



**Appendix of paragraph 3
of the Conditions of Use for the oSa Trademark**

**Additional requirements and conditions for abrasive
products to be marked with the oSa symbol**

Conformance with the European safety standards is the primary requirement for membership of oSa, these being:

- **EN 12413** Safety requirements for Bonded Abrasives
- **EN 13236** Safety requirements for Superabrasives
- **EN 13743** Safety requirements for Coated Abrasives

There are also additional requirements of oSa that must be complied with and these are given in the following documents:

- The Technical Annex (this document) which gives additional technical requirements
- The Ethical Annex which gives the social, health, safety and environmental requirements

This technical annex covers the following requirements:

- 1) **Essential test equipment**
- 2) **Design and in-process testing**
- 3) **Scope of the verification for design testing**
- 4) **Sampling procedure for independent testing**
- 5) **Additional test methods**
- 6) **Products outside the safety standards**



1) ESSENTIAL TEST EQUIPMENT

The following test equipment must be available at each manufacturing location and calibrated periodically. Consideration will be given to two or more sites sharing specific high cost equipment where the proximity between the individual sites makes it possible to carry out regular tests.

Equipment required	Bonded Abrasives	Superabrasives	Coated abrasives
Destructive and non-destructive speed test equipment for products over 80mm diameter ¹⁾	●	●	●
Destructive and non-destructive side load and impact test equipment (wheel types 27, 28, 29, 41 & 42)	●		
Balance checking equipment	●		
Destructive and non-destructive bending test equipment for diamond saws		●	
Destructive and non-destructive shear test equipment for portable dish wheels		●	
Tensile test equipment for wire saws		●	

¹⁾ For products 80 mm diameter and under, burst testing can be carried out at an independent testing facility or by producing a larger diameter wheel in the same specification. The spindle deflection test can be carried out externally or derived from the formulae given in the respective EN Standard, if specified.

2) DESIGN AND IN-PROCESS TESTING

2.1 Design testing

Design tests should be carried out when designing new products, when there is a significant change to the product design, the raw materials, the process or the site of manufacture. It should also be carried out periodically by random sampling of production batches to verify that design requirements have been maintained.

Records should be sufficient to verify conformance and repeatability of the requirements. An example of how this should be carried out is given in section 3.2.

Design tests should be conducted on the weakest specifications within each of the product groups under the scope of the oSa certification (see section 3). Guidance on how to select the weakest product is given in section 4.

In exceptional cases, it may not be possible to break the product although the minimum value of the design test has been exceeded. The requirement will be considered to be met if all samples withstand a test level of at least 110% of the requirement.



2.2 In-process testing

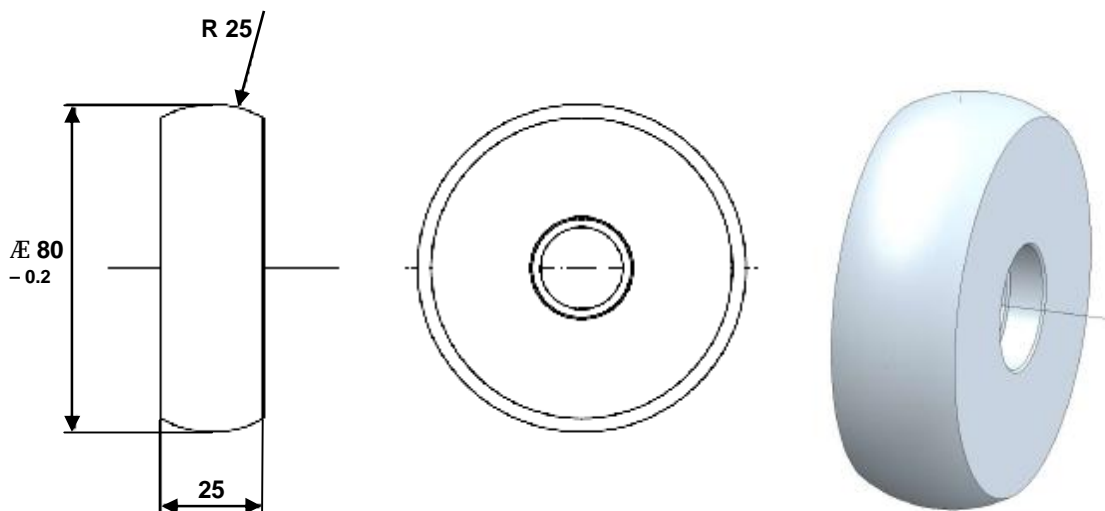
In-process testing must be carried out on all production batches at a sampling level sufficient to verify conformance.

