

Zakłady **Mechaniczne** Tarnów

INDUSTRIAL SERVICES

ELECTROPLATING PLANT, HARDENING SHOP, STAMPING PLANT, METAL SHEET CUTTING



urządzenia dla przemysłu
AUTOMATYCZNA LINIA
KROJOWANIA
info@jco.pl www.jco.pl

Electroplating treatment

The galvanic coverings are available in different thicknesses and finishing:

- **technical chrome plating** – the technical chrome plating manufacturing line is designated for large items and it is equipped with baths for processes such as: preparatory operations, chrome plating removal, or a process of dehydrogenation, which is performed right after chroming – the dehydrogenation is rendered in vacuum furnaces and dryers,
- **blackening (oxidizing)** – steel and cast-iron blackening – this process is used for creating anti-corrosion surface or decorative surface (black), the dimensions of the bath are the following: 2000x900x1300 mm,
- **manganic-zincous phosphatizing** – the dimensions of the bath are the following 2000x900x1300 mm,
- **acid and cyanide copper plating** – it is a detached operating stand, the maximum length of the element: up to 2400 mm, the maximum diameter: \varnothing 400 mm, the dimensions of the bath are the following: 1500x750x500 mm,
- **two layer coats with polishing (copper-nickel)** – the dimensions of the bath are the following: 1500x750x500 mm, the maximum surface of the element is equal to 100 dm²,
- **three layer coats with polishing (copper-nickel-chrome or copper-nickel-brass)** – the dimensions of the bath are the following: 1500x750x500 mm, the maximum surface of the element is equal to 100 dm²,
- **nickel-copper-nickel-chrome coatings in the machine on hangers** – the dimensions of the bath are the following: 2000x1000x500 mm, the maximum surface of the element is equal to 150 dm²,
- **nickel plating with polishing and satin nickel plating** – the dimensions of the bath are the following: 1500x820x520 mm, small components undergo nickel plating in a drum mechanism device,
- **zinc plating with polishing** – the dimensions of the bath are the following: 2000x1300x700 mm, small components undergo zinc plating in a drum mechanism device,
- **cadmium plating** – the dimensions of the bath are the following: 2000x700x1000 mm, small components undergo cadmium plating in a drum mechanism device,
- **decorative aluminum anodizing (black and yellow coloration)** – the dimensions of the bath are the following: 1500x1000x1100 mm,
- **hard anodizing of aluminum** – without coloration or with black and olive coloration, the dimensions of the bath are the following: 1500x1000x1100 mm,
- **aluminum chroming (alodining)** – the dimensions of the bath are the following: 1000x820x520 mm
- **controlled dehydrogenation in the NX-822 device**: it is a process that improves the quality of galvanized surface, the device is equipped with a triple-fired electric heaters system – the temperature in each heated area can be adjusted separately, the furnace is charged vertically, the maximum temperature achieved in the furnace is 600°C, furnace dimensions: \varnothing 800x2200 mm, the maximum weight of the charge is equal to 2000 kg.



Heat treatment and thermochemical treatment

Hardening

- **volumetric hardening** – hardening in air temperature practically all kinds of steel: structural steel, tool steel, alloy steel; the maximum length of the component: 2500 mm, the maximum weight of the component 650 kg (larger components require individual consultation),
- **salt-bath hardening** – the maximum component dimensions: 400x300x100 mm, (maximum length of the treated components 1000 mm),
- **isothermal quenching (hardening)** – the maximum component dimensions: 400x300x100 mm
- **tool hardening** – tools made of fast finishing steel, high-speed steel and high-alloy steel undergo salt-bath hardening, this type of technology assures the highest quality, and preservation of tools is achieved through individual hardening; furnace chamber dimensions: Ø 180 mm, length: 650 mm,
- **induction hardening** – shaft hardening, sprocket wheel hardening, pin hardening etc. the maximum component diameter: Ø150 mm, length: 800 mm,
- **constant spot surface hardening of structural material in furnace** – the 4-axis device is designated for induction hardening and drawback treatment (in vertical position); the furnace is equipped with thermal camera which allows manual adjustment of the temperature between 300° C ÷ 900° C; the induction hardening goes 0,5mm ÷ 5mm deep, furnace length: 700 mm, the maximum length of retail component cannot exceed 1200 mm, the maximum weight of the retail component equals 15 kg.



