

# SOLUTIONS FOR THERMAL POWER

Atomenergomash JSC





## ABOUT COMPANY



### Atomenergomash (AEM)

is a machine building division of Rosatom, one of the largest providers of effective technological solutions for thermal energy in Russia and abroad.

Our companies have a long-term experience in design and supply of thermal power equipment. The company combines scientific research, engineering, manufacturing, service and commissioning organizations in Russia, CIS and European Union countries. The holding's design and engineering companies possess high potential and necessary competences for full-service development and design: from R&D and detailed engineering docu-

ments to computer aided manufacturing and further manufacturing of heat-power equipment. Our partners and customers trust our technology, professional experience both in supplying new equipment for thermal power plants (TPPs) under construction, as well as in the field of engineering and providing efficient solutions for the modernization of existing TPPs.

## KEY MILESTONES of thermal power

### 1942

The first drum boiler with natural circulation

### 1949

The world's first experimental prototype boiler 60-OP with a capacity of 12 t/h for ultra supercritical (USC) steam parameters

### 1966

For the first time in Russia, at the Kashirskaya GRES, the PK-37 boiler was put into commercial operation as part of a 100 MW power unit ultra supercritical (USC) steam parameters

### 60s

First supercritical once-through boilers with a steam capacity of 950 t/h for 300 MW power units has been mastered

### 70s

First supercritical pulverized-coal boilers with a steam capacity of 1650 t/h for 500 MW power units has been mastered

### 80s

First supercritical pulverized-coal boilers with a steam capacity of 2650 t/h for 800 MW power units has been mastered

### 90s

First domestic Heat Recovery Steam Generators (HRSG) for power plants based on combined-cycle gas turbine (CCGT) was mastered in Russia

### Today

The production of modern three-circuit HRSGs for high capacity gas turbines or high-capacity gas turbines has been mastered. The import-substituting production of equipment for the new generation waste incineration plants — air-cooling condensers (ACC) has been mastered



# EQUIPMENT AND SERVICES FOR THERMAL POWER ENTERPRISES

## >800

boiler units of various capacities and parameters produced by our enterprises

for

## >150

domestic and foreign power plants with a total capacity of over 66 GW, including more than 16 GW for export

### Equipment

- boilers for power units with a capacity of 50 to 800 MW
- HRSGs for CCGT with a power capacity of 20 to 800 MW
- hot-water HRSGs for gas turbines with a capacity of 6 to 45 MW
- hot-water HRSGs
- boiler auxiliaries
- steam and hot-water calorifiers from spiral finned tubes
- unified sections of tubular air heaters
- regeneration system equipment
- pumping equipment
- water-water heaters
- cooling towers
- large welded structures
- vessels equipment, including pressure vessels
- deaerators
- burners
- steam silencers
- steam-water heaters
- filters
- pipeline power fittings
- parts and assembly units of pipelines
- metal structures
- distillation and desalination plants
- dust and air pipe valves



## in 20

**countries around the world,**  
power plants equipped with our  
products are operating

### Services

- engineering
- complete supply for TPPs
- complete supply for WIPs
- project management
- commissioning
- modernization



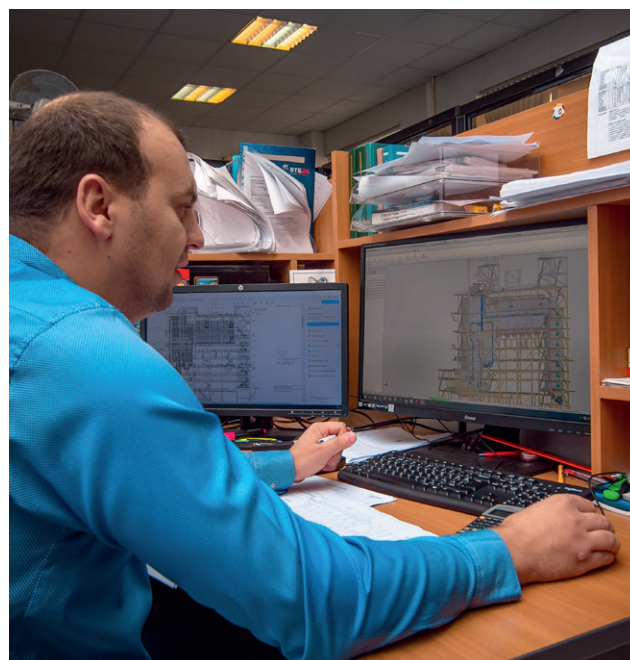
# ENGINEERING

Atomenergomash consolidates enterprises with unique engineering competencies and powerful research base.



Based on our enterprise, PJSC ZiO-Podolsk, design and development work is underway for Russian and foreign thermal and nuclear energy facilities and the oil and gas industry. Work is carried out with the participation of our leading specialized institutes and organizations: JSC EDB Hidropress, JSC OKBM Afrikantov, JSC NPO CNIITMASH.

We hold licenses and permits from state and regulatory authorities of the Russian Federation necessary to conduct our activities, including a license issued by the RF Gosatomnadzor for the right to design and carry out author's supervision at all stages of the life cycle of nuclear power plant equipment and pipelines. Our experts are certified under the rules and regulations in nuclear energy in force in the Russian Federation.



## Engineering Division for thermal power at ZiO-Podolsk

- carries out complex design work on the construction of boilers, HRSGs for CCGT and other power equipment
- develops documentation for the equipment manufactured at ZiO-Podolsk production facilities
- performs thermal, hydraulic, aerodynamic calculations, strength calculations, as well as the simulation of unsteady processes during start-ups and shutdowns of equipment
- carries out installation and adjustment supervision of the supplied equipment
- examines existing power facilities for their reconstruction and modernization

# PRODUCTION COMPLEX

The unique Atomenergomash production capabilities allow us to offer our customers equipment meeting the strictest requirements.

## ZiO-Podolsk

One of the largest power engineering enterprises in Russia with centennial history. Today, the enterprise possesses almost all types of basic engineering industries, which makes it possible to manufacture modern production equipment. The main competitive advantage of ZiO Podolsk is the consolidation of a unique production complex, design and marketing services able to carry out a wide range of operations in power machine-building: from design to supply and maintenance service of equipment. The technological capabilities of the power engineering enable unique operations, while the welding engineering is one of the most qualified in Russia, both in mastered welding and cutting processes, weld materials, and in long-term experience in the shipment of critical welding metal structures for various industries.

## Energomashspetsstal (EMSS)

The largest enterprise in Eastern Europe manufacturing large cast and forged blanks from special steels. EMSS has a wide metal-cutting equipment park, including turning, boring, turning-and-boring, deep-boring, plane-milling, mortising, gear-hobbing, bandsaw and other machines. The production facilities of the arc-furnace melting shop make it possible to produce forged steel blanks from various large-size steel grades.

## GANZ EEM

Located in the European Union, this enterprise specializes in the production of pumping equipment for enterprises in the thermal and nuclear power and oil and gas industries and also produces hydropower equipment.

## AEM-technology (ATOMMASH)

The largest power engineering enterprise in southern Russia with a total area of 1.7 hectares. The manufacturing capabilities make it possible to produce any heat exchange, body and vessel equipment for nuclear power plants, spatial engineering structures, boiler modular equipment of a high availability.

