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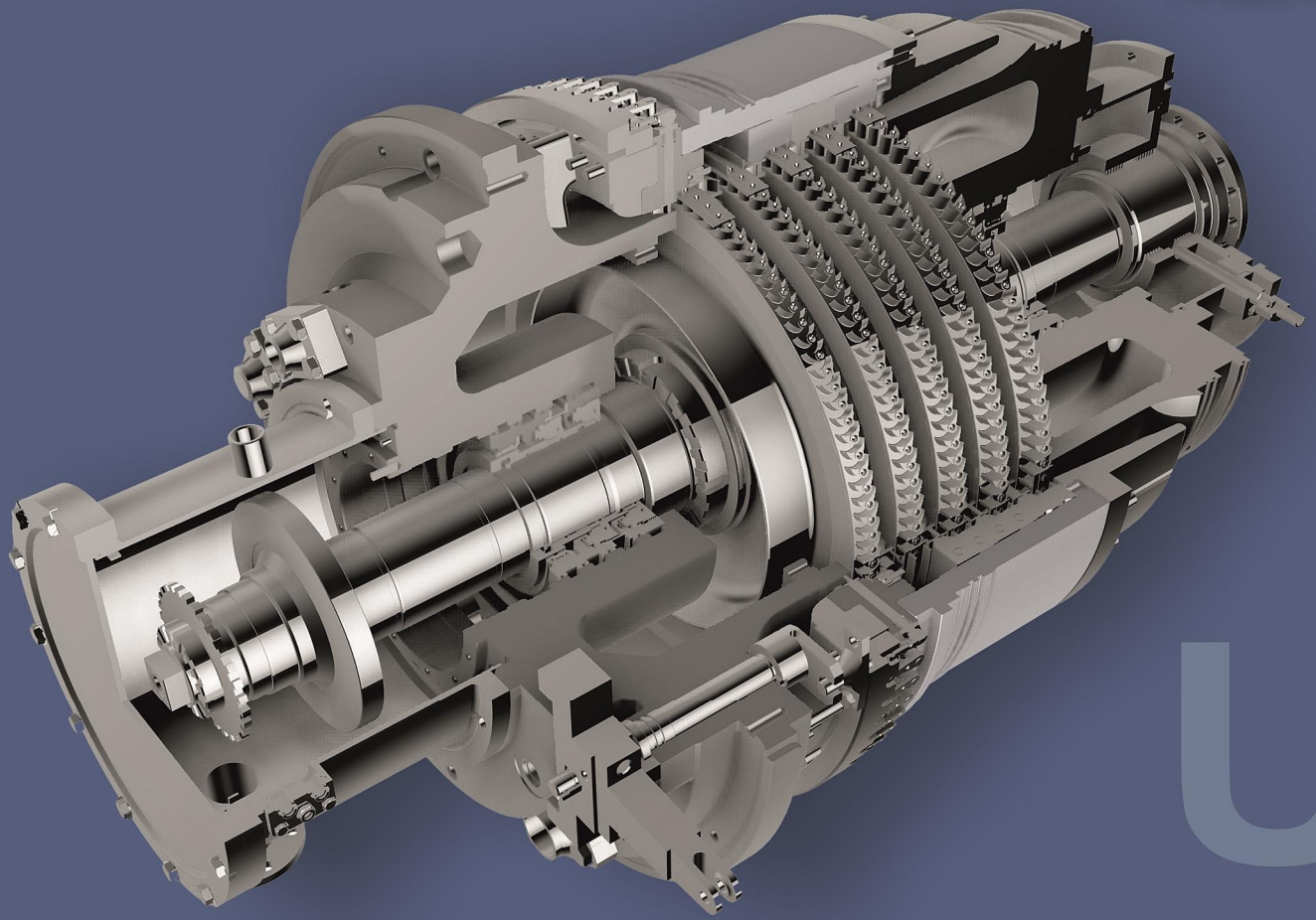
Leader in turbo-expander hardware production



UTDU

Design and implementation of power recycling turbo-expander units (UTDU) at gas distribution stations and gas treatment plants are one of the PJSC “Turbogaz” profile activities. Power recycling turbo-expander units are designed to generate electric power at the expense of excessive gas pressure drop at the turbine, loaded with generator. Depending on the power recycling unit deployment (gas distribution station (GDS), gas distribution point (GDP), or gas treatment plant (GTP), it can solve the following tasks:

- If installed at GDS and GDP, it generates electric power. Preliminary gas heating is required to ensure standard gas temperature at GDS or GDP outlet;
- If installed at GTP, it generates electric power and ensures gas cooling. Preliminary gas heating is not required.

PJSC “Turbogas” has designed and made commercially available UTDU of the capacities ranging from 8 kW to 8 MW with gas pressure of 6.3 MPa. Depending on the initial parameters the turbo-expander units could be of different designs:

- For available low pressure drop in the turbine and big gas consumption PJSC “Turbogaz” designs and manufactures multi-stage (up to 6 stages) axial turbines to work on a direct drive, i.e., the turbine is directly combined with the generator shaft via transmission. In this design the turbine rotor speed is 3,000 rpm.
- For high pressure drops at the turbine (Pt>2) PJSC “Turbogaz” designs & manufactures UTDU with reduction gear. In this design the generator speed is 3,000 rpm, and turbine rotor speed is 8,000 rpm.

