

VECTOR™

ONE MACHINE, INFINITE APPLICATIONS.



CURTIS MACHINE TOOLS

www.curtisgrinding.com

THE COMPANY



CMT is a well-established British manufacturer of high precision grinding machines for small precision components. It supplies bespoke engineered grinding solutions to manufacturers worldwide, with over 50 years' experience within a variety of industries, such as automotive, bearing, cutting tool, defence and hydraulic.

The company's patented "Grind in a Box" technology has proven itself to be a global success and, based on this innovative concept, **CMT** have designed and manufactured the **VECTOR** family of grinding machines. The engineering team at **CMT** are constantly developing new grinding methods and subsequent applications; as these are precisely tailored to customer demands and market conditions, they are able to achieve maximum production efficiency. In addition, the integration of ancillary processes can be offered to provide a complete Turnkey system. Processes such as deburring, washing, inspection, marking, packing etc, can be carried out in parallel to the grinding process.

CMT offer limitless possibilities to engineer and implement these user-specific requirements and already has hundreds of machines in the field, ranging from standalone solutions to fully automated production lines.

VECTOR™

CUSTOMISATION AS STANDARD

The **VECTOR** has been designed to provide maximum productivity and precision whilst maintaining a very small footprint, making it an excellent return on investment.

- Applications from a single machine to a fully integrated production line
- Angular or straight approach operation
- Multiple workhead options for cycle time optimisation
- Perfect for medium to mass production
- Integrated loading system
- Multiple part presentation options
- Pre, In and Post Process component measurement
- Part identification and data traceability
- Siemens Sinumerik One control and drives
- Ancillary process integration
- Fully managed Turnkey solution



VECTOR™

BASICS



Siemens Sinumerik One
touchscreen control

Optional integrated:

- Gauging
- Balancing
- Gap & crash elimination
- Vision system

Hand-held teach pendant

Linear guideways for X and Z axis built as a
cross slide assembly

Machine bed designed for low vibration

Coolant and debris lift tank

Magnetically connected loading arm to reduce
damage in the event of a collision

Fully enclosed patented 'Grind in the box'
wheel guard

Integrated loading system

Application specific workhead options

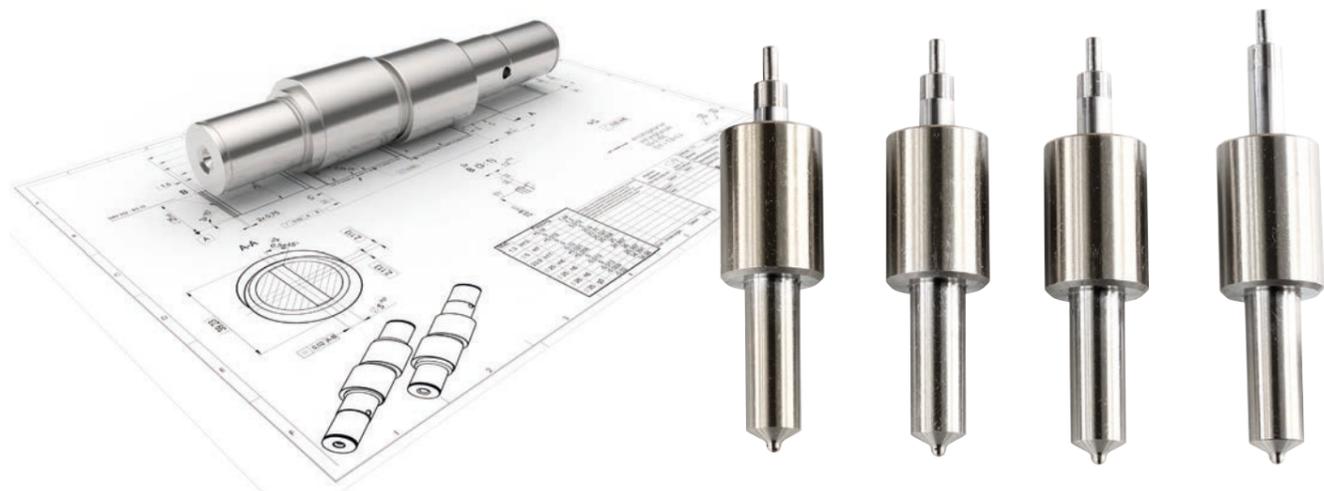
Easy access to working area for efficient setup

