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Final Technical Report, Power Tools 1, Hand held electric angle- and straight grinders

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Abbreviations

ADCOs	Administrative Cooperation Groups of market surveillance authorities
ANEC	The European consumer voice in standardisation
CE	European Conformity (Conformité Européene) mark for products sold in the EEA have been assessed to meet high safety, health, and environmental protection requirements
Chafea	Consumers, Health, Agriculture and Food Executive Agency
CEN	European Committee for Standardisation
DG TAXUD	Directorate-General for Taxation and Customs Union of the European Commission
DYI	Do It Yourself
DOP	Date of Purchase
DOW	Date of Withdrawal
EGMF	European Garden Machinery Federation
EN	European Standard
EO	Economic Operator
E/P	Electric-/Petrol driven tool
EPTA	European Power Tool Association
EU	European Union
GPSD	General Product Safety Directive 2001/95/EC
ICSMS	The Information and Communication System on Market Surveillance
IEC	International Electrotechnical Commission
IHF	Institute for Trade Research GmbH (Institut für Handels Forschung)
JA2014	Joint Market Surveillance Action 2014, GA no. 666174, coordinated by PROSAFE with an implementation time-frame of May 2015 up to July 2017
MD	Machinery Directive 2006/42/EC
MSA/s	Market Surveillance Authority(ies)
MS/s	Member State(s)
PPE	Personal Protective Equipment
PROSAFE	Product Safety Forum of Europe
RAPEX	The EU Rapid Alert System for non-food dangerous products
WP	Work Package

Executive Summary

This report presents the activities undertaken and the results achieved by the Product Activity Power Tools 1 - Hand-Held Electric Angle and Straight Grinders of the “Joint Market Surveillance Action on GPSD Products - JA2014”, which was co-financed by the European Union under Grant Agreement No. 666174.

The twelve participating Market Surveillance Authorities (MSAs) who were involved in this specific Activity were from Bulgaria, the Czech Republic, Croatia, Germany (Bavaria), Finland, Luxembourg, Latvia, Malta, Poland, Portugal, Slovakia, Slovenia. The entire JA2014 project was carried out by 35 MSAs from 27 Member States of the European Union and the European Economic Area, under the coordination of PROSAFE. Turkey participated for internal instruction purposes in parallel in the Joint Action as a collaborating partner outside the financial scheme.

The Product Activity aimed to:

- Ensure that hand-held electric grinders on the EU market were safe and carried the appropriate tool-marking, warnings and instructions,
- Develop best practices and exchange experience by carrying out market surveillance activities for grinders in the consumer ‘do it yourself’ (DIY) market,
- Develop and focus on risk assessment for grinder scenario’s,
- Detect non-compliant and unsafe grinders on the marketplace and take action against them,
- Develop a priority list of Power Tools in general, to be targeted in this and future joint actions.

Within the Activity 60 grinders have been sampled at different economic operators in the 12 participating countries, 10 out of them were sampled by internet ordering. Sampling has taken place in the lower end of the market, supposing to find there the most non-compliant grinder-brands. The potentially non-compliant products have been sent for testing and examination at an accredited laboratory, which had been previously selected through a public tendering procedure.

Tests criteria have been defined from clauses in a pair of harmonised standards, a general one on safety for all Power Tools and a specific one for grinder safety. The test results showed (multi) non-conformities in all grinders. Risk assessment on realistic scenarios brought up different risk levels: serious risks (electrocution through broken housing), high risks (through deficient protection guards in a bursting grinding wheel situation), medium risks through severe temperature rise in normal operation and low risks through lacking product information on marking and in instruction manuals. Stakeholders were informed, the related Economic operators were visited and appropriate enforcement measures have been taken. Standard remarks were directed to the relevant Technical Committee and ADCO-Machinery. This Report closes with some lessons learned.

The Joint Actions provide added value in many different ways. With so many Member States working together the product activities reflect a truly pan-European survey of the marketplace. The Commission’s generous funding ensures that the number of samples tested greatly exceeds the number that individual Member States could afford. Moreover, the Joint Actions deliver economies of scale driving down unit test costs helping to stretch the limited resources even further. The product activities within the Joint Actions also provide a platform for sharing expertise and the spread of best practice. Member States also discuss their risk assessments promoting a more consistent approach. Overall the Joint Actions make a significant contribution to achieving a high level of consumer protection and a level playing field for all economic operators throughout Europe.

Caution!

The results are based on products that were sampled from the markets in the participating countries by experienced market surveillance inspectors that were looking for non-compliant and potentially unsafe products. As in any routine market surveillance activity, the results represent the targeted efforts that authorities undertake to identify unsafe products. They do not give a statistically valid picture of the market situation. The samples were tested at accredited laboratories. The test focused on those safety requirements that have the largest impact on consumer safety.

1 Introduction

The JA2014 is an umbrella project co-funded by the European Union the Grant Agreement No. 666174 [1]. The project participants are MSAs from the European Member States (MS) that cooperate under PROSAFE's coordination. One of the work packages of this action (no. 10) focuses on Power tools - Angle grinders.

The report contains the following sections:

Section 1 of the report sets out the basic facts about the Power Tools 1 activity. The main phases of the activity and the timeline are described and the priority setting Power Tools is summarised.

Section 2 of the report explains how a joined test laboratory was chosen for the hand-held electric grinder activity and indicates how sampling was carried out by the market surveillance authorities (MSAs) participating in the activity. Some online developments are mentioned.

Section 3 summarises examinations and tests that were carried out by the selected laboratory. The results of the examinations and tests are then presented and analysed. Some added activities are explained for laboratory and officials of the MSA like checking the declarations of conformity for the latter one.

Section 4 of the report presents the way the participating authorities assessed the risks associated with the non-conformities detected and describes the follow-up measures taken with respect to the Economic Operators responsible for placing non-compliant products on the market. A proposal for a small new activity is done and a suggestion to improve the fastening system for the grinding wheel protection guard.

Section 5 of the report mentions the several liaisons maintained during the activity and appointments made.

Section 6 sets out observations made from standard based testing, evaluation of tender and sampling procedures plus lessons learned in the activity phases, the importance of involving stakeholders is stressed.

1.1 Participating Member States

The activity was undertaken by 12 MSAs from 12 Member States (Bulgaria, the Czech Republic, Croatia, Germany (Bavaria), Finland, Luxembourg, Latvia, Malta, Poland, Portugal, Slovakia, Slovenia). Furthermore, Turkey participated as an observer.

The applicant body that also took overall responsibility for the Joint Action was PROSAFE.

1.2 Overview of Key Staff in the Activity

The Activity Leader was Maksimiljan Bornsek from the Market Inspectorate Republic of Slovenia (MIRS). The Activity Leader was supported by the PROSAFE Consultant, Berend Kamerling, acting as Activity Coordinator.

1.3 Main Objectives

The main objectives of this product activity were:

- To ensure that hand-held electric grinders on the EU market were safe and carried the appropriate tool-marking, warnings and instructions.
- To develop best practices and exchange experience by carrying out market surveillance activities for grinders in the consumer 'do it yourself' (DIY) market,
- The development of and focus on risk assessment for grinder scenarios,
- To detect non-compliant and unsafe grinders on the marketplace and take action against them,
- To develop a priority list of Power Tools in general, to be targeted in this and future Joint Actions.

1.4 The volume of the Activity

The Grant Agreement envisaged to sample 60 grinders. 10 out of them (17%) were ordered online, the remaining 50 samples were sampled ‘physically’ at the premises of retailers, wholesalers, importers and manufacturers. It seemed possible to test all 60 samples within the test budget available. A laboratory was selected for joint sample-testing. Testing included the examination of tool marking and the safety warnings and instructions in the manual. The check on CE marking and the examination of the declaration of conformity is done by the market surveillance officials in the sampling stage.

1.5 The phases of the Activity

The Activity was a market surveillance action that followed these phases:

- Deciding on sampling criteria

The Activity decided on how the MSs should carry out sampling, i.e. how many samples would be taken by each authority, when would the sampling take place, should sampling take place in one or more rounds, what criteria would be applied when selecting the specific samples, and how many items should be taken of each product in order to avoid “duplicate sampling” in the different participating MS.

