



**VERTICAL TURNING  
TECHNOLOGIES  
LIMITED**



VTT updating qualities that made Britain a world leading machine tool designer and builder

For the support and modernization of  
Webster & Bennett CNC vertical turning centres

For the service, rebuild and modernization of all  
Webster & Bennett conventional machines

## The VTT Webster & Bennett Millennium Vertical Turning Centre

### Model 3E-160/175H with new high spec Siemens 840Dsl CNC

The Millennium range was designed and the built to provide a unique turning and machining capability.

These machines handle very efficiently both simple turning processes and the very complex combination of turning, drilling, contour milling and grinding of large basically round components.

The machine on offer has been used solely in the production of high precision aerospace components and has never been used in heavy metal removal conditions.

However, the Millennium is also suitable and proven for very heavy machining – see *films on web site*

We are offering a machine in the process of bringing it back to new operating condition with 12 months warranty. From March 1 it can be completed with **new Siemens 840Dsl CNC** ready for re-installation and commissioning 8 weeks after receipt of order. **Guarding is similar to the photo below** of the Millennium we were commissioned to refurbish prior to installation and commissioning in the new factory of a well known aero engine manufacturer in 2017.

We are part of the team that designed and built these machines and are experienced in dismantling, uplifting, refurbishing, modernising, installing, commissioning and maintaining them

**The 18 pocket ATC magazine is fully loaded with standard toolholders and KM63 tooling.** It also has tool pockets to accept 50 taper live tools. Each pocket can be for live or turning tools.

**As option a second 18tool ATC magazine** can be installed on the left side of the machine. In this case the swarf conveyor will need repositioning and minor modifications made to the guarding

**PRICE £340,000 includes a 12 month new machine warranty with full planned maintenance service at 6 months and 12 months**

Installation and commissioning on your prepared foundation – engineers costs including travel and accommodation (subject to review) £25,400 plus any contracted transport and lifting costs.

---

Incorporated in England number 7389920  
Butterthwaite Industrial Estate, Butterthwaite Lane, Ecclesfield, Sheffield S35 9WA

Directors: **Iain Exeter**  
**Petr Gabrhelik**

[iain@vtt-wb.com](mailto:iain@vtt-wb.com) 07808 789597  
[peter@vtt-wb.com](mailto:peter@vtt-wb.com) 07808 789598

An associate company of CTL Seal Ltd, Diamond Seating Ltd and TFL Responsive

## Basic Specification

### Capacities –

Maximum swing and turning diameter.....	1750mm
Max workpiece + fixture weight .....	10,000kgs

Auto latching and clamping elevating crossrail.

Maximum height under ram.....	1200mm.
-------------------------------	---------

### Table

4 jaw steel chuck.....	1600mm diameter
Table turning speeds .....	1 – 400rpm.
Minimum table speed at full power .....	36rpm.
Table drive motor, high torque DC .....	37kw
Feed force for turning (X axis) .....	30kN.

### Live spindle ram for full contour milling and turning

Forged steel ram, square section.....	200mm sq.
Feed force .....	45kN
Live spindle power .....	17kw.
Live spindle speeds .....	20-3000rpm.
Z axis feeds .....	0 – 5000mm/min.
Stroke of ram (Z axis) .....	1000mm

**Ram saddle travel** - X axis range left and right of centre is 1430mm (2860mm total)

This enables ATC/tool pick up to be arranged from magazines on either side

***This machine has the magazine on the right and chip conveyor on the left***

**Positional accuracy** in X and Z =  $\pm 0.0075\text{mm}/1000\text{mm}$ . Repeat  $0.005\text{mm}/1000\text{mm}$

### C axis table drive for contour milling and PCD drilling

<b>Table positional accuracy</b> .....	$\pm 5$ arc secs,
<b>Table positioning repeatability</b> .....	$\pm 2.5$ arc/secs.

*Our experience is to achieve significantly higher accuracy than as shown.*

**C axis** table rotation speed for **PCD positioning**.....up to 5.3rpm.

**C axis** table rotation speed for **contour milling** .....

**C axis torque** .....

### Photos following

*Laser testing for 1 arc sec positioning accuracy at recent installation after refurbishment*

The machine on offer is fully guarded similar to



## **SOME TECHNICAL DETAILS OF THE MILLENNIUM RANGE**

*This relates to the Millennium range. Not all paragraphs apply to the machine on offer*

**All Millennium machines have the unique HIV involute form metal belt drive that provides all the power and torque you need - very fast and very quietly**

1. Introduction to the Millennium range
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**

All machines in the Millennium range of Vertical Turning Centres have a high quality production capability and are 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** 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/mm<sup>2</sup> 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 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. 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** enabling tool and attachment pick up from magazines on both sides of the machine.

The cross rail structure is a substantial, 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/mm<sup>2</sup> minimum ultimate tensile strength and fully stress relieved prior to final machining.

The cross rail is fitted with precision ground hardened steel guideways on which the ram saddle slides 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, optionally, as a live spindle ram for 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 drive motor mounted on the top of the ram is 17 (Siemens) or 18 kw (Fanuc) in 200mm rams and 30 – 34.5 kw in 250mm 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 3000 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.

In the 200mm ram static toolholders are pulled up by the draw bar into a precision locating disc. In the 250mm ram very heavy static toolholders 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. A 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.

A very high resolution encoder provides precise 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 long life between change. This includes the X axis gearbox, the tool changer gearbox, the C axis gearbox and the live spindle cartridge bearings. The maintenance documentation recommends the frequency of oil/grease change

### **2.1.7.- Operators Control console**

The control is mounted at the end of a swing arm located conveniently to the right of the main work access doors. 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 panels in the doors are made with high specification material to allow the operator visual access to the machine table area with total safety.

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 is 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 separates lubrication oil from the coolant fluid.

### **2.1.10.- Disc type automatic tool changer**

If the customer specification requires a single tool magazine 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 and support arms.

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 work with an increased number of tools. In this case an optional tool magazines may be required.

### **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 2 speed 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.

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 repeatability 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 axes positional and repeatable accuracies.
- Certification of ball bar test.

## 5.- MILLENNIUM DOCUMENTATION

Documentation covering the operation and maintenance of the equipment will be supplied in digital 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.

This is the machine we are offering, midway through the mechanical and hydraulic updating and refurbishing process