Carburizing

- **gas carburizing** – it is a computer controlled process with a full and adequate parameter archiving process, this type of technology allows achieving accurate manufacturing replicability; the maximum component dimensions are the following: Ø 300x1000 mm and the allowed weight equals 700 kg,
- **powder carburizing** – it's perfect for small components rendered in small series – these components undergo partial protection with formulations against carburization (e.g. threads).



Annealing

- **normalizing annealing** – (e.g. after forging), furnace chamber dimensions: 3000x1800x1200 mm,
- **stabilizing annealing** – (e.g. after initial mechanical treatment), furnace chamber dimensions: 3000x1800x1200 mm,
- **stress relief annealing** – (e.g. after grinding), furnace chamber dimensions: 3000x1800x1200 mm,
- **annealing in a furnace with a protective nitrogen atmosphere** – component annealing after laser cutting or burner cutting in order to prepare the material for further mechanical working (e.g. bending, turning, beading); the applied vacuum or protective atmosphere secures the components from surface decarburization, especially those components that are made of sheet metal; furnace chamber dimensions: Ø 600x1100 mm.

Heat treatment and thermochemical treatment

Nitriding

▪ **gas nitriding using NITREG® method** – according to AMS 2750D and 2759/10 methods, there are three types of processes:

- NITREG®–C–nitro-carburizing,
- ONC® – used for oxidation,
- NITREG®–S – used for nitriding of stainless steel and acid-resistant steel.

The NITREG® technology unlike other standard processes used for gas nitriding gives a possibility to control the factors such as hardness parameters and thickness of diffusion area. The method is conducted through usage of highly advanced technology, namely the furnaces manufactured by NITREX® Canada.

The advantages of NITREG® processes are the following:

- excellent dependability and replicability of results,
- entire control of process parameters,
- deformations minimizing,
- greater usage properties that give full control over nitrogen fixed in a layer.

The NITREG® process basically allows nitriding all sorts of steel alloys.

Usable size of the furnace: Ø 800x2000 mm, the maximum weight of the charge – 1500 kg.

▪ **salt bath nitriding using TENIFER® method** – salt-cyanide (plating) bath treatment in two varieties: QP and QPQ. The pre-finished components undergo nitriding through this method. Most types of machined steel components appear in color black. This method is used for details that must exhibit high resistance to abrasion, corrosion and high fatigue strength (e.g. hydraulic cylinders, shaft joints or slide valves). Injection moulds for thermoplastic weights guarantee better surface smoothness and maintain permanent parameters. At the same time, the tools that undergo nitriding and are used for plastic workings are not susceptible to adherence of material. The achieved surface hardness depends on a given sort of material and is equal to 500 HV_{0.3} or higher up to 1300 HV_{0.3}. The corrosion resistance is greater than chromium and nickel coatings. Furnace chamber dimensions: Ø300x600 mm, the maximum weight of the charge: 50 kg.



Hyper-quenching and quench ageing

Aluminium alloys, copper alloys and high-chromium steel.



Machining processes

Milling

CNC processing centers

- **5-axis** – usable area: X=1135mm, Y=1050mm, Z=750mm, rotary swivel table dimensions: 1050x850, the maximum weight of milled detail: 2000 kg,
- **4-axis** – usable area: X=1035mm, Y=560mm, Z=510mm, the maximum weight of milled detail: 125 kg using dividing head and 255 kg using dividing head and loose headstock,
- **2-axis** – usable area: X=1000mm, Y=540mm, Z=620mm, the maximum weight of milled detail: 1000 kg.
- **Conventional milling machine** – swivel table dimensions: 400x1000 mm.

Integrated Mill-Turn CNC Centers

- **5-axis OKUMA** – using intercepting spindle and milling swivel head, the maximum turning diameter: \varnothing 630mm, usable area Z=900mm, Y=160 mm
- **5-axis DMG** – the maximum turning diameter: \varnothing 500 mm, usable area: Z=3000 mm, Y=400 mm, the loose headstock is controlled through software, it is equipped with two steady rests and the scope of their grip equals \varnothing 30 ÷ 253 mm.

