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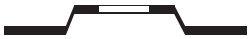
CUTTING-OFF & GRINDING WHEELS

TECHNICAL INFORMATION

SHAPE SPECIFICATION SYSTEM

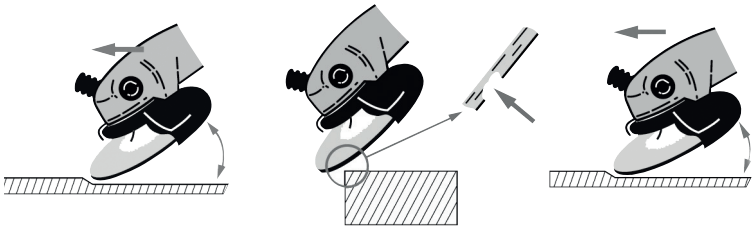
BF 27	BF 29	BF 41	BF 42
			
DEPRESSED CENTRE GRINDING WHEELS	DEPRESSED CENTRE GRINDING WHEELS	FLAT CUTTING-OFF WHEELS	DEPRESSED CENTRE CUTTING-OFF WHEELS
Available in diameters 76-230mm for hand-held machines.	Available in diameters 115mm & 125mm for hand-held machines.	Available in diameters 40-400mm for hand-held machines & 250-400mm for stationary machines.	Available in diameters 76-230mm for hand-held machines.
Application: grinding	Application: grinding	Application: cutting-off	Application: cutting-off

RECOMMENDED PRACTICE

PORTABLE GRINDERS

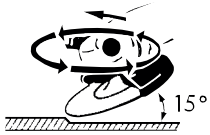
GRINDING ROUGH WORK

- Do not use a cutting-off wheel for snagging
- Do not work with the side of a wheel, you will cut the reinforcing cloths
- Work at an angle of 10 to 30º with a longitudinal action



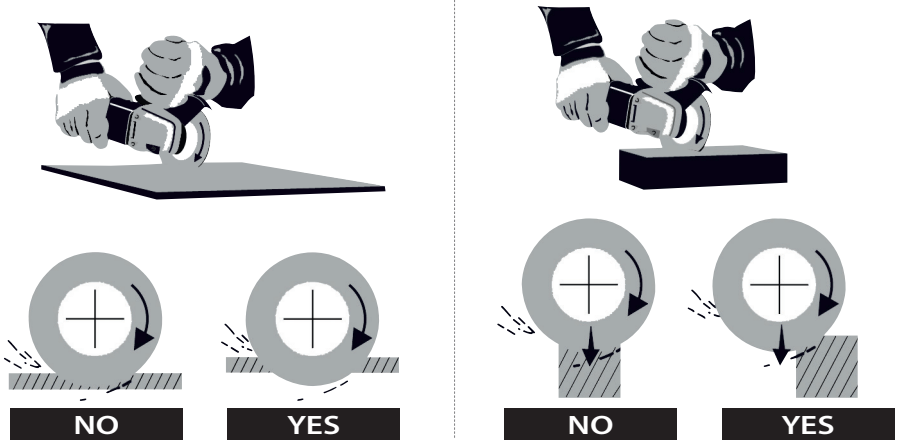
GRINDING FINISHING WORK

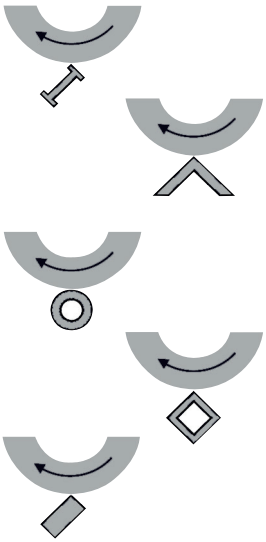
- Angle of work 15º
- Rotary action



CUTTING-OFF

- Arrange the workpiece so that a uniform section can be cut

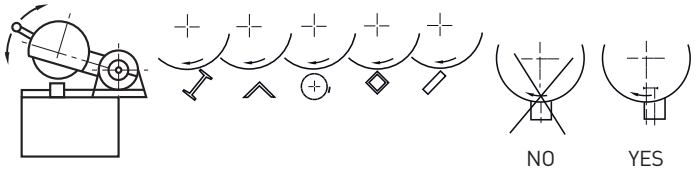




FIXED MACHINE

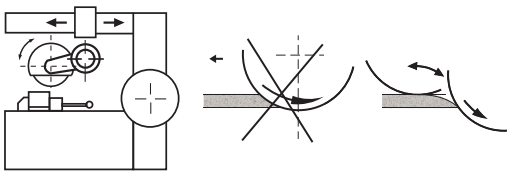
DOWNSTROKE HEADS

- Lay out the shape parts in order to have a constant section
- Avoid any wedging of the grinding wheel
- Make sure the wheel is cleared



AUTOMATIC FEED

- In the case of thick parts, use the reciprocating motion of the carriage

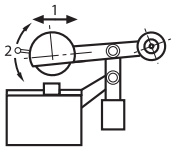


OSCILLATING HEADS

OPERATING MODE

1. Oscillating
2. Cutting-off

Do not use this type of machine with a downstroke action



METAL RING WITH VALIDITY DATE

V = VALIDITY DATE (PRODUCTION QUARTER + 3 YEAR)

V01	V04	V07	V10
1st quarter	2nd quarter	3rd quarter	4th quarter

EXAMPLE:
V04/2016 indicates production in the 2nd quarter of 2013 and advised usage before the 2nd quarter of 2016

PERSONAL PROTECTION

Safety goggles, ear defenders, safety gloves, dust masks and, if conditions are severe, additional face protection. Leather aprons and safety shoes must be worn.


Mouth Protection


Wear Gloves


Eye Protection


Ear Protection


Read Instructions


Damaged Wheel – Do not use


Dry


Wet

GENERAL PRECAUTIONS

Safety instructions provided by the machine manufacturers must be followed. Where fitted, all guards, covers and hoods must be in place on the machine during grinding, and should not be modified in any way. Abrasives should not be used near inflammable material or in an environment where there is a risk of explosion.

Sparks should be directed away from the face and body, if possible towards the floor. Dust extraction equipment must be used whenever it is available. The instructions for use given by the abrasive manufacturer must be followed e.g. 'Not to be used without a support', or 'Not to be used for wet grinding'. The workpiece must be firmly fixed before grinding starts. Check all abrasives visually before use and make certain that the product is suitable for the application. No modifications should be made to abrasive products after delivery.

When using a portable grinder always switch it off and allow the spindle to stop completely before putting the tool down. Wet grinding should only be carried out on machines designed for this purpose and with abrasives designated as suitable for this type of operation.

OPERATING SPEEDS

Norton products are designed and tested for certain applications and operating speeds. Choose a wheel suitable for the application material. Suitable materials are indicated on the wheel label. Before mounting the grinding or cutting-off wheel on the machine, ensure that the operating speed of the machine does not exceed the maximum operating speed as it is marked on the product.

WHEEL DIAMETER (mm)	SPEED CONVERSION FOLLOWING EN 12413								
	MAXIMUM OPERATING SPEED (RPM)								
	35	40	50	63	80	100	125	140	160
6	112000	128000	160000	201000					
8	84000	95500	120000	150500	191000				
10	67000	76500	95500	120500	153000	191000			
13	51500	58800	73500	92600	118000	147000	184000	206000	
16	41800	47800	59700	75200	95500	120000	150000	168000	191000
20	33500	38200	47800	60200	76500	95500	120000	134000	153000
25	26800	30600	38200	48200	61200	76500	95500	107000	123000
32	20900	23900	30000	37600	48000	60000	75000	84000	95500
40	16750	19100	23900	30100	38200	47200	59700	67000	76500
50/51	13400	15300	19100	24100	30600	38200	47750	53500	61200
63/65	10650	12150	15200	19100	24300	30250	37900	42500	48500
76	8800	10100	12600	15850	20150	25150	31450	35200	40250
80	8400	9550	12000	15100	19100	23900	29850	33500	38200
85	7900	9000	11250	14200	18000	22500	28100	31500	36000
100/102	6700	7650	9550	12100	15300	19100	23900	26800	30600
115	5850	6650	8350	10500	13300	16650	20800	23250	26600
125	5350	6150	7650	9650	12250	15300	19100	21400	24500
150/152	4500	5100	6400	8050	10200	12700	16000	17850	20400
180	3750	4250	5350	6700	8500	10650	13300	14900	17000
200	3350	3850	4800	6050	7650	9550	11950	13400	15300
230	2950	3350	4200	5250	6650	8350	10400	11650	13300
250/254	2700	3100	3850	4850	6150	7650	9550	10700	12250
300/305	2250	2550	3200	4050	5100	6400	8000	8950	10200
350/356	1950	2200	2750	3450	4400	5500	6850	7650	8750
400/406	1700	1950	2400	3050	3850	4800	6000	6700	7650
450/457	1500	1700	2150	2700	3400	4250	5350	5950	6800
500/508	1350	1550	1950	2450	3100	3850	4800	5350	6150
600/610	1150	1300	1600	2050	2550	3200	4000	4500	5100
750/762	895	1050	1300	1650	2050	2550	3200	3600	4100
800/813	840	960	1200	1550	1950	2400	3000	3350	3850
900/914	750	850	1100	1350	1700	2150	2700	3000	3400
1000/1020	670	765	960	1250	1550	1950	2400	2700	3100

TROUBLESHOOTING

CUTTING-OFF WHEELS

WHEEL DOES NOT CUT

Cause	In case of blue cutting: wheel too hard or too thick
Solution	Use softer or Norton Thin Cut wheels, check peripheral speed
Cause	Peripheral speed too low
Solution	Increase rpm up to max. (80m/sec)

EXCESSIVE WEAR

Cause	In case of white cutting edge: wheel too soft
Solution	Use harder wheel
Cause	Operating speed too low
Solution	Increase rpm up to max (80m/sec)
Cause	Decrease of rpm during cutting
Solution	Use machine with more power, reduce pressure on the machine

CRUMBLED WHEEL EDGE

Cause	Cutting-off wheel used for grinding operations
Solution	Use a grinding wheel for grinding operations
Cause	Workpiece is moving
Solution	Clamp the workpiece properly
Cause	Too much side-pressure
Solution	Add only the radial pressure to the wheel

ARBOR HOLE OR CENTRE BREAK OUT

Cause	Wheel sticks in the workpiece/material
Solution	Use more radial pressure & swing the wheel forwards and backwards
Cause	Cutting-off wheel used for grinding operations
Solution	Use a grinding wheel for grinding operations
Cause	Too much side pressure
Solution	Add only the radial pressure to the wheel
Cause	Different diameter top/bottom flange
Solution	Use flanges with the same diameter

GRINDING WHEELS

WHEEL DOES NOT CUT

Cause	Wheel too hard, wheelglazing
Solution	Use softer wheel
Cause	Not enough pressure
Solution	Increase pressure
Cause	Machine power too low
Solution	Use machine with more power
Cause	Loading & wheelglazing (non-ferrous)
Solution	Use Norton Alu wheels which counteract loading & wheelglazing

EXCESSIVE WHEELWEAR

Cause	Wheel too soft
Solution	Use harder wheel
Cause	Too much pressure
Solution	Reduce pressure, let the wheel do the grinding
Cause	Decrease of peripheral speed
Solution	Use machine with more power, reduce pressure on the machine
Cause	Too low peripheral speed
Solution	Max. 80m/sec is optimum speed

CRUMBLED WHEEL EDGE

Cause	Grinding angle too flat
Solution	Change angle to 30 - 40°
Cause	Workpiece is moving
Solution	Clamp the workpiece properly
Cause	Too much pressure
Solution	Reduce pressure, let the wheel do the grinding

CRACKS ON THE BOTTOM OF THE WHEEL

Cause	Contact area too large
Solution	Reduce contact area
Cause	Too much pressure
Solution	Reduce pressure, let the wheel do the grinding

UNBALANCE

Cause	Dirty flanges
Solution	Clean flanges
Cause	Wheel mounting insecure
Solution	Tighten flanges
Cause	Flanges with different diameter
Solution	Replace flanges

SAFETY ADVICE

DOs

✓	DO	Always handle & store wheels carefully. Cutting-off wheels should be stacked horizontally & flat, preferably on a steel base plate. Depressed centre wheels should be placed on top of each other or stored in the original packaging
✓	DO	Always visually inspect all wheels before mounting for possible damage in transit
✓	DO	Always use a safety guard & ensure that it is correctly positioned & securely fitted. It should cover at least one half of the wheel & protect the operator in the unlikely event of a wheel breakage. NON-REINFORCED CUTTING-OFF WHEELS SHOULD ONLY BE USED ON FIXED MACHINES & SHOULD BE CORRECTLY GUARDED.
✓	DO	Always switch 'OFF' the power at supply source &/or remove the plug from the socket before changing the wheel
✓	DO	Always ensure that the spindle speed of the machine does not exceed the operating speed marked on the wheel
✓	DO	Always use the correct wheel mounting flanges & ensure that they are undamaged, clean & free from burrs
✓	DO	SEE EN 12413
✓	DO	Allow newly mounted wheels to run at operating speed, with the guard in place, for a reasonable time before cutting or grinding
✓	DO	Always wear EYE PROTECTION
✓	DO	Always wear appropriate safety clothing such as DUST MASK, GLOVES, EAR PROTECTION, OVERALLS & SAFETY SHOES
✓	DO	Always have machine speeds checked regularly, especially after maintenance or repair. Machines fitted with speed control devices (Governors), must be properly maintained at all times
✓	DO	Check tension of driving belts, where fitted, on a regular basis. Belts must be kept tight to ensure full power transmission.
✓	DO	Always secure the workpiece firmly while it is being cut or ground
✓	DO	Put portable machines in suitable cradles, when not being used, to avoid damage to the wheel
✓	DO	Always use a portable machine in a comfortable position, where the workpiece is well balanced & the machine is well supported
✓	DO	Grind at an angle above 30 degrees to the workpiece with a depressed centre grinding wheel
✓	DO	Keep the working area around cutting & grinding operations clear. It is very dangerous if an operator trips & falls with an operating machine in his hands

