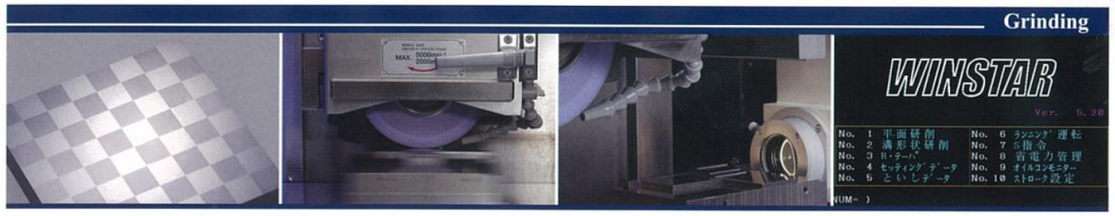
SOLUTION

WINSTAR

Ultra high precision forming grinder

SERIES

WINSTAR / WINSTAR-SP



The Engineering AMADA

Before using this product,
please read the operator's manual carefully and follow all applicable instructions.

- When using our products, safety equipment is required depending on the operational task.

* Specifications, appearance and equipment are subject to change without notice for improvement.
* The example grinding performance data in this catalog can be affected by temperature, grinding materials, grinding tool and grinding conditions etc. Please note that such data is not guaranteed.
* Please use the machine model name with a hyphen such as WINSTAR-SP, when applying for administration applications. Examples: installation report, export, and financing, etc.
* For Japan domestic market.

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Inquiry

AMADA head office is certified and registered of ISO14001.

1GC-07094-C000
May. 2016

Ultra high precision forming grinder, the pride of AMADA MACHINE TOOLS. Supports any application with high performance & automation

The WINSTAR-SP forming grinder is the highest level model. It delivers short lead times and unmatched grinding precision required in all technology driven markets, including medical, semiconductor and electronics. Inheriting its basic structure from its predecessors, the WINSTAR-SP has developed the elements required for the future of automated grinding. This future is realized in the WINSTAR-SP (V-spec) which provides CCD camera for measurement as well as NC controlled ball screw / direct longitudinal table drive. Moreover, while achieving measurement with a CCD camera, [WINSTAR-SP (V-spec)] has pursued further high performance and high precision with its space-saving body with an innovative design combines the latest technologies, and supports the business solutions of our customers to make it truly worthy of its name, "SP = Small & Precision".

Ultra high precision forming grinder

WINSTAR-SP (V-spec)

WINSTAR SP

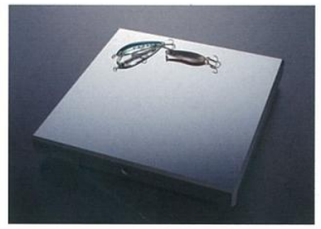
WINSTAR-SP/SP (V-spec) development concept

Our **Triple Crown** grinder is the future of grinding

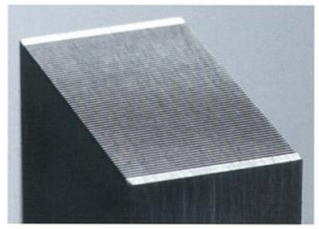
Stability An embrace of basic structure for stable grinding accuracy
Security Reduced thermal displacement for grinding repeatability you can trust
Safety Space saving full enclosure that guarantees work safety

Solutions for various grinding issues

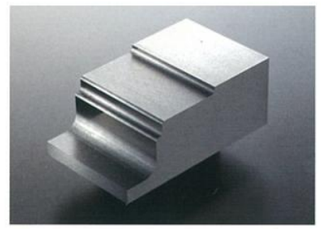
Mirror surface finishing
□180mm



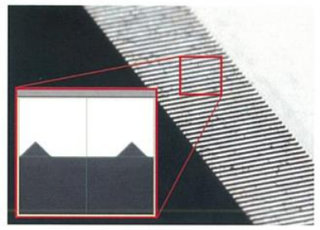
Groove grinding
width 0.2mm depth 0.4mm
P0.3mm 60 grooves



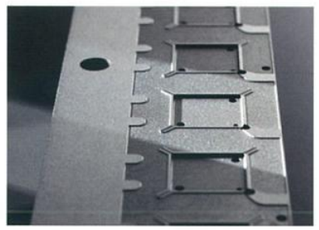
Contour grinding



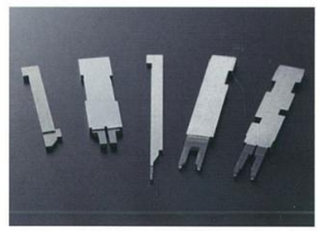
Micro pitch grinding
height 0.05mm P0.3mm
100 slots



