HEAT RECOVERY
STEAM GENERATORS

THE TAGANROG BOILER-MAKING WORKS KRASNY KOTELSHCHIK
COMPANY MISSION

To provide reliable and efficient integrated solutions to meet the needs of the global energy system ever-improving in the technologies and business processes.

COMPANY VISION

To be ranked first in the power market in Russia and the CIS and to be a key player in the global market.

CORPORATE VALUES

CUSTOMER ATTENTION
EFFECTIVENESS AND EFFICIENCY
INNOVATION
SAFETY
TEAMWORK
RESPECT FOR PEOPLE

Power Machines is the largest power engineering company in Russia, with international experience and competence in engineering design, manufacturing and complete delivery of equipment for thermal, nuclear, gas turbine and hydraulic power plants.

Power Machines creates effective complex projects for global power industry relying on the sesquicentennial experience in the company business assets and applying the state-of-the-art developments in science and technology.

The equipment manufactured and supplied by enterprises of the company is in operation in 57 countries all over the world. At the present the equipment total installed capacity is 300,000 MW.

- **57 COUNTRIES**
  have operating equipment supplied by the facilities of Power Machines

- **65% IS A COMPANY SHARE OF**
  the Russian and CIS market

- **OVER 300 GW –**
  is the aggregate capacity of the equipment, manufactured by the company
Public Joint-Stock Company the Taganrog Boiler-Making Works Krasny Kotelschchik (TKZ), a member of the Power Machines group of companies, is one of the leading Russian boiler-making companies, which has an international experience and competence in design, manufacture and complete delivery of equipment for the power industry.

The products of Krasny Kotelschchik rightfully enjoy the well-deserved recognition of consumers, including in such responsible field, as the nuclear power generation industry. The Quality Management System of the company is certified for compliance with the requirements of the international standard ISO 9001 and the American Society for Mechanical Engineers (ASME).

PJSC Krasny Kotelschchik stands for:

**BOILER EQUIPMENT INSTALLED AT EVERY SECOND POWER PLANT IN RUSSIA AND THE CIS**

TKZ is the largest supplier of the boiler equipment for power plants and generating facilities of other energy-intensive industries (metallurgy, gas and oil refining, chemistry).

**POWERFUL DESIGN CENTRE, MODERN 3D-DESIGN SYSTEMS**

The company consolidates the experience of two Local schools of the boiler construction and has the ability to attract international manufacturers for the development and implementation of innovative technologies.

**RELIABLE SUPPLIER OF THE HI-TECH SOLUTIONS**

Thousands of foreign and domestic references including one as an EPC-contractor for new construction and retrofit projects.

**MORE THAN 100 YEARS IN THE MARKET OF POWER-PLANT ENGINEERING**

Highly professional team, vast experience in manufacture, in-house unique designs, high quality of the project implementation.

**Key Competence in Engineering and Manufacturing:**

- **Solid Fuel Technology**
  - Pulverized-coal sub/supercritical
  - CFB (joint technology)

- **Combined-Cycle Technology**
  - Combined-Cycle Plant (CCP) with or without post combustion
  - CCP with GT gas exhaust

- **Pipeline Technology**
  - Pipeline fittings for Gazprom and Transneft

- **Gas/Oil Technology**
  - Gas-fuel oil sub/supercritical
  - Metallurgical gas combustion

- **Heat-Exchange Technology**
  - Heat-exchange equipment for TPP and NPP
  - Water purification equipment

- **Biomass Technology**
  - Pellets, husks, straw and waste wood

The production structure of Krasny Kotelschchik is unique in its capabilities and includes units that are typical for the large power engineering enterprise. Production units are grouped under four technological features, which allows for implementing full manufacturing cycle of the equipment, with regard to the customer’s needs.
PJSC Krasny Kotelschchik is a largest supplier of HRSG for electric power plants, as well as for power generating plants in other energy-intensive industrial sectors (metallurgy, gas and oil developments, and chemical industry).
The Following Indicators Confirm the Equipment Reliability

