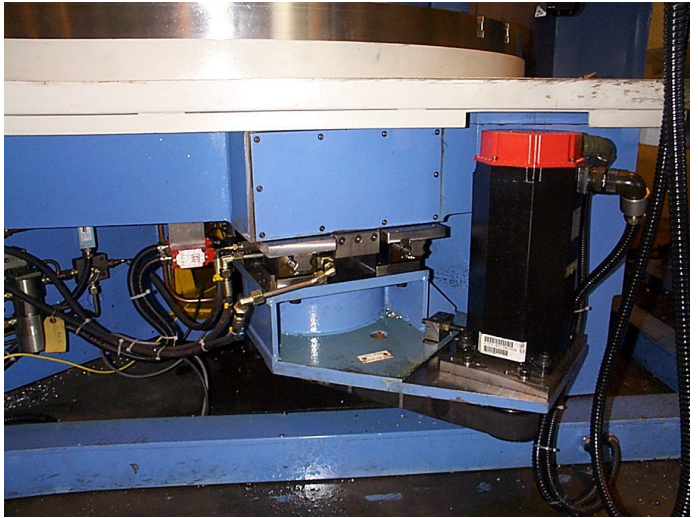
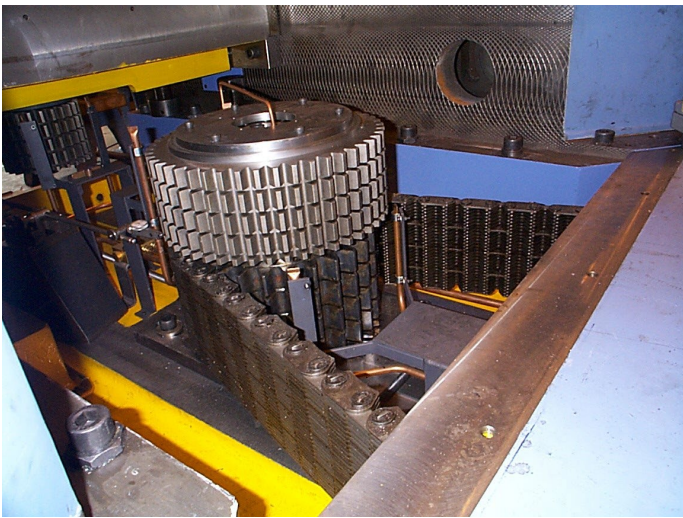


WEBSTER & BENNETT MILLENNIUM VERTICAL TURNING LATHES AND VERTICAL TURNING & MILLING CENTRES

Conceived, designed and built with innovative world leading features that won multiple orders from world leading companies in demanding industries - aero engine manufacture and repair, missiles, compressors, turbines, oil and gas, rail and submarine transmissions, locomotive turbo chargers, space rockets, military tank drives, Cranes, Medical body scanners, Crushers – *components ranging from light cutting with super precision to heavy duty cutting with precision*



Two innovations in particular made these machines unique

- **the involute chain drive** from the motor to the table enabled very high speeds with a noise level <80db, way below the current norm
- **the C axis drive** was very powerful and backlash free enabling precision rotary contour milling at metal removal rates not seen before on C axis VTL's

20 years later these machines still provide these world class features. **6 years ago** we refurbished a machine that had been in storage because of a factory move. Very little updating was required. The user is one of the world's foremost engineering companies. Since we commissioned it the machine has been producing very high precision components. *This can be seen in a short film on our web site*

The Webster & Bennett Millennium range of vertical lathes and vertical turning centres

1. Introduction to the technical features of the Millennium range and optional specifications
2. The Machine Construction
 - 2.1 Millennium design overview
 - 2.1.1 Base
 - 2.1.2 Table and main spindle drive
 - 2.1.3 Crossrail
 - 2.1.4 Ram with live spindle
 - 2.1.5 C axis table drive
 - 2.1.6 Machine lubrication
 - 2.1.7 Control console
 - 2.1.8 Machine safety guard
 - 2.1.9 Coolant tank and pumping system
 - 2.1.10 Automatic tool changer
 - 2.1.11 Hydraulic power pack
3. Machine alignments and axis accuracies
4. Acceptance protocols
5. Millennium documentation