The enterprise has an extensive a wide metal-cutting equipment park of metal-cutting, pressing, thermal, and welding equipment. The company's advantage is also the ability to transport equipment both by road truck and rail, as well as by water from its own pier.

## AEM-technology (Petrozavodskmash)

One of the largest power engineering enterprises in the north-west of Russia, supplying body, vessel and other equipment. The enterprise has unique melting and lifting capacities ensuring the production of castings of almost all standard sizes. The enterprise possesses a unique machine park: turning-and-boring, horizontal-milling, boring, gang-drilling, grinding, finishing with CNC, balancing and other machines. PZM production facilities are connected with all European ports through its own pier and the Volga-Baltic Waterway.

## ARAKO

Located in the European Union, the enterprise specializes in the production of pipeline fittings for thermal and nuclear power, oil and gas and chemical industries.

## Our advantages

- the producibility of steam-water cycle equipment operating under extreme pressure (all-welded screens, convective heating surfaces, pipelines, drums, etc.), two steam pulverized-coal boilers for 500 MW power units and two HRSGs for CCGT with a capacity of 450 MW per year
- up to 6 GW of equipment per year for all thermal power programs
- production capabilities for spiral tape finning of pipes up to 8 thousand tons per year
- castings from iron, steel, non-ferrous alloys up to 60 thousand tons per year
- ISO standards



# SALES GEOGRAPHY

of AEM heat thermal power equipment



## Power unit construction projects involving AEM enterprises over the past 30 years

### Russia

- Berezovskaya GRES-1
- Reftinskaya GRES
- Ryazanskaya GRES-24
- Mosenergo HPP-1
- Mosenergo TPP-27
- Severo-Zapadnaya TPP
- Ivanovo CCGT
- Kaliningradskaya TPP-2
- Kirishskaya GRES
- Mosenergo TPP-26
- Novomoskovskaya GRES
- Nizhnevartovskaya GRES
- Nazarovskaya GRES
- Yuzhnouralskaya GRES-2

- Verkhnetagilskaya GRES
- Mosenergo TPP-21

### Belarus

- TPP OJSC Naftan

### Hungary

- Heller TPP

### North Macedonia

- TPP Bitola

### Bulgaria

- TPP Maritsa-Vostok 2
- TPP Maritsa-Vostok 3

### Ukraine

- Dnepropetrovsk Metallurgical Plant TPP

### India

- Neyveli TPP

### Kazakhstan

- Ekibastuz GRES-2

### Uzbekistan

- Novo-Angren GRES

### China

- Jixian TPP
- Emin TPP

## References

### Boilers

Belarus	15
Bulgaria	20
Bosnia and Herzegovina	2
Vietnam	4
Germany	16
Greece	1
India	2
Kazakhstan	48
Kyrgyzstan	1
China	14

Lithuania	2
North Macedonia	4
Poland	9
Russia	338
Romania	18
Serbia	1
Turkmenistan	2
Uzbekistan	7
Ukraine	29
Croatia	2

### HRSBs

Belarus	2
Hungary	1
Russia	77



# BOILER EQUIPMENT

## Atomenergomash is experienced in the design and production of boiler equipment for thermal power.

The main products are boilers for power units with a capacity of 50 to 800 MW and HRSGs for modern combined-cycle gas turbines with a capacity of 20 to 800 MW.

### Types of produced equipment

#### Boilers

Designed for the production of steam used in steam turbines, or for generating steam for technological needs. Boilers with steam capacity from 50 to 2650 t/h can produce steam of any value up to supercritical. They can burn various types of fossil fuel (coal, gas, fuel oil) and solid household waste. Boilers are structurally performed with drum, natural and forced circulation, and non-circulation. In recent years, boilers have used furnace units allowing to burn low-grade fuel in a circulating fluidized bed, as well as cyclone furnaces of various structures.

#### HRSGs for CCGT

Complete disposal plants include HRSGs with flues and chimneys. HRSGs are equipped with auxiliary equipment, including blowdown expansion tanks, deaerators, water-water heat exchangers, feeding and circulation pumps, non-metallic expansion joints, afterburners, flue valves, and other equipment.

We provide supervised installation services for boiler equipment, including pre-installation check, supervision and assistance in the installation, adjusting, testing, sampling, starting and commissioning, personnel training and post warranty support.

#### Heat Recovery Steam Generators

Modern gas-oil hot-water boilers with a thermal capacity of 70 and 120 Gcal/hr are designed and manufactured. Boilers are manufactured in gastight versions from all-welded panels with a tower-type arrangement of heating surfaces; they are delivered along with auxiliary equipment, including gas-air pipe valves, forced-draught fans, silencer, and chimneys.

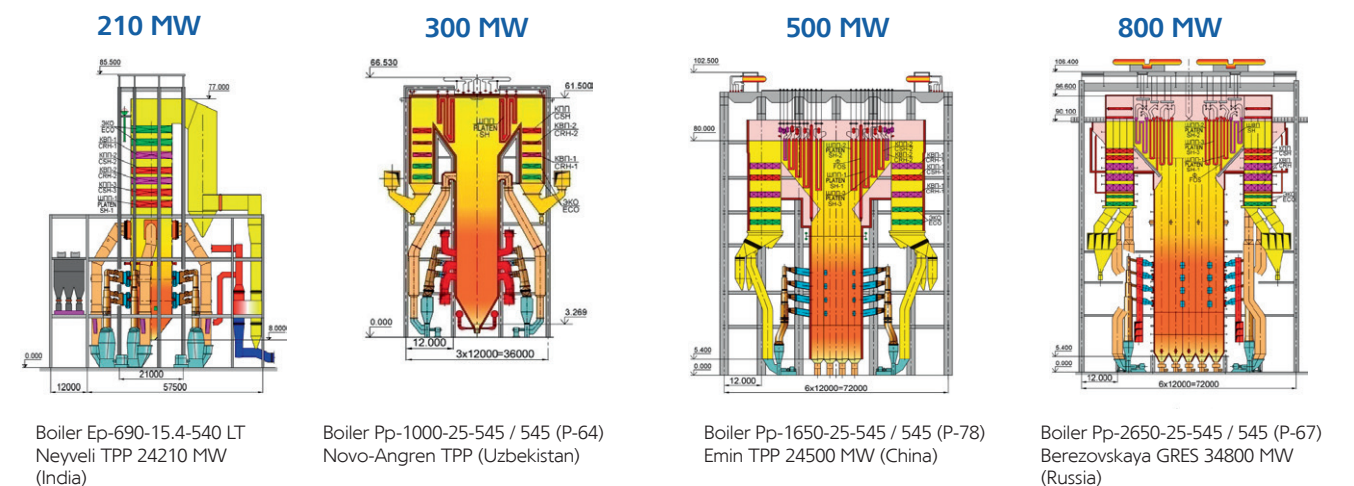
#### Hot-water HRSGs

Hot-water recovery boilers for gas turbines with a capacity of 6 to 45 MW. In the hot-water RB of this series can regulate the released heat capacity while maintaining the nominal electric load of the gas-turbine unit. The regulation of heat output is achieved with the help of dense gas valves designed in-house.

# BOILERS

Atomenergomash's solutions include a wide range of boilers designed and delivered for brown coal and lignite power units with a capacity of up to 800 MW.

