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Transfer of innovation and new methods for identifying vocational competence within vocational education in the metal and electrical sector as illustrated by two vocations

QUALIFICATION GRID

The qualification grids presented below are based on the national curriculum for metal and electrical industry adopted by the Finnish National Board of Education on 17.2.2000 and amended on 19.6.2002 (metal industry) and 19.6.2006 (electrical industry).

It should be outlined that the Finnish system of vocational education there is no such separate occupation as "metal-cutting technician". All the works related directly or indirectly to cutting metal sheets (plates) are scattered amongst different professional descriptions.

A) Metal cutting technician

General activities and competences
Cutting metal sheets (plates)
Trimming
Sawing
Bending
Screw cutting
Flame cutting and thermal cutting

Competence dimension				
Phases of the complete activity	**Specialist competence**	**Methodological competence**	**Social competence**	**Personal competence**
ANALYSING	Able to read dimensioning symbols concerning metal cutting; Able to identify means of marking in the cutting process; Able to use the right cutter, according to the type and physical characteristics of a material Able to choose a proper blade for a turning lathe; Able to assess physical and chemical features of cutting coolants and proceed relevantly; Able to evaluate cutting parameters; Cautious about the basic range of use regarding	Able to identify the 'cause and effect' relation and draw relevant conclusions; Able to develop solutions to the encountered problems; Able to get data/information using different contemporary techniques Careful about industrial safety and environmental norms; Cautious about quality assessments; Cautious about energy saving; Able to adjust blade's clearance, cutting-edge angles and stroke's dimension using measuring scales; Cautious about operational		Able to analyze independently the relevant information;

	flame cutting and its applicability towards different substrates; Cautious about metal sheet's bending characteristics and elasticity;	safety linked to the hot work operations; Cautious about quality standards II B SFS-EN ISO 9013;		
PLANNING	Careful about safe and economical use of electrical apparatus; Able to plan a workpiece; Able to predict changes and transformations of the materials' characteristics throughout and after the working process; Able to plan the use of auxiliary materials; Able to plan and assess such operations as line segments or segments halving; Able to plan and assess perpendicular drafting, as well as angle or circular dividing into pieces; Able to program a conventional trimming press and other NC trimming machines; Able to organize and assemble a functional working site necessary to perform an acetylene-oxygen flame cutting; Able to choose relevant accessories depending on the material thickness;	Careful about industrial safety and environmental norms; Cautious about product's life cycle and relevant energy transformations; Able to plan a waste management;		Able to plan independently his working schedule, main activities and work processes;
PERFORMANCE	Able to calculate all the necessary dimensions of the materials and components; Able to execute refinements and rectifications; Acting with compliance to sustainable development; Able to count surface area and volume using scales and geometrical modules & formulas; Able to count percentage values; Cautious about use, conservation and disposal of the most common and most central compounds used in the metal industry (oxygen, nitrogen, hydrogen, carbon, alkali, albumens, salts etc)	Able to comply with industrial safety and environmental norms; Cautious about work-related risks and able to prevent accidents in the working place; Able to use application programmes used in the metal industry;	Tolerant towards each other; Entrepreneurial and customer-oriented; Resourceful; Able and willing to communicate and interact with his working colleagues; Able to interact orally and express himself correctly in a written form; Able and willing to provide assistance to his colleagues/customers; Able to work within a team;	Able to speak at least 2 foreign languages; Industrious; Diligent and meticulous; Punctual; Flexible; Able to provide first aid in correctly and hygienically;

	Able to execute such operations as line segments or segments halving; Able to execute perpendicular drafting, as well as angle or circular dividing into pieces; Able to count half-finished products' length using their diameter; Able to estimate product's bending (deflection) and rolling, considering product's material thickness; Able to cut sheets (plates) using cutting shears and cutting markings; Able to cut sheets using gnawers and fancy-cutting machine Able to make corners and roundings using bending roller adjustments; Cautious about functioning of a guillotine shear; able to adjust its settings and fastenings in order to execute a cut; Able to operate a conventional trimming press; Able to trim using pressing punch; Able to perform a parting-off using a bench saw, steel-band saw and circular saw; Able to bend profiled poles/pipes, as well as able to determine their bending points and bending radius; Able to use riding bolsters; Able to dimension , cut and perforate different materials using cutting coolant (cutting fluid), screw cutting tools and bolt oils; Able to perform a screw cutting on ridges, corbels, bevels and roundings; Able to use screwing tap and cutting dies in a turning lathe; Able to use cutter bars and execute a soft chopping; Able to choose a blade and place it in a turning lathe;			

