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MAIN ACTIONS BY STARTING A NEW MACHINE TOOL IN OPERATIONAL PROCESS

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ABSTRACT
Many of enterprises are buying modern and expensive machine tools. But it is not necessary, that investment like mentioned bring 100% of success, why more of important element are missing. This paper is presenting some of important segments, which have important influence on the efficiently and good use of the machine. Mechanical engineer must in the first stage of planning buying a new machine provide the type of use, if it is a fine – precise machine with small cutting forces, or it is a big machine designed for a large cut volume of chips per minute taken. With this are also requirement for rigidity and choking characteristic captured. Next step is weight of the machine, which can causes some problems at transporting, that problems will show as extra costs. The machine weight is also important factor, if machines are placed in floors and not on ground where we could set some quality basis for the machine. That is why are present machines built with composite materials and "sandwich" panels, where we have less weight at the same characteristic. After the machine buying is important the correctly delivery of the machine, where the important elements of machine must be protected and blocked up. The machine placing must be performed by an expert. Some tests must be execute, like machine precision and we have to make some test pieces. On which we check tolerances, than roughness on product and also time necessary for making, which is connected with manufacturing costs. Above listed elements, requests and measurements are illustrated in this paper.
Keywords: cutting machine tools, modules of machine, HSC machines, static properties, dynamic properties.

1. INTRODUCTION
To access very good or excellent machining results it is necessary to have the best machine tool. Rigiolity is one of requested parameter and this characteristic we achieve with special materials and composite structure of modules. The design of machines which contains more modules insure higher rigidity and choking by smaller weight [1]. Machining the materials as are Ti and TiNi alloys request machine without „lekage" in every of contact between modules. Figure 1 shows turning process of Ti Alloy machining under ecological parameters.

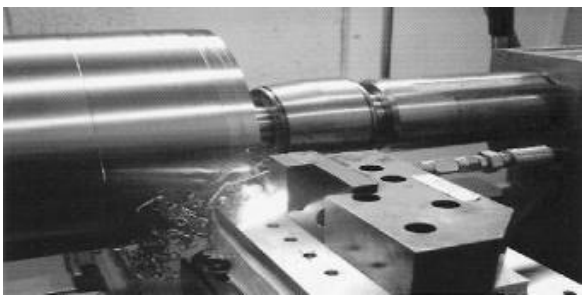


Figure 1. Turning process of Ti Alloy machining under ecological parameters.

Machine is ever adapted with additions modules as request process. This one on Figure 1. as sampler-supporting example is adapted with equipment for rigid supporting of cutter and with high pressure equipment for minimal cooling [3]. Modules producing of elements made from composite materials are include in machines, to achieve better statistics and dynamics properties of system [4]. Maybe the most popular and critical element of machine is spindle or spindle box - housing. This type of design is also strong connected with so called light construction against conventional one.

2. MODULES AND REGIDYTY

For better understanding it is showed on figure 2, haw degree of choking with degree of components increases. Choking of naked bed of lathe is showed in diagram first, and than the choking, when second is attaching component parts gradually on bed, all to final fitting of lathe.

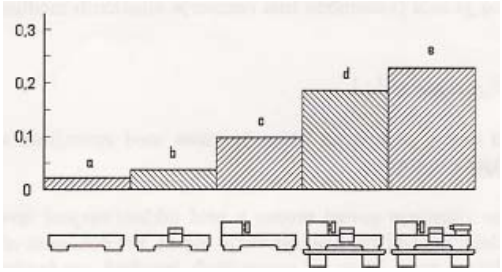
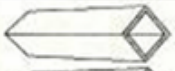


Figure 2. Dependence of degree choking from configuration of the machine

Various openings may reduce good characteristic of box shape sections strongly, that are of necessary from constructional reasons or because of consent of cores at pouring into.
Openings in neutral axle of section are comparatively innocent, around which works flexible circumstances. They highly reduce rigidity, if they are in zone, where flexible suspenses are largest.
A few square box shape holders are showed in table 1, that are in interior additionally intensify with ribs. Next to are written in flexible and torsion rigidities and increases of mass because of additional ribs. All values are listed relatively considering the holder without ribs.

Table 1. Relative flexible and torsion rigidity, and masses of box shape holders, intensity with ribs.

Holders shape	Relative flexible rigidity	Relative torsion rigidity	Relative mass
	1,00	1,00	1,00
	1,09	1,39	1,05
	1,10	1,63	1,10
	1,17	2,16	1,38
	1,78	3,69	1,49
	1,55	2,94	1,26

3. MODULES MADE FROM COMPOSITE MATERIALS

Loads of carrying parts and housings are a consequence of machining forces, workpieces masses, of clamping forces etc. Analyses are showing, that are walls of carrying parts loaded with tensile and pressure and also with flexible and torsion forces. First two of then aren't critical, but flexible and torsion forces can cause bigger deformations.
We acceded, with this starting point, to analyses of static and dynamic characteristic¸ of wall elements from composite materials. We made 15 test elements and at this varied before specified influential

parameters. Figure 3 shows some of this elements, where structural characteristic are visible [4]. We were establishing their flexible and torsion rigidity for the valuation of static characteristic of singly structures (Figure 4).

