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“Sumy NPO” PJSC

Technical Catalogue

RECIPROCATING COMPRESSORS

RECIPROCATING COMPRESSORS

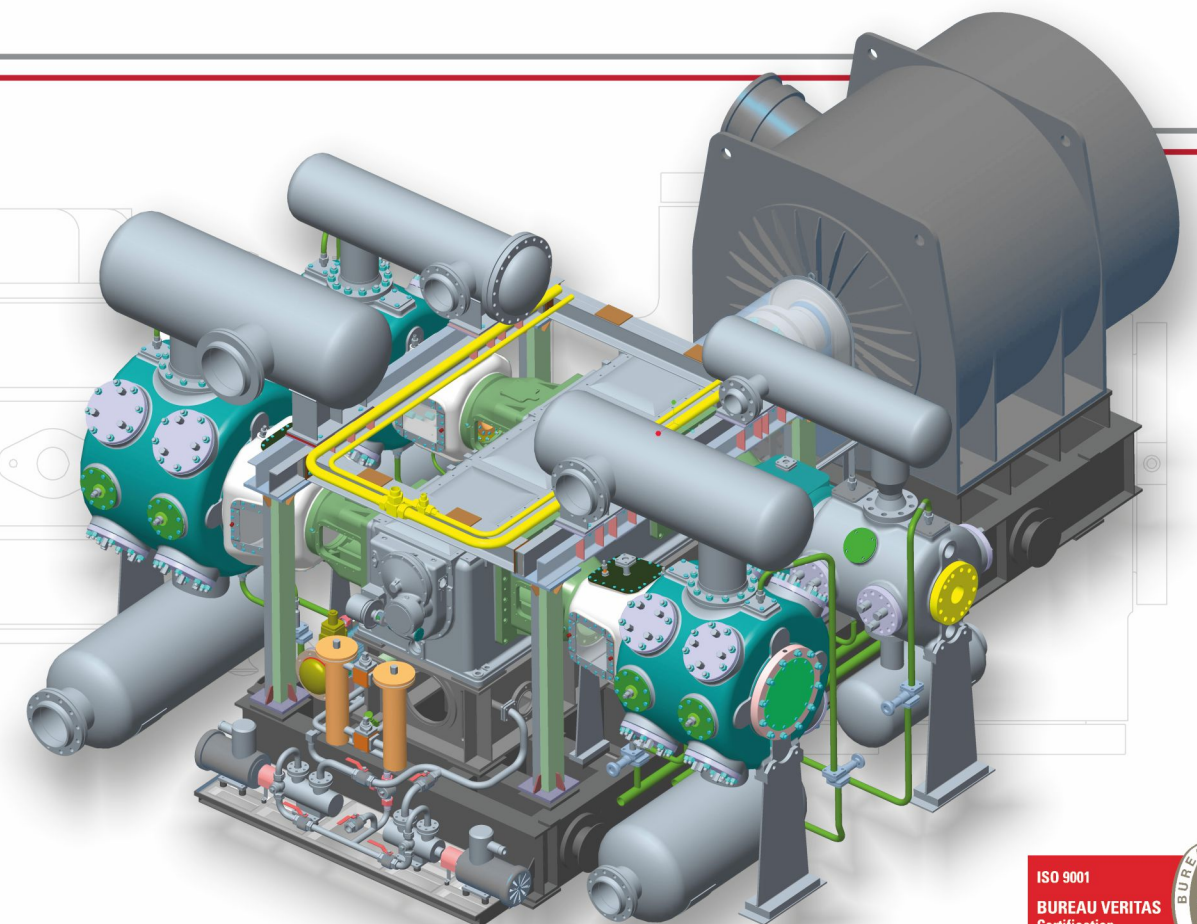
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“Sumy NPO” PJSC, founded in 1896, is now one of the largest machine-building enterprises in Europe manufacturing equipment and developing complex solutions for oil, gas, chemical, petrochemical and power industries.

Company products and services include the following:

- compressor equipment and gas pumping units;
- full range of process equipment for gas compressor stations;
- general-purpose industrial pumps and electric pump units;
- pumps and electric pump units for nuclear power plants;
- heat-exchange and mass-transfer equipment, pressure vessels and tanks;
- process units for cleaning, processing, treatment and primary conditioning of natural gas and crude; complete oil and gas industry facilities and complete chemical and petrochemical production lines;

- facilities on EPC terms;
- installation, supervision over installation, pre-commissioning, designer's supervision, training of Customer's personnel;
- spare parts supply, modernization and replacement of equipment;
- engineering.

