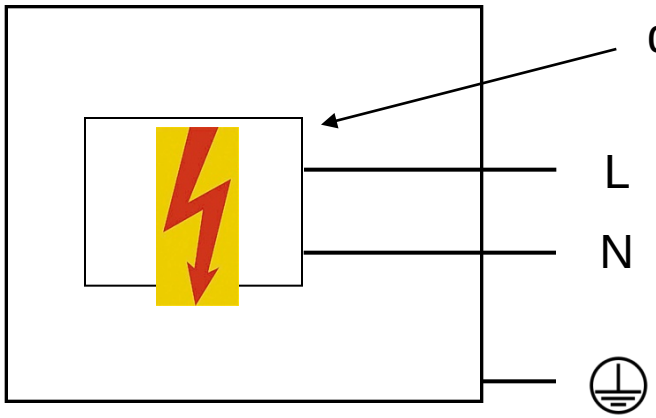
However, **hand-held appliances** and hand-held parts of steam cleaners and high pressure cleaners shall be **class II** or **class III**.

Cl. 6.2 Protection degree against ingess of water

Defined in (IEC / EN 60335-2-x).

Cl. 6.1 Classification protection class

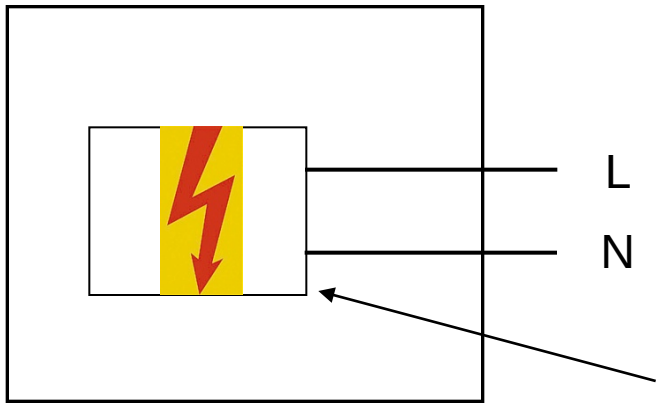
conductive metal enclosure



dangerous touchable voltage > 42V

protection Class I

isolating plastic or sufficiently separated metal enclosure



protection Class II

dangerous touchable voltage > 42V

Protection Class III: U<42V (not dangerous) = Safety extra low voltage (SELV)

§ 15 Moisture resistance

- Enclosure must comply with the classified IP code of Cl. 6.2
  - **High Pressure Cleaners: IPX5** (Protected against water jets - Water projected at all angles through a 6.3mm nozzle at a flow rate of 3.3 gpm (12.5 liters/min) at a pressure of 4.35 psi (30 kN/m2) for 3 minutes from a distance of 118” (3 meters)
  - Dry Vacs and scrubbers for dry use: IPX0
  - Wet & Dry Vacs, Single Disc Machines, scrubbers for wet use, Garden pumps: IPX4
  - Submersible pumps: IPX8

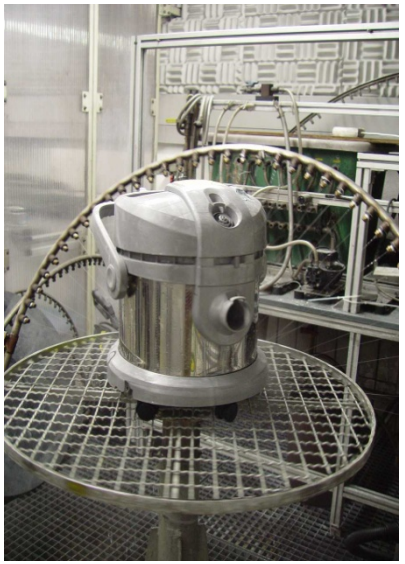
§ 15 Moisture Resistance

IP protection acc. IEC 60529:

0	no protection
1	protection against straight water drops
2	protection against dropping water if enclosure is tilt up to 15°
3	protection against spraying water max. 60° out of the vertical axis
4	protection against spraying water out of all directions (angles maybe limited by certain parts 2)
5	**protection against splashing water (out of a nozzle)**
6	protection against strong splashing water
7	protection against temporarily submersion
8	protection against permanent submersion

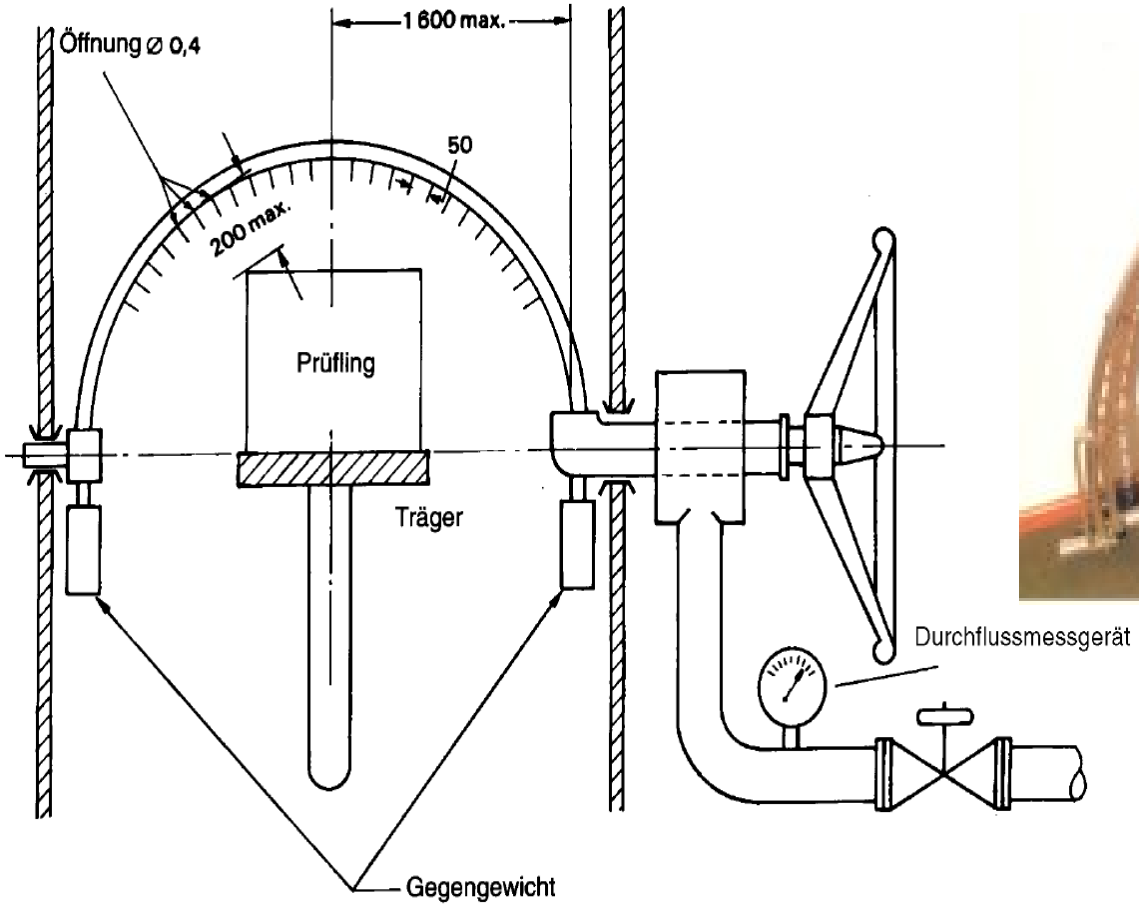
§ 15.1 IP-Testing

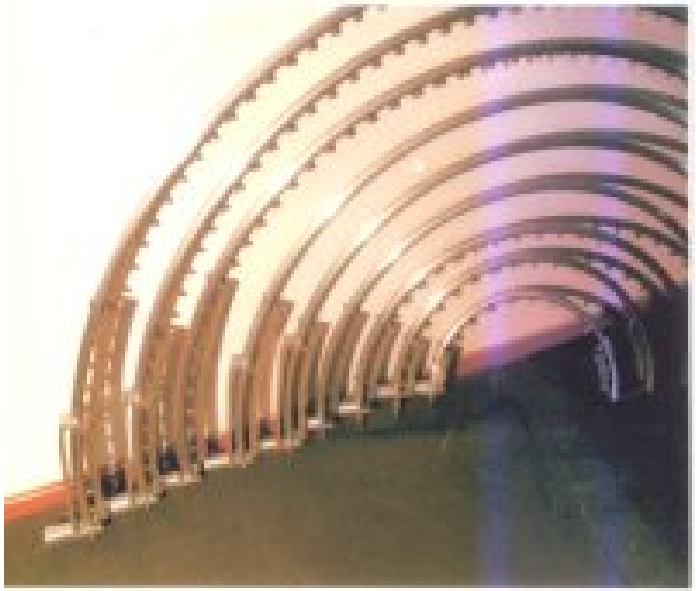
- Testing according Cl. 15.1.1 except IPX0 (no test) done like described in IEC 60529.
- IPX3 / IPX4 for small products performed with a semi-circular spray bar and with a mobile spray nozzle head for large products
- IPX3: max. +/- 60° Tilting against the vertical plane
- IPX4: max +/- 90° or +/- 180° Tilting against the vertical plane
- **IPX5: Splashing water nozzle**
- IP-testing performed with appliance switch off 
- Detachable parts are opened or removed except for covers necessary to be opened or removed for user maintenance and if a tool is needed.
- Acceptance criteria after the test:
  1. Passing a dielectric strength test acc. Cl. 16.3
  2. Visual check of clearances and creepage distances after dismantling: No traces of liquid should reduce the minimum values of Cl. 29.
- Products with liquid tanks (e.g. detergent tanks): Tank will be filled completely + 15% or 0,25l whatever is the greater within a minute. Acceptance criteria: Passing dielectric strength afterwards.