1. INTRODUCTION

The Millennium range of Vertical Turning Centres has a high quality production capability and is of a modular design which provides the following machine specification options for each basic size of machine:-

- **Fixed cross rail models** provide high rigidity and operating accuracy where a working height up to 1.800 mm is required – a very cost effective option.
- **Elevating cross rail models** are recommended where working heights greater than 1.800mm are required.
- **Live spindle and full contouring 'C' axis option** is available on both fixed and elevating cross rail models

A range of machine specification options and accessories are available.

2. MACHINE DESCRIPTION

2.1 MILLENNIUM DESIGN OVERVIEW

The machine is a substantial construction comprising of a base and a vertical column that supports the cross rail and the ram saddle. It is designed and built to provide high rigidity, accuracy and thermal stability under a wide range of cutting conditions. Its structural elements are designed to absorb the stresses and dampen the vibrations induced by cutting forces, even under very heavy duty conditions.

2.1.1.- Base

The base is a substantial and heavily ribbed casting providing a high degree of stability to the machine assembly. It is cast in grey iron grade 300 to BS1452:1990 with 300 N/mm² minimum ultimate tensile strength and is fully stress relieved prior to final machining.

The base supports the rotating table and houses the main spindle bearing and table drive assembly. A labyrinth seal is provided between the bottom of the table and a cover plate thus protecting the main spindle bearing and drive from the ingress of cutting fluid, swarf or any other particles.

If the 'C' axis option is selected the drive assembly is located at the front of the base.

2.1. 2.- Table and main spindle drive

The table is directly mounted on the main spindle running on a specially selected high precision Timken crossed roller bearing. The use of this type of bearing offers a much simpler and shorter spindle configuration with high load bearing capacity on a single bearing. The bearing is assembled with a specific preload to ensure maximum rigidity and minimum run out, radially and axially.

The main spindle is driven from a vertically mounted motor at the back of the base, directly coupled to a two-speed planetary gearbox. From this, the drive to the spindle is provided through a two-stage metal belt and gear reduction transmission. The belts used are of inverted tooth type, of true involute form, giving a smooth, highly efficient and low noise transmission which also creates minimal heat and therefore minimal distortion in the Z and Y axes, this being even more controlled through the use of the controlled temperature lubrication system, described fully in 2.1.6.

2.1.3.- Cross rail

The cross rail can be fixed, permanently attached to the column (fixed rail model) or can be raised and lowered on guideways attached to the column face (elevating rail model). Various height options are available.

In each case the construction of the cross rail remains the same.

The crossrail is a full length design in accordance with the machine's symmetrical design criteria. This enables tool and attachment pick up from magazines on both sides of the machine.

It is a 3 guideway design for optimum performance

The cross rail is a substantial and heavily ribbed casting providing a high degree of rigidity under heavy loads. It is cast in grey cast iron grade 300 to BS1452:1990 with 300 N/mm² minimum ultimate tensile strength and fully stress relieved prior to final machining.

The cross rail is fitted with precision ground hardened steel guideways onto which the ram saddle is supported and is able to slide horizontally (X-axis). All bearing and sliding surfaces in the saddle are lined with a non-metallic material of high-performance, low-friction and low-wear characteristics.

This arrangement provides adequate plain bearing surface to allow the machine to withstand heavy cutting forces and shock-loads under the most arduous of conditions.

Travel of the ram saddle is provided by a large diameter high precision ballscrew driven from the X-axis servomotor. A linear scale fitted to the cross rail provides high accuracy X-axis positional feedback.

A set of telescopic steel covers is fitted to protect the guideways, the ballscrew and the linear scale against cutting fluid, swarf and any other particles. Additionally, wipers are fitted to all faces of the guideways and the linear scale is pressurised for maximum protection.

2.1.4- Ram and live spindle

The Millennium ram is available with traverses from 1000mm – 1500mm.

