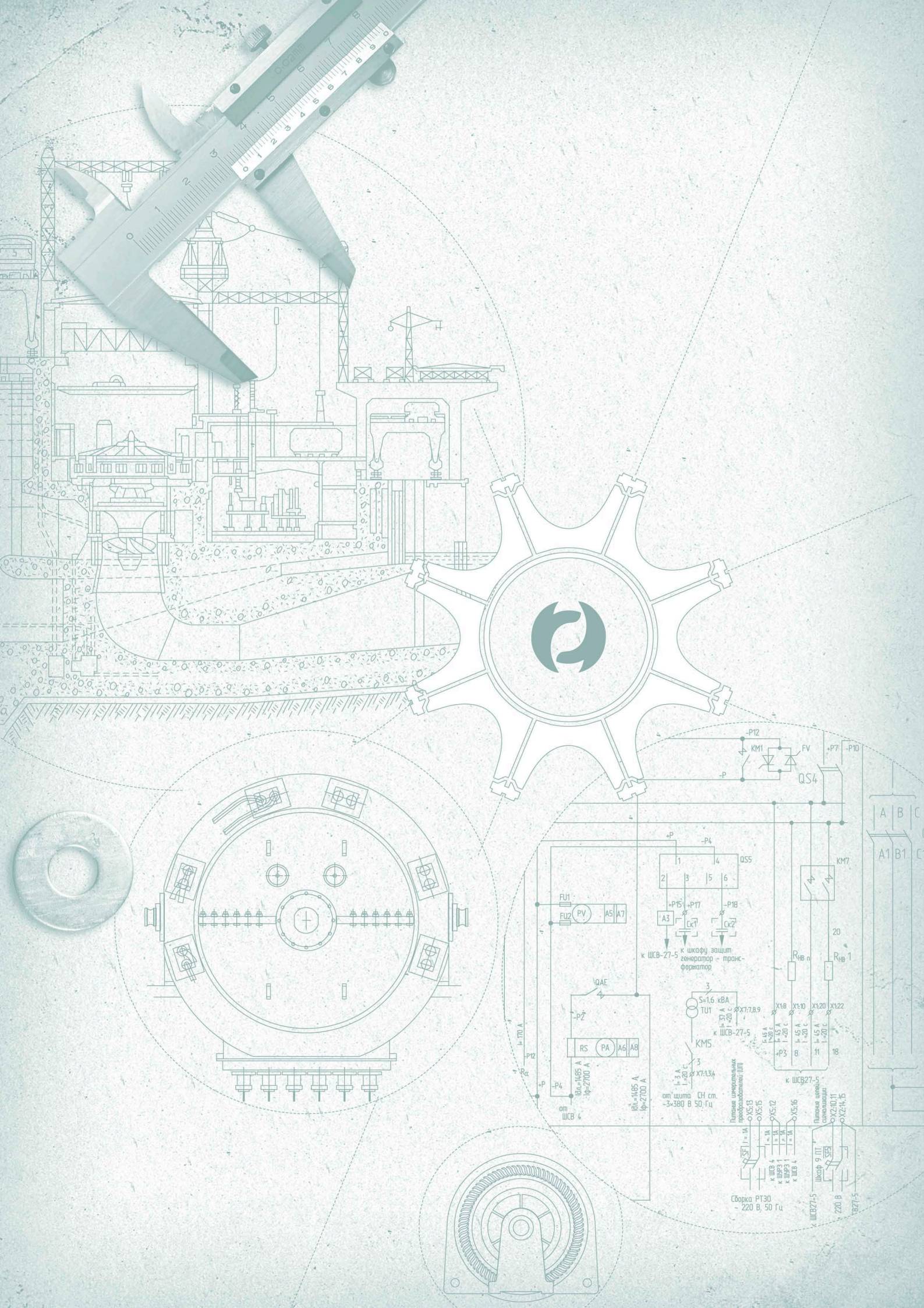


SERVICE

NPO «ELSIB» OAO

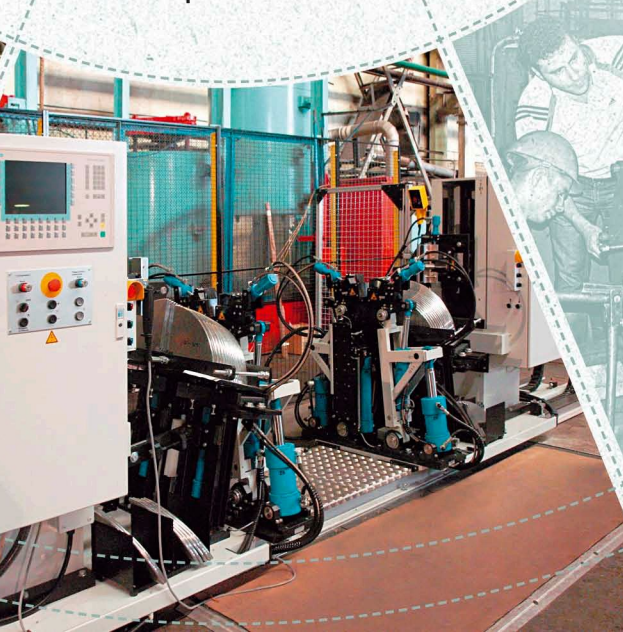
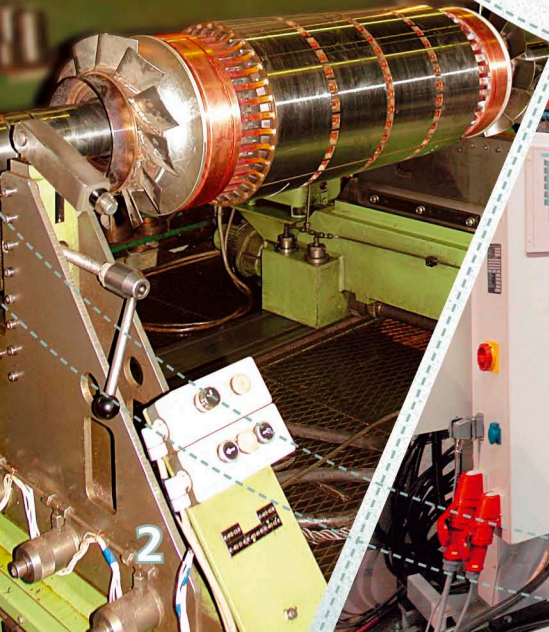
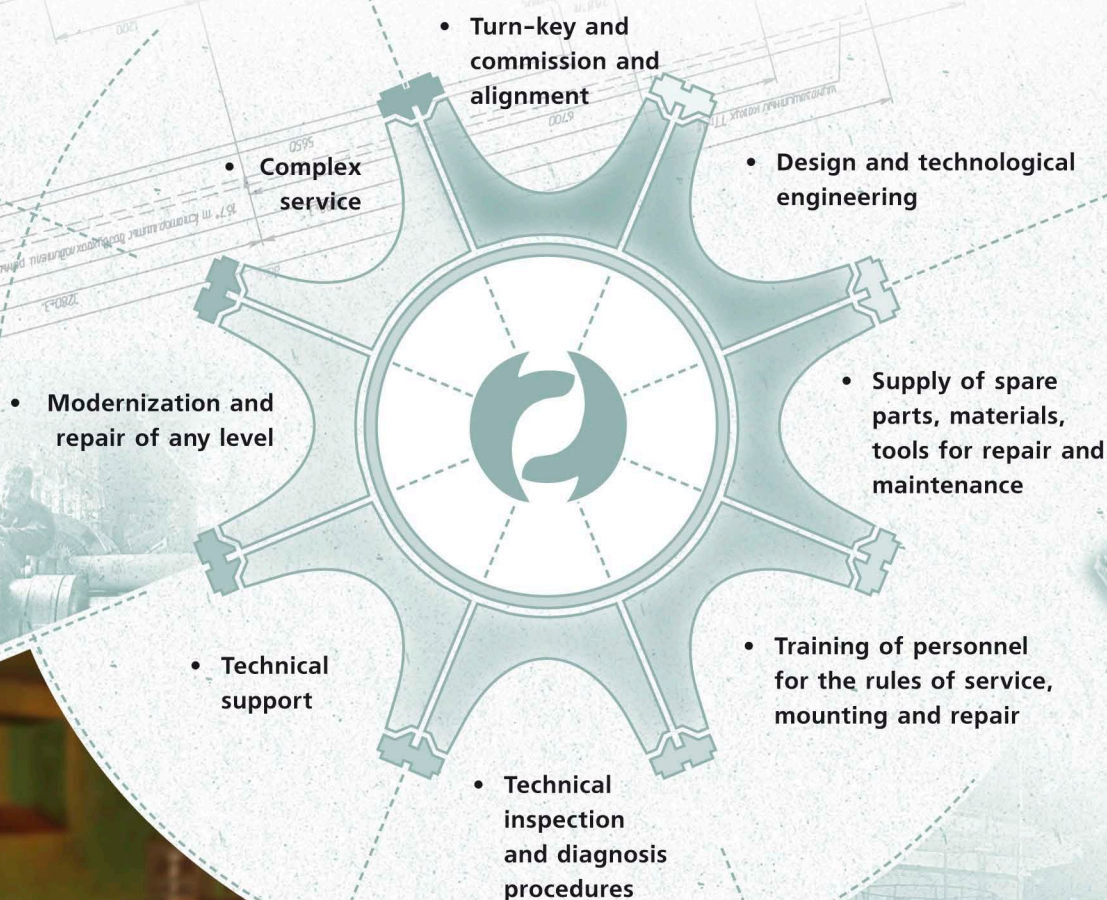


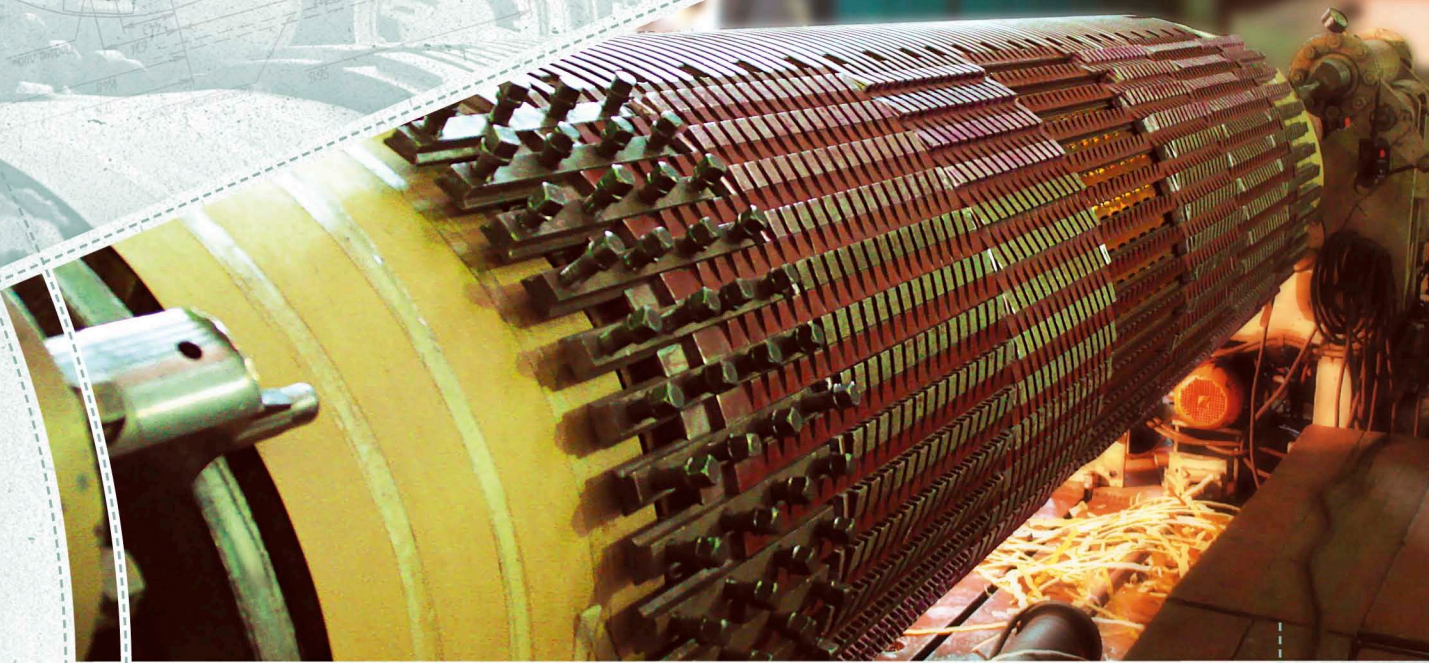
SERVICE

NPO «ELSIB» is a leading Russian producer of the large electric machines. The main products of the company are the following:

- the turbogenerators of rated capacity up to 500 MW and more with air, hydrogen and liquid cooling coupled with the steam and gas turbines;
- powerful hydrogenerators coupled with hydraulic turbines of all kinds;
- high voltage asynchronous electric motors of capacity up to 8000 kW and more;
- the excitation systems of the generators.

The company conducts the researching works, executes the design of new machines, an issue of complete design and technological documents, a manufacturing, testing, supply, turn-key and commission and alignment works. **Therefore, NPO «ELSIB» OAO is able to offer a whole range of services demanded today on a market to its clients:**





Offering a wide range of services, NPO «ELSIB» OAO signs the contracts with the clients both for long-term complex service maintenance and the concrete kinds of the works, services.