Turning

- **CNC turning lathes** – the maximum turning diameter: \varnothing 560 mm, spindle clearance: \varnothing 100 mm, the maximum length of turned component: 1500 mm, axis displacement: X=230 mm, Y=100 mm
- **universal turning lathes** – the maximum turning diameter/length \varnothing 520 mm/2500 mm, \varnothing 560 mm/2000 mm, \varnothing 165 mm/3000 mm,
- **boring and turning lathe** – the maximum turning diameter \varnothing 2000 mm,
- **facing lathe** – the maximum turning diameter \varnothing 1620 mm.

Boring

- **WK130/2 boring machine** – usable area 2000 x 2000 x 1800 mm, the maximum weight of treated detail: 1000 kg,
- **SIP boring machine** – usable area 1400 x 950 x 800 mm



Machining processes

Drilling

- **DIXI coordinate jig drilling machine** – usable machining area 780x650x70 mm
- **drill lathe (horizontal drilling) for long hole drilling** – the maximum diameter: $\varnothing 120$ /the maximum length 4000 mm; the drill lathe is equipped with tools for holes of the following diameters: $\varnothing 7.6$ mm, $\varnothing 10$ mm, $\varnothing 11.1$ mm, $\varnothing 11.7$ mm, $\varnothing 13.25$ mm, $\varnothing 16$ mm, $\varnothing 20$ mm, $\varnothing 22$ mm, $\varnothing 29.3$ mm, $\varnothing 32.5$ mm, $\varnothing 33.6$ mm, $\varnothing 35.5$ mm, $\varnothing 38$ mm, $\varnothing 49$ mm, $\varnothing 58$ mm, $\varnothing 60$ mm, $\varnothing 61$ mm, $\varnothing 64.9$ mm, $\varnothing 86$ mm, $\varnothing 120$ mm



Honing

- **SUNEN HTC 4132 CNC honing machine for long hole honing** – the scope of honed diameter is equal to $\varnothing 7.5 \div 60$ mm, the maximum length of honed detail cannot exceed 3000 mm, the honing machine is equipped with heads for machining of full-ended holes in the following diameters: $\varnothing 7.6 \div 7.8$ mm, $\varnothing 8.1$ mm, $\varnothing 12.7$ mm, $\varnothing 21.3 \div 30.2$ mm, $\varnothing 40$ mm, $\varnothing 48.5 \div 63.5$, and grooved holes in the following diameters: $\varnothing 7.62$ mm, $\varnothing 12.5$ mm, the grooves can be profiled in the following diameters: $\varnothing 7.82$ mm, $\varnothing 12.96$ mm,
- **horizontal honing machine** – the scope of honed diameters: $\varnothing 50 \div 112$ mm, the maximum length: 2200 mm,
- **vertical honing machine** - the scope of honed diameters: $\varnothing 7 \div 50$ mm, the maximum length: 1000 mm



Grinding

- **CNC grinding machine** – manufactured by Jones & Shipman 524 EASY, grinder table dimensions: 500x200 mm,
- **surface grinder** – grinder table dimensions: 320x1000 mm,
- **cylindrical grinder** – the maximum grinding diameter/length: $\varnothing 400/1650$ mm, $\varnothing 315/2000$ mm,
- **internal grinder** – grinding diameter/length: $\varnothing 40-400/250$ mm, $\varnothing 10-165/175$ mm,
- **centerless grinder** – the maximum grinding diameter/length $\varnothing 125/200$ mm



Other machines

- **broaching machines** – pull broaching length: 750 mm/force: 10T,
- **thread-rolling machines** – the scope of diameter: $3 \div 70$, the maximum length: 125 mm

Plastic working

Metallurgical material cutting

- **sheet material cutting with guillotine shear** – the maximum cutting length: 2000 mm, the maximum sheet metal thickness: 6 mm,
- **pipe cutting, rod cutting, rectangular profile cutting, flat cutting using band-sawing machine** – the maximum cross-section dimensions: 270x270 mm or \varnothing 270 mm, angles range of blade guide arm: $0^\circ \div 60^\circ$,
- **die shearing of metal sheet components** – the maximum sheet metal thickness: 3 mm