Power recycling turbo-expander units are designed to be used with the Ukrainian manufactured reduction gears as well as with BHS (Germany) reduction gear

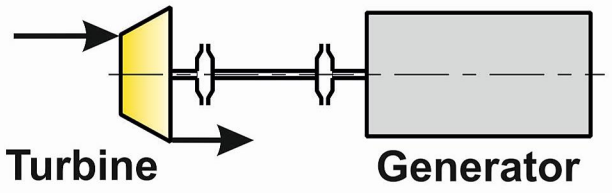
Power recycling turbo-expander units are manufactured and supplied as a complete package with all the auxiliary equipment to include: lube oil system, dry gas seals system, switchgear and control gear cabinets, shut-off and control valves, including also quick acting shutoff valve at the turbine inlet as well as proportioning valve and bypass control valve at the turbine by-pass, heat-exchanger & gas reheater, automatic control system (ACS).

Structurally turbo-expander is manufactured at the highest technical level:

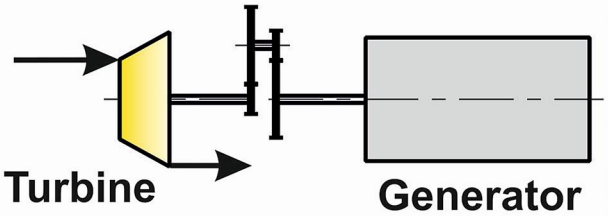
- Each turbine stage presupposes to have an adjustable nozzle assembly providing for the unit optimal operation in different modes and for obtaining the maximum efficiency ratio;
- Dry gas seals, that increase the unit environmental friendliness, are used in the expander
- Flexible dry transmission of BHS Company (Germany) is used from the generator.

UTDU DIFFERENT DESIGNS

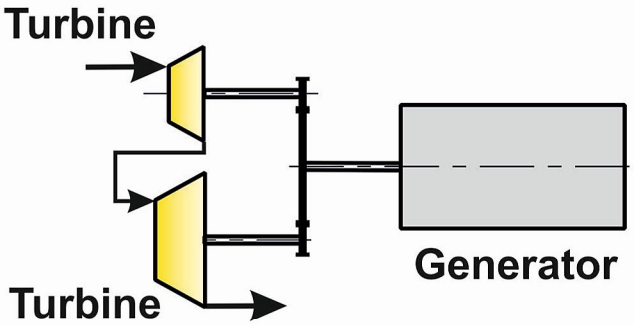
Multi-stage axial-flow direct-drive turbines



Multi-stage axial-flow geared turbines



2-stage radial turbines with Integrated Reduction Gear BHS



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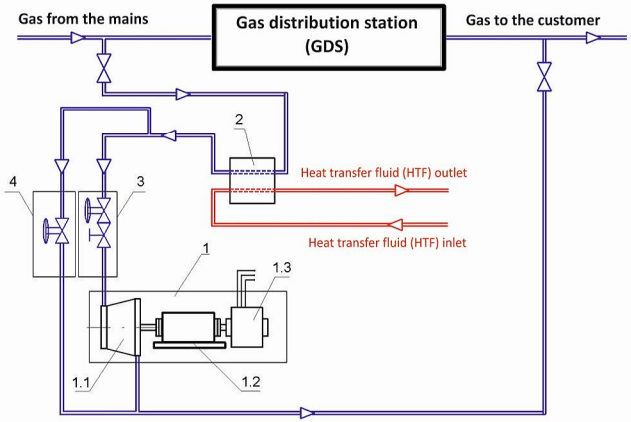
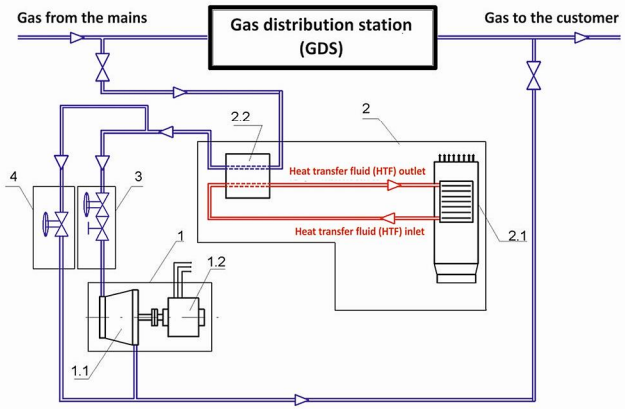
Diagrams to hook-up UTDU to GDS