Part presentation options to suit
customer requirements

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THE FAMILY

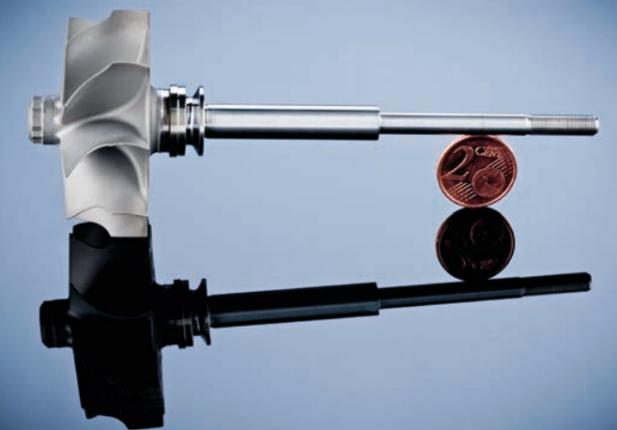
- The **VECTOR Twin** integrates an indexing twin-spindle work head, facilitating loading and secondary operations. This dual-spindle design enables concurrent loading and unloading while grinding occurs on the other spindle, minimising spark-to-spark time and optimising cycle time for production.
- The **VECTOR Quad**, an evolution of the VECTOR Twin, transforms production grinding. Featuring an innovative four-spindle work head, it allows simultaneous outer diameter or contour grinding on two workpieces using the same grinding wheel, effectively doubling the output.
- The **VECTOR Thread/Worm** revolutionises the production grinding of threads and worms. Featuring an adjustable wheel and dressing spindle with an inclination ranging from -20 to +20 degrees, coupled with a grinding spindle speed of 140 m/s and simultaneous loading/unloading during the grinding process, this advancement signifies a new level of optimisation in thread/worm grinding.
- The **VECTOR Pendulum** is purposefully designed with two workpiece spindles on either side of the main grinding spindle, enabling the combination of two grinding processes in one machine. Loading and unloading occur while the part in the opposite workhead is being ground.
- The **VECTOR GFS** (Grind from Solid) builds upon the VECTOR's foundation, incorporating a bar feed system for precision grinding of small intricate parts from standard or hardened bars. The workpiece is subsequently cut off using a separate spindle, eliminating the need for turning or hardening operations.



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THE FAMILY

- The **VECTOR Rotary**, is based on the established VECTOR model. Its workhead is positioned on a programmable B-axis, enabling the machine to produce complex angles and blended spherical profiles.
- The **VECTOR Concen** (Concentric/Centreless), a derivative of the VECTOR, integrates a control wheel and work rest blade setup. This configuration allows for plunge or angle approach centreless/concentric grinding of complex and slender parts.
- The **VECTOR Surface** has been specifically designed to cater for small, high-precision surface grinding applications where high volumes necessitate the need for automation. It is based on the Vector Grind in a Box principle and has a twin station indexing table that can accommodate automatic fixturing.
- The **VECTOR Duplex** has been specifically designed for components that require two features to be ground parallel to each other on either side of a static component, based on the Vector concept with enclosed grinding and full automation.
- The **VECTOR Nano** has been tailor-made for ultra precision grinding, featuring a hydrostatic wheel spindle and workhead to guarantee minimal axial and radial position variation.
- The **VECTOR XL** has a longer Z-axis than any other VECTOR variant, which allows for cylindrical components of up to 150mm in length to be ground using any of the previously described Vector technology.



VECTOR™ TWIN



- The **VECTOR TWIN** boosts grinding cycle time efficiency by allowing part exchange and certain ancillary processes to occur simultaneously while grinding on the opposing spindle.
- With a variety of part presentation systems available, the workpieces are loaded by either the integrated cartesian system or a robot.
- Components are ground using either a straight or angled approach for plunge, peel or profile grinding.
- The workpieces can have a maximum diameter of 100 mm and can be held in either collets, chucks or between centres.
- Super abrasives can also be used, as the machine is capable of peripheral speeds of up to 140 m/s.
- Wheel dressing is facilitated using either static single point or rotary single point / full form dressing system.
- Optional side grinder station, a secondary operation is carried out concurrently to the cylindrical grinding operation.

