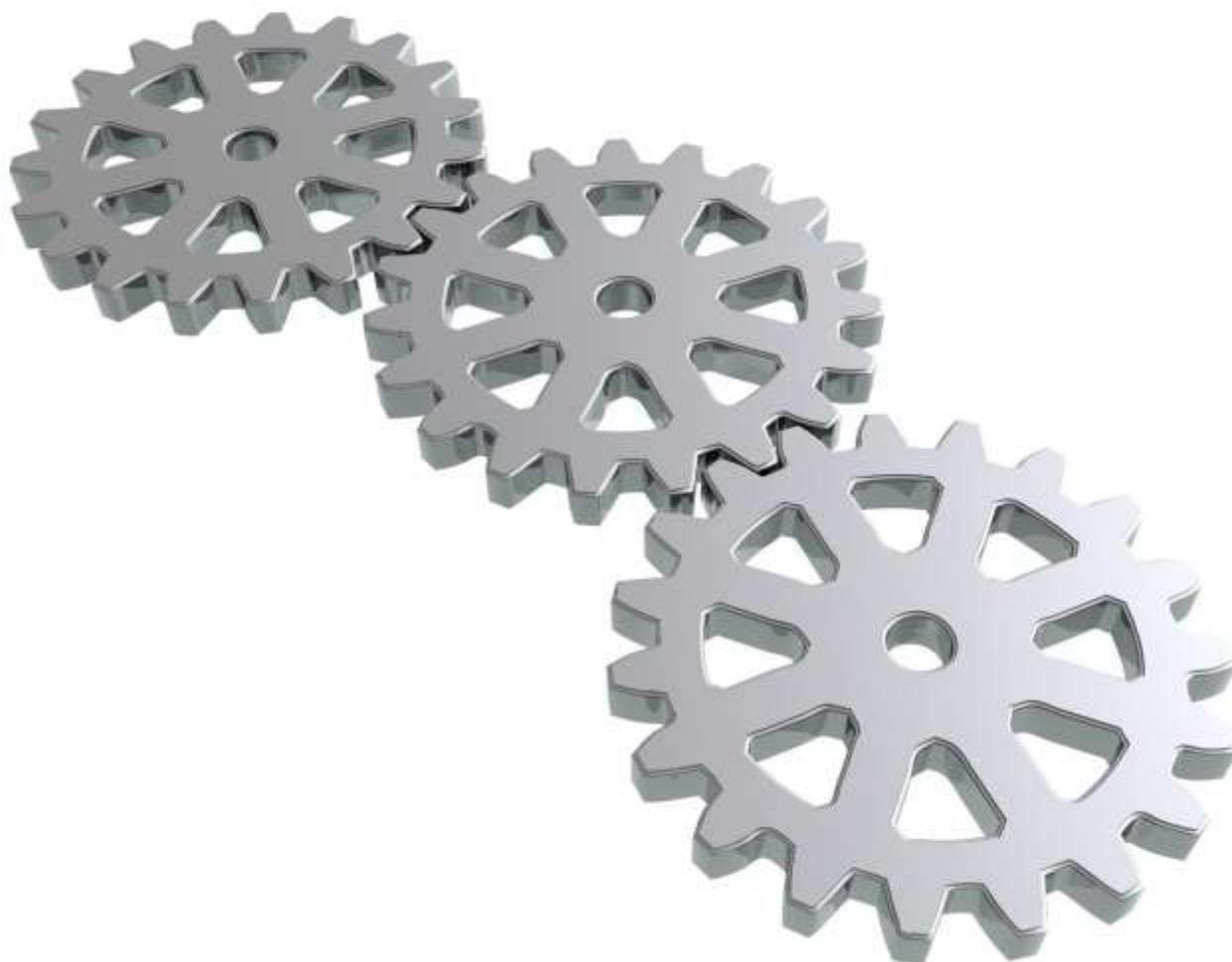


SOLPIN TECHNICAL CONSULTANCY

MECHANICAL PLANT – COOPERATION PROPOSAL



SOLPIN TECHNICAL CONSULTANCY is a group of experts with long-term experience from different industrial areas like industrial engineering, maintenance, technical installations (electrical, automatic, heating, water, gas) and industrial buildings.