§ 15 Spray arch

- Spray arch (IPX3 / IPX4)

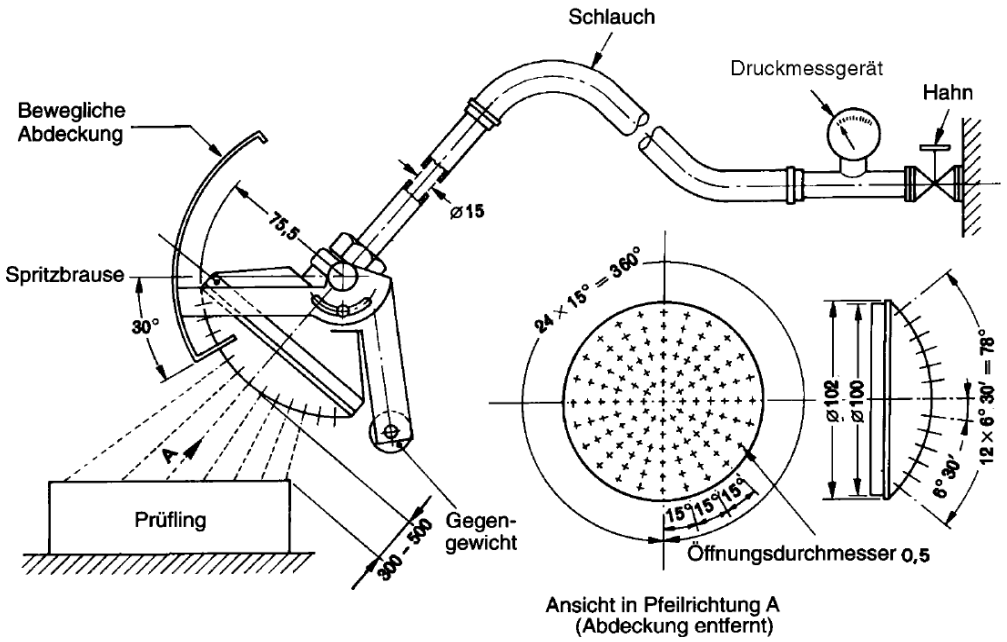


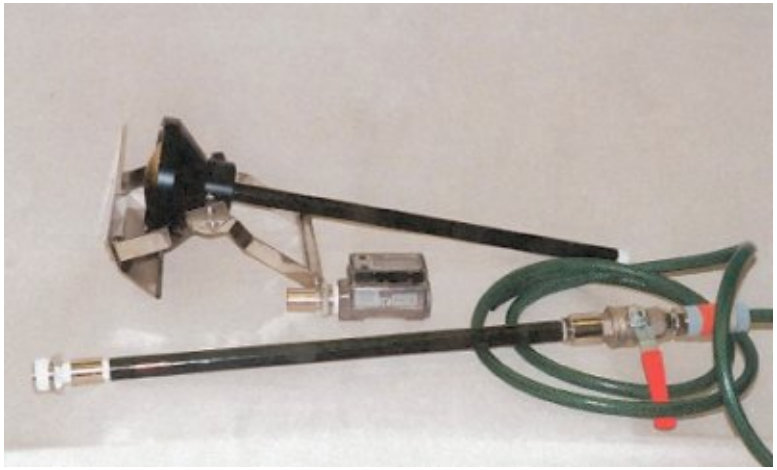


§ 15 Spray arch

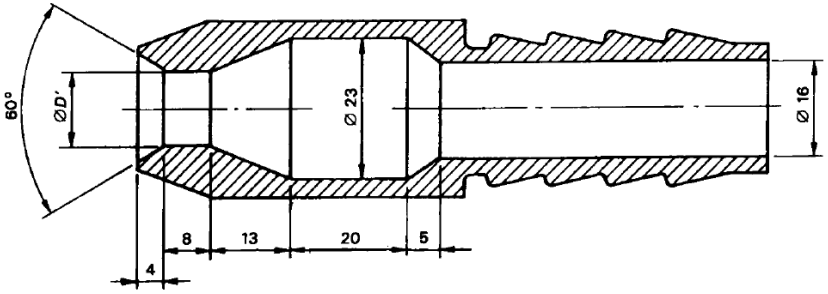
§ 15 Test nozzle

- Hand nozzle for IPX3 / IPX4



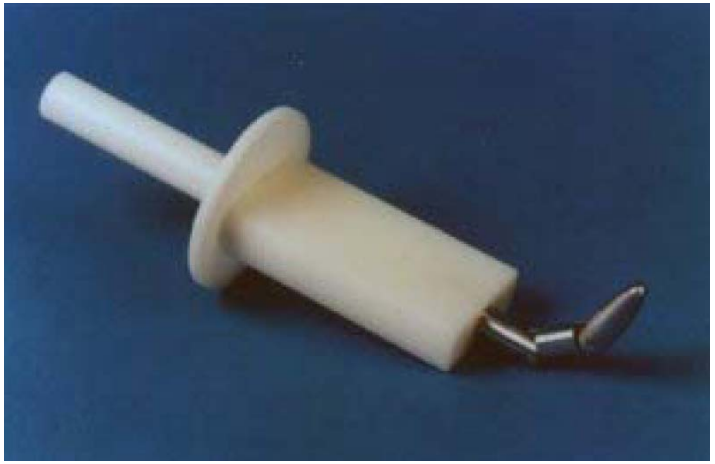


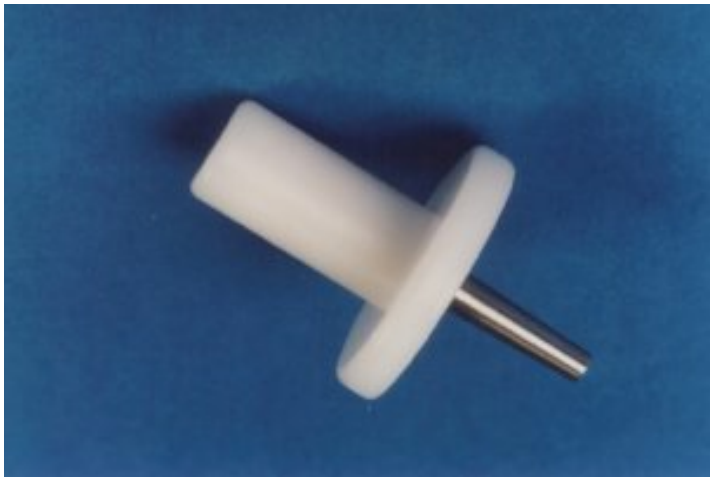
- **Splashing water nozzle for IPX5**



§ 8.1 Protection against access to live parts

- General: durable fixing of electrical components
- “free flying” wiring should be avoided
- detachable parts are removed
- various test probes
  - Probe B of IEC 61032 for Class I (Simulation of a long thin index finger)
  - Probe 13 of IEC 61032 for Class II (Total appliance & details of Cl. II products)
    Length of tip: 15mm
- For vulnerable people also Probe 18 (Europe only)





Tolerances acc. IEC/EN 60335-2-79 / Rating plate / Cl. 7.1(.x)

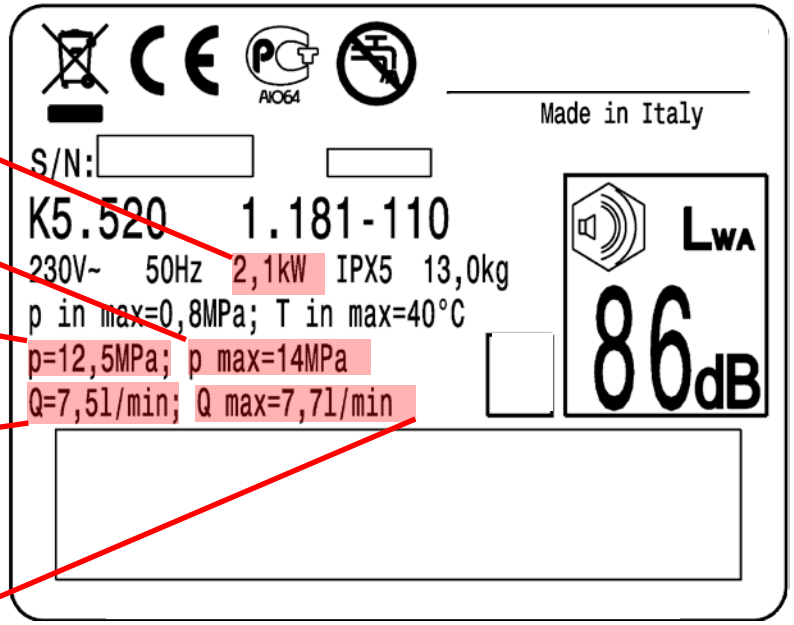
rated power input
Tolerance +15% or 60W,
(whichever is the greater)

allowable pressure
1,1x - 1,5x rated pressure

rated pressure
Tolerance +/-10% in hp mode

rated flow
measured in hp mode,
no tolerances defined

max. flow rate
measured in detergent mode
with detergent nozzle, includes
amount of detergent,
Tolerance +/-10%



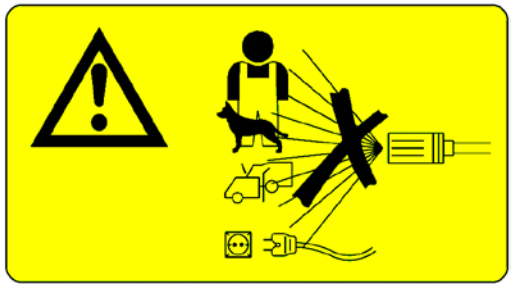
General rules for all tolerances:
Values on the rating plate are the starting point for all tolerances mentioned.

Important Content – rating plate (Cl. 7.1)

- Serial number is not mandatory
- Complete address of manufacturer (to be reached by mail)
- TOW (typical operation weight) shall appear on rating plate: The weight of the machine ready for operation in lb/kg, rounded to one decimal place, including
  - with cable/cord (not relevant for cordless machines); with batteries (not relevant for hard wired connected
  - machines);
  - with all standard equipment necessary for normal use: Hose, Spraying device, Standard nozzle (but no extra nozzles), machine and hoses completely empty, fuel tank filled, tank for descaling detergent is filled, tank for cleaning agent, where applicable, is not filled
- “Designation of machinery” & “designation of series or type”
  - Original intent of the EU Com was that a drilling machine should be marked with “drilling machine” due to difficulties of the market surveillance officers to identify the purpose of some machines
  - The official wording in the machinery directive (MD) (Annex 1, Cl. 1.7.3) is much stricter, but weakened by the official Guideline to the MD.
  - Original intend of the EN version of standard transferred into the IEC standards
- Year of production
  - Year when the production process was finished
  - High Pressure Accessories no longer need a marking / symbol of manufacturer (relevant for OEM products)

Additional markings

- General warning sticker for all machines



- Products not equipped with back flow prevention

- LPG engine driven products intended for indoor use

Important Content – User manual (Cl. 7.12)

- Language versions verified by the manufacturer need to be marked with "**Original instructions**"
- Other versions (e.g. translations created by a dealer) need to be marked with "**Translation of the original instructions**"
- Technical data: Content of the rating plate need to be shown in the instructions
- Explanation of all symbols used on the machine
- Clear identification of intended use, typical cases of foreseeable misuse
- information regarding putting into service, safer operation, handling, transportation, and storage
- conditions in which the machine meets the requirement of stability during use, transportation, assembly, dismantling, when out of service, testing or foreseeable breakdowns
- Safety warnings now clearly separated into Warning, Caution, Danger (input from ANSI Z535 series)

Important content – User manual (Noise & Vibration)

- User manual – Noise (Cl. 7.12.102 / Annex CC)
  & Vibration (Cl. 7.12.103 / Annex DD)

- Noise
  - Noise measurement according Annex CC (harmonised with EN 1829-1)
  - sound pressure level shall be given as a dual number value (value + uncertainty separately)
  - sound power level shall be given as a single number value (value including uncertainty)
  - Reference to the test standard used (=> IEC 60335-2-79) has to be stated
  - Measurement & statement in instruction is not mandatory for non-EU countries

- Vibration
  - Vibration measurement according to Annex DD
  - Measurement of hand-arm acceleration or whole-body-vibration
  - If measurement is below 2.5m/s² resp. 0.5 m/s², this has to be stated
  - Reference to the test standard used (=> IEC 60335-2-79) has to be stated
  - Uncertainty of measurement has to stated
  - Measurement & statement in instruction is not mandatory for non-EU countries

§ 10 Power input and current

- Starting point of all evaluations is always the rated value (**rated input** power, **rated current**) as marked on the rating plate – measured at rated voltage

- Attention: Solenoid valves and reciprocating plunger type pumps change a **heating appliance** into a **combined appliance**

Table 1 – Power input deviation

Type of appliance	Rated power input W	Deviation
All appliances	≤25	+20 %
Heating appliances and **combined appliances**	>25 and ≤200	±10 %
	>200	+5 % or 20 W (whichever is the greater) –10 %
Motor-operated appliances	>25 and ≤300	+20 %
	>300	+15 % or 60 W (whichever is the greater)

- For **motor-operated appliances** (like high pressure cleaners), tolerances are mostly single-sided only, causing the fact that the value on the rating plate can be underrun in reality

- Marked values of rated input power are typical for Europe, values for rated current are typical for (North-) America

§ 11 Heating

- Measurement to be performed with fine thermocouples or (usual for windings) by the rise-of-reasistance-method. RoR is perferred, whereever possible.

