MACHINE TOOLS

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DU

GRINDING SOLUTIONS

HIGH PRODUCTIVITY CNC CRANKSHAFTS GRINDING MACHINES

DU	SINGLE GRINDING WHEEL CARRIAGE
DU2W	DOUBLE GRINDING WHEEL CARRIAGE

MAIN FEATURES

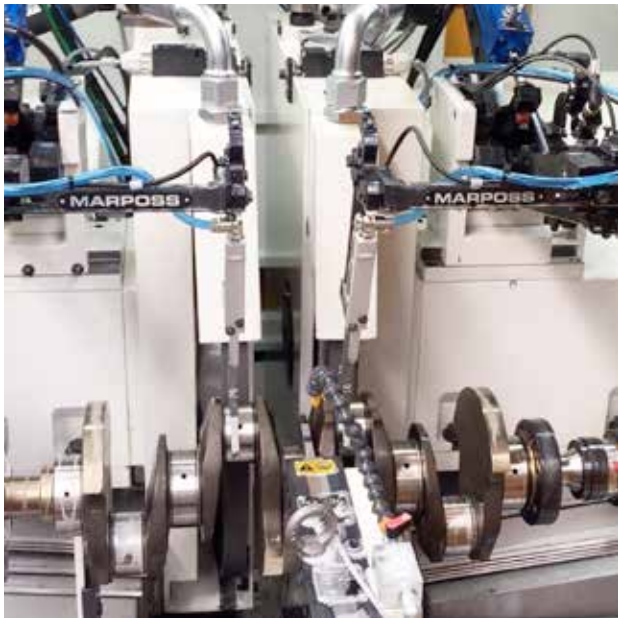
- SINGLE OR DOUBLE GRINDING WHEEL CARRIAGE
- CAPABLE TO WORK MAIN PINS, CRANKPINS AND FLANGE IN ONE SET UP
- DOUBLE GRINDING SPINDLE TO REDUCE CYCLE TIME
- GRINDING OPERATION WITH CBN GRINDING WHEELS

BASEMENT AND STRUCTURE

The crankshaft orbital grinding machine is made of a **welded base structure**, made of **composite material** specifically designed by finite element method, to obtain the best compromise between structural deformations and permitted natural frequencies. The solution of the **multicomponent composite material,** offers great advantages compared to other traditional solutions particularly in terms of dynamic performance, which translate into a **better vibrational** response and considerable advantages in terms of weight. The basement is ready to be connect with a temperature control system, to control and stabilize temperature by heating ducts / cooling, embedded in composital. This system allows to reduce the times of warm-up and the problems of thermal nature caused by downtime, production breaks or changes of use. (Optional temperature control unit). The fixed table on the machine base is made of **monolithic cast iron high strength, thermally stabilized**. The table shaped to ensure the correct coupling and the ease of handling of all the components and equipment upon it accommodated.

CRANKSHAFT MACHINING PROCESS

The **crankshaft machining process** include grinding of all mains and crankpins include radius and thrust surface. Also the fly wheel external diameter. Assuming that the crankshaft is previously machined at the sides and the shoulder of the flange, we identify **best solution for high production,** the use of a grinding machine with two independent grinding wheels carriage.



WHEELHEAD UNIT

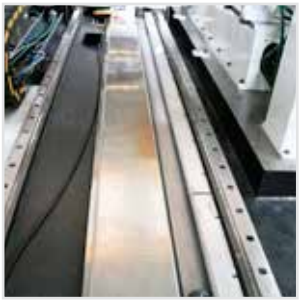
The grinding wheel heads are constructed by a **single or double pair of orthogonal carriages,** made by cast iron, thermally stabilized, connected between them and to the basement through recirculating preloaded roller guide ways to ensure linearity and flatness in all positions of the carriage and in all loading situations. The movement of carriage provided by a pair of linear motors, independent and sized to work in the field of application required. Each upper carriage houses a stationary turret, which is designed to be configured with **different types of spindles** for the different types of processing: such as **internal or external grinding**.

LINEAR AND ANGULAR ENCODER

The linear and angular movements of the grinding head are made by linear and torque motors. The position of these is continuously monitored by "closed loop" with absolute encoders, linear and angular, that provide a positioning accuracy of + - 0.0005 mm and + - 0.005 ° respectively.

THE GRINDING WHEELS

The **vitrified CBN grinding wheels** have a standard diameter of 610 mm and a thickness of the abrasive of 5 mm. The grinding wheel body is made of aluminum, to ensure lightness, stiffness and avoid acoustic sensors problems. The standard cutting speed is 125 m/s. The grinding wheels supplied can be with radius, contouring and tapered according to the needs of the customer and component work cycle. All to ensure the optimum surface result, and the absolute absence of burns.