Air vent grinding



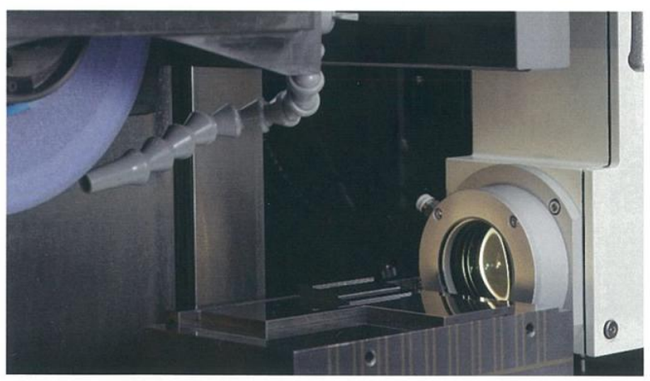
Core pin part

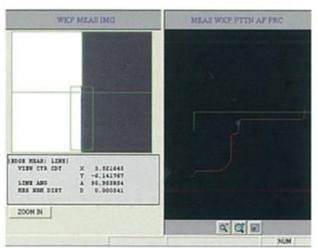


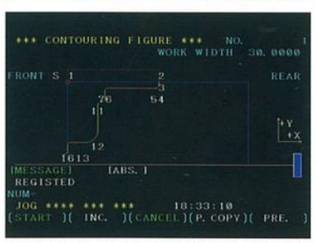
V-spec

CCD camera measurement system

The CCD camera and original software can measure shapes on the machine. There is no need to remove the workpiece, reducing processing time, and eliminating handling errors when measuring.







Years of technological refinement have given rise to a new dimension of grinding. The King of Surface.

WINSTAR is the best seller from AMADA MACHINE TOOLS superior forming grinders. 15 years after its market debut, it remains a top brand, and is equipped to continue its popularity into the future. It is an ultra-precision CNC forming grinder, achieving higher efficiency and higher quality in "mirror surface," and "forming" grinding.

Ultra high precision forming grinder

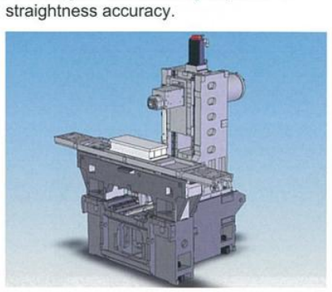
WINSTAR

WINSTAR

Machine structure that achieves high precision grinding

AMADA MACHINE TOOLS proprietary column type three plane independent structure

Its foundation is a T-bed with an elongated slide and column base. High static accuracy is assured through an independent moving column design that provides excellent operability. In addition, the V-V slideway is fully supported eliminating overhang and maintaining superior straightness accuracy.

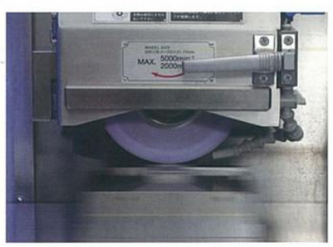


Ultra-low vibration spindle motor achieves ultra mirror surface finish capability

The grinding spindle achieves ultra mirror surface finishes, through a class V1 ultralow vibration, oil cooled spindle motor, equipped with an extra oil bath cooling function as standard equipment which provides great thermal stability.

Table reciprocating specifications guarantee high productivity

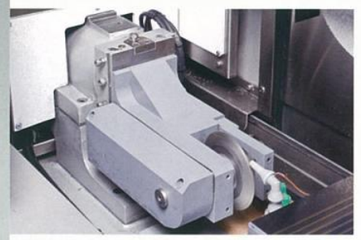
WINSTAR-SP table reciprocation uses a high speed servo valve for high seed stroking. At a 15mm stroke it can achieve 200min^{-1} inverse velocity. Alternatively, SP (V-spec) is an NC controlled servo motor ball screw drive system. It is a hydraulic-less eco-friendly machine. All series models boast high stroke reversal accuracy for stop grinding and can supply accurate longitudinal processing.



Application that extends across a wide range of grinding needs

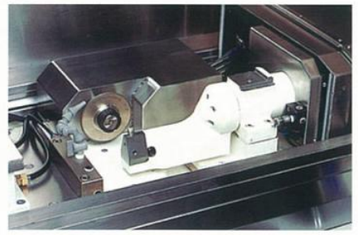
NC swivel rotary dresser

The swivel rotary dresser achieves high precision form dressing by means of 3-axis simultaneous control with "normal" position dress capability. Together they provide a leap in wheel-forming accuracy, from taper to straight, and radius forming. High speed diamond disk dressing also greatly reduces imnaccuracies due to diamond wear.