- Heating measurements are always expressed as relative temperature rises ΔT (max. temperature – starting temperature), not as absolute values!

- Measurements are performed until stable conditions are established (stable is not defined!) – take care: some products get hotter after switching off

- Operating conditions (supply voltages) according to type of product (§11.4 – 11.6):
  - **Heating appliances**: Two measurements: 100% und 115% of **rated voltage**
  - **Combined appliances** or **motor-operated appliances**: most unfavorable voltage within the range of 94% – 106% of **rated voltage**
  - Attention: Products with a **supply voltage range** („220-240V“) are operated with a combination of extreme voltages and factors: 0.94*220V – 1.06*240V => 206 – 254V

§ 11 Heating of windings

- Windings (e.g. motors, but also coils of solenoid valves) are classified in insulation classes acc. IEC 60085– different insulation classes allow lead to different temperature limits

- During the selection of a component a declaration of insulation, issued by the manufacturer has to be supplied Otherwise there is no change to test and evaluate against the correct limit

Part	*Temperature rise K*	
Windings [a], if the winding insulation according to IEC 60085 is:		
– *class 105 (A)*	*75*	*(65)*
– *class 120 (E)*	*90*	*(80)*
– *class 130 (B)*	*95*	*(85)*
– *class 155 (F)*	*115*	
– *class 180 (H)*	*140*	
– *class 200 (N)*	*160*	
– *class 220 (R)*	*180*	
– *class 250*	*210*	

- Remark: Insulation classes with classification letters („A“) have been replace by numbers („Class 105“)

§ 11 Heating of components

- Various components (swítches, supply cords, capacitors) are available with or without a „T“-marking – this marking shows the acceptable limits of the surrounding area within 5mm distance to the component surface
- Without T-marking: More stringent limits

*Ambient of switches, **thermostats** and **temperature limiters** [b]:*	
– *without T-marking*	*30*
– *with T-marking*	*T-25*
*Rubber, polychloroprene or polyvinyl chloride insulation of internal and external wiring, including **supply cords**:*	
– *without temperature rating or with a temperature rating not exceeding 75 °C*	*50*
– *with temperature rating (T) [j] where T exceeds 75 °C*	*T-25*
Outer surface of capacitors [h]:	
– *with marking of maximum operating temperature (T) [i]:*	*T-25*
– *without marking of maximum operating temperature:*	
• *small ceramic capacitors for radio and television interference suppression*	*50*
• *capacitors complying with IEC 60384-14*	*50*
• *other capacitors*	*20*

§ 11 Heating: Enclosure (not handles)

- Temperature limits for surfaces of enclosures differ actually between IEC and EN 60335. The scope was broadened to cover „vulnerable people“ (disabled, elderly people or children) leading to reduced surface temperature limits acc. CENELEC Guide 29 – this will be implemented into IEC 60335-1 Edition 5.1 or 5.2 (drafts currently under voted). Proposed values:

*External enclosure of **motor-operated appliances** except handles held in normal use* [za, zb]*:*	
– *of bare metal*	*50*
– *of coated metal* [zc]	*60*
– *of glass and ceramic*	*65*
– *of plastic having a thickness exceeding 0,3 mm* [zd]	*75*

Add the following footnotes

za Values for temperature rises of accessible parts in case of appliances that may be used by vulnerable people are given in relevant Parts 2.

zb When the thickness of plastic coating does not exceed 0,3 mm, the temperature rise limits of coated metal or glass and ceramic apply.

zc Metal is considered coated when a coating having a minimum thickness of 80 µm made by enamel or non substantially plastic coating is used.

zd The temperature rise limit applies also for plastic material having a metal finish of thickness less than 0,1 mm.

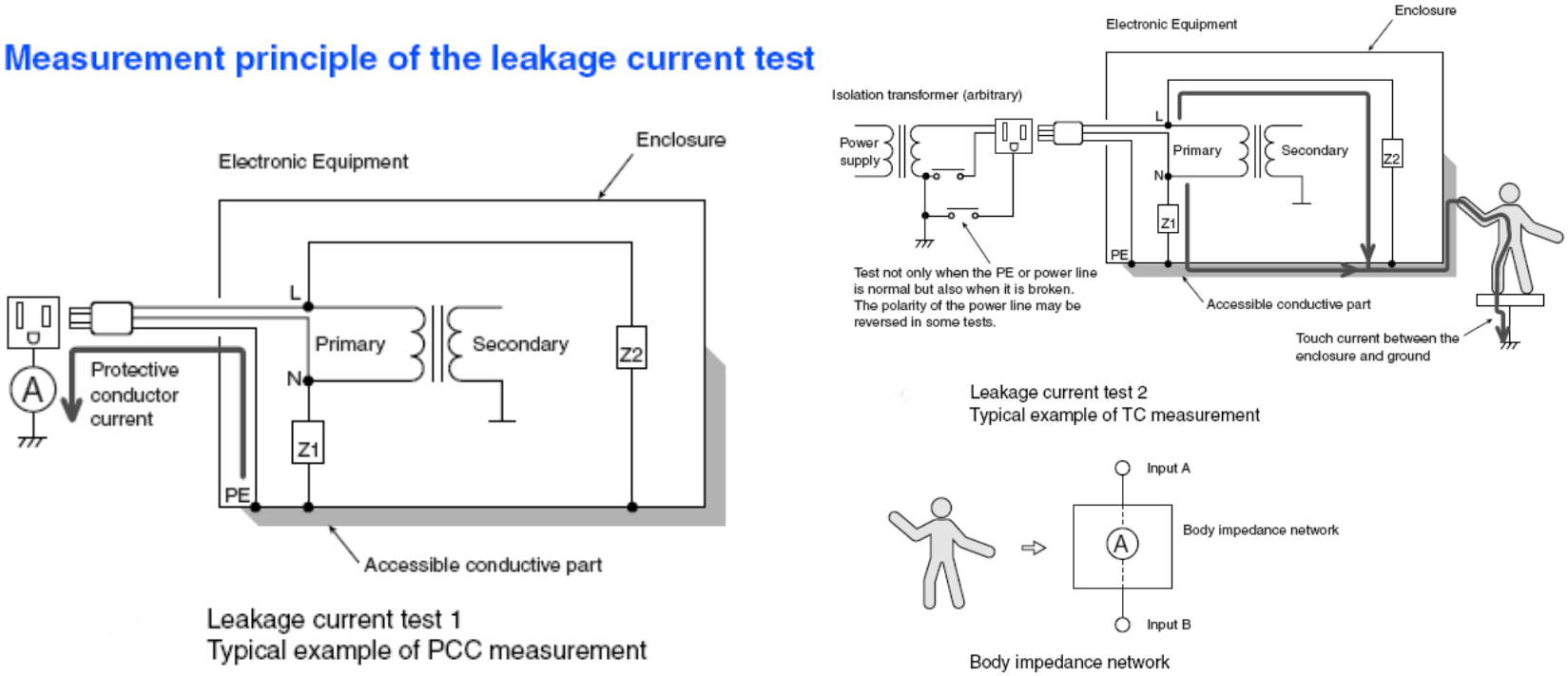
§ 11 Heating of handles, grips and knobs

- Handles are classified into two groups
  - Continously used (e.g. Trigger gun of a high pressure cleaner)
  - Short term use (e.g. switch knob for operation modes):

Surfaces of handles, knobs, grips and similar parts which are continuously held in normal use (e.g. soldering irons):	
– of metal	*30*
– of porcelain or vitreous material	*40*
– of moulded material, rubber or wood	*50*
Surfaces of handles, knobs, grips and similar parts which are held for short periods only in normal use (e.g. switches):	
– of metal	*35*
– of porcelain or vitreous material	*45*
– of moulded material, rubber or wood	*60*

§ 13 / §16 Leakage current (§13 warm / §16 cold)

Leakage current exist for technical reasons could not be avoided. They are generated due to limited resistances of insulation materials like cords and cables, terminals, also Y-capacitors (rfi-filters) for EMC-reasons. These leakage currents flow through the enclosure and the ground connection back to the supply system – or to a person touching the enclosure (=>measurment with a 20 x 10cm aluminum foil around a plastic enclosure)



§ 13 / §16 Dielectric voltage withstand (§13 warm / §16 cold)

- Dielectric voltage withstand tests (also called HiPot-tests) are used to check the quality of the electrical insulation
- Application of a high voltage for 60s between the combined supply connections (phase+neutral) and touchable metal parts (PE) or the insulating enclosure.

Table 4 – Voltage for electric strength test

Insulation	Test voltage V			
	Rated voltage [a]			Working voltage (U)
	SELV	≤150 V	>150 V and ≤250 V [b]	>250 V
Basic insulation	500	1 000	1 000	1,2 U + 700
Supplementary insulation		1 250	1 750	1,2 U + 1 450
Reinforced insulation		2 500	3 000	2,4 U + 2 400

[a] For multi-phase appliances, the line to neutral or line to earth voltage is used for **rated voltage**. The test voltage for 480 V multi-phase appliances is that specified for a **rated voltage** in the range > 150 V and ≤ 250 V.

[b] For appliances having a **rated voltage** ≤ 150 V, these test voltages apply to parts having a **working voltage** > 150 V ≤ 250 V.

230V-appliances

Prot. Class I

Prot. Class II

Cl. 20 Stability / Cl. 21 Mechanical Strength

- Stability
  - All accessories in their intended position
  - Place high pressure cleaner in the worst position on an incline of 10°
  - No tip over

- Mechanical Strength
  - Spring hammer test on all enclosure parts with 1J
  - Afterwards application of test probe B

- Hydrostatic pressure test
  - 2x rated pressure complete system
  - 4x high pressure hose (next edition: only for high pressure hoses outside of the pressure washer)

- Safety valve / Pressure relief valve / Bypass valve
  - Pressure is increased to 1,1x allowable pressure: Component must act (Additional requirements for steam producing hot water high pressure cleaners)

Important content – Mechanical Strength (Cl. 21Z101)

- Allowable pressure shall not exceed 1.5 times rated pressure. This requirement was moved from Cl. 10.101 – and due to the effective date of the new standard no transition period is available
- Indirect limitation of “max. pressure” marketing values!