Solpin is a member of the following chambers of commerce:



In the range of further presented offer we are acting as authorized representative of the mechanical plant with its wide offer ranging from precision mechanics to molding. Over 60-year-long experience together with modern, high quality machine park are strong benefits, what is confirmed by certificates ISO 9001, ISO 14001, OHSAS 18001.

Mechanical plant – business areas:

- commercial and industrial power generation,
- mining industry,
- automotive industry,
- metallurgic industry,
- medical instrument components,
- optical industry,
- commercial machining services,
- metal castings and surface treatment,
- measuring and testing.

The plant provides a wide selection of services for industrial sectors, with a key focus on machining of components and assemblies, metallurgical heat and chemical treatment processes as well as metal castings production. The wide range of activities also includes technical support services, repair and overhaul services, toolmaking, laboratory testing and research, along with a variety of special products and services tailored to individual client needs.

Main departments:

- BLADE DEPARTMENT
- MECHANICAL DEPARTMENT
- FOUNDRY AND SHOT BLASTING DEPARTMENT

I. BLADE DEPARTMENT

Manufacturing of turbine flow system parts

The plant includes a well-equipped department for flow system parts manufacturing. Production activities encompass flow parts delivery for all types of steam and gas turbines, axial compressors, generator fan blades and flow parts for hydro power turbines.

Product range:

Complete blade rings, composed of:

- rotor blades, guide vanes, blade nozzles and welded blade segments
 - blade locking pieces
 - locking blades
 - shrouds
 - locking pins
 - stiffening and damping wires
- and
- fully milled welded nozzles



- welded and cast diaphragms
- reversing rings
- interstage turbine and labyrinth seals.

The long-standing experience of our employees in the manufacturing of turbine blades and vanes, coupled with intense capital investments in the latest machine tools allow us to manufacture even the most elaborate of rotor blade and guide vane geometries.

We also provide additional special surface treatments for flow parts.

These include (among others): shot peening; hardening of blade leading edges using the following methods: laser hardening; HVOF (high velocity oxygen fuel) or stellite strip application.

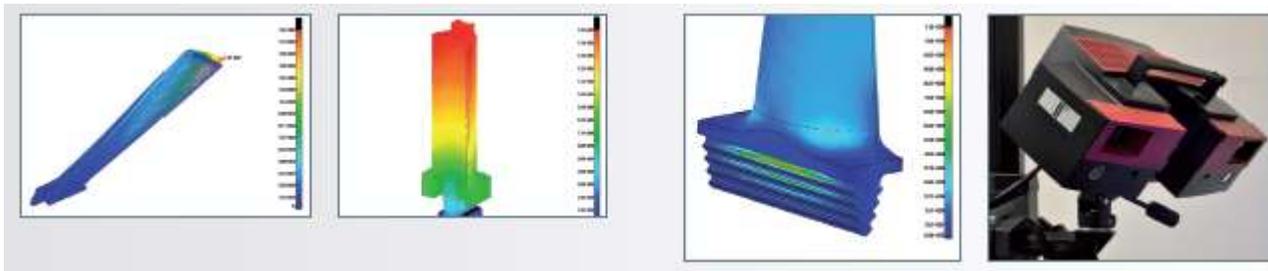
MATERIALS

The input materials for blades include rolled and forged square bars, drawn profiled bars, as well as precision drop forgings or regular forgings. Blades and vanes are manufactured from materials supplied by recognised and reliable steel vendors. We also process customer entrusted materials. Commonly used material grades used in steam turbine flow parts production are stockpiled in house in rectangular or squared bar form. The extensive range of cross sections immediately available help us to realise urgent projects with extremely short lead times.

ENGINEERING OFFICE

The plant operates its own Design and Process Engineering Office, which prepares design documentation for the manufacturing and processing units within our company. We manufacture parts on the basis of technical documentation supplied to us by our Customers or documentation prepared in - house. Our design process is based on a range of CAD/CAM software (these include programmes such as: NX, Inventor, AutoCAD, MasterCAM, HyperMill and RCS).

It also offer FEM strength and modal analyses of turbine flow system parts to simulate the operation of tested components. The analytical processes are carried out with FEA (finite element analysis) using the most advanced commercially available software for virtual testing which allows our engineers to simulate real-life operating conditions of blades, vanes and other components. Design engineers are able to help you solve any engineering problem with their knowledge and experience.