VECTOR™ QUAD



- The **VECTOR QUAD** revolutionises the world of production grinding by increasing productivity by 100%.
- Two workpieces are ground simultaneously on the four spindle workhead and in parallel to this, parts are loaded and unloaded at the other two work spindles.
- Components are ground using a straight angle of approach for conventional plunge or peel grinding.
- Whilst the two parts are being ground, either the standard loading system, or a robot, loads the two other spindles with the next two workpieces, giving a spark-to-spark time of almost zero.
- The workpieces can have a maximum diameter of 45 mm and can be held in either collets or chucks.
- Super abrasives can also be used as the machine is capable of peripheral speeds of up to 140 m/s.
- Wheel dressing is facilitated using either static single point or rotary single point / full form dressing system.

VECTOR™

THREAD / WORM



- The **VECTOR THREAD/WORM** uses the same philosophy as the VECTOR Twin, thus giving the maximum productivity yield from a single machine.
- The wheel and dressing spindle are adjustable with inclination range from -20 to +20 degrees; this facilitates dressing with either a single point or full form rotary dresser with no need to reorientate the wheel spindle.
- The machine is equipped with a unique part location system to ensure rapid definition of the thread / worm helix position, eliminating the need for lengthy component probing.
- With a variety of part presentation systems available, the workpieces are loaded by either the integrated cartesian system or a robot.
- The workpieces can have a maximum diameter of 80 mm and can be held in either collets, chucks or between centres.
- Super abrasives can also be used as the machine is capable of peripheral speeds of up to 140 m/s.

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PENDULUM



- The **VECTOR PENDULUM** concept was developed to fill a gap in the grinding market and give the technology output of two machines in one, quickly and with the smallest possible footprint.
- With two workpiece spindles on either side of the main grinding wheel, this machine combines two processes in one machine.
- With the workheads being adjustable for either straight/angle approach or a combination of both, chuck, collet and tailstock options are also easily configured into this innovative solution.
- The machine loading and unloading takes place whilst the part in the opposite workhead is being ground, which ensures almost zero impact on cycle time.
- The centrally located dressing unit also saves time-consuming dressing cycles, which are performed whilst the grinding wheel is moving from station 1 to station 2, giving the possibility for conventional abrasives to be used and thus reducing consumable costs.
- A variety of loading options are available, from a drawer system to a conveyor system.

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GFS



- The **VECTOR GFS** (Grind from Solid) has been designed specifically for small intricate parts where turning, hardening and grinding operations are impractical due to their size.
- With integral bar feed unit, the machine accepts hardened bar in 1.2m sections up to 5mm in diameter.
- Separate servo driven cut-off spindle and part positioning system.
- Parts can either be offloaded using a gravity system or with a robot into pallets.
- Components are ground using either a straight or angled approach for plunge, peel or profile grinding.
- Super abrasives can also be used as the machine is capable of peripheral speeds of up to 140 m/s.
- Wheel dressing is facilitated using either static single point or rotary single point / full form dressing system.

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ROTARY



- The **VECTOR ROTARY** has been developed for grinding complex forms requiring a high-profile and geometric accuracy, it is also the ideal solution for materials not suited to plunge grinding, such as Tungsten Carbide, PCD (PKD), PcBN, Ceramic etc.
- The workhead is mounted on a programmable 'B' axis which allows for 3 Axis simultaneous interpolation of complex profiles.
- Optional work spindle 'C' axis control can be added to enable 4 axis simultaneous interpolation.
- With a variety of part presentation systems available, the workpieces are loaded by either the integrated cartesian system or a robot.
- The workpieces can have a maximum diameter of 100 mm and can be held in either collets, chucks or between centres.
- Super abrasives can also be used as the machine is capable of peripheral speeds of up to 140 m/s.
- Wheel dressing is facilitated using either static single point or rotary single point / full form dressing system.

VECTOR™ CONCEN



- The **VECTOR CONCEN** (Concentric/Centreless) is based on the age-old centreless grinding principle but uses a hardened steel control wheel and concentric roller in conjunction with a Tungsten carbide or PCD workrest blade.
- The control wheel set-up can facilitate either straight or angular approach grinding, and is ideal for grinding secondary features on previously ground cylindrical parts where geometry is critical.
- The system is also suitable for standard centreless grinding operations on part blanks where angle approach is required for shoulders etc.
- Loading is via a hopper feed or bowl feeder; offloading is via a gravity system or with a robot into pallets.
- Super abrasives can also be used as the machine is capable of peripheral speeds of up to 140 m/s.
- Wheel dressing is facilitated using either static single point or rotary single point / full form dressing system.