Where a burst speed test, side load or impact test is specified, if the product survives the minimum requirement there is no need to take it to destruction. However, these products must be destroyed after testing.

2.3 Testing requirements for abrasive products

	DESIGN TEST ON WEAKEST PRODUCT	IN-PROCESS TEST	RANDOM PERIODIC DESIGN TEST
	Tested to destruction (see section 2.1)	Tested to minimum requirement (see section 2.1)	Tested to destruction (see section 2.1)
BONDED ABRASIVES			
Reinforced wheels for hand-held machines	Burst speed test Side load test ²⁾ Impact test	Burst speed test Side load test ²⁾ Impact test	Burst speed test Side load test ²⁾ Impact test
All other wheels	Burst speed test	Safety speed test	Burst speed test
COATED ABRASIVES			
Flap wheels, flap discs and fibre discs	Burst speed test	Burst speed test	Burst speed test
SUPERABRASIVES			
Non-precision diamond saws	Burst speed test Bending test	Bending test	Bending test
Portable dish wheels	Burst speed test Shear test	Shear test	Shear test
Diamond wires	Tensile test		
Precision superabrasives	Burst speed test		

²⁾ Side load tests: the roller wear should not exceed more than 1 mm for abrasive tools with $D \leq 150$ mm and 3 mm for abrasive tools with $D > 150$ mm of initial roller diameter. The roller diameter should be 80 mm at a tolerance of minus 0.2 mm. Roller geometry:





3) SCOPE OF THE VERIFICATION FOR DESIGN TESTING

When selecting products for design testing, the weakest specifications within each specific product range should be selected. Once consistent verification of the requirements has been obtained, the records can be used as verification for other products within the range for which the oSa trademark is being sought provided that the following criteria can be met:

Basic categories (see 3.1)

- The product group must be the same
- The machine category must be the same
- The basic bond type must be the same
- The basic abrasive type must be the same
- The core type must be the same (superabrasives)
- The connection of the superabrasive section or segment must be the same
- For coated abrasive flap discs, the backing material must be the same.

Dimensions

- The outer diameter must be equal or smaller
- The hole to diameter ratio must be equal or smaller
- For spindle-mounted products the spindle diameter must be equal or greater
- The thickness must be equal or smaller for burst test
- The thickness must be equal or thicker for side load/impact test
- For cup wheels the wall thickness/outer diameter ratio must be equal or greater
- For cup wheels the back thickness/overall thickness ratio must be equal or greater
- For segmented diamond saws and dishes the segment height must be equal or less
- For segmented diamond saws and dishes, the connection between abrasive section and core must be equal or greater
- For segmented diamond saws the core thickness must be equal or greater

Specification

- The maximum operating speed must be the same or lower
- The abrasive grain size must be the same or finer
- For coated abrasive products the base material tensile strength must be equal or higher
- The grade of the wheel must be the same or harder (the bond content must be same or higher)
- For glass reinforced products, the number and weight of reinforcing discs must be the same or greater
- For coated flap products the number of flaps must be equal or less

Diamond wires cannot be grouped and each product should be tested individually.



3.1 Basic categories

When supplying the product details required in the membership application (section 3), the following descriptions should be used when completing the form:

Product group

Bonded abrasives product group	Any of the ISO types in each product group
Plain, tapered and hubbed wheels	1, 3, 4, 38, 39
Recessed and relieved wheels	5, 7, 20, 21, 22, 23, 24, 25, 26
Cups, dishes and saucers	6, 9, 11, 12, 13
Depressed centre grinding wheels	27, 28, 29
Segments	31
Discs, Cylinders	2, 37, 35, 36
Flat cutting-off wheels	41
Depressed centre cutting-off wheels	42
Mounted points & wheels	52