Hook-up diagram with external heat source



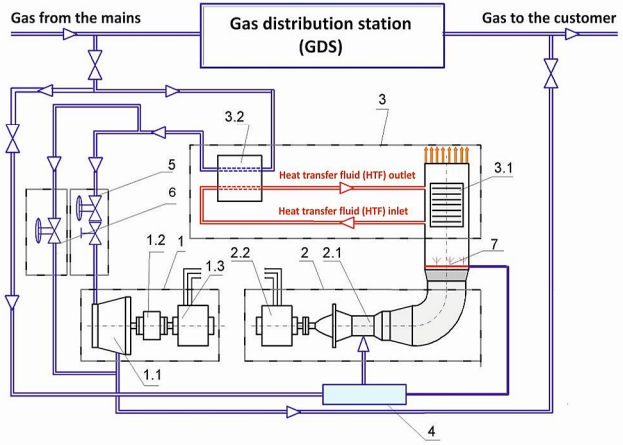
1.Turbo-expander unit
1.1.Turbo-expander
1.2.Reduction gear
1.3.Generator
2.Heat exchanger
3.Valve skid (isolation and proportioning valves)
4.Skid of bypass-control valve

Hook-up diagram with self-contained heat source



1.Turbp-expander unit
1.1.Turbo-expander
1.2.Generator
2.Heat exchange equipment
2.1.Waste-heat boiler
2.2. Heat exchanger
3.Valve skid (isolation and proportioning valves)
4.Skid of bypass-control valve

Hook-up diagram combined with gas-turbine power plant



1.Turbp-expander unit
1.1.Turbo-expander
1.2.Reduction gear
1.3.Turbo-expander generator
2.Gas-turbine unit
2.1.Gaas-turbine engine (GTE)
2.2.GTE generator
3.Heat exchange equipment
3.1.Waste-heat boiler
3.2. Heat exchanger
4.Fuel gas treatment unit
5.Valve skid (isolation and proportioning valves)
6.Skid of bypass-control valve
7.Reheat system

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UTDU-2500. GDS-7, Dnipropetrovsk, Ukraine, 1991

Name	Country	Start year, aver.runtime, h	Q, mln.m^3/day	Capacity, kW	Number of supplied units	Pin, Mpa	Pout, MPa	Du in, mm	Du out, mm	Reduction gear (a, n/a)
UTDU-2500. GDS-7 Ukrtransgaz, Dnipropetrovsk	Ukraine	1991	4,5	2500	1	2,15	1,0	300	400	n/a

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Building with two UDEU-2500-UHL4.
Minsk CGPP-4 (Belarus), 2005

Name	Country	Start year, aver.runtime, h	Q, mln.m^3/day	Capacity, kW	Number of supplied units	Pin, Mpa	Pout, MPa	Du in, mm	Du out, mm	Reduction gear (a, n/a)
UDEU-2500-UHL4. Minsk CGPP-4 (Belarus)	Belarus	2005 24247 h.	2,4	2500	2	0,9	0,3	500	700	n/a

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UDEU-2500-UHL4.
Minsk CGPP-4 (Belarus), 2005

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UDEU-2500-UHL4 Generator. Minsk
CGPP-4 (Belarus), 2005

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UDEU-2500-UHL4.
Lukoml GDP-2 (Belarus), 2006

Name	Country	Start year, aver.runtime, h	Q, mln.m^3/day	Capacity, kW	Number of supplied units	Pin, Mpa	Pout, MPa	Du in, mm	Du out, mm	Reduction gear (a, n/a)
UDEU-2500-UHL4, GDP-2, Novolukoml (Belarus)	Belarus	2006 25640 h.	2,4	2500	1	0,9	0,3	500	700	n/a

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Building with UTDU-4000-1.2-2.6-UHL4. Homel CGPP-2 (Belarus), 2008

Name	Country	Start year, aver.runtime, h	Q, mln.m^3/day	Capacity, kW	Number of supplied units	Pin, Mpa	Pout, MPa	Du in, mm	Du out, mm	Reduction gear (a, n/a)
UTDU-4000-1.2-2.6-UHL. Homel CGPP-2	Belarus	2008 11233 h.	2,6	4000	1	1,2	0,2	500	500	a

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UTDU-4000-1.2-2.6-UHL4.
Homel CGPP-2 (Belarus), 2008

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Building with UTDU-4000-4.5-4.5-UHL4 of 4 MW capacity. Severodonetsk GDS (Ukraine), 2008