Metal material bending

- **sheet metal bending using numerically controlled hydraulic bending brake press – tonnage capacity: 100 tonnes** – the maximum bending length: $L_{\max} = 3000$ mm for the maximum sheet metal thickness up to $G_{\max} = 2.5$ mm (S235JR), the maximum sheet metal thickness $G_{\max} = 8$ mm for the material type S235JR and $R_{\text{bending}} \sim 1.2 G_{\max} [M.] = \frac{7}{5} / \text{Max}(G; 2.5)$
- **sheet metal bending using hydraulic bending brake press controlled numerically – tonnage capacity: 500 tonnes** – the maximum bending length: 4000 mm for the maximum sheet metal thickness up to 12 mm (S235JR), the maximum bending length: 3000 mm for the maximum sheet metal thickness up to 15 mm (S235JR),
- **sheet metal rolling using 3-cylinder rolling mill** – the maximum sheet metal thickness: 3 mm, the maximum bending length: 1000 mm,
- **sheet metal stamping (forming)** – the maximum sheet metal thickness: 3 mm, the maximum stamping depth: 170 mm, overall dimensions of the expanded sheet metal: 1500x500 mm,
- **pipe bending, rod bending rectangular profile bending using numerically controlled 5-axis bending brake press** – the maximum detail length: 4000 mm, bent material types:
 - round pipes made of soft steel ($R_m \leq 45$ kg/mm²) up to 65 mm in diameter, the maximum thickness of the wall: 4 mm,
 - round pipes made of stainless steel: the maximum diameter: 60 mm, the maximum thickness of the wall: 3 mm
 - rectangular or square profiles made of soft steel, overall dimensions: 50x50 mm, the maximum thickness of the wall: 2 mm,
 - round rods made of soft steel – the maximum diameter: \varnothing 35 mm,
 - square rods made of soft steel in the following dimensions: 30x30 mm

Flat-die forgings

- **round and flat rods, plain and stepped shafts** – the maximum forging length: 1500mm, the maximum forging diameter: \varnothing 320 mm, the maximum forging weight: 150 kg,
- **cubes, disc sheaves and pierced discs** – the maximum forging diameter: \varnothing 400 mm, the maximum forging weight: 140 kg,
- **rings and bushings beaked with cylindrical mandrel** – the maximum forging diameter: \varnothing 400 mm, the maximum forging height: 150 mm, the maximum forging weight: 120 kg



Impression-die forgings

- **plain and off-center shafts, lever connecting rods, valve housings, tee and straight elbow housings, cogwheels, integral collars** – the maximum forging diameter: \varnothing 180 mm, the maximum forging length: 300 mm, the maximum forging weight: 0.20÷9.0 kg,
- **shaft forgings using single driven cold header** – the maximum forging diameter \varnothing 38 mm

Applied material grades

- structural carbon steel and alloy steel,
- heat-treatable steel, carburizing steel and nitriding steel,
- stainless steel,
- acid-resistant steel



Precision material cutting – laser beam cutting, water-jet cutting and electrical discharge cutting

Laser beam metal sheet cutting

- **Laser beam cutter – BY SPRINT 3015 Bystronic** – for the components of the following dimensions: 1500x3000 mm and weight up to 750 kg.

Types of steel materials designated for cutting:

- steel up to 15 mm thick,
- stainless steel and acid-resistant steel up to 8 mm thick,
- aluminum and its alloys up to 6 mm thick,
- brass up to 3 mm thick.

The machine performs engraving on each component, so they are properly labeled



Water-jet cutting

- **The brand of water-jet cutter currently in use: Waterjet Bystronic Byjet Flex 6030** – the maximum dimensions of components: 6000x3000 mm, the maximum weight pressuring the table up to 1600 kg per square meter (1600 kg/m²), the maximum component height: 205 mm, placement accuracy: ± 0.05 mm/m, water-jet cutter cuts different types of materials (steel, aluminum, artificial and recycled plastic, granite, marble, glass, ceramic ware, composite material, foams, sponges etc.), the rendered details do not require after-treatment, the replicability average ratio: ± 0.025 mm, 2D and 3D cutting, the maximum head turning angle 3D 45°, the machine is adjusted to engraving of components