- Sample products

The MSs would acquire products according to the sampling criteria. This implied that the MSAs would visit manufacturers, importers, wholesalers and retailers to collect products. The check on CE marking and the examination of the declaration of conformity is also done in this sampling stage. Sampling was coordinated and regularly reported back to the Activity Coordinator.

- Test products at a laboratory

The Activity issued a call for tender and selected an appropriate laboratory and the MSs were instructed how to send their products for testing. The products were shipped and the laboratory submitted test reports after the testing had taken place. The Joint Action shared all test reports with all the participants. The laboratory facilitated sharing information through providing access to a specific account, set up for checking sample package arrival from shipping (pictures), download opportunities for test reports and interesting non-conformity pictures.

- Risk assessment

The participants developed a common approach to the application of the RAPEX risk assessment guideline for the particular product to assure that the resulting assessments were harmonised to the extent possible. The MSs then assessed the risk for the products applying the agreed approach and any relevant national conditions.

- Follow-up on non-compliant products and exchange information on follow-up activities.

The Member State authorities followed up towards the economic operators in their countries, i.e. consulted the economic operators on the results from the risk assessment, agreed on appropriate measures and followed-up that these were properly implemented. The resulting measures were reported to the Joint Action and shared with all participants.

1.6 Timeline for Activity

Month	M*	Main activities	Meetings	Documents**
May 2015	M1	Preparation of Joint Action programme by PROSAFE		
Jun 2015				
Jul 2015	M3	Presentation Joint Action 2014	Launch event JA2014	
Aug 2015				
Sep 2015	M5			D10.1_ms96

Oct 2015		Activity start. Establish project plan, detailed objectives and -activities, analysis of RAPEX, market and known hazards. First priority setting in Power Tools.	Kick-off with stake-holders/ Planning meeting	D10.1_ms97
Nov 2015				
Dec 2015	M8	Finalising priority setting Power Tools. Set up means for exchange of information to guide which MS samples what brand, to avoid doubling. Samples for free? Transport costs? Sample scheme, guideline how and where to sample. Set up checklist for sampling.		D10.3_ms98 D10.3_ms99 D10.3_ms100
Jan 2016	M9	Discuss sampling progress, inventory suitable laboratories. Ideas on risk assessment and realistic scenarios. Seeking collaboration with customs. Development test criteria for most effective MS activities and follow up. Call for tender testing to a number of known accredited laboratories. Public published on PROSAFE's website.	1 st meeting	D10.2_ms101
Feb 2016				
Mar 2016				
Apr 2016	M12	Selection of laboratory on set criteria. Contract with selected laboratory, tuning for test period and transport. Discuss laboratory issues and sample supply.	2 nd meeting	D10.4_ms102 D10.4_ms103 D10.4_ms104 D10.4_ms105 D10.2_ms106
May 2016		Sample testing during the summer months		
Jun 2016				
Jul 2016				
Aug 2016				
Sep 2016	M17	Visit test laboratory for demonstration tests and to receive test results with explanation. Use of test reports, analysis non-conformities.	3 rd meeting	D10.2a_ms107 D10.2b_ms107
Oct 2016				
Nov 2016				
Dec 2016				
Jan 2017	M21	Development of risk assessments to find non-conformities on realistic scenarios. Trials to harmonise risk levels in intervention tools.	4 th meeting	D10.2_ms108
Feb 2017				
Mar 2017	M23	Present to the specific stakeholders the Activity results (open session). Exchange of info on follow up and discuss dissemination of results in MS's (closed session).	Final meeting	D10.4_ms110 D10.5_ms111 D10.5_ms112
Apr 2017				
May 2017	M25	Presentation Activity results to MSAs participating in JA2014 and general stakeholders in final workshop.	JA2014 Workshop	
Legend: Mxx* = Project month no.; Documents**: Dxx.x ms = Deliverable; Work package no; milestone				

Table 1: Timeline for the Power Tools1 Activity

Workshops & Final Conference

Besides the six main project meetings, PROSAFE organised periodic workshops and seminars as part of the activities surrounding all the work packages within JA2014. The Activity Leader and/or Activity Coordinator (Consultant) of this Activity took part in all these workshops in order to update the rest of the participants and also serve as a means of sharing best practices between various other product-specific activities comprised within JA2014, including a Risk Assessment seminar organised by PROSAFE.

Main Activities

The main activities have been divided into three main phases:

PHASE 1 - Preparation stage - (around 8 months, M1-M9) - this involved finalisation of the detailed activity plan, preparing guidance to the participating authorities in the form of checklists, sampling schemes and other related guidance. A Priority list has been set up during this initial phase. Additionally, the test criteria and the call for tenders to lab testing.

PHASE 2 - Implementation stage - (around 8 months, M9-M17) - adjudication of the laboratory contract. This phase involved the actual inspections, sampling and testing of the hand-held electric grinders. Sampling activities were held between mid-January 2016 to end of April 2016. Checklists were utilised to help zoom in on grinders which already showed signs of non-compliances. 60 samples were sent for testing.

PHASE 3 - Final Results & Follow-up - (around 8 months, M17-M25) - This of measures and follow-up action taken by the respective MSAs. It also involved presentation results to stakeholders and participants, the finalisation of involved the discussion of non-compliances found, risk assessment involved and the actual implementation statistics and the development of this Final Technical Report.

1.7 Hazards and priority setting power tools

The use of hand-held grinders is an inherently risky activity. Accidents involving the use of specific angle grinders may result in lacerations, cuts and severe injuries, particularly at the hands, chest, face and the eyes. The reduction of accidents involving grinders depends, for an important part, on measures taken by the users such as taking account of the warnings and instructions provided by the manufacturer and the wearing of personal protective equipment such as gloves and safety goggles (please see figure 1). Specifically, for the user category ‘unexperienced DIY consumers’ warnings and instruction shall be studied carefully due to lack of professional instruction and supervision which employees are used to receive from their employer.

M002



M004



Figure 1: EN ISO 7010 symbols, which should be printed on the tool mark plate

Hazards however shall be reduced, in first place, by appropriate risk assessment, design choices and construction measures, to be taken by the manufacturers. Such design choices and construction measures are required by the applicable EU legislation [4], lined up by the requirements in the harmonised European standards for hand-held electric grinders [5][6].

In a priority setting document reasons are given why participants have been chosen firstly for the hand-held electric grinder. This choice is based on:

- Accident data available (e.g. in Hospital Emergency Departments),
- RAPEX notifications over the last five years,
- Earlier experiences by participating MSAs,
- Availability of harmonised standards,
- Power tool migration and frequency of ownership by DIY consumers.

The proposed priority setting for power tools categories is as follows:

- Electric hand-held,
- Electric transportable,
- Electric garden tools,

And within the Electric hand-held:

- (Angle) grinders,
- Circular saws,
- Impact drills.

2 Setting up the Product Activity

2.1 Tendering Process for Test Laboratories

The call for tender was published on the PROSAFE website in the first week of January 2016. The working group had prepared a list of laboratories that would have the capability and be accredited to test power tool, in doing so they also used the PROSAFE database of known laboratories. The labs in this list were also invited by e-mail to react to the call for tender. The most important requirements set out in the call for tender were experience of testing and examination of Power Tools, relevant accreditation and clear reporting. Candidate laboratories were therefore requested to propose a compliance test and examination programme for market surveillance purpose, which is deviating from the usual product certification testing, and to determine the minimum number of samples required in such a programme.

The deadline for submitting the tenders was the 28 February 2016. Eleven responses were received to the call for tender, only 2 had submitted a bid with a good value for money characteristic. Initial screening of the two offers showed that one of them was not accredited for the specific standard series EN 60745. Thus, remained the selected laboratory in terms of accreditation, relevant experience and cost. The Activity Leader and the Activity Coordinator then visited the Laboratory, in order to view the test equipment, to discuss the test programme and to ensure that the reporting requirements were clearly understood. At the second project meeting held in April 2016, the Project Group decided to accept the offer.

2.2 Selecting Products, Sampling

The twelve Activity participants decided to target 60 electric hand-held grinders as foreseen the grant agreement and agreed to sample five each of them. In the Kick-off meeting, the participants decided to target the sampling in the lower end of the market. This decision was supported by stakeholders, such as the European Power Tool Association (EPTA), European Garden Machinery Federation (EGMF) and ANEC.