<table>
<thead>
<tr>
<th>Estimated life, hours</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Tube heating surfaces, min.</td>
<td>100 000</td>
</tr>
<tr>
<td>Superheater outlet headers, min.</td>
<td>100 000</td>
</tr>
<tr>
<td>Other parts, min.</td>
<td>200 000</td>
</tr>
<tr>
<td>Boiler mean time between failures, min.</td>
<td>8 000</td>
</tr>
<tr>
<td>Estimated service life, years</td>
<td>40</td>
</tr>
<tr>
<td>Availability factor, %, min.</td>
<td>98</td>
</tr>
</tbody>
</table>

SCOPE OF SUPPLY AND SERVICES

- Engineering
- Manufacturing
- Packaging
- Delivery (transportation)
- Commissioning supervision
- Erection supervision
- Field personnel training
- Maintenance service

QUALITY ASSURANCE

The entire boiler plant meets the most rigorous international requirements and thus conforms to Russian quality standards and provides all the certificates and permits for use as required for commissioning, upon request by the regulatory authorities of Russian Federation.

PJSC Krasny Kotelschik Quality System is certified for compliance with the International Standard ISO 9001 by TUV Rheinland Cert GmbH.
PJSC Krasny Kotelshchik comprises two Design Offices (in Taganrog and in Barnaul) designing the boiler island equipment for projects in Russia and abroad, including EPC projects. The Design Offices are furnished with the equipment necessary for completing the full spectrum of tasks on developing various types of power generating equipment.

When designing HRSGs, long-term design solutions have been applied along with the best world practices.

PJSC Krasny Kotelshchik’s large experience in the boiler products development and manufacture dates back to 1896. Three spiral fin-tube production lines (HAN-SUNG), D 32 to 76 mm and L=24 m, for the manufacture of the HRSG module units were put into operation. The module maximum dimensions are as follows: 3500x3500x26,000 mm. Special assembly sites and workplaces furnished with the most. Up-to-date equipment allowing fabricating up to 10 high capacity HRSGs per year.

Advantages of the HRSG with natural circulation
- Circulation pumps are not required for HRSG start-up and operation
- Reduced auxiliary energy demand
- Less number of spare parts
- Less scope of maintenance services

Design/layout special solutions
- High modular boiler design
- Light-weight framework modular design
- Self-supported stack and staircase tower attached to HRSG

An absolute advantage of the HRSGs is horizontal arrangement with natural circulation and space-saving dimensions comparable to vertical boiler design. In addition, horizontal boilers are more effective, reliable and adjustable.

Horizontal HRSG compactness allows installation in vertical boiler cell, thus the boilers can be considered as the universal solution for customers even if the space for construction or modernization is limited.
SERVICEABILITY

- When designing HRSGs, special consideration is given to shortening the working hours on site
- High design modularity provides field labor minimization and substantial price reduction (almost twice compare to the erection expenses for the additional assembly works at site with the boiler delivered loose)
- Advantages of delivery in prefabricated sub-assemblies, the light-weight modular design of the framework, makes it possible to combine in one common delivery module the HRSG gas light casing columns and panels with shop-installed insulation and sliding liner; the heating surfaces and tube hangers are delivered as prefabricated assemblies; the hangers design is provided with rotary joints and eliminates welding at site
- Special design solutions applied to the HRSG designed by PJSC Krasny Kotelshchkik allow for heating surface assemblies back-to-back arrangement, thus making the Boiler compact. The proposed design, as regards the cell overall dimensions, is not larger than that of the vertical HRSG and the weight is much less than that of the vertical HRSG and less than that of the similar Russian designs. The HRSG gas-tight casing panels are supplied completely with insulation and shop-installed sliding liners (sandwich panels)
- Main gas duct erection takes 2 to 3 weeks
- Installation of one or two heating surface assemblies per shift is possible
- Welding of pressure parts inside the casing is not required

HRSG TECHNICAL FEATURES

- Distribution grid level velocity fields and gas flow directions when required
- Steam temperature control at reheater outlet by means of a bypass system
- Alloy steel used for the low pressure evaporator prevents destruction due to corrosive and erosive wear
- Special design of the economizer coils, when required
- Modern cost-effective condensate/feed water preheating systems
- Free thermal expansion of coils and piping
- Strengthened casing design of the inlet/main gas duct
- Provision for installation of the NOx and CO inhibition systems
- Installation of the high efficiency and pollution-free duct burners