The long-term complex service maintenance includes, also, the planned and unplanned actions, and allows to organize the saving, long-term and no emergency operation of the equipment as the best. This form of co-operation allows:

- to rise the operation speed for services;
- to conduct the comprehensive and in time monitoring of state of the equipment units in course of exploitation;
- to prepare a schedule of planing repairs on a base of actual status of equipment;
- to manage an inventory of spare parts;
- to rise a quality of maintenance and qualification of personnel.

The diagnosis procedures of electrotechnical equipment offered by NPO «ELSIB» OAO include a complex of electric, vibration, thermal, acoustic tests allowing, on a base of existing knowledge and experience, to do the expert conclusion on a technical status of equipment with an issue of the recommendations on repair, further service.

The electric measurements include a definition of dielectric strength of insulation by a way of partial discharges and, on a ground of the measurements of insulation resistance, leakage currents, speed of measuring of the leakage currents, angle of dielectric losses $\text{tg}\Delta$. Also, the experiments of idle and short-circuit with revealing of defect places, their rates, are conducted.

The thermal measurements are implemented both by contact and no contact methods. The vibro-diagnosis procedures of the electric machines are supplemented with a whole complex of the measurements using the specialized equipment allowing to rise a reliability of evaluation. For technical diagnosis procedures, the updated diagnostic equipment is used.

The experience of co-operation with different companies showed the large advantages of technical diagnosis procedures to plan the repair of equipment taking into account its actual status.

SERVICE

The complex of design and technological engineering services includes a preparation of the recommendations on further exploitation, repair or modernization directed to:

- restoration of operation ability;
- increase of reliability;
- improvement of thermal and vibration status;
- rising of capacity or extending of admitted operation modes according to a diagram of capacities and etc.

And also, the development of the projects of modernization, technologies of repair, fabrication of necessary units and spare parts, conducting of the tests, supply of special tools and materials, auxiliary equipment for mounting.

The complete production cycle organized with NPO «ELSIB» OAO, a presence of large and unique machines, the updated methods of production and application of modern materials, device equipping, qualified personnel allow to conduct, with the enterprise, the repairs of electrotechnical equipment, practically, of any level, to modernize it.

The scope of necessary repair is defined in each concrete case on a ground of defect revealing of the machines. The repair cycle includes a plan of quality control. On completing of repair, the acceptance tests are conducted, and for repaired machines, units, the factory warranty up to 2 years is presented.

Offering the most profitable kinds of services to its clients, NPO «ELSIB» OAO aspires to use the capabilities of repair of equipment on site. Therefore, a quality of repair is a priority for NPO «ELSIB» OAO.





The high qualification of design engineers, the significant accumulated experience allow to do, with NPO «ELSIB», a repair and modernization of equipment of a production of other domestic and foreign companies, there is an experience in repair and modernization of the machines produced in Japan, Italy, Germany, Poland, England, France, USA. Today, the company possesses an experience in capital repair for more than 150 versions of the electric machines both of domestic and foreign companies, including the turbogenerators of capacity up to 165 MW, asynchronous and synchronous electric motors from 80 to 9000 kW for different speeds.

The main advantages of NPO «ELSIB» OAO are the following:

- high qualification of personnel;
- large experience in an execution of service, repair works based on a scientific and design approach;
- application of new methods and technologies;
- presence of production base providing the complete cycle of fabrication and testing of equipment;
- factory repair of the stators of the motors and generator bars with an insulation of "Monolyth" type;
- balancing of the rotors at rated and overrunning speed with researching capabilities;
- complex approach to repair with complete defect revelation and restoration of all units and parts;
- modernization of the electric machines of own production and other producers to improve their performances, prolongation of lifetime;
- capabilities of conduction of complex technical inspection of the generators on site with an issue of the recommendations on further exploitation and repair.