## Development, engineering and production ZiO-PODOLSK



### Completing units of boilers

- draught equipment
- coal-pulverizing equipment
- steam/water circuit fittings
- gas-air pipeline fittings
- burner arrangement with ignition safety devices and flame monitoring sensors
- fuel-oil atomizers
- equipment for cleaning heating surfaces from external deposits
- service platforms (scaffolds and stairs)
- boiler fittings
- pipelines within the boiler
- gas pipelines with fittings within the boiler
- oil steam traced pipelines with fittings within the boiler
- embedded fittings for monitoring instrumentation sensors
- air preheaters in front of the air heater
- condensing plants for releasing own condensate
- live-steam reheaters and spray attemperators
- lining and insulating materials, decorative coating
- sampling coolers

- supports and hangers of boiler pipelines
- lens compensators for gas-air pipelines
- non-metal gas duct compensators
- rain gates
- silencers at the outlet of the boiler

### Performance indicators of boilers

#### Natural-circulation high pressure boilers

- evaporation capacity 120—670 t/h
- vapour outlet temperature 510—540 °C
- outlet vapour pressure 100—160 kp/cm<sup>2</sup>

#### Non-circulation high pressure boilers

- evaporation capacity 540—670 t/h
- vapour outlet temperature 540—570 °C
- outlet vapour pressure 140 kp/cm<sup>2</sup>

#### Non-circulation supercritical boilers

- evaporation capacity 950—2650 t/h
- vapour outlet temperature 545—565 °C
- outlet vapour pressure 255 kp/cm<sup>2</sup>



HOT-WATER BOILERS

For the needs of industrial power and utilities, ZiO-Podolsk has developed modern gas-oil and gas-fired hot-water boilers with a thermal capacity of 70, 100 and 120 Gcal/h. The boilers are designed to cover peak and main loads in district heating systems and are direct-flow units heating the water of heating systems. Structurally, the boilers are designed with the possibility of their installation within obsolete boilers. All types of hot-water boilers are equipped with low emission burners. In order to reduce harmful NOx emissions in boilers, a staged (along the height of the combustion chamber) combustion is organized with the partial supply of the air necessary for burning through the top blast nozzles.

Auxiliary equipment (supplied by agreement with the customer)

- forced draught fans
- tight valves according to the scheme of gas-air pipes
- tight-valve electric actuators (SEA) with articulation elements
- gas-air pipe compensators
- gas-air pipe flow meters
- ACS lower level

Performance indicators

Indicators	KV-G- 81.4-150N	KV-GM-140150N	KVGM-116.3-150N
Heat capacity (gas/fuel oil), Gcal/h	70	120	100
Fuel	gas	gas/fuel oil	gas/fuel oil
Boiler outlet water temperature, °C	150	150/160	150
Boiler outlet water pressure, kp/cm²	12	12	12
Estimated boiler efficiency (gross),%	95,0	95,5/90,8	93,9/91,1
Nitrogen oxides emissions behind the boiler (at a = 1.4), mg/sm³	≤125	≤125/300	≤125/300

Hot-water HRSGs for gas-turbine units from 6 to 45 MW

Hot-water HRSGs are designed for the production of hot water by using the heat of exhaust air coming from a gas turbine. The technical indicators of the HRSG

and the types of gas turbines behind which they are installed are presented in the table below. HRSG allows operation with changes in the flow rate and temperature of the combustion products behind the gas turbine due to changes in the temperature of the outside air and the gas turbine load.

Performance indicators

Generator type (manufacturer's designation)	KUV-5.5/110 (P-104)	KUV-13.0/150 (P-105)	KUV-35.0/150 (P-106)	KUV-17.0/150 (P-109)	KUV (B)-35.0/150 (P-122)	KUV-12.2/150 (P-126)	KUV-19/130 (P-128)	KUV-60/150 (P-129)
GTU type (GTU capacity)	GTE-6/6.3 M1UHL1 (6 MW)	GTA-6RM (6 MW)	LM2500+ DLE (30 MW)	GTE-10/95BM (8 MW)	LM2500+ DLE (30 MW)	GTES Ural-6000 (6 MW)	GTG-12VE (12 MW)	SGT-800 (43 MW)
HRSG inlet gas temperature, °C	303	416	505,2	420	505,2	437	283	523,5
Utilized exhaust air consumption, kg/s	37,71	48	80,8	57,8	80,8	34,72	93,2	143,47
Exit gas temperature, °C	138	133	95	110	109	111	103	99
HRSG inlet water temperature, °C	70	70	61	73	65	80	70	70
HRSG outlet water temperature, °C	110	150	129,3	155	150	150	130	150
KUV aerodynamic drag, Pa, not more	1800	2000	1300	2500	2300	1500	2500	2500

HEAT RECOVERY STEAM GENERATORS (HRSG)

Vertical type with forced circulation in evaporative circuits, single and double circuit.

Designed to generate superheated steam of one and two pressure due to heat recovery of exhaust combustion products after a gas turbine. HRSGs are available in a wide range of sizes, they can work with a stand-alone deaerator or a deaeration head or deaeration bead integrated in a low-pressure drum. The condensate gas heater circuit (recirculation line) may include a water-water heat exchanger for heating system water or have a separate gas heater circuit for heating system water. To obtain higher performance and steam temperature indicators, HRSGs can operate in a combined mode (heat recovery of exhaust gases and additional combustion of natural gas in the afterburner using the excessive air from exhaust gases as an oxidizing agent).

HRSGs can be equipped with a bypass system (with a separate bypass chimney or integrated chimney) for operation of a GTU with a stopped boiler.

Advantages of Heat Recovery Steam Generators

- the ability to install the boiler on the portal above the gas turbine with vertical exhaust from the gas turbine
- fewer pipelines, as well as drains and air vents and fittings on these lines
- high blocking of heating surfaces supply
- quick start and high cycling capability

Performance indicators

Generator type	GTU type, capacity, MW	Steam conditions		
		D, t/h	P, bar	T, °C
P-90	V-94.2 Siemens 160 MW	242/56	82/7,0	515/200
P-91	V-94.2 Siemens 160 MW	310	15	275
P-103	GT-10C Alstom	39/8	55/6	487/212
P-107	GTE-160 160 MW	224/51	77/5,8	509/206
P-108	SGT-800 Siemens 45 MW	58/12	74/7,0	525/209
P-116	GTE-160 160 MW	224/51	77/5,8	509/206
P-120	GTE-20S/40P 20 MW	40	40	440
P-134	GTE-160 160 MW	224/57	71,5/5,3	509/207
P-137	GTE-160 160 MW	224/49	98/8,7	508/222
P-144	GTE-160 160 MW	232/47	78/7,9	503/217

Key references

- 2xCCGT-450, Severo-Zapadnaya TPP, St. Petersburg, power unit №1 and № 2 — 4 boilers
- 2xCCGT-450, TPP-27, Moscow, power unit №3 and № 4 — 4 boilers
- CCGT-190, Dzerzhinskaya TPP, Dzerzhinsk
- 2xCCGT-39, Sochi TPP, Sochi — 2 boilers
- 2xCCGT-130, DTPP Strogino, Moscow — 4 boilers
- CCGT-450, TPP-21, Moscow — 2 boilers
- CCGT-52, Eletsкая TPP, Elets — 2 boilers
- CCGT-230T, Chelyabinskaya TPP-3, Chelyabinsk
- CCGT-210, Novgorodskaya TPP, Novgorod
- CCGT-450, Huadian-Teninskaya TPP, Yaroslavl — 2 boilers



Horizontal type with natural circulation in evaporative circuits, single, double and triple circuits.