Cl. 22 Construction / Cl. 24 Components

- No openings from underneath in the enclosure up to 60mm that could allow access to electrical parts (“puddle test”)
- Drain hole openings: Circular openings: min diameter 5mm or area not less than 30 mm^2, the width not being less than 3 mm
- Trigger gun: No locking in the opening position, locking must be in the closed position (“children protection”). Trigger shall be protected from unintended actuation (mech. protector around trigger), Locking mechanism is tested with a load of 150N actuation force. Trigger endurance: Test for 50.000 cycles und high pressure.
- Minimum length of spray lance: Nozzle – trigger min. 750mm distance if used with a pencil jet nozzle (0°C incl. rotary nozzles)

Important Content – Guards (Cl. 22.111)

- **Guard** is a new defined term: part of the machine specifically designed to provide protection by means of a physical barrier
- Fixing systems shall remain attached to the guards or to the machine when the guards are removed, with the exception of fixing systems than can remain detachable without impairing safety

  This does not apply if, after removal of the screws, or if the component is incorrectly repositioned, the machine becomes inoperative or is obviously incomplete.
- Enclosures are not regarded as **guards**.
- Additional help out of the draft guideline to the MD:
  For the same reason, it may not be necessary to apply the requirement to the casings of machinery intended for use by consumers, when the design of the fixing system and the manufacturer's instructions restrict to a specialist repair workshop any repairs that may require the guards to be removed.

Important Content – Guards (Cl. 22.111)

MUFFLER PROTECTOR

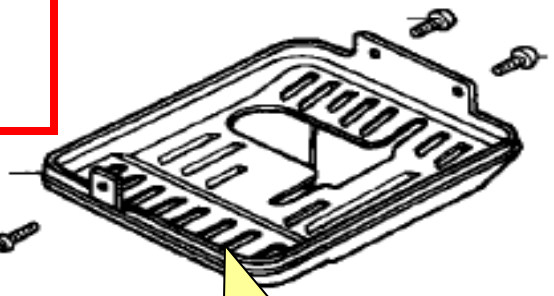
TAPPING SCREW

Guard from Hot parts

All mentioned items are no guards – their connectors need not to remain on the guard or the machine.

Reason: The user manual does not instruct to remove the muffler guard for any reason. This is independent from any removal done in a professional repair workshop!

Guard from Hot parts



TAPPING SCREW

LOWER PROTECTOR

Important Content – Low pressure accessories (Cl. 22.110 & PPE (Cl. 22.113)

- Low Pressure Accessories need a nozzle size > 2mm: Old requirement formerly located in Cl. 3.117
- If Personal Protection Equipment (PPE) is necessary for the safe use of products, all controls shall be designed to be operated safely with the PPE
- Example: A high pressure washer maybe used with gloves as PPE. All controls need to be designed in a way to be operated safely while the operator wears gloves!

Mechanical Endurance – Screws (Cl. 28)

- Screwed Joints have to be tested if they are tightened
  - during user maintenance (not repair by a specialist) or
  - during replacement of a supply cord (type X)
- Screwed Joints have to be tested if they are used for electrical connections (normally no problem)
- Test: Tighten and loosening of connection
  - 10 times for screws in engagement with a thread of insulating material
  - 5 times for nuts or other screws

  with a torque for standard metal screws of

Nominal diameter of screw (outer thread diameter) *mm*	***Torque*** *Nm*
	II
≤2,8	*0,4*
>2,8 and ≤3,0	*0,5*
>3,0 and ≤3,2	*0,6*
>3,2 and ≤3,6	*0,8*
>3,6 and ≤4,1	*1,2*
>4,1 and ≤4,7	*1,8*
>4,7 and ≤5,3	*2,0*
>5,3	*2,5*

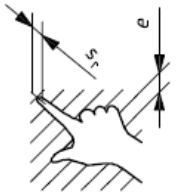
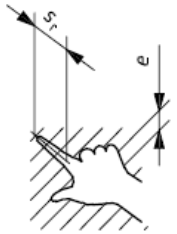
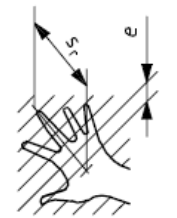
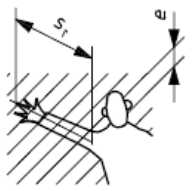
- Acceptance criteria: Screwed joint still capable to hold this torque
- Ref. Cl. 28.1

Protection against crushing / cutting – ISO 13857

- Upper limbs

Table 4 — Reaching through regular openings — Persons of 14 years of age and above

Dimensions in millimetres

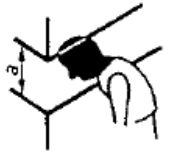
Part of body	Illustration	Opening	Safety distance, s_r		
			Slot	Square	Round
Fingertip		$e \leqslant 4$	$\geqslant 2$	$\geqslant 2$	$\geqslant 2$
		$4 < e \leqslant 6$	$\geqslant 10$	$\geqslant 5$	$\geqslant 5$
Finger up to knuckle joint		$6 < e \leqslant 8$	$\geqslant 20$	$\geqslant 15$	$\geqslant 5$
		$8 < e \leqslant 10$	$\geqslant 80$	$\geqslant 25$	$\geqslant 20$
Hand		$10 < e \leqslant 12$	$\geqslant 100$	$\geqslant 80$	$\geqslant 80$
		$12 < e \leqslant 20$	$\geqslant 120$	$\geqslant 120$	$\geqslant 120$
		$20 < e \leqslant 30$	$\geqslant 850$ [a]	$\geqslant 120$	$\geqslant 120$
Arm up to junction with shoulder		$30 < e \leqslant 40$	$\geqslant 850$	$\geqslant 200$	$\geqslant 120$
		$40 < e \leqslant 120$	$\geqslant 850$	$\geqslant 850$	$\geqslant 850$

The bold lines within the table delineate that part of the body restricted by the opening size.

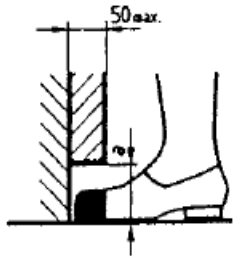
[a] If the length of the slot opening is $\leqslant$ 65 mm, the thumb will act as a stop and the safety distance can be reduced to 200 mm.

Protection against crushing / cutting – EN 349 (1)

- Values should be used as a guide for manually operated parts (like handles), depending on the risk (-> weight)
- Corresponding ISO-standard in preparation

Part	Minimum distance in mm	
Body	500	
Head	300	
Leg	180	
Foot	120	

Protection against crushing / cutting – EN 349 (2)

Toe	50	
Arm	120	
Hand, Wrist, Fist	100	
Finger	25	

Electrical Requirements – Components (1)

- General
  - components must comply with the relevant IEC-standard for this component category acc. Cl. 24
  - component should be tested and certified by a accredited 3rd party lab: VDE / ENEC, UL, CSA, … - certificate shall refer to the correct standard
  - a lot of component manufacturers certify for both worlds and have double marking, e.g. “120V UL” + “250V VDE”
  - sometimes optional “checked in the appliance”, typically used if component is used not within scope of certification/specs (higher load, hotter ambient temperature, exceeding nominal cycles of operation)

Electrical Requirements – Components (2)

- Switches
  - Main switch for 230V machines: all-pole disconnection
  - all switches: endurance test:
    - frequently used: 50.000 operation cycles (typical marking “5E4” = $5 * 10^4$)
      -> main switch, operator presence control etc.
    - others: 10.000 operation cycles (typical marking “1E4” = $1 * 10^4$)
      -> operation mode switches, drive directions
  - relevant standard IEC / EN 61058-1
  - optional “checked in the appliance”: switch not certified by manufacturer or used not within specs (e.g. higher load)
  - check for ambient temperature rating (“T-marking”)

  - Ref.: Cl. 22.105, 24.1.3

Electrical Requirements – Components (3)

- Other controls
  - relevant standard IEC / EN 60730-standard series
  - endurance requirements
    - thermostats 10.000 cycles
    - temperature limiters 1.000 cycles
    - self-resetting thermal cut-outs 300 cycles
    - voltage-maintained non-self-resetting thermal cut-outs 1.000 cycles
    - other non-self-resetting thermal cut-outs 30 cycles

  - Ref. Cl. 24.1.4

Electrical Requirements – Components (4)

- Transformers
  - relevant standard IEC / EN 61558-2-6
  - double insulation between primary and secondary winding
  - secondary voltage: less than 42 V -> SELV (safety-extra low-voltage)
  - Relevant standard for ignition transformer IEC / EN 61558-2-3

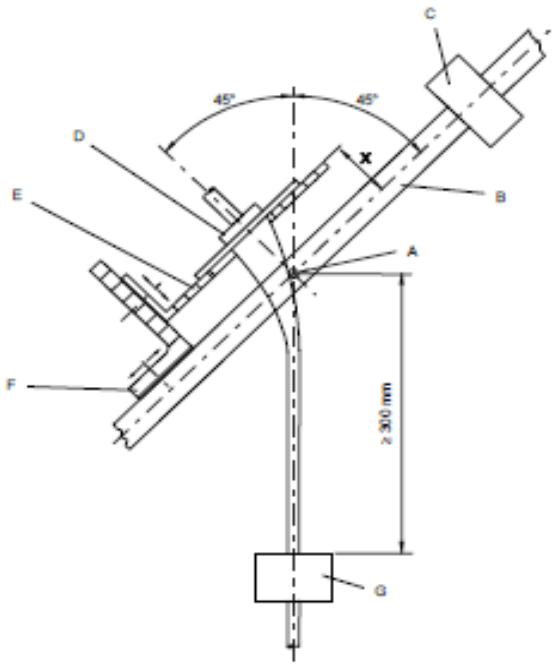
  - Ref. Cl. 24.1.2

- Receptacles / connectors for accessories
  - relevant standard IEC 60320-standards family