Unique manufacturing and testing complex together with advanced scientific and technological potential and human resources of the Company enables to solve non-standard tasks in terms well ahead of traditional ones. Products quality is ensured by means of quality control system at all production stages in accordance with international standard ISO 9001. Designing, production and testing of finished products are performed in compliance with domestic (GOST, Ukr SEPRO) as well as recognized international standards (API, ASME, ISO, EN).



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3 Introductory part

PJSC «Sumy NPO» is one of the oldest enterprises in manufacturing of heavy duty reciprocating compressors. The first super power compressor with capacity of 10 000 m³/hour for pressure of 300 atmosphere was manufactured by the company in 1933 for Bereznikovsky chemical plant. In 1949 the first heavy duty horizontal compressor 1G-166/320 was produced. Reciprocating compressors of high and super-high pressure are used for the production of mineral fertilizers, for production of polyethylene under high pressure, compression of natural and associated petroleum gas, air, nitrogen, hydrogen, in the petrochemical and metallurgical industries.

The specialists of the company have mastered the production of a number of general-purpose compressors, unique compressors for hydrogen-containing gas compressing in the oil refining industry, fuel gas for power plants, for complete facilities when compressing associated petroleum and natural gas, compressors for locking end gas-dynamic seals of centrifugal compressor units. The company focuses on the production of high-speed reciprocating compressors, which makes it possible to create reciprocating gas-compressor units driven by gas-piston engines.

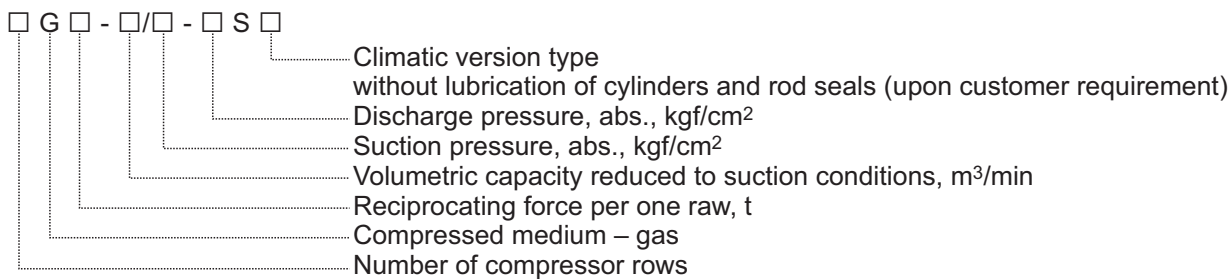
All compressors are equipped with a system of automatic control and protection, which ensures control of basic operating parameters, emergency warning and alarms and shutdown of prime movers.

Depending on the requirements of the customer, the equipment is manufactured for various parameters of capacity and power, final pressure and compression ratio. Possessing a powerful production and scientific and technical potential, the enterprise can execute the development of drawings as soon as possible, produce, test and deliver the required equipment to the customer, perform its installation, commissioning and, if necessary, provide its servicing.



No.	Base designation	Number of rows	Maximum reciprocating force, t	Maximum shaft rotational speed, rpm	Type of bearings	Catalogue page No.
1	2GM2.5	2	2.5	1000	roller	10
2	4GM2.5	4	2.5	1000	roller	11
3	2GM4	2	4.0	750	sliding	12
4	2GM10	2	10.0	600	sliding	13
5	4GM10	4	10.0	600	sliding	14
6	2GM10A	2	10.0	1000	sliding	15
7	2GM16	2	16.0	375	sliding	16
8	4GM16	4	16.0	375	sliding	17
9	4GM25	4	25.0	375	sliding	18
10	6GM25A	6	25.0	1000	sliding	19
11	GT1	1	1.0	1000	roller	20
12	2GT1.6	2	1.6	1000	roller	21
13	6W	6	1.6	1500	roller	22

Reciprocating compressor designation structure:



Compressor designation example:

4GM10-48/2-57S UHL4

- 4 - number of rows;
- G - gas (compressed medium);
- M10 - opposite with reciprocating force for one row - 10 t;
- 48 - volumetric capacity reduced to suction conditions, m³/min;
- 2 - absolute suction pressure, kgf/cm²;
- 57 - absolute discharge pressure, kgf/cm²;
- S - version without lubrication of cylinders and rods seals;
- UHL4 - climatic version as per GOST 15150