SPINDLES FOR EXTERNAL WORKING

The grinding wheel turrets are set with two opposing electro-spindles. Lubrication is with permanent grease and seals are non slippery pneumatic (filter 5µm). The cooling is forced to thermo regulated liquid externally. In the electro-spindle are arranged two thermocouples for control and regulation of the cooling system. The rotation is controlled by the angular encoder. The spindle is designed to work with CBN wheels. Coupling system between flanges and spindle is conical type. The **dynamic grinding wheel balancing** is ensured by an internal dynamic balancer with GAP and crush control sensor.

HEADSTOCK

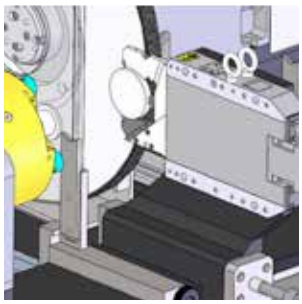
The headstock is made by high-strength cast iron, thermally stabilized. It's developed for the **permanent grease lubrication** and **pneumatic non-contact seals** (filter 5µm). The cooling is forced by externally liquid and two thermocouples are arranged for the control and regulation of the cooling system. The rotation is controlled by angle encoder with 10,000 pulses/rev to ensure the accuracy of orbital system.
On the headstock spindle is installed an **auto-clamping** and **auto-compensating hydraulic three jaws chuck system.** This ensures an extreme level of **accuracy** and **repeatability** of automatic workpiece clamping. Driving system have 3 jaws chuck with clamping force 20 [kN]. Opening is made by hydraulic system.

DRESSING SYSTEM

The automatic cycle of shaping and dressing of the grinding wheels is realized by a **couple of electric spindles**. Both are pressurized and capable to work under continuous emulsion jet. The dressers are placed on the table, the first unit behind the headstock and the second behind the tailstock. On them are installed **two rollers diamond dresser**, which allow all dressing operations on a CBN grinding wheel: **front, radial and taper.** Diameter, longitudinal and geometric dimensions of CBN grinding wheels is checked and update by **touch probe.**

TAILSTOCK

The tailstock is **divided in two parts**, made by cast iron high strength thermally stabilized. In this casing are housed bushings that ensure the proper sliding of the quill, arranged with coupling Morse 5. The load on tailstock is adjusted by means of a spring system compressed, manually adjustable and controlled continuously by a load cell connected to the CNC. The **movement** of the sleeve is **hydraulic**. The tailstock is equipped with **air suspension system** that ease the manual movement along the table. The cooling is forced externally by thermo regulated liquid. The division body into two parts allows the tailstock micrometer roundness between the centers. The tailstock can be equipped with automatic handling system and locking along the table (optional). The machine can be equipped with tailstock synchronized if the processing and the type of drag piece required (optional).



STEADY REST

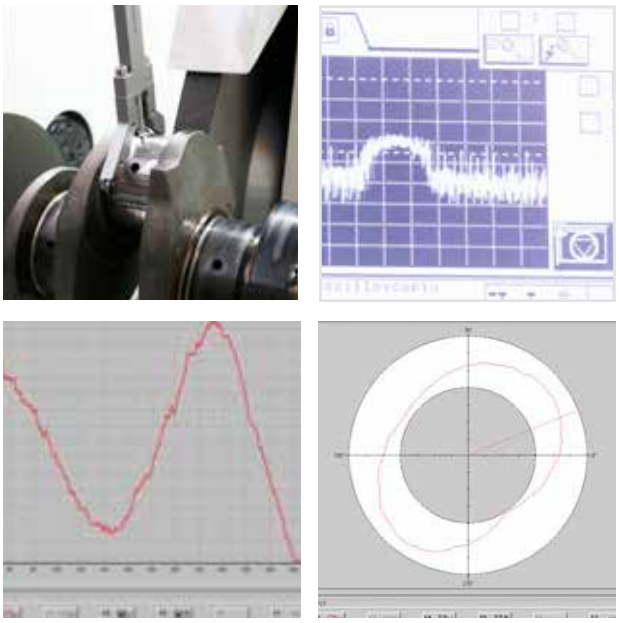
The grinding machine is equipped with two **hydraulic automatic steady rests,** that allow to **support the piece on the main pins** selected during processing. The machine is equipped with kit for **gripping main diameter of crankshaft**. Steady rests are installed on the table using a support with an **automatic system** of engagement / disengagement, orthogonal to the workpiece axis, with hydraulic movement. The clamping and positioning along the table is manual.

IN-PROCESS MEASUREMENT

Both grinding spindles are equipped with an in-process measurement, dedicated for crankshaft application. This instrument has the ability to measure **following the orbital movement** of the machining providing continuously **reading of ovalization of the pins**. The instrument is supplied with fork with measuring field diameter from Ø 50 to Ø 75 mm, resolution 0.001 mm.