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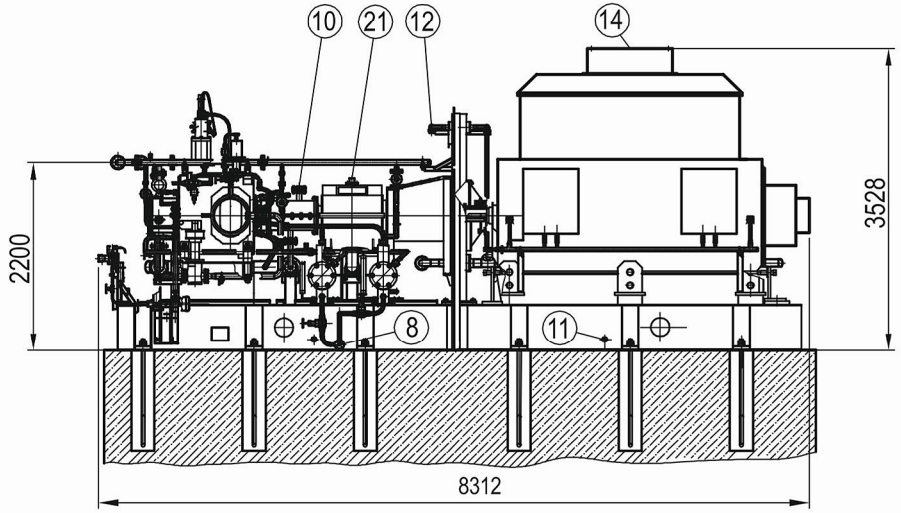
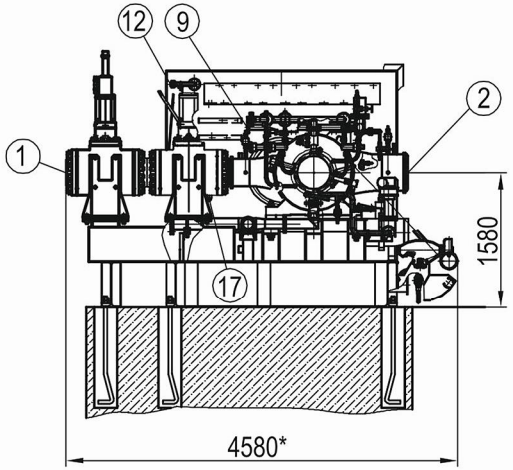
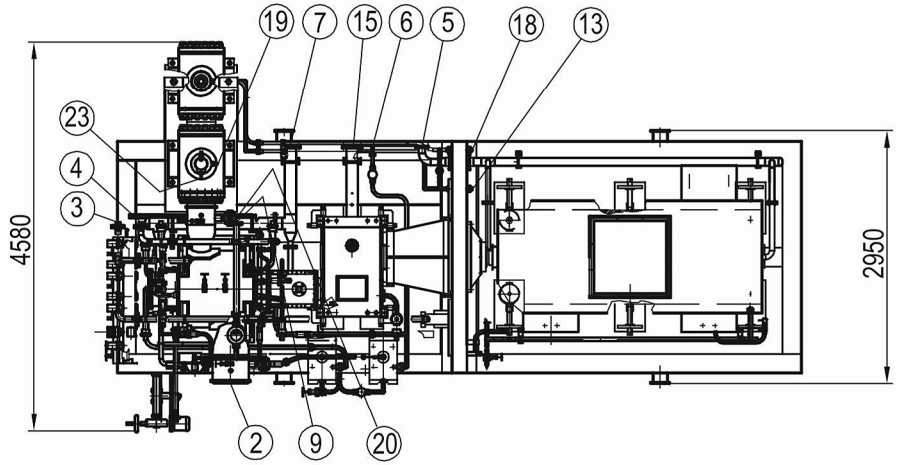
Unit size and terminal points.
UTDU-4000-4.5-4.5-UHL4







1.Gas inlet
2.Gas outlet
3.Inlet of oil from the filtering unit to expander and reduction gear bearings
4.Inlet of oil into the seal system from filters unit
5.Oulet of oil from generator bearings to lube oil system
6. Venting of filter unit casing head
7.Outlet of oil from expander bearings into lube oil system
8.Bleed-off from MO1&MO2 into lube oil system
9.Bleed-off from RPD to lube oil system
10.Expander crankcase venting
11.Outlet to industrial sewage system
12.Oil inlet to generator bearings
13.Oil inlet/outlet to shutoff/proportioning system
14.Generator cooling air outlet
15.Outlet of oil from reduction gear bearings to lube oil system
17.Gas inlet from GDS input
18.Oil inlet/outlet to shutoff/proportioning system
19.Gas outlet from isolation valve
20.Into the bypass line of shut-off/proportioning system
21.Venting of reduction gear housing
23.Oil inlet from control system to pneumatic hydraulic valve

Name	Country	Start year, aver.runtime, h	Q, mln.m^3/day	Capacity, kW	Number of supplied units	Pin, Mpa	Pout, MPa	Du in, mm	Du out, mm	Reduction gear (a, n/a)
UTDU-4000-4.5-4.5-UHL4. GDS, Severodnonetsk	Ukraine	2008 27123 h.	4,2-5,9	4000	1	3,27-4,5	1,1-1,4	300	400	a

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UTDU-4000-4.5-4.5-UHL4, 4 MW capacity.
GDS, Severodonetsk, Ukraine, 2008

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Heat exchanger and by-pass control valve.
UTDU-4000-4.5-4.5-UHL4, 4 MW capacity. GDS, Severodonetsk, Ukraine, 2008

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4 MW Generator. UTDU-4000-4.5-4.5-UHL4.
GDS, Severodonetsk, Ukraine, 2008

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"Buderus" heating boiler. UTDU-4000-4.5-4.5-UHL4.
4 MW capacity. GDS, Severodonetsk, Ukraine, 2008

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High voltage transformer to connect to the mains. UTDU-4000-4.5-4.5-UHL4. 4 MW capacity. GDS, Severodonetsk, Ukraine, 2008

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Expander-generator unit. DGU-8-220-T-UHL2, Volgograd, Russia, 2008

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UDEU-2500-U2. Power recycling expander unit. Cold generation in low-temperature adsorption system with simultaneous power generation. GS "Soloha", Ukraine, 2009