NC profile dresser

Wheel forming is performed by a servo driven, swing arm mounted, profiling diamond. 3-axis simultaneous control is used to keep a constant angle between the diamond and the wheel form. Because forming is always with one point of the dresser, high accuracy forming can be obtained. Additionally, a rough / fine duo diamond system can be provided.

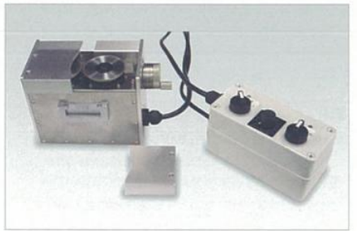


High precision rotary dresser

High efficiency dressing is possible with a max 3000min^{-1} rotary dresser. Rough dressing to finishing of simple shapes is supported. Two types, single and twin can be selected. The twin type supports two diamond disks for multiple rough and finish functions. Rough plunge dressing greatly reduces lead time for wheel preparation.

Twin dresser TD-100

Previously, thin wheel dressing with a conventional wheel required a high degree of skill, but by using the TD-100, dressing efficiency has made a great leap forwards. Through use of new thin grinding wheels, 0.05mm wide forming has been achieved.



Vertical rotary dresser VRD-125

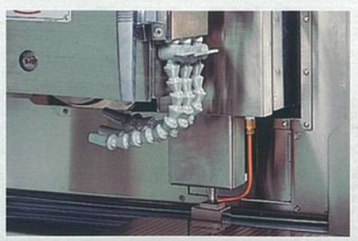
A motorized rotary dresser with a high rigidity spindle. High performance truing and dressing can be performed on diamond and CBN wheels.

High speed spindle 8000min^{-1} (SP only)

Equipped with ultra-low vibration (V1) 2.2kW oil cooled high speed motor. It provides 2.2kW at 2500min^{-1} and covers a wide range from normal grinding into the high speed range. It uses ceramic ball bearings for both the spindle and motor supporting high RPM's. While enabling wheels with smaller bores it still provides power in high speed grinding.

Automatic measurement system (touch sensor type)

Automatically performs measurements after grinding to given dimensions within canned cycle. Automatically re-grinds surfaces when measurement is out of tolerance. Measurement resolution is 0.05 µm. Automatic workpiece approach setting is an optional function. It also supports multiple workpiece measurement.



Automatic programming system used by WAPS-WIN grinder

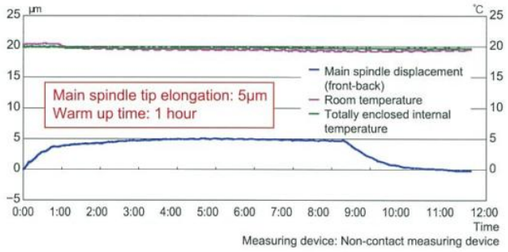
Forming grinding know-how has been converted into software. By loading CAD data, a NC program is created from rough to finishing. A variety of software options have been developed: wheel forming, rotary table applications (B/C table axis), air vent grinding, etc.

An uncompromising machine design capable of high precision grinding

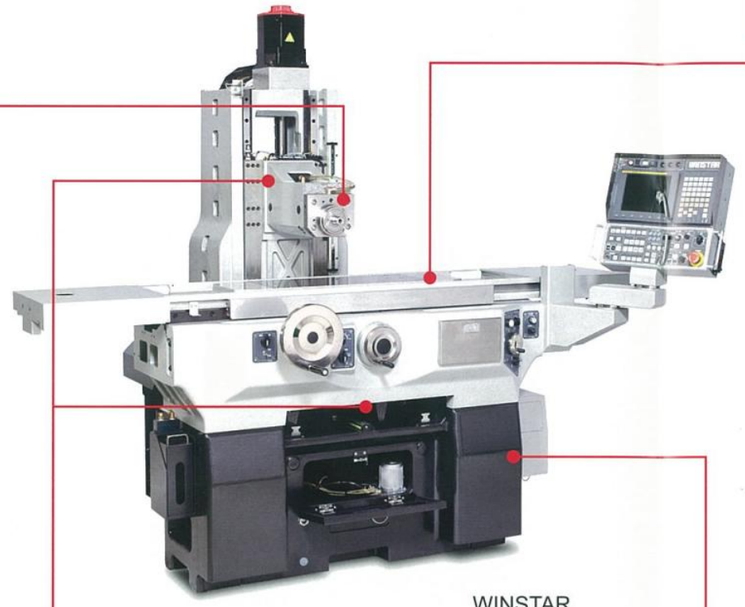
Ultra-low vibration spindle motor achieves ultra mirror surface finishes

Thermal displacement is controlled by using a proprietary ultra-low vibration, oil cooled spindle motor, with an oil bath cooling function as standard equipment.