  - Ref. Cl. 24.1.5

Cl. 25 Supply connection and external flexible cords

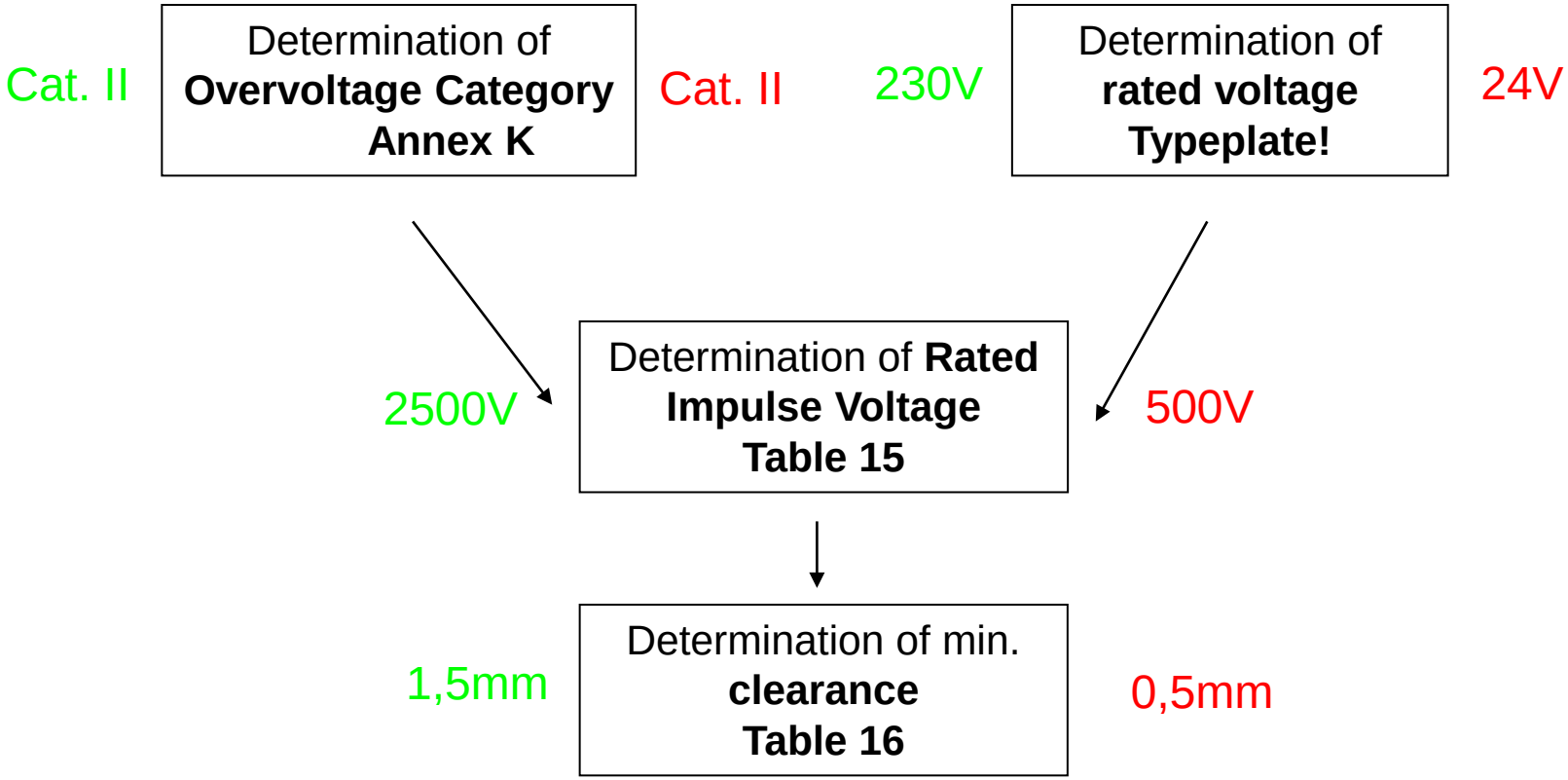
- Products must be fitted with a supply cord (except 3AC products and machines for fixed installation)
- Quality (for Brazil it is slightly different – type designation is different)
  - PVC: 60227 IEC 53 (H05VV-F) for home&garden products
  - Heavy rubber sheathed: 60245 IEC 57 (H05RN-F) for home&garden products
  - Heavy rubber sheathed: 60245 IEC 66 (H07RN-F) for professional products
- Length: Mobile machines need 5m of length available to the user
- Strain relief and flexing test:
  push force 125N, 25 times;
  0,4 Nm for 1 min,
  flexing on the test bench
  (10.000 cycles +/- 45°)
- Plug: 1AC machines need to be equipped with a plug; 3AC machines not



Cl. 25 Supply connection and external flexible cords

Clearances of electrical insulation (1) – Ref. Cl. 29.1

- IEC term “clearance” = UL term “spacing through air”
- Examples: Mains supplied 230V / Battery supplied 24V



§ 29.1 Clearances

Min. clearances acc. **Tabelle 16**

↓

= clearance of basic insulation

or if below(only for „rigid“ parts)

Surge-Test acc. § 14

↓

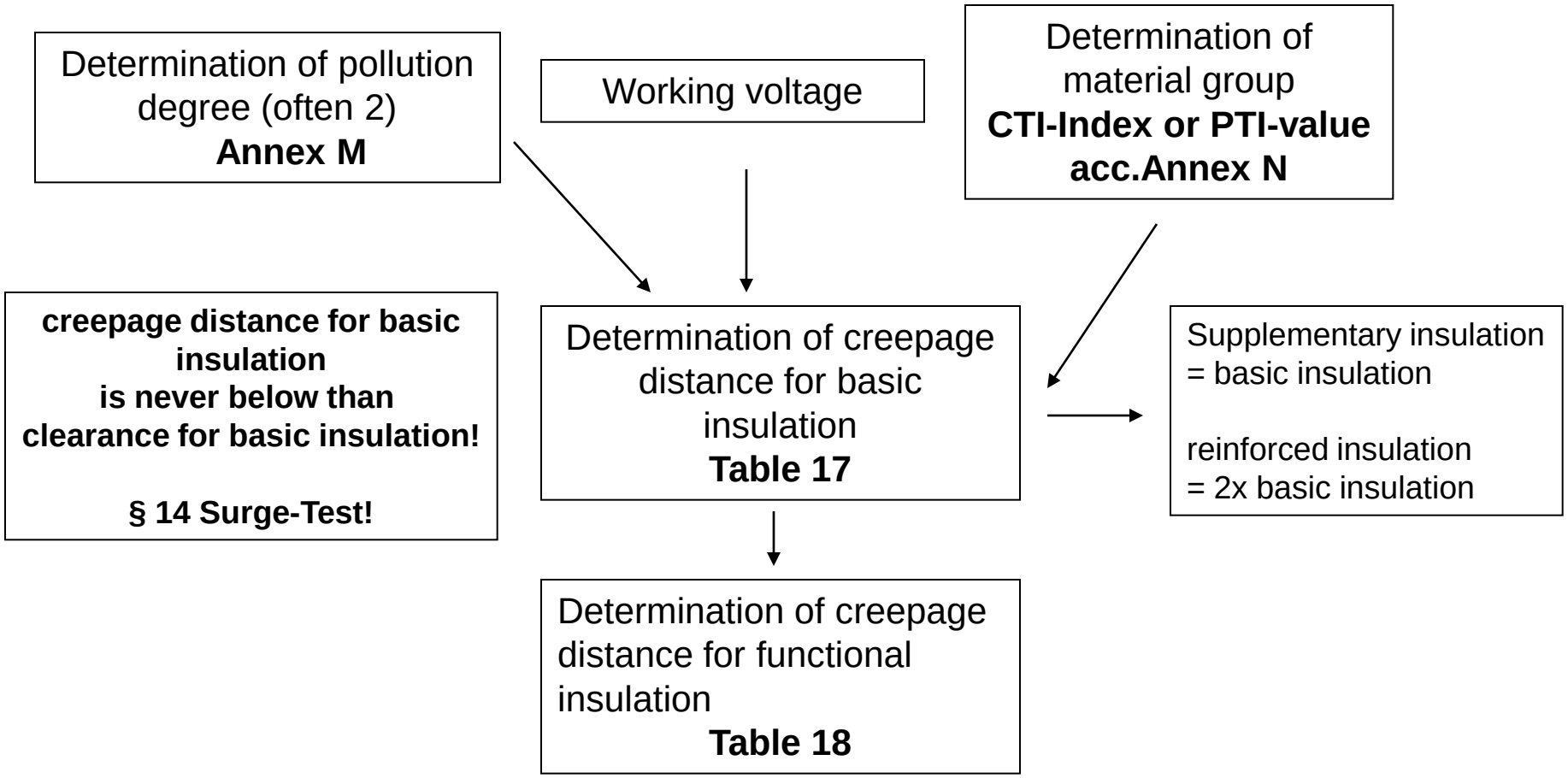
= clearance of supplementary insulation

To be below is not accepted!

clearance of reinforced insulation: Table 16 - use value of next higher step of rated impulse voltage

To be below is not accepted!

§ 29.2 creepage distances



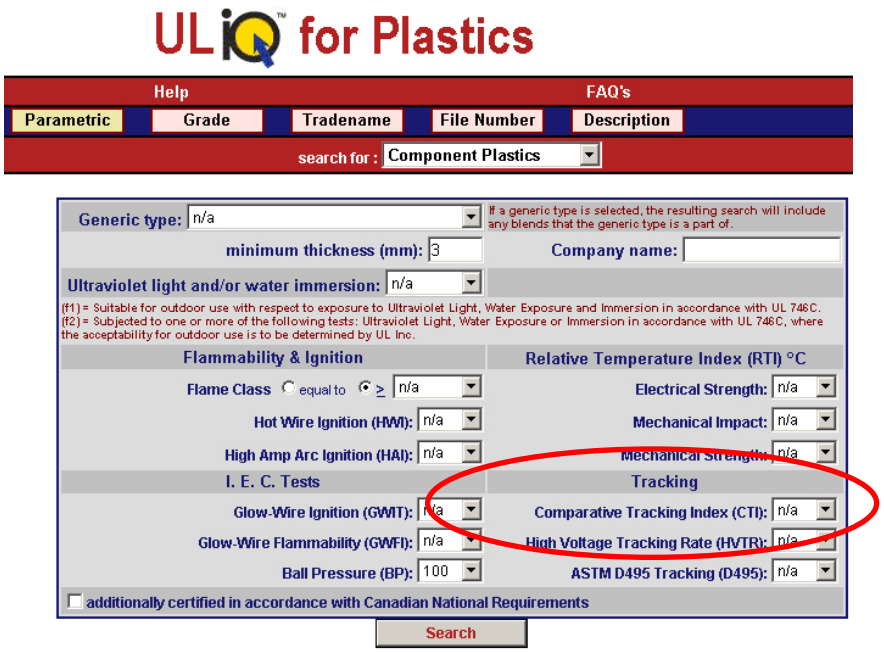
Clearances of electrical insulation (2)

Table 17 – Minimum creepage distances for basic insulation

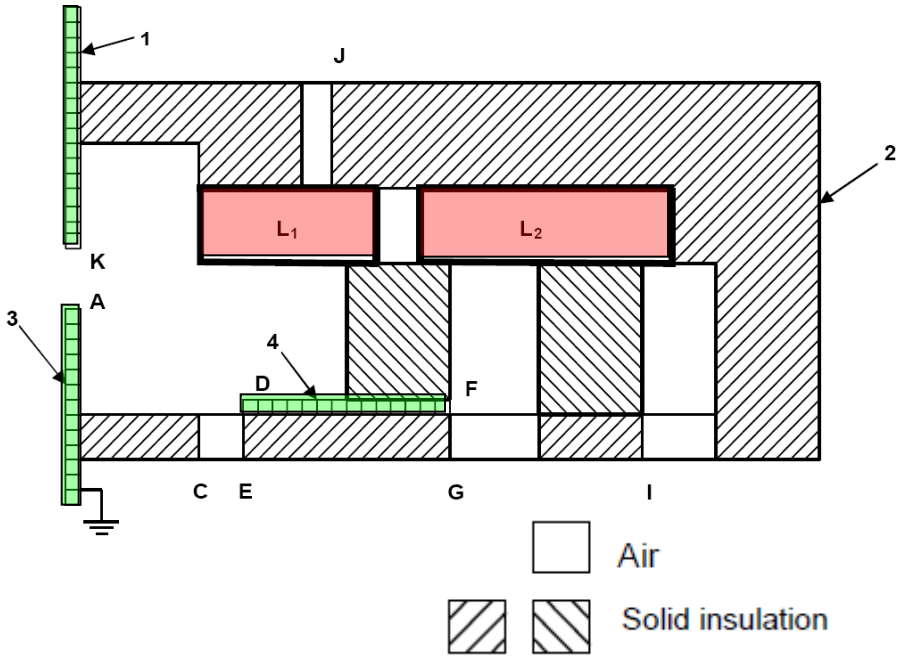
Working voltage V	Creepage distance mm Pollution degree						
	1	2			3		
		Material group			Material group		
		I	II	IIIa/IIIb	I	II	IIIa/IIIb [a]
≤ 50	0,18	0,6	0,85	1,2	1,5	1,7	1,9
125	0,28	0,75	1,05	1,5	1,9	2,1	2,4
250	0,56	1,25	1,8	2,5	3,2	3,6	4,0
400	1,0	2,0	2,8	4,0	5,0	5,6	6,3

Creepage distances of el. insulation (1) – Ref. Cl. 29.2

- Table 17 with input of:
- Working voltage (example 240V, 24V)
- Pollution degree = 2, exemption:
  Pollution degree = 1 if special protection is applied (encapsulated pcb…)
  Pollution degree = 3 if conductive dust occurs (dust of carbon brushes…)
- Material group: CTI – Comparative Tracking Index I, II, IIIa/b
- Preselection research for CTI possible: UL IQ Plastics Database
- Result: min. creepage distance
  - for basic or supplementary insulation: 2,5mm / 1,2 mm
  - for reinforced insulation: 5,0 mm / 2,4 mm (2x basic ins.)