It is available as a plain ram for turning tools only **or with the optional** live spindle ram and C axis table control for rotary contour milling, drilling, grinding and turning tools.

The ram may be ordered as a 200mm square or 250mm square structure according to the users requirements. When using angle milling attachments or heavy duty grinding attachments it is recommended that the 250mm ram is chosen.

The square ram is made from a normalised EN8 steel forging, induction hardened and precision ground. It is mounted in a robust housing made in high quality close grained grade 275 Mehanite cast iron, which in turn is rigidly supported by the cross rail saddle. The bearing and sliding surfaces in contact with all four sides of the ram are lined with a non-metallic material of high-performance, low-friction and low-wear characteristics. 950-mm of the ram length is within the housing, and gib strips are provided within this arrangement for easy adjustment when required. This substantial design allows the ram to withstand heavy bending moments and shock loads with minimum deflection even when fully extended.

The live spindle is powered by a motor, options from 18 to 34.5kw, mounted on the top of the ram. The spindle cartridge unit mounted in the nose of the ram runs on grease lubricated high precision angular contact bearings and is designed for speeds up to 4000 rpm. Driven tools are retained by a standard pull stud to ISO 7388/2 type B and are located by an ISO 7388/1 size 50 taper.

Static tools are retained by 4-hydraulically actuated wedge lock clamping elements to ensure high rigidity and accurate tool clamping.

Vertical travel of the ram is provided by a high precision ballscrew driven from the Z-axis servomotor. The hydraulic counter balance system applied to the ram slide prevents the Z-axis ballscrew from being subjected to high loads and maintains high positional accuracy. An optional linear scale provides high accuracy Z-axis positional feedback.

2.1.5.- C-axis table drive (option)

A rotary indexing and milling axis to the table is provided by the C axis drive. The C axis drive assembly is mounted to the front of the base and comprises a servo motor, a high reduction gearbox, and a pinion which engages the main spindle gear under hydraulic actuation. The hydraulic pressure is maintained throughout C drive operation to ensure a total elimination of backlash effect.

An encoder of the highest resolution provides positional feedback

Selection of C axis automatically disengages the main drive.

This option provides the ability for drilling operations with high positional accuracies, and the variable low speeds and high torques available at the table allow for precise and powerful continuous contour milling.

2.1.6.- Machine lubrication

Several lubrication systems are provided with the machine to ensure an efficient and long-life operation.

Oil lubrication of main spindle drive.

A pressurised recirculating oil lubrication system ensures adequate lubrication for the main spindle gearbox, the inverted tooth belt train and the table bearing. A lubrication unit comprising of oil reservoir, motorised pump and filters is provided with the machine for this purpose. Additionally and to ensure thermal stability and minimise table thermal growth, an oil chiller unit is also provided. Both the lubrication and chiller units are floor-mounted at the rear of the machine with all required interconnecting piping. A series of thermostats, pressure and level switches provide the machine controls with full and continuous monitoring for safe operation.

Oil lubrication of guideways and ballscrews.

A total-loss motorised pulse lubrication system is provided for the X and Z axis ballscrews and all the plain bearing guideways in the machine, saddle traverse (X axis) and ram vertical travel (Z axis). The pump units deliver flow to positive displacement metering units at each lubrication point. Level and pressure switches provide the machine controls with continuous monitoring feedback for safe operation.

Oil lubrication for live spindle drive.

A pressurised recirculating oil lubrication system provides lubrication for the live spindle gearbox and transmission train and bearings. The lubrication unit comprising of oil reservoir, motorised pump and filter is mounted on the top of the ram. Pressure and level switches provide the machine controls with full and continuous monitoring for safe operation.

Grease lubrication.

A number of elements are grease lubricated for life. These elements include the X axis gearbox, the tool changer gearbox, the C axis gearbox and the live spindle cartridge bearings.

2.1.7.- Control console

The control is mounted at the end of a swing arm that is fixed to the floor. The console itself can also be rotated at the end of this swing arm, giving the operator greater flexibility around the work area. The console houses all operator's controls, the display screen, the keyboard and the manual pulse generator (MPG). The MPG is fitted to a hand held box with flying lead connected to the control console to give the operator easier control when making manual adjustments and settings.