VECTOR™ SURFACE



- The **VECTOR SURFACE** is a dedicated surface grinding machine and a deviation from the Vector Cylindrical grinding range which retains the same principle of 'Grinding in a Box'.
- The machine has been specifically designed for small intricate MIM parts that require precisely-ground features, and is equally suited to bearing runner block and intricate tooling.
- The 3-axis surface grinding system operates inside the wheel guard with a two-position servo driven indexing table delivering the parts to the grinding area.
- The indexing table uses the same philosophy as the Vector Twin, enabling part exchange to take place concurrently within the grinding cycle and thus giving a near zero spark to spark time.
- With a variety of part presentation systems available, the workpieces are loaded by either the integrated cartesian system or a robot.
- Super abrasives can also be used as the machine is capable of peripheral speeds of up to 140 m/s.
- Wheel dressing is facilitated using either static single point or rotary single point / full form dressing system.

VECTOR™ DUPLEX



- The **VECTOR DUPLEX** has been specifically developed for parts that require two opposite faces to be ground true to one another either parallel or multi-faceted, faithful to the 'Grind in a Box' philosophy all grinding debris and coolant is contained in the grinding area.
- The twin opposed grinding wheels allow both sides of the component to be ground simultaneously with a reciprocating motion.
- Parts are held in two separate work holding devices to allow loading and unloading to take place whilst grinding on the other fixture.
- With a variety of part presentation systems available, the workpieces are loaded by either the integrated cartesian system or a robot.
- Suitable for plated super abrasives wheels either formed or parallel, the machine is capable of peripheral speeds of up to 140 m/s.
- Optional secondary process for finishing part lengths.

VECTOR™ NANO



- The **VECTOR NANO** has been developed specifically to meet the ever-tightening requirements of new technologies, materials and products on complex components, with grinding to sub-micron accuracies and a mirror-like finish becoming the norm.
- It offers high mechanical rigidity, extremely high spindle speeds, excellent damping, high overall loop stiffness and thermal stability.
- It has a 11.4kW liquid cooled hydrostatic wheel spindle capable of delivering grinding peripheral speeds of up to 120m/sec.
- The 2.7kW liquid cooled hydrostatic workhead, with guaranteed axial and radial position variation of less than 0.0001mm, can be equipped with either a collet, chuck or centre - all of which can be used in conjunction with a tailstock.
- Glass scale absolute linear encoders are fitted to both the X axis and Z axis with 0.000001mm (1 nano metre) measurement increment.
- Integral temperature monitoring and compensation system.

VECTOR™ XL



- The **VECTOR XL** has a longer Z-axis than any other VECTOR variant, which allows for cylindrical components of up to 150mm long to be ground using any of the previously described Vector technology.
- Various part presentation systems are available, with components being loaded by either the integrated three axis cartesian system, or with a robot.
- Components are ground using straight, angle approach, or peel grinding.
- The workpieces can have a maximum diameter of 150mm and can be held either in collets, chucks, or between centres.
- Super abrasives can be used as the machine is capable of peripheral speeds of up to 140 m/s.
- Wheel dressing is facilitated using either static single point or rotary single point / full form dressing system.

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ENGINEERED SOLUTIONS

The **ENGINEERING TEAM** designs and develops solutions that are precisely tailored to maximise the production output of the system and satisfy the customer's ancillary requirements. From the concept stage, everything is considered to give a truly Turnkey process, from pre-process inspection to the final packaging. The **VECTOR** is much more than just a machine - it is the foundation for the complete solution.



