1.SERVIS-ENERGO, s.r.o.

Plzeň

Tylova 57a

301 00 Plzeň

1.SERVIS-ENERGO, s.r.o.

Plzeň, location in Škoda Plzeň area (former Power plant ELÚ I)

GPS: N 49°44'38", E 13º21'36"

Organisation, activities

Grounding of the company:

- Company 1. SERVIS – ENERGO, s.r.o. was launched on 5. 1.1994 .
- Incorporation, County court in Plzeň , IČ 49786 393; DIČ CZ49786 393.

Official name:

- The official company name is „1. SERVIS – ENERGO, s.r.o. ”

The head office is:

- Plzeň, Tylova 57a, PSČ 301 00.
- Some storage space are in Plzeň, Hřbitovní 37.
- **Branch office:**
- Slovakia, 911 01 Trenčín, Partizánská 4C IČ: 37912704; DIČ: SK2020179898. This branch supplies only business activities, follows all rules of the Head office.

Sphere of business are:

- Manufacturing, installation and repair of electric machines and apparatuses
- Manufacturing, installation, repair and testing of electric equipment
- Revision ant tests of pressure equipment
- Revision ant tests of gas equipment
- Activities of technical consultant in power engineering
- Locksmithery

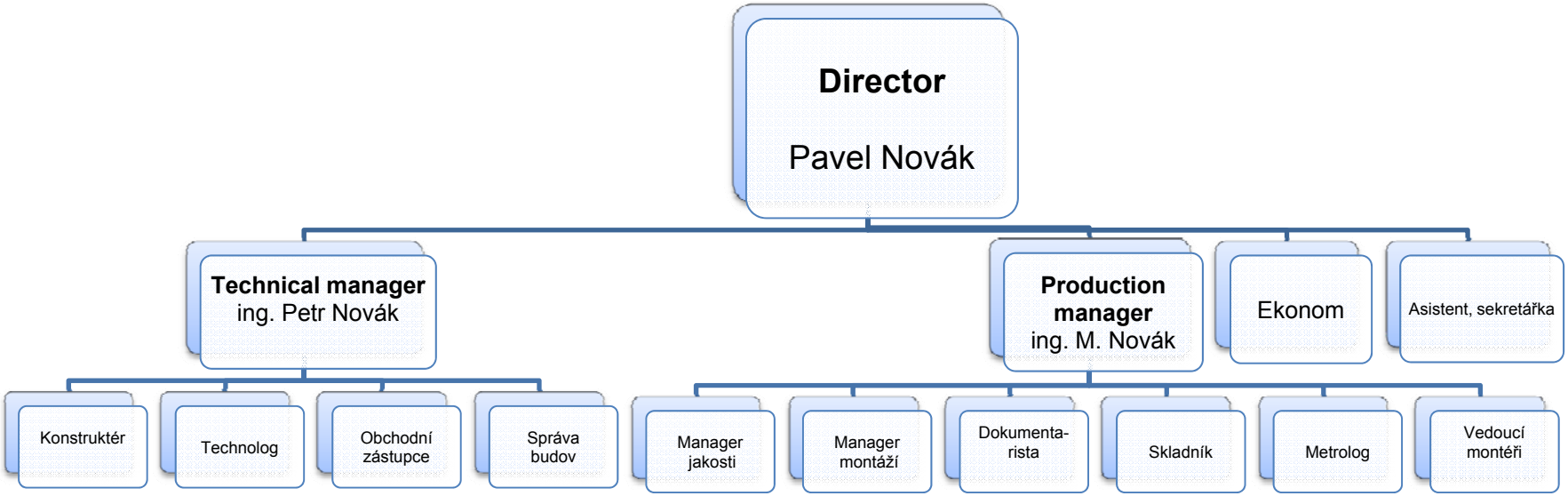
Company bodies:

- Representatives of company are 2 Executives.

Integrated System of management:

- Company earned on 20.12.2002 ISO 9001:2001 Certificate from Bureau Veritas Quality International (BVQI) for **Repair, maintenance and starting up of turbogenerators, hydrogenerators and their accessories. Design, production, repair and maintenance of their equipment.** In the year2005 the top management decided to introduce the integrated management system according CSN EN ISO 14000 and specification OHSAS 18000. Integrated system was introduced in 2007.

Organisation



New generator erections

2004 – replacement and overhaul of generator 16 MW to Termal Plant Ústí nad Labem

2006 – new generator 35 MW, manufacturer JEUMONT / France, Komořany

2007/8 – new generator 150 MW, manufacturer BRUSH SEM, Riga, Latvia

2008/9 – new generators 200 MW, manufacturer Siemens Erfurt , Tušimice 23/24 a 21/22

2008 - replacement and overhaul of generators 12 and 25 MW to Bukocel Hencovce, Slovakia

2009 – new generator 107,5 MW, manufacturer Siemens, Industriepark Frankfurt, Germany

Power Plant Tušimice 23/24 a 21/22, 4 x 200 MW

Stators

The company 1. SERVIS – ENERGO, Ltd already more than 15 years performs repairs and generator overhaul of all power and types including its accessories, i.e. oil, water and hydrogen accessories. We execute own project documentation and technological preparation of repair. Our specialization is repairs of electric parts, i.e. winding and bushings and interrelated assembly works. We delivery entire spare parts – from sealing , stator slot wedge, pads and ring-type sealing until delivery of new winding or complete magnetic circuit. We use own hydraulic method with wedging on one grinding pad under wedge for locking of optimal stiffness of slot wedging. We can use this method already for initial tension wedging with use of top ripple spring. For side wedging of winding we use semi conductive filling Pregnit, i.e. semi conductive ripple spring or flexible placing of winding in semi conductive silicon rubber. For repairs and assembly we use so-called technology on site, already very large-scale repairs as is change of stator sheets we perform direct in power station without any transport of sizeable consignment.