Designed to generate superheated steam of one and two pressure due to heat recovery of exhaust combustion products after a gas turbine. HRSGs are available in a wide range of sizes, they can work with a stand-alone deaerator or a deaeration head or deaeration bead integrated in a low-pressure drum. The condensate gas heater circuit may include a water-water heat exchanger for heating system water or have a separate gas preheater circuit for heating system water. To obtain higher performance

and steam temperature indicators, HRSGs can be equipped with afterburners. HRSGs can be equipped with a bypass system (with a separate bypass chimney or integrated chimney) for operation of a GTU with a stopped boiler. Boiler heating surfaces can be supplied for installation as separate sections, or modules, including sections of heating surfaces with pipelines, suspensions, beams and ceiling with heat insulation.

Performance indicators

Boiler type	GTU type, capacity, MW	Outlet steam conditions		
		D, t/h	P, bar	T, °C
P-88	GTE-110110 MW	155/35	72/7,0	501/231
P-96	GTE-160160 MW	232/45	77,5/5,0	510/226
P-131	PG-6581 GE 45 MW	58/12	74/7,0	525/209
P-132	SGT5-4000F 280 MW	258,4/309,3/35,1	149,9/31,4/4,4	540/534,6/263,2
P-133	GT-26 Alstom 288 MW	315/357/30,9	139/30/4,7	567/566/284
P-140	SGT5-4000F 280 MW	259/311/42	119/29/4,3	543/542/234
P-142	PG9171E 125 MW	186/39	74,9/7,25	515/229
P-143	PG9351FA 260 MW	277/302/44,1	110/22/3,9	566/565/300
P-146	SGT5-4000F 280 MW	288,6/317,1/42	138/32,5/5,2	566/568/244

Advantages of Heat Recovery Steam Generator

- minimum dimensions of HRSG
- tested implementation of guaranteed indicators
- high mounting adaptability of heating surfaces using special mounting tools

Key references

- CCGT-325, Ivanovo CCGT, Ivanovo
- CCGT-450, Kaliningradskaya TPP-2, Kaliningrad
- CCGT-60, Noyabrskaya CCGT, Noyabrsk
- CCGT-800, Kirishskaya GRES, Kirishi
- CCGT-420, TPP-26, Moscow
- CCGT-420, Yuzhnouralskaya GRES-2 unit 1 and unit 2, Yuzhnouralsk
- CCGT-190, Novomoskovskaya GRES, Novomoskovsk
- CCGT-400, Nizhnevartovskaya GRES, Nizhnevartovsk
- CCGT-420, Verkhnetagilskaya GRES, Verkhny Tagil

BOILER EQUIPMENT MODERNIZATION

Our enterprise ZiO-Podolsk performs technical re-equipment (modernization) of boiler equipment.

Main areas of customer support on the modernization of previously manufactured equipment

Monitoring the technical condition of a power asset

Action plan to improve efficiency of power assets

- monitoring the technical condition of a power asset
- identifying efficiency reduction and assessing causes of inconsistency
- studying best practices on similar inconsistencies
- analysis, preparation and approval of the solution to eliminate the inconsistency
- development of the project and custom specifications
- implementation of modernization
- final verification of modernization (testing)

Identifying efficiency reduction and assessing causes of inconsistency

Operation modes

- adjustment of operation modes
- testing
- efficiency assessment

Technical condition (operation life, quality of the project and installation)

- studying local and foreign experience
- development of technical specifications for modernization
- development of design documentation
- implementation of modernization
- final verification of modernization and efficiency assessment

The above mentioned operations are impossible without the use of new technologies. The plant is equipped with modern machining facilities. The design department is equipped with the necessary computer resources and software. Development of design documentation is performed using modern two- and three-dimensional drawing programs (Autodesk Inventor, SolidWorks). Calculations are performed using numerical modeling programs (ANSYS, Flow Vision), which allow to receive results as close as possible to experimental usage data.

Types of boiler equipment modernization

- increase in the adjustable load range of the unit (lowering the threshold of stable operation)
- switching to non-standard fuels
- introduction of a slag-free operating mode of the combustion chamber for slagging coals due to low-temperature and tiered fuel combustion
- increasing the stability of fuel ignition and expanding the operation range without fuel oil highlight due to the installation of telescopic dust collectors and special dust concentrators, high air heating, the use of LTV technology, etc.
- improving technical and economic indicators by optimizing design and implementation of modern design and circuit solutions (the use of membrane and spiral finned heating surfaces, light pipe insulation, etc.)
- modernization improving environmental indicators
- increase in steam production of steam boilers due to the installation of intensified heating surfaces in economizer, evaporation and overheating zones of the boiler

# EQUIPMENT FOR WASTE INCINERATION PLANTS

**Atomenergomash has plenty of experience in the design and production of equipment for modern waste incineration plants.**

Together with the technological partner, boiler and turbine equipment, ACC, etc. are produced and completely delivered.

## Equipment

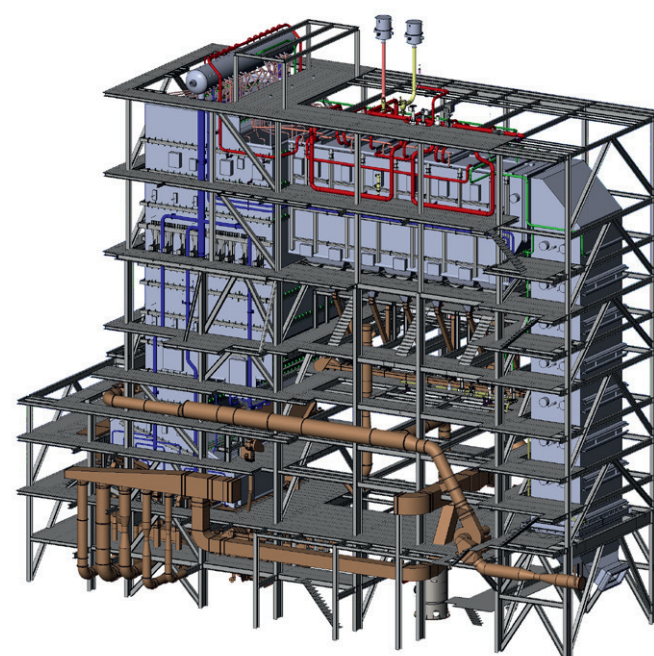
- basic parts of P-152 steam boiler
- gastight panels of the combustion chamber
- convective heating surfaces (superheaters, economizers, condensate pre-heaters)
- boiler drum
- pipelines

## ZiO-Podolsk references in the design and production of plant equipment for thermal treatment of MSW

The production of WIP equipment at ZiO-Podolsk includes surfacing of the special Inconel 625 nickel alloy using the unique Cold Metal Transfer (CMT) technology, which ensures high quality, production capacity and durability of the final product.