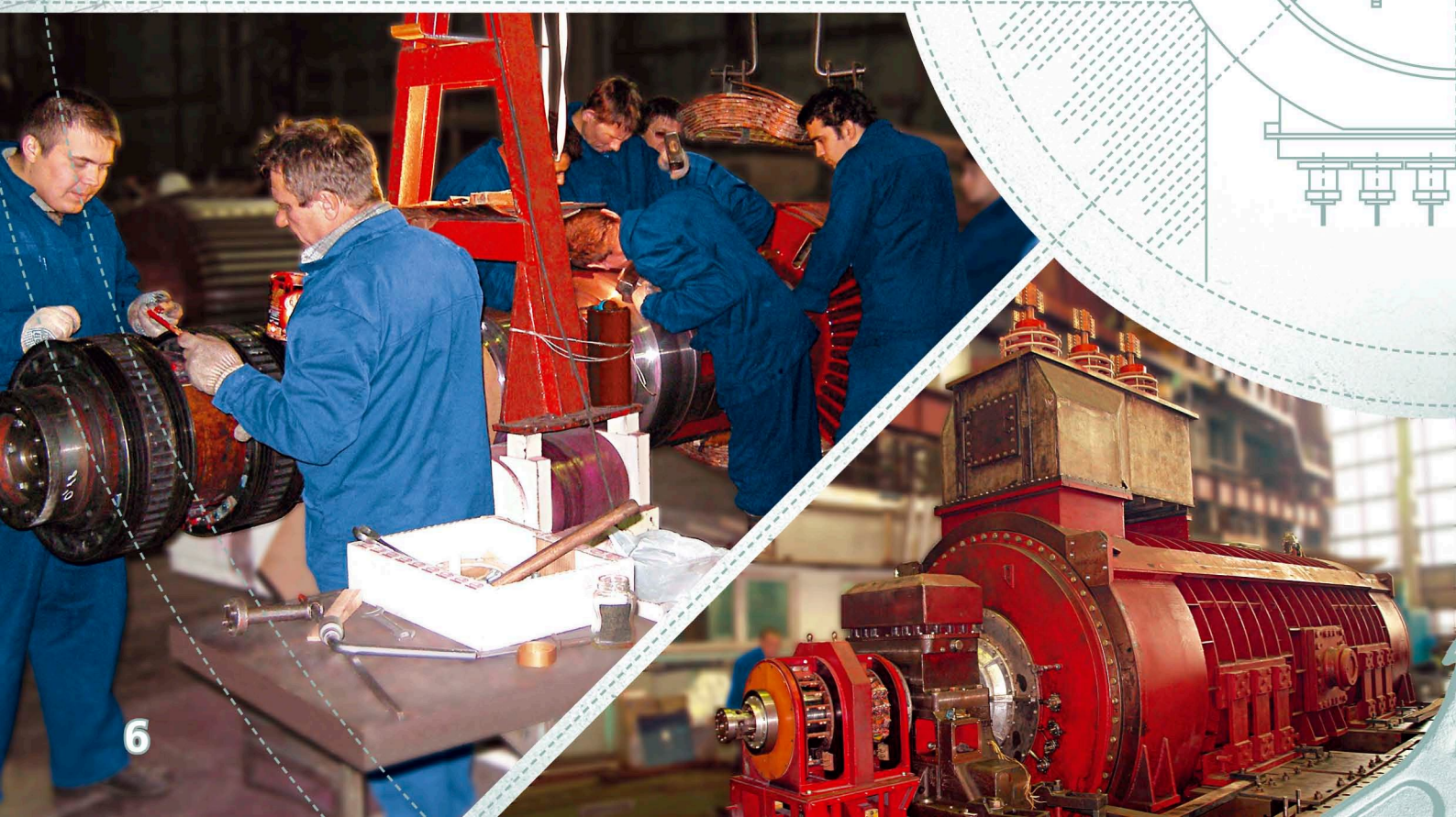
REPAIR AND MODERNIZATION OF THE TURBOGENERATORS

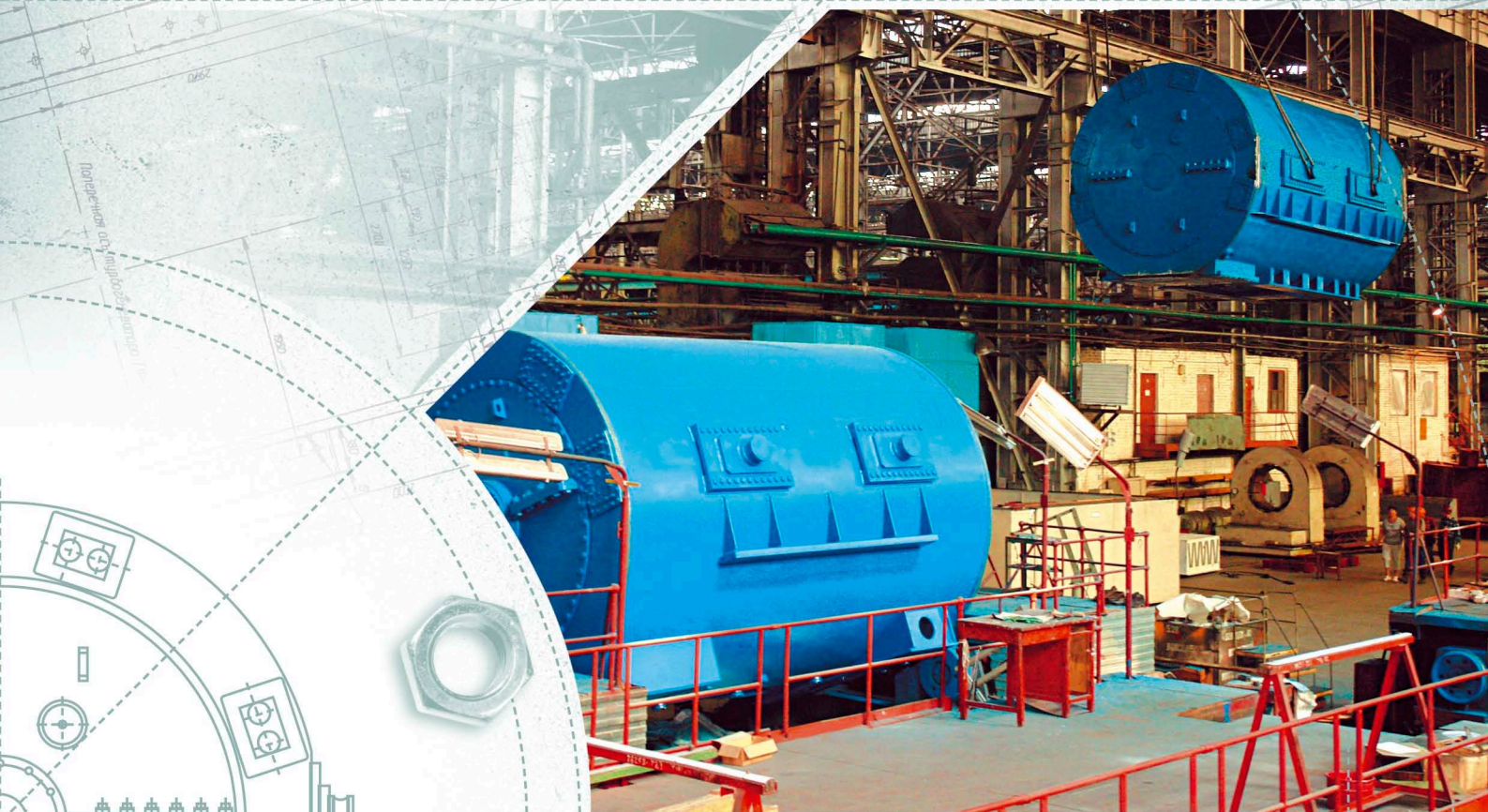
At present time, the main part of the turbogenerators installed with the power plants of Russia and CIS countries including the ones produced with NPO «ELSIB» OAO have worked off their rated term. However, the capabilities on a prolongation of their lifetime due to a modernization and repairs are not completed. The modernization of the turbogenerators is being conducted both to prolong the lifetime and increase their capacities at range of 5-15 %.

Therefore, the significant volume of the diagnostic measurements is done on site of the turbogenerators. Also, the vibration tests of the turbogenerators, diagnosis procedures of appearing and development of cracks in the rotors are conducted, in parallel, the alignment of vibration status of bearings, stator and rotor, liquidation of low frequency vibration of shaft and bearings are done.

The capital repair and modernization of the turbogenerators with NPO «ELSIB» OAO are implemented both with complete replacement of the stator and rotor windings and with restoration of insulation using an old copper of the bars and coils. At the capital repair and modernization, such works are executed as:

- replacement of stator winding to the new bars with thermosetting insulation of F class;
- replacement of the shaft seals of end kinds to the updated ring ones;
- equipping of brush and contact device with thermal control system for diagnosis procedures of its state;
- modernization of design of bandage unit of the rotors of two pole generators with installation of corrosion resistive retaining rings (including of titanium alloy) and a transition to single set design of retaining ring;
- improvement of oil reflection systems in the shaft seals from a side of high pressure (stator);
- improvement of acoustic insulation in area of brush and contact device using a mounting of acoustic housing.





One of the most difficult units of the turbogenerator is rotor. The high level of the electromagnetic, thermal and mechanical loads, abnormal operation modes in a combination with a long term of service cause an aging of insulation of turbogenerator rotor windings, that requires their replacement, and in some cases, a replacement of winding copper. Moreover, it is necessary to conduct a defect revelation for all sections of rotor shaft.