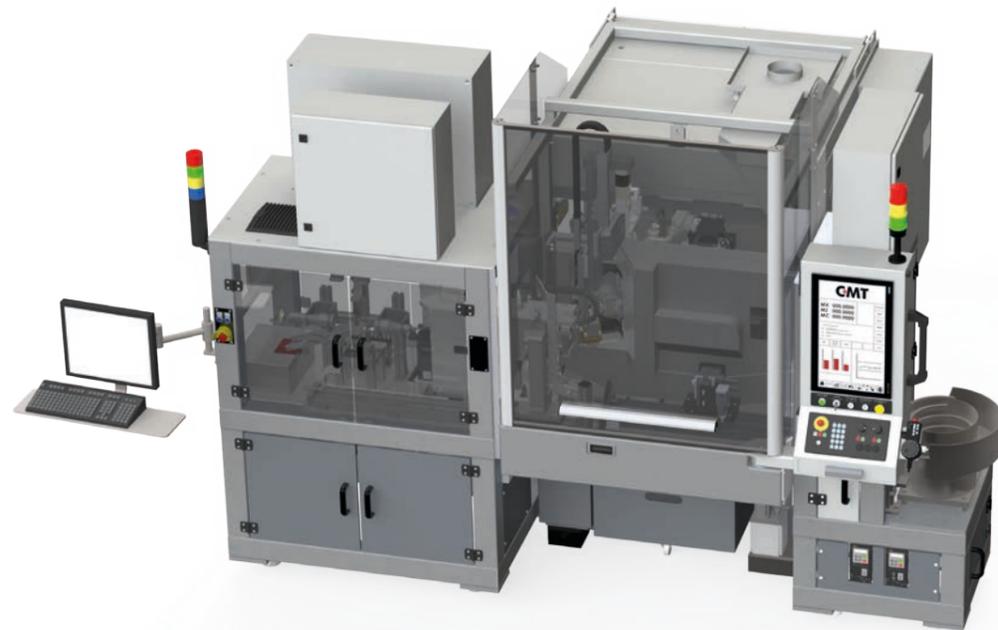
- Pre and post process measuring
- Laser marking
- Single part washing systems
- Demagnetisation
- Deburring
- Integration of other processes



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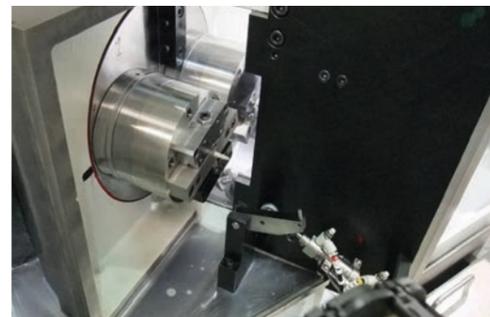
RANGE OF APPLICATIONS

The application spectrum of the **VECTOR** is infinite thanks to its modular design and can be combined with a wide variety of loading systems. Whether it is a single machine loading from a drawer, or multiple linked machines with a stacking system for automatic pallet change or alternatively, a complete production line - anything is possible.



The picture shows a stand-alone machine for grinding guide vanes for turbochargers, the diameter of the shaft as well as the blade top contour are ground.

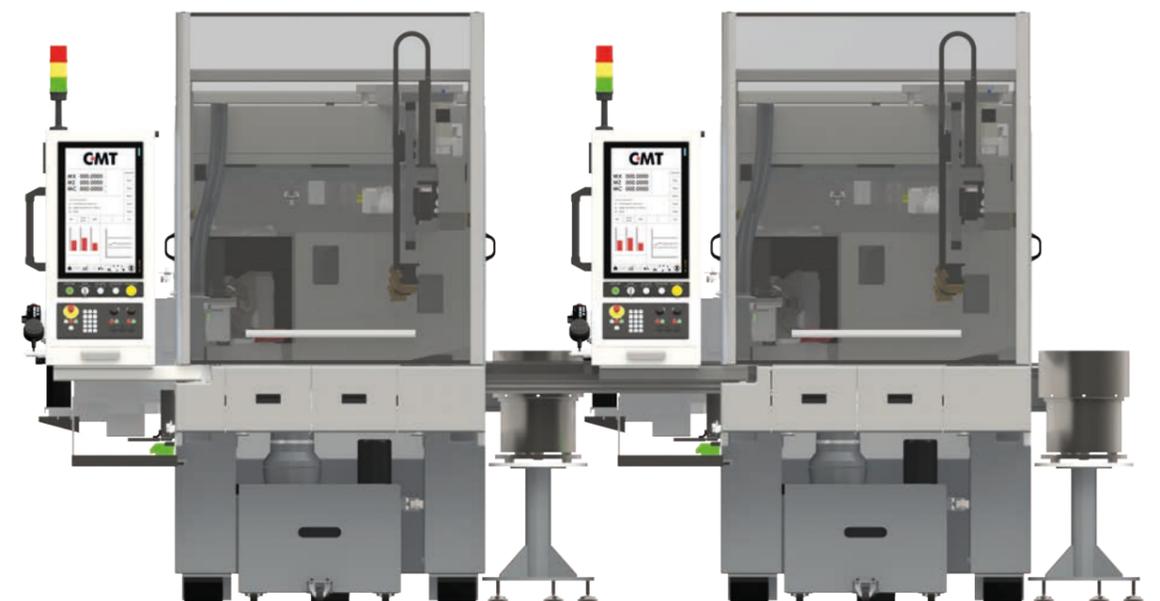
An automatic gauge system (left) checks the parts using tactile measurement and a high-resolution camera system.



