Multi-functional CNC lathe, for turning, milling, drilling, and tapping

Atomat has developed the Giana AT925E multifunctional CNC lathe. It has a solid design to ensure precision, reliability, and safety in turning operations of large workpieces, as well as being a multi-functional machine, with the possibility to execute very demanding milling, drilling and tapping operations.

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For a tool machine manufacturer, it's important to develop products based on a well-defined philosophy, that, on the one hand, guarantees competitive advantages to the end user and, on the other make its machines easily noticeable compared with those of its competitors. In a dynamic market, such as now, this approach is no longer enough. Technological innovation and tailored customization are essential to realizing a product as close as possible to customer demands. This is even more relevant where the size of the workpiece to be machined increases. Atomat, aware of this need to combine tradition and innovation, developed the new AT925E CNC multifunctional lathe (*Figure 1*). It is a 9xx series of lathes, with a maximum workpiece capacity between centres of 25t and the capacity to perform milling, drilling, and tapping operations, thanks to four controlled axes, a powerful motorized turret, and a special steady rest.

FROM ROLLING MILLS TO THE GENERAL MACHINE

Thanks to the long experience gained in the field of roll shop machine tools, where high performance is requested from lathes in terms of strength and precision, Atomat focused on the bedplate as the main element of the project. Despite its large size – with a total length of 14m and 8m between the centers – the bed is produced from a single casting. It is monolithic along the whole length and manufactured by trusted Italian foundries, proven to produce high-quality products.

The monolithic base is robust, stable, and not affected by the relative movements between parts that can occur in structures composed of separate elements. This aspect guarantees greater geometric precision of the structure, on which the various systems and equipment are fixed. Accordingly, the whole assembly results in higher machining accuracy.

The bedplate configuration consists of four guides that have been ground and heat-treated to achieve a hardness of 500HB. There are sliding guideways, coupled with anti-friction material to the carriage, ensuring additional strength and stability. This is important for a machine dedicated to heavy-duty applications, with loads and significant forces involved. The lathe AT925E CNC can turn parts up to 1,200mm in diameter, 8,000mm in length, and 25 tons in weight. More detailed specifications are shown in *Table 1*.

Starting from the bedplate, Atomat has equipped the machine with a sturdy live-tool turret, to mill the ▷

Fig 1 **AT925E - Multifunctional Super-Heavy-Duty turning lathe**

Name	AT925E CNC
Qualification	Multifunctional lathe
Builder	ATOMAT SPA
Technical features	
Max diameter over the bedplate	Ø1.520
Max diameter on the X/Z carriage	Ø1.170
Distance between the centers	8,000mm
Max weight of the piece supported by the centers	25,000kg
Head	
Spindle nose	ISO-ASA 702/I 15"
Number of speed ranges	3
Spindle speed	20-400rpm
Spindle motor power (AC brushless digital)	60kW
Dedicated C-axis with two motors operating in master-slave mode	
Max torque at the spindle	27,000Nm
XXL four independent jaws chuck	
Diameter	Ø1,200
Overhang	5,000daN
Range between	25
Motorized tool turret with the integrated y-axis	
N°	12 POS.
Coupling	BMT85
Maximum motor torque at the power	100Nm
Maximum engine power	15kW
Maximum speed at power	3,000rpm
Y-axis guides: ground and hardened 60mm monolithic guides, sliding through turcite	60mm
Y-axis recirculating	Ø50x5
Y-axis motor force	30,000N
Colling pressure	Max 40bar
Bedplate	
Width at the level of the bedplate	1,250mm
Number of ground and hardened slideways to 500HB	4+1
Single cast iron bedplate	Monolithic throughout
Z-axis (longitudinal)	
Governed by two digital motors operating in master-slave mode	
Hydraulic quick coupling/release system with 8 coupling/release points	
Autoblock hydraulic steady rest	
Capacity	8,700daN
Grip range	Ø150-570
Hydraulic quick coupling/release system with 8 coupling/release points	
Control unit	
Siemens 840D Solution Line with Safety Integrated included and Industry 4.0 readiness	

Table 1 Technical datasheet of the AT925E

GIANA gt SPA

ATOMAT GROUP

CNC NOTCHING & MARKING MACHINES, CNC GRINDING MACHINES, CNC LATHES

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Fig 2 **Clamping system of four independent jaws**

driving plane of cylinder necks. It moves along the Z-axis (longitudinal), the X-axis (transverse), and the Y-axis (vertical), with a total vertical travel of 400mm for the execution of all milling operations. The Y-axis was developed in collaboration with Baruffaldi. Atomat was also involved in the manufacture of the ground and hardened 60mm Y-guides of the turret body. These are sliding guides coupled utilizing antifriction material to ensure maximum stability on the vertical axis during machining. The Y-axis is moved by a generously sized recirculating ball screw with a diameter of 50mm.

The X/Z carriage is driven by a system of two motors in a master/slave configuration along the Z axis. A solution that is combined with a linear encoder and ensures more precise positioning and linear, backlash-free motion. This is because, during the master-slave configuration, the two motors move in such a way to always guarantee the correct drive torque and thus avoid positioning errors, especially in the case of reversal of motion, since backlash is practically zero.