During a repair of turbogenerator rotors with NPO «ELSIB» OAO, the balancing of rotor with operation speed is conducted, the tests of rotor for overrunning speed and absence of turn short-circuits, the high voltage tests with operation speed are done.

The above said complex of the works allows to provide a prolongation of the lifetime and reliable service of the turbogenerator rotors with the power plants with the commission without aligning works.

At the same time with a repair of the turbogenerators of own production, NPO «ELSIB» OAO executes a modernization and repair of the generators of other enterprises-producers, in particular, of a production of JSC "Electrosila" (St.-Petersburg), "Electrotyazhmash-Privod" LTD (Lys'va), JSC "Electrotyazhmash" (Kharkov), and also, it has an experience in the repairs of the generators of foreign producers such as "Metropolitan-Vickers", "CUMMINS", "CATERPILLAR".

REPAIR AND MODERNIZATION OF THE HYDROGENERATORS

NPO «ELSIB» OAO, using an accumulated many years experience in a production of powerful hydrogenerators, offers a wide range of the measures on a modernization and repair of the hydrogenerators of any companies installed on existing HPPs. By the enterprise, a reconstruction and modernization of 45 generators on a Cascade of Vilyui HPPs, Ust-Khantai HPP, Irkutsk HPP, Bratsk HPP, Bukhtarma HPP, Andijan HPP, Shardarya HPP and a number of others were done.

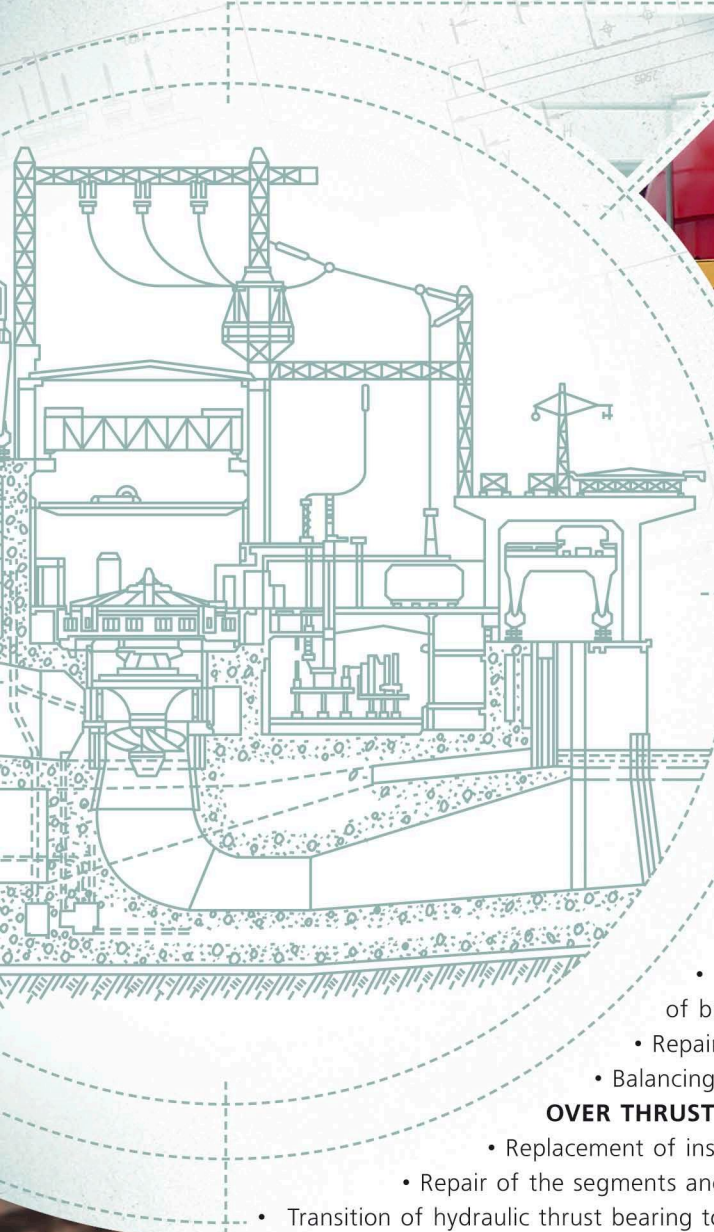
By the results of inspection of the hydrogenerators, the engineers-designers of NPO «ELSIB» OAO prepare the recommendations on a repair and modernization of the machine, define the capabilities of increase of reliability, an improvement of thermal and vibration status, rising of capacity, effectiveness or extending of admitted operation modes according to a diagram of capacities.

The modernization and repair including the development of the projects, technologies, a fabrication of necessary units and spare parts, a conduction of the tests, supply of auxiliary equipment for erection and testing are conducted over the following directions:

OVER STATOR:

- Replacement of the windings completely or concrete bars using the thermosetting insulation;
- Replacement of insulation of old or damaged bars;
- Liquidation of the defects of active steel (core) including the complete re-stacking and replacement of thermal control sensors;
- Supply of specialized set for high voltage tests of stator winding;
- Supply of the machines for brazing of the heads of winding bars;
- Centering of stator;
- Repair of the joints of cores of two part stators;





OVER ROTOR:

- Repair of the coils of field winding with replacement of insulation and reconstruction of inter-pole joints;
- Replacement or reconstruction of the cores of the poles to reduce the losses and heats at the end area of stator core;
- Additional pressing of rotor rim and restoration of required radial tightness;
- Repair and replacement of the contact rings and traverse of brush holders;
- Repair of the shafts including the turbine shaft;
- Balancing;

OVER THRUST BEARING AND BEARINGS:

- Replacement of insulation of the bearings;
- Repair of the segments and mirror of thrust bearing;
- Transition of hydraulic thrust bearing to rigid one to increase a reliability and efficiency;
- Replacement of the sensors of oil level at the baths;
- Repair and replacement of oil separators;
- Repair and replacement of the shields of the seals against oil leakage and its vapours;
- Additional pumping of oil into a system of hydraulic thrust bearing;
- Repair of the inserts of thrust bearing;
- Repair and replacement of the units and parts of governor generator;

OVER COOLING SYSTEM:

- Repair and replacement of air coolers and air separating shields including a transition to one side ventilation system to rise efficiency and reduce oiling and soiling by the products of braking of stator and rotor windings;
- Aligning of air flow to reduce the ventilation losses and rise efficiency;
- Replacement of the excitation systems to the updated microprocessor thyristor systems of CTC-KHΦP type;
- Replacement of thermal control systems to the updated ones.