Superabrasive product group	Precision grinding wheel	Precision cutting wheel	Mounted point	Diamond saw	Dish wheel	Diamond wire
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Connection of abrasive section or segment	Moulded or sintered	Cemented	Brazed	Laser welded	Laser melt	Electroplated
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Coated abrasives product group	Fibre disc	Flap disc	Flap wheel	Spindle mounted flap wheels
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Flap disc backing	Glass fibre	Plastic	Metal	
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Machine type

Machine description	Machine types covered
Enclosed	Totally-enclosed machine/working area/ robot process
Mechanical	Stationary machine, mechanically guided wheel / workpiece
Manual	Stationary or mobile machine, manually-guided
Hand-held	Hand-held machine

Basic bond type

Bonded abrasives	Vitrified	Resinoid	Resin Reinforced	Shellac	Rubber	Rubber reinforced	Magnesite	Plastic
Superabrasives	Vitrified	Resin	Electroplated	Metal				
Core material	Vitrified	Resin	Metal					

Basic abrasive type

Bonded & coated abrasives	Aluminium oxide	Zirconia alumina	Silicon carbide	Superabrasives	Diamond	CBN
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3.2 Example for verification

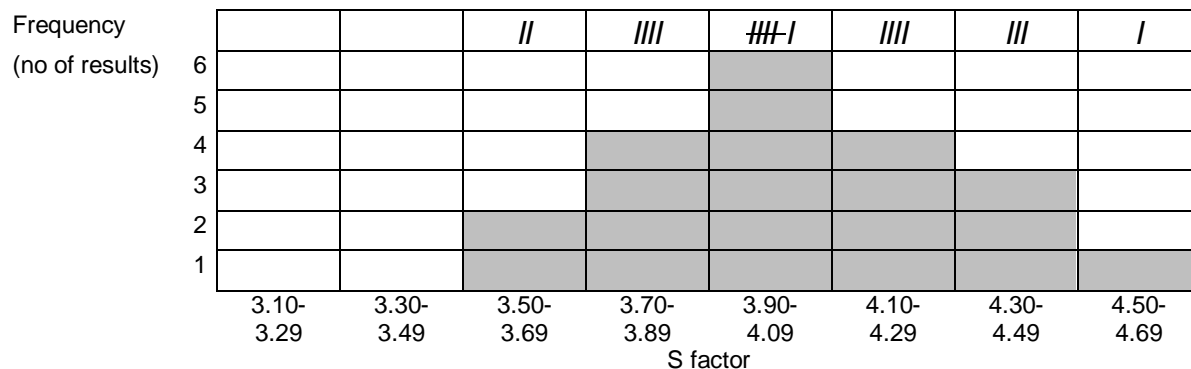
Select the weakest product in the particular product range. Guidance is given in section 3. Record the product details, for example:

Wheel type: Type 27 Depressed centre grinding wheel
 Wheel size: 230 x 6 x 22.23mm (largest diameter, thickest wheel, largest bore)
 Application: Hand-held machine
 Specification: A24 NBF (softest and coarsest in the range)
 Test requirement: Minimum bursting speed
 Maximum operating speed: 6650 rpm
 Minimum burst speed: 12436 rpm (1.87 x MOS = S factor of 3.5)
 Sample size: 20 wheels

Record actual bursting speed in rpm. Calculate S factor.

rpm	S	rpm	S	rpm	S	rpm	S	rpm	S
12440	3.5	12790	3.7	13465	4.1	12960	3.8	13465	4.1
13130	3.9	13300	4.0	14100	4.5	13790	4.3	13790	4.3
13300	4.0	12790	3.7	13130	3.9	13300	4.0	12620	3.6
12960	3.8	13630	4.2	13630	4.2	13950	4.4	13130	3.9

Plot S factor against frequency (histogram and/or distribution curve). Any result below 3.5 is a failure and product design must be improved.



Repeat the exercise until consistency can be demonstrated. Further checks can then be done using a smaller sample size.

Records such as these should be available for the weakest specification in every range of products within the scope of the oSa membership. This demonstrates the quality of records the factory inspector will expect to see during an audit and may be required by oSa to be submitted in future with the membership application form.