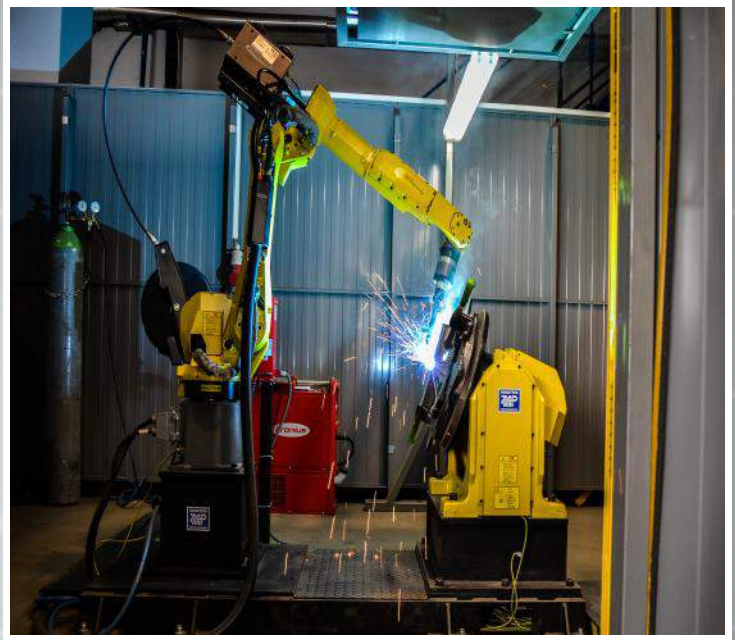
Electrical discharge cutting

- **The brand of wire electric discharge cutter currently in use – MV2400S Tubular Mitsubishi Electric** – power cross traverse: X: 600 mm, Y: 400 mm, Z: 310 mm, U and V axis traverse: 150x150 mm, the maximum component dimensions: 1050x820x305 mm, the maximum component weight 1500 kg, table dimensions: 840x560 mm, the maximum cutting angle/height of the component: $\pm 15^\circ/260$ mm, $\pm 45^\circ/75$ mm, the applied wires have the following parameters: 0.10÷0.30 mm



Welded structures

- **structural steel components spot welding** – (max. 0.22%),
- **soft and hard soldering,**
- **steel structures welding according to MAG and TIG methods structural steel components** – including stainless steel structures, the maximum dimensions: 3000x5000x15000 mm, the maximum structure weight: 20000 kg,
- **steel alloy structures welding according to MIG and TIG methods** – the maximum dimensions: 3000x5000x15000 mm, the maximum construction weight: 1000 kg,
- **an automated welding station** – an application of the FANUC ARC Mate 100iC/7L – 6-axis robot with 2-axis positioner. It is a gas shielded welding with application of a consumable electrode
- **blast cleaning** – the maximum component dimensions: 1500x2000x1200 mm.



Other industrial services



Vacuum washing

- **vacuum washing and solvent cleaning machine – CASTO VACUUM-CAST 3000** – precision washing and detail degreasing of complex geometry structure components, blind holes, high porosity components, components stained with oils, coolants, abrasive compounds which are hard to remove. The cycle of work is hermetic, air-proof, leak-proof and emission free. The process is characterized by a high level of cleanliness. The internal dimensions of the device: 2450x500x450 mm. The maximum charge weight: 250 kg

Thickness measuring of electroplated coatings according to the X-ray fluorescence spectroscopy method

Fischerscope X-Ray XDL 230s – testing station built according to DIN 50987, ISO 3497, ASTM B568 standards respectively:

- single, double and triple electroplated coatings measuring,
- composition and thickness testing of binary and three component alloy coatings as well as sublayer and inverse array layer testing,
- alloy composition testing up to 4 alloy components,
- the maximum sample weight: 20 kg,
- internal dimensions of the test chamber: (Height/Width/Length) 140x460x500 mm



Research and Development Center

Informational Technology systems branch in our company is open to cooperation in scope of software and hardware development in the following areas:

- software for dedicated control units – in-house production of enhanced modular computers,
- testing software development, service and interface user support,
- specialized integrated systems,
- low-level software of systems physical layers,
- security systems and high reliability systems software development.

Our workshops are equipped with the following software and tools:

- QT, Visual Studio, AVR Studio, LPC Xpresso, Matlab, SVN, GitHub.