REPAIR AND MODERNIZATION OF THE ELECTRIC MOTORS

NPO «ELSIB» OAO does a repair and modernization of asynchronous and synchronous motors in common industrial and explosion-proof version, of motor with squirrel-cage rotor, of direct current machines. By our specialists, the significant experience in a repair and modernization of the motors of ДАЗО, АН, А, А4, СТД, СТМП, СДЭ, ДСК, ВАО, ВАОУ, ВАОВ, АК4, АК3, АКДЗ, ФАМКО series and others, has been accumulated.

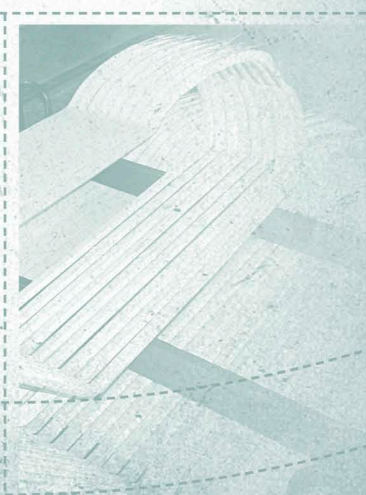
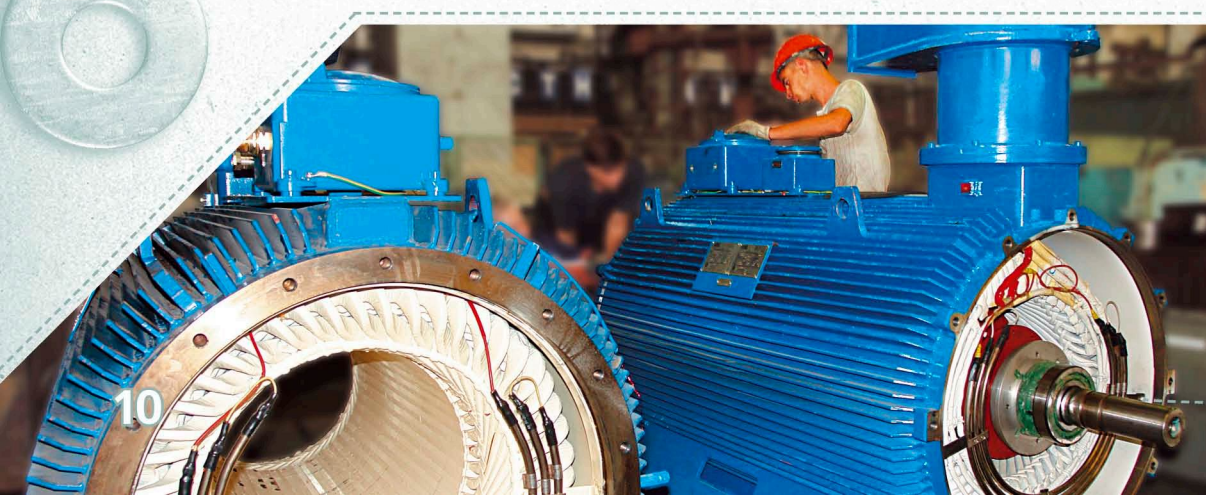
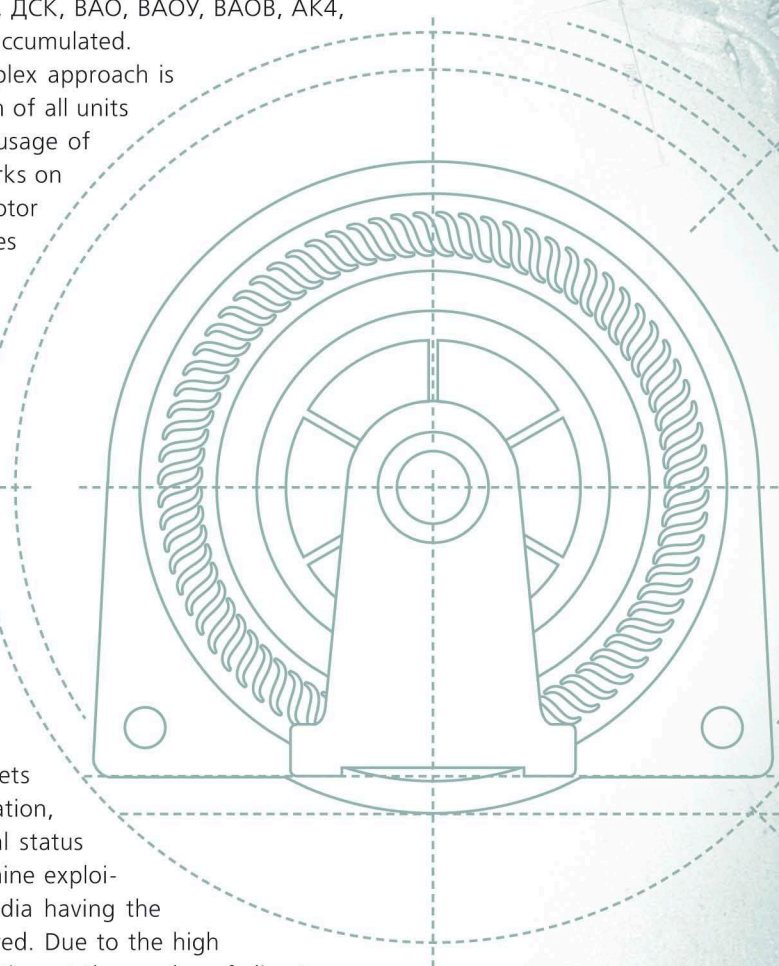
At a repair with NPO «ELSIB» OAO, the complex approach is implemented. The disassembly and defect revelation of all units and parts of electric motor are done including an usage of ultra-sonic method. At the result, the list of the works on a liquidation of revealed defects of the electric motor is defined. After a repair, the electric motor passes the tests in accordance with the rules for new products.