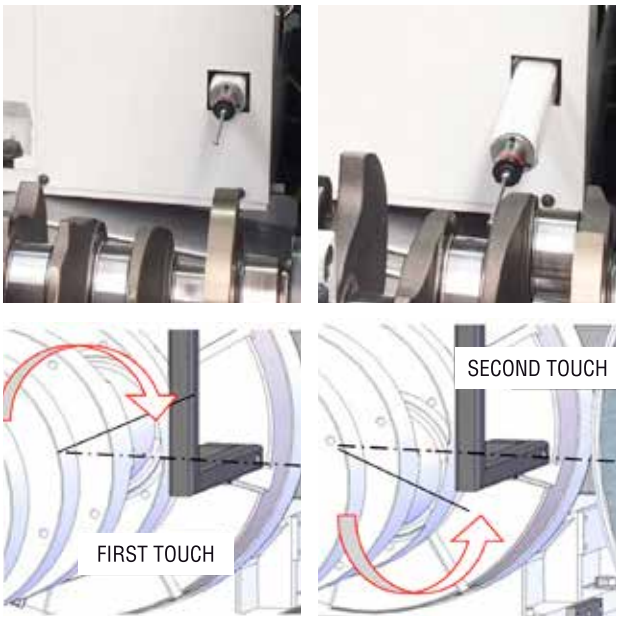
WORKPIECE MEASUREMENT SYSTEM

The measurement of workpiece position along the Z axis can be detected **automatically** at the end of loading, before the beginning of the work cycle, by means a group pneumatic to large travel, with engagement / disengagement automatic and manual longitudinal positioning on the table.



ANGULAR POSITIONING SYSTEM

The angular position measurement on first crankpin can be detected automatically after zero longitudinal axis of the piece, before the beginning of grinding cycle. A system with **pneumati rotary arm,** positioned on the wheel carriage engages a **touch probe.** Using a special program with double touch, the angle is calculated without any need of reading the diameter of the pin.



CNC CONTROL SYSTEM

AZ use Siemens Sinumerik 840D is a Digital CNC System for Complex Tasks. A special parametrical program developed for **orbital and special shape**, like camshaft, permit programming and monitoring of all grinding work. The version of CNC Siemens Sinumerik 840D provided is updated to the latest available.

		DU600	DU800	DU1200	DU1600
Height centers	*[mm]*	**270**	**270**	**320**	**320**
Swing over table	*[mm]*	**510**	**510**	**610**	**610**
Max length of external grinding	*[mm]*	**600**	**800**	**1200**	**1600**
Max diameter of CBN grinding wheel	*[mm]*	**610**	**610**	**700**	**700**
Max diameter to be grind with new wheel	*[mm]*	**270**	**270**	**320**	**320**
Width of grinding wheel	*[mm]*	**18÷50**	**18÷50**	**22÷80**	**22÷80**
Max weight between centers	*[kg]*	**80**	**150**	**300**	**300**
Min distance between centers	*[mm]*	**30**	**30**	**30**	**30**
Max distance between centers	*[mm]*	**650**	**850**	**1250**	**1650**
Grinding wheel spindle power	*[kW]*	**24.2**	**24.2**	**24.2**	**24.2**
Grinding wheel spindle torque	*[Nm]*	**66**	**66**	**66**	**66**
Max angular speed	*[rpm]*	**6000**	**6000**	**6000**	**6000**
Cutting speed CBN grinding wheel	*[m/s]*	**125**	**125**	**125**	**125**
Drive X and Z axes	*[type]*	**Linear motor**	**Linear motor**	**Linear motor**	**Linear motor**
Positioning accuracy X-axis	*[mm]*	**-0,0005**	**-0,0005**	**-0,0005**	**-0,0005**
Positioning accuracy Z-axis	*[mm]*	**-0,0005**	**-0,0005**	**-0,0005**	**-0,0005**
Speed range X axis	*[mm/min]*	**0÷20000**	**0÷20000**	**0÷20000**	**0÷20000**
Speed range Z axis	*[mm/min]*	**0÷20000**	**0÷20000**	**0÷20000**	**0÷20000**
Headstock spindle power	*[kW]*	**7.4**	**7.4**	**7.4**	**7.4**
Headstock spindle torque	*[Nm]*	**71**	**71**	**71**	**71**
Max angular speed headstock	*[rpm]*	**1000**	**1000**	**1000**	**1000**
Coupling cone	*MORSE*	**5**	**5**	**5**	**5**
Tailstock quill diameter	*[mm]*	**80**	**80**	**80**	**80**
Tailstock quill travel length	*[mm]*	**70**	**70**	**70**	**70**
Dressing spindle power	*[kW]*	**4.6**	**4.6**	**4.6**	**4.6**
Dressing spindle torque	*[Nm]*	**4.2**	**4.2**	**4.2**	**4.2**
Max dressing angular speed	*[rpm]*	**18000**	**20000**	**22500**	**25000**

**Based on specific customer requirements.The different application possibilities of our machines depend on the technical equipment specifically requested by our customers and workpiece drawing.*

Marketing Dept. of AZ spa EN/IT - 20170905

AZ spa
via dell'elettronica 20
36016 Thiene (VI) ITALY

T +39 0445 575543
F +39 0445 575756
info@azspa.it