DON'Ts

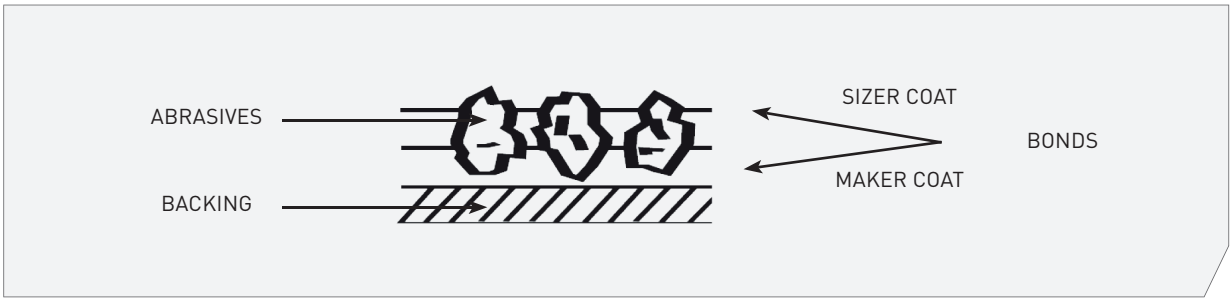
✘	DON'T	Handle wheels roughly
✘	DON'T	Use non-reinforced cutting-off wheels on portable machines
✘	DON'T	Store wheels in a damp atmosphere or in extreme temperatures
✘	DON'T	Mount a damaged wheel
✘	DON'T	Tighten the mounting nut or locking flange excessively. To do so can distort the flanges
✘	DON'T	Force a wheel onto a machine spindle
✘	DON'T	Use mounting flanges which are incorrect, damaged, dirty or burred
✘	DON'T	Use blotters with depressed centre wheels less than or equal to 406mm (EN 12413)
✘	DON'T	Use a machine which is not in good mechanical condition
✘	DON'T	Use a machine without a wheel guard
✘	DON'T	Use wheels without proper ventilation or dust protection equipment
✘	DON'T	Apply side pressure to cutting-off wheels. You should not bend the wheel
✘	DON'T	Stop the wheel by applying pressure to the periphery or face. Always switch the machine off & allow the wheel to stop revolving
✘	DON'T	Allow the wheel to be trapped or pinched in the cut
✘	DON'T	Apply excessive pressure onto the wheel so that the driving motor slows down
✘	DON'T	Grind on the side of cutting-off wheels or depressed centre wheels below 4,0mm thickness
✘	DON'T	Drop or lower a portable machine by the cable or airline onto the floor. A wheel can be easily cracked, if it is put down hard, by the weight of the machine. This is a common cause of wheel breakage
✘	DON'T	Grind with a depressed centre grinding wheel at an angle below 30 degrees to the workpiece
✘	DON'T	Use a machine in a position where you do not have full control of the machine & you are not well balanced

COATED ABRASIVES

TECHNICAL INFORMATION

WHAT IS A COATED ABRASIVE?

Modern coated abrasives are the product of an extremely technical process developed through many years of research and development. They remain, however, a product composed of three basic elements: a flexible or semi-rigid backing to which abrasive grains are bonded by an adhesive.



ABRASIVE TYPES

The ideal abrasive grain offers maximum resistance to point wear, yet fractures before serious dulling occurs, thereby satisfying both stock removal and finishing requirements.

SYNTHETIC ABRASIVES

- Aluminium oxide is tough and well adapted to grinding high tensile materials, such as carbon steel, alloy steels, tough bronze and hard woods. Wherever toughness (ability to resist fracturing) is the main consideration, aluminium oxide out performs all other coated abrasive grains
- Silicon carbide is the hardest and sharpest of the minerals used in coated abrasives. Its hardness and sharpness make it the ideal abrasive for sanding non-ferrous metals (aluminium, brass, bronze, magnesium, titanium, etc.), rubber, glass, plastics, fibrous woods, enamel and other relatively soft materials. Silicon carbide is superior to any other abrasive in its ability to penetrate and cut faster under light pressure
- Zirconia alumina has a unique self-sharpening characteristic which gives it long life on rugged stock removal operations. Zirconia alumina is well suited for heavy grinding of metals and planing of wood, because the controlled fracturing of the grain continuously produces sharp, new abrading points
- Ceramic aluminium oxide is a long-lasting, tough, dense abrasive due to its micro structure. The extremely small micron size particles break off during grinding, producing multiple new cutting edges. As it stays sharp, especially when used in medium and high pressure operations, it cuts at a higher rate than other abrasives. Recommended for use on forged and carbon steels, high nickel and cobalt alloys

NATURAL ABRASIVES

- Emery is a natural composite of corundum and iron oxide. The particles are blocky in shape and tend to cut slowly, thereby producing a polishing action on the material being abraded. Used for general maintenance and polishing of metals and in very fine grits for highly technical polishing, such as preparing metallurgical specimens requiring very close tolerances. Emery products are black in colour

ABRASIVE GRAIN DISTRIBUTION

There are two types of abrasive grain coverage on the backing:

- Openly spaced distribution where between 30% and 60% of the backing is covered leaving large spaces between each abrasive grain. It is used in operations where the grinding swarf would otherwise 'load' or clog the surface, reducing cutting efficiency and shortening the coated abrasive life
- Closely packed grain distribution is where the grain completely covers the backing. The greater number of abrading points in a given area leads to faster stock removal. It is recommended where loading is not a problem and where smoother surface finishes are desired

ABRASIVE GRAIN SIZE

After the crude abrasives have been crushed, the grains are separated (graded) into standard particle sizes using screens carefully made from silk threads of exact size and number per square inch to ensure extreme accuracy. The grit number (mesh number) appearing on the coated abrasive backing represents the number of openings per linear inch in the final screen. Grits 240 and finer, called flours, are graded by hydraulic separators, air classifiers and levigating tanks.

The European standard of grit sizes is the FEPA grading system. All FEPA grit sizes are preceded with the letter 'P', i.e. P180 etc.

In the USA a different grading system called CAMI is used. This chart provides a comparison between FEPA and CAMI grades and also shows average particle sizes in microns and inches.

Additionally, some products produced for the woodworking and floor sanding markets are identified with a 'grit symbol'. Although use of this symbol is infrequent, the backing of these products contain both the mesh number and the grit symbol.

PARTICLE SIZE IN INCHES	PARTICLE SIZE IN MICRON	ALUMINIUM OXIDE, GARNET, SILICON CARBIDE, ZIRCONIA ALUMINA			EMERY		GLASS PAPER
		GRADING SYSTEMS		COMP. GRIT SYMBOL	POLISHING PAPER	CLOTH	
		CAMI	FEPA				
,0000118	0,3	–	–	–	–	–	–
,0000197	0,5	–	–	–	–	–	–
,0000394	1,0	–	–	–	–	–	–
,0000787	2,0	–	–	–	–	–	–
,000118	3,0	–	–	–	–	–	–
,000158	4,0	–	–	–	–	–	–
,000197	5,0	–	–	–	–	–	–
,000236	6,0	–	–	–	–	–	–
,00026	6,5	1200	–	–	–	–	–
,00035	9,0	–	–	–	–	–	–
,00036	9,2	1000	–	–	–	–	–
,00047	12,0	–	–	–	–	–	–
,00048	12,2	800	–	–	4/0	–	–
,00059	15,0	–	–	–	–	–	–
,00060	15,3	–	P1200	–	–	–	–
,00062	16,0	600	–	–	3/0	–	–
,00071	18,3	–	P1000	–	–	–	–
,00077	19,7	500	–	–	2/0	–	–
,00079	20,0	–	–	–	–	–	–
,00085	21,8	–	P800	–	–	–	–
,00092	23,6	400	–	10/0	0	–	–
,00098	25,0	–	–	–	–	–	–
,00100	27,75	–	P600	–	–	–	–
,00112	28,8	360	–	–	–	–	–
,00118	30,0	–	–	–	–	–	–
,00118	30,2	–	P500	–	–	–	–
,00137	35,0	–	P400	–	–	–	–
,00140	36,0	320	–	9/0	–	–	–
,001575	40,0	–	–	–	–	–	–
,00158	40,5	–	P360	–	–	–	–
,00172	44,0	280	–	8/0	1	–	–
,00177	45,0	–	–	–	–	–	–
,00180	46,2	–	P320	–	–	–	–
,00197	50,0	–	–	–	–	–	–

ABRASIVE GRAIN SIZE

PARTICLE SIZE IN INCHES	PARTICLE SIZE IN MICRON	ALUMINIUM OXIDE, GARNET, SILICON CARBIDE, ZIRCONIA ALUMINA			EMERY		GLASS PAPER
		GRADING SYSTEMS		COMP. GRIT SYMBOL	POLISHING PAPER	CLOTH	
		CAMI	FEPA				
,00204	52,5	–	P280	–	–	–	–
,00209	53,5	240	–	7/0	–	–	–
,00217	55,0	–	–	–	–	–	–
,00228	58,5	–	P240	–	–	–	–
,0023	60,0	–	–	–	–	–	–
,00254	60,5	–	P220	–	–	–	–
,00257	66,0	220	–	6/0	2	–	–
,00304	78,0	180	P180	5/0	3	–	00
,00363	93,0	150	–	4/0	–	Fine	–
,00378	97,0	–	P150	–	–	–	0
,00452	116,0	120	–	3/0	–	–	–
,00495	127,0	–	P120	–	–	–	1
,00550	141,0	100	–	2/0	–	Medium	–
,00608	156,0	–	P100	–	–	–	1½
,00749	192,0	80	–	0	–	–	–
,00768	197,0	–	P80	–	–	–	F2
,01014	260,0	–	P60	–	–	–	M2
,01045	268,0	60	–	1/2	–	Coarse	–
,01271	326,0	–	P50	–	–	–	S2
,01369	351,0	50	–	1	–	–	–
,01601	412,0	–	P40	–	–	–	2½
,01699	428,0	40	–	-1½	–	–	–
,02044	524,0	–	P36	–	–	–	36
,02087	535,0	36	–	2	–	Extra coarse	–
,02426	622,2	–	P30	–	–	–	–
,02488	638,0	30	–	2½	–	–	–
,02789	715,0	24	–	3	–	–	–
,02886	740,0	–	P24	–	–	–	–
,03530	905,0	20	–	3½	–	–	–
,03838	984,0	–	P20	–	–	–	–
,05148	1320,0	16	–	4	–	–	–
,05164	1324,0	–	P16	–	–	–	–
,06880	1764,0	–	P12	–	–	–	–
,07184	1842,0	12	–	4½	–	–	–

NARROW BELTS & WIDE BELTS

The results achieved when sanding with belts depends on several factors including:

- The machine condition & available horsepower
- The belt speed
- The grinding pressure
- The contact wheel
- The choice of the belt in relation to the shape of the part & material type
- The use of coolant (when machine & belt allows)

BELT SPEED

The speed of the belt has a direct relationship with its cut rate, as well as the amount of heat generated, the surface finish achieved, and the stress on abrasive grain. Some abrasives like zirconia alumina and ceramic support much higher stresses because they have a better resistance to uncontrolled fracture. Some materials are more sensitive to heat generation. The chart below gives the recommended speed range according to material.

RECOMMENDED GRINDING BELT SPEED

Heat sensitive materials, plastics, etc.	5-15m/s	Stainless steel, high-speed steel & tool steel	20-30m/s
Sintered metals & carbides	8-15m/s	Grey cast iron & cast steel	30-40m/s
Titanium & similar alloys	8-15m/s	Carbon steel	30-40m/s
Glass, porcelain & special steel	8-15m/s	Brass, copper, zinc, bronze & tin	25-35m/s
Heat-resistant plastics	20-30m/s	Aluminium & light metal	20-35m/s
Wood	15-30m/s	Varnish	10-15m/s

GRINDING PRESSURE

The amount of grinding pressure depends on:

- The force used
- The size of the contact area between the belt & the workpiece
- The backing on which the belt runs (generally a contact wheel)

Higher pressure increases the cut rate and the amount of heat generated increases the stress on the individual abrasive grain (a minimum stress is necessary to achieve a controlled fracture of the abrasive grain), and generally generates a rougher finish.

CONTACT WHEELS

Many machines use contact wheels as a backing for belts. Contact wheels are generally covered with rubber, polyurethane, steel, rubber foam, felt, or compressed canvas, and are classified from soft to hard, with or without serrations. Using a different type of contact wheel has a direct effect on the end results.

