Improvement actions: Chip conveyor

according to ISO/DIS 14955-1

No.	Requirements on	Description	Relevant for machine type	Estimated Energy savings
1	Regenerative feedback of inverter system (servo motor/spindle; afe-technologie)	The infeed unit is capable to feed back the braking energy to the mains power supply.	Metal cutting; Mechanical Press; Servo Press; Hydraulic Press	4,6 – 5,5%
2	Intelligent drive management	Intelligent drive management turns off energy consumers (e.g. electric motors) when not needed.	Hydraulic Press	
3	Optimisation of installed motor power	Select motor operating close to optimum of efficiency factor, oversizing and overloading creates energy losses.	Mechanical Press; Servo Press;	<=3%
4	High efficient power devices for inverter systems	Usage of inverter system with high efficient power device. Substituting line connected motors by inverter motors	Hydraulic Press	
5	Use of energy efficient motors	Declaration of energy efficiency class and size of the motors (IE / capacity)	Mechanical Press; Servo Press;	
6	Use of energy efficient pumps	Different pump principles lead to different pump efficiencies	Mechanical Press; Servo Press;	3,1 – 3,6%
7	Intelligent drive management	Intelligent drive management turns off energy consumers (e.g. electric motors) when not needed.	Mechanical Press; Servo Press; Hydraulic Press	3,1 – 3,6%
8	Use of energy efficient pump-motor units	Either pump principle and sizing in combination with the electrical motor influences the efficiency of the unit. Pump principle, size and speed shall be selected so that the pump system operates near to its optimum efficiency for as long as possible. See also 3-1	Mechanical Press; Servo Press;	>= 5,6%
9	High efficient power devices for inverter systems	Usage of inverter system with high efficient power device. Substituting line connected motors by inverter motors	Mechanical Press; Servo Press;	4,6 – 5,5%
10	Optimisation of the dynamic parameters	Option to limit the acceleration in the set point signal results in a better exploitation of the motors' efficiency. In this case, the overload capability of the motor is not utilized.	Mechanical Press; Servo Press; Hydraulic Press	3,1 – 3,6%

11	Use of energy efficient motors for auxiliary units	Use of an energy efficiency class according to IEC 60034-30 and size of the motors (IE/capacity). Magnetic flux to be controlled on asynchronous motors to reduce losses.	Metal cutting	3,7 – 4,5%
12	Use of energy efficient motors for intelligent magnetic flux control	Example to be added.	Metal cutting	3,7 – 4,5%
13	Use of high quality reducers	- Use of gears sets quality as defined in ISO standards (ISO 1328);- Use of low friction seals;- Optimize lubrication;-Examples for transmission units to be added.	Metal cutting	3,7 – 4,5%
14	Optimisation of installed motor power	Select motor operating close to optimum of efficiency factor, oversizing and overloading creates energy losses.	Hydraulic Press	
15	Minimisation of spare capacity/customer specific layout of motors	Select motor operating close to optimum of efficiency factor, oversizing and overloading creates energy losses.	Mechanical Press; Servo Press;	3,1 – 3,6%
16	Mass free compensation of load for vertical axes	In case of vertical spindle: compensation of weight force (e.g. spring type mounting).	Metal cutting	3,7 – 4,5%
17	Use of energy efficient motors	Use of an energy efficiency class according to IEC 60034-30 and size of the motors (IE/capacity)	Hydraulic Press	
18	Minimisation of spare capacity/customer specific layout of inverter system	Select inverter close to motor size, oversizing creates energy losses.	Mechanical Press; Servo Press;	3,1 – 3,6%
19	Use of break for non-moving axes	The feed axes that are not involved in the interpolation during the part program are switched off (pulses deleted) and clamped by a brake. swivel head or swivel table, auxiliary axes.	Metal cutting	3,7 – 4,5%
20	Provide most efficient drive system	Provide most efficient drive system for operating conditions in which the press is mostly working. Compare energy efficiency of different types of drive systems (e. g. direct pump drive for processes	Hydraulic Press	