REVERSE ENGINEERING

Engineering Office provides reverse engineering services. The required design engineering documentation is developed by measuring provided sample blades or other flow system components. Reverse engineering process is based on:

- Carl Zeiss Prismo CMM;
- 3D optical scanner measurements (portable);
- turbine component natural vibration measurement instruments.

TEST LABORATORY

Our laboratory is extensively equipped with all instrumentation required for:

- precision measurements of geometry, including flatness and angular length;
- precision surface roughness measurements;

- testing of basic mechanical and metallographic parameters;
- iron alloy hardness with the use of stationary and portable hardness testing machines from “EMCO Test” and “Krautkramer-Branson”;
- NDT chemical composition analysis with the Spectro-Test equipment • (including the composition of Fe, Cu and Al based metals), this enables the identification of material grades and performance of material composition % analysis.



Our services include testing of the following with the Carl Zeiss Prismo coordinate measurement machine:

- turbine blades;
- involute cylindrical gears (with spur teeth, helical teeth, as well as internal and external teeth);
- linear measurements of workpieces, shape, feature location, flatness, roundness and other parameters

Plants' laboratory also provides magnetic powder testing (MT) with the Portaflux 2000 magnetic flux detector. The Company issues NDT certificates. Our measurement instruments are controlled acc. to ISO 9001 with the Q-MS/GM 2000 specialist software suite. The laboratory staff is UDT-CERT Level 2 (MT-2) certified.

MODERN CNC MACHINE PARK



Team of CNC programmers utilises the great capabilities of CNC machine tools. Their tools of the trade include the following CAM systems: Master CAM, RCS and HyperMill. Plant operates a number of CNC machines of Swiss and German production. These include (among others): STARRAG LX 251, DMU 80P and DMP 60S.

TOOL SHOP

Our tooling manufacturing department benefits from the latest tooling machines:

- CNC wire cutting machine,
- wire Cutting Machine EXCETEK R2000,
- dowelling machine EXERON EDM 313,
- jig boring and milling machine

SAACKE UW I D tool grinding machine

We manufacture:

- standard tools (e.g. shank cutters, tapered cutters, drill bits and reamers);
- special tools (e.g. profile cutters for root machining of flow parts).

Our range of tool manufacturing includes HSS and SC tooling.

II. MECHANICAL DEPARTMENT

The core business of the Mechanical Department is the manufacturing of equipment and components for power generation and mining industries, as well as various workpieces for other industries based on customer entrusted technical documentation or design documentation prepared internally. The Department is staffed with experienced and qualified specialists who can boast great expertise in design engineering, machining, welding and heat treatment required for the production of demanding components, assemblies and machinery.

Design and Process Engineering Office

The plant operates its own Design and Process Engineering Office, which prepares the design documentation for the manufacturing and processing units, that frequently includes new product manufacture. Our employees are high-class specialists with great engineering knowledge, they possess manufacturing organisational skills and experience.

Services

- machining of workpieces on modern CNC machines with 5 axis capability
- machining of workpieces on vertical and horizontal milling machines
- machining of workpieces on carousel type and horizontal lathes
- final machining by grinding of cylinders, bores and flat surfaces
- machining of cylindrical gears
- slotting, boring and cutting
- heat treatment: annealing, quenching and tempering, and induction hardening
- low-speed dynamic balancing
- welding services
- overhauls of all pump types
- overhauls of axial and radial compressor rotors.

Products

High pressure plunger pumps

Type AZ hydraulic power units and pumping engines

Application:

The Type AZ power units are primarily intended to power hydraulic roof supports used in the long wall mining process. Oil/Water emulsions working fluid typically contains 1% of emulsifying oil. The Type T high pressure pump is a three plunger piston pump intended for forcing water oil emulsion (or water, if necessary). It can also be installed in the spraying systems of longwall cutters and their motor cooling systems.

The pumping engine is designed for ganged or standalone operation. The equipment is designed for operation in underground mining excavations qualified at the methane explosion hazard level "a", "b" or "c" and the coal dust explosion hazard class "A" or "B" acc. to Polish classification. The Type AZ power units and pumping engines are certified for compliance by KOMAG Gliwice.