This reflects concerns about the safety of these products as they have migrated from the professional market to the less experienced consumer-DIY market. Specifically, it appears that the ‘big body tools’ with large diameter wheels (230 mm) and low speed (6000 t/min) predominantly have been replaced by cheaper ‘small handy tools’ with small diameter wheels (115 mm and high speed (12000 t/min). In these small handy tools, some more expensive solutions or improved safety features have been omitted, for example:

- hold to run switch;
- soft start;
- kick-back stop;
- improved guard fixation/adjustment mechanism;
- anti-vibration handle.

These missing features combined with the higher speed of the cheaper tool do not reflect the state of the art in safety, although standard requirements formally can be fulfilled. The activity chose the lower end of the market, where this kind of angle grinders were easy to recognise during sampling.

Grinders are available in two configurations, the straight grinder, a version with the rotating grinding element straight in line with the electro motor rotor (please see figure 2) and the angle grinder, a version with the rotating grinding element under an angle of 90 degrees to the electro motor rotor (see front page). The latter is very popular as a tool and much more frequently found in the professional - and DIY consumer market. To reflect this occurrence the factor 10 (table 2) is applied in sampling them.

Grinder configuration	Number of samples
Angle grinders	55
Straight grinders	5

Table 2: The two grinder configurations that were tested in the Joint Action

EN 60745 does not distinguish in testing, marking and manual requirements between the two grinder configurations, reason why they are not treated as different categories further on. So, where grinder is written, the both grinder configurations are mentioned unless mentioned apart.

To prevent duplicate-sampling of brands, models or types, a ‘booking’ system was developed and used successfully. If Member State 1 is sampling, sampling for the other MSs is blocked until an updated list with the sampled brands, models or types (only) has been distributed the day after sampling in Member State 1.



Figure 2: Straight grinder with grinding accessories

Figure 3 shows the breakdown of the 60 grinder samples into visiting the premises of the economic operators, most of them (65%) came from retailer shops.

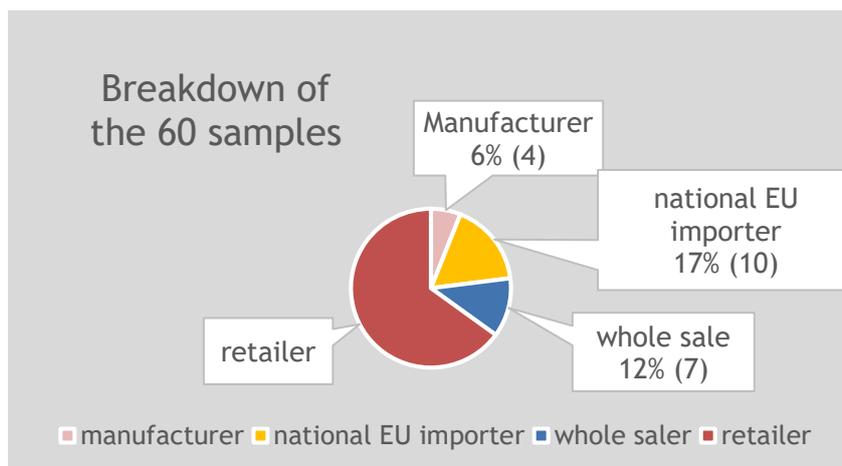


Figure 3: Breakdown of the 60 grinder samples into kind of economic operators

Online Sales

Participants in the Activity also tried to see whether they could perform a certain level of sampling on online sales of grinders. The MSAs from Germany, Czech Republic, Latvia, Slovakia and Slovenia, managed to

acquire in total 10 (out of the 60) samples by ordering online (17%). Some others had difficulties by ordering online, because of financial restrictions in the inspection level to buy them. Others encountered a conflicting situation due to the fact that sampling should legally happen for free. Moreover, the fact that online ordering was quite unusual or never done, did not help in setting up this way of sampling. However, to inventory for selecting the different sample brands available on the current market ‘online desktop search’ appeared to be a workable tool, even when sampling occurred physically at the premises of other economic operators. Concerning the product ‘grinders’ it could be determined that in many cases the web shop of a ‘brick and mortar’ economic operator offers more brands than there are to be found at the physical location. Figure 4 shows the breakdown of the 60 grinder samples in the ‘online’ ordering from the economic operators, again most of them (60%) came from retailers also having a website. The online sample percentage (17%) equals nearly the averaged online share for technical consumer goods of retailers in 18 European countries of sale values in the first quarter of 2016 as shown in table 3. The huge differences in online share between countries however are striking.

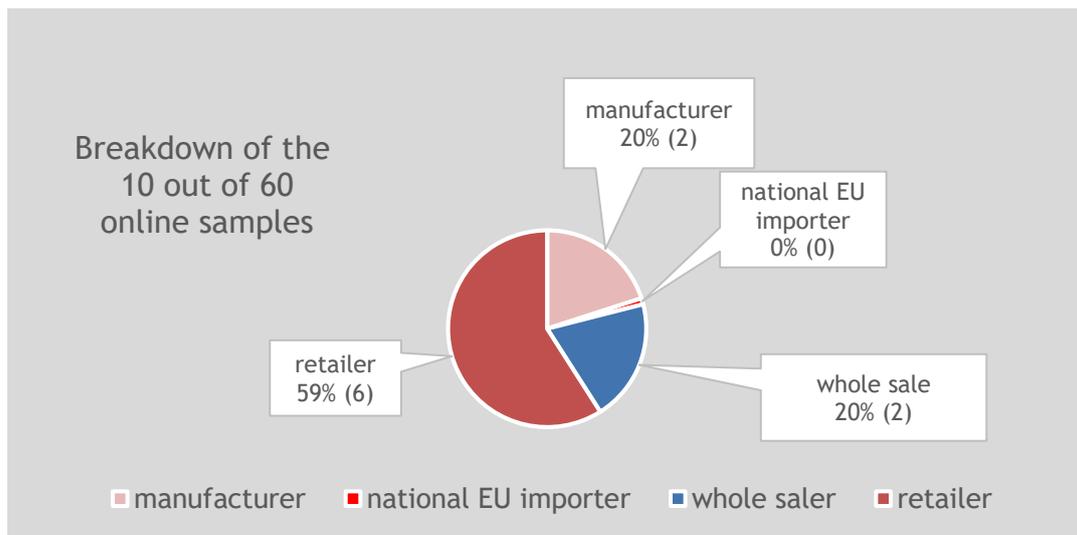


Figure 4: Breakdown of the 10 online samples ordered from economic operators

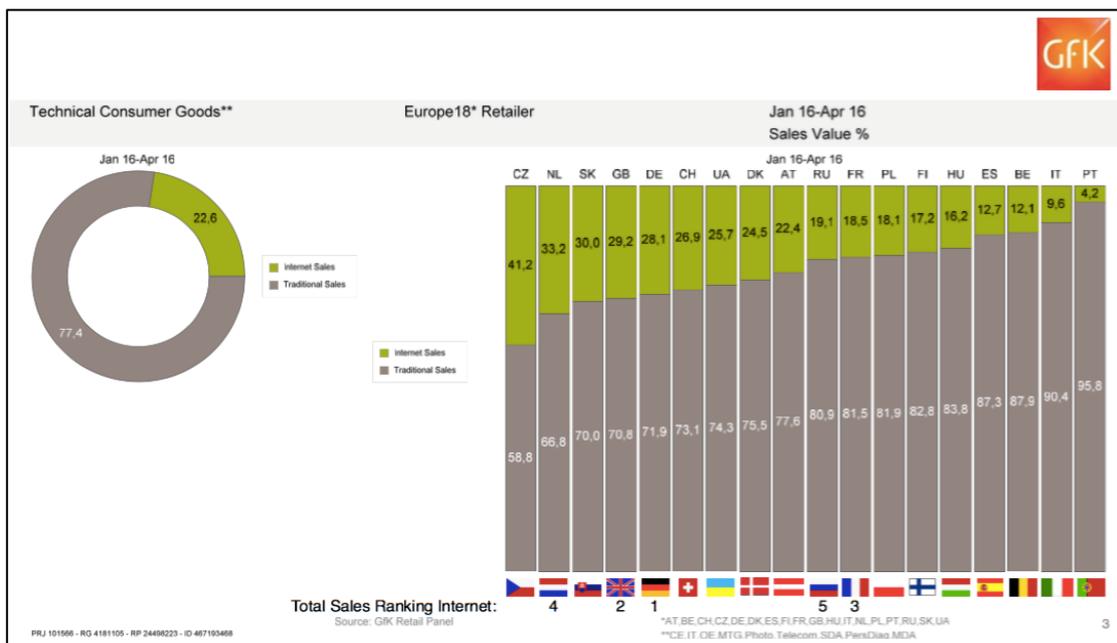


Table 3: Online/traditional sales values in % for retailers in 18 EU countries¹

¹ First quarter 2016

The data tables 3 and 4 are acquired from the German Institute for Trading Investigation (Institut für Handels Forschung -IHF), established in Köln, and were presented by the EPTA during the Kick-off meeting of this Product Activity after our request for current online data in the Power Tool branch. Interesting in Germany (and in many other European countries) is the double-digit growth over the last years in related market sectors like ‘home and garden tools’. Table 4 shows that trend over the last 7 years. In the 2016 IHF spring seminar the expectations were expressed that this growth tempo will continue in future years.