Example for evaluation of clearances (Figure 11)



The live parts L_1 and L_2 are separated from each other and partially surrounded by a plastic enclosure containing apertures, partially by air and are in contact with solid insulation. A piece of inaccessible metal is incorporated inside the construction. There are two metal covers, one of which is earthed.

Type of insulation	Clearance
Basic insulation	L_1A
	L_1D
	L_2F
Functional insulation	L_1L_2
Supplementary insulation	DE
	FG
Reinforced insulation	L_1K
	L_1J
	L_2I
	L_1C

Key

1 accessible unearthed metal part

2 enclosure

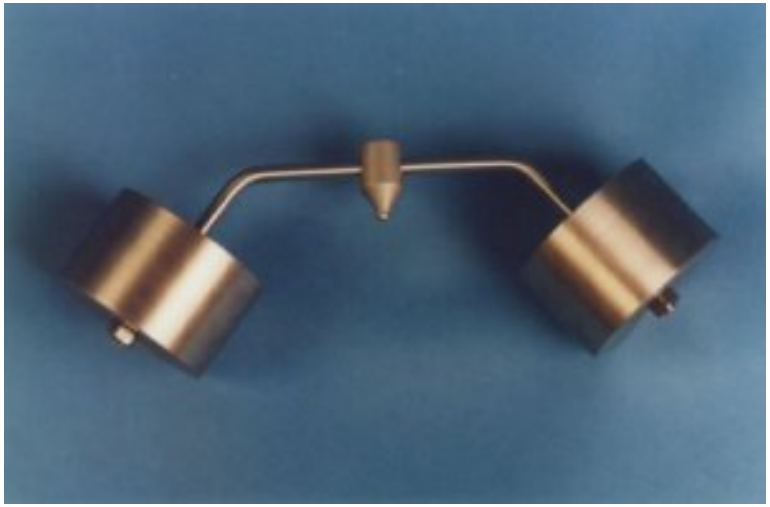
3 accessible earthed metal part

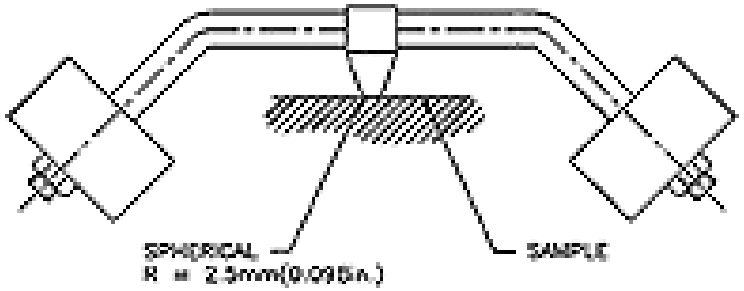
4 inaccessible unearthed metal part

Cl. 30 Resistance to heat and fire

Ball Pressure Test (1)

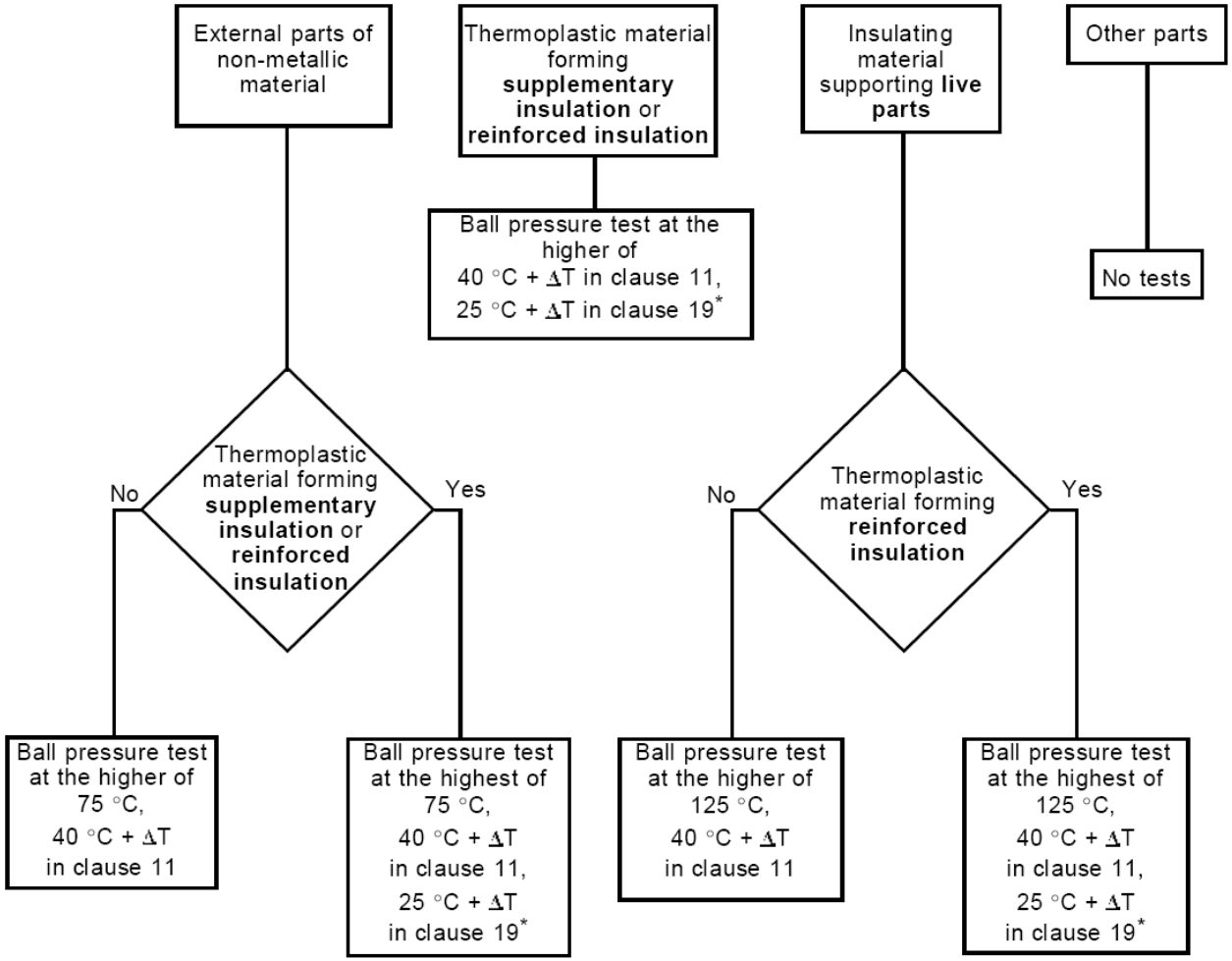
- Test of external parts, insulation parts
- Test on plastic softening
- Preselection research possible:
  UL IQ Plastics Database
- Ref. Cl. 30.1, Annex O





Cl. 30 Resistance to heat and fire

Ball Pressure Test (2)



Ref. Cl. 30.1,
Annex O

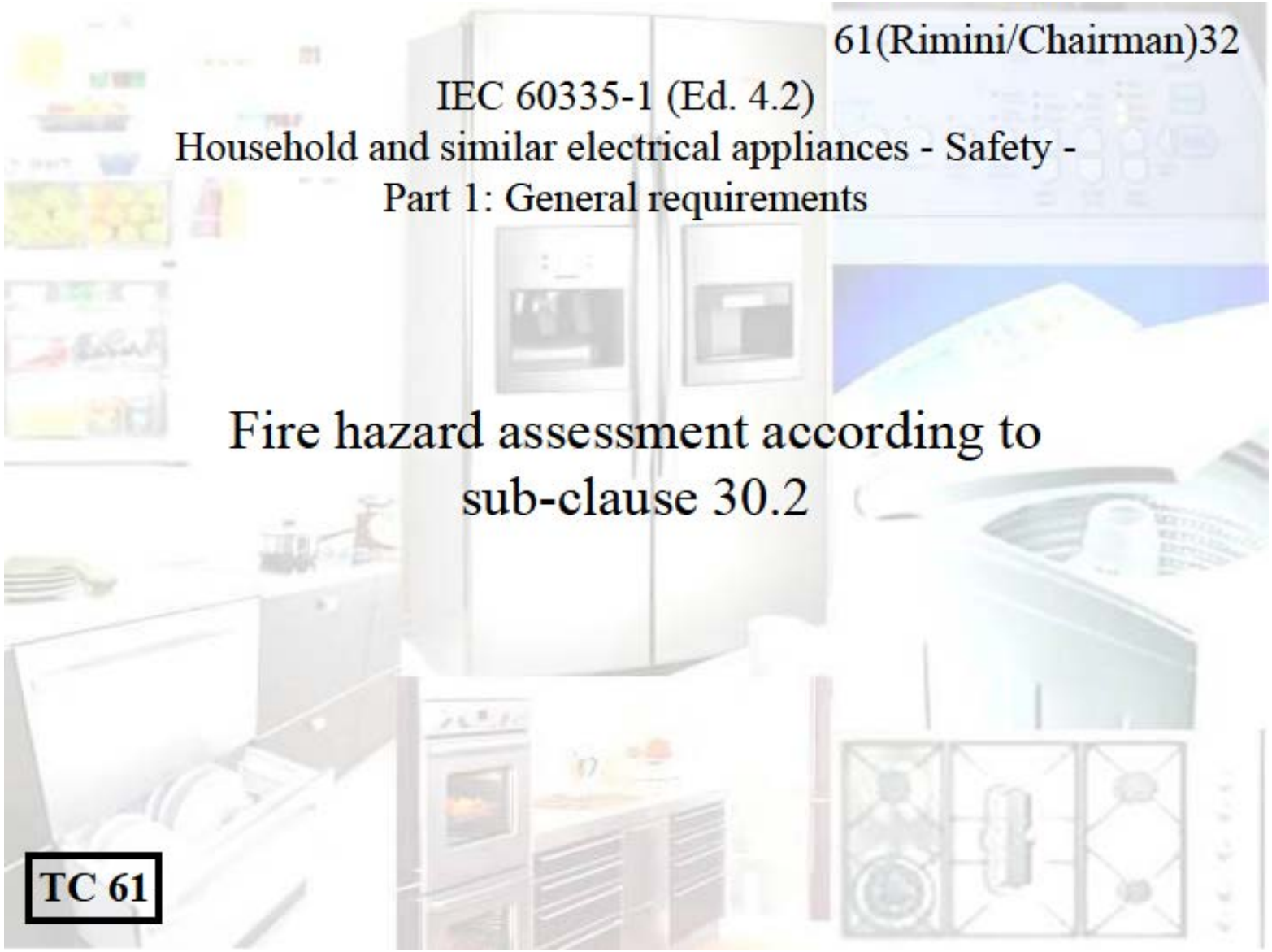
Cl. 30 Resistance to heat and fire

Glow Wire Test (1)