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FLEXIBLE PRODUCTION CELLS

Two **VECTOR** machines can be connected as seen for machining parts with two separate operations. The variation of work which can be catered for with this system is almost limitless, and the **VECTOR** system is unrivalled in floorspace and variations.



*The flexible characteristics of the **VECTOR** concept strengthens the calculation of return of investments when the application and type of work is changing. The machine and loading setup can be easily adapted to accommodate the change of workload, operation and part type.*

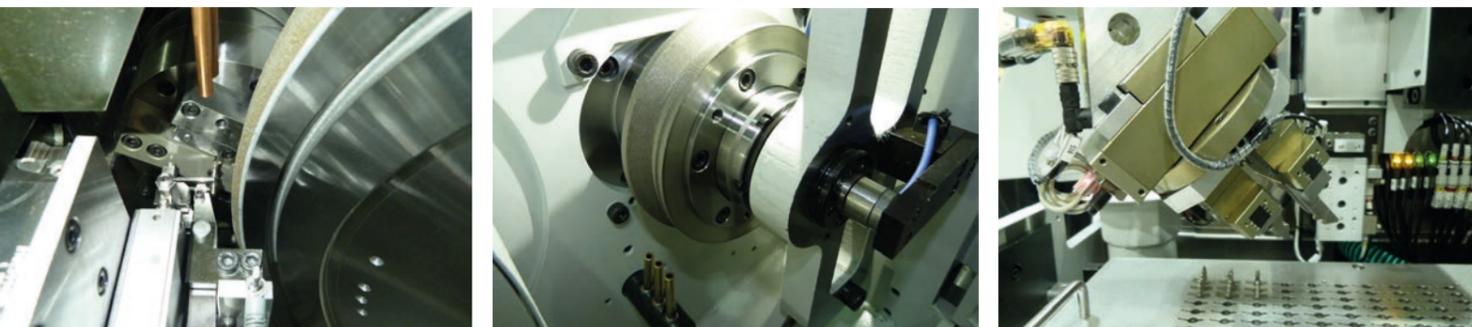
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PRODUCTION LINES

The **VECTOR** concept is equally designed for high volume production lines. It can be set up as a Turnkey solution together with other processes, such as electron beam welding, super-finishing, brush deburr, wash, measurement, balancing etc., to build a modular, flexible production line with the smallest footprint.



The picture shown is a production line to grind the groove and profile form in turbo charger shafts



VECTOR™

MACHINE SPECIFICATION

Technical Data	Vector Standard	Vector XL	Pendulum
Max. grinding wheel diameter	457 mm	457 mm	457 mm
Max. wheel width	50 mm	60 mm	60 mm
Wheel bore diameter	152/203 mm	203 mm	152/203 mm
Grinding spindle power	5 kW	5 kW	5 kW
Max. wheel speed	6,000 RPM	6,000 RPM	6,000 RPM
Travel X direction	190 mm	200 mm	200 mm
Travel Z direction	60 mm	150 mm	90 mm
Centre height	150 mm	225 mm	150 mm
Machine control systems	Siemens Sinumerik One	Siemens Sinumerik One	Siemens Sinumerik One
Machine dimensions	1200 mm x 1925 mm	1500 mm x 1400 mm	1500 mm x 1400 mm



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Martells Industrial Estate · Slough Lane
Colchester · Essex · CO7 7RU · United Kingdom

 +44 (0) 1206 230032

 info@curtisgrinding.com