The main spindle is also driven by a master-slave motor system for the C axis, as well as a belt-driven motor with a power of 60kW and a torque of 27,000Nm. The workpiece clamping platform has an independent four-jaw system (*Figure 2*). The decision not to adopt an auto-centering system arises from the need to clamp cylinders that have flat surfaces on their necks and therefore have an asymmetrical profile that precisely requires the movement of the individual jaws for proper clamping.

VERSATILE AND RELIABLE

As for the turret, it is a Baruffaldi 320TBMR equipped with a 12-position disc on which Sandvik Capto tools can be mounted (*Figure 3*). There are also some positions assigned to motorized tools, with radial or axial modules, equipped with 15kW drives to perform heavy-duty milling, with end-mill up to Ø60mm. A forced cooling system

Fig 3 **12 position heavy-duty motorized turret**

ensures quality, accuracy, and repeatability in drilling and tapping with threads up to M32.

In addition to the turret, a hydraulic steady rest is provided for supporting long and heavy cylinders (*Figure 4*). The steady rest has a capacity of 8,700daN with a self-centering automatic hydraulic clamping system. The steady rest is fixed to its carriage through a hydraulic quick coupling/uncoupling system – a technological choice designed to allow the end customer to quickly replace this steady rest with one of a different size and gripping range. Therefore, the decision was made to mount the steady rest on a very robust and oversized carriage. The lathe is also equipped with an 18-bar high-pressure lubrication system, with dedicated coolant filtration.

SPECIAL OPTIONS FOR ATOMAT LATHES

Atomat has developed systems for checking the geometry of a groove, using probes that can be directly mounted on the machine (*Figure 5*). Here, a measuring cycle can be launched, such that the machine performs tolerance checks on the newly made geometry and then produces a report. The same system can be used to center parts and set tools.

Among the options that can complement the AT925E CNC, is a special workpiece loading and unloading system, which is particularly popular in the U.S.A. market (*Figure 6*). This system eliminates several manual steps and allows the operator to follow the workpiece load operations from a safe position. The solution consists of two arms positioned on the opposite side from that of the operator. When it becomes necessary to position the workpiece in the machine, the operator activates the arms, which then lift to the correct position and center line. The workpiece is laid down on the arms and the system automatically moves inside the chuck the workpieces. At this point, the tailstock is automatically activated and positioned close to the other end of the workpiece. The arms are now free to move down and the part is ready to be machined.

SOLUTION TO INDUSTRY 4.0

The AT925E CNC lathe is complemented by a series of digital tools that make it even more powerful, integrating it seamlessly into the customer's production. The Atomat technical department has developed software solutions starting with a simple and intuitive man-machine interface, which enables even less skilled operators to exploit the lathe's full potential (*Figure 7*). The interface relies on Siemens ONE numerical control and all the electronics are also supplied by Siemens. The interface developed by Atomat allows an embedded CAM to be loaded directly onto the machine, allowing a series of machining programs designed for simple geometries to be used, such as are typical for long product rolling mills. Alternatively, the machine can be run by the "Shop Turns" Siemens software.

Fig 4 **Automatic and hydraulically controlled steady rest**

Fig 5 **Probe system for in-process geometry checking**

Fig 6 **Roll lifting system**

Fig 7 **Operator control panel equipped with Industry 4.0 software**

Fig 8 **Overview of the latest Atomat AT925E turning a roll of 20t**

This solution enables even the less experienced operator to operate the lathe, as only a few simple commands are needed to start the machining cycle. In the world of general mechanics, however, the machining of more complex templates becomes necessary. In that case, it is possible to prepare the program using an external CAM supplied to the technical department, which can be the one already in the customer's hands or, if necessary, can be supplied by Atomat. Since the AT925E CNC lathe is networked, the programs can be sent directly from the technical department to the machine, streamlining the process flow and speeding up time to market.

In general, the AT925E CNC lathe is classified as an Industry 4.0 machine, in line with all the guidelines dictated by the digitization process taking place in the industrial world. It allows for the collection of production data, which is transferred to the customer's informatic system through the connection between the company network and the machine tool. Data collected can be reprocessed for different purposes, starting with production status management, including the situation and progress of the various batches which can also be reprocessed. This approach is designed to prevent failures and validate the status of the various systems supporting predictive maintenance. Finally, the possibility to connect the lathe to the service office of the producer, allows Atomat itself to give assistance where needed, diagnose system issues, resolve alarms, or help with programs.

EVOLUTION OF A FAMILY

The reliability, robustness, and precision performance of the AT925E CNC lathe is the result of constant product R&D carried out by Atomat over many years. It started in the 1990s when the company was looking for a line of lathes that could complete its offer of machines for the roll-shops of the long product rolling mills. That's when the collaboration between Atomat and Giana SpA started. Atomat decided to take over the historic brand from Milan in 2018 and moved production of the Giana heavy-duty turning lathes in-house, to the plant in Udine, in the North-East of Italy, which is equipped with state-of-the-art manufacturing technology and plenty of new space for efficient production flow for machines of this size. The AT925E CNC is the intermediate size in a family of lathes, ranging from the smallest with a capacity of up to 6t to the largest with a maximum capacity of 40t (*Figure 8*). MS

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