- Test on flammability w/ various temperatures:
  - Standard 550°C -> uncritical
  - attended, connection <= 0,5 A: 650°C
  - attended, for connections > 0,5 A: 750°C
    -> ambitious, often UL 94 V0 necessary
  - High pressure cleaners are regarded as attended
- Connection: plastic part around a current-carrying connection and its surrounding within 3mm distance.
- Connections are: crimped, rely on spring load etc. Connections are not welded etc.
- Preselection research possible: UL IQ Plastics Database
- IEC/EN 60335-1 requirements supersede component standard requirements! Components maybe have to be retested!
- Ref. Cl. 30.2, Annex O

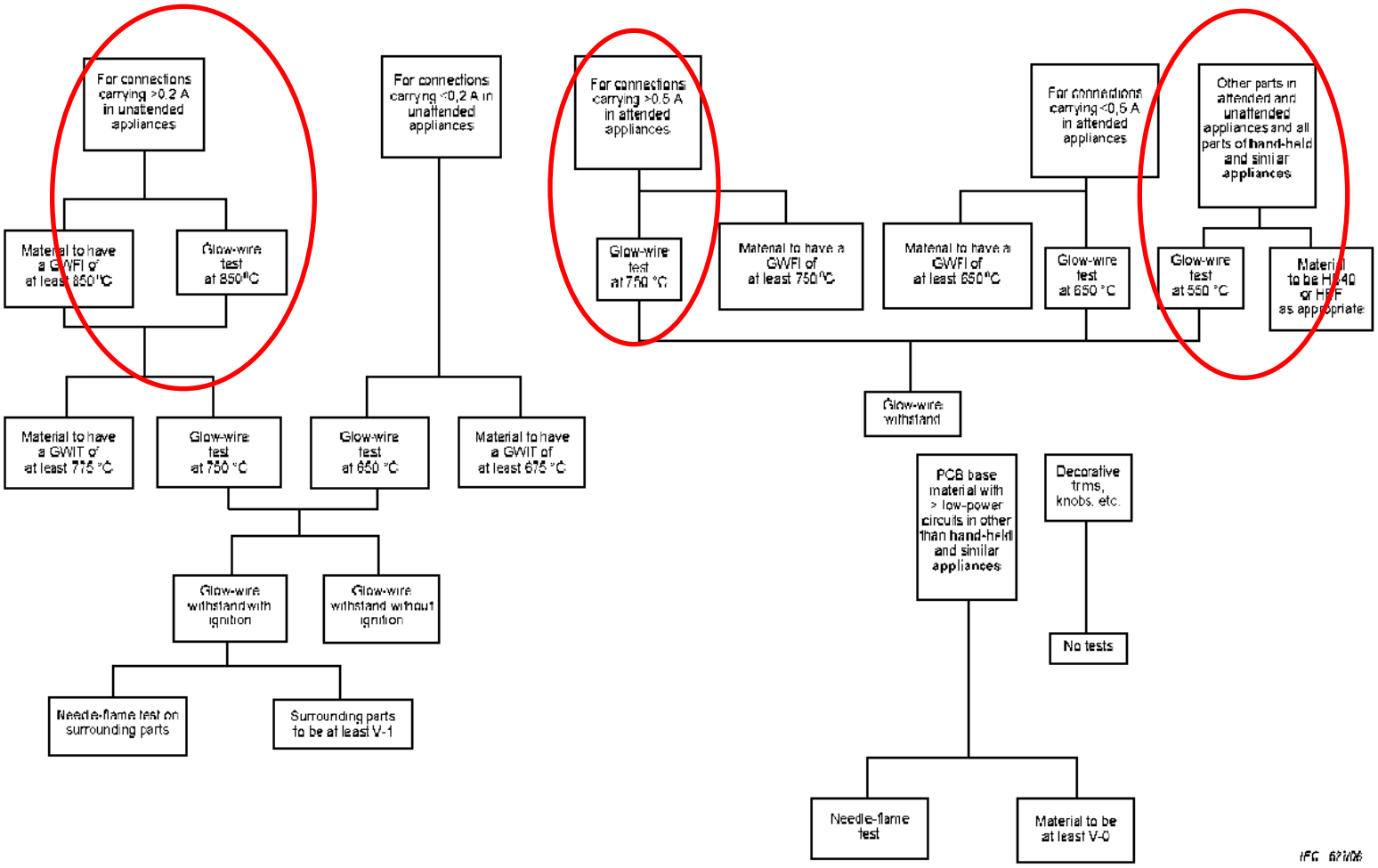
Cl. 30 Resistance to heat and fire

Glow Wire Test (1)



Cl. 30 Resistance to heat and fire

Glow Wire Test (3)

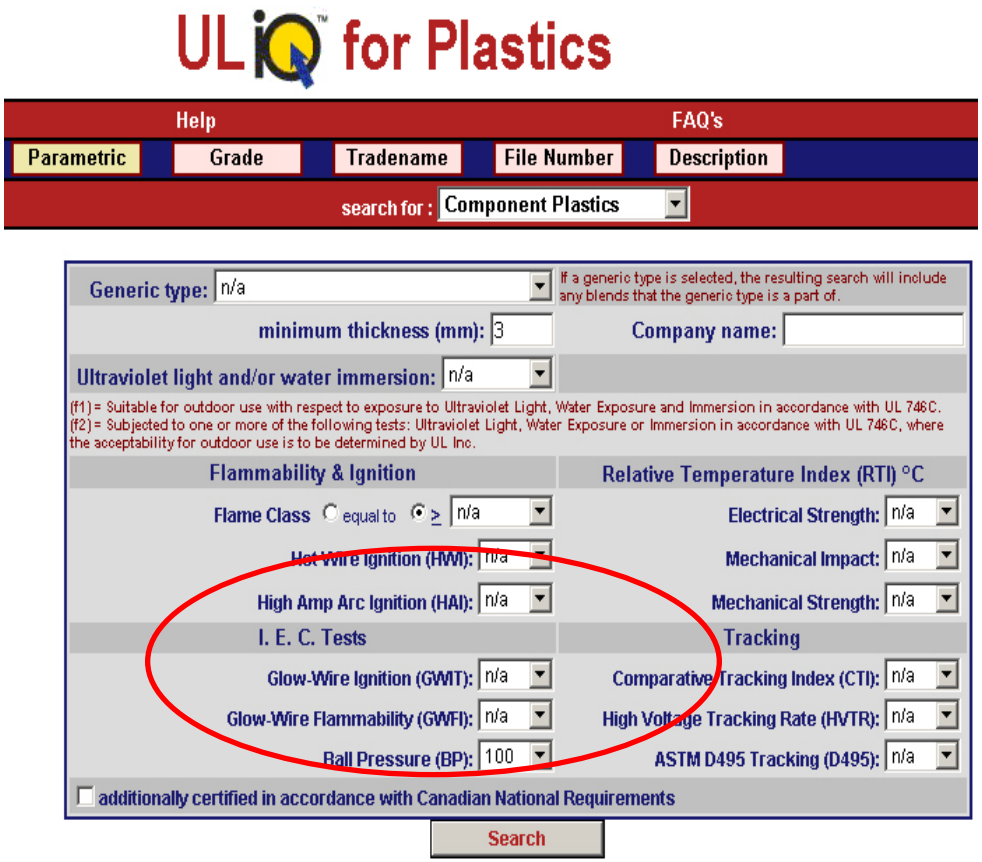


attended: nearly all products

unattended: battery charger & areas involved in charging process

Cl. 30 Resistance to heat and fire – UL database

- Underwriters Laboratories offers the world-leading plastics research database – free of charge!



- UL IQ Databases for Plastics, Switches, Insulation Systems etc. http://my.home.ul.com

Regional details: Australia & New Zealand

- C-Tick Mark with ID-Code N1417 /
  to be replaced by RCM Mark
- EMC compliant – requirements identical to Europe
- Rating plate and user manual according IEC standard
  (SI units, not imperial units)
- Requirements relevant for both electric and gas engine driven products
- Electric products equipped with AS/NZS 3112 certified plug & AU/NZ accepted supply cord (either Nxxxx-certified or European HAR certificate)

Regional details: Argentina

- S-Mark mandatory for electric products (< 5 kVA)
- EMC compliant – requirements identical to Europe
- Rating plate and user manual according IEC standard (SI units, not imperial units)
- Supply: 220V 50Hz, special plug

- Additional warning markings in Spanish on the supply cord next to plug
- Difficult: Import only allowed for three months after certification was issued. Companies in Argentina has to present products to IRAM locally twice a year. Otherwise import license certificate will be withdrawn
- Most licenses do not require factory inspections

Regional details: Brazil

- INMETRO mandatory according to IEC standard,
  but only ILAC test reports are accepted,
  not CB reports according the IECEE CB-scheme

- Two supply voltages:
  127 V / 60 Hz & 220V / 60 Hz,
  but using the same plug type!

- Additional cord hang tag marking as “industry standard” in orange resp. white to identify the supply voltage incl. warnings

- Certification: Still complicated, performed locally

General requirements #1

- In general, it‘s is best that all electrical components comply with the applicable IEC, UL, GB, … test standard for the component!
- Additionally, IEC 60335-1 may specify additional requirements for components even if they comply with their component standard!
  - Glow wire testing with higher temperatures
  - Clearances & creepage distances
  - Additional design restrictions / protection elements (two capacitors…)
- **Drawings should contain reference to component standard (+ additional standard(s) if necessary) and technical specs like:**
  - Voltage and current ratings (e.g. 230V / 10 (6) A)
  - ambient temperature (e.g. „T85“)
  - Endurance information (switch cycles e.g. 5E4)

General requirements #2

- 3rd party testing and certification is necessary
  => type testing of end products should be a company-standard
- Unlisted components or checked in the appliance is possible, but not recommended; it causes additional testing and inspection activites
- Copies of certificates should be requested from the supplier for future use; validity / edition of standards has to be checked in advance of end-product type-testing!