Important orders:

2001 – 2004 – new magnetic core and rewinding of 4 hydrogenerators 91 MW VE Orlík

2002, 2003 - new magnetic core and rewinding of 2 hydrogenerators 11,25 MW VE Štěchovice

2004 - stator rewinding TG 60 MW EMĚ I after breakdown TG4

2004, 2005 a 2006 - rewinding of stators TG 110 MW EPR I (for BRUSH SEM and for ČEZ, a.s.)

2005 - rewinding of hydrogenerator stator HG 11 MW, VE Orava, Slovakia

2006 - rewinding of stator TG 500 MW EMĚ III for BRUSH SEM.

2006 ,2007 a 2008 - rewinding of stators TG 57 MW PP Opatovice.

2004/7 - rewinding of 4 hydrogenerator stators 115 MW, Černý Váh, Slovakia

2008 - rewinding of hydrogenerator stator HG1 a 2 11,2 MW, Sarobi, Afghanistan (Voith Siemens Hydro, BRUSH SEM).

2008 a 2009 - rewedging of stators DGS (Dolmel Wroclaw, Poland) a stators HCČ (Main circulation pump, Silovije mašiny, Rosia) NPP Temelín

2009 - rewinding of hydrogenerator stator HG 120/125 MW PVE Dalešice

Magnetic core exchanging of hydrogenerator 11,25 MW TG 2 Water PP Štěchovice, rewinding

All works were done in situ.

Magnetic core repair, rewinding of hydrogenerator 115 MW, TG 1 – 4 PVE Černý Váh, Slovakia.

All works done in situ during 2003-2007.

Stator rewinding TG 500 MW EMĚ III

All works done in situ in 2005

Stator PVE Dalešice

Rewinding of stator in 2009

Rotors

- The company 1. SERVIS – ENERGO, Ltd, already more than 15 years performs overhauls and large-scale repairs of all power generator rotors. It performs tests of nonmagnetic retaining rings of two-poles generators by crack detector, repairs of winding, brackets, re-winding and re-insulating, change of collector rings, repair of bearings and complete diagnostic mechanical and electrical values.
  The company performs the repairs and overhauls in own production workshop or direct in power house by owner using our technology. This works are performed by workers, which have large-scale experience with manufacturing and assembly of rotors.
- The company provides mechanical repairs of shaft ends of rotors on turning lathe, balancing of rotor on balancing machine or direct in generator, grinding of collector rings in generator and so on. It delivery new collector rings, insulated bolts and inlets for excitation, bearings, nonmagnetic retaining rings from material CrMn 1818.
- We provide re-winding and repair of pole coils, re-insulating of winding, repairs of pole shoes, amortisseur winding, diagnostic and tests for multiple-pole machines too.
- In cooperation with the experts of Applied Science Institute of West bohemian University Mr. Las and Mrs. Las was accomplished tension analyse of nonmagnetic retaining rings by method of finite element analysis. By solution of this task there is the mechanical adjustment of surface of retaining ring, which shape is expressed by formula and it is possible it apply by computer program for various types of rotors. This solution eliminates concentration of tensions on edges of locking surface and steady expand it into complete surface of locking. By it is eliminated the possibility of rise and transmission of cracks and it contributes to increase of reliability and durability of rotors.