Name	Country	Start year, aver.runtime, h	Q, mln.m^3/day	Capacity, kW	Number of supplied units	Pin, Mpa	Pout, MPa	Du in, mm	Du out, mm	Reduction gear (a, n/a)
UDEU-2500-U2. GS, Soloha, Ukraine. HID "Potavagazdobycha",	Ukraine	2009 28453 h.	4,2	2500	1	5,4	3,1	200	300	n/a

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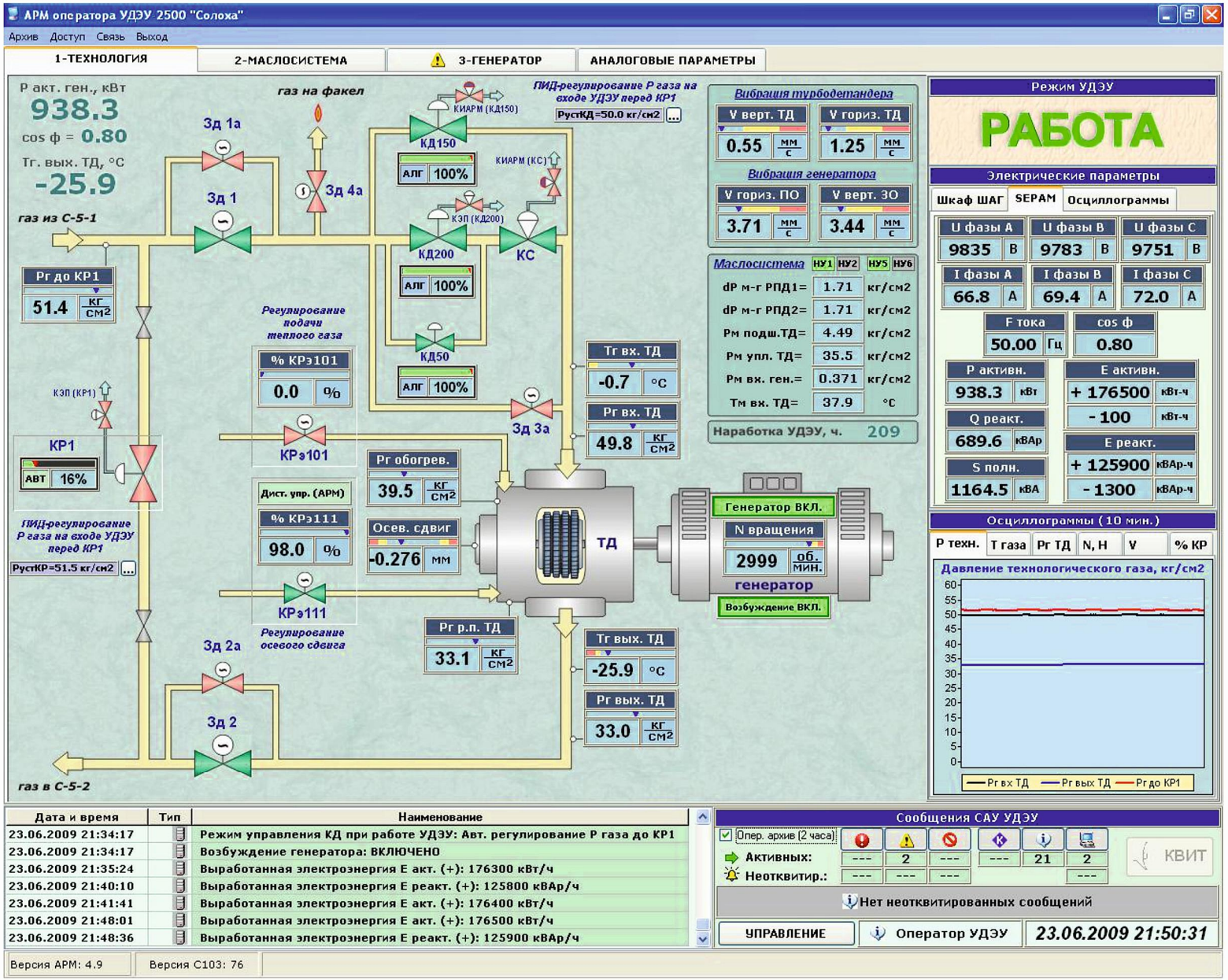
UDEU-2500-U2. Mnemonic diagram.
GS "Soloha", Ukraine, 2009