Main spindle thermal displacement (WINSTAR-SP)
Main spindle rotation speed: 3000 min^{-1}
Coolant Oil Cooler: Machine body temperature setting -2˚C
Constant room temperature measurement



Measuring device: Non-contact measuring device



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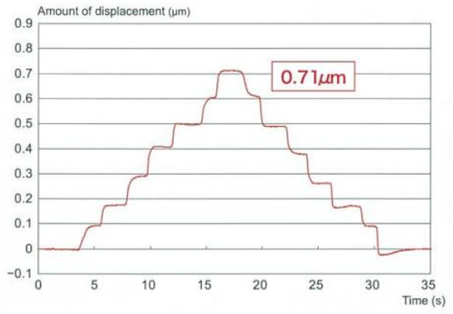
Hybrid guide surface loaded with glass linear scale

This dou system uses both a linear roller guide slideway that achieves backlashless submicron accuracy and a hybrid box way for sliding surfaces with enhanced vibration dampening for the vertical and cross axes. A 0.05μm resolution scale is also included as standard equipment.

Less than 0.1μm backlash capability (WINSTAR-SP):
X axis 0.68μm / 0.7μm
Y axis 0.71μm / 0.7μm



Ball screw driven, no overhang, V-V sliding surface

Superior straightness we achieved through the no overhang design with wide 1340mm (1400mm) table base providing a maximum table stroke of 600mm (780mm). In addition, the servo driven, ball screw drive system was used in WINSTAR-SP (V-spec), achieving smooth table feed with a stroking speed of 180min^{-1} / 15mm, eliminating the hydraulic system.

* Values in ( ) are for WINSTAR

Table straightness accuracy

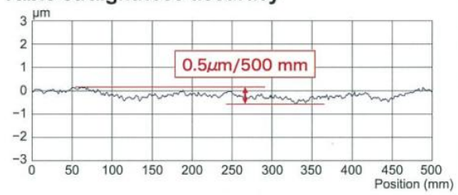
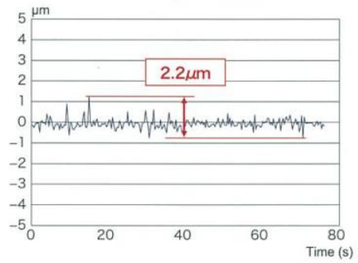
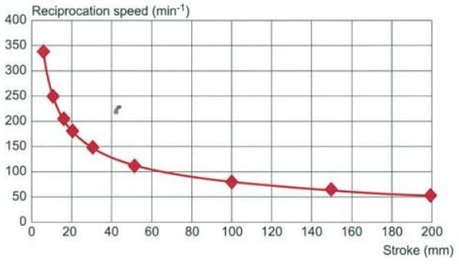


Table reciprocation accuracy



Stroke: 15mm
Number of reciprocations:
180 min^{-1}
Table mounted:
400 x 200 chuck
NC swivel
rotary dresser
n=250
MAX 1.27μm
MIN −0.74μm
3σ 0.69μm

Table reciprocation speed

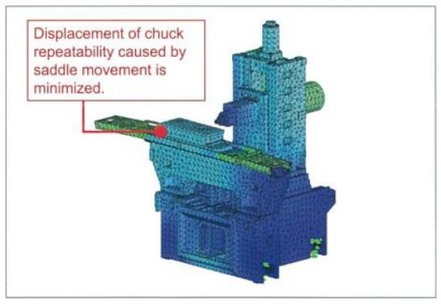


Measuring device: Bottom dead point detector (manufactured by K company)

Column type three-face independent structure

With AMADA MACHINE TOOLS' unique three-face independent structure whose column moves front to back, the vertical, cross, and side to side axes are not dynamically affected by other moving axes, thus providing stable processing accuracy.