## Air-cooling condenser

Within the framework of the project "Power from Waste", as of 2019, an air-cooling condenser (ACC) for a new generation WIP is under development for the first time in Russia. It is designed to condense exhaust steam from the turbine and return to the boiler. Condensers produced by ZiO Podolsk will be distinguished by their mechanical and thermal integrity, corrosion and freezing resistance, low power consumption, reliability and low maintenance.



## 1995

Equipment for the Ruhleben waste incineration plant (Berlin) has been mastered by German standards.

## 2003–2004

Two boilers for the waste incineration plant processing municipal waste in Zorbau, Germany (under the project of Von Roll Inova) were developed and manufactured. Production was carried out in compliance with European standards under the supervision of TUV inspection.

## 1996–2004

According to the Holter's basic project (Germany), a detailed design was completed and three boilers to Rudnevo WIP №4 were delivered. The total weight of the equipment supplied to the three production lines is 4200 tons. The last line was commissioned in 2004.

## 2004–2005

Orders from Lurgi Lentjes Service GmbH (Germany) for the manufacture and installation of parts against pressure, pipelines and auxiliary equipment for two boilers, the supply and installation of thermal insulation, the installation of two afterburner grates for the Moscow WIP № 3 under the project of Baumgarte (Germany) were completed.

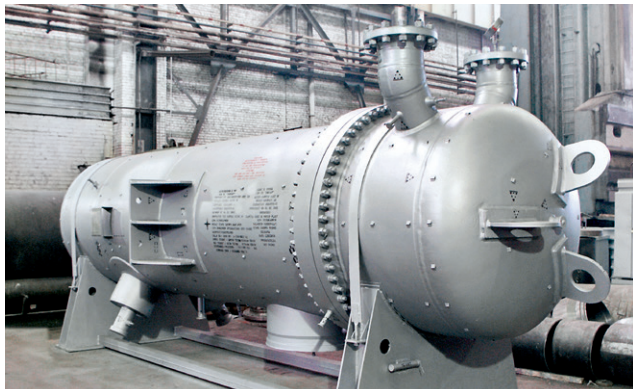
Project, country	Technical indicators, t/h; t °C/bar	Grate system	Year	Client	The number of delivered boilers
Berlin-Ruheleben, Germany	13	Roller grate	1996	BLK, Germany	1
Moscow, WIP №4, Rudnevo, Russia	13,5 310/17		1996—2004	Holter/Balke-Durr/Lurgi, Germany	3
Zorbau, Germany	19,3 400/44	Air-cooled staged grate	2004—2005	Von Roll Inova, Germany	2
Moscow, WIP №3, Russia	27 360/36	Air-cooled staged grate	2005—2006	LLS, Germany	2
Moscow, WIP №1, Russia	27400/40	Air-cooled staged grate	2006—2008	Badpro LLC, plant №1	2



# LOW PRESSURE PREHEATERS (LPP)

AEM’s enterprises produce and successfully operate LPP for power units turbines. A typical range of new advanced devices for thermal power plants eliminates flaws of the structures currently used at thermal power plants.

Low pressure preheaters are designed to heat the main condensate with extracted steam in the low pressure regeneration system of steam turbine plants.



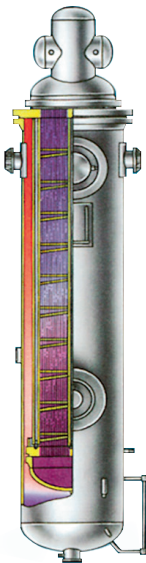
Low pressure preheaters manufactured at ZIO-Podolsk are successfully operating at Mosenergo TPP-27 as part of the PT-80 turbine plant

LPP main features	PND-2	PND-3	PND-4
Turbine condensate nominal flow rate, t/h	464	565	565
Turbine condensate pressure, kp/cm² (MPa)	14 (1,373)	13,0 (1,275)	12,0 (1,177)
Turbine condensate estimated pressure, kp/cm² (MPa)	20,0 (1,96)		
Turbine condensate inlet temperature, °C	57	99	128
Turbine condensate outlet temperature, °C	95	127	157,6
Turbine condensate estimated temperature, °C	100	130	160
Heating steam flow rate, t/h	31,3	25,5	28,4
Heating steam pressure (g.), kp/cm² (MPa)	0,98 (0,096)	2,8 (0,275)	6,22 (0,605)
Heating steam estimated temperature, °C	170	260	380
Heating steam outlet temperature, °C	166	253	364
Turbine condensate underheating at a turbine condensate nominal flow rate (no more), °C	3	2,9	1,8
Tube system pressure resistance, kp/cm² (MPa)	0,51 (0,05)	0,92 (0,09)	0,91 (0,089)
Total heat exchange surface area, calculated (constructional), m²	362	366	362
Preheater mass, kg:			
during installation	10 906	11 633	11 135
during pressure test	18 386	19 863	18 615

# HEATER OF HEATING SYSTEM WATER (HHSW)

Recent AEM’s projects made it possible to upgrade previously produced HHSWs in terms of optimizing the movement of heat-exchanging areas, organizing directed condensate drainage from the heating surface, increasing efficiency of non-condensing gas drainage, modernizing the distribution chamber, unifying basic components and parts.

Heaters of Heating System Water are installed in the heat supply scheme and are meant for preheating heating system water at thermal power plants with steam from turbine offsets.

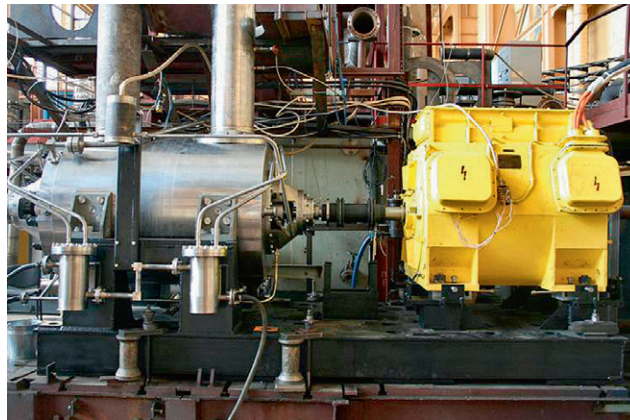


HHSW main features	PSV-530-0,29-2,25	PSV-530-1,37-2,25
Heat exchange surface area, calc./constr., m²	530/644	
Tube system working pressure (g.), kp/cm² (MPa)	23 (2,25)	
Case working pressure (g.), kp/cm² (MPa)	3,0 (0,29)	14,0 (1,37)
Heating system water temperature, ° C:		
inlet	120	70
outlet	150	110
Heating steam maximum temperature, °C	400	
Heating system water nominal mass flow rate, t/h	1130	
Tube system pressure resistance at a heating system water nominal mass flow rate, kp / cm2 (MPa)	0,54 (0,053)	0,65 (0,064)
Nominal heat flux, MW (kcal/h)	66,0 (56,7)	53,4 (45,9)
Total heating system water underheating, °C	12,7	8,7
Heating steam flow rate, t/h	110	94
Apparatus dry weight, t	18,3	19,9
Water-filled apparatus weight, t	30,3	31,9



# PUMPING EQUIPMENT

AEM enterprises produce a wide range of pumps diverse in design, calculated parameters and materials.