The economizer special design provides for medium velocity and temperature field uniformity in package and free expansion of all elements, as well as eliminates medium boiling in tubes.
DUCT BURNER APPLICATION
(Heat recovery steam generators with duct burners)

Duct burners application allows maintaining the required steam parameters downstream of the HRSG in case these parameters are not achieved by GT exhausts due to climatic/seasonal conditions or due to the gas turbine type.
Duct burners are arranged in the HRSG inlet gas duct. For their installation, a provision is made in panels for installation of embedded parts. The duct burners installed in the HRSGs of Krasny Kotelshchik are supplied by the leading manufactures.

Mathematic simulations of HRSG duct burner operation at the design stage allows determining the gas flow temperature field action and elaborating a design solution for optimizing its distribution for the HRSG safe operation.
SERVICE AND SPARE PARTS

Krasny Kotelschik provides after-sales services and supply of the required spare parts delivery for the guaranteed equipment operation period, and guarantees quality of the supplied equipment. The Service Maintenance Program ensures a wide range of services within the whole equipment lifecycle: equipment condition monitoring, diagnostics of technical condition, preventive maintenance (during scheduled shutdown), repair, spare parts and components delivery and replacement, in so doing, ensuring the high quality and reliability of operation.

HEAT RECOVERY STEAM GENERATORS FOR SMALL SCALE ELECTRIC POWER INDUSTRY

Krasny Kotelschik also designs and supplies different types of Heat Recovery Steam Generators for Small Energy projects within the range of gas turbine capacities up to 60 MW:

- Steam and Hot Water Boilers
- With or without duct burners
- One or multiple pressure levels
- Vertical or horizontal type
- Suspended, self-supported

One steam pressure level, natural circulation HRSG with bypass gas duct for industrial requirements
HEAT RECOVERY STEAM GENERATORS
FOR VARIOUS BRANCHES OF INDUSTRY

One of the perspective projects of PJSC Krasny Kotelschchik is the design and manufacture of Once–Through Heat Recovery Steam Generators for the Enhanced Oil Recovery (EOR). One of the prevailing EOR methods is the thermal recovery method using steam or water. This worldwide applicable technology provides high efficiency at low cost.

Steam injection into the oil well lasts for a few days or weeks, whereafter the well head has to be plugged up to soak steam within several days up to one month or more (well steam soaking period). Upon expiration of this period, oil extraction from the well is restarted and lasts for 6 months and then thermal recovery process is applied again.

To provide work under this technology, the steam is generated in special once-through Heat Recovery Steam Generators (OT HRSG) with an output from 1.26 Gcal/h to 63 Gcal/h.

Integration of steam generating units for improving oil development of the gas-turbine stations offers an opportunity of the replacement of the traditional steam generators by Once-Through Heat Recovery Steam Generators, thus providing essential savings of the plant operational costs while decreasing atmospheric CO₂ emissions simultaneously on annual basis. At that, the Once-Through HRSGs are designed considering customer requirements and are operated downstream of various gas turbines, providing the GT waste gas heat recovery and heat transfer to the softened water for quality saturated steam with steam quality 60-80%.

At the same time, there are being developed the boilers for the metallurgical and chemical industries where exhaust gases from primary production equipment are used as the heat transfer medium. The development of HRSGs with nonorganic heat transfer medium is planned.
PJSC «POWER MACHINES»
3a Vatutina St., Saint Petersburg, 195009, Russia
Tel.: +7 (812) 346-7037
Fax: +7 (812) 346-7035

PJSC KRASNY KOTELSHCHIK
220 Lenina St., Taganrog, Rostov Region, 347900, Russia
Tel.: +7 (8634) 31-36-01
Fax: +7 (8634) 31-63-01

Department of Boiler Equipment
Sale and Service
Tel.: +7 (8634) 34-29-53
Fax: +7 (8634) 34-29-54

E-mail: postmaster@tkz.su
www.tkz.su