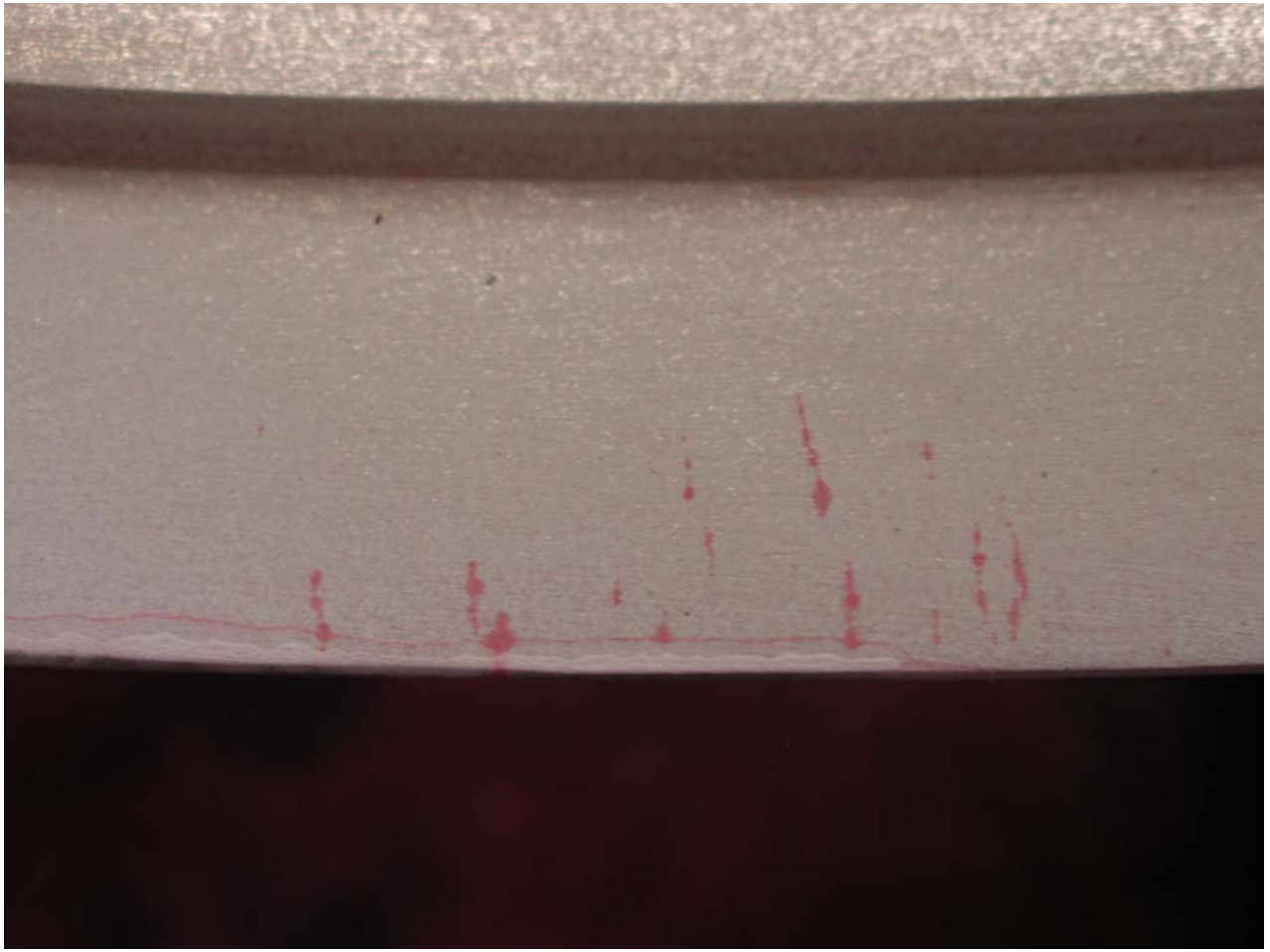
Preparation for rewinding of rotor 220/255 MW

Rewinding of 15 rotors of NPP Dukovany and J. Bohunice , delivery and machining of all insulating material

Rotor 220/255MW after rewinding

Retaining ring cracks

The delivery and finishing of new retaining rings from material P900 (X8CrMnN18-18ESR)



Rotor repair of TG 12 MW ETI

Breakthrough and following rotor body damage

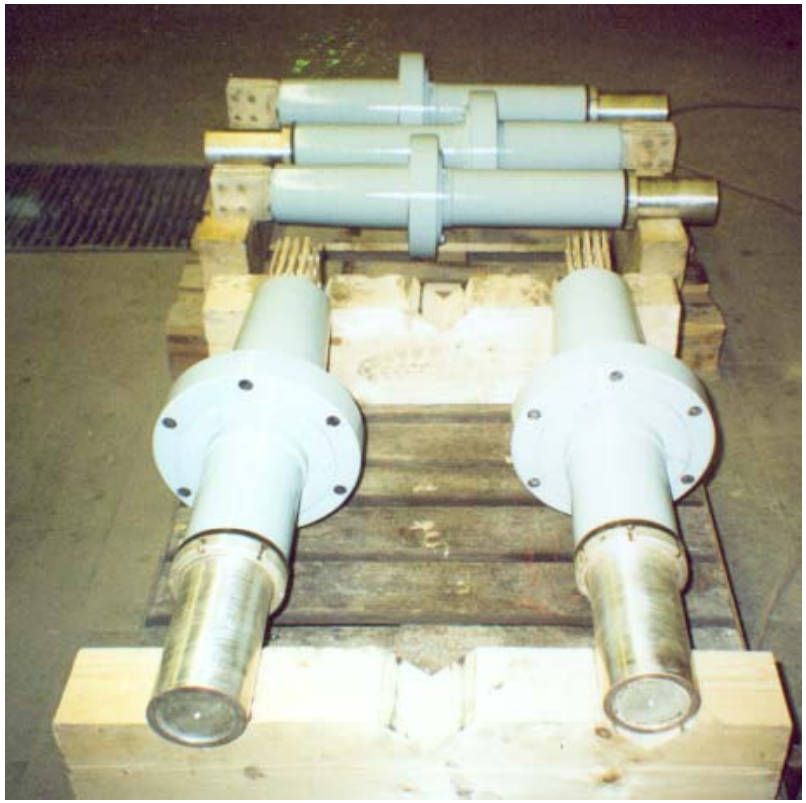
Retaining ring defects – asynchronous operation of TG