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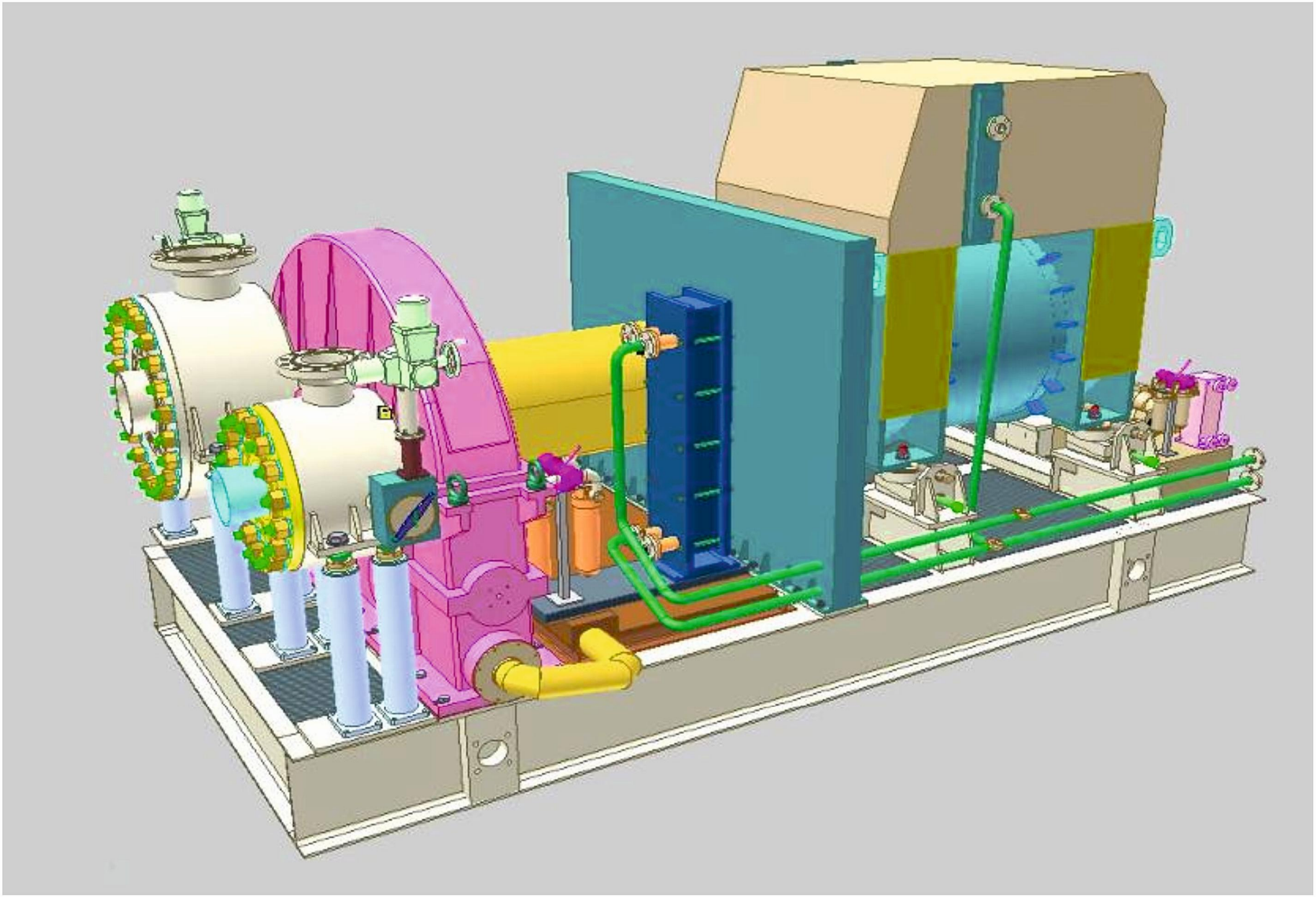
Design sketch of power recycling unit with integrated reduction gear BHS (Germany)