Multi-stage centrifugal horizontal sectional and twin-furnace



Horizontal centrifugal with a double inlet impeller with a horizontal and vertical joint



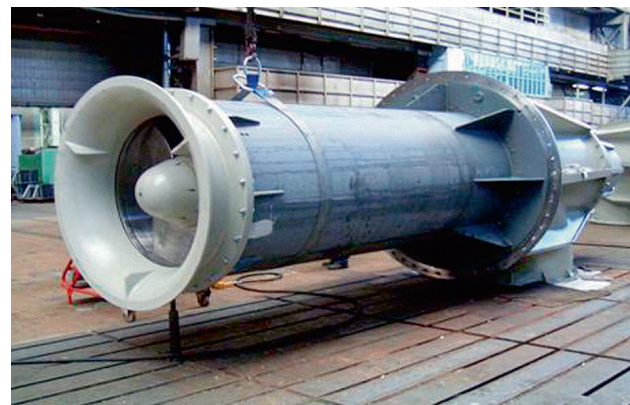
Horizontal and vertical single-stage centrifugal with spiral case



Single and multi-stage centrifugal vertical semi-submersible



Axial and diagonal single-stage semi-submersible with hydraulic regulation system



Single and multi-stage centrifugal vertical semi-submersible

# VESSEL EQUIPMENT

Used in processing installations at thermal power plants, gas, oil, oil refining, petrochemical and other industries, including combustible and hazardous environments. Large-sized products are transported disassembled with additional site assembly.



Deaerator



Gas condenser



Steam separation unit for Verkhne-Mutnovskaya GPP

## Types of vessel equipment

- vessel equipment operating under pressure (up to 70 MPa), up to 1000 m<sup>3</sup>
- horizontal and vertical vessels for flow media
- vertical vessels for air and gases
- evaporators

## Performance indicators

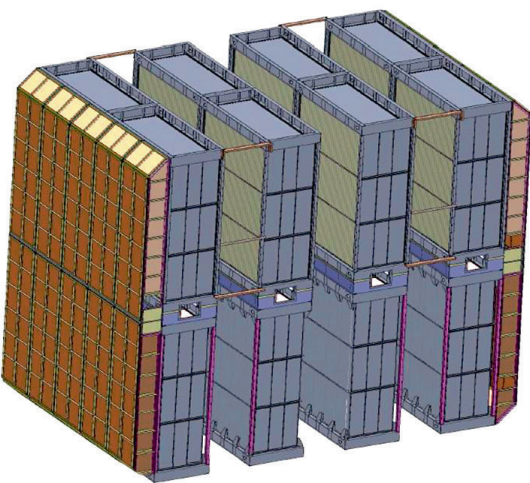
volume, m <sup>3</sup>	up to 300
diameter, mm	up to 3800
schedule pressure, MPa	up to 70
temperature, °C	from -70 to +950
material	carbon and stainless steel, iron-nickel alloys

## Supply references

- vessel equipment for the production of catalysts at the Ishimbay oil refinery plant (JGC Corporation, Japan)
- vessel equipment for hydrocyanic acid and acrolein production plants (ERA, Mexico)
- sewage disposal plant for Nevinnomyssk (TEC, Japan)
- steam collectors, separators, receivers, filters and other equipment for installing residual oil vacuum distillation (LLC Lukoil-Permnefteorgsintez)
- degasifiers, acid sumps, separators, economizers, tanks for an alkylation unit for the Omsk oil refinery plant (TECHNIP, France)
- vessels equipment for sulphuric acid production (LLC Lukoil-Permnefteorgsintez)
- separators for the construction of the Verkhne Salym oil-gas deposit (Salym Petroleum Development, SHELL subsidiary)



# AIR HEATERS AND CALORIFERS



### Air heaters

ZiO-Podolsk produces the whole range of tubular air heaters used in the construction of steam and hot-water boilers. The air heater is installed in the convective pass of the boiler to heat the air sent to the furnace to increase the efficiency of fuel combustion, and in coal-pulverizing devices due to the use of exhaust gases heat. Air heaters are available with different cubes and layouts depending on the type of burning fuel and the boiler steam capacity.



### Main technical features of steam calorifers

### Calorifers

Sections of SP-type steam heaters from steel pipes with welded spiral-ribbon fins are designed for heating blast air in boilers operating on solid, liquid and gas fuels, as well as for ventilation and air heating systems of power plants, public buildings and industrial enterprises.

Sections of SP-type steam heaters are divided into three-row and four-row ones depending on the heat power and aerodynamic resistance, and also have different heights of heating finned pipes. The heat-releasing element is made of a steel pipe with welded spiral ribs.

- inlet air temperature — minus 15 °C
- inlet heating steam temperature — up to 250 °C
- mass flux of air in approach flow — 9.4 kg/m<sup>2</sup>s
- inlet steam pressure — up to 16 kg/cm<sup>2</sup>

# DUST-GAS-AIR PIPE VALVES

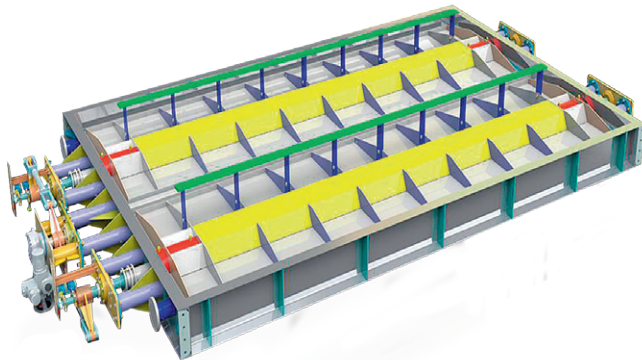
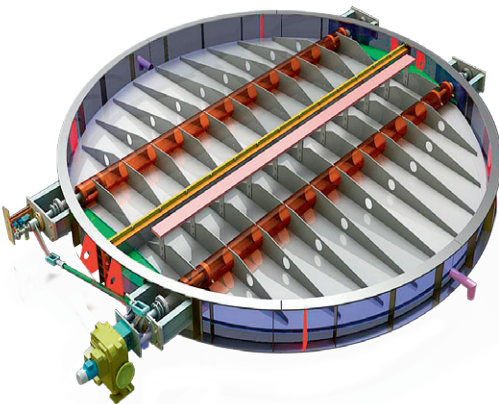
### Valves (isolating and regulating)

Designed for dust-gas-air pipelines (DGAP) of TPP power unit boilers with a temperature of handled medium up to 425 °C or up to 550 °C, pressure up to 20 kPa and dust concentration up to 100 g / Nm<sup>3</sup>.

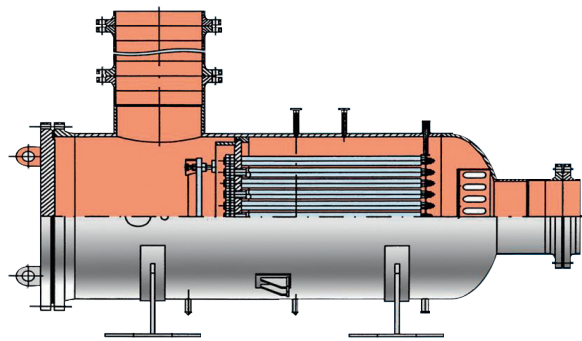
Valves are made of circular and rectangular cross-section. Circular cross-section valves have one closure or regulating unit made in the form of a damper. Rectangular cross-section valves have one, two, three or more dampers with parallel rotation and pairwise counter-rotation of the dampers, providing an extended range of flow performance and eliminating asymmetric flow deviation. In addition, valves with out-in traverse of the damper are available.