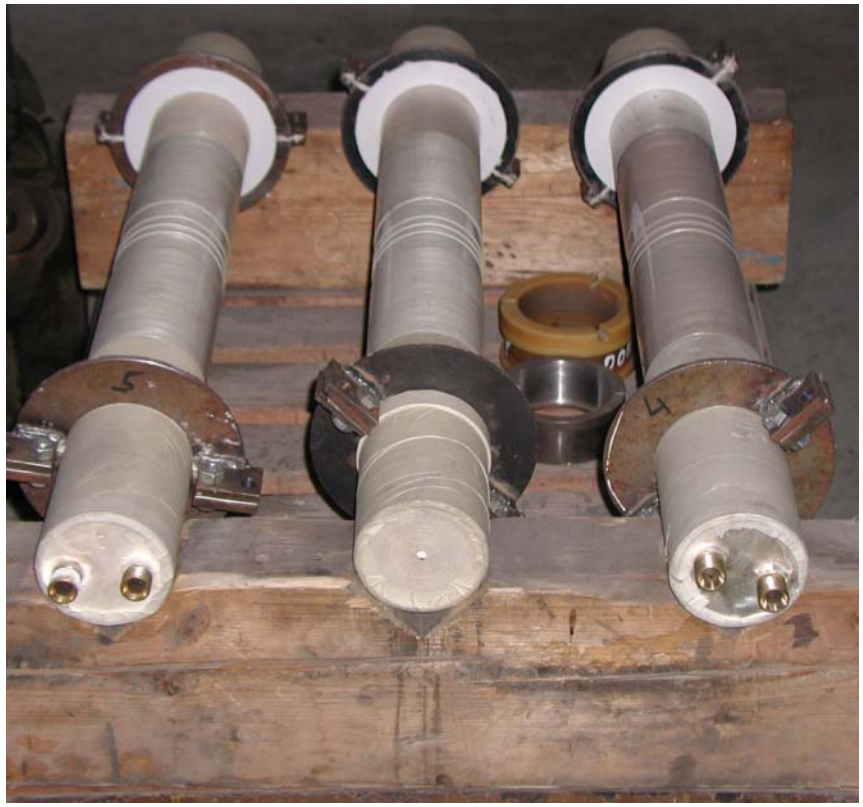
Repair of hydrogenerator rotor 91 MW Water PP Orlík