The procedure should be used for the following tests:

Test requirement	Destructive burst speed	Spindle deflection test	Side load test (1 & 3 point)	Impact test	Destructive bending test	Destructive shear test
Measurement	Speed to cause wheel burst	Speed to cause permanent spindle distortion	Lateral force to cause rupture	Impact to cause rupture	Force to cause segment or its joint to rupture	Shear force to cause segment or its joint to rupture
Unit	rpm	rpm	N	Nm	N/mm ² or Nm	N
Graph axes	Frequency S factor	Frequency S Factor	Frequency Force	Frequency Impact	Frequency Force	Frequency Force

4) SAMPLING PROCEDURE FOR INDEPENDENT TESTING

4.1 Bonded abrasives

Products should be selected for burst speed testing as shown below. Selected samples should have the coarsest grit and the softest grade. The data is valid for all bond types.

Wheel group	ISO type number	Minimum No of samples	Diameter	Thickness	Bore	Back thickness	Rim width
Plain, tapered and hubbed wheels	1, 3, 4, 38, 39	3	max	max	max		
Recessed and relieved wheels	5, 7, 20–26	3	max	max	max		
Cups, dishes and saucers	6, 9, 11, 12, 13	3	max	max	max	min	min
Depressed centre grinding wheels	27 – 29	3	max	max	max		
Segments	2, 37	3	max	max			min
Discs, Cylinders	35, 36	3	max	max	max		
Cutting-off wheels	41, 42	3	max	max	max		

Testing of the following products will depend on the capacity of the speed tester available

Wheel group	ISO type number	Minimum No of samples	Diameter	Thickness	Thread or spindle
Plugs and cones	16–19	3	max	max	min
Mounted points & wheels	52	3	max	max	min

Products should be selected for side load and impact testing as shown below. Selected samples should have the coarsest grit and the softest grade. The data is valid for all bond types.

Wheel group	ISO type number	Minimum No of samples	Diameter	Thickness	Bore
Depressed centre grinding wheels	27, 28, 29	3 per test	max	min	max
Cutting-off wheels	41, 42				



4.2 Coated abrasives

Products should be selected for testing as shown below. Selected samples should have the maximum weight (usually given by the coarsest grit) and the weakest backing material. Testing of the spindle mounted flap wheels will depend on the capacity of the speed tester available.

Wheel group	Test	Minimum No of samples	Diameter	Thickness	Bore or spindle	weight of flaps
Vulcanised fibre discs	Burst speed	3	max	max	max	-
Flap discs	Burst speed	3	max	max	max	max
Flap wheels	Burst speed	3	max	max	max	max
Spindle mounted flap wheels	Burst speed	3	max	max	min	max
	Spindle deflection	3				

4.3 Superabrasives

Superabrasives should be selected for testing as shown below. With the exception of electroplated bonds, precision wheels should be the weakest specification (coarsest grit, softest grade or smallest bond content).

For all other superabrasives, the weakest specification for each individual product group should be selected as using the criteria given in section 4.

Product type	Test	Minimum No of samples	Diameter	Thickness	Bore, wire or spindle diameter
Precision grinding wheels	Burst speed	3	max	max	max
Cut-off wheels (Diamond saws) continuous rim	Burst speed	3	max	max	max
	Bending - 4 positions	3	-	min	-
Diamond Wires	Tensile	3	max	-	min
Mounted points	Burst speed	3	max	max	min
	Spindle deflection	3			

Testing of mounted points will depend on the capacity of the speed tester available.

Product type	Test	Minimum No of samples	Blank thickness	Segment height	Segment area at joint
Cut-off wheels (Diamond saws) segmented	Burst speed	3	min	max	max
	Bending, all segments	1	min	max	min
Dish wheels	Burst speed	3	-	max	max
	Shear test - all segments	1	-	max	min



5) ADDITIONAL TEST METHODS

5.1 Verification of the bursting strength of resinoid-bonded abrasives for wet grinding

For abrasives with resinoid bond used for wet grinding, the bursting strength can be for example determined by a centrifugal force test conducted following wet treatment, if required: For the wet treatment, the abrasive tool is immersed in an autoclave at a pressure lower than 200 hPa in 3% aqueous soda solution (Na2CO3 calcinated, pH-value 11 ± 1). Afterwards the abrasive is stored for 24 hours at atmospheric pressure in soda ash at a temperature of 35 ± 2 °C. Then the mass is determined and its increase compared to the state prior to the wet treatment is measured. Subsequently, the abrasive is mounted on the speed test equipment for 2 minutes at a peripheral speed of a quarter of the respective maximum operating speed. Then the bursting strength is determined by the burst speed test.

