

# Duplomatic Oleodinamica in the Machine Tool sector



Transfer



Milling machines



Clamping control



Grinding machines



Nibbling machines



Sawing machines



References

## TRANSFER High performance systems for transfer machines

The spreading of the digital technology has deeply changed the offer of the hydraulic solutions for transfer machines. The digitalization, on one side, means a better resolution in the position detection, a higher immunity towards electromagnetic noises and a lower thermal drift. On the other side it implies a higher flexibility and rapidity in the management of new operative needs: a process can be simply modified by changing the program controlling its logic.

Thanks to considerable investments in the R&D department, Duplomatic Oleodinamica has lead and sometimes anticipated such changing process. Nowadays the hydraulic solutions by Duplomatic for transfer machines consist of a servo-valve, a servo-cylinder, a position transducer and a digital control electronics; they represent a real alternative to the traditional systems, in terms of performance and cheapness, and, at the same time, they effectively meet the requirements of any transfer machine: high productivity, minimum machining times and almost zero scraps.

**Better performance:** better performances in terms of rapidity and accuracy in the axis control. Thanks to the digital technology and to the performances of the state-of-the-art servo-valves, the hydraulic axis can reproduce with extreme precision the speed profile given by the control unit, with an error level approaching to zero.

**More responsibility:** the power unit can develop a high power density into an extremely reduced space: adding one or more axes does not imply the need to change the switchboard in order to host the new components and their drivers. Similarly the processes of revamping, replacement and re-equipment are easier and less invasive than traditional systems

**Less maintenance:** in the electromechanical systems the axes are handled through a recirculating balls motor which means a strong wear of the components and the need of a constant maintenance. The Duplomatic system solves the problem because neither the servo-valve nor the servo-cylinder are subject to wearing processes.

# Stability of the motorized head

Milling machines are machine tools with a very solid structure, as they must absorb the strong vibrations generated by the motorized head which is used for complex processing phases such as borings, perforations, cuttings etc. of metal parts (or other material). The state-of-the-art milling machines are equipped with automatic systems for the tool replacement, in order to turn the whole production process into a completely automated procedure. The machine can also be defined as boring mill: it is a special milling machine capable to perform boring procedures thanks to the high level precision of the movement control and to the stability of the motorized head.

These machines must be able to move on the piece surface; such movement can occur in two different ways:

- Moving the workbench on two axes (X and Y) and in case lifting the motorized head along the axis Z (for machines with a small dimension)
- Keeping the workbench in a fixed position and moving the head along three or more axes, (for machines with a large dimension, which are also called machining centers).

Operator footboard, tool blocking/unblocking, tool warehouse etc. are some of the several controls developed by employing Duplomatic hydraulic components.



DZCE5G proportional valve with integrated electronics

It is currently in progress the balancing of the vertical head of a boring mill weighing about 5000 kilos with a fast moving speed of 20 m/min; its open circuit system employs a VPPL070-PCX variable displacement piston pump with a flow rate set at 80 l/min and a working pressure of about 180 bars.

The balancing valve, which allows the zero setting of the load without harmful overloads on the head electric motor, is a DZCE5G-210 proportional valve with integrated electronics mounted into a block suitably studied and positioned near the use points.

Such a solution allows to obtain a balancing error threshold equal to zero compared to an error percentage of  $\pm 10\%$  noted in case a solution with closed circuit accumulators is applied.

This system is much more flexible than the closed circuit with accumulators but it must be applied with considerable strokes and weights of the head.



Milling machine

# Solutions for state-of-the-art machine tools

The clamping and fixing operations performed by CNC machine tools require a high precision level during their execution. The pressure supplied to the cylinders in order to keep the material fixed during the machining process requires to be adjusted according to the stock removal needed power. The removal size and the machine features stand out as the main characteristics affecting the tangential forces acting on the spindle. The hydraulic section of the clamping device has therefore to be designed in such a way as to meet these requirements with much accuracy and rapidity.

The key element that plays a major role in obtaining the required pressure is the 3-way pressure reducing valve. The valve maintains the set pressure in both ways reducing the pressure from line P to A (or B), while also allowing the return flow from A (or B) to discharge in T. The pressure switch inside the valve makes sure that the signal is triggered only when the machining pressure is reached in the monitored outlet port of the valve (when the machining conditions are settled). Thanks to the use of a special pressure switch with a low hysteresis it has been possible to monitor the real machining pressure with an error ranging from 3% to 5% of the set value and to connect the line signalling when the pressure has been reached. The 3-way construction also helps the flow return to the tank in case of exceeding pressure arising out of the forces on the actuator side.

**Aiming at developing energy saving systems, the hydraulic system is supported by a variable displacement pump coupled with an accumulator:** the pump simply inlets the flow rate needed during the movement while possible requests for higher flow rates are guaranteed by the accumulator. This soft

motion extend the system lifetime by eliminating the pulses possibly generated by a fixed pump. Furthermore the accumulator reduces the minimum time required for the system to reach the set pressure.