2004

Bushings

Producing and repair of 100 – 220 MW bushings



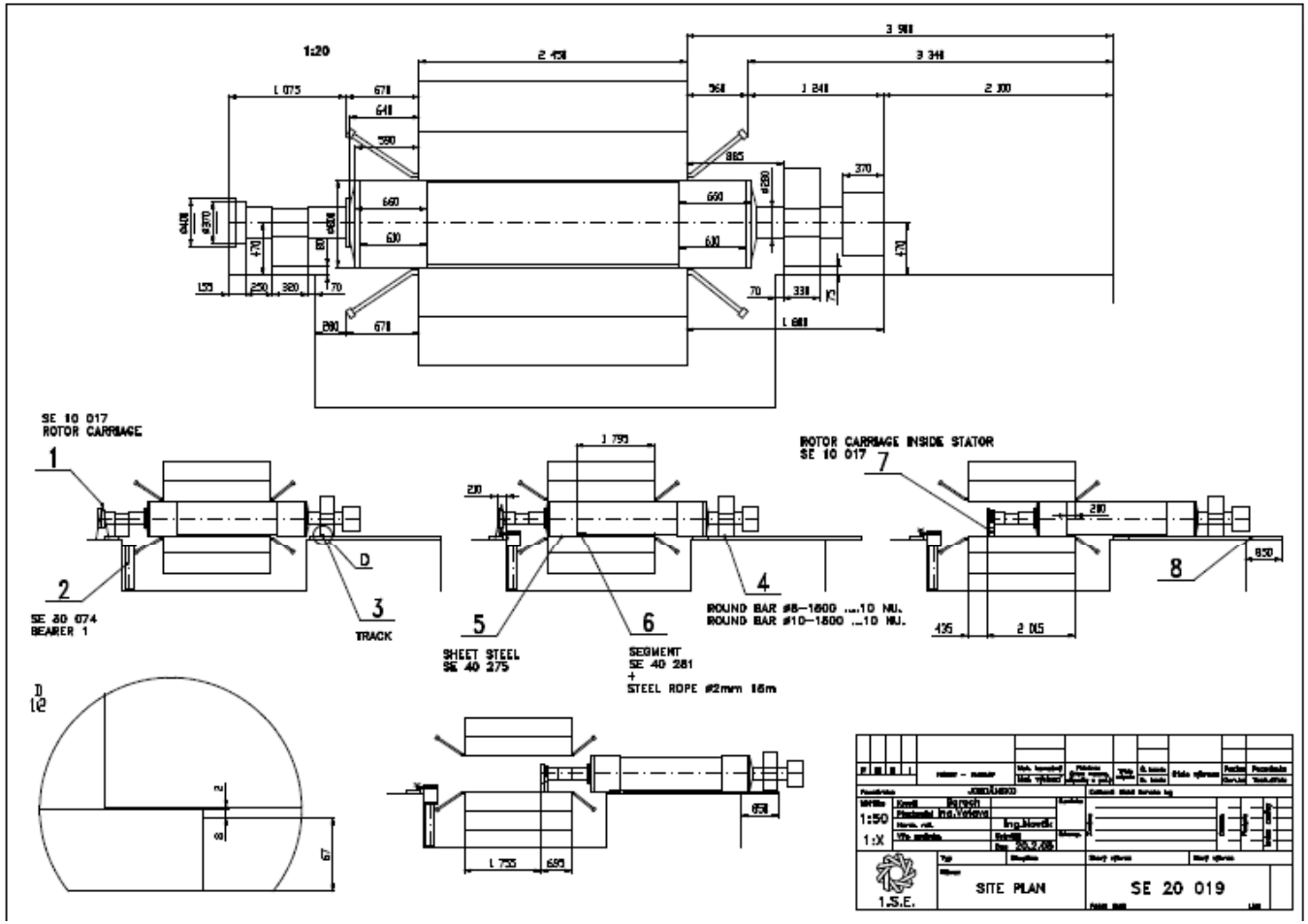


Spare parts, fixturing

Transportation stand for rotor 20 MW – design and producing

Spare parts, fixturing

Fixturings for rotor removal and repair, generator AEG 32 MVA, Jordan



Hydrogen dryer

Design, producing and putting into operation

Modernization of auxiliary systems of generators

Design, producing, erection and putting into operation

Modernization of units 1-4 Power Plant EDĚ, 4 x 200 MW

From the year 2006 company 1.SERVIS-ENERGO, s.r.o. Plzeň is providing this Modernization. Main requirements was to improve the reliability of operation and the possibility of parts replacements, some spare parts are not produced now. After modernization the units were succcessfully putting into operation.

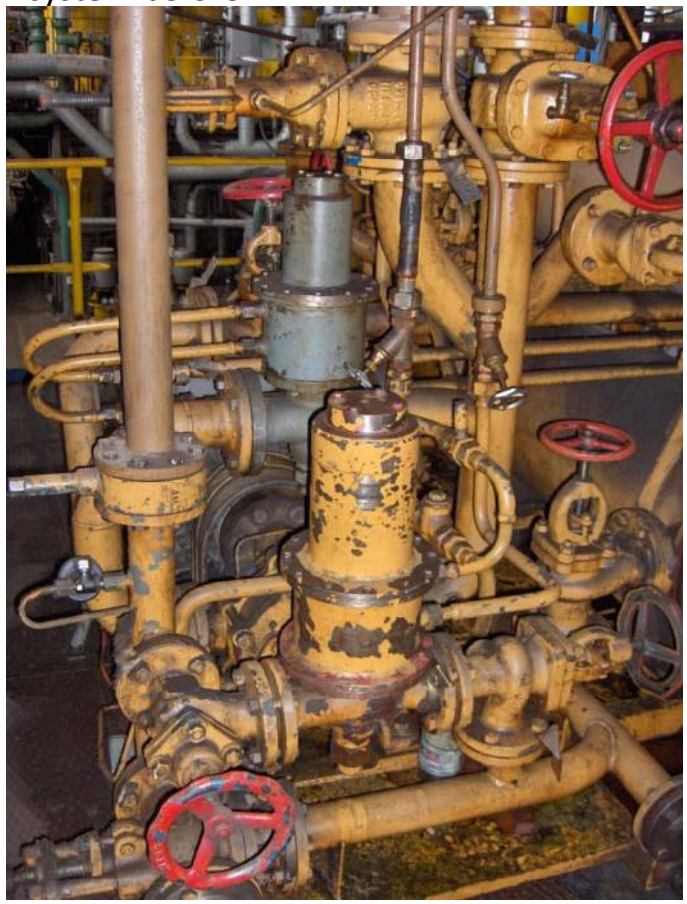
Modernization of unit 10 EMĚ, 110 MW

In 2008 there were provided the modernization of auxiliary oil system of TG 110 MW (pumps, filters, valves). After modernization the units were succcessfully putting into operation.

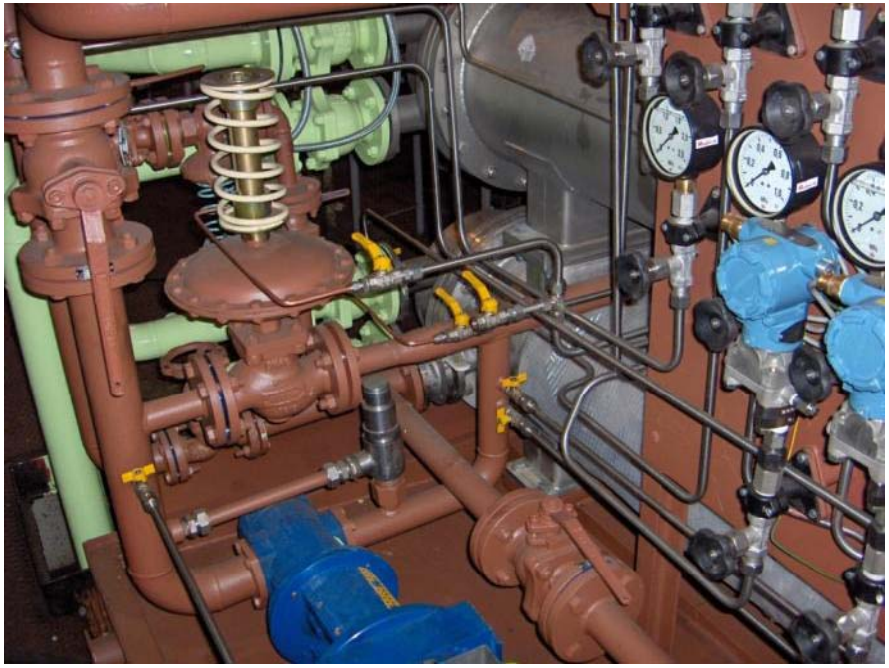
Modernization of auxiliary systems TG 200 MW (oil, hydrogen, water) EDĚ, 4 x 200 MW

2006-8

Oil system before



After



Modernization of auxiliary systems TG 200 MW (oil, hydrogen, water) EDĚ, 4 x 200 MW