CAE structural analysis by 3D digital design
- Analyzes the displacement of structure caused by own-weight, table movement, and column movement
- Digital design such as the best rib placement, jack placement, and mass balance



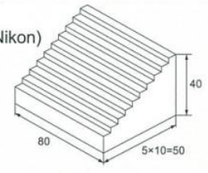
WINSTAR-SP

Unrivaled grinding precision produced by sublime design

❶ Step grinding accuracy

- **Grinding conditions**
  Grinding wheel: CBN170 ø200 x 10 x ø31.75
  Table stroke: 120mm 57min^{-1}
  Stock removal: 0.0200mm
  Grinding processing time: 230sec
  Measuring device:
  Digital length measuring device (Nikon)

	Cumulative errors	Pitch error
Minimum value	-0.0002	-0.0002
Maximum value	0.0003	0.0003
Maximum error	0.0005	

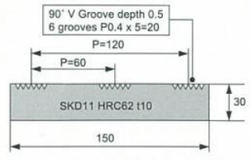


SKD11 HRC62

❷ V groove pitch grinding precision

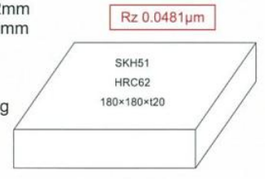
- **Grinding conditions**
  Grinding wheel : 89A400I (Tyrolit) ø205 x 6.4 (V mountain forming) x ø31.75
  Table stroke: 20mm 150min^{-1} Number of grooves: 18
  Stock removal: 0.5mm Times sparked out: 5 times
  Grinding processing time: 85min
  (including in processing dress one time per groove)
  Measuring device: Non-contact laser 3D measuring device
  (Mitaka Kohki.Co., Ltd.)

	Cumulative errors	Pitch error
Minimum value	-0.0003	-0.0004
Maximum value	0.0004	0.0004
Maximum error	±0.00035	



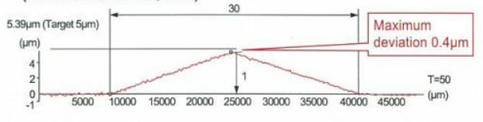
❸ Mirror grinding

- **Grinding conditions**
  Grinding wheel: D2000 ø200 x 6 x ø31.75
  Wheel speed: 900min^{-1} (peripheral speed 580m/min)
  Table stroke: 200mm
  Table speed: 10m/min
  Total grinding: 0.0080mm
  Rough / fine: 0.0005 / 0.0002mm
  Rough / fine in feed: 0.5 / 0.2mm
  (sync feeding)
  Grinding time: 83min
  Measuring device:
  Surface roughness measuring device (Taylor Hobson)



❹ Contouring grinding

- **Grinding method**
  After forming the grindstone corner radius with the rotary dresser, contouring grinding is performed.
- **Grinding conditions**
  Grinding wheel: 1GB100 2 J 6VCSS ø170 x 4.5 x ø31.75
  Table stroke: 35mm 120min^{-1}
  Number of grinding passes: 1
  Grinding time: 30min
  Measuring device: Non-contact laser 3D measuring device
  (Mitaka Kohki.Co., Ltd.)



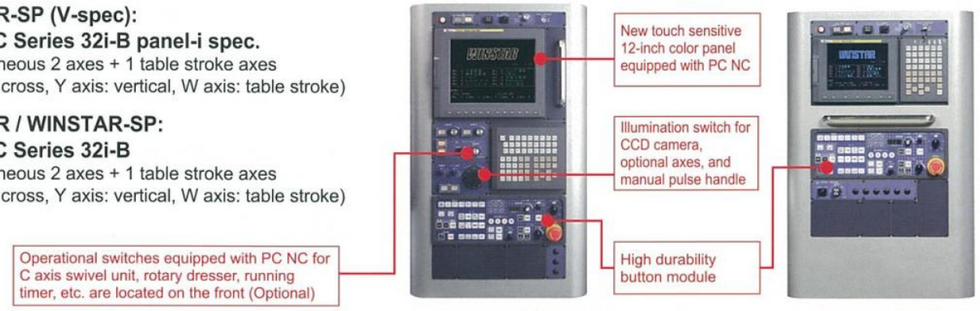
Original software makes craftsmanship a digital process

1 The most innovative technology in forming grinding

A new touch sensitive 12-inch color panel is used, which drastically improves operability. The operation panel has been newly designed so that functions are easier to select. The innovative design makes it intuitive and fun to use. (WINSTAR-SP (V-spec))

WINSTAR-SP (V-spec):
FANUC Series 32i-B panel-i spec.
Simultaneous 2 axes + 1 table stroke axes
(X axis: cross, Y axis: vertical, W axis: table stroke)

WINSTAR / WINSTAR-SP:
FANUC Series 32i-B
Simultaneous 2 axes + 1 table stroke axes
(X axis: cross, Y axis: vertical, W axis: table stroke)



WINSTAR-SP (V-spec) operation panel

WINSTAR-SP operation panel

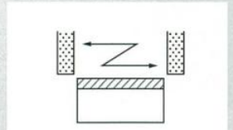
2 Simple operation that requires no program

Software

Canned cycles are fixed cycle for conversational input. Complicated G-code program knowledge is not necessary. Operators have full command of the technology.