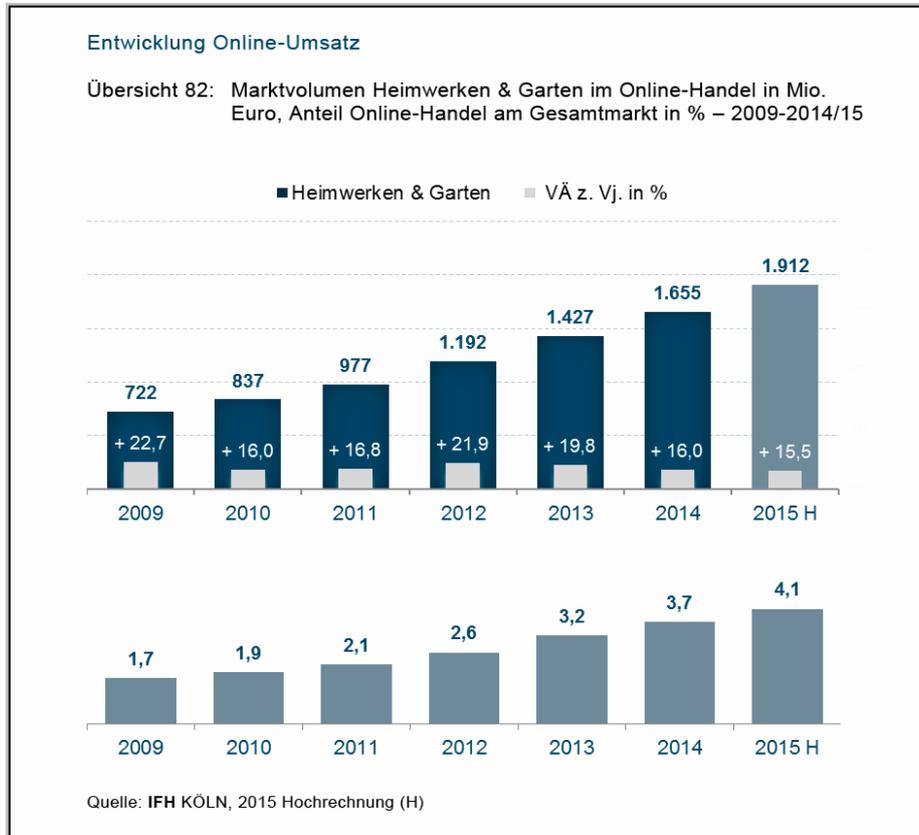


Table 4: Growing market volume online in millions of Euro and in % between 2009 and 2015²

Sample price classes

As above mentioned, participants decided to sample in the lower end of the market supposing that the likelihood to find non-compliant products is the largest in that market segment). Figure 5 shows the price class distribution in four increasing classes of 40 Euro. The cheapest sample class appears to be with 60% share the largest, indeed, even the lowest end of the market!

Here it must be noted that market surveillance sampling in general never intends to be representative of the EU market, regardless the product sector, and is not statistical based; it aims to detect dangerous and/or unsafe products for withdrawing them from the market.

² In Germany for the ‘Home and Garden tools’ sector

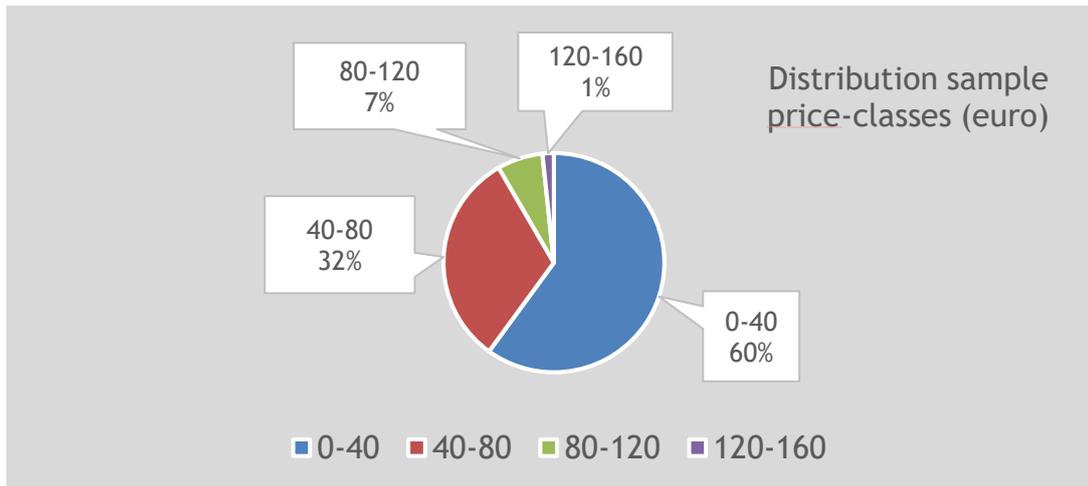


Figure 5: The price class distribution in the 60 sampled angle grinders

3 Testing

3.1 The Test Program

For MSAs, a test programme does not intend to deliver a product certification, but to (let) check where the product fails with prevailing regulations. The product in focus, the hand-held electric grinder is ‘machinery’ as defined in the Machinery Directive (MD) 2006/42/MD [4]. As a consequence of this EU regulation and implementation in National legislations the tool has to fulfil the essential health and safety requirements described in annex I of the Directive. For manufacturers of this product, one manner to fulfil these requirements is, to meet the clauses of the harmonised standard(s) developed for that product or product group as far as they cover the requirements of annex I. A product is noncompliant whether it fails to meet (the tests for) these clauses. The relevant standards (including their amendments over the years) are a general one (Part 1) where clauses and their tests for a whole group of power tools are described and a number of standards (Part 2) consisting of 23 different specific tool standards with belonging more specified clauses and tests. The amendments over the years have led to lots of additions, modifications and/or replacements in the clauses which make the combined content difficult to read. For the angle grinder applies the combination:

- EN IEC 60745-1:2009 + A11:2010 [5],
Hand-held motor-operated electric tools - Safety - Part 1: General requirements and
- EN IEC-2-3:2011/A2:2013/A11:2014/A12:2014/A13:2015 [6],
Hand-held motor-operated electric tools - Safety - Part 2-3: Particular requirements for grinders, polishers and disk-type sanders.

The amendments A2, A11, A12, A13 that followed up EN IEC 60745-2-3:2011 are rather recent. Two important dead line dates concerning apply, the date of publication in the OJ (DOP) and the date of withdrawal (DOW) of an old or conflicting (national)version. The latter (DOW) determines the start of the standard validity which for our angle grinders is illustrated in table 5 below:

EN IEC 60745-2-3:2011 amendments:	(A2:2013)	A11:2014	A12:2014	A13:2015
Concerning the tests description in:	Clause 21	Clause 21	Clause 19	Clause 19
DOP	2014-02-25	2015-04-21	2015-11-17	2016-09-28
DOW	2016-02-25	2016-04-21	2017-11-17	2018-09-28

Table 5: Validity dates of some clauses in standard amendments

This validity criterion implies that the sampled grinders were tested according to EN 60745-1:2009 + A11:2010 (general requirements) and EN 60745-2.3:2011/A2:2013/A11:2014/A12:2014/A13:2015 (specific requirements) according to the clause description in table 6 below.