- Harder contact wheels provide a higher cut rate, a rougher surface finish & generate a much more uniform surface than softer contact wheels. They are used with stiff belts for a faster cut
- Softer contact wheels provide lower cut rates, a better surface finish & follow the contours of the part. They are generally used for finishing contoured parts or for generating slightly rounded surfaces. They are much less hard wearing on the belt & its joint

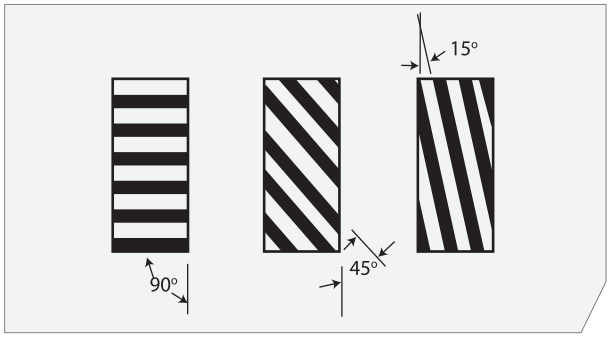
The design of the contact wheel will also have an effect on the contact area, which in turn affects grinding pressure.

- Contact wheels with a larger diameter act softer & should generally be used on larger surfaces
- Serrated contact wheels act harder but should generally be used on smaller surfaces

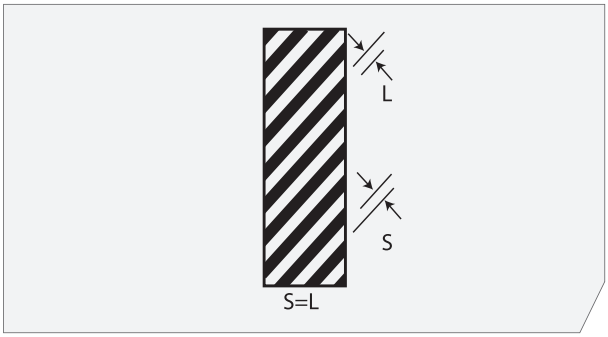
CONTACT WHEEL TYPES

HARD ⟷ SOFT

Aggressiveness increases as angle increases



Contact surface decreases as lands decrease giving a more aggressive, harder wheel



JOINT TYPES

Belts are made with a standard joint design best adapted to the product and its main application:

Butt joint with tape

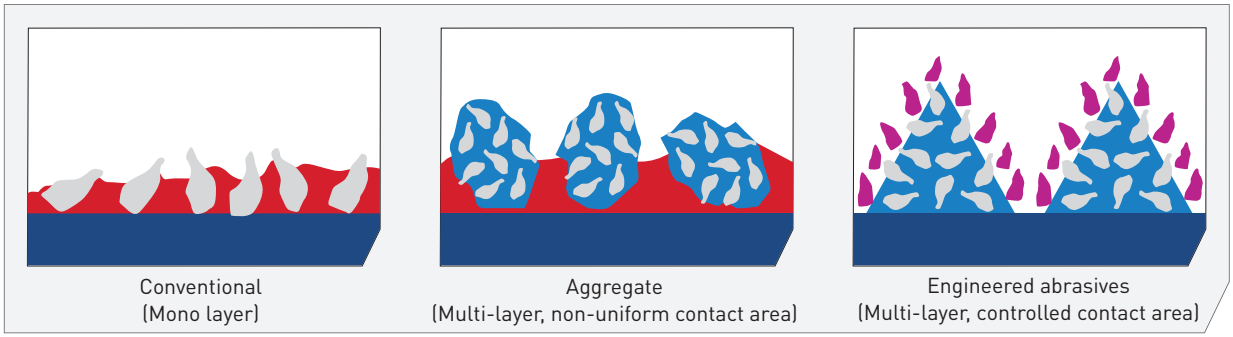
Overlap joint with no topskive

Overlap joint with extra topskive

NORaX AN INNOVATIVE TECHNOLOGY

NORaX is the innovative coated abrasive technology from Norton. The innovation lies in the abrasive layer: a multi-layer coating of abrasive is engineered into a 3D pattern. These patterns give a controlled contact surface between the abrasive and part that optimises belt performance.

NORaX works like a grinding wheel on a cloth backing. As the belt wears, dull abrasive particles are removed from the belt surface to expose a new layer of sharp abrasives. This continuous replacement of dulled abrasives results in longer life, higher cut rates, and a more consistent surface finish throughout the belt life. Also, contributing to this higher performance, NORaX is also covered with a surface powder grinding aid that increases cut and life while decreasing grinding temperature.



For more information on NORaX please contact your local Sales or Customer Service Representative.

BACKING TYPES

Whether paper, cloth, vulcanised fibre, a combination or polyester film, the backing must be smooth enough for uniform adhesive coating, strong enough to withstand grinding pressures and flexible enough to conform to contours (if necessary). For reasons of economy, the least expensive backing compatible with the job requirements should be selected.

PAPER

The standard paper weights used in coated abrasives are indicated by a letter code which appears immediately after the grit size on the finished product backing. Briefly stated, the lighter the backing, the greater the degree of flexibility; the heavier the backing, the greater the resistance to tearing.

A-weight (70gms)
Light and flexible, A-weight is used primarily for hand finishing operations both wet and dry. Grits 80 and finer.

C-weight (120gms)
Stronger and less flexible than A-weight. This backing is chosen for hand sanding, dry or wet, and for use on small portable power sanders. Intermediate through fine sanding. Grits 60 through 180.

D-weight (150gms)
Stronger and less flexible than C-weight. This backing is also chosen for hand sanding and for use on small portable power sanders. Coarse through intermediate sanding. Grits 36 through 80.

E-weight (220gms)
Stronger and less flexible than D-weight, this backing is used primarily on roll, belt and disc applications where high resistance to tearing is needed.

F-weight (300gms)
The strongest, least flexible paper backing utilised. Used for crankshaft lapping rolls, tannery industry belts and rolls, and NorZon belts only.

BACKING TYPES

CLOTH

Cloth backings are more durable than paper, offer greater resistance to tearing, and tolerate continual bending and flexing during use. Norton use traditional woven cloth in the manufacture of their coated abrasives. The backing has construction and finishing characteristics designed to make it ideally suited to a specific application. The standard cloth weights used in coated abrasives are indicated by a letter code which appears immediately after the grit size on the finished product backing.

J-weight
The lightest and most flexible cloth backing, this backing is used where finish and uniformity of the surface are more important than stock removal. Ideal for finishing, blending and where flexibility and conformity are required, such as contour work or curved surfaces.

X-weight
Stronger and relatively stiff when compared to J-weight, this backing is used on products designed for coarse grit stock removal applications through fine grit finishing and polishing. Consistent productivity, relatively good finishes and long product life are characteristics of products made on X-weight backings.

Y-weight
Stronger and more resistant to longitudinal splitting than regular drills cloth, Y-weight backing is used on products designed for severe applications, such as narrow belt grinding of hand tools and wide belts sanding of lumber and particleboard dimensioning.

FIBRE

Fibre backings, made of multiple layers of impregnated paper, are very hard and strong, yet provide sufficient flexibility for the intended applications. 0,8mm thick fibre has the greatest strength of any backing used for coated abrasives. This backing is used on resin bonded fibre discs designed for heavy duty portable grinding applications.

COMBINATION

Combination backing, constructed by laminating light cloth and stiff E-weight paper, is used where resistance to tearing and breaking is a requirement. Primarily utilised on products designed for chipboard/MDF sanding.

FILM

Polyester is used as the backing media for Norton's range of precision graded microfinishing products. Film backings can be used wet or dry and have excellent resistance to chemical attack, while being tear resistant and durable.

SPECIAL COATED SURFACE TREATMENT

NO-FIL TREATMENT

In order to provide even further resistance to loading, some Openkote paper products are given a special surface treatment of zinc stearate after the sizing operation. Such products are ideal for sanding between sealer coats on furniture, sanding after primer coats on automobiles, removing varnish from wood, and numerous other operations where conventional abrasive products fail prematurely due to loading.
Norton's trademark for products utilising this treatment is No-Fil.

SURFACE FINISH & GRINDING EFFICIENCY VARIABLES

SURFACE FINISH VARIABLES

Changes in any one of many factors can affect the surface finish generated by a product. The purpose of this chart is to show the effect on surface finish by changes in single factors of product specifications. Arrows have been used to signify the trend direction. The length of the arrows have no significance as the effect of each variable factor will not be the same. The chart is meant to be general in nature and to show direction or trend.

	VARIABLE FACTOR	ROUGH HIGHER RA READING				SMOOTH SURFACE LOWER RA READING
1.	Grit Size	Coarse				Fine
2.	C/A Product Condition	New				Used
3.	Adhesive Bond	Resin		Resin/Glue		Glue
4.	Coating Method	Open-Coated				Close-Coated
5.	Product Flex	Single Linear				Double Triple
6.	Contact Wheel Configuration	Serrated				Smooth
7.	Composition	Wider Groove Width Steel		Rubber		Wider Width Canvas
8.	Diameter	Smaller				Larger
9.	Belt Speed	Slower				Faster
10.	Grinding Aid	Dry	Water	Oil Solubles	Straight Oils	Grease
11.	Abrasive Mineral Type	Zirconia Alumina	Ceramic	Aluminium Oxide	Silicon Carbide	Emery
12.	Workpiece Hardness	Softer				Harder

CUTTING EFFICIENCY

Although general in nature, this chart can serve as a useful guide as to what effect a change in a single given factor in the specification will have on the cutting efficiency of coated abrasive products. Arrows have been used to signify the trend direction. The length of arrows has no significance. Some important machine and setup parameters have also been included since they do have significant impact on product performance.

	VARIABLE FACTOR	MORE AGGRESSIVE BETTER CUT				SMOOTH SURFACE LOWER RA READING
1.	Workpiece Feed Speed	Slower				Faster
2.	C/A Belt speed (m/s)	Slower				Faster
3.	Abrasive Product Condition	New				Used
4.	Grit Size	Coarse				Fine
5.	Product Durability	Fibre		Cloth		Paper
6.	Abrasive Mineral Type	Zirconia Alumina	Ceramic	Aluminium Oxide	Silicon Carbide	Emery
7.	Adhesive Bond	Resin		Resin/Glue		Glue
8.	Coating Method	Close-Coated				Open-Coated
9.	Contact Wheel Configuration	Serrated				Smooth
10.	Composition	Steel		Rubber		Canvas
11.	Diameter	Smaller				Larger
12.	Pressure	High				Low
13.	Grinding Aid	Oil	Soluble Oil		Water	Dry
14.	Workpiece Hardness	Softer				Harder

SAFETY ADVICE

SAFETY IN THE STORAGE & USE OF COATED ABRASIVES

TRANSPORT & STORAGE

All coated abrasives should be handled carefully. Damage can be caused by mishandling, which should be avoided.

Coated abrasives should be stored in dry, frost free conditions. They should be kept away from heat sources, cold, damp walls, doors or windows and should not be in direct contact with the floor. Temperatures and humidity should be between 18°C and 22°C and 45%-65% relative humidity. Coated abrasives should not exposed to direct sunlight. Products should be kept in their original packaging until immediately before use. Once unpacked, they should be stored in a way which avoids distortion.

PERSONAL PROTECTION

Safety goggles, ear defenders, safety gloves, dust masks and, if conditions are severe, additional face protection. Leather aprons and safety shoes must be worn.

GENERAL PRECAUTIONS

Safety instructions provided by the machine manufacturers must be followed. Where fitted, all guards, covers and hoods must be in place on the machine during grinding, and should not be modified in any way. Abrasives should not be used near inflammable material or in an environment where there is a risk of explosion.

Sparks should be directed away from the face and body, if possible towards the floor. Dust extraction equipment must be used whenever it is available. The instructions for use given by the abrasive manufacturer must be followed e.g. 'Not to be used without a support', or 'Not to be used for wet grinding'. The workpiece must be firmly fixed before grinding starts. Check all abrasives visually before use and make certain that the product is suitable for the application. No modifications should be made to abrasive products after delivery.

When using a portable grinder always switch it off and allow the spindle to stop completely before putting the tool down. Wet grinding should only be carried out on machines designed for this purpose and with abrasives designated as suitable for this type of operation.