Grinding cycle program patterns — GRINDING CYCLES

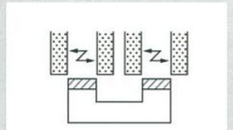
Surface grinding



Standard

Traverse grinding is easy because it's digital.
The front-back and side-side positions can be typed as dimensions or input by electronic teaching button.

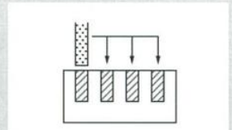
Traverse jump grinding



Standard

Automatically jumps across a space between multiple surfaces on the same height. All surfaces can first be roughed then all finished for more uniformity. (WINSTAR optional)

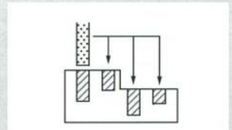
Equal depth slot grinding



Standard

Single or multiple grooves can be easily input and ground. Equal pitch of 999 grooves, or unequal pitch of 16 grooves can be set.
(WINSTAR optional)

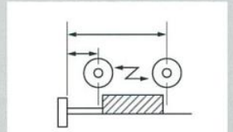
Unequal depth slot grinding



Standard

Complex multiple grooves can be easily input and ground. Fifty grooves of unequal depth / unequal pitch can be set.
(WINSTAR optional)

Table position setting



Standard

Table stroke position can be set on the screen. For workpieces on the chuck, end stroke positions can be set with the teaching button. The position setting screen enables changing centerline, length and left and right position.

Taper mode

Standard

Set the taper angle. Amazingly, when you turn the handle, the wheel moves on the angle. When re-grinding workpieces with unknown angle, the angle can be measured with two-point teaching. Using this function, any angle can be ground or dressed quickly, with no special fixtures.

Taper R

Standard

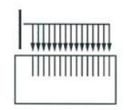
Grinding / dressing is performed by selecting 6 types of patterns and simply setting them. By setting rough or fine cut, grinding and wheel forming from a blank are possible.

R mode (Radius)

Standard

Locate the front side and top of a workpiece and set the radius required. Amazingly, when you turn the handle, the wheel grinds a radius profile. The feed speed is controlled by the handle. There is no faster way to grind any radius.

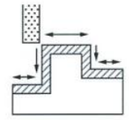
Tie bar grinding



Optional

Pitch data for multiple groove grinding can be edited easily. Finishing is done by grinding leaving several μm each per groove. Creep grinding can also be supported.
(WINSTAR select)

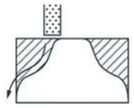
Pattern grinding



Optional

By combining the 5 most typical patterns, processing of complex shapes can be performed easily. Plunge / traverse can be combined for the most efficient grinding possible. (WINSTAR select)

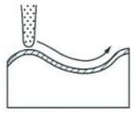
Pattern contouring



Optional

Simple shape contour grinding can be performed just by inputting dimensions required for basic shapes on the screen. Each shape is automatically displayed after input for operator review.

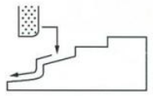
Contouring grinding



Optional

Complex contour grinding can be performed by conversationally inputting figure data. A rough plunge cycle can be created and displayed automatically by the machine. G-code programs can also be uploaded and displayed for grinding.

Terraced grinding



Optional

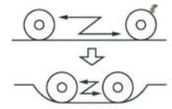
Step forms are combined and processed. Forms can be set with 5 steps and 4 processes in 1 pattern. Dressing cycles have been built-in, grinding wheels can be dressed to radius or taper.

Trapezoidal groove grinding

Optional

Multiple groove grinding can be performed on trapezoidal grooves. When the groove dimensions / pitch data is set, wheel forming and processing are performed automatically. It is possible for grinding to combine plunge, traverse and contouring. Rough, medium and fine processing are performed separately.

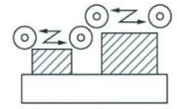
Table stroke



Optional

The speed switching function / plunge grinding / traverse grinding each have rough, medium and fine grinding; table speed and stroke length adjusted automatically.

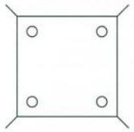
Multi workpiece function



Optional

By setting multiple workpieces on the chuck, continuous grinding processing can be performed. A maximum of 5 types of grinding data can be called up.