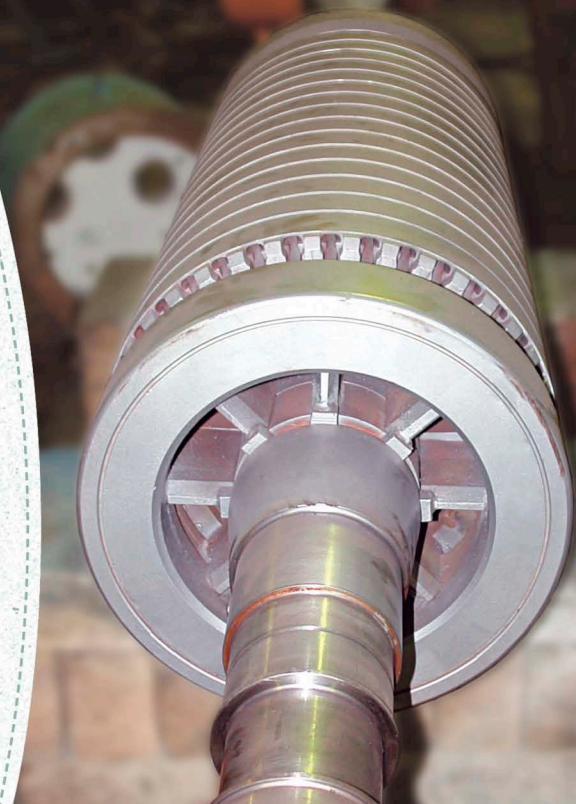
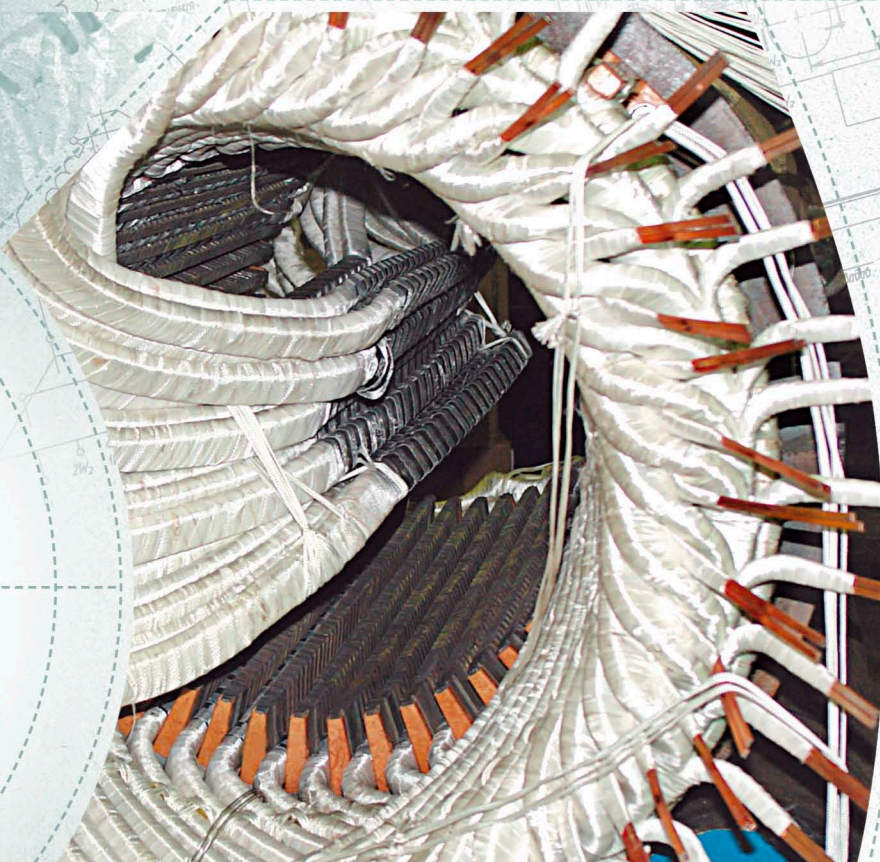
One of the main units undergoing a repair and modernization is stator winding. The main insulation used with NPO «ELSIB» at a repair of the stator windings is an one of "Monolyth-2" type. The coils of the winding are manufactured with updated shaping equipment of "Henry Schumann GmbH & CoKG" company using the most modern electric insulating materials. The core with a winding put into it is impregnated with epoxy compound in the special boilers. The pre-vacuuming of core in a boiler and supply of compound under pressure provide the high degree of impregnation of insulation and core.

After baking of insulation, the "Monolyth-2" gets the high electric strength and stability. At its application, due to the higher thermal conductivity, the thermal status of the winding is improved. The possibility of machine exploitation at the higher humidity, and also, at the media having the higher degree of chemical aggressiveness is appeared. Due to the high mechanic strength, the reliable operation of insulation at the modes of direct starts of the motors is provided.

If necessary, the repair of the stator windings is done with a restoration of turn insulation. At a process of repair, the turn and body insulation are undergone to the tests for electric strength in accordance with the rules for new products.

At the failures of electric machines caused by the failures of insulation, turn short-circuits or failures of bearings with a touching of rotor and stator, the short-circuits between the sheets of the cores are occurred, they would be cancelled to exclude the local heats causing the repeated failures. With all electric machines repaired on NPO «ELSIB» OAO, these short-circuits are completely cancelled. The quality of repair is checked by the appropriate tests.





At the serious emergencies or at weakening of pressing, the re-assembly of core with cleaning and re-lacking of the sheets is carried out.

NPO «ELSIB» OAO carries out a repair and modernization of the rotors of the electric machines of any type including a repair of the rotor windings of the asynchronous motors with squirrel-cage rotor, the synchronous motors with two and more poles. Also, a repair of brush and contact device is carried out, at that, the modernization with execution of unit of contact rings on mutual insulated bush and installation of the brush holders with rolled spring providing the constant pressing on the brushes with required force, is supposed. At that, it is not necessary to control the pressing force for all time of the brush operation.

Using the method of electric spark thin coating, the enterprise restores up to required size of the rotor necks under the rolling bearings, the driven ends of the shafts in case of their weakening or curving. The advantages of this method is a capability of coating of any metal onto the shaft including more strong one than a base, at that, at the places of thin coating, the concentrators of stress which can cause a damage of shaft, as for example, that can take place at the restoration by the method of additional melting by electric welding, do not appear.