ATEX: Ex I M2

Technical data

| Power unit type Parameter | Designation | AZ-2sM | AZE-3 | AZE-5 | AZE-5 variant II & III | AZE-6W |
|---|-------------|------------|------------|------------|---|------------|
| Power unit output [dm ³ /min] | Q | 2x100 | 2x125 | 2x150 | variant II 4x150 variant III 3 x 150 | 2x220 |
| Operating pressure [MPa] | p | 20÷32 | 20÷32 | 20÷30 | 20÷32 | 20÷32 |
| Pumping engine type | | 2xT-100/32 | 2xT-125/25 | 2xT-150/30 | 4(3)xT-150/30 | 2xT-220/32 |

Spray pumping engine technical data

| Pumping engine type Parameter | Designation | T-220/12 | T-270/10 |
|---------------------------------------|-------------|----------|----------|
| Pump output [dm ³ /min] | Q | 220 | 270 |
| Operating pressure [MPa] | p | 4÷12 | 4÷10 |



Type WUP-1 high pressure pump

Application:

the pump unit is designed for high pressure water cleaning of e.g. condenser tubes, boiler tubes, evaporator tubes, vacuum filters, rotating filters, and outer surfaces of structures and equipment.

- Pump output 63 dm³/min
- Operating pressure 45 MPa
- Peak pressure 50 MPa

Type PEŁ, OPEŁ and PEM electrical actuators

Application:

axial force and stroke drive control units with a diverse range of applications including for example rail turnouts, barriers, air ventilation gates, swing gates, braking systems etc.

– whenever reciprocating back and forth motion within a defined stroke is required.

- Service rod force 3 to 28 kN
- Stroke length 250 to 850 mm

Type PEŁ electrical actuator

Application:

- operation in dust explosion hazard areas restricted to equipment qualified as Group II Cat. 2 Zone 21 and Group II Cat. 3 Zone 22
- operation in underground mining excavations not including methane explosion hazard environments and qualified for dust coal explosion hazard (class "A" and "B" rooms)

Degree of protection: IP-65, PN-EN 60529:2003.

ATEX:

II 2DEx t IIIC T1250C Db I M2 IP6



Type OPEŁ flame-proof electrical actuator

Application:

- operation in ATEX Group I Cat. M2
- operation in underground mining excavations qualified at the methane explosion hazard level "a", "b" or "c" and the coal dust explosion hazard class "A" or "B"

Degree of protection: IP-65, PN-EN 60529:2003.

ATEX:

I M2 Ex d[ib] I Mb



Type PEM electrical actuator

Application:

- operation in ATEX Group II Cat. 3 Zone 22
- operation in underground mining excavations safe from gas/dust/vapour explosion hazards

Degree of protection: IP-54, PN-EN 60529:2003.

ATEX:

II 3DEx tD A22 IP54 T 1250C



Type APE-1 emulsion pumping engine

Application:

- pumping of Oil/Water emulsion from walking shields operated below the central pumping station level
- operation in underground mine excavations qualified at the methane explosion hazard level "a", "b" or "c" and the coal dust explosion hazard class "A" or "B" acc. to Polish classification

ATEX:  I M2

- Pump output 210 dm³/min.
- Operating pressure 25 MPa



Type PZW-2,2-36 submersible pumping engine

Application:

- pumping of clean water with low levels of contaminants and ≤ 5 mm solids
- operation in underground mine excavations qualified at the methane explosion hazard level "a", "b" or "c" and the coal dust explosion hazard class "A" or "B" acc. to Polish classification

ATEX:  I M2 c Ex Di Mb IP68

i II 2G c Ex d IIA T5 IP68.

- Pump output 36 m³/h
- Delivery head 17,5 m



Cement grout pumping engine

Application:

- the engine is designed for feeding of water and cement mixers (to produce cement grout) for high-pressure construction applications
- the main purpose is injection of grouting for performing pilework

- Maximum output 280 dm³/min
- Maximum injection pressure 25 MPa
- Overall machine length L = 3500 mm

The T-280/25 is driven with a Diesel engine. The pumping engine is housed in a protective metal casing.