6	Environmental requirements	20	Mechanical strength
8	Marking and instructions	21	Construction
9	Protection against access to live parts	22	Internal wiring
10	Starting	23	Components
11	Input and current	24	Supply connection and external flexible cables and cords
12	Heating	25	Terminals for external conductors
13	Leakage current	26	Provision for earthing
14	Moisture resistance	27	Screws and connections
15	Electric strength	28	Creepage, clearances distances and distances through insulation
16	Overload protection of transformers and associated circuit	29	Resistance to heat, fire and tracking
17	Endurance	30	Resistance to rusting
18	Abnormal operation	31	Radiation, toxicity and similar hazards
19	Mechanical hazards		

The test programme has comprised all standard clauses except the clauses 6, 30 and 31 for the following reasons:

6	Noise and vibrations are phenomena with health effects in the long-term exposure which are less relevant for DIY- consumers. However, information upon levels for noise and vibration must be given under clause 8 Marking and instructions with pointing to warnings to use personnel protective equipment (PPE).
30	Rusting (outdoor exposure) has no strong relation to consumer safety
31	Radiation, toxicity and similar hazards are not applicable

Table 6: Clause descriptions standard EN 60745 part 1/part 2.3 and some exclusions

When the tests had finished, the laboratory prepared a test report for each sample. It included the test and examination results obtained in the verdict terms Pass or Fail, indicating the non-conformity to the particular (sub) clauses of the standard and provided descriptions of the failing items for tests and checks defined in these clause requirements. Additionally, pictures of any non-conformity as well as comments or other relevant clarifications were included. All participants have got access to a specific ftp account of the laboratory for consulting all test reports and were able to follow as such the progress in testing during the whole testing phase.

The testing had finished end of summer 2016. A laboratory visit, in September, provided participants several testing demonstrations, presentation and explanation of the final results.

3.2 Results

Table 7 presents number and percentage share of the samples with non-conformities related to the single clauses of the standard (including a breakdown of some of the more relevant sub-clauses) found after testing and examination of the 60 samples. Tests and examination showed that the most common non-conformity is related to the instruction manual where 75% of all samples examined failed (clause 8.12 of the standard); the important and most recent complemented safety warnings were commonly missing. The table presents further in decreasing order the following non-conformities related to the grinder safety: missing restart prevention device in the lock-on switch category (clause 21.18.1), reduced and/or failing grinding wheel

protection guards in the wheel burst test (clause 20.101.5), lacking tool marking items (clause 8.1), extreme temperature rise/overheating under steady normal load (clause 12), failing guard enclosure and/or arrangement of moving parts (clause 19.101), failing housing integrity after the drop fall test (clause 20.3), various failure(s) during or after the endurance test (clause 17.2). Tests and examinations all together showed non-conformity percentages ranging from 8% to 75%.

(sub) clause	Wording (sub)clause requirement/ <i>-verdict from testing and/or examination</i>	Number of non-conformities (n=60)	Percentage %
8.12	Instruction manual and safety instructions / <i>-Missing instruction items and/or -safety warnings</i>	45	75%
21.18.1	Construction of the lock on category switches / <i>-Missing restart prevention device in the lock on switch category brands</i>	42	73%
20.101.5	Mechanical strength of the protection-guard / <i>-Reduced and/or failing guard protection in the wheel burst test</i>	30	50%
8.1	Tool marking / <i>-Lacking tool marking items</i>	29	48%
12	Heating and excessive temperature during normal use / <i>-Extreme temperature rise/overheating under steady normal load</i>	13	22%
19.101	Enclosure- and arrangement hazards of moving parts / <i>-Failing guard enclosure and/or arrangement of moving parts</i>	8	13%
20.3	Mechanical strength of the housing / <i>-Failing housing integrity after the drop fall test</i>	7	12%
17.2	Endurance and extended use / <i>-Various failure(s) during or after the endurance test</i>	5	8%

Table 7: % of found clause non-conformities according to EN 60745 part1 and 2.3

None of the 60 samples however appeared to be without non-conformities; on the contrary, 51 out of the 60 samples (85 %) even showed 2,3 or 4 non-conformities, some even 5 or 6 (see Table 8).

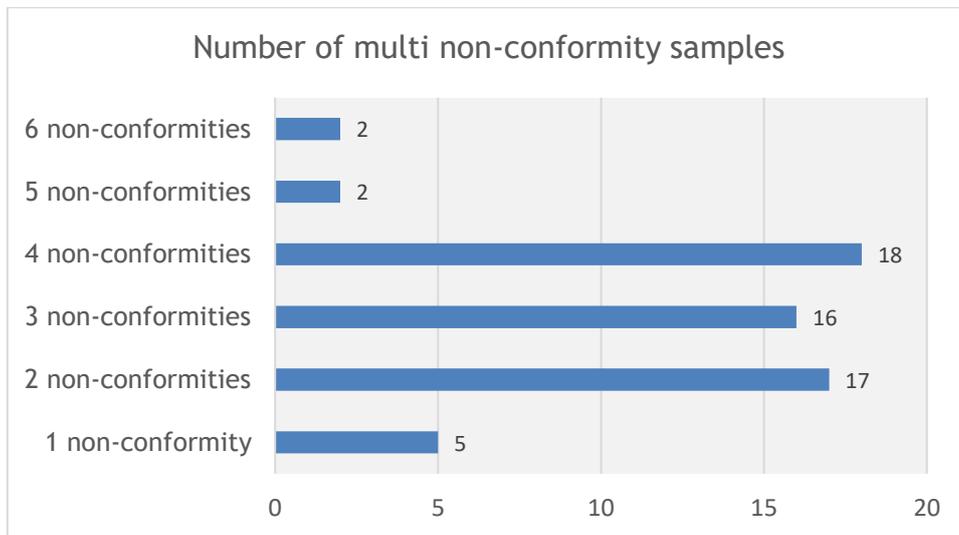


Table 8: Number of multi non-conformity samples (n=60 samples)

The non-compliance of all samples might have their reason in the fact that has been chosen for sampling in the lower end of the grinder market, estimating that prices shall have a relation to the level and nature of non-conformities. A comparison with the more expensive (professional) market however has not occurred within this Activity.

3.3 Additional Actions

3.3.1 Restart prevention

Clause 21.18.1 distinguishes two switch categories. The first one is the so called manually hold-on switch, which stops the grinder automatically if the switch-hold-on grasp is released (see figure 6). The second one switches on through (thump)shifting and allows to lock in this 'on' position through press down that switch (two dissimilar movements to lock: shift and press). To switch-off this category a light 'push and (spring supported) shift-back' movement at the back side of the switch suffice, but is definite not equal to an automatic release. For that reason, the standard clause obligates for this category an incorporated 'restart prevention device' to prevent restart in case of mains interruption or mains failure (see the figures 6 and 7 for both switch configurations).

On special demand, the laboratory tested the 'restart prevention function' of all 60 samples which appeared to be manufactured in 2014 and /or 2015. The function was present in only 27% of the related 'lock on switch' category. Although the validity of this clause starts for products manufactured after DOW date 2016-04-21 the results showed that 73% of the manufacturers (see table 7) apparently did not yet anticipate on this requirement in the year between the DOP and DOW dates. Only an incorporation of a 'restart prevention device' for this switch configuration will provide a presumption of conformity to the MD annex I: clause 1.2.3 and clause 2.2.1. This result has been fed back by the Activity Leader to 'ADCO-Machinery and to the IEC/TC 116 chairman, who attended the final activity meeting.