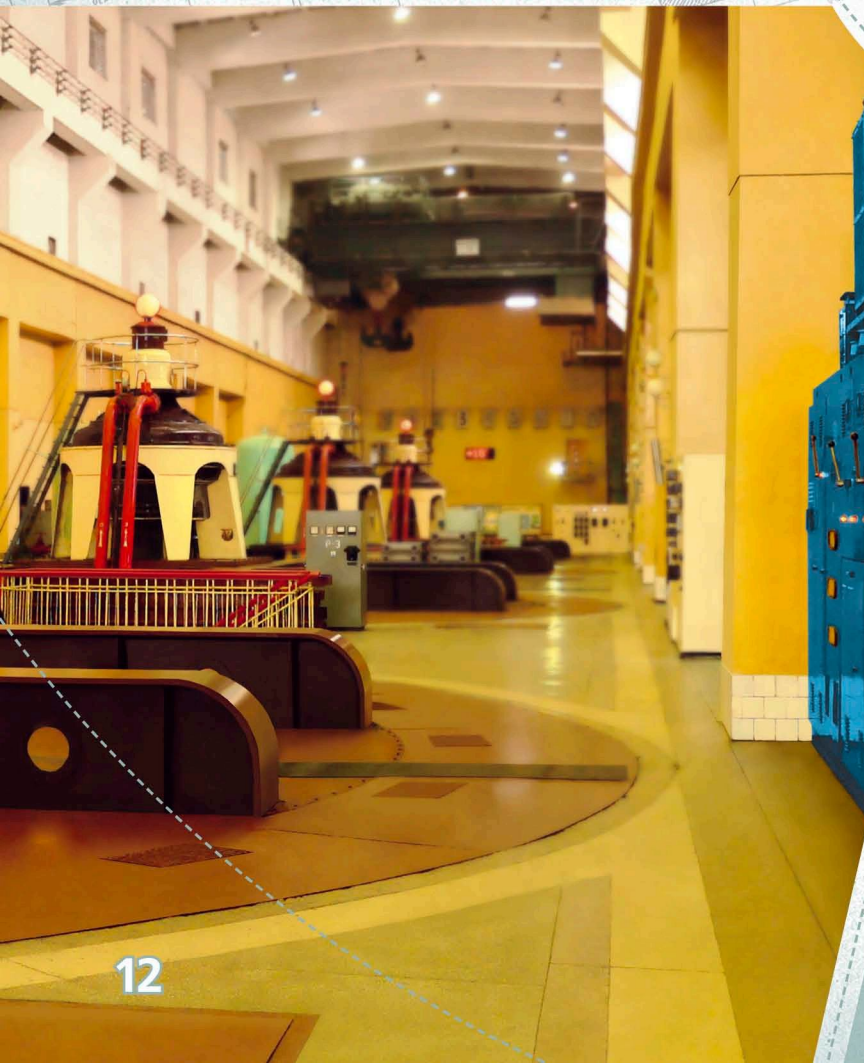
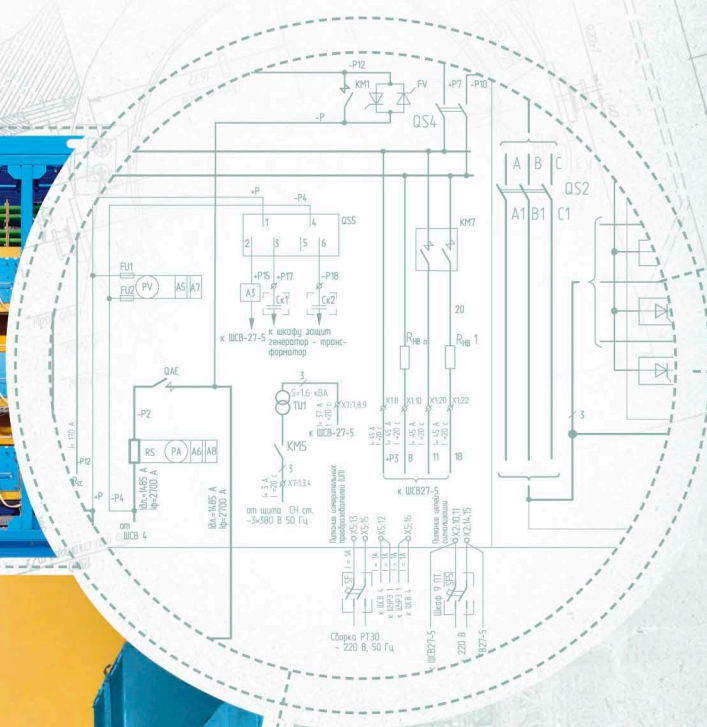
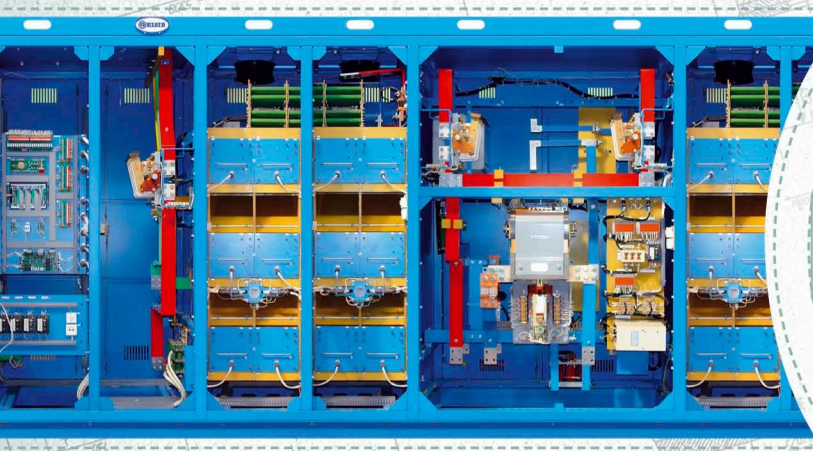
In case of appearance of the cracks in the shafts or their crashing, strong curving and others, the enterprise fabricates the additional setting or produces a replacement of the shaft at a keeping of rotor core.

As a rule, all rotors, before an assembly, are balanced on an overrunning and balancing device. At present time, NPO «ELSIB» OAO possesses two overrunning and balancing devices of "Schenck" company, one of which has a load capacity up to 90 tons.

At appearing of higher vibration of the machines on site, NPO «ELSIB» OAO directs their specialists to define the reasons of arisen situation and issue the recommendations on its cancellation.

SERVICE AND MODERNIZATION OF THE EXCITATION SYSTEMS

NPO «ELSIB» offers to its clients the turn-key, commission and alignment, warranty and service maintenance for the excitation systems supplied. Moreover, the enterprise has an experience in a modernization of high frequency excitation systems of the turbogenerators. At that, from the system, the sub-excitors that operate non-reliably are excluded, and the obsolescent panels of automatic excitation control are replaced. Instead of the excluded elements, the microprocessor excitation control system of the turbogenerator is used. By a design, the control system is designed as a MPCB-120 cabinet containing the microprocessor excitation controller and power output for a supplying of the independent field windings of high frequency exciter. The system has 100 % reservation of excitation controller and power thyristor converters.





OUR PARTNERS

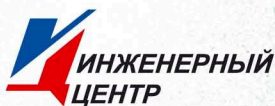
The main priority at presenting of the services and repair for NPO «ELSIB» OAO is quality. At the same time, the company aspires to close their services to the client, to rise an access capability of qualitative repair and service. In connection of this, NPO «ELSIB» OAO develops the partner relations with the regional repair and service organizations having the own production base, qualified personnel and using the updated methods of repair, state-of-the-art equipment and materials. In 2008, 3 companies got the official certificates for service maintenance of the machines of NPO «ELSIB» OAO production:



- ZAO «E4 Centrenergomontazh»;



- «Uralenergосervice»;



- ZAO «E4 Inzhenernyy centr».

NPO «ELSIB» OAO realizes the training programs for the specialists of the customers and its partners on service of the equipment, erection and repair.

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