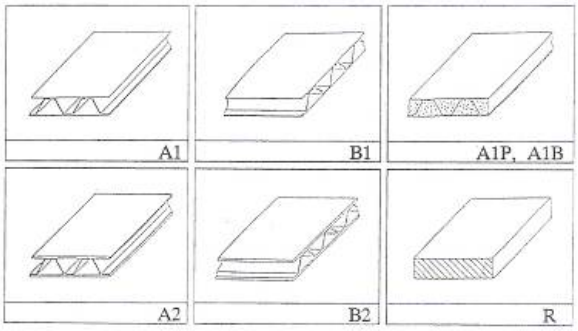


Figure 3. Cases of composite wall elements

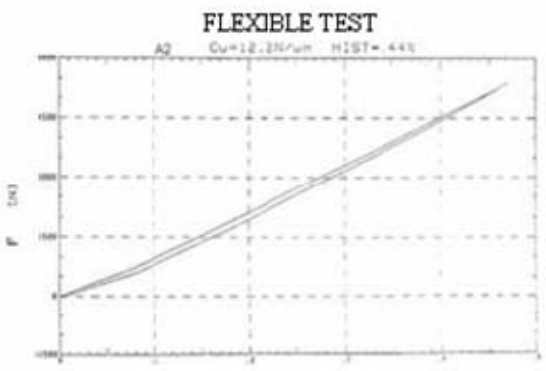


Figure 4.. Diagram of flexible rigidity of the wall element A2

Characterization of composite wall elements: A – plate with longitudinal directed core; B – plate with transversally directed core; R – reference, massive plate; 1, 2 – thickness of wrap wall in "sandwich" plate; P – filled by polyurethane; B – filled by polymeric concrete.
Basic mass values of made modules and of additional elements are showed in table 2. Measured static rigidities on both glued realizations and on massive reference module are calculated from three measurements and showed in table 3.

Table 2. Masses of component parts.

module	box kg	spindle kg	base kg
L1	28.35	13.95	36.10
L2	37.10	13.95	36.10
M	81.25	13.95	36.10

Table 3. Measured rigidities of test modules.

module	static rigidity (N/μm)		
in axle	x	y	z
L1	117	122	24
L2	140	189	47.5
M	211	250	161

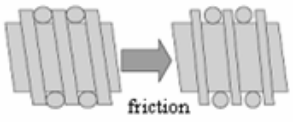
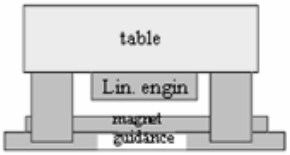
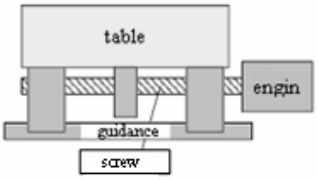
Auer results above, we can conclude, that composition between clerical and light construction indicate more advantage for composite modules made on light design. One of important positive characteristic is better dynamic properties.

4. IMPORTANT STEPS BY MACHINE STRTING

The location of machine must be properly chosen, because only so the machine will correctly and carefully work, and it will have extremely long operation age. At the location choice are important the next choices: machine let not be directly exposed to sun and UV light, place let no be too hot, to cold (20°C) or too damp (assured microclimate), place let not be exposed to dust, acids or salts, we must prevent transfer of other vibrations from floor on machine (for accurate treatment), need is enough large distance of machine from other machines and of walls in place, because of access at dismantling and changes of component parts next to repairs and services. Also foundations of machines are base for correct and accurate activity of machine. We can reduce passing of machine with correct foundations and with this swerving of the bed, than we reduce vibration and impact of other vibrations from surrounding.
Correctly levelling machine is accurate and his working age prolongs. The levelling of machine is performing with very accurate water technicians. Another important step is the choice of an drive system. We know that linear engine is making movement and transfer of force in axial direction

possible for us and so we don't need translational spherical drives any more, that enable changes of rotational movement of servomotor to linear transfer. From table 4 we can see comparison between drives considering accuracy, consumption of energy and realization.

Table 4. Comparison between drive systems.

	Linear drive	Translation spherical drive
Accuracy	Accuracy is conserved	Accuracy worsens 
Energy	$\frac{1}{2} \cdot M \cdot V^2$	$\frac{1}{2} \cdot M \cdot V^2 \cdot \frac{1}{2} \cdot I \cdot \omega$
Realization		

We notice at translational spherical drive, that next to alternating several hours activity between two point on distance 150 mm the translational spherical drive locally warms up (Figure 5.). Warming in middle surpasses 50°C. The consequence of warming is deformation, this leads to primary accuracies loss.