  Cooperation between R&D, testing, certification and sourcing dep.
- **Drawing should specify information on available component certification**
- **For UL-listed or UR-recognized components, the UL-file number, the manufacturer as shown in the UL-file and the exact component designation should be stated**

Motor Capacitor (starting & running)

- Reference to Motor Capacitor Standard IEC 60252-1 changed from undated to dated: IEC 60252-1:2010
- Consequences:
  - IEC 60252-1:2010 + A1:2013 changes type designations of motor capacitors from P0, P1, P2 to S0, S1, S2, S3
  - S-types are not equal to P-types
  - IEC TC61 decided to continue to refer to P-types also in future
  - Step-by-step updated certificates from capacitor suppliers will need to show S- and P-types in parallel, otherwise we can‘t use the component!
  - Glow-wire testing according IEC 60335-1 is necessary
- **Drawings should refer to the dated standard IEC 60252-1:2010 and state type P0, P1 or P2 as necessary & for GWT to IEC 60335-1**

Component: Supply cord & Plug #1

- **Supply cords** of multi-phase appliances shall have a neutral conductor in blue color
- Supply cords for Europe shall comply with EN 50525 standards family (see separate document for details)

- **Plugs** shall have a current and voltage rating being not less than the corresponding appliance
- Plugs for various countries could be found in IEC/TR 60083 (international) or here for Europe: ftp://ftp.cencenelec.eu/CENELEC/TCs/61/PlugsSockets.pdf or CLC/TR 50417 (will possibly be a new Annex ZH to EN 60335-1)
- Certification of plug is limited to certain types & cross-sections of cords!
- Important: Supply cord and plug are two separate components, also separately certified

Component: Supply cord & Plug #2

Table ZD.1 – IEC and CENELEC code designations for flexible cords

Type of flexible cord	Code designations	
	IEC	CENELEC
PVC insulated cords		
Light polyvinyl chloride sheathed flexible cord	60227 IEC 52	H03VV-F
Ordinary polyvinyl chloride sheathed flexible cord	60227 IEC 53	H05VV-F
Heat resistant light polyvinyl chloride sheathed flexible cord	60227 IEC 56	H03V2V2-F
Heat resistant ordinary polyvinyl chloride sheathed flexible cord	60227 IEC 57	H05V2V2-F
Rubber insulated cords		
Ordinary tough rubber sheathed flexible cord	60245 IEC 53	H05RR-F
Ordinary polychloroprene sheathed flexible cord	60245 IEC 57	H05RN-F
Cords having high flexibility		
Crosslinked PVC insulated and sheathed cord	60245 IEC 88	-

- Excerpt out of EN 60335-1:2012

Component: Appliance Inlets

- Appliance Inlets shall comply with
  - IEC 60320-1 for standardized household connectors in conjunction with
    - IEC 60320-2-2 for dry applications
    - IEC 60320-2-3 for humid or wet applications higher than IP X0
  - IEC 60309 for special (industrial) connectors
  - the connection (plugged-in or detached) shall have a IP rating minimum the same of the end product (taking into account the way the coupler is built-in)

Component: (Not certified) Switches

- Switches shall comply with IEC 61058-1
- **Drawing shall refer to the component standard**

- Switches not provided with a type test certificate acc. IEC 61058-1 can be tested acc. Annex H of IEC 60335-1
- Application of Cl. 20 of IEC 61058-1 for clearances and creepage distances now described more precisely

- **Drawing shall refer to Annex H of IEC 60335-1**

Electrical Motors & Coils & Solenoids

- Motors do not need to comply with IEC 60034-1
- Clearances & creepage distances need to comply with IEC 60335-1
- Declaration of insulation acc. IEC 60085 is necessary from the supplier
- For US-versions, a listed UL-insulation system acc. UL 1446 is necessary for classes other than Insulation Class 105 (former „A“). A UL-listing of the electric motor acc. UL 1004-1 is recommended.

- **Drawing shall contain**
  - Insulation Class (Class 105, 155…) – the classes with letter are no longer valid (Class A, Class F) according to IEC 60085 or UL 1446

Transformers

- Transformers shall comply with IEC 61558-1 and the special parts 2:
  - IEC 61558-2-3 for ignition transformers (=> burners)
  - IEC 61558-2-6 safety isolating tranformer (=> secondary output is SELV)
  - IEC 61558-2-16 for SMPS / switch mode power supply (see separate page)

- **Drawing should refer to the correct standard**

SMPS – Switch Mode Power Supply

- Reference to switch mode power supply standard IEC 61558-2-16 was added in IEC 60335-1 Ed. 5.1.
- Consequences:
  - SMPS need to comply with IEC 61558-2-16 Annex BB
  - Clause 26 and Annex H of IEC 61558-1 are not applicable
  - Additional requirements of IEC 60335-1 need to be followed also:
    - Cl. 22 two impedances in series (IEC 61558-2-16: one impedance is sufficient)
    - Cl. 29 clearances and creepage distances
    - Cl. 30 fire resistance
  - **Drawings should refer to the component standard IEC 61558-2-16 and to IEC 60335-1**

Automatic electrical controls acc. IEC 60730 #1

- Standards family IEC 60730 specifies requirements for automatic electrical controls to be used in products acc. IEC 60335.
  It‘s a Part 1 + Part 2-x system (simliar to IEC 60335-series)

  - -2-3: Thermal protectors for ballasts for tubular fluorescent lamps

- -2-5: Automatic electrical burner control systems (not relevant for High Pressure Cleaners!)
- -2-6: Automatic electrical pressure sensing controls
- -2-7: Timers and time switches
- -2-8: Electrically operated water valves
- -2-9: Temperature sensing controls (various types included) (thermostats, temperature limiters, (non-)self-resetting thermal cut-outs)

Automatic electrical controls acc. IEC 60730 #2

- -2-10: Motor-starting relays
- -2-11: Energy regulator
  - -2-12: Electrically operated door locks
- -2-13: humidity sensing controls
- -2-14: Electric actuators
- -2-15: Autom. electrical air or water flow and water level sensing controls
- -2-22: Thermal motor protectors (formerly -2-2 and -2-4)
- **Drawings should contain the component standard and, if applicable, the class of the device (if the standard covers several different types of controls) + the tech specs. + minimum operation cycles of IEC 60335-1 Cl. 24.1.4**

Component: Thermal cut-out

- **Thermal cut-out** of the capillary type shall comply with the requirements for type 2.K controls in IEC 60730-2-9.
- **Drawings should refer to IEC 60730-2-9 Type 2.K**

Component: Relay

- No reliable safety standard for relays has been available!
- New requirements:
  - Relay shall be tested in the appliance or
  - Relay shall comply with IEC 60730-1, but tested separately to show compliance with IEC 60335-1 also
  - Motor starting relays shall comply with IEC 60730-2-10 in addition
- **Drawings should refer to IEC 60730-1 + IEC 60335-1**

Surface Temperatures Cl. 11 – handles, grips …

Surfaces of handles, knobs, grips and similar parts which are	old	New
continously held in normal use (e.g. soldering iron):		
– of bare metal	30	30
– of coated metal (coating min. 90 µm enamel, powder, plastic)	30	34
– of porcelain or vitreous material	40	40
– of rubber or of plastic having a thickness exceeding 0,4 mm (including metal coated plastic parts if coating is < 0,1 mm)	50	50
– of wood	n/a	50
held for short periods only in normal use (e.g. switches) + 5mm surround around the control:		
– of bare metal	35	35
– of coated metal (coating min. 90 µm enamel, powder, plastic)	35	39
– of porcelain or vitreous material	45	45
– of rubber or of plastic having a thickness exceeding 0,4 mm (including metal coated plastic parts if coating is < 0,1 mm)	60	60
– of wood	60	65

Old: 0,3 mm

new!

Old: 0,3 mm

- More materials – Better differentiation
- Limits identical or improved, depending on material

Surface Temperatures Cl. 11 – Ext. Enclosures

External enclosure of appliances except handles held in normal use:	Old	New
– of bare metal	50 K	48 K
– of coated metal (coating min. 90 µm enamel, powder, plastic)	60 K	59 K
– of glass and ceramic	65 K	65 K
– of plastic having a thickness exceeding 0,4mm (including metal coated plastic parts if coating is < 0,1 mm)	75 K	74 K

Old: 0,3 mm

- Less rounding of original values: Limits reduced by 0-2K
- Parts 2, especially in european EN-version, are giving more and typically more restrictive limits

Overflow test Cl. 15.2

- Overflow test of liquid containers was tested until now with water containing 1% NaCl
- New requirement adds 0,6 % rinsing agent to the NaCl solution
- Rinsing agent specs: viscosity 17 mPa· s; pH 2,2 (1 % in water)
- In case of doubt, this rinsing agent has to be used:

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

- Rinsing agent helps the liquid to creep into openings, cracks and gaps!
- Test w/ rinsing agent is a good simulation of a full detergent tank!

Construction Cl. 22

- Cl. 22.5 Plug pin voltage 34V after 1s: Exclusion capacity changed from <0,1 µF to ≤ 0,1 µF

  Electronics influencing the 34V after 1s test (e.g. standby controllers) have to be tested as a **PEC** (protective electronic circuit)

- Cl. 22.54 Access to button cells and R1 batteries:
  Dimensions type R1: 36,2 mm x Ø 12 mm
  Comparison: AAA-Battery „Micro“: 44mm x Ø 10mm,
  AA-Battery „Mignon“ 50mm x Ø 14 mm

- These batteries shall not be accessible
  - without the aid of a tool or
  - the cover of their compartment can only be opened after at least two independent movements applied simultaneously

- Remote controls! VC 6.xxx !

- Not relevant for: IEC 60335-2-67 / -68 / -69 / -72 but for IEC 60335-2-79

Clearances Cl. 29 / Higher altitudes

- Appliances intended for use at altitudes exceeding 2000m, the clearances (Table 16) shall be increased according to the multiplier values in Table A.2 of IEC 60664-1.

Altitude m	Normal barometric pressure kPa	Mulitplication factor for clearances
2000	80	1,00
3000	70	1,14
4000	62	1,29
5000	54	1,48

- Standard altitude is 2000m – extended altitude level 4000m (Alps, Andean Region, Himalaya, Rocky Mountains?)

- Specs in LH / PH need to be amended if high altitude is wanted!

Mandatory for global market access

Product Certification

- Product Certification is voluntary, but
  - Various countries have mandatory certification schemes used as trade barriers (Russia, Ukraine, Belarus, Kaszachstan, Argentina, Brazil, Mexico, China, Korea, Taiwan, Japan, Nigeria, Saudi Arabia

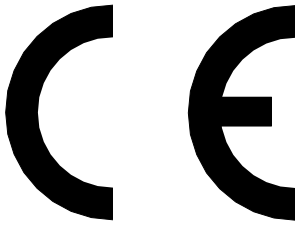
  - List of countries is growing!
  - Certification provides a reduction of product liability risks (European Union)

Mandatory for global market access

Product Certification – what is needed for safety?

- IEC test reports & CB test certificate including
  - the correct product designation and ratings
  - All relevant components in the component list
  - Actual component standards used (supplier!)
  - Not older than 3 years (Taski OEM products!)

- For Europe
  - EN test reports (may be included in the IEC test reports)
  - Test reports not older than 3 years (otherwise loss of presumption of conformity)



  - Risk assessment acc. EN ISO 12100 (former ISO 14121-1; ibf SafeExpert)

Mandatory for global market access

Product Certification – what else is needed?

- For Europe and other countries with EMC requirements
  - EMC / EMF test reports based on the latest test standards

- For Europe and other countries with implemented ErP measures
  - Test reports showing compliance with all applicable ErP regulations (motors, pumps, fans…)

- For Europe and other countries with implemented environmental regulations (RoHS / Restrictions of use of Hazardous Substances)

  - Documentation showing RoHS-compliance (material analysis, declarations of suppliers, delivery history)
  - Use of EN 50581:2012 “Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances” is recommended

Mandatory for global market access

Product Certification – Hints & Outlook

- Product modifications like
  - modified / replaced components
  - modified ratings

  need to be addressed in product certification
- Audits performed by customs authorities (e.g. in Asia) block partly products from being delivered further due to differences of the test documentation and the real delivered products
- IECEE is in process of modifying the documentation procedures – implementation dates not clear yet. Content – amongst others:
  - Documentation of used plastics (similar to UL)
  - Documentation of Glow Wire Tests, Ball Pressure Tests…