Mouth Protection


Wear Gloves


Eye Protection


Ear Protection


Read Instructions


Dry


Wet

TUNGSTEN CARBIDE BURRS

DOs

✓	DO	Always operate the burr within the recommended speed range
✓	DO	Select the appropriate shape, diameter & cut style for the application
✓	DO	Ensure the appropriate grinder is used & that it is regularly maintained
✓	DO	Fix the maximum length of the burr in the collet (recommended max 10mm overhang)
✓	DO	Check that the burr is running true in the grinder before use
✓	DO	Securely fix workpiece & hold the grinder firmly
✓	DO	Use a smooth cutting action with constant movement in both directions. Use light pressure, letting the burr do the work
✓	DO	For best finish, always end on a reverse stroke

DON'Ts

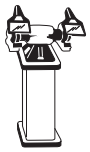
✘	DON'T	Run burr above the Maximum Operating Speed
✘	DON'T	Run burr too slowly (refer to recommended speed guide)
✘	DON'T	Allow burr to be exposed to excessive mechanical or thermal shock
✘	DON'T	Sink the burr to more than one-third of its periphery
✘	DON'T	Jam the burr into grooves, crevices & cavities
✘	DON'T	Allow burr to become too hot, causing braze to weaken (applies to burrs where head diameter is greater than shank diameter)
✘	DON'T	Apply shock or excessive force to the product or let it overheat

BEARTEX

PRODUCT SELECTION - BY MACHINE

STATIONARY MACHINES

Product selection guide & Starting Points recommendation

MACHINES		PRODUCT	DEBURRING	CLEANING	BLENDING & FINISHING	REQUIRED ACCESSORY
STRAIGHT SHAFT EQUIPMENT						
Bench Grinder		Plain Discs	n/a	F2303 HS Med A	F2520 VF A	n/a
		Convolute Wheels	D19 SF	DCS	DMA 5AM	Reduction Bushings
		Polybond Wheels	C150-H10BTM	n/a	C240-D4BTM	Reduction Bushings
		Flap Wheels	n/a	F2301 Med A	F2501 VF A	Reduction Bushings
		Unitised Wheels	U2301 8AM	U2401 6AF	U4401 2SF	Reduction Bushings
		Lap Mops	n/a	F2520 VF A	F2520 VF A	n/a
Pedestal Grinder		Plain Discs	n/a	F2303 HS Med A	F2520 VF A	n/a
		Convolute Wheels	D19 SF	DCS	DMA 5AM	Reduction Bushings
		Polybond Wheels	C150-H10BTM	n/a	C240-D4BTM	Reduction Bushings
		Flap Wheels	n/a	F2301 Med A	F2501 VF A	Reduction Bushings
		Unitised Wheels	U2301 8AM	U2401 6AF	U4401 2SF	Reduction Bushings
BELT EQUIPMENT						
Back Stand		Surface Blend Belts	DSB Coa or DSJ Ex Coa	DSJ Med	Superflex Med	n/a
Stroke Grinder		Surface Blend Belts	DSB Coa	DSJ Med	Superflex Med	n/a
Centerless Polisher		Surface Blend Belts	DSB Coa	DSJ Med	Superflex Med	n/a

MACHINES		PRODUCT	DEBURRING	CLEANING	BLENDING & FINISHING	REQUIRED ACCESSORY
FEED-THROUGH EQUIPMENT						
Sheet/Coil Processing Machine		Surface Blend Belts	DSB Coa	DSJ Med	Superflex Med	n/a
		Flap Wheels	n/a	F2301 Med A	F2501 VF A	Reduction Bushings
		Convolute Wheels	D18 SF	DCS	DMA 5AM	Reduction Bushings
Rotary Disc/ Planetary Disc Machine		Surface Blend Discs	DSB Coa	DSJ Med	DSJ Med	n/a
AUTOMATED EQUIPMENT						
Rotary Machine		Plain Discs	n/a	F2303 HS Med A	F2520 VF A	n/a
		Convolute Wheels	D18 SF	DCS	DMA 5AM	Reduction Bushings
		Polybond Wheels	C150-H10BTM	n/a	C240-D4BTM	Reduction Bushings
		Surface Blend Belts	DSB Coa	DSJ Med	Superflex Med	n/a
		Unitised Wheels	U2301 8AM	U2401 6AF	U4401 2SF	Reduction Bushings
		Flap Wheels	n/a	F2301 Med A	F2501 VF A	Reduction Bushings
Straight-Line Machine		Plain Discs	n/a	F2303 HS Med A	F2520 VF A	n/a
		Convolute Wheels	D18 SF	DCS	DMA 5AM	Reduction Bushings
		Polybond Wheels	C150-H10BTM	n/a	C240-D4BTM	Reduction Bushings
		Surface Blend Belts	DSB Coa	DSJ Med	Superflex Med	n/a
		Unitised Wheels	U2301 8AM	U2401 6AF	U4401 2SF	Reduction Bushings
		Flap Wheels	n/a	F2301 Med A	F2501 VF A	Reduction Bushings
Centerless Polisher		Surface Blend Belts	DSB Coa	DSJ Med	Superflex Med	n/a
		Convolute Wheels	D18 SF	DCS	DMA 5AM	Reduction Bushings
		Polybond Wheels	C150-H10BTM	n/a	C240-D4BTM	Reduction Bushings

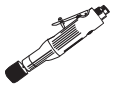
SPEC CHECK

SPEC CHECK
Did you pick the most efficient solution?
The most cost effective method usually involves getting the job done fast and efficiently.
The most dramatic savings come from labour expenses, rather than material costs.

MACHINES		PRODUCT	DEBURRING	CLEANING	BLENDING & FINISHING	REQUIRED ACCESSORY
AUTOMATED EQUIPMENT						
Robotic Equipment		Surface Blend Discs	DSB Coa	DSJ Med	DSJ Med	n/a
		Convolute Wheels	D18 SF	DCS	DMA 5AM	Reduction Bushings
		Polybond Wheels	C150-H10BTM	n/a	C240-D4BTM	Reduction Bushings
		Surface Blend Belts	DSB Coa	DSJ Med	Superflex Med	n/a
		Flap Wheels	n/a	F2301 Med A	F2501 VF A	Reduction Bushings
		Plain Discs	n/a	F2303 HS Med A	F2520 VF A	n/a
		Unitised Wheels	U2301 8AM	U2401 6AF	U4401 2SF	Reduction Bushings

PORTABLE MACHINES

MACHINES		PRODUCT	DEBURRING	CLEANING	BLENDING & FINISHING	REQUIRED ACCESSORY
STRAIGHT-SHAFT TOOLS						
Drill		Plain Discs	n/a	F2303 HS Med A	F2520 VF A	Mandrels
		Convolute Wheels	D16 SF	DCS	DMA 5AM	Mandrels
		Polybond Wheels	C150-H10BTM	n/a	C240-D4BTM	Mandrels
		Flap Wheels (Spindle)	n/a	F2301 Med A	F2501 VF A	n/a
		Unitised Wheels	U2301 8AM	U2401 6AF	U4401 2SF	Mandrels
		RapidStrip Wheels/Discs	n/a	R4101 S Ex Coa	n/a	Mandrels
		Lap Mops	n/a	F2520 VF A	F2520 VF A	XL Mandrels
Straight-Shaft Grinder		Plain Discs	n/a	F2303 HS Med A	F2520 VF A	Mandrels
		Convolute Wheels	D19 SF	DCS	DMA 5AM	Mandrels
		Unitised Wheels	U2301 8AM	U2401 6AF	U4401 2SF	Mandrels
		RapidStrip Wheels	n/a	R4101 S Ex Coa	n/a	Mandrels
		Flap Wheels (Spindle)	n/a	F2301 Med A	F2501 VF A	n/a

MACHINES		PRODUCT	DEBURRING	CLEANING	BLENDING & FINISHING	REQUIRED ACCESSORY
STRAIGHT-SHAFT TOOLS						
Die Grinder		Flap Wheels (Spindle)	n/a	F2301 Med A	F2501 VF A	n/a
		Unitised Wheels	U2301 8AM	U2401 6AF	U4401 2SF	Mandrels
		Lap Mops	n/a	F2520 VF A	F2520 VF A	XL Mandrels
Flexible-Shaft Motor e.g. Suhner, Biax		Plain Discs	n/a	F2303 HS Med A	F2520 VF A	Mandrels
		Convolute Wheels	D16 SF	DCS	DMA 5AM	Mandrels
		Polybond Wheels	C150-H10BTM	n/a	C240-D4BTM	Mandrels
		Surface Blend Belts	DSB Coa	DSJ Med	Superflex Med	n/a
		Unitised Wheels	U2301 8AM	U2401 6AF	U4401 2SF	Mandrels
		RapidStrip Wheels	n/a	R4101 S Ex Coa	n/a	Mandrels
		Flap Wheels	n/a	F2301 Med A	F2501 VF A	Mandrels
RIGHT ANGLE TOOLS						
Right Angle Grinder/ Polisher		Surface Blend Discs	DSB Coa	DSJ Med	DSJ Med	Self-Grip back up pads
		RapidStrip DPC discs	n/a	R4101 S Ex Coa	n/a	n/a
		RapidFinish DPC discs	U2301 2AM	F2303 HS Med A	U4401 2SF	n/a
		SpeedLok Discs	DSB Coa	R4101 S Ex Coa	DSJ Med	SpeedLok Holders
Vertical Grinder		Surface Blend Discs	DSB Coa	DSJ Med	DSJ Med	Self-Grip back up pads
Right Angle Die Grinder/ Mini Grinder		SpeedLok Discs	DSB Coa	R4101 S Ex Coa	DSJ Med	SpeedLok Holders
		Specialised SpeedLok discs	U2301 6AM	F2303 HS Med A	U4401 2SF	SpeedLok Holders
Satinex machine		Satinex Wheels	F2200 A Coa	R4101 S Ex Coa	F2300 Med A	n/a

MACHINES		PRODUCT	DEBURRING	CLEANING	BLENDING & FINISHING	REQUIRED ACCESSORY
BELT TOOLS						
File		Surface blend File belts	DSB Coa	DSJ Med	Superflex Med	n/a
Portable Belt Sander		Surface Blend Belts	DSB Coa	DSJ Med	Superflex Med	n/a
Expander Wheel		Surface Blend Belts	DSB Coa	DSJ Med	Superflex Med	n/a
VIBRATING TOOLS						
Orbital Sander		Plain Discs	n/a	F2303 HS Med A	F2520 VF A	Self-Grip back up pads
		Surface Blend Discs	DSB Coa	DSJ Med	DSJ Med	Self-Grip back up pads
Straight-Line Sander		Hand Pads	F2302 Extra Cut A	F2504 VF A LL	F4804 UF S	n/a
		Rolls	F2300 Med A	F2504 VF A LL	F4804 UF S	n/a
HAND PAD / MANUAL SANDING						
Hand Applications		Hand Pads	F2302 Extra Cut A	F2504 VF A LL	F4804 UF S	n/a
		Rolls	F2300 Med A	F2504 VF A LL	F4804 UF S	n/a
		Sheets	F2302 Extra Cut A	F2504 VF A LL	F4807 UF S	n/a

Warning - Do not use a product which was not designed specifically for that tool.
Always verify that the speed rating of the product meets or exceeds the rating of the tool!

SPEC CHECK

SPEC CHECK
Starting point recommendations can vary depending on the level of aggression required, by choosing a different product grade
Depending upon performance results, other specifications may be substituted on the basis of product testing.
The best practice is to test at least 2 variations of specifications to obtain the desired result.

Ask your Norton contact for more advice.

PRODUCT SELECTION- BY APPLICATION

SHORTCUT TO FINDING THE RIGHT PRODUCT...

For deburring or cleaning/finishing, or on completely new operations, the product specifications listed below are recommended as starting points.

Depending upon performance results, other specifications may be substituted on the basis of product testing.

We believe that the best practice is to test at least 2 variations of specifications to obtain the desired result.

DEBURRING

Medium Burrs	Light Burrs
CONVOLUTE WHEELS	
Series 1000 Long Life 1 - 8 SF C4408	Series 1000 Long Life 1 - 7 SF C4408
or (for extra cut)	
Series 1000 Long Life 1 - 9 SF C4408	
UNITISED WHEELS	
NEX -6AM (or 8AM) U2301	NEX -2SF U4401
For Ti and Aerospace Alloys, use 6SF U4401	
RIGHT ANGLE DISCS	
Surface Blending DSJ or DSB	Surface Blending DSJ
Aluminium Oxide 120 Medium	Aluminium Oxide 320 Very Fine
HAND PADS	
F2302 Heavy Duty Extra Cut Tan Pad	F2504 VFA LL Maroon General Purp Pad

WOOD CONDITIONING

Sanding and Shaping	Finishing and Rubbing
CONVOLUTE WHEELS	
Series 1000 Long Life 1 - 8 SM C4308	F2801 Micro Fine S Gold Pad

CLEANING AND FINISHING

Clean / Medium Grain Finishing	Fine Grain Finishing
CONVOLUTE WHEELS	
DSS Surf Fin S/C Med Wheel C4302	DCS Clean/Finish S/C Fine Wheel C4401
or	or
Series 1000 Long Life 1 - 6 SM, C4308	Series 1000 Long Life 1 - 6 SF C4408
UNITISED WHEELS	
NEX -4AF U2401	NEX -2SF U4401
FLAP WHEELS	
Med Grit Aluminium Oxide F2301	Fine Grit Aluminium Oxide F2401
Medium Density Flap Wheel	Medium Density Flap Wheel
HAND PADS	
F2504 VFA LL Maroon General Purp	F2801 Micro Fine S Gold Pad
or	
F4300 Medium S Pad for stainless steel	

HAND PAD APPLICATIONS

Heavy Duty Cleaning & rust removal	Medium Cleaning	Light Cleaning & Finishing
HAND PADS		
F2302 Heavy Duty Extra Cut Pad Tan	F2504 VFA LL General Purpose Pad Maroon	F2801 Mfine S Pad Gold

MATERIAL IDENTIFICATION

PRODUCT SHAPE	COLOUR	GRADE	GRIT TYPE	SIZE	FIBRE	STRENGTH
Flastock - Hand Pads - Rolls	White	White Cleaning	None	None	Polyester	Least Aggressive - Most Aggressive
	Green	General Purpose Clean & Scour	Aluminium Oxide	320	Nylon	
	Gold	Micro Fine A	Aluminium Oxide	1000		
	Gray	Ultra Fine S	Silicon Carbide	800		
	Maroon	Very Fine A	Aluminium Oxide	320		
	Maroon	Fine A	Aluminium Oxide	180		
	Maroon	Medium A	Aluminium Oxide	120		
	Brown	Extra Cut	Aluminium Oxide	80		
	Black	Medium S	Silicon Carbide	60		
Bearflex	Gold	Micro Fine A	Fused Alumina	1000	Nylon	
	Maroon	Very Fine A	Aluminium Oxide	600		
	Gray	Ultra Fine S	Silicon Carbide	320		
High Strength	Maroon	Very Fine A	Aluminium Oxide	280	Nylon	
	Maroon	Medium A	Aluminium Oxide	100		
Surface Blending SCM Discs and Belts	Gray	Super Fine	Silicon Carbide	600	Nylon	Least Aggressive - Most Aggressive
	Blue	Very Fine A	Aluminium Oxide	180		
	Maroon	Medium	Aluminium Oxide	100		
	Maroon	Heavy Medium	Aluminium Oxide	80		
	Brown	Coarse	Aluminium Oxide	50		
	Dark Brown	Extra Coarse	Aluminium Oxide	46		
Rapid Strip	Black	Extra Coarse	Silicon Carbide	36	Nylon	
Floor Pads Thick Line General Purpose	White	White Super Gloss	None		Nylon	Least Aggressive - Most Aggressive
	Beige	Beige Polish &Burnish	Aluminium Oxide			
	Maroon	Red Buffer	Aluminium Oxide			
	Blue	Blue Super Clean	Aluminium Oxide			
	Green	Green Super Scrub	Aluminium Oxide			
	Black	Black Super Strip	Aluminium Oxide			
Floor Pads Thin Line General Purpose	White	White	None		Nylon	Least - Most Aggressive
	Tan	Tan	Aluminium Oxide			
	Green	General Purpose Pad	Aluminium Oxide			
	Black	Black Strip	Aluminium Oxide			

Finishing characteristics of non-woven abrasives are determined by many attributes in addition to grain size, the data provided here is for reference only - and cannot be considered as a specification of our products.
Sizes - colours are approximate.