2006-8

Water system before

After

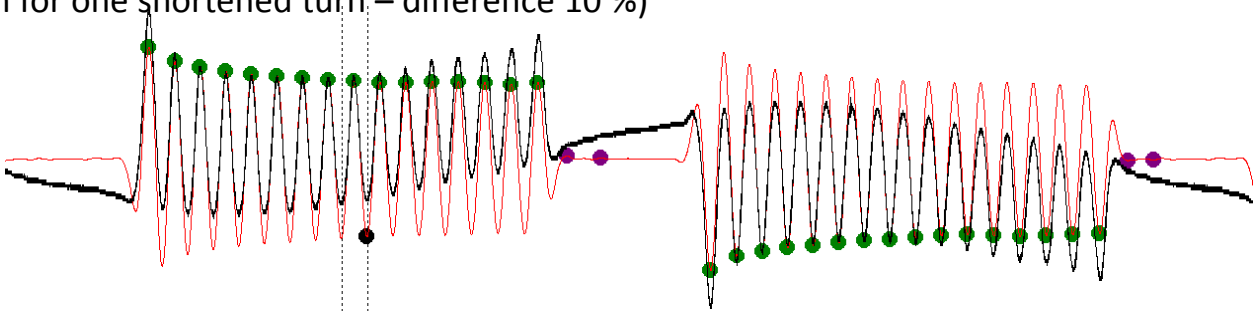
Diagnostics of electric machines

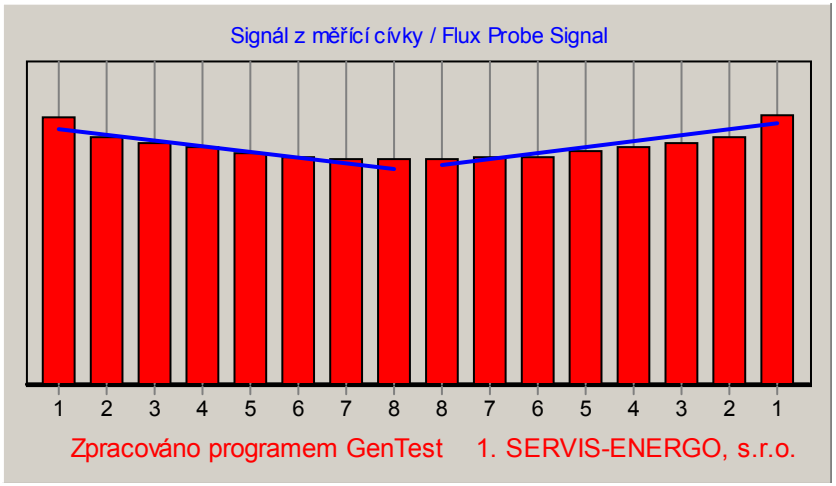
Measuring, diagnostics:

1. Insulation state measuring, polarization index (PI) of winding by measuring instrument MEGGER DM11D, MEGGER MIT520 or CAUVIN Arnoux C.A.65545 (50-5 000 V). For measuring on high voltage level by HIGH VOLTAGE PTS-75F5, up to 75 000 V.
2. Absorption, capacitance, insulation resistance on voltage by MEGGER MIT520.
3. High voltage test DC by BAUR PGK 45 ,BAUR PGK 150.1 or HIGH VOLTAGE PTS-75F5. HV tests are possible to do up to 150 000 V DC. Measuring of current during HV tests.
4. High voltage tests of rotor by stand still or during rotation AC or DC. HV test during rotation are made during rotor balancing in balancing pits.
5. Interturn connection of rotor winding measuring during balancing – after rotor overhaul.
6. Interturn connection of rotor winding measuring during power operation – measuring by measuring coil on stator wedge or by RSO (Recurrent Surge Oscillation) method. The measuring coils are produced and erected during overhauls.
7. Interturn connection of rotor winding during rotor repair by RSO.
8. Vibration diagnostics and balancing by VIBROPORT 41, manufacturer Brijel &Kjaer).

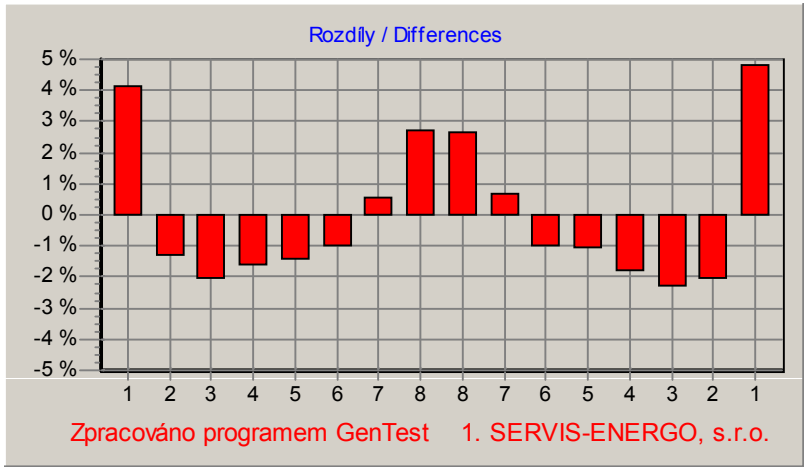
Interturn connection of rotor winding measuring during operation or in the balancing pit