Regarding the electronic engineering domain of electronical devices we cooperate in the following areas:

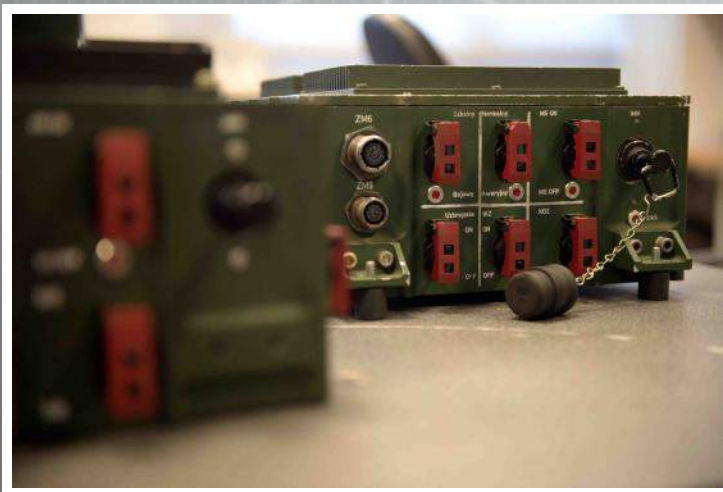
- specialized modular computers,
- drive systems,
- control consoles,
- specialized master-slave manipulators,
- data acquisition and data visualization systems through sensor network.

Regarding the specialized electronics domain we cooperate in the following areas:

- oscilloscope and multispectral measurements for devices,
- preparations for testing the electromagnetic compatibility,
- insulation resistance measurements,
- torque measurements,
- climatic stress research on devices,
- mechanical hazard research

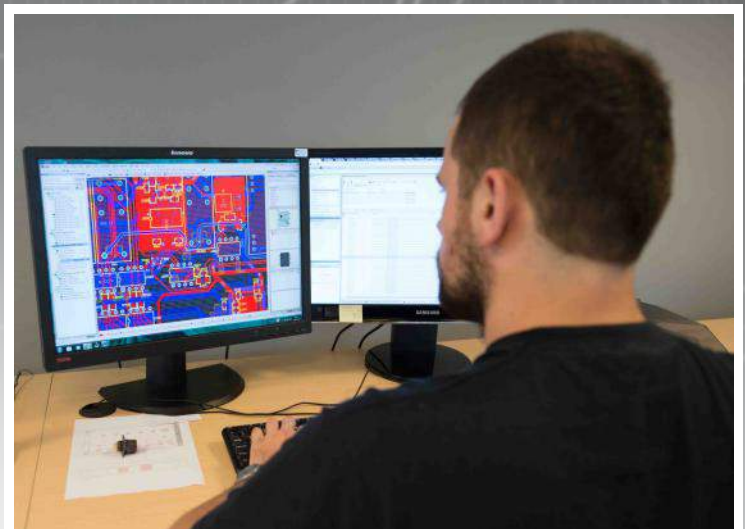
In our daily work we use the following software and tools:

- Altium Designer,
- Matlab,
- Lab View,
- Laboratory devices such as: Tektronix and Fluke



Cooperation with the Research and Development Center

The cooperation with the R&D center may include participation of our experts who specialize in electronics, software development or engineering mechanics in clearly defined areas that aim for specific results and effective technical advice. Such cooperation might include a broader scope of works, for example device manufacturing, starting with an idea and set of objectives and ending with an extensively tested ready product. We design complex electronical and mechanical devices. Military and defense industry is very demanding; therefore the group of interdisciplinary engineers working in our Research and Development Center achieves safe solutions in an estimated time frame taking into consideration cost-optimized budget. Concluding, excellent project management system ensures easy flow of information and reliable progress update for customer and employees



Laboratory research

Measurement laboratory:

- the lab is responsible for taking length and angular measurements, error shape measurements and roughness measurement,
- validation of control-measuring equipment (e.g. vernier calipers, micrometer gauges etc.).