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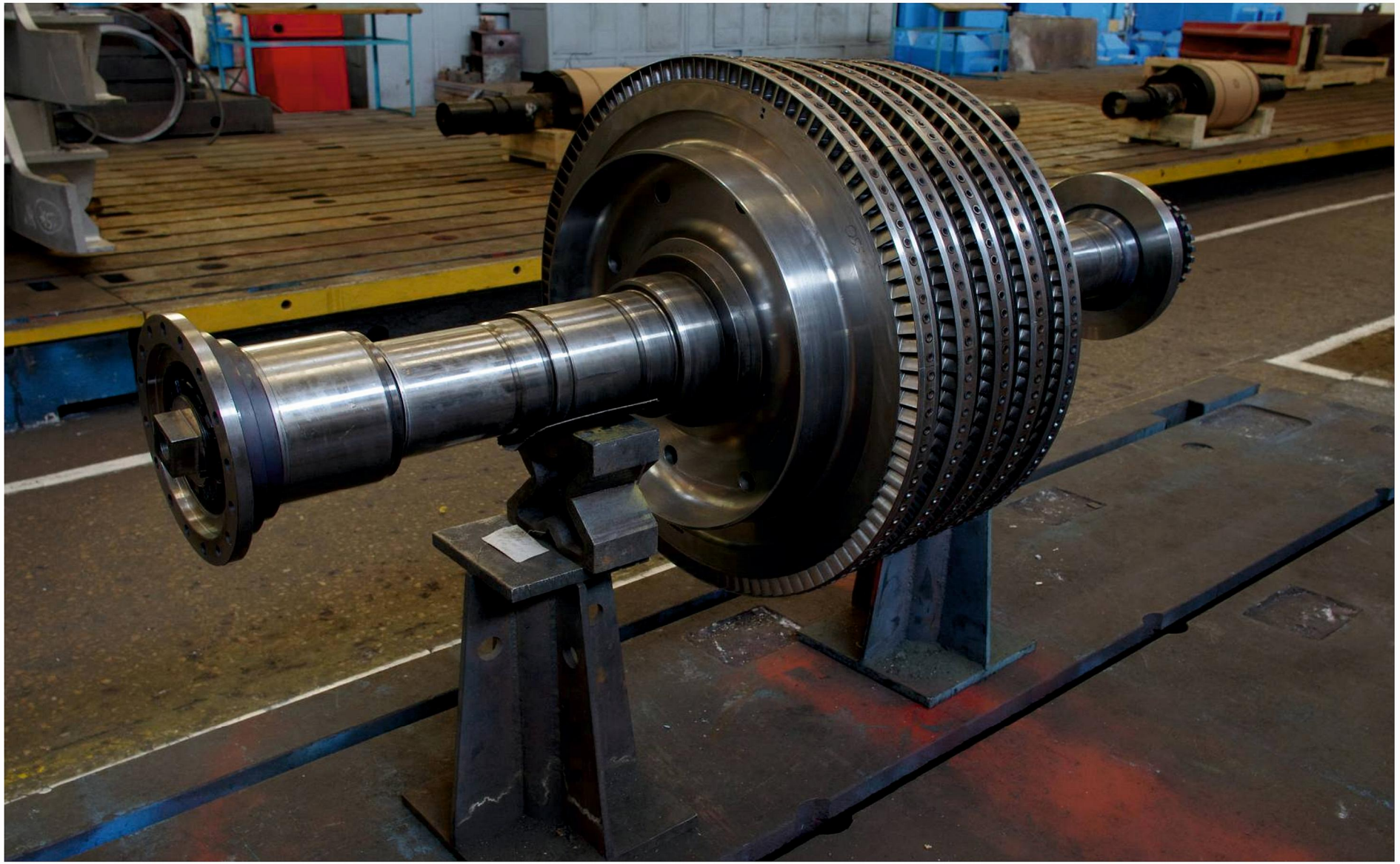
UTDU-4000-4.6-4.0-UHL4.
Rotor for OJSC "Belgorodgazenergo", Russia



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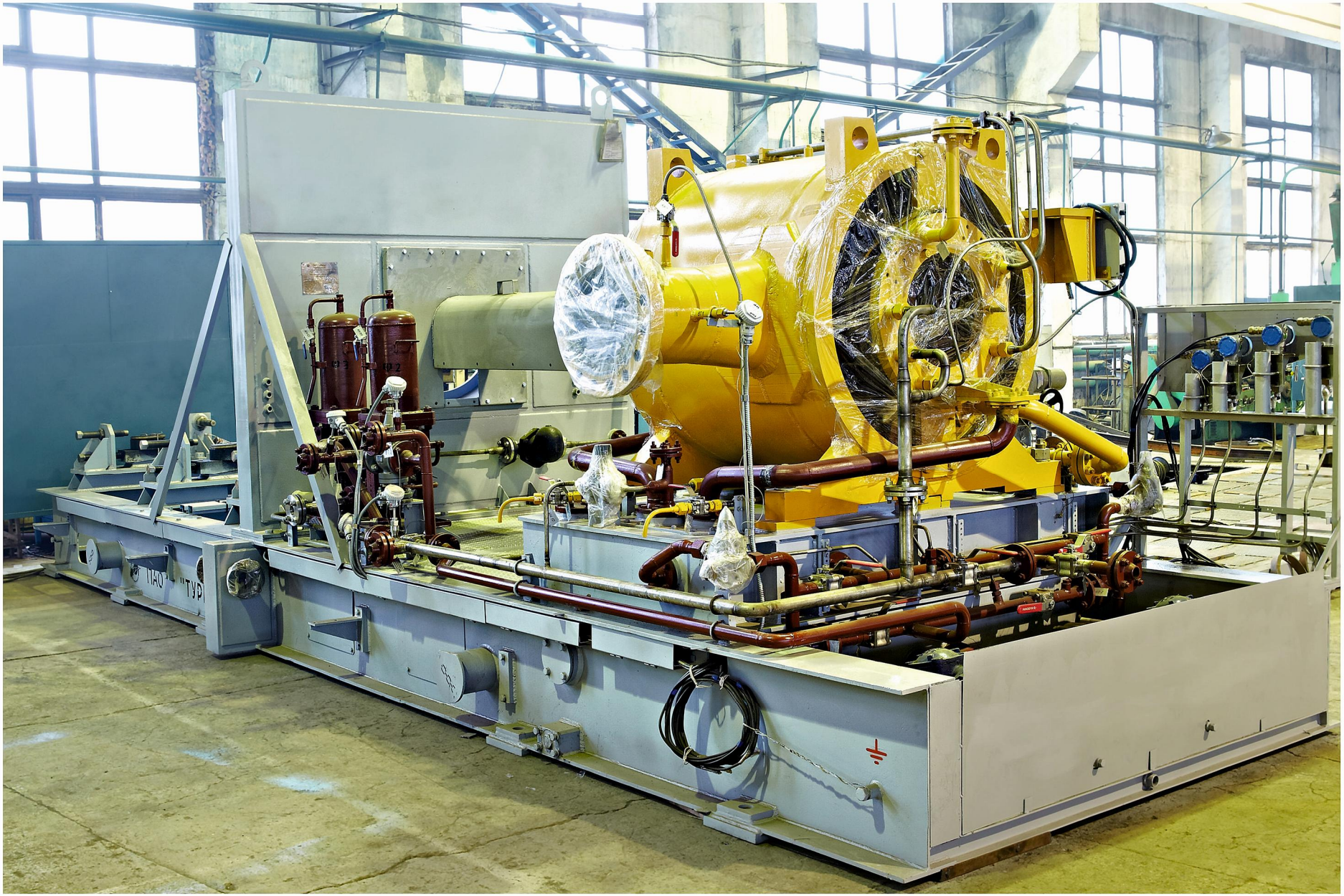
UTDU-4000-4.6-4.0-UHL4
for OJSC "Belgorodgazenergo", Russia