	Able to sharpen bore cutters freehand and how to use a bench grinding machine while edging or trimming; Able to execute a sheet flame cutting according to engravings; Able to execute a acetylene-oxygen flame cutting; Able to execute a thermal cutting using rollers and compasses; Able to handle substrates and alloying elements generated during the thermal cutting, like dirt, rust, paint, mill cinders etc. Able to use burners and dumpers;			
CHECKING	Able to check the quality and results of his work; Able to check operational safety of the flame cutting device			Able to check his personal compliance with norms and standards required in his work;
DOCUMENTATION	Able to prepare and read statistics, tables and graphical designs/presentations concerning the metal branch; Able to compile legible reports out of undertaken measurements;	Having a hot work permit; Able to document quality systems;		Able to present and demonstrate his work results, using patterns and models;
EVALUATION	Able to assess independently data obtained from different sources and transform it into practical mode; Able to evaluate operational safety of the flame-cutting device; Able to evaluate whether the executed cut corresponds to the quality standards; Able to assess cut's dimensional accuracy and, if needed, perform refining changes; Able to assess cut's parameters using a programming device and NC-machine; Able to evaluate whether the executed bending corresponds to the given forms and dimensions;	Able to evaluate (measure) quality systems	Able to evaluate and give a constructive feedback on his own work, as well as tasks performed by his colleagues;	Able to evaluate his work costs; Able to evaluate the overall costs of materials used in the cutting operations; Able to evaluate his work, as well as his personal development in the working place;

B) Electro-mechanical technician

Competence dimension

Phases of the complete activity	Specialist competence	Methodological competence	Social competence	Personal competence
ANALYSING	Able to analyze and relevantly apply the basic electrical modules and formulas; Able to read and understand circuit diagrams; Able to analyze and understand the essence of the elementary physics' phenomena and their applicability in the everyday working activities; Able to define the theoretical basics of the electrical engineering; Able to measure basic electronical features; Able to execute engineering works technical measurements; Able to identify the basic components and their commercial appellations; Able to define the mechanical and electrical basics of robotics; Able to analyze data in condition monitoring system (movement, speed, acceleration, vibration); Able to read blueprints and bill of materials;	Able to identify the 'cause and effect' relation and draw relevant conclusions; Able to develop solutions to the encountered problems; Able to get data/information using different contemporary techniques Careful about industrial safety and environmental norms; Cautious about quality assessments; Cautious about energy saving; ;		Able to analyze independently the relevant information
PLANNING	Careful about safe and economical use of electrical apparatus; Careful about the storage of the devices and apparatus;	Careful about industrial safety and environmental norms; Cautious about product's life cycle and relevant energy transformations;		Able to plan independently his working schedule, main activities and work processes;
PERFORMANCE	Able to plan the use of auxiliary materials; Able to execute refinements and rectifications; Able to identify and use materials/items used in electrical installations; Able to handle activities with piping, wiring and electrical armatures; Able to connect inputs with outputs;	Respectful towards industrial safety and environmental norms; Able to manage waste; Cautious about work-related risks and able to prevent accidents in the working place; Able to use application programmes used in the metal industry;	Tolerant towards each other; Entrepreneurial and customer-oriented; Resourceful; Able and willing to communicate and interact with his working colleagues; Able to interact orally and express himself correctly in a written form;	Able to speak at least 2 foreign languages; Industrious; Diligent and meticulous; Punctual; Flexible; Able to provide first aid in correctly and hygienically;

	Able to install (assemble) low voltage switchgear; Able to execute automation systems' cabling work; Able to assemble controlling system's apparatus; Able to handle programmable controllers in control boxes (relays); Able to set-up and manipulate transfer gears; Able to install high-speed readers and power supplies; Able to work with coders/decoders, analogical and digital compounds; Able to work with integrated circuits; Able to use NC programming and basics of mechanization; Able to execute assemblage with mounting on a bearing, shaft locking and nave connections, chains and belts, gears; Able to assemble and control electric motors; Able to work with CAD/CAM Able to perform simple welding activities, necessary for assemblage;		Able and willing to provide assistance to his colleagues/customers; Able to work within a team;	
CHECKING	Able to check the quality and results of his work; Able to check and maintain the state of devices; Able to troubleshoot technical or electrical errors in his work;			Able to check his personal compliance with norms and standards required in his work;
DOCUMENTATION	Able to prepare and read statistics, tables and graphical designs/presentations concerning the metal branch; Able to compile legible reports out of undertaken measurements;			Able to present and demonstrate his work results, using patterns and models;
EVALUATION	Able to assess independently data obtained from different sources and transform it into practical mode;		Able to evaluate and give a constructive feedback on his own work, as well as tasks performed by his colleagues;	Able to evaluate his work costs; Able to evaluate the overall costs of materials used in

				the cutting operations; Able to evaluate his work, as well as his personal development in the working place;

GLOSSARY

- **NC** (Numerical Control) **–** method of automatic operation of machine tools
- **CAD -** (Computer-aided Design) refers to the use of software to assist engineers, architects and other design professionals in their design activities. It is the main geometry authoring tool within the Product Lifecycle Management (PLM) process and involves both software and sometimes special-purpose hardware
- **CAM –** (Computer-aided Manufacturing) refers to the use of computer systems for the control of robotics and tools during product manufacturing

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