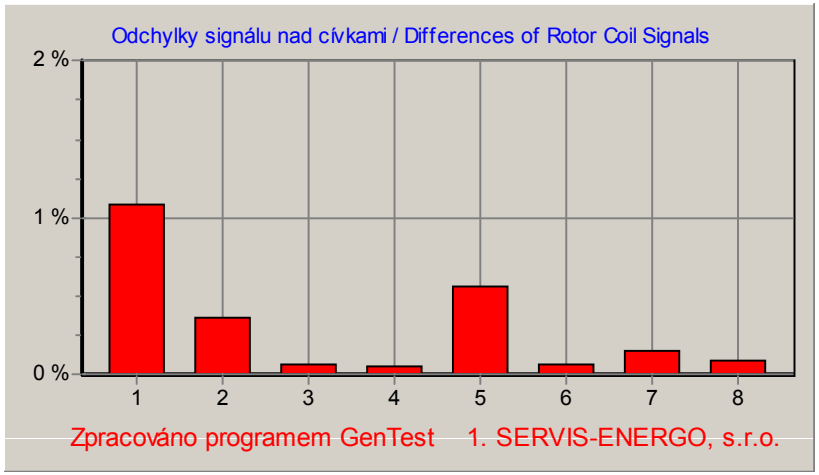
Rotor:
16 slots winded for one pole, 0 empty slop for one pole, 10 wires in one slot
(criterion for one shortened turn – difference 10 %)



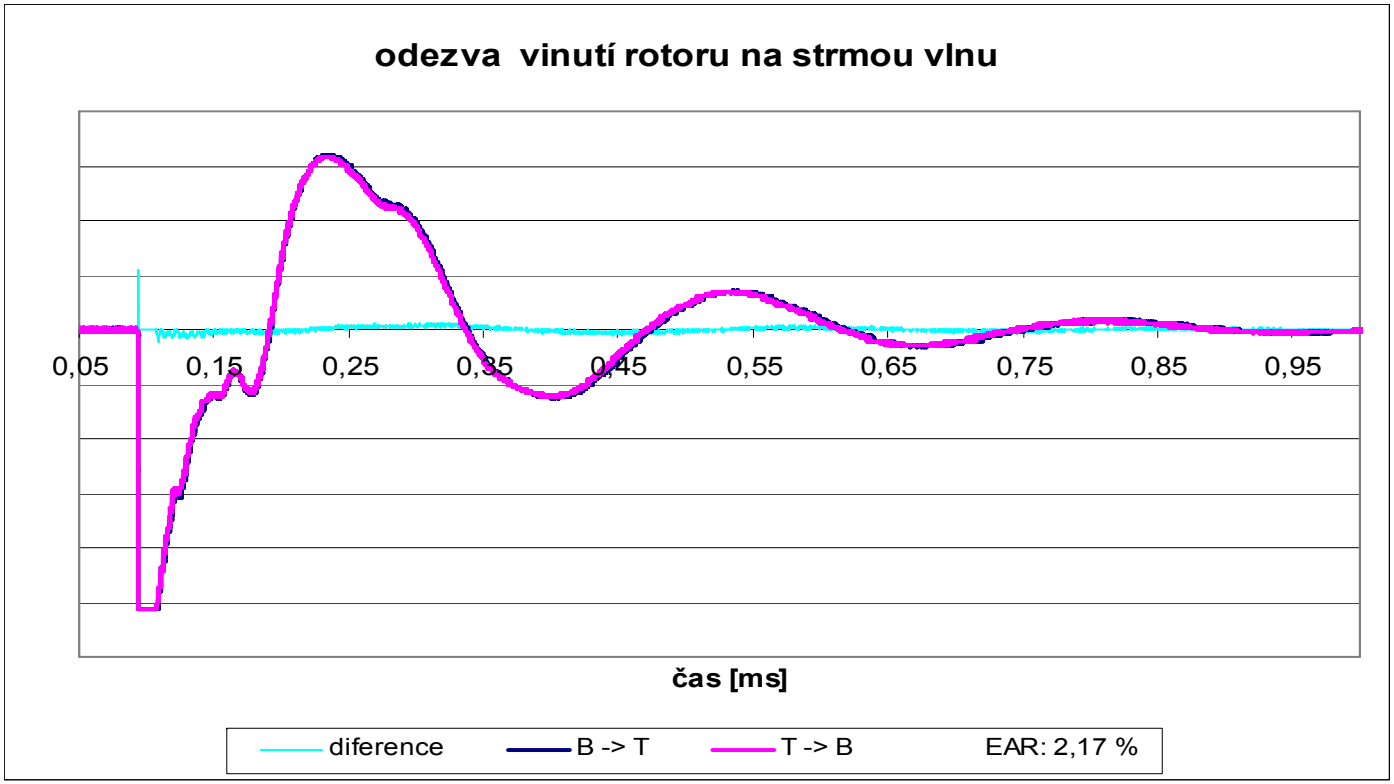


Interturn connection of rotor winding measuring during operation or in the balancing pit