SAFETY ADVICE - DO'S & DON'TS

For your safety you should ensure that you are fully aware of how to safely use abrasives

✓	DO	Read the safety instructions provided by the abrasives and equipment supplier
✓	DO	Store abrasives in dry, frost-free conditions avoiding wide variations in temperature
✓	DO	Ensure that the product is suitable for its purpose
✓	DO	Handle, store and transport products with care
✓	DO	Disconnect the power to the machine before fitting the product
✓	DO	Examine all products before mounting and periodically during use for possible defects or damage (core flatness, fatigue cracks, undercutting, arbor hole damage...)
✓	DO	Check that correct mounting devices are used and that they are clean, undistorted and free from burrs
✓	DO	Ensure that work rests are properly adjusted and secure
✓	DO	Always use a correctly designed and adjusted guard (on belts)
✓	DO	Ensure that the workpiece is secure
✓	DO	Wear appropriate personal protective equipment at all times
✓	DO	Avoid clogging and uneven wear to ensure that the product is working efficiently
✓	DO	Ensure accordance between product direction arrow / machine rotation
✓	DO	Ensure that all machines using abrasives meet the requirements of the current european machinery directives-CE
✓	DO	Be aware of the hazards likely during the use of abrasives and observe the recommended precautions to be taken: • Bodily contact with the abrasive product at operating speed • Injury resulting from product breakage during use • Grinding debris, sparks, fumes and dust generated by the grinding process • Noise • Vibration

SAFETY ADVICE - DO'S & DON'TS

For your safety you should ensure that you are fully aware of how to safely use abrasives.

✘	DON'T	Allow untrained people to use abrasives
✘	DON'T	Use a product that is damaged
✘	DON'T	Use a product if it cannot be properly identified
✘	DON'T	Use a machine that is not in good working order or one with defective parts
✘	DON'T	Force the abrasive onto the mounting device or modify the size of the mounting hole
✘	DON'T	Exceed the maximum operating speed marked on the product
✘	DON'T	Apply shock or excessive force to the product or let it overheat
✘	DON'T	Use mounting flanges which are not clean and flat
✘	DON'T	Tighten the mounting device excessively
✘	DON'T	Start the machine until the guard is in place and fastened securely
✘	DON'T	Continue to use a product if vibration occurs. True or replace it
✘	DON'T	Grind on the part of the product which is not designed for the operation
✘	DON'T	Start the machine with the workpiece in contact with the abrasive product
✘	DON'T	Grind material for which the product is not designed
✘	DON'T	Stop the abrasive by applying pressure to its surface, let it stop naturally
✘	DON'T	Wear loose clothing, ties and jewellery
✘	DON'T	Use abrasive products near flammable materials

BONDED ABRASIVES

TECHNICAL INFORMATION

WHAT IS A GRINDING WHEEL?

A grinding wheel is a precision tool with thousands of cutting points. It consists of abrasive grains held in a matrix of bond and separated by pores. The abrasive grains are the cutting points while the purpose of the bond is to hold the individual grains together. The pores (hollow spaces between adjacent abrasive grains and the bond) serve to provide clearance for coolant penetration and metal chips removed in the grinding process.

When the wheel is rotated at grinding speed and applied to the workpiece, the abrasive grains cut the material that is being ground, removing the material in small chips.

Under the action of the forces imposed during grinding the abrasive cutting points are worn flat, resulting in the points becoming blunt. This causes an increase in friction, and a build up of heat.

The increase in grinding forces causes either the abrasive to fracture, exposing new cutting edges, or fractures the bond bridges holding the abrasive grains. In the latter case fresh abrasive grains are exposed to cut the workpiece.

In normal vitrified grinding applications the wheel has to be dressed.

By varying the properties of the abrasive, the type of bond, the make-up of the wheel, it is possible to produce grinding wheels with a vast range of different grinding characteristics.

ABRASIVES

Modern synthetic abrasives allow accurate control over the physical properties and form of the abrasive grain. This helps to ensure that grinding wheels can be manufactured with consistent cutting properties.

Norton offers a comprehensive selection of abrasive types to provide a wide range of specific grinding characteristics. This is necessary for maximum efficiency in the large variety of operations demanded by the industry today.

Abrasive Grain Size

The grain or grit size is most important in determining a wheel's ability to achieve the required surface finish and remove stock. The size is designated by a number which increases as grain size decreases.
For example 10 grit has a median size of about 2,0mm and 60 grit 0,25mm.

Standard sizes are used in all Norton wheels as specified in the European Standards laid down by FEPA.

An ideal grinding abrasive has the ability to stay sharp with minimum point dulling, and when dulling begins it fractures revealing new sharp cutting edges. Abrasive grains used in the manufacture of bonded abrasives come in three main categories.

UNDERSTANDING THE SPECIFICATION

ABRASIVE			GRIT SIZE			GRADE			STRUCTURE		BOND
ALUMINIUM OXIDE	SILICON CARBIDE	CERAMIC ALUMINIUM OXIDE	COARSE	MEDIUM	FINE	SOFT	MEDIUM	HARD	CLOSED	OPEN	
A	37C	SGB	12	30	80	E	I	Q	5	10	VS
19A	39C	3SG	16	36	90	F	J	R		11	VXP
25A		5SG	20	46	100	G	K	S		12	VXPM
38A		1TGP	24	54	120	H	L	T			VTECH
40A				60			M				
57A				70			N				
86A							O				
IPA				60				EH		17	VTX
								XH		20	
		ES5		60	80		J	L			VX
							K				

ABRASIVE TYPES

ABRASIVE TYPE	DESCRIPTION
A	This is a particularly tough form of aluminium oxide. Its toughness is due to the presence of 3% of titanium oxide in the abrasive. Fired at low temperature the abrasive retains its natural brown colour. Fired at high temperature further oxidation of the titanium oxide takes place which changes the normal brown colour to a grey-blue. Because of its toughness, regular brown alumina is suitable for grinding high tensile strength materials, specifically off-hand grinding (bench grinding wheels) & sharpening stones.
19A	A blend of A & 38A abrasives. This abrasive gives a grinding action that can be compared to the average of its components. It is supplied in some standard tool room wheels, used for surface, cylindrical, centreless & miscellaneous grinding on less heat sensitive steels.
38A	White fused aluminium oxide (99,8% pure). The most friable & cool cutting of the aluminium oxides. This abrasive is supplied in all types of standard range wheels ideal for use on hard & heat sensitive steels & alloys. It has traditionally been used for sharpening high-speed steel & cast alloy tools & cutters. 38A is used for cylindrical, surface & internal grinding of tools, dies & gauges.
57A	Semi-pure brown fused aluminium oxide (98% pure). The higher purity of 57A makes it a good general purpose abrasive. Its versatility enables it to be used for grinding steel parts in both soft & hard states, especially on large cylindrical & centreless operations. U Treatment (U57A) is a ceramic coating applied to this abrasive to increase its durability in resin bonded cutting-off wheels. It is used in the advanced range resinoid cut-off wheels.
86A	Pink aluminium oxide is a highly refined form of alumina containing a small proportion of chromium oxide. This addition makes 86A a little tougher than pure white, increasing the strength along the shear planes. This abrasive is available in a range of mounted points & wheels.
SGB	A blend of premium abrasives that include a medium concentration of ceramic Norton SG.
3SG	A blend of premium abrasives that include a high concentration of ceramic Norton SG.
5SG	A blend of premium abrasives that include a very high concentration of ceramic Norton SG.
37C	Crystolon silicon carbide abrasive. Supplied mainly in the resin bonds of advanced wheels used for grinding grey iron, non-ferrous metals & in vitrified bonds for grinding non-metallic materials, such as rubber & stone.
39C	Crystolon is the highest purity silicon carbide abrasive. It is ideal for grinding cemented carbide cutting tools, fired ceramics & glass, where it provides advanced performance.

BOND TYPES

VITRIFIED

Vitrified bonds are the most common precision grinding bond. Porosity and strength of the wheels made with this bond give high stock removal along with their rigidity helping to attain high precision. Not affected by water, acid, oils or ordinary temperature variations. The most common vitrified bonds are:

V	V is the original high temperature vitrified bond, usually used where tougher acting wheels are required
VS	VS is a very versatile, low temperature, high performance vitrified bond system used in almost all applications but predominately for tool room, centreless, cylindrical, & surface grinding
VTECH	Low temperature, very technical bond, used with conventional abrasives & recommended for high tech applications to maximise performance & dressing parameters
VX	VX bond provides improved corner/form holding for most applications – it is the first choice bond for our premium abrasives
VXP	Induced porosity VX bond suitable for large contact areas & surface grinding

BOND TYPES

ORGANIC

These bonds are used in two types of wheels. Firstly, wheels used on portable or fixed machines for the rapid removal of metal. Secondly, cutting-off wheels either un-reinforced or reinforced, for use on portable or fixed machines. The most common organic bonds are:

SNAGGING WHEELS & CUPS

B & B3	Foundry wheels: multi-purpose bond that gives satisfactory results on most applications
B28	Foundry wheels: high level bond suitable for most technical applications requiring high powered machines

CUTTING-OFF WHEELS

BF1	Specific bond ensuring the best quality of cut in dry or wet conditions
BF3	New generation bond assuring the best wheel life in dry cutting operations; versatile & long wheel life. Ideal for heavy duty operations
B24	New generation bond used on silicon carbide cut-off wheels that gives the best performance & the ultimate cut quality on non-ferrous metals in wet conditions
B25	Standard multi-purpose bond that offers durability & freeness of cut in a wide variety of materials & applications. Can also be used in wet cutting on softer grades
B26	New generation bond used on aluminium oxide cut-off wheels that gives the best performance & the ultimate cut quality on ferrous metals in wet conditions
B65	Traditional bond gives good performance & long wheel life in dry cutting conditions

WHEEL GRADES

The grade indicates the relative holding power of the bond, which holds abrasive grains in a wheel. This is represented in the specification by letters running through the alphabet from hardest to softest. The following rules should be followed with regard to grade:

USE SOFT GRADE

- For hard materials such as hard tool steels & carbides
- For large areas of contact
- For rapid stock removal

USE HARD GRADE

- For soft materials
- For small or narrow areas on contact
- For longer wheel life

COMMON RANGE OF GRADES

E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
					CYLINDRICAL/CENTRELESS											
SURFACE GRINDING																
					ID GRINDING											
				TOOL GRINDING												
						THREAD GRINDING										
	NON-REINFORCED ORGANIC															
											REINFORCED ORGANIC					

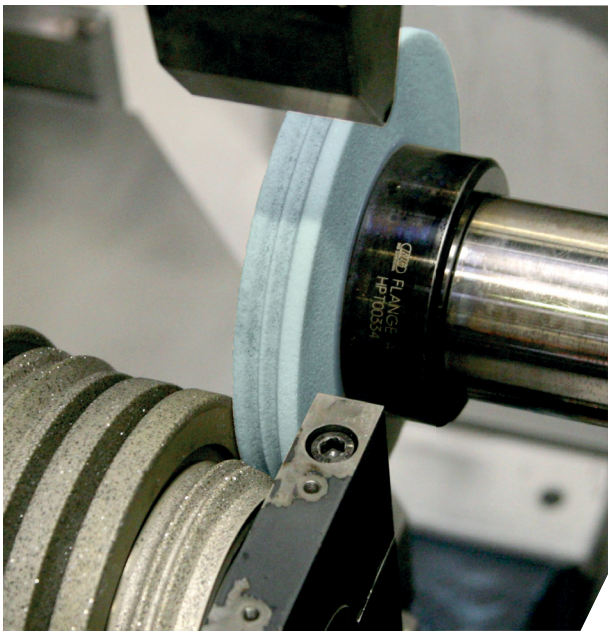
AVAILABILITY SUMMARY

ABRASIVE TYPE	BOND	ABRASIVE COLOUR
IPA	VTX	White
SGB-3SG-5SG-ES5-1TGP	VX-VXP	Blue
A–19A	VS	Brown
86A	VS-VXP-VTECH	Ruby
38A	VS	White
37C	V-VP	Black
39C	V-VS	Green

SELECTING THE RIGHT PRODUCT

There are nine main factors to be considered when selecting a grinding wheel for any application:

- The material to be ground – its type & hardness
- The stock to be removed
- The workpiece geometry & surface finishes required
- The grinding machine, the type of machine, the power available & its conditions
- Wheel speeds & feeds
- Grinding contact area
- Grinding fluid – whether the operation is wet or dry
- The severity of the grinding operation
- The dressing method



MATERIAL TO BE GROUND

The type of material affects the selection of abrasive, grit size and grade. Alumina type abrasives are the most suitable for grinding high tensile materials such as steel and ferritic cast irons. The more friable types of alumina are preferred on harder steels and applications having large arcs of contact.