21	Optimized axis servo motors	Optimized regarding energy efficiency	Mechanical Press; Servo Press;	3,7 – 4,5%
22	Inverter system with high efficient power device	Usage of inverter system with high efficient power device. Substituting line connected motors by inverter motors.	Metal cutting	4,6 – 5,5%
23	Use of multi-pressure accumulator system for main axis	Multi-pressure accumulator systems reduces pressure drop between accumulator and actuator.	Hydraulic Press	
24	Use of energy efficient motors for auxiliary units	Use of an energy efficiency class according to IEC 60034-30 and size of the motors (IE/capacity)	Mechanical Press; Servo Press;	
25	Higher voltage inverter systems (e.g. 400V) to substitute 200V systems (where applicable)	-Higher voltage inverter systems (e.g. 400V) leads to a higher energy efficiency due to reduced ohmic losses.	Metal cutting	3,7 – 4,5%
26	Use of energy efficient pump-motor units	Either pump principle and sizing in combination with the electrical motor influences the efficiency of the unit. Pump principle, size and speed shall be selected so that the pump system operates near to	Hydraulic Press	
27	Use of high quality reducers	- Use of gears sets quality as defined in ISO standards (ISO 1328);- Use of low friction seals;- Optimize lubrication;Examples for transmission units to be added.	Mechanical Press; Servo Press;	<=3%
28	DC voltage link to balance the energy between different drives	-The DC voltage link balances the energy between different drives and may reduce the size of the infeed unit	Metal cutting	
29	Direct coupled energy storing drive systems for main drives	Direct coupled energy storage support (e. g. flywheel) may reduce installed power of main motors.	Hydraulic Press	
30	Inverter controlled motors for auxiliary units	Substitution of line connected motors by inverter motors	Mechanical Press; Servo Press;	3,1 – 3,6%
31	Indirect coupled energy storing drive systems for main drives	Indirect energy storing drive systems like electrically coupled flywheels, capacitor banks etc. reduces load peaks.	Hydraulic Press	
32	Indirect coupled energy storing drive systems for main drives	Use of energy storing drive systems to reduce cyclic power peaks; for Hydraulic Press: Indirect energy storing drive systems like electrically coupled flywheels, capacitor banks etc. reduces load peaks.	Mechanical Press; Servo Press; Hydraulic Press	3,1 – 3,6%
33	Minimize energy losses in power supplies	Usage of high efficiency transformer or voltage-proof converters instead of conventional transformers (e.g. controlled switching power for auxiliary power 24V).	Metal cutting	3,1 – 3,6%

34	Avoidance energy losses of power supplies	Avoid power losses in the transformer by use of e. g. voltage-proof converter, controlled switching power supply for 24V control voltage	Mechanical Press; Servo Press; Hydraulic Press	
35	Converter with power factor correction	Power factor in the infeed unit for feed operation and regenerative feedback saves energy losses.	Metal cutting	3,7 – 4,5%
36	High efficiency transformer	Load requirement of a machine tool is not constant during the cycle. Therefore it is more efficient to install transformers optimized on low Fe- losses instead of transformers optimized on low Cu-	Mechanical Press; Servo Press; Hydraulic Press	3,1 – 3,6%
37	Thermal management regarding control cabinet	Optimized concept for thermal management of the control cabinet;1. Minimization of waste heat;2. If waste heat is not avoidable, it has to be dissipated (air cooling or water cooling); for reuse of thermal	Metal cutting	3,7 – 4,5%
38	Apply the simultaneity factor when designing the power system	Avoid oversizing of power supply leads to lower absolute energy losses. Avoid overload as well.	Mechanical Press; Servo Press; Hydraulic Press	3,7 – 4,5%
39	Converter/inverter with power factor correction	Power factor in the infeed unit for feed operation and regenerative feedback saves power losses.	Mechanical Press; Servo Press; Hydraulic Press	3,7 – 4,5%
40	Thermal management regarding control cabinet	Optimized concept for thermal management of the control cabinet;1. minimization of waste heat;2. if waste heat is not avoidable, it has to be dissipated (air cooling or water cooling); for reuse of thermal	Mechanical Press; Servo Press; Hydraulic Press	3,7 – 4,5%
41	Demand depending controlled peripherals (..devices like mist extraction, chip	Active mode of oil mist exhaust system, depends on operating mode	Metal cutting	3,7 – 4,5%
42	Controlled peripheral devices like mist extraction, scrap conveyor, etc	Active mode of devices, dependent on mode of operation	Mechanical Press; Servo Press; Hydraulic Press	