Isolating valves are designed to cut off individual DGAP sections during repair work. Special purpose valves and valves of other sizes and parameters with operating temperatures up to 700 °C are produced. Established resource before full repair is at least 35,000 hours under observance of service instructions. Meantime between failures is at least 4000 hours. The average service life is 30 years except for dampers operating in dust-gas flows.

Title	Measures, mm	Case passage area, m²
Round isolating and regulating valves	from 100 to 2000 (diameter)	0,01 to 3,1
Rectangular isolating and regulating valves	from 300×500 to 5500×2500	0,01 to 13,75
Rectangular special regulating valves	from 800×400 to 1600×3000	0,32 to 3,8
Regulating cut-off valves	from 1000×1000 to 2206×2206	1 to 4,9
CCGT cut-off valves	from 1800×1800 to 11680×6000, from 4600 to 6850 (diameter)	3,24 to 70



# FILTERS

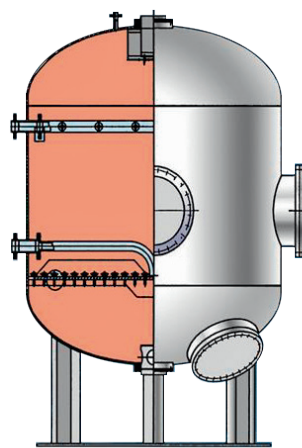


## Entrainment filters

Entrainment filters are manufactured with a diameter of 0.2 to 0.8 m. As filter elements, filter screens and filter cartridges are used depending on the purpose indicators.

Wire-type filter cartridges provide steady interception of particles larger than 0.1 mm. Cartridges are made of stainless steel.

Depending on the purpose of the entrainment filter case, they are made of both stainless steel and carbon steel in vertical and horizontal designs.



## Ion exchangers

The list of ion exchangers, mixed-bed filters and regenerators varies in the case diameter from 1 to 3.4 m. Depending on the processing medium and regenerant solution, cases are made of both stainless steel and carbon steel with an anti-corrosive coating. There are two types of filter elements:

- stainless caps with slots from 0.4 to 0.1 mm, which have proven their efficiency and reliability during operation at various facilities
- plastic caps used in corrosive environments where the use of stainless caps is unacceptable

Upper and middle precast switchgears are made of both stainless steel and polymeric materials.

The use of a "false bottom" device for filters made of carbon steel with an anti-corrosive coating as a bottom assembly and distribution device is a design feature for the part of apparatus.

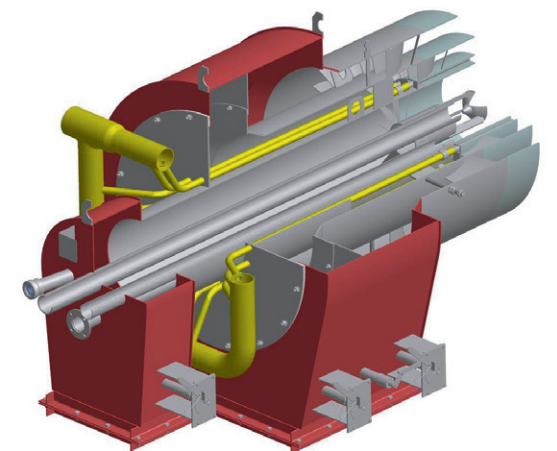
# BURNERS

Atomenergomash has significant experience in manufacturing high-quality and reliable burner equipment for boilers and hot-water boilers.

## Burners

The burners are divided into swirl and straight-flow (pulverized-coal, coal/gas-fired) by the design. AEM produces burners that burn various types of fuel both separately and in a mixture (gas, fuel oil, coal). Burner's capacity is from 5 to 80 MW.

The burner is completed with an igniter, a torch sensor and other necessary equipment upon delivery to the customer if necessary.



# STEAM SILENCERS

## Steam silencers

Silencers are designed to reduce the sound power of the discharged vapor stream. Water vapor with a working temperature of not more than 570 °C and working pressure not more than 25 MPa is working medium. Medium flow rate is from 20 to 350 t/h.

The design of a silencer provides a noise level reduction to the standards established by CH2.2.4 / 2.1.8.562-96 or required by customer. The design of a silencer is developed individually based on the technical specifications or data provided in a questionnaire by customer.

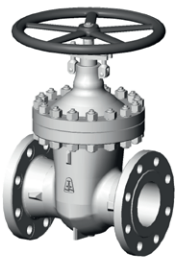




# ISOLATING AND REGULATING FITTINGS

Pipeline fittings of the Czech company Arako are designed and used in thermal and nuclear power, oil and gas industry. These fittings are manufactured up to SN, DIN, EN, ANSI standards. The company's range includes fittings made of carbon,

alloy and stainless steel. The company's product range includes pipe valves, isolating, regulating and non-return valves, bellows and quick-response valves, drain and blowing valves, ball valves, filters.



Pipe valves



Isolating and regulating valves



Drain and blowing valves

## Features of valves produced for power, chemical, petrochemical and gas industries

	High-pressure valves	Low-pressure valves	Isolating and regulating valves, bellows valves	Isolating high-pressure valves
DN	50—350	40—500	15—200	10—150
NP	160—500	10(6)—100	10—40	63—630
Minimum operating temperature, °C	–50	–105	(–196) –50	–196
Maximum operating temperature, °C	600	540	400	650
Usage	Gas, water, etc.	Gas, steam, water, oil, oil products, aggressive and non-aggressive fluids, etc.	Gas, steam, water, oil, oil products, aggressive and non-aggressive fluids, etc.	Gas, steam, water, oil, oil products, aggressive and non-aggressive fluids, etc.

## Supply references

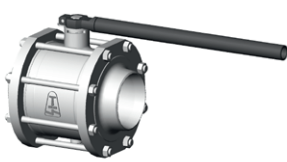
- E-ON, Germany
  - Skoda, Czech Republic
  - AREVA, France
  - Slovenske Elektrarne, Slovenia
  - Maeikiu Nafta, Latvia
- Siemens AG, Germany
  - EZ a.s., Czech Republic
  - ALSTOM, France
  - ENEL, Italy
  - Thyssen Krupp, Germany



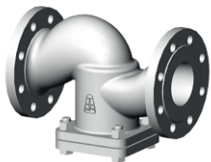
Non-return valves



Back flow valves



Ball valves



Filters

	Drain and blowing valves	Non-return valves	Back flow valves	Ball valves	Filters
DN	10—50	10—200	50—400	10—150	10—150
NP	63—500	10—630	10—630		10—160
Minimum operating temperature, °C	(–196) –10	–196	–105	–196	–196
Maximum operating temperature, °C	580	600	540	200	550
Usage	Gas, water, etc.	Gas, steam, water, oil, oil products, aggressive and non-aggressive fluids, etc.	Gas, steam, water, oil, oil products, aggressive and non-aggressive fluids, etc.	Gas, steam, water, oil, oil products, aggressive and non-aggressive fluids, etc.	Gas, steam, water, oil, oil products, aggressive and non-aggressive fluids, etc.