Low tensile strength materials and non-metallic materials are most efficiently ground or cut with silicon carbide abrasive.

The hardness of the material governs the amount of penetration that can be achieved by the abrasive. For this reason finer grit size wheels are required to grind hard materials and soft materials are best ground with medium to coarse grit size wheels.

For most efficient operation, the grade must be adjusted to suit the hardness of the material. As a general guide, the harder the material, the softer the grade of wheel required.

STOCK TO BE REMOVED

This affects the choice of abrasive size and bond type.

High stock removal rates, as in fettling operations, require coarse grit wheels, typically 12 to 24 mesh. Fine finishes and tight limits on finished workpiece geometry require finer grit sizes.

Final surface finish is often achieved by 'spark out'. No further infeed is applied and the wheel is allowed to grind until the majority of the grinding sparks cease.

SURFACE FINISH

Usage Key ● Highly recommended		SURFACE FINISH & GRIT SIZE							
SURFACE	FINISH	GRAIN SIZE							
µ in CLA	µ m Ra	46	60	80	100	120	150	180	220
42	1,10	●							
32	0,80	●							
26	0,70	●							
21	0,50		●						
16	0,40		●						
14	0,35		●	●					
11	0,25		●	●					
8	0,20			●	●				
7	0,17			●	●	●			
6	0,14				●	●	●		
5	0,12					●	●	●	
4	0,10						●	●	●
3	0,08							●	●
2	0,05								●
MIN FORM RADIUS	METRIC (mm)	0,75	0,50	0,40	0,25	0,20	0,18	0,13	0,10
	IMP INS	,030	,020	,015	,010	,008	,007	,005	,004

The achievable surface finish in any grinding operation is highly dependent upon the grit size of the grinding wheel. The following chart shows the range of surface finishes achievable when using grinding wheels of different grit sizes on conventional precision grinding applications, together with the minimum form radius that can be ground using each grit size.

Other factors can affect the surface finish achieved. In particular:

- Production grinding applications, with higher stock removal ranges, will give surface finishes at the coarser end of the range
- Plunge grinding applications will often require the selection of a grit size one size finer than shown
- Dressing techniques & the type of material can also affect the surface finish achieved

ACHIEVING IMPROVED SURFACE FINISHES

By changing the wheel dressing technique, it is possible to achieve finer surface finishes than those shown. As well as reducing the dresser infeed per revolution of the grinding wheel, it is also possible to reduce the infeed and traverse rate when grinding, thus reducing the stock removal rate. Obviously this approach will have limited application in production grinding but it can be very useful in tool room work.

THE GRINDING MACHINE

The type of machine can effectively define the grinding contact area and the ease with which grinding fluid can be applied to the grinding zone.

The power available on the machine governs the stock removal rate. The greater the power available, the harder the grade of wheel that is required for efficient operation.

Any deterioration in the condition of machine bearings and slideways will lead to vibration and, consequently, premature wheel breakdown. This can, in part, be overcome by using a harder grade wheel and/or a tougher abrasive but the only effective solution is to maintain the machine as recommended by the machine manufacturer.

SPEEDS & FEEDS

The effect of speeds and feeds on grinding action and, hence, the selection of wheel, can best be summarised in the following table:

EFFECT ON GRINDING ACTION

SPEED	INCREASED	DECREASED
Wheel speed*	Harder	Softer
Work speed	Softer	Harder
Traverse speed	Softer	Harder
Infeed rate	Softer	Harder

*The maximum peripheral speed (m/s) specified for the wheel must never be exceeded

GRINDING CONTACT AREA

The contact area affects the selection of wheel grade and structure. Large contact areas, as on segmental grinders, generally produce low grinding pressures and require soft grade, open structure wheels. Induced porosity wheels are most efficient for grinding very large contact areas. Conversely, small contact areas, as on cylindrical grinding machines, require harder grade and/or closer structure wheels.

The size of workpiece can also affect the grinding contact area. In general, the larger the workpiece, relative to the grinding wheel diameter, the larger the contact area, requiring softer grade wheels.

GRINDING FLUID

Dry grinding with vitrified wheels require wheels one or two grades softer than when wet grinding.

SEVERITY OF THE GRINDING OPERATION

This can affect the choice of abrasive type, grade and even bond type. Where the wheel is subjected to shock loads, as in fettling operations, a resinoid bond should be used. In general, the more severe the grinding operation, the harder the grade of wheel required and the tougher the abrasive that can be used. Severity of grinding operation can be due to heavy infeeds, high work speeds and traverse rates or intermittent grinding contact. The latter is usually due to workpiece geometry, resulting in a dressing action on the wheel.

GRINDING WHEEL DRESSING & TRUING

Truing and dressing of grinding wheels are often considered to be the same thing, since they are frequently performed as one operation. Truing is performed to ensure concentricity and introduce any profile that may be required on the wheel face. Dressing conditions the wheel surface to give the desired cutting action.

SINGLE & MULTI-POINT DIAMONDS

Diamonds are the first choice where close tolerances, fine finishes, speed and flexibility are required. Since diamond dressing is primarily a machining operation rather than a crushing operation, the surface formed on the wheel is closer than that obtained from mechanical dressers. This results in a slower cutting wheel with better form holding characteristics and superior finish control.

By varying the depth of cut per pass made by the diamond and changing the traverse rate, different wheel surfaces, and hence different cutting actions, can be achieved.

The following are general recommendations for dressing with single-point diamonds.

	ROUGHING	FINISHING
Diamond infeed mm per pass	0,025mm	0,012-0,020mm
Diamond traverse rate mm/wheel rev.	0,18mm	0,10mm

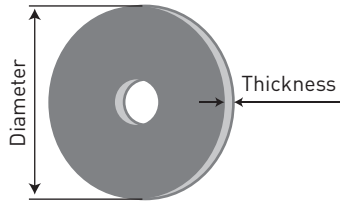
The diamond should always be applied at the centreline of the wheel with a 5°-15° drag angle.

DIAMOND SIZE

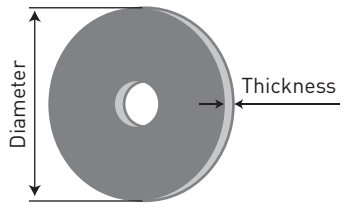
The size of diamond is important when selecting a dressing tool and several factors are relevant in this selection, e.g. large, coarse grit wheels require a larger diamond than smaller, fine grit wheels. If a fine finish is required, the use of a diamond which is too large can adversely affect the finish and cancel the effect of fine grit selection. The trend today is away from single-point dressers and towards multi-point dressers employing a matrix shape to suit the form required.

A useful formula for determining single-point & multi-point diamond size is:

Wheel diameter (mm) x Wheel thickness (mm)

SINGLE-POINT	MULTIPLY THE DIAMETER OF THE WHEEL BY ITS THICKNESS	
	Diameter x Thickness (mm)	Carat
	<6000	0,33 Carat
	6000-18000	0,50 Carat
	>18000	1,0 Carat

For best results, always use a coolant when dressing

MULTI-POINT	MULTIPLY THE DIAMETER OF THE WHEEL BY ITS THICKNESS	
	Diameter x Thickness (mm)	Carat
	<30000	1,3 Carat
	30000-60000	2,5 Carat
	>60000	5,0 Carat

For best results, always use a coolant when dressing

COOLANT

Dressing with diamonds should always be carried out using a copious supply of coolant. The coolant should always be turned on fully before the diamond touches the wheel. The diamond life will deteriorate rapidly if it is allowed to become hot and then cooled rapidly as can be experienced with an intermittent coolant flow.

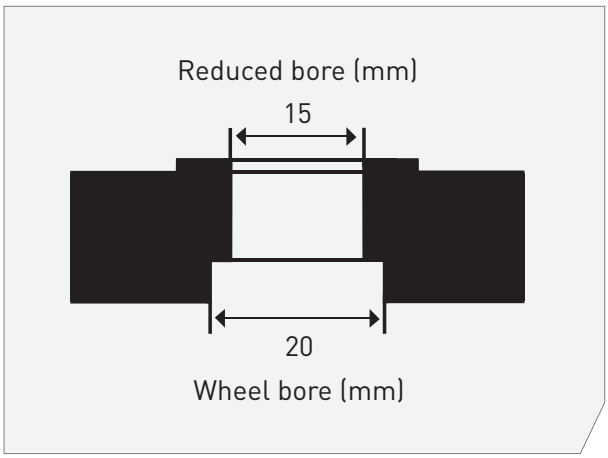
ROTATION OF THE DRESSING TOOL

To ensure maximum diamond life, single-point and conical cluster diamond dressing tools should be systematically rotated after every four or five dressings to ensure that the keen edge generated from the drag angle is constantly presented to the wheel.

REDUCTION RINGS

Plastic reduction rings may be used to adapt grinding wheels to fit on various spindle sizes. These rings reduce the bore hole size, allowing the wheel to be safely mounted on a spindle with a smaller diameter.

- Reduction rings should never come in contact with the flange
- Reduction rings should not be used on wheels of thicknesses less than 6mm, nor greater than 50mm
- Always use one reduction ring on each side of the wheel when the wheel is thick enough to allow correct seating
- Never use reduction rings to reduce the hole below the minimum specified in the FEPA safety code



WHEEL BORE (mm)	REDUCED TO (mm)	REDUCTION RING
50,8	35	07660704766
32	25	07660717540
32	20	07660717538
31,75	15,88	07660704757
31,75	12,7	07660704755
20	16	07660717530
20	15	07660717529
20	13	07660717527
20	12	07660717525
20	10	07660717524
16	6	00510008919

MOUNTING

A wheel should only be mounted onto the machine for which it was intended. The speed of the spindle on which the wheel is mounted should not under any circumstances exceed the maximum RPM speed specified for the wheel when it is full size. The wheel should fit freely, but not loosely, onto the spindle or spigot diameter of the flange plates. Wheels, blotting paper washers and flanges should be free from foreign matter. Certain wheels have a positioning mark (Mount Down or Mount Up) marked on them. Care must be taken to ensure that this mark occupies the position stated by the manufacturer.

REDUCING BUSHES

Where a removable bush is used as a means of reducing the bore of an abrasive wheel, care must be taken to ensure the bushes should not project beyond the side of the wheel and the wheel blotter. The clamping faces of the flange plates MUST clamp on the mounting washers attached to the wheel and not on any part of the reducing bush. Reducing bushes should never be used on wheels less than 6mm thick or on products with a back or web of less than 6mm. Never use plastic bushes on wheels used with portable grinding equipment.

MOUNTING WASHERS

Blotters should be used with all grinding wheels unless there is a specific exemption. Blotters should be slightly larger in diameter than the mounting flanges and free from any scuffs, wrinkles or other damage.

MOUNTING FLANGES

Mounting flanges are designed to clamp the wheel to the machine and transfer the driving forces from the machine spindle to the grinding wheel. They should be designed to take the driving forces away from the area around the grinding wheel bore and generally should be not less than one third of the grinding wheel diameter.

Flange surfaces should be flat, free from burrs, bumps, bruises and other damage. Flanges should be of equal diameter, have equal bearing surfaces and be properly recessed or undercut.

The rear flange must be positively driven by the machine spindle, being either keyed or shrunk onto the spindle.

Flanges must run true to the machine spindle.

Clamping nuts (centre nut locking) should only be tightened sufficiently to hold the wheel securely without slippage and must not be over-tightened. When flanges are clamped by a series of screws, they should be tightened in stages uniformly in a diametric sequence.

In most instances it is appropriate to tighten the nut or screws by hand with the correct tool (spanner or hexagonal socket key) until they stop turning. By adopting this technique it is very rare that the wheel would be under-tightened and impossible to over-tighten the wheel. Bolts for mounting wheels with inserted nuts should be long enough to engage an adequate length of thread, i.e. equal to the thread diameter, but must not protrude through the nut insert.

For recommended designs of flanges, refer to the FEPA Safety Guidelines.

CAUTION

After mounting or re-mounting a grinding wheel on a machine, stand well clear, ensuring that there are no persons in line with the wheel and allow the wheel to run free for two minutes. A re-mounted wheel should always be treated as if it were a new wheel.

TYPE 06 CUP WHEELS – FIXED MACHINES

The diameter of the flange and paper washer inside the cup must be smaller than the diameter of the cup recess to avoid any risk of radial pressure on the wheel. When used for work heavier than light tool and cutter grinding, the back flange may be larger than that inside the cup but the recess diameter of both flanges must be equal.

MOUNTED POINTS & WHEELS

The spindle dimensions of the mounted point must be suitable for the collet being used, and the spindle overhang corresponding to the machine speed should be observed.