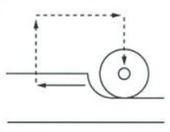
Air vent grinding



Optional

(WAPS-WIN required)
Multiple grooves set on a plate can be processed while determining table stroke position. This function processes by loading data created earlier with AMADA MACHINE TOOLS' WAPS-WIN air vent cycles.

Hydraulic creep grinding

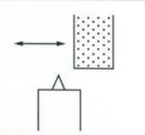


Optional

By means of table scale feedback control, grinding can be performed setting table stroke shift speed to low speed. Both up-cut and downcut are supported. Groove grinding software or tie bar grinding software are required.

Dressing cycle program patterns — DRESSING CYCLES

Straight dress

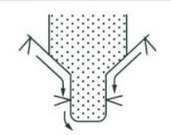


Dressing of wheel periphery is performed using a table top single point dresser or high speed disk dresser. This dressing cycle can be executed at most any time by operator or canned cycle.

Pattern dress

Wheel forming is performed using a simple profile dresser / NC profile dresser / high speed wdisk dresser. Form is created by just inputting dimensions required for basic shapes on the screen. This dressing cycle can be executed at most any time by operator or canned cycle.

Profile dress



Wheel forming is performed on various shapes using a simple profile dresser / NC profile dresser / high speed disk dresser (oval fillister). Rough dress can also be performed. G-code programs can also be uploaded and displayed for dressing.

Overhead dress

Wheel periphery dress is performed using an overhead dresser. This dressing cycle can be executed at most any time by operator or canned cycle.

Grooving dress

Wheel width is dressed to set values using a lateral face dresser and high speed wafer dresser. When the lateral face dresser is used, a back taper can be formed on the wheel.

■ Machine specifications

Model					WINSTAR-SP	WINSTAR-SP (V-spec)	WINSTAR
					Simultaneous 2-axis + 1-axis (hydraulic)	Simultaneous 2-axis + 1-axis (non-hydraulic)	Simultaneous 2-axis + 1-axis (hydraulic)
Type					Column type		
Capacity	Table working surface (length x width)			mm	550 x 200		610 x 270
	Table maximum side to side displacement			mm	600		780
	Column maximum front-back displacement			mm	250		340
	Spindle hight (spindle C/L to table)			mm	90 - 400		80 - 450
	Chuck size (length x width x height)			mm	500 x 200 x 100		600 x 300 x 100
	Table hight to floor			mm	1000		
	Maximum weight (chuck included)			kg	150		250
Reciprocation (right to left)	Manual	Handle feed / rotation	Normal	mm	100		
			Slight	mm	5		5 (OP)
		Drive system			Hydraulic servo / Mechanical manual pulse handle	Ball screw & servo motor / Mechanical manual pulse handle	Hydraulic servo / Mechanical handle (Mechanical manual pulse handle: OP)
	Automatic	Feedrate	Normal	m/min	1 - 40		
			Creep feed (OP)	mm/min	Hydraulic creep Low speed: 10 - 200 High speed: 10000	NC control (dialog software) 0.1 - 20000	Hydraulic creep Low speed: 10 - 200 High speed: 10000
		Drive system			Servo valve + scale / Hydraulic cylinder	Servo motor (base cooling) + ball screw (spindle core cooling)	Servo valve + scale / Hydraulic cylinder
		Reciprocation speed (15 mm stroke)		min^{-1}	200	180	200
	Minimum setting units			mm	0.01	0.0001	0.01
	Position detection / Scale resolution			μm	Magnetically guided ABS scale / 0.1	Semi-closed	Linear scale / 1
	Guide surface				VV turcite		
Cross	Manual	Handle feed (Magnification switch: x1, x10, x100, x400, automatic)	One rotation	mm	0.01, 0.1, 1.0, 4.0		0.01, 0.1, 1.0, 10.0
			One scale	mm	0.0001, 0.001, 0.01, 0.04		0.0001, 0.001, 0.01, 0.1
		Drive system			Ball screw / Mechanical manual pulse handle		
	Automatic	Feedrate	Jog feed	mm/min	0 - 400, 1000, 2000		0 - 400, 500, 1000, 2000
			Rapid traverse	mm/min	4000		5000
			Grinding feed	mm/min	0.1 - 4000		0.1 - 5000
	Minimum setting units			μm	0.01		
	Position detection / Scale resolution			μm	ABS linear scale / 0.05		Linear scale / 0.05
	Guide surface				Linear roller guide + slide (hybrid guide)		
Vertical	Manual	Handle feed	One rotation	mm	0.01, 0.1, 1.0, 4.0		
			One scale	mm	0.0001, 0.001, 0.01, 0.04		
		Drive system			Ball screw / Mechanical manual pulse handle		
	Automatic	Feedrate	Jog feed	mm/min	100, 1000, 2000		100, 200, 500, 1000
			Rapid traverse	mm/min	2000		
			Grinding feed	mm/min	0.1 - 500		
	Minimum setting units			μm	0.01		
	Position detection / Scale resolution			μm	ABS linear scale / 0.05		Linear scale / 0.05
	Guide surface				Linear roller guide + slide (hybrid guide)		
Wheel	Outer diameter x width x bore diameter			mm	ϕ205 x 6.4 - 25 x ϕ31.75	ϕ65 - 100 × 3 - 10 x ϕ22.23	ϕ255 x 6.4 - 25 x ϕ50.8
	Spindle speed			min^{-1}	500 - 5000 (inverter)		
Hydraulic	Hydraulic oil / Lubrication oil / Cooling oil			L	Hydraulic oil 40 (tank separated) Lubrication oil 12 (tank separated)	Cooling oil 15 (tank separated) Lubrication oil 12 (tank separated)	Hydraulic oil 100 (tank separated) Lubrication oil 20 (bed)
	Hydraulic / Cooling unit capacity (hydraulic oil not included)			kg	130	70	250
	Oil cooler capacity (50 / 60Hz)			kW	2.8 / 3.2	1.3 / 1.4	3.8 / 4.3
	Cooling medium				HCFC R410 (Zero for Ozone Depletion Potential)		
Motors	Wheel spindle			kW	3.7 (oil cooler)		
	Hydraulic pump			kW-P	1.5-4	None	2.2-4
	Cross feed			kW	1.0		0.6
	Longitudin feed			kW	1.2		0.4
	Reciprocation feed			kW	None	1.8 (β12 is)	None
	Automatic lubrication pump			W	25		
	Cooling pump (50 / 60Hz)			kW	0.4 shared with oil cooling pump (24 / 28.8 L/min)	0.4 Shared with oil cooling pump (12 / 14.4 L/min)	0.4 shared with oil cooling pump (24 / 28.8 L/min)
Power requirement				kVA	12		14
Mass of machine				kg	4000		4700