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Testing process at the Proving Range PJSC "Turbogaz"

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Parameters of power recycling turbo-expander units.
1991 – 2012 supply

Name	Country	Start year, aver.runtime, h	Q, mln.m^3/day	Capacity, kW	Number of supplied units	Pin, Mpa	Pout, MPa	Du in, mm	Du out, mm	Reduction gear (a, n/a)
UMG "Kharkovtransgas" subsidiary company "Ukrtransgaz", GDS-7 of Dnepropetrovsk LP UMG	Ukraine	1991	4,5	2500	1	2,15	1,0	300	400	n/a
Minsk TEhTs-4	Belarus	2005 31 318 h.	2,4	2500	2	0,9	0,3	500	700	n/a
GDP-2, Novolukoml city	Belarus	2006 31 719 h.	2,4	2500	1	0,9	0,3	500	700	n/a
GDS, Odessa	Ukraine		2,4	4000	1	2,535	0,461	300	400	a
Gomel TEhTs-2	Belarus	2008 17 893 h.	2,6	4000	1	1,2	0,2	500	500	a
GDS, Zaporozhye	Ukraine		2,6-3,02	4000	1	2,9-4,2	0,7-0,75	300	400	a
** UTDU-6000 project is developed, TEhTS-5, Kiev	Ukraine		3,36	6000***		3,73	0,73	300	500	a
* "Belgorodgasenergo", Belgorod	Russia		3,6-3,84	4000	1	4,1-4,6	1,3-1,4	300	500	n/a
** UTDU-5000 project is developed	Uzbekistan		3,94	5000		0,5-1,0	0,15-0,18	400	800	n/a
GPU "Poltavagasdobycha", "Solokha" GS	Ukraine	2009 31 141 h.	4,2	2500	1	5,4	3,1	200	300	n/a
** UTDU-8000 project is developed	Iran		4,8	8000***		0,9	0,218	400	900	n/a
GDS, Severodonetsk city	Ukraine	2008 29 673 h.	4,2-5,9	4000	1	3,27-4,5	1,1-1,4	300	400	a
** UTDU-4000 project is developed	Ukraine		3,6-8,2	4000		0,73-6,6	2,8-3,5	300	500	a

* - Under construction
** - Project developed
*** - Two-shafts with integrated gear

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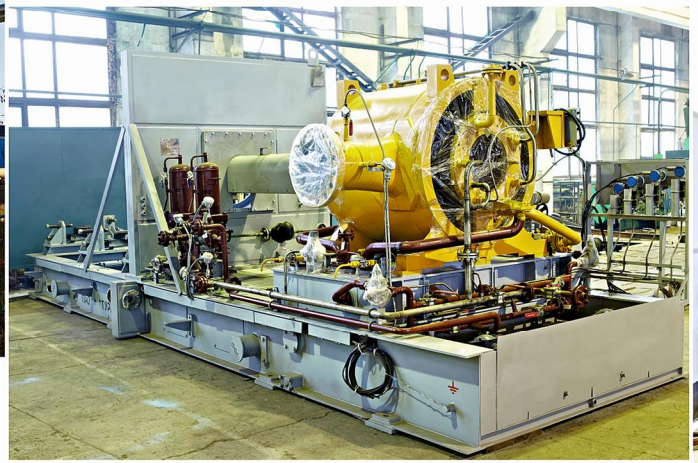
Advantages of Turbo-Expander Units Produced by PJSC "Turbogaz"

Advantages of UTDU and NTDA produced by PJSC "Turbogaz":

- Individual approach to every project, i.e., UTDU and NTDA design and production apply directly to the running conditions of the specific site
- Equipment could be supplied in different configurations depending on Customer's requirements, i.e.:
- UTDU supplied in a set with generator, low/high voltage equipment, ACS, locking-metering unit, bypass-adjustment unit, heat exchanging equipment, etc.
- Supply time is reduced
- Wide range of equipment applications as regards climatic conditions, productivity, capacity
- Wide range of support services (engineering, Feasibility Study development, supervised installation, start-up and commissioning, Customer's staff training, warranty and post-warranty servicing, spare parts supply)
- Quick response to Customers calls regarding their sites' visiting



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