2.1.8.- Machine safety guard

The machine is fully guarded in conformity to the current health & safety regulations. The guarding has safety interlocked doors allowing the machine to be fully operational only with the doors fully closed. Viewing windows with safety glass pane to the front allow the operator visual access to the machine table area. Incorporated at the bottom of the guarding is a drip tray.

2.1.9.- Coolant tank and pumping system

A tank of 680 l capacity will be provided to collect coolant fluid by gravity from the machine. Two motorised pumps, each with a capacity of up to 25 l/min at 4 bar, will deliver through-spindle coolant and static tooling coolant respectively. Washable metal mesh cartridge filters provide a filtration level of 25 microns. The pumps are controlled from the CNC with manual override switching.

Optional flows and pressures are available.

A tramp oil system will also be supplied to separate lubrication oil from the coolant fluid.

2.1.10.- Disc type automatic tool changer

The 18-station disc automatic tool changer is provided to the right hand side of the machine. The tool changer is a floor mounted fabricated base structure supporting the toolholder disc. The indexing of the disc is driven from a cnc servomotor via a timing belt and planetary reduction gearbox. The disc with its arms is designed to hold a maximum of eighteen (18) static and ISO50 driven tool holders (an appropriate adaptor plate is required for each station destined for driven tooling). With tooling systems such as CAPTO, KM etc it is possible to a larger number of tools. A number of optional tool magazines are available.

2.1.11.- Hydraulic power pack

A hydraulic power pack is supplied with the machine to control all hydraulically operated machine functions such as ram counter balance, static tooling locking, driven tooling locking, main spindle gearbox speed selection, etc. This unit, comprising of oil reservoir, motorised dual pressure pump, filters, pressure gauge and stack of solenoid operated directional valves, is floor mounted and situated towards the rear of the machine.

3.- MACHINE ALIGNMENTS AND AXIS ACCURACIES

The Millennium vertical turning machine will be built to conform to the following standards:

- Machine alignment: ISO 3655
- Machine axis accuracies: ISO 230 part 2

The axis accuracies will be demonstrated with a laser inspection equipment.

Additionally, a ball bar test will be performed to assist accuracy reproduction at installation.

4.- ACCEPTANCE PROTOCOL

The acceptance of the machine will be subject to the following protocol:

Provisional acceptance

The provisional acceptance protocol will be implemented at the machine builders factory in the presence of customer representatives prior to delivery. Should customer decline to send any representatives for the provisional acceptance, the certificate of provisional acceptance issued by the builder will be deemed accepted by customer.

The provisional acceptance of the machine will be declared and certified upon successful completion of the following:

- Check of machine alignments ISO 3655.
- Check of machine axis accuracies and repeatabilities ISO230 part 2
- Ball bar test.

Final acceptance

The final acceptance protocol will be implemented by the machine builder at customer's works as completion of the commissioning of the equipment.

The final acceptance of the machine will be declared and certified upon successful completion of the following:

- Certification of machine alignments.
 - Certification of machine axis accuracies and repeatabilities.
 - Certification of ball bar test.
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5.- MILLENNIUM DOCUMENTATION

Two (2) sets of documentation covering the operation and maintenance of the equipment will be supplied in hard copy format. This documentation will comprise the following items:

Operator's handbook and programming guide comprising:

- Operation instructions.
- Maintenance instructions.
- General arrangement drawings and schematics, foundations drawing, control parameters and software listings, list of parts.
- Health and safety instructions.
- Certified machine alignments.
- Certified laser calibration of machine axis.

PLEASE NOTE – REFERENCE MACHINES FOR RESALE

For resale machines we will always complete as many of the acceptance protocols and provide as much of the documentation as possible.

The amount we can do and can provide depends to a degree on whether we are selling from an existing users factory or from our own workshop where we have refurbished and fully tested the machine

However, we have huge pride in these machines and in supporting them and their owners. This is our company's major business focus together with providing the continuing support of Planned Maintenance Programs to enable 96%+ uptime