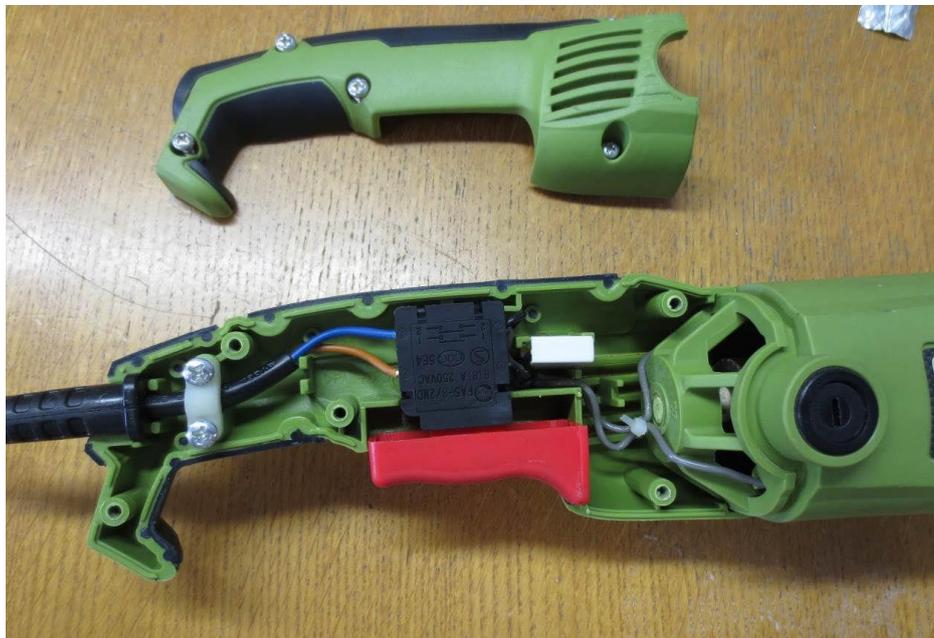


Figure 6: Hold-on grasp category switch with automatic switch off through grasp-release

3.3.2 Documentary checks

The sample list, primary intended to identify the samples and their economic operators also comprised a check-list on the declaration of conformity to fill by the market surveillance official. The list contained the 10 requirements for a declaration of conformity which are defined in the Machinery Directive Annex II-1A

Result:

- CE marking on tool incorrect or missing in 20%.
- Declaration of Conformity: incorrect-, incomplete- or missing items in 85%; most common lack (23%) appeared to be “the name and address of the person (natural or legal) authorised to compile the technical file, who must be established in the Community”.



Figure 7: Thump operated lock-on category switch (without restart prevention)

3.4 Conclusions

The overall result of testing and examination of the sampled grinders was that none of the 60 samples passed all of the applicable standard clauses; 85% showed even 2, 3 or 4 non-conformities. This shows that the chosen sampling in the lower end of the market was very effective and the inspectors were able to identify potentially non-compliant products in their sampling, so no resources were wasted in testing safe and compliant products.

Remarkable results from the examination of the information provided packed together with and ‘on’ the grinders. The share of lacking and/or non-compliant information is very high (8.12: 75 % and 8.1: 48 %) while this is mainly due to the fact that recent standard amendments concerning specific safety warnings and instructions were not (yet) elaborated in the instruction manuals. Particular for DIY consumers marking, instructions and safety warnings are essential for safe handling and sufficient control of this powerful tool. For the non-conformities found in clause 21.18.1 (73 %), a need exists for incorporation a restart prevention for the lock-on switch category in the current and future grinder production.

For the high non-conformities found in clause 20.101.5 (50 %), a careful risk assessment may give direction for follow up. Finally, the declaration of conformity shows many shortcomings (85 %).

Note: The overall results from these tests and examinations however do not represent the actual safety level of all grinders in the European market.

4 Risk Assessment & Action Taken

4.1 The Risk Assessment Method

Each of the MSAs participating in the Power Tools 1 Activity carried out an assessment of the risks associated with the non-conformities detected on the brands and/or models of grinders they had sampled, using the methodology described in the Commission's RAPEX Guidelines [7].

Risk assessments for a given type of non-conformity may differ, since the estimation of the probability of accident scenarios and of the type and severity of injuries depends on the specific characteristics of the sample. The purpose of the risk assessment is to ensure that the follow-up actions decided by the authorities is proportional to the risk involved by the non-compliant products and in accordance with the EU rules on market surveillance. The product concerned and also the application of the product may vary from one country to another. Nevertheless, during the Power Tools 1 Activity, the following steps were followed to facilitate a more common approach to the risk assessment with a more convergent outcome:

(a) Risk assessment templates

In light of the outcome of testing, participants prepared at several meetings risk assessment templates for grinders with the help of supporting tools prepared in the Risk Assessment Activity from the same project coordinated by PROSAFE. Two participants, also members of this Risk Assessment group, brought in useful experiences regarding templates, scenario development and probability steps. For each of the most common non-conformities, risk scenarios are described. The probability steps in each scenario and the severity of the possible injuries that may result are then estimated. Applying of the RAPEX method enables the authorities to assign one of the following 4 risk levels to each non-conformity detected: low, medium, high or serious.

(b) Discussion of the outcome of testing and examination

In addition to the test reports, input for the risk assessment was provided by discussion of the outcome of the testing and examination of the tested samples with the laboratory staff during the third project meeting. Following this discussion, 3 examples of risk assessments with scenarios for specific clauses were worked out in common by participants in the 3 and 4 project meeting. Helpful were the consequent descriptions in checking 'pass or fail' of clauses in the EN 60745 standards.

(c) Comparison of assigned risk levels

The risk assessments carried out by each participating authority were circulated to the other participating authorities. The risk level assigned by each participating authority to each of the most frequently occurring non-conformities was recorded in a table.

Participants then examined the cases where differing risk levels were assigned to the same non-conformity. In most cases, the discussion enabled such differences to be resolved.

Most problematic is the estimation of probabilities in chosen scenarios.

(d) The Risk Assessment Results

Following table 9 indicates the risk levels assigned by the participating authorities to the most frequent non-conformities found on grinders. Where the risk level is marked in bold and followed by an asterisk (*), this indicates that the risk level concerned was assigned by the majority of the participating MSAs.

Clause	Non-conformity	Risk level) most common
8.1	Lack in tool markings	Low*
8.12	Missing instruction items and/or safety warnings	Low/Medium*
12	Extreme temperature rise/overheating under steady normal load	Medium*/High
17.2	Failure(s) because of the endurance test	Medium*/High
19.101	Upon guard enclosure and/or arrangement of moving parts	Medium*/High/
20.101.5	Reduced and/or failing guard protection in the wheel burst test	Medium/High*/Serious
20.3	Failing housing integrity after the drop fall test	Medium/Serious*
21.18.1	Missing restart prevention device in the lock on switch category	Medium*

Table 9: Risk levels of found non-conformities in average

4.2 Action & Measures taken

As shown in table 9, the various non-conformities found through testing and examination has led to different risk-level results due to the risk assessments carried out on the scenarios chosen.

The risk assessments are however based on chosen scenarios for one single non-conformity. Table 8 earlier showed that all sampled grinders had more than one non-conformity, which means that risk assessments for more non-conformities will lead to more risk levels which likely will be different. Because risk levels cannot be added as such, participants have chosen for the principle of the ‘leading highest risk- level’. This ‘leading highest risk level’ determines the tool-severity the MSAs shall apply in the follow up of the non-compliant products. Besides it must be remarked that single clause related non-conformities as given in table 7 also may differ in ‘level’ and so, as such, lead to different risk-levels too.

Three examples in the higher risk levels are relevant as such within this Activity:

1. The non-conformity ‘Failing housing integrity after the drop fall test (clause 20.3)’, showed after testing damage with different patterns. If a broken housing discloses life parts, an electrocution is likely and the risk level is considered as a serious risk (3 sample test cases), please see figure 8, however a broken housing which partly discloses rotating parts may be classified as medium risk (see figure 9).



Figure 8: The drop fall test caused a broken housing and discloses life parts



Figure 9: The drop fall test caused a broken housing and discloses rotating parts

2. The clause 20.101.5 non-conformity ‘Reduced and/or partly failing guard protection in the wheel burst test**’, showed after testing a guard rotation of more than the allowed 90 degrees ‘slip rotation’ due to centrifugal, Coriolis- and friction forces (16 sample test cases). Moreover, a stronger effect, the complete ‘fall-off ‘of the whole grinding wheel protection guard, is determined in another 14 sample test cases, which explains the difference in the risk-levels medium and high. (please see figure 10 derived from the standard).

Here it is noted that a 180° rotation test-result or a protection guard fall-off result, will cause in a ‘reality wheel-burst’ due to a damaged or worn out situation, an unprotected facing towards the user holding the grinder. So, this case is classified as a high risk.

*Note **)* Objective in the wheel burst test is testing the strength and function of the grinding wheel protection guard. The grinder to be tested, is provided with a grinding wheel that is strongly weakened on purpose by cutting four radial notches where after the grinder is hanged-up in a surrounded shatter-absorbing box. After reaching full velocity the grinding wheel will break out and pieces will shatter around ‘attacking’ the grinder wheel protection guard. The weakening is assumed to simulate a damaged or worn-out grinding wheel in reality.