# WATER CONDITIONING AND WATER TREATMENT

**AEM provides a full range of unique modern technologies** for water conditioning, purification and desalination methods for thermal power plants, gas and petrochemical and other industries.

## Expertise areas in water conditioning technologies

### Ion exchange technology

- counter-flow and parallel-flow water ionization in filters

### Membrane technology

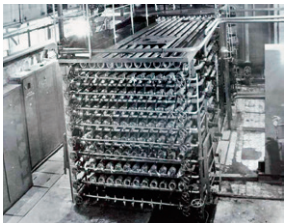
- reverse osmosis
- nanofiltration
- ultrafiltration
- electric deionization

### Supply references

- PJSC Tatneft. Turnkey project delivery of an automated water conditioning plant for deep desalination of surface water and purification of oil contaminated condensates from the Taneco JSC petrochemical plants in 2010
- JSC Taif. In 2014–2018, the development and staged supply of an oil-containing condensate treatment system at PJSC Nizhnekamskneftekhim was carried out

### Thermal technology

- evaporators
- evaporating apparatus
- distillation desalination plants



In 1989, the first domestic industrial reverse osmosis plant UOO-50 with a capacity of 50 m³/h was developed for Zuevskaya ETPP

### Products & Technologies

- associated reservoir water treatment ( $\pm \leq 1.0 \mu\text{S/cm}$ )
- distilled water production for oil-gas power enterprises ( $\pm \leq 0.2 \mu\text{S/cm}$ )
- desalination systems, including drinking water supply (SanRaN)
- radioactive elements entrapment



LLC ZapSibNeftekhim. Sale-containing water evaporation plant with a capacity of 150 m³ per hour



Kaliningrad salt factory. Two vacuum-evaporation plants with a total capacity of 200 t/h in initial salting liquid and 50 t/h in common salt



Sibur-Khimprom JSC. Water trecoatment for water desalination, capacity 700 m³/h,  $\pm \leq 0.2 \mu\text{S}$



PJSC Nizhnekamskneftekhim. Oil-containing condensate treatment systems, capacity 800 m³/h, TOC  $\leq 200 \mu\text{g/dm}^3$



PJSC Tatneft. Taneco JSC petrochemical plants. Water conditioning for deep water desalination with a capacity of 1000 m³/h

# QUALITY MANAGEMENT SYSTEM

**Quality management system consistent with modern global expertise such as ISO 9001** international standards is the basis for ensuring the quality of produced equipment for thermal power.

The quality management system covers the entire management system at AEM and our enterprises.

Certified quality management system of our enterprises is consistent with ISO 9001 requirements.

We are qualified by the expert international certification bodies such as Lloyd's Register Quality Assurance, AFNOR Certification, DQS GmbH, TUV Thuringen, Bureau Veritas.

All equipment manufactured by our enterprises undergoes strict quality control, including comprehensive examination of documentation and testing. Supervision starts at the stage of contract conclusion. In accordance with its requirements, the manufacturer develops and agrees on quality plans with the customer, including all the main stages of equipment production: from the design

documentation reconciliation with the customer, production control, procedure, equipment and personnel qualification, input control of purchased materials and components, to the production process and final delivery to the customer.

Total incoming inspection of purchased materials and components is mandatory before production start-up. The visual inspection of the incoming materials, semi-finished products, welding materials, as well as the supporting documentation verification are carried out. The enterprise laboratories conduct the following types of control in the equipment production: chemical analysis, metallographic studies, corrosion tests, metal and welded joint mechanical tests, radiographic, ultrasonic, magnetic-particle test, dye penetrant inspection, metal and welded joint leakage monitoring.



# ATTESTATION AND INTERNATIONAL CERTIFICATION FACTS

Our enterprises hold more than 20 various certificates, quality certificates and other permits.

Certification Body, Certificate №	Certificate functional area
Lloyd's Register Quality Assurance SPB0006278	Design, development, production and supply of equipment and related components for nuclear power facilities, including watercraft, thermal power, gas and petrochemical industries
TUV-ZUD Certificate № TUV SUD-DG-0430.2016.001	Production of pressure equipment
International Institute of Welding (IIW) and European Welding Federation (EWF) 1) ISO 3834 Part 2– Doc.IAB-340 RU-003 – Rev.01 2) EN ISO 3834 Part 2 (Doc. EWF 636-Part 1) RU-003 – Rev.01 3) RSP SMK.01M.0007 rev.01 RSP P.01.MO.0007.00A rev.01 RSP P.01.M.0007.00V rev.01	Assembly and welding production, welding coordinators
ASME Certificate 51,249 51,250	Production and assembly of power boilers in accordance with ASME standards (ASME certification mark with S designation)  Production of pressure vessels in accordance with ASME standards (ASME certification mark with U designation)
Document of the TURKAK Turkish Accreditation Agency № 50264901-105.01-1435	Design, development, production and supply of equipment and related components for nuclear power facilities, including watercraft, thermal power, gas and petrochemical industries

## OUR ENTERPRISES

### Moscow, Russia

**CNIITMASH**  
+7 (495) 675 83 02  
www.cniitmash.ru  
cniitmash@cniitmash.ru

### Podolsk, Russia

**OKB GIDROPRESS**  
+7 (495) 502 79 10  
www.gidropress.podolsk.ru  
grpress@grpress.podolsk.ru

**ZiO-Podolsk**  
+7 (495) 747 10 25  
www.aozio.ru  
zio@eatom.ru

### Volgodonsk, Russia

**The branch of AEM-technology "ATOMMASH"**  
+7 (8639) 29 20 79  
www.atommash.ru  
office@atommash.ru

**Atomtruboprovod-montazh**  
+7 (8639) 23 97 99  
vfatm@atom-tm.ru  
atom@dol.ru

### Nizhny Novgorod, Russia

**Afrikantov OKBM**  
+7 (831) 241 87 72  
www.okbm.nnov.ru  
okbm@okbm.nnov.ru

### Saint-Petersburg, Russia

**CDBMB**  
+7 (812) 676 63 63  
www.ckbm.ru  
postbox@ckbm.ru

**AEM-technology**  
+7 (812) 457 05 88  
www.aemtech.ru  
info@aemt.su

**Turbine Technology AAEM**  
+7 (812) 635 81 19  
www.aaemturbines.com  
info@alstom-aem.com

### Yekaterinburg, Russia

**SverdNilkhimmash**  
+7 (343) 263 90 91  
www.sverd.ru  
niihm@ural.ru

### Petrozavodsk, Russia

**The branch of AEM-technology "Petrozavodskmash"**  
+7 (814) 271 69 20  
www.pzm.su  
info@pzm.su

### Kramatorsk, Ukraine

**Energomashpetsstal**  
+38 (062) 646 01 32  
www.emss.ua  
kants@emss.dn.ua

### Opava, Czech Republic

**ARAKO spol. s.r.o.**  
+420 (553) 694 111  
www.arako.cz  
arako@arako.cz

### Budapest, Hungary

**Ganz EEM LLC**  
+36 1 872 58 00  
www.ganz-eem.com  
info@ganz-eem.com



Atomenergomash JSC  
Nuclear and power engineering

**115184, Moscow,  
Ozerkovskaya nab. 28, bldg. 3  
+7 (495) 668 20 93**

**www.aem-group.ru**  
**aem@aem-group.ru**  
**www.facebook.com/aemgroup**