6) PRODUCTS OUTSIDE THE SAFETY STANDARDS

The following approval procedure applies to innovative rotating abrasive tools with maximum operating speeds ³ 40 m/s not covered by the existing safety standards EN 12413, EN 13236 or EN 13743. Especially for products with potential safety hazards a verification of a safety standard is important both for the user and the producer of the product.

Descriptions are valid for design tests as well as in-process tests, number of tests to be defined by manufacturer. The approval procedure is based on a potential hazard analysis on the use of rotating grinding tools. Criteria for the hazard analysis are:

- Type of machine: handheld, mobile, stationary, stationary totally enclosed
- workpiece handheld or fixed
- application cutting off or grinding
- potential hazards are:

Potential hazard	Test method	Parameter	Description
Bursting	Burst speed test	Safety factor s_{br}	EN 12413, EN 13236, EN 13743 (whichever is closest in product description)
Spindle break	Spindle deflection test ¹⁾	Safety factor s_{ab}	
Breaking tools	Side load / impact test ²⁾	load [N] / impact [Nm]	EN 12413
	Destructive bending test ³⁾	load [N]	EN 13236
	Destructive shear test ³⁾	load [N]	EN 13236

¹⁾ only applicable for spindle mounted abrasive tools
²⁾ for bonded abrasives in applications where side load can occur
³⁾ for superabrasives

6.1 Requirements for products outside the safety standards

Given values in the following table are worst case values (highest value in safety standards for a similar application). For products listed in the applicable safety standard the value given in the standard applies.

MACHINE TYPE	WORKPIECE	APPLICATION	TYPE	MINIMUM BURST SPEED TEST S FACTOR	SPINDLE DEFLECTION TEST S FACTOR	SIDE LOAD AND IMPACT TEST			BENDING TEST	SHEAR TEST
						Single-point side load (N)	Three-point side load (N)	Impact (Nm)		
Hand-held	Fixed	Grinding	Bonded abrasives similar to types 27, 28 & 29	3.5	-	290	-	4.5 (150mm) 5.4 (180mm) 6.9 (230mm)	- -	- -
			All other products		-	-	-	-	-	
			Diamond dish wheels		-	-	-	-	> 6400 N or ≥ 60 N/mm ²	
			All spindle-mounted		1.3	-	-	-	-	
		Cutting	Bonded abrasives similar to types 41 & 42	3.5	-	40 (115-125mm) 50 (150-230mm)	--	1.2 (150mm) 1.5 (180mm) 2.0 (230mm)	-	-
			Bonded abrasives similar to type 41	3.5	-	125 (>230mm)	150	5.4	-	-
			Diamond saws	3.5	-	-	-	-	segmented: $\sigma_b = 900 \text{ N/mm}^2$ or $M_b = 10 \text{ Nm}$ (whatever larger) continuous rim: $M_b = 125 * D/2 \text{ Nm}$	-
Mobile	Fixed	Grinding	All products	3.5	-	-	-	-	-	-
		Cutting	Diamond saws	3.5	-	-	-	-	450 N/mm ²	-
			All other products	3.5	-	-	-	-	-	-
Stationary	Hand-held	Grinding	All products	3.5	-	-	-	-	-	-
		Cutting	All products	3.5	-	-	-	-	-	-
	Fixed	Grinding	High pressure grinding	3.5	-	-	-	-	-	-
			All spindle-mounted	3.0	1.3	-	-	-	-	-
			All other products	3.0	-	-	-	-	-	-
		Cutting	Diamond saws	2.0	-	-	-	-	450 N/mm ²	-
All other products	2.0		-	-	-	-	-	-		
Stationary Totally enclosed	Fixed	Grinding	High pressure grinding	3.0	-	-	-	-	-	-
			All other products	1.75	-	-	-	-	-	-
		Cutting	All products	1.75	-	-	-	-	-	-