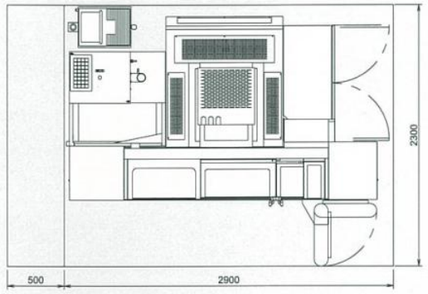
(Note) OP indicates an option.

■ Floor space and travel

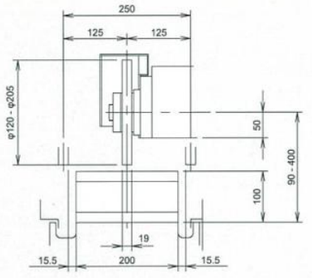
Unit: mm

● WINSTAR-SP / SP(V-spec)

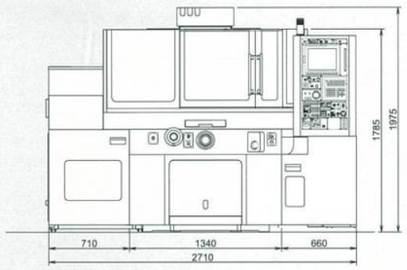
Plane view



Travel

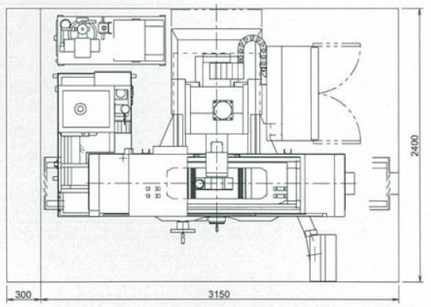


Front view

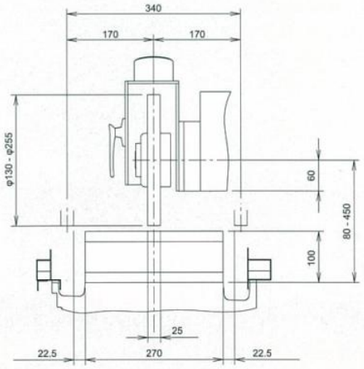


● WINSTAR

Plane view



Travel



Front view