TYPE 31 GRINDING SEGMENTS

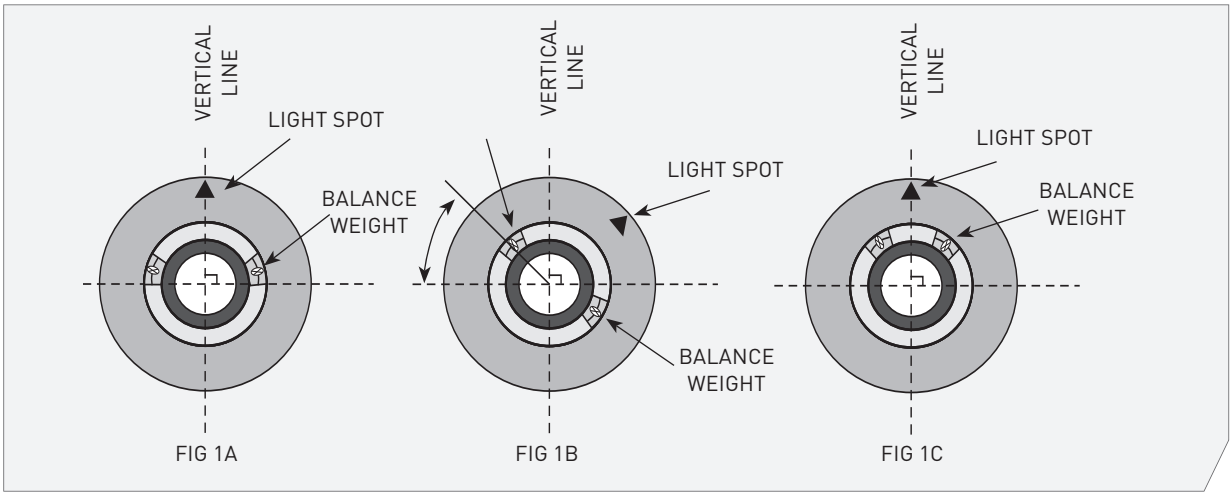
Segments are held by special chucks with suitable provision for adjustment to compensate for segment wear. To prevent breakages segments should not protrude more than 1,5 times their thickness from the clamping chuck face, and should be mounted with markings uppermost.

WHEEL BALANCE

Most Norton grinding wheels are balance corrected to a minimum of ISO Standards. Precision grinding machines usually provide methods of accurately balancing the complete wheel and flange assembly. Modern production machines are now supplied with automatic balancing systems, whereas, tool room and older production machines still have to be manually balanced, ensuring the best possible grinding performance from the wheel.

The balancing procedure can be carried out either on a special balancing stand or in-situ on the machine. The machine manufacturer's instructions should be closely followed. There are many methods of manually balancing the wheel assembly, depending upon the number of balance weights in the wheel arbour. A typical 'two weight' balancing system technique is described below:

TWO WEIGHT SYSTEMS



- Mount wheel between flange plates
- Remove balance weights from annular groove on mounting flange (can also be set diametrically opposite if preferred – ensuring the weights cancel each other out)
- Dress periphery of wheel until running in perfect truth
- Remove complete wheel assembly from the machine (after allowing sufficient time for the coolant to spin out) & fix assembly onto the balancing mandrel
- Place on balancing unit & allow to turn freely. When stationary, mark top centre (light spot) with chalk
- Re-position the balance weights so that the bottom side face of each weight, that is furthest from the light spot, forms a right angle i.e. 90°. See illustration 1A
- Turn wheel assembly so that one balance weight is approximately 45 degrees from the horizontal line & release the wheel. Note the direction in which wheel rotates, the weight may revolve upwards towards the vertical line. In this instance the weight should be moved down away from the light spot (always adjust the weights in the opposite direction of rotation) to begin bringing the wheel into balance. See illustration 1B
- Continue checking the weights, alternating between the left & right hand balance weights in turn. Repeat until the wheel remains stationary in all positions. Move the weights a maximum of 3mm at a time, reducing this amount as the wheel rotates slower. See illustration 1C
- Continue until assembly remains static in all positions. Lock balancing weights in position & remount assembly onto the machine spindle
- Important: – Ensure the balancing ways (knife edges or rollers) on the balancing stand are level in all directions. Care must be taken to initially find the true light spot of the wheel

TROUBLESHOOTING

SOLVING SURFACE FINISH PROBLEMS

Many problems associated with grinding relate to surface finish defects. The following chart describes some common surface finish problems, shows the probable causes and suggests remedies to cure the problem.

REGULAR SPACED CHATTER MARKS

Immediately after dressing

Cause	Machine vibration
Solution	Check for wear in machine bearings

REGULAR SPACED CHATTER MARKS

After a period of time

Cause	Wheel too hard
Solution	Use softer grade of wheel

CHEQUERED PATTERN

Cause	Wheel out of balance
Solution	Balance wheel

CHATTER MARKS

Cause	Wheel out of truth
Solution	Re-dress wheel

IRREGULAR CHATTER MARKS

Cause	Wheel mounting insecure
Solution	Tighten wheel mounting
Cause	Workpiece centres loose
Solution	Adjust centres

SPIRAL MARKS

Cause	Dressing techniques
Solution	Check diamond is sharp & secure
Cause	Dressing techniques
Solution	Check dress is parallel

FINISH TOO COARSE

Cause	Grit size too coarse
Solution	Use fine, slow traverse dress
Cause	Wheel too soft
Solution	Decrease workspeed. Use harder grade wheel
Cause	Metal pick-up on wheel
Solution	Dress more frequently. Use more open, softer grade wheel

SAFETY ADVICE

SAFETY IN THE STORAGE & USE OF GRINDING WHEELS

Stringent safety standards are maintained throughout the manufacture of Norton Grinding Wheels. To reduce the risk of accidents further, the law requires that certain basic precautions are taken in the storage and use of abrasive wheels.

RECEIPT

On receipt, grinding wheels should be thoroughly examined to see if they show any signs of damage, such as chips, cracks or discolouration. Damaged wheels must not be used.

HANDLING

Any mishandling that results in the wheel being subjected to any shock loading can damage all grinding wheels. This can occur if the wheel is inadvertently dropped, knocked over or banged against any other object. This is equally true if the wheel is secured on a pallet, which has been dropped heavily from a forklift truck.

Any grinding wheel subjected to such mishandling should be carefully examined for signs of damage. If in any doubt – do not use.

STORAGE

Small wheels up to 80mm diameter, together with cones, plugs, mounted points and wheels may be stored in suitable bins, drawers or boxes. Type 02 cylinder wheels, type 06 straight cup wheels, type 12 dish wheels and type 13 saucer wheels should normally be stacked on flat sides with cushioning material between them. Thick rim and hard grade cylinder and straight cup wheels may be stored on their periphery as for plain wheels. Soft grade, straight cup wheels, and all type 11 taper cup wheels, should be stored base to base and rim to rim, to prevent chipping of edges and cracking of walls. Thin plain wheels, such as cutting-off wheels or saw sharpening wheels should be stacked on a flat surface of steel, or similar rigid material. Other plain or shaped wheels of appreciable thickness, are best supported on their periphery in racks. The racks should provide cushioned, two point, cradle support to prevent the wheels from rolling.

STORAGE CONDITIONS

During storage, grinding wheels must not be subjected to:

- Exposure to humidity, water or other liquids
- Freezing temperatures
- Any temperature low enough to cause the formation of condensation on the wheels when moving from storage to an area of high temperature

SHELF LIFE OF RESINOID & VITRIFIED BONDED WHEELS

The outer surfaces of certain organically bonded wheels may be affected by oxidation if they are stored for long periods. These types of wheel should not be stored for more than three years and proper stock control should ensure that older wheels are used first. In use, a three year old Resinoid product will act considerably softer than a brand new wheel (wheel will wear away more quickly).

The glass bonding system used in vitrified wheels is very inert and generally only attacked by certain acids. Cold temperatures can result in a vitrified wheel cracking if wheels are put away wet and are subjected to freezing temperatures. It must be remembered that the longer a product is in storage the chances of it becoming damaged increases. Provided vitrified wheels are stored correctly, thoroughly examined and mounted correctly they will last for many years.

RING TEST

The ring test depends upon the damping characteristics of a cracked wheel to alter the sound emitted when it is lightly tapped. The test is applicable only to vitrified bonded wheels.

To perform the ring test; support the wheel gently with a finger through the bore section. Using a light non-metallic implement (a file handle is ideal), gently tap the wheel about 45° each side of the vertical centre line. Rotate the wheel 45° and repeat the test.

The sound and undamaged wheel will omit a clear tone. If cracked, there will be a dead dull sound – not a clear ring – and the wheel should NOT be used. The ring test should be carried out in a place where the ring can easily be heard.

SAFE WORKING PRACTICES

PERSONAL PROTECTION

Safety goggles, ear defenders, safety gloves, dust masks and, if conditions are severe, additional face protection. Leather aprons and safety shoes must be worn.

TRAINING OF OPERATORS

Grinding operators should be trained in the safe use of each machine they operate.

SPEEDS

No abrasive wheel should be operated at a speed in excess of the maximum permissible speed marked on the wheel in RPM when the wheel is new and full size. It is permissible, however, to increase the spindle speed of the machine beyond the RPM stated on the wheel provided the increase is in proportion to the reduction in diameter and that the original peripheral speed is not exceeded (quoted on the wheel in metres/sec). In high production areas it is now normal for machines to have constant peripheral speed spindles. This is an electronic device that automatically increases the spindle speed of the machine as the wheel diameter wears down and prevents most of the reduction in wheel performance that is experienced when the wheel becomes smaller.

COOLANTS

The strength of resin bonded grinding wheels can be reduced by coolants. The concentration and alkalinity of coolants should be regularly checked and a pH value of 8 should not be exceeded. Prolonged immersion of a stationary wheel in coolant can produce an out of balance condition. Coolant should be shut off before stopping a wet grinding wheel, and the wheel allowed to run free until all the coolant has been spun out.

WORK RESTS

Work rests should be kept adjusted as close as possible (gap between wheel and work rest should not exceed 3mm) to the wheel and maintained in good condition.

TRUING & DRESSING

Re-dressing of wheels that have become malformed and out of truth in off-hand operations must only be performed by a competent person.

If an out of balance condition, due to the wheel wearing excessively out-of-round, cannot be corrected by truing, the wheel should be removed from the machine. Wheels should be dressed regularly to avoid loading

SIDE GRINDING

Side grinding should only be performed with wheels designed for this purpose (straight cups etc.).

Grinding on the flat sides of wheels designed for peripheral grinding may be dangerous and cause a wheel breakage. This does not preclude their use for certain precision applications such as shoulder and form grinding, where it is recognised that a limited amount of side grinding is performed; however, in these operations the operator has control of the pressure through the hand wheels of the machine whereas with bench grinding and off-hand machines the pressure is uncontrolled. Extreme caution should be exercised not to use excessive pressure.

As a general guide, do not use a straight wheel which has a thickness of less than 10% of the wheel diameter for side grinding.

ORGANIC CUTTING-OFF WHEELS

'Non-reinforced' cutting-off wheels should never be used:

- On a portable grinding machine
- On any machine where the workpiece is fed into the wheel by hand

Cutting-off wheels should only be mounted on machines designed for their use.

Cutting-off wheels should be inspected for warping before use. Warped wheels should not be used.

When grinding, twisting or the exertion of any pressure on the side of the wheel should be avoided.

Workpieces should be rigidly supported and firmly clamped wherever possible.

STOPPING WHEELS

Wheels should not be brought to rest by applying pressure to the periphery or face of the wheel.

SUPER ABRASIVES

TECHNICAL INFORMATION

DESIGNATION OF GRIT SIZES

FEPA MICRONS	US MESH	JIS	DWMI	DIAMOND	CBN	Ra (µm) SURFACE FINISH CARBIDE	RA (µm) SURFACE FINISH STEEL PLUNGE	RA (µm) SURFACE FINISH STEEL OSCILLATING
1181	16/18							
1182	16/20			16				
1001	18/20							
851	20/25							
852	20/30	20		24	24			
711	25/30							
601	30/35							
602	30/40	30		36	36			
501	35/40							
426	40/45							
427	40/50	40		46	46			
356	45/50							
301	50/60	50		50	50			
	50/80							
251	60/70			60	60			
252	60/80	60	60	80c	80c	0,6-0,9		
213	70/80			80	80			
181	80/100	80	80	100	100	0,4-0,7	1,0-1,1	0,9-1,1
	80/120			110c				
151	100/120	100	100	110	120		0,9-1,0	0,8-0,9
126	120/140	120	120	120	150	0,4-0,5	0,8-0,9	0,6-0,8
107	140/170	140	150	150	180		0,6-0,8	0,5-0,6
91	170/200	170	180	180	220	0,3-0,4	0,5-0,6	0,4-0,5
76	200/230	200	220	220	230			
64	230/270	230	240	240	240	0,2-0,3	0,4-0,5	
54	270/325	270	320	320	320			
46	325/400	325	400	400	400	0,1-0,2		
	400/500	400		500	500			
M63	40/60							
M40	30/40	500		500				
M25	20/30	700						
	15/25	800						
M16	*10/20*	1000		600				
	8/16	1500						
M10	*6/12*	2000		800				
M6,3	*4/8*	2500						
	3/6	4000						
M4	*2/4*	5000						
M1	*0/2*	15000						

CONCENTRATION

The concentration is defined by a standard and indicates the weight of abrasive (in carats) contained in 1cm^3 of abrasive strip – 1 carat = 0,2 grams.