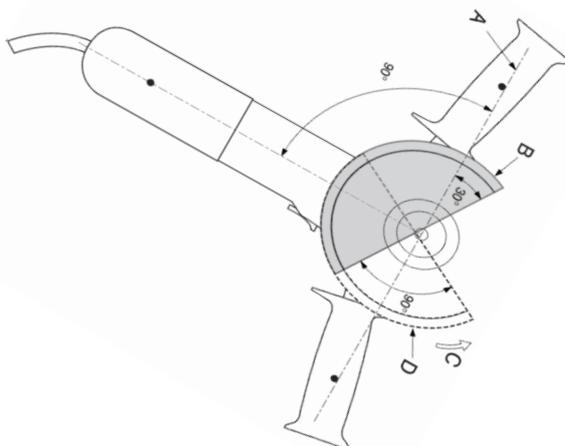


Figure 10: Angle grinder pictured in work position.³

³ The striped 90° angle shows the maximum allowed guard (slip)rotation after a wheel-burst test due to test forces.

3. The non-conformity ‘extreme temperature rise/overheating under steady normal load’, means that within the test an overheating after temperature rise occurred or even a go ‘on fire’. Both cases happened among the tested samples and explain the different risk-levels medium and high (figure 11).

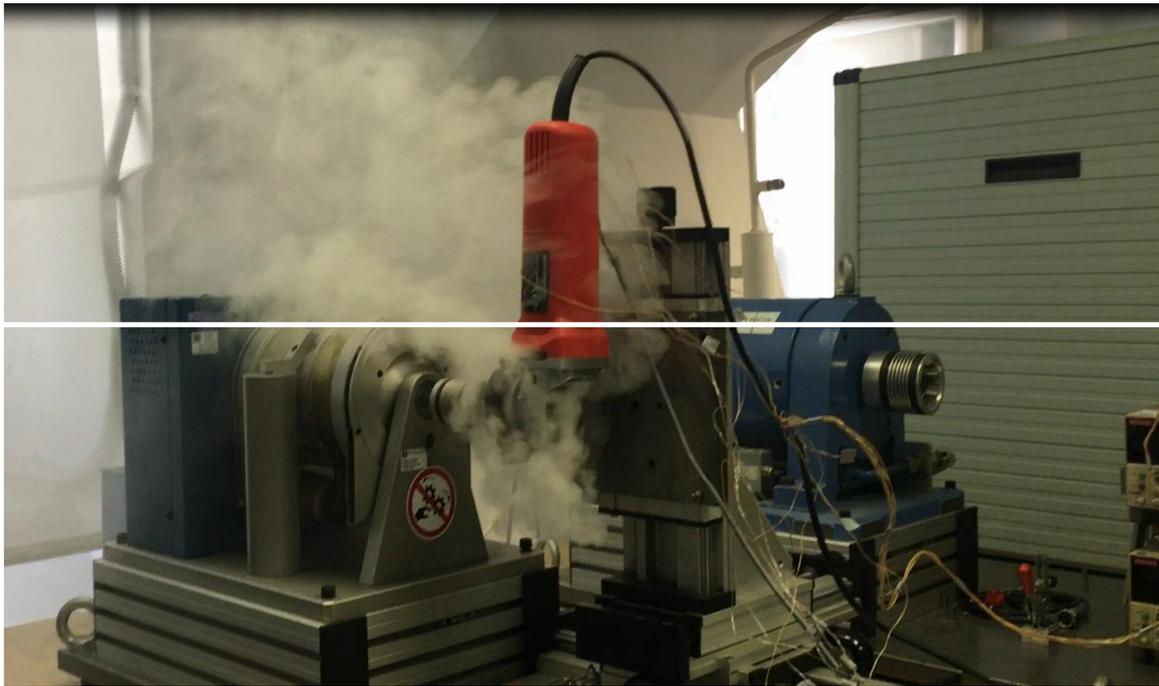


Figure 11: heating test, the grinder burned and stopped functioning under normal load

Table 10 below gives the ‘risk-level-based’ follow up measures which are taken by the various MSAs. For ‘multi non-conformity’ products, the non-conformity which lead to the highest risk level will be ‘leading’ in that follow up. Officials confronted economic operators with the test reports and discussed risks from- and the various non-conformities found in testing and examination. In the majority of the cases the economic operator took the measures proposed by the authority voluntary. The table comprises 4 serious, 19 high, 15 medium and 21 low risk levels cases among the non-compliant samples.

A Voluntary market surveillance measures	20	Totals	Risk
A1 Sales ban and/or withdrawal from the market		3 7 5	S H M
A2 Sales ban and/or withdrawal from the market and recall from consumers		1 3 1	S H M
B Mandatory market surveillance measures	15		
B1 Sales ban and/or withdrawal from market		4 9 2	H M L
C Measures (diverse)	25		
C1 Product information voluntary completed by EO		13	L
C2 Minor non-conformities		11	L
C2 Production brand/model has stopped		1	H
All measures totalised: 60			

Table 10: Overview of measures taken against EO’s with non-compliant grinders

The actions mentioned in the table have the following meaning:

- Sales ban. The product is prohibited from sale permanently or until certain conditions are met.
- Withdrawal from the market. This measure is defined in the GPSD (Directive 2001/95/EC). The distribution, display and the offer of a product which is dangerous to consumers is stopped.
- Recall. This measure is defined in the GPSD (Directive 2001/95/EC). Any means aimed at achieving a return of a product that has already been supplied or made available to consumers.
- Product information to complete. Either issues identified with the tool-marking or safety warnings and instructions in the manual are lacking. They are completed voluntarily by the economic operator. The related risks are low.
- Minor non-conformities, like a tool marking missing the rated revolution number per minute, the thread diameter of the spindle for mounting the grinder wheel or the rated voltage.
- Production brand/model has stopped meaning that the product version regards either the stop of a brand production or regards an old model that is no longer obtainable in the trading chain.
- A combination of the above measures.
- Four cases are pending on date of reporting due to counter-testing and objections from economic operators

Table 10 remark: not included in the table are ‘missing restart prevention devices (risk level Medium)’ in grinders produced before DOW 2016-04-21 (all samples). The economic operators stated that the ‘next year production’ shall be brought in conformity as adapted to the last standard requirements. Notifications concerned are sent out by the MSA.

4.3 RAPEX

E Notification to RAPEX (EC765/2008 Art. 22 and 23 [8])	34	Totals	Risk
E1 Notification to RAPEX - serious risk (765/2008, art22)		4	S
E2 Notification to RAPEX less than serious risk (765/2008, art23)		15	H
		15	M
F ICSMS reports	55		

Table 11: RAPEX notifications and ICSMS reporting

Table11 shows the notifications to RAPEX for serious and for ‘less than serious’ risk-levels. Notable here is that regarding to:

- The serious risk, all four cases are related to a ‘*Failing housing integrity after the drop fall test (clause 20.3)*’ with a damage effecting the disclosure of life parts.
- The high risk, that the majority (19 cases) is related to a ‘*failing guard protection in the wheel burst test (20.101.5)*’ with a guard slip-rotation followed by a complete fall-off of the whole protection guard.
- The medium risk, that the majority (15 cases) is related to a ‘*Reduced guard protection in the wheel burst test (20.101.5)*’ with a guard slip-rotation well exceeding the allowed 90 degrees.
- Low risk levels are mainly found in minor lacking items in marking and user manual; all five straight grinders failed (besides missing restart prevention devices) in this way on both clauses 8.1 and 8.12.

4.4 Additional Actions

4.4.1 ICSMS

Fast all MSAs have registered the actions undertaken on sample brands in the ICSMS system for cross-border cooperation (see table 11 under F). Only Bulgaria (5 samples) did not have ICSMS available.

4.4.2 Proposal restart prevention check

Concerning the lacking restart prevention device (see 3.3.1), the Activity Leader proposes to include an Activity to check the restart prevention functions for the (cheap) 'lock-on switch' grinders in future market surveillance activities. Without any laboratory interference, such a check can easily be done 'on the spot' by any instructed market surveillance official through plug, un-plug and re-plug again a grinder in the main supply under holding the switch in the on position. In the 're-plug status' a restart prevention device shall not allow re-starting. A clear reset is needed to allow a restart.