Chemical laboratory:

- determination of chemical composition according to the spectrometric method,
- measuring the thickness of electroplated coatings according to the X-ray fluorescence spectroscopy method,
- electroplating solution analysis,
- inspection of paints, varnishes, lubricants and oils,
- corrosivity testing and leak-proof testing of protective coatings in salt spray chambers



Material strength, metallography and flaw detection testing laboratory:

- hardness testing according to Vickers, Rockwell and Brinell methods,
- material mechanical properties testing: tension testing, impact testing (also in lower temperature),
- hardened coatings thickness testing according to the hardness penetration pattern method,
- microscopic and macroscopic steel examination and its alloy compounds testing,
- nitrided, anodized, galvanic and carburized coatings quality determination,
- nondestructive testing (flaw detection): magnetic and penetration tests,
- the lab is responsible for expertise execution in scope of metal science and heat treatment. We specialize in technical and technological problem solving that occur during manufacturing process. The aforementioned research is conducted according to a set of the following standards: PN, PN-EN, PN-EN, ISO. Laboratory apparatus and measuring equipment are a subject of internal supervision and metrological confirmation by the Regional Verification Office



Laboratory research

Environmental chamber research, vibration and shock resistance testing, impact resistance trials and physical quantity measurements

Environmental chamber testing:

- environmental chamber – type: UC7 = -60/+120, usable area: 8.5 m³ (1.7x2.5x2 m), temperature range: -60÷+120°C, the scope of relative humidity: 10÷95%, range of temperature intervals: 20÷80°C, shooting can be performed from the inside of the chamber,
- rapid temperature changes environmental chamber – type: SU1000 C10 ESS, usable area: 1320 liters (1x1, 2x1, 1 m), temperature range: -70÷+180°C, the scope of relative humidity: 10÷98%, range of temperature intervals: 20÷95°C, rapid temperature changes maximum velocity: 10°C/min.,
- corrosion resistance chamber – type: DCTC 1200P, usable area: 1200 liters (0.7x0.78x1.7 m), temperature range: ambient temperature: ÷+55°C, the chamber is used for material and coating corrosion resistance,
- dust-proof and dust-resistant chamber – type: TPSD 8500, usable area: 8.36 m³ (2x1, 9x2, 2 m), temperature range: ambient temperature: ÷+65°C, shooting can be performed from the inside of the chamber,
- rainwater chamber – type: WD 10000, usable area: 12.48 m³ (1.95x2.0x3.2 m), temperature range: ambient temperature: ÷+80°C, 20 spray nozzles/jets including: 4 vertical nozzles, 8 horizontal nozzles and 8 angular nozzles, shooting can be performed from the inside of the chamber



Processes are recorded with camera

Recording camera for registering rapid change occurrences – type: Phantom v. 711, capacity/bandwidth: 7 G pix/s, the maximum recording rate in HD resolution (1280x800 pix.) equals: 7530 frames per second, the maximum resolution 128x8 pix.



Object testing with the DONGLING ES-30-370 vibration system using GT800 slide table

The system operates on 3-axis mechanism in simple harmonic motion and stochastic motion, the applied force is equal to 30kN and in impact movement the value is equal to 60kN. The maximum acceleration equals 100 g, vibration amplitude: 25.4 mm. Static load capacity equals 500 kg





INDUSTRIAL SERVICES SALES DEPARTMENT

Ewelina Koza

HEAD OF DEPARTMENT

tel. 14 630 63 85

kom. 726 202 607

e-mail: ewelina.koza@zmt.tarnow.pl

Halina Wojtas

ELECTROPLATING TREATMENT

tel. 14 630 64 40

e-mail: halina.wojtas@zmt.tarnow.pl

Łucja Marek

HEAT TREATMENT AND THERMOCHEMICAL TREATMENT

tel. 14 630 64 36

lucja.marek@zmt.tarnow.pl

Lesław Hirsz

TECHNICAL CONSULTATION

tel. 14 630 62 47

kom. 595 200 722

leslaw.hirsz@zmt.tarnow.pl

tel/fax. 14 630 64 40



Zakłady Mechaniczne Tarnów

Zakłady Mechaniczne Tarnów SA
ul. Kochanowskiego 30, 33-100 Tarnów
tel. 14 630 62 00, fax 14 630 62 04

www.zmt.tarnow.pl

MACHINING PROCESSES, WELDING, LABORATORY RESEARCH