CONCENTRATION*			NUMBER OF CARATS/cm^3		ABRASIVE WEIGHT PER cm^3
DIAMOND ABRASIVE		CBN ABRASIVE*			
100	=	W	4,4	=	0,88g/cm^3
75	=	T	3,3	=	0,66g/cm^3
50	=	Q	2,2	=	0,44g/cm^3

* Other concentrations available upon request

SELECTION OF CONCENTRATION

The choice of concentration depends on the machining parameters:

HIGH CONCENTRATION	MEDIUM OR LOW CONCENTRATION
Roughing operations	Finishing operation
Powerful machine	Low power machine
Small contact area	Large contact area
Retention of profile or sharp edges of wheel	Cutting without temperature rise

OPERATION	INTERNAL GRINDING	EXTERNAL GRINDING	SURFACE GRINDING	SHARPENING
Diamond	100	75	50	50/75
CBN	W	T	Q	Q/T

COOLANT

Generally speaking, working with coolant is preferable to working without coolant because the coolant reduces friction and dissipates heat generated by machining.

However, many sharpening operations are performed without coolant under good conditions and with appropriate bonds.

Choice of coolant:

- DIAMOND wheel = pure water + 1,5% rust inhibitor or soluble oil
- CBN wheels = pure oil or water, always with 5 to 10% soluble oil
- For CBN wheels, changing from soluble oil to pure oil increases the service life of the wheel

MOUNTING, TRUING & DRESSING

To achieve the best results using Norton Diamond and CBN products, the following steps for mounting, truing and dressing should be practised:

MOUNTING – PUTTING WHEEL ON MACHINE SPINDLE

- Examine wheel flanges & spindle carefully
- Be sure flanges' surfaces are clean & free of damage
- Ensure that the mounting flanges are flat & of equal diameter, especially on wheels with rigid centres, such as vitrified bond wheels
- Inspect machine spindle for excessive runout – TIR (Total Indicated Runout) should be no greater than 5 microns

- Mount wheel between hand-tightened flanges
- Using a dial indicator, tap the wheel lightly with a rubber or wooden block to minimize runout to less than 25 microns
- Tighten flange securely & recheck with indicator
- Allow a newly mounted wheel to operate for one full minute before grinding
- The use of one permanent mounting for the life of the wheel is recommended whenever possible:
  - If the grinding machine has a tapered spindle, mount each straight, flaring cup or dish wheel on a separate collet or adapter
  - When changing wheels the entire unit is removed, keeping the wheel in running truth
  - When needed again, the entire unit can be placed directly on the spindle or arbor, thereby eliminating the time & abrasive lost in retruing

TRUING – MAKING WHEEL ROUND & CONCENTRIC WITH THE SPINDLE AXIS

- Prior to truing the wheel, run a wax crayon over the wheel face. Important: do not use any liquid based ink on super abrasive wheels
- Any crayon left on the wheel face after truing will reveal untrued areas
- Norton Brake Controlled Truing Devices are most commonly used to true Diamond & CBN straight, cup & cylinder wheels
  - Always use Brake Controlled Truing Device dry
  - Bring the Diamond/CBN wheel & the truing wheel together until they almost touch
  - Start the Diamond/CBN wheel to normal speed; start the truing wheel in the same direction
  - Bring the two wheels together until they touch
  - Make sure the truing wheel is spinning at time of contact
  - Traverse the wheel back & forth at 10-20mm/s
  - Downfeed 0,01-0,02mm at the end of each traverse
  - At the end of truing, the Diamond/CBN wheel should be smooth & in truth

DRESSING - OPENING THE FACE OF A TRUED WHEEL

The core material (the part of the wheel that holds and supports the abrasive-bearing section) should never contact the workpiece during grinding; rubbing will generate excessive heat. As the abrasive section of a cup wheel wears, the core material may become exposed - necessitating dressing.

- Use a single-point carbide or steel tool to dress an exposed resaloy core
- Clamp the tool in a vice
- Direct the cutting edge accurately to leave a 1,5mm of abrasive section exposed

DRESSING THE ABRASIVE TO EXPOSE THE GRITS

Purpose: to expose the grinding stone face to give a better cut

After each truing operation, dressing is necessary to give a more precise cut to the wheel. This operation consists of highlighting the grits by eliminating part of the bond and is generally carried out using vitrified bonded abrasive sticks.

Selection of the stick specification depends mainly on the nature of the bond of the super abrasive grinding stone and its grit size.

STICKS RECOMMENDED

BOND	GRIT SIZE	TRUING STICKS
Resin	126 & bigger	38A 150 HVBE
	107 - grit - 64	38A 220 HVBE
	54 & finer	38A 320 HVBE

TROUBLESHOOTING

USE RIGID WORK SUPPORT

- All workpieces should be supported firmly during the grinding process. Any amount of vibration will cause wheel wear & produce chatter or wave marks on the ground surface
- On work ground between centres, centreholds should be properly prepared
- Minimise work overhang
- If the ground work is supported by a work finger, ensure the finger is strong enough to provide vibration-free support

AVOID EXCESSIVE FEEDS

- Excessive feeds will result in premature wheel wear. Excessive feed rates are characterised by:
  - A hard grinding sound
  - Chatter
  - Burn
  - High wheel wear rate
  - Vibration

DRY GRINDING

BURNING (EXCESSIVE HEAT)

Cause	Wheel loaded or glazed
Solution	Dress wheel with a dressing stick
Cause	Excessive feed rate
Solution	Reduce infeed of wheel or workpiece
Cause	Wheel too durable
Solution	Use freer cutting specification or slow down wheel speed
Cause	Wheel speed too high
Solution	Slower wheel speed

POOR FINISH

Cause	Grit size too coarse
Solution	Select a finer grit size
Cause	Excessive feed rate
Solution	Reduce infeed of wheel or workpiece

CHATTER

Cause	Wheel out of truth
Solution	True wheel; ensure it is not slipping on mount
Cause	Wheel too hard
Solution	Check specification

WET GRINDING

BURNING (EXCESSIVE HEAT)

Cause	Wheel glazed or loaded
Solution	Re-dress wheel
Cause	Poor coolant placement
Solution	Apply coolant directly to wheel/workpiece interface
Cause	Excessive material removal rate
Solution	Reduce downfeed &/or crossfeed
Cause	Wheel speed too high
Solution	Slower wheel speed

POOR FINISH

Cause	Excessive dressing
Solution	Use lighter dressing pressure Stop dressing as soon as wheel starts to consume stick rapidly
Cause	Grit size too coarse
Solution	Select a finer grit size
Cause	Poor coolant flow or location
Solution	Apply heavy flood so it reaches wheel/work interface

CHATTER

Cause	Wheel out of truth
Solution	True wheel; ensure it is not slipping on mount
Cause	Wheel too hard
Solution	Check specification

WHEEL WILL NOT CUT

Cause	Glazed by truing
Solution	Dress lightly until wheel opens up
Cause	Wheel loaded
Solution	Dress lightly until wheel opens up Increase coolant flow to keep wheel surface clean Never run wheel with coolant turned off
Cause	Grit size too fine
Solution	Check specification

SLOW CUTTING

Cause	Low feeds & speeds
Solution	Increase feed rate; increase wheel speed (observe maximum wheel speed)

SHORT WHEEL LIFE

Cause	Incorrect coolant flow
Solution	Apply coolant to flood wheel/work surface
Cause	Low wheel speed
Solution	Increase wheel speed (observe maximum operating speed)
Cause	Excessive dressing
Solution	Use lighter dressing pressure
Cause	Wheel too soft or too hard
Solution	Change grit or grade; use higher concentration

DIAMOND BLADES

TECHNICAL INFORMATION

OPERATING SPEEDS

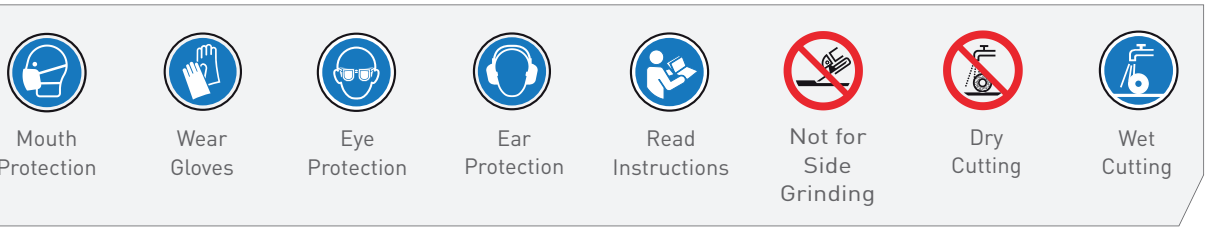
MAXIMUM OPERATING SPEED		
DIAMETER (mm)	MAX M/S	MAX RPM
100	80	15300
115	80	13300
125	80	12250
150	80	10200
180	80	8500
200	80	7650
230	80	6650
250	80	6100
300	100	6400
350	100	5500
400	100	4800
450	63	2700

Never exceed the Maximum Operating Speeds:

- Hand held blades ø ⩽ 230mm: 80m/s
- Hand held blades ø > 230mm: 100m/s
- Others: 63m/s

PERSONAL PROTECTION

Safety goggles, ear defenders, safety gloves, dust masks and, if conditions are severe, additional face protection. Leather aprons and safety shoes must be worn.



TROUBLESHOOTING

DIAMOND BLADE DOES NOT CUT

Cause	The segments are too hard for the material
Solution	Check if the blade is suitable for the material
Cause	The segments have become blunt
Solution	Sharpen the segments by cutting an abrasive material (e.g. sandstone)
Cause	Insufficient machine power
Solution	Check the voltage, machine power & filters

EXCESSIVE WEAR

Cause	The segment is too soft for the material (e.g. if a blade for hard material is used to cut abrasive material)
Solution	Check if the diamond blade is suitable for the material

CRACKING OF STEEL CENTRE

Cause	The segments are too hard for the material
Solution	Check if the blade is suitable for the material
Cause	Excessive cutting pressure, overheating, material slippage, twisting or jamming in the cut
Solution	Leave the blade to do the work, do not exert too much pressure & allow the blade to cool regularly by leaving it to rotate away from the workpiece for a few seconds

LOOSENING OR CRACKING OF SEGMENTS

Cause	The segments are too hard for the material. This results in the diamond blade bouncing in the cut resulting in cracking segments
Solution	Check if the diamond blade is suitable for the material

SCORCHING OF SEGMENTS

Cause	Excessive cutting pressure causing overheating. This is easily recognisable from the blue colouring where the segments & the steel core are welded together
Solution	Allow the diamond blade to cool regularly by rotating the blade away from the workpiece for a few seconds
Cause	The segments are too hard for the material
Solution	Check if the diamond blade is suitable for the material. Alternatively use less cutting pressure & let the blade do the work

UNDERCUTTING

Cause	Undercutting occurs when the steel core wears faster than the segment, i.e. where the segment & steel core meet. This is usually caused by materials that are highly abrasive. The cutting debris is not removed sufficiently & the steel core is affected. Undercutting is certain to occur if a diamond blade for hard materials is used to cut abrasive materials
Solution	Use a diamond blade suitable for the specific material

SAFETY ADVICE

SAFETY DOs

For your safety you should ensure that you are fully aware of how to safely use diamond blades

✓	DO	Read the safety instructions provided by the abrasives & equipment supplier
✓	DO	Store abrasives in dry, frost-free conditions avoiding wide variations in temperature
✓	DO	Ensure that the product is suitable for its purpose
✓	DO	Handle, store & transport products with care
✓	DO	Disconnect the power to the machine before fitting the product
✓	DO	Examine all products before mounting & periodically during blade use for possible defects or damage (core flatness, fatigue cracks, undercutting, arbor hole damage...)
✓	DO	Check that correct mounting devices are used & that they are clean, undistorted and free from burrs
✓	DO	Ensure that work rests are properly adjusted & secure
✓	DO	Always use a correctly designed & adjusted guard (on the blade and belts)
✓	DO	Ensure that the workpiece is secure
✓	DO	Wear appropriate personal protective equipment at all times
✓	DO	Avoid clogging & uneven wear to ensure that the product is working efficiently
✓	DO	Ensure accordance between product direction arrow / machine rotation
✓	DO	Ensure that all machines using abrasives meet the requirements of the current European machinery directives-CE
✓	DO	Be aware of the hazards likely during the use of abrasives & observe the recommended precautions to be taken: • Bodily contact with the abrasive product at operating speed • Injury resulting from product breakage during use • Grinding debris, sparks, fumes & dust generated by the grinding process • Noise • Vibration

SAFETY DON'Ts

For your safety you should ensure that you are fully aware of how to safely use diamond blades

✘	DON'T	Allow untrained people to use abrasives
✘	DON'T	Use a product that is damaged or one which has been dropped
✘	DON'T	Use a product if it cannot be properly identified
✘	DON'T	Use a machine that is not in good working order or one with defective parts
✘	DON'T	Force the abrasive onto the mounting device or modify the size of the mounting hole
✘	DON'T	Exceed the maximum operating speed marked on the product
✘	DON'T	Apply shock or excessive force to the product or let it overheat
✘	DON'T	Use mounting flanges which are not clean & flat
✘	DON'T	Tighten the mounting device excessively
✘	DON'T	Start the machine until the guard is in place & fastened securely
✘	DON'T	Continue to use a product if vibration occurs. True or replace it
✘	DON'T	Grind on the part of the product which is not designed for the operation
✘	DON'T	Start the machine with the workpiece in contact with the abrasive product
✘	DON'T	Grind material for which the product is not designed
✘	DON'T	Stop the abrasive by applying pressure to its surface, let it stop naturally
✘	DON'T	Exceed permissible rotation speeds: refer to values engraved on product
✘	DON'T	Use blades with missing segments or core cracks
✘	DON'T	Use dry products marked for wet use
✘	DON'T	Wear loose clothing, ties & jewellery

NOTES

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