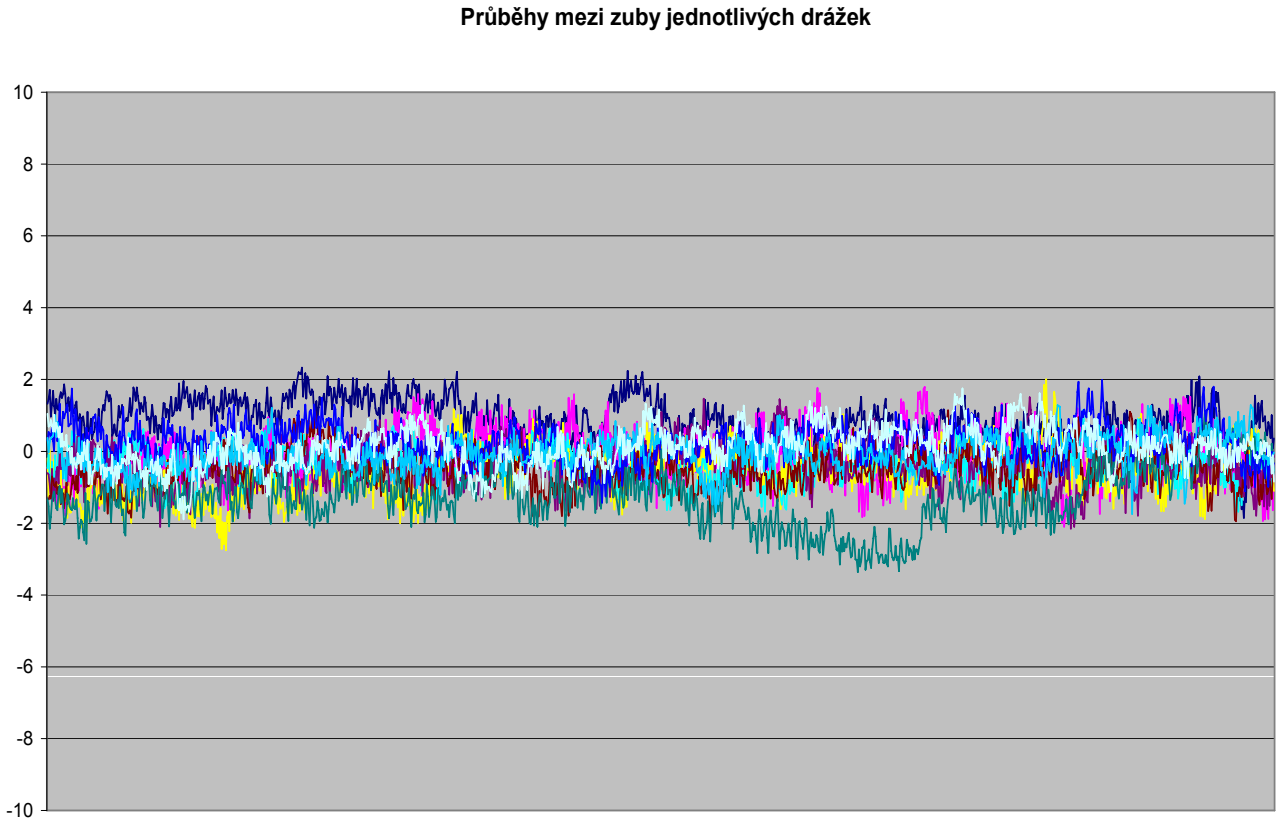


RSO – winding without shortened turns



Magnetization test – ELCID (Electromagnetic Core Imperfection Detection)

For one slot is calculated: maximum, minimum, average, difference (°C)



Diagnostics before shutting down / after putting into operation

Diagnostics (typical range):

1. Checking of operation parameters
2. Visual checking, oil leakages, ….
3. Vibration diagnostics (VIBROPORT 41, Brijel &Kjaer):
4. Diagnostic tests and measuring:
    - Shaft voltage, eventually delivery of grounding brush lately.
    - No-load characteristic – comparison with previous measuring or with the calculation sheet
    - Insulation state of rotor during rotation – without exciting.
    - Impedance of rotor winding during rotation and during shutting down
    - Time of running down.
    - Temperature and current of individual brushes (infrathermometers, A meters)
    - Interturn connection of rotor winding by measuring coil (if installed)

Realized orders 2001-9

1.9.2009 state

Orders:

Totally 997 registered orders:

237 without realization

132 not sended

Totally 563 realized

Orders from 1 000 MW (ETE) do 36 kW (exciter of TG Thermal Plant Bratislava II, Slovakia)

Approximately one half of orders is realized for generator over 50 MW.

Main clients:

ČEZ, a.s. – the biggest client.

BRUSH SEM s.r.o. – overhaul and rewinding of rotors 255 MW JE Dukovany a JE Bohunice

Alstom Brno – during 2001 – 2003

EKOL Brno, EKOL Martin – overhauls of generators up to 55 MW

Energetické strojírny Brno – technical assistance and special measuring

NPP Opatovice, International Power Opatovice – regulary overhauls of TG 55 MW from 2003

ČEZ Energoservis – special winding works NPP Dukovany, Temelín, generators 1000, 200 (220)

Škoda Power – overhauls, contract for servicing of new generators, erection of new generators (Komořany, Riga – Latvia, Tušimice II)

Škoda Praha (Škoda Praha Invest), Atel Energetika Zlín, Pražská teplárenská

Siemens IT –

Realized orders 2001-9

1.9.2009 state

Servicing contracts:

Service for new installed generators – Škoda Power

Service for compensators Krasíkov – Invelt Energo

Service for generators Thermal Plant Zlín

Service of generators 1000 MW / machine hall ETE – Škoda Power

Service of generators 60 MW EMĚ I – Pražská teplárenská / Energotrans