**For the speed regulation of the actuator driving the tailstock, the system is equipped with two directional solenoid valves (4/2 and 4/3) positioned after the 3-way pressure reduction valve.** The tailstock motion is achieved in two speed settings. One is for the rough approach while the other is for the final positioning which has to be slow and gentle. Each valve, when enabled, creates a different flow rate thanks to the openings placed on the inlets "A" or "B", which can be optimized according to the different applications.

Upon request, the MZE\*T3 proportional version of the pressure reducing valve is also available ensuring the precise, fast pressure adjustment with electronic control. Thanks to the proportional feature the clamping pressure can be changed in real time without interrupting the machining process.

The proportional option increases the productivity of the machine especially in case of series production thus obtaining important reductions in the cycle total duration period.



Clamping control kit



Multi-axis lathe

# Complete digital control system

For more than fifty years Duplomatic has been present on the machine tool market, i.e. a sector under constant development where the request for a



Grinding machine

production increase is always combined with machining accuracy. It is the case of the tangential grinding procedure with the complete digital control of the table movement (speed and movement reversal are completely managed with a closed loop). In the last years the role played by electronics in the machine tool sector has become more and more important, to such an extent that the final user can guarantee a growing accuracy level in machining precision.

By cooperating with another sector leading company, Duplomatic has developed a tangential grinding procedure for flat surfaces where the electronic section plays a fundamental role.

The tangential grinding machine for flat surfaces with complete digital control is featured by a structure made

of Meehanite cast iron in order to ensure the highest rigidity without vibrations, grinded and scraped guides with a Turcite® coating on the coupling of the base of the transversal table and a high pressure cartridge spindle which guarantees the highest accuracy during the flat, geometric and shaped grinding procedures.

The machine is equipped with a digital 840DI CNC from Siemens supplied with drives, motors and position control performed via Heidenhain linear scales whereas the transversal table is moved through an hydraulic circuit with a Duplomatic DXJ3-DOL/40 proportional valve with integrated electronics; the valve is controlled via Heidenhain millesimal scales in order to obtain, together with the standard swinging, accurate positioning procedures. The table speed is 40 m/min and the



Proportional valve with integrated electronics

positioning and reversal accuracy is equal to 0,01 mm. The user-friendly and intuitive man-machine interface allows to import geometries from DXF files in order to create any sort of profile.



VPPL piston pump



# Turnkey solutions for nibbling machines

Here following are in short the most important requirements for cold forming machining procedures on metal plates: cutting quality avoiding burs and whitish patinas, accuracy in synchronizing the operations and highest speed in the production cycle.



Metal processing line

In order to meet such needs Duplomatic Oleodinamica has decided to capitalize the know-how acquired thanks to a 50-year long production activity and has developed a turnkey solution capable to overcome the limits set by traditional systems, aiming at offering the most effective and performing response to the modern production needs.

The solution consists of a punching circuit board (EWM series), a servo-valve and a servo-actuator and is mainly featured by compact overall dimensions, which

are drastically smaller than traditional systems, thanks to the project philosophy which foresees the presence of a single card and the integration of the control components directly into the servo-valve.

The use of the digital technology, the core of the system, offers a double advantage. First of all, as compared to traditional systems, it considerably reduces the machine start-up times: no manual setting is required because the logic of the punching process is already implemented in the electronic card which can be interfaced with a PC or PLC through a serial protocol and suggests to the user only the parameters needed by the configuration. Secondly, it considerably quickens the machining speed: after the end of the sensor calibration and the enabling of the closed loop system, the card performs the punching operations in compliance with the preset and programmed values without carrying out calculations which would slow down the production speed. Such a solution can shorten the machining times (start-up, punching and come back) of one third: for example for a 9-mm stroke of the actuators, the punching cycle is reduced from 150 to 105 ms.

The use of standard products, which do not need a special customization, the lower number of components, possible thanks to the hydraulic technology, and the simplicity of the start-up operations make the Duplomatic solution extremely competitive, both economically and in terms of installation, mounting and maintenance, as compared to the traditional systems.

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Machine  
tool



# Sawing machines

As compared to other machines, for example band saw machines, the circular cold saw machines for the cutting of tubes, bars and profiles offer qualitative, technological and processing advantages. In particular they are featured by a higher cutting accuracy and repeatability, a better quality of the surface finishing with a higher productivity and a reduced scrap quantity.

In order to guarantee a higher cutting accuracy and repeatability, **Duplomatic Oleodinamica** has developed for this machines a special direct operated proportional valve with integrated electronics capable to allow a better control of the cutting head during the machining procedure.

According to the different kind of material to be processed, for example aluminium, brass or high tensile alloy steel, the shifting speed of the cutting head can vary from a maximum of 130 mm/sec to a minimum of 0.3 mm/sec.



At the end of the machining process the head must go back to its starting position ready to restart for a new cycle with a position speed of 250 mm/sec.

Apart from personalizing the electronics of this specific application, Duplomatic Oleodinamica has studied a special spool capable to control both very small flow rates (right for these kinds of speeds) up to a minimum of 0.02 l/min, and bigger flow rates up to a maximum of 20 l/min.

Considering the different speeds required by the present application, the use of a normal proportional valve with a standard asymmetric spool would have caused speed and repeatability controlling problems.



Cold saw machine