Improvement actions: Air compressor according to ISO/DIS 14955-1				
No.	**Requirements on**	**Description**	**Relevant for machine type**	**Estimated Energy savings**
1	Selection of optimal drive subsystem (motor-pump system)	- Different function sequences create the need for pump system which match the requirements profile;- Power on demand depending on the load cycle;- Select the correct size and type of motor and pump to avoid over-dimensioning and operate the pump in the optimal efficiency range;- Temporary storage of hydraulic energy (e.g. accumulator charging operation) to achieve the best possible match between the pump drive and the load cycle and to compensate for demand peaks (potential downsizing);- Speed controlled pumps allow pressure control with variable speed instead of control valves;- Use switching valves with optimized technology;(e.g. alternative control via Pulse Width Modulation or use of low power solenoids when applicable).	Metal cutting; Mechanical Press; Servo Press; Hydraulic Press	3,7 – 4,5%
2	Optimized compressed air system with minimum losses (differentiation between sealing air and pneumatic drives)	Allow for different kind of measures: Single master switch-off; Individual switch-off capability for specific modules; Intelligent shut down procedures; - Leak indicator, on demand monitoring;One of the main avoidable causes of energy dissipation is leakage in pressure piping and tubes. Leakage and condition monitoring systems as part of the control system of the machine tool shall be implemented in order to easily locate leakage and eliminate leakage directed.;Functions shall be identified and described where this requirement is applicable.	Metal cutting; Mechanical Press; Servo Press; Hydraulic Press	
3	Reduction of dead volume (Vcut)	Distance between valve and cylinder shall be kept as short as possible. Long tubes are dead volumes which cause a major loss of energy in each switching cycles as they have to be pressurized and exhausted. This amount of compressed air will be wasted.;Functions shall be identified and described where this requirement is applicable	Metal cutting; Mechanical Press; Servo Press; Hydraulic Press	
4	Directed switch off of not needed branches.	It shall be verified if all branches of pneumatic circuits need to be pressurized in all modes of the machine tool. If not take measures to switch these branches off in order to prevent from energy losses caused by not needed volume;Functions shall be identified and described where this requirement is applicable.	Metal cutting; Mechanical Press; Servo Press; Hydraulic Press	

5	Dimensioning of tubes and pipes	Optimize the design of piping (length, diameter, …) and reduce flow resistance.;Tubes and pipes cause friction losses and thus energy losses. Finally the tube or pipe causes a pressure drop which effects negatively to the energy balance of the machine tool. Length, inner diameter, flowrate and installation radius of tubes, pipes and fittings shall be optimised to the application;Functions shall be identified and described where this requirement is applicable.	Metal cutting; Mechanical Press; Servo Press; Hydraulic Press	
6	Correct layout of pneumatic drives	Pneumatic drives shall not be oversized. Unneeded air consumption and thus loss of energy were the result. The layout of the pneumatic system and its components shall be tailored to suit of the machine tools need. Functions shall be identified and described where this requirement is applicable.	Metal cutting; Mechanical Press; Servo Press; Hydraulic Press	
7	Reduction of pressure	The interaction of pressure supply reduction to machine tool performance shall be verified. (Depending on the application 1 bar reduction can result in up to 10% increased efficiency).;The reduction of pressure shall not have negative influence on the correct function of the machine. Functions shall be identified and described where this requirement is applicable.	Metal cutting; Mechanical Press; Servo Press; Hydraulic Press	
8	Directed switch off	Check, if all branches of pneumatic circuits need to be pressurized in all operating states of the machine tool. If not take measurements to switch these branches off.	Metal cutting; Mechanical Press; Servo Press; Hydraulic Press	
9	Optimise cylinder force for the required function.		Metal cutting; Mechanical Press; Servo Press; Hydraulic Press	
10	ISO 4414 shall be applied		Metal cutting; Mechanical Press; Servo Press; Hydraulic Press	
11	Overall system	Optimization of total pneumatic system	Metal cutting; Mechanical Press; Servo Press; Hydraulic Press	

12	Thermal management of machine tool and all components (e.g. cooling devices, ...)	Optimized concept for thermal management of all machine tool components regarding:;1. Minimization of thermal power losses;2. If thermal power loss is not avoidable, it has to be dissipated by air or water cooling; for reuse of thermal energy water is given a preference compared to air; further reuse of thermal energy has to be checked/discussed with customer (e.g. via standardized interface);3. Controlled ventilation (fan)	Metal cutting	4,6 – 5,5%
13	Lubrication flow depending on demand	Active mode of cooling and lubrication system. E. g.;- discontinuous operating pumps;- controlled flow rate;- adjustable pressure.	Mechanical Press; Servo Press; Hydraulic Press	3,7 – 4,5%
14	Apply direct cooling of components depending on process (cooling at the source)	Temperature controlled	Metal cutting	3,7 – 4,5%
15	Low flow rate for lubrication pump	Install not more than sufficient pump flow and distributor instead of orifices	Mechanical Press; Servo Press; Hydraulic Press	3,1 – 3,6%
16	Demand dependend cooling	E.g. substituting line connected motors by inverter motors	Metal cutting	3,7 – 4,5%
17	Consideration of applied sub-systems with regard to synergies	To obtain the maximum possible energy savings it is often not sufficient to only look at the individual components and modules that are used for the individual functions. In addition it must be checked if it possible to extend the use of a supply unit (e.g. hydraulic), particularly during idle periods where other machine functions could be supplied or driven by it. In addition to the increase in the total efficiency of the supply unit due to the improved utilisation, a complete drive unit can be omitted (e.g. generation of high pressure coolant) and a large part of the previous energy requirement saved (avoidance of electrical, mechanical and volumetric losses).	Metal cutting	