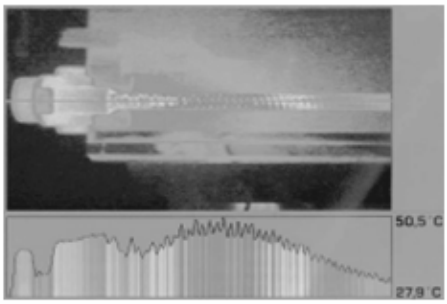


Figure 5. Thermo graphical illustration of temperature of classical drive.

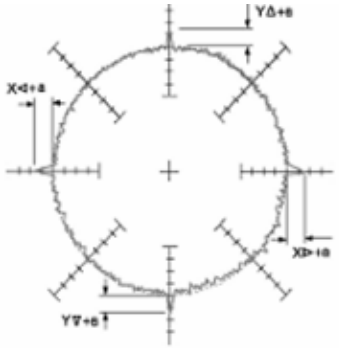


Figure 6. Phenomenon called backflash.

At translational spherical drive came to, because of usage in time, to phenomenon called backflash (Figure 6). Backflash appears in an instant change of direction movement. Consequence of this is fitful change of movement, that it leads to vibrations. We don't have this problem at linear drive.

5. SPECIFIC MODULES BY HUGE MACHINE TOOLS

Jo'mach 145 is 5 axial modern and high productivity numerically control machine (Figure 7.). It is designed to processing and repair of large tools for transforming of sheet metal in car industry. In large field of activities is capable to treat work pieces do 5m length, 3m width and 1.5m height. Because of it size and incredible rigidity is possible with him to do such graves, as also good quality final treatment of products. But at huge machine we can have a lot of problems with geometric accuracy. One of contemporary and very successful methods for quick finding of geometric accuracy of machine is bases on circular test with the device Ballbar QC10 (QC10 – Quick Check 10 min), (Figure 8). The main part of device is presents the LVDT sensor, which is placed between two small steel balls on every end of measuring stick. This is placed in magnetic seat, that we attach them on machining table and clamped in machine spindle. Over serial connection RS 232 (COM) is LVDT

sensor connected wit computer, where a suitable programme is capturing small radial movements of sensor between execution of circular test. From record of measurements results is visibly which type of mistakes appear on measured machine, with values for individually axle.

Figure 7. Machining machine Jo'mach 145

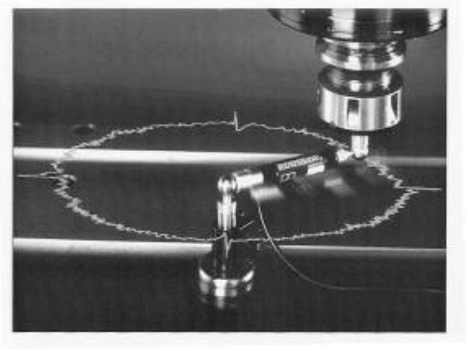


Figure 8. Test device Ballbar QC10

6. CONCLUSION

To complete many of necessary action by new machine tool installation we have to proceed some obligatory steps. All mentioned factors connect with machine as modules, composite materials, characteristics is possible to content in "HSC requirements", where Control Engineering play important mater [9].

ISO 14001 request also many actions by machine installation. All of them are necessary to protect worker and surrounding of the machine. As we say "safety first" must be on first place, because great electro power is connect on machine. After sources as cooling/lubricant fluids in Europe can no more content Cl, S, Pb. The systems for filtering and cleaning as necessary adaptable modules on machine must be applicate.

Maybe modern but urgent terming is Sustainable manufacturing. Sustainable machining can be part of sustainable manufacturing [J. Kopac, J. Jurkovic – CIM 07].

By machining on modern CNC HSC machines is necessary to find the way, how to include the machines in one of segment with great interface on human and ecological production.

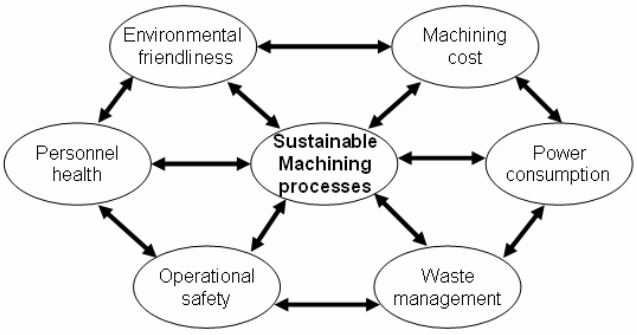


Figure 9. Basic elements of sustainable machining[10]

All those segments are in very close relationship with machine tools. On this way machining processes constitute a major manufacturing activity that contributes to the growth of global economy. Figure 9 shows some of basic elements of sustainable machining [11].

7. ACKNOWLEDGEMENT

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