MACHINE PARK

Our machine park capabilities are very high: we can machine on traditional, and modern CNC tools. Examples of CNC machines that we operate inc.:

GBR-4 LAGUN bed milling machine

Characteristics:

- Table size 4100x1000 mm
- Maximum load 7000 kg
- Traverse
 - Longitudinal (X Axis) 4000 mm
 - Cross (Y Axis) 1200 mm
 - Vertical (Z Axis) 1500 mm
- Turntable Ø800 mm
- 2-plane swivel head, 2.5°/2.5° indexing



Solaruce CNC milling machine

Characteristics:

- Max. work space 2000x1000x1000 mm
- Table size 2000x800 mm
- Turntable size 600x600 mm
- Max. table load 4000 kg
- Max. turntable load 1000 kg
- Swivel head with 2.5° x 2.5° indexing
- Measurement probes for work pieces and tooling



CNC lathes

Characteristics:

- Max. disc turning diameter ø600 mm
- Max. turning diameter ø400 mm
- Max. work piece length 900 mm
- Max. weight in chuck 100 kg
- Max. weight in centres 350 kg
- Bar machining range ø16 to ø63 mm



CNC turning centre Doosan PUMA 600 LM

Characteristics:

- Max. diameter above the bed 1030 mm
- Turning diameter above transverse slide 800 mm
- Max. turning diameter 900 mm
- Max. turning length 3200 mm
- Permissible load
 - Chuck operation 900 kg
 - Bar (tailstock) operation 5500 kg
- Spindle bar (bore)
 - Diameter: 117 mm



GEAR MACHINING

External teeth gear machining:

- Max. module 8
- Max. milling diameter \varnothing 315 mm
- Max. rim width 280 mm
- Accuracy class 10, acc. to PN/M-88522.01

Teeth grinding:

- Max. module 8
- Min. grinding diameter \varnothing 50 mm
- Max. grinding diameter \varnothing 630 mm
- Rim width vs. angle 140 mm at $\beta = 45^\circ$, 215 mm przy $\beta = 0^\circ$
- Teeth per gear 12 ÷ 140
- Accuracy class 7, acc. to PN/M-88521.01



HEAT TREATMENT

Types of heat treatment processes performed by Mechanical Department:

- annealing, quenching and tempering; furnace size: W 1100 mm x L 1500 mm x H 550 mm
- induction hardening; characteristics: max. diameter: \varnothing 1000, max work piece length: 1200 mm
- treatable steel grades: structural, carbon, alloy and tool grades



Electric chamber furnace with annealing

- furnace chamber service dimensions: 1500 mm x L 2500 mm x H 1000 mm
- max. operating temperature: 1100°C
- max. charge weight: 1200 kg
- control, visualisation and data archiving system – process run printouts

Hardening Furnaces POK 73

- furnace chamber service dimensions: 740 mm x L 1200 mm x H 540 mm
- max. operating temperature: 1100°C
- max. charge weight: 550 kg
- control, visualisation and data archiving system – process run printouts



Hardening Furnaces POK 71

- furnace chamber service dimensions: 420 mm x L 830 mm x H 320 mm
- max. operating temperature: 1100°C
- max. charge weight: 200 kg
- control, visualisation and data archiving system – process run printouts



III. FOUNDRY AND SHOT BLASTING DEPARTMENT

Foundry and Shot Blasting Department produces made to order castings. We have a long-standing experience in metal castings production, often involving very challenging and complicated projects.



Casting materials and unit weight:

- grey cast iron and spheroidal cast iron: max. 500 kg
- AISi10Mg (AK9) alloy: max. 120 kg
- BK331 bronze: max. 350 kg

Metal melting process

- the cast iron is melted from the highest quality machine scrap and certified founding blanks in a modern medium frequency induction furnace.
- copper and aluminium alloys are melted only from certified ingots in liquid fuel crucible furnaces.

Mould and core manufacturing process

The casting cores and moulds are made from bentonite compounds, oil-based compounds, self-curing powders and with the CO₂ gaseous process.

Technical service

We provide start to finish technical and engineering service for casting orders. The plant casts from entrusted engineering designs and casting models.

Shot blasting

Shot blasting of various work pieces and steel structures is also among our services. Shot blasting serves to clean and treat surfaces to be painted, galvanized or otherwise processed to produce higher durability. We operate a shot blasting cabin sized 12 x 4 x 5 m, which enables processing anything from small to very large work pieces.

**I hope that you found this material helpful.
We would be delighted cooperating with you!
If you have any further questions do not hesitate to ask.**

Paweł Żurawski - CEO
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