4.5 Conclusion

Given the risk based approach and the sampling from the cheap end of the market for grinders (60% of the products sampled were from the lowest price category under €40), the participants had expected that many of the products would be non-compliant. An easily broken housing after a fall down from the workbench can be expected, but such weak grinders are hazardous and ought to be withdrawn from the market. One can expect that a grinder overheats from extended use, and fortunately it will reach the end of its lifetime. Moreover, a long endurance will not be guaranteed (restricted endurance) within this price level.

However, deficient grinder wheel protection guards are hazardous for users and need an improved construction before they are made available on the market.

Economic operators shall be made aware of the importance and completeness of instructions and safety warnings. Market surveillance officials asked operators to complete this information on a voluntary basis in first instance.

5 Liaisons

5.1 Involvement of customs

Due to the special developed strict booking system to prevent duplicate sampling, an involvement of customs in the sampling phase would complicate the system. In the follow-up phase, a TAXUD work group member was invited, in an early stage, to attend a project meeting in his own country. Opportunities for collaboration in that stage were planned to be discussed. Unfortunately, the customs official cancelled the appointment just before the meeting. No further attempts for involvement were undertaken.

5.2 Other liaisons

5.2.1 Stakeholders

The Commission participated in most of the Activity project meetings. The final project meeting, which took place in March 2017, was also used to disseminate the results of this Activity. Stakeholders like the Director General of the EPTA, the chairman of the involved Standard Technical Committee IEC/TC116 (EN 60745 developments), the ANEC representative and the Commission representative of DG Justice, all attended the final meeting where the full Activity results were presented and discussion time served to have a better insight in results and feasibility of applied standards.

5.2.2 ADCO-Machinery

Strong liaison with ADCO-Machinery was established and further strengthened by the fact that three project The Leader reported the progress made within this Activity at each ADCO Machinery meeting, which took place during the project duration

An angle grinder item that interested the ADCO machinery for years was the missing of the 'restart prevention' device in the lock-on switch configuration which shall set in after a mains interruption. This device is, as earlier explained, after 21-4-2016 (DOW) a valid standard requirement for *all* single-phase grinders with a lock-on switch produced after that date and presumes so conformity with the MD, annex 1 clauses 1.2.3 'starting' and 2.2.1 'general'. For this reason, testing of the 'restart prevention function' has been included in advance in the test programme of the Activity. Furthermore, the results of the wheel burst test are to be presented by the Activity Leader to the ADCO members. The project participants consider that by this action, the Machinery Committee (MD art 22) will be informed about the failing grinding wheel protection guard. This shows the on-going cooperation and collaboration which exists between the respective parties.

6 Evaluation, Lessons Learned

The Joint Actions provide added value in many different ways. With so many Member States working together the product activities reflect a truly pan-European survey of the marketplace. The Commission's generous funding ensures that the number of samples tested greatly exceeds the number that individual Member States could afford.

Moreover, the Joint Actions deliver economies of scale driving down unit test costs helping to stretch the limited resources even further. The product activities within the Joint Actions also provide a platform for sharing expertise and the spread of best practice. Member States also discuss their risk assessments promoting a more consistent approach. Overall the Joint Actions make a significant contribution to achieving a high level of consumer protection and a level playing field for all economic operators throughout Europe.

Some of the most obvious lessons learned by the participants of this Activity relate to gaining more experience with the feasibility of the standards and test methods applicable to the grinders. Regarding the European Standard EN 60745-1 general [5] and 2.3 specific for grinders [6], participants made a number of observations.

Although the standard foresees more than one sample for testing the critical clauses, good experience has been acquired with only one sample per brand or model by a smart testing sequence or a smart acting in testing. For example, the drop fall test onto a concrete floor asks for 3 samples to drop from 3 different positioned orientations (3D orientation). It is however rather foreseeable which orientation will be the worst case, so that one sample would suffice. Many other tests can be done before the drop fall test is executed. If the test result is "Fail" for a given clause, it may be impossible to see how close the product was to fulfilling the requirement. Further information would be useful in the risk assessment, so the test report should provide information on the number of deviations from the requirement. Particularly, this is the case for clause 20.101.5 - wheel burst test- where a (slip)rotation of 90° is allowed but failing for a larger rotation angle is not classified.

Values for torque-moments for screws and nuts, are only found in table 9 - Torque for testing screws and nuts - of the general part of standard EN 60745, and these are mainly intended for fastening electric wiring. This table, with a maximum torque value 2,5 Nm for over 5,3 mm diameter screws, does not seem suitable in case of an adjustable screw-fastening of a grinding wheel protection guards in general. Application may lead to ambiguous results in the wheel burst test for some design configurations.

The standard describes in clause 12 - Heating - table 1- maximum normal temperature rises for winding insulations according to IEC 60085 classes. To derive the allowable temperature rise, the applied class must be known; range: class 105/75 Kelvin up to class 250/210 Kelvin. This knowledge is not available for the laboratory, reason why the laboratory has chosen for the common and realistic class, namely 120/90 Kelvin. For cheap grinders one may overestimate this class, with the allowable temperature rise.

Other lessons learned

The Member States chose to have an Activity on Power Tools within JA2014 based on the fact that the professional equipment developed within the last century migrated from the professional area into the consumer applications area, and to date it has been assimilated. Particularly, the handheld electric tools are leading in this trend, with a rapid acceleration of the battery driven tools caused by recent (lithium) battery improvements. The handy transportable electric tools are following rapidly.

It must be noted that the MD within the definition 'operator' does not exclude the consumer-user, on the contrary, as follows: "Where a machine (e.g. power tool) may be used by a consumer, that is to say, a non-professional operator, the manufacturer should take account of this in the design and construction. The same applies where a machine (e.g. power tool) is normally used to provide service to a consumer" (MD, 2006, alinea 15, p.25). The project managed to prevent the duplication of samples amongst the participating MSAs due to a 'booking system'. Sampling by MS1 blocks sampling in other MSs until an updated sample-list has been distributed by the coordinator the day after sampling in MS1. A quick distribution of the main data, like brand, model and type, suffices for this purpose.

The tendering process was found to be very beneficial. Pooling all the testing gave an economy of scale that lead to very competitive quotes from the laboratories. This meant that the laboratory of choice could have performed some additional tests for the allocated budget within the same timeframe. However, this did not happen because not all the samples could be delivered at the start of the multiple-testing timeframe.

It is recommended that European organisations representing businesses, manufacturers, importers and traders are encouraged to participate in Joint Actions. The participating MSAs found it important to maintain a healthy dialogue between all stakeholders to help identifying and preventing possible future safety issues and establish practical solutions. This seems to be particularly relevant for the whole power tools product group, where the economic operators need to be more aware of the hazards and risks associated with the products steady migrating from the professional user to the DIY consumer/user.

7 Bibliography

All references in the text are stated with a number in brackets, e.g. [1]. The full list of references is given below:

1. “Grant Agreement for an Action - Multiple Beneficiaries no. 2011 82 01 - GPSD JA”.
2. “Grant Agreement no. 666174-GPSD JA2014”.
3. Directive 2001/95/EC of the European Parliament and of the Council of 3 December 2001 on general product safety.
4. Directive 2006/42/EC of the European Parliament and of the Council of 17 May 2006 on machinery, and amending Directive 95/16/EC.
5. EN 60745-1:2009 + A11:2010, Hand-held motor-operated electric tools - Safety - Part 1: General requirements *).
6. EN-2.3:2011/A2:2013/A11:2014/A12:2014/A13:2015 *) Handheld motor-operated electric tools - Safety - Part 2-3: Particular requirements for grinders, polishers and disk-type sanders.
7. “Commission Decision 2010/15/EU of 16 December 2009 laying down guidelines for the management of the Community Rapid Information System ‘RAPEX’ established under Article 12 and of the notification procedure established under Article 11 of Directive 2001/95/EC (the General Product Safety Directive)”. Published in the Official Journal of the European Union L22/1.
8. Regulation (EC) No 765/2008 of the European Parliament and of the Council of 9 July 2008 setting out the requirements for accreditation and market surveillance relating to the marketing of products.

*) All standards can be obtained from the national standardisation bodies if nothing else is stated. An overview of these bodies can be found on the website of the European Committee for Standardisation, CEN at www.cen.eu.