5 Basic Design Solutions

Design solutions	Compressor base:						
	M 2.5	M 4	M 10	M 10A	M 16	M 25	M 25A
Number of rows	2, 4	2	2, 4	2	2, 4	4	6
Number of main bearings	2, 3, 4	2	3, 5	2	3,5	5	7
Moving mechanism lubrication	Sprinkling	Circulation under pressure					
Lube oil pump drive		-	Crank shaft	Auxiliary electric motor			
Barring gear	no	no	yes	no	yes	yes	no
End of crankshaft	keyed/ flange						
Lubrication of cylinders and rod seals	with lubrication	with lubrication/ w/o lubrication	with lubrication/ w/o lubrication	with lubrication	with lubrication/ w/o lubrication	with lubrication/ w/o lubrication	with lubrication
Intermediate insert	Type A, B, C, D (as per API 618)						
Main parts manufacturing method:							
Crankcase	Casting						
Crankshaft	Stamping	Forging					
Connecting rod	Stamping	Forging			Forging/ Stamping	Forging	
Connecting-rod bolt	Forging or machining of bar stock						
Connecting-rod nut	Forging or machining of bar stock						
Crosshead	Casting		Forging		Casting		
Crosshead pin	Forging or machining of bar stock						
Crosshead nut	Forging or machining of bar stock						
Intermediate insert	Casting						
Cylinder	Casting/Forging/Forging+welding						
Cylinder sleeve	Casting						
Cylinder cover	Casting/Forging						
Piston	Casting/Forging/Welding						
Rod	Forging or machining of bar stock						
Rod nut	Forging or machining of bar stock						
Valve cover	Forging						
Rod seal casing and flange	Forging						
Valve body	Forging						
Valve plate	Sheet machining						
Valve spring	Broaching						



Compressor

1. Forged steel crankshaft for heavy duties.
2. Horizontally balanced opposite rows.
3. Crossheads made of casted steel with iron shoes (babbit filled) or aluminum shoes. Forced lube oil supply under pressure to upper and lower sliding surfaces for minimum wear.
4. Forged steel connecting rods.
5. Barring gear.

Cylinders and piston groups

1. Cylinders with bottom part and rod seals mounted therein (fig. 1) and without bottom part with rod seals mounted into intermediate insert (fig. 2).
2. Guide (journal) rings of pistons for lubricated and non-lubricated operation.
3. Indication of cylinder cavities.
4. Rod seals purging.
5. Rod seals cooling with cooling fluid (water, anti-freezing agent) or oil.
6. Cylinders structure without cooling or with cooling with cooling fluid.
7. Piston rods made of alloyed or corrosion resistant steel.

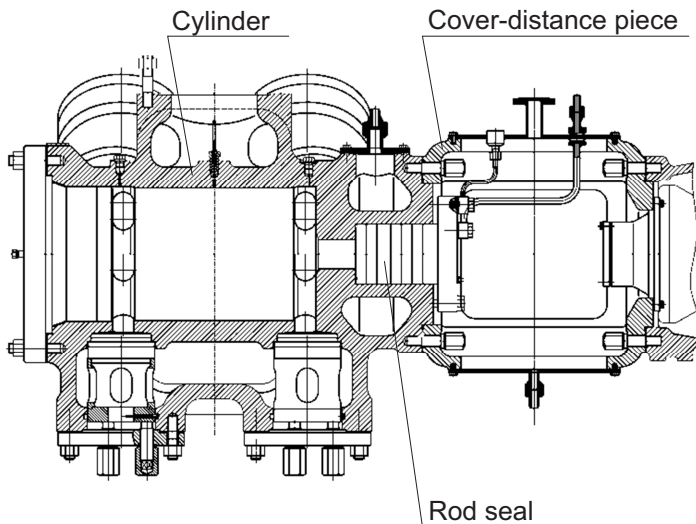


Figure 1

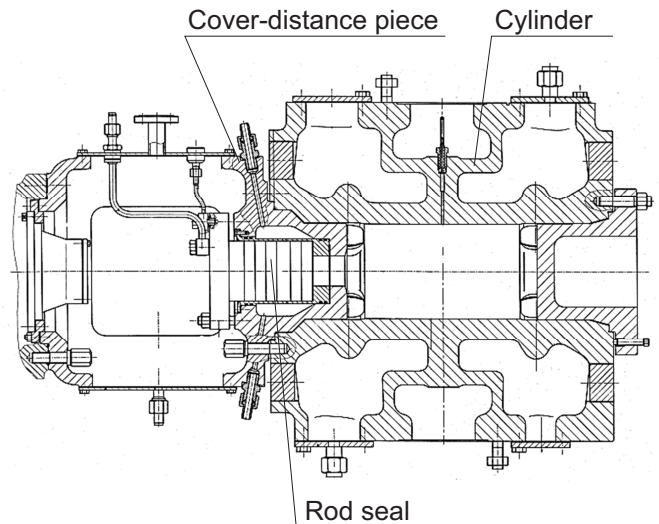


Figure 2

Valves

Disc, ring or band automatic valves depending on compressed gas and average speed of piston.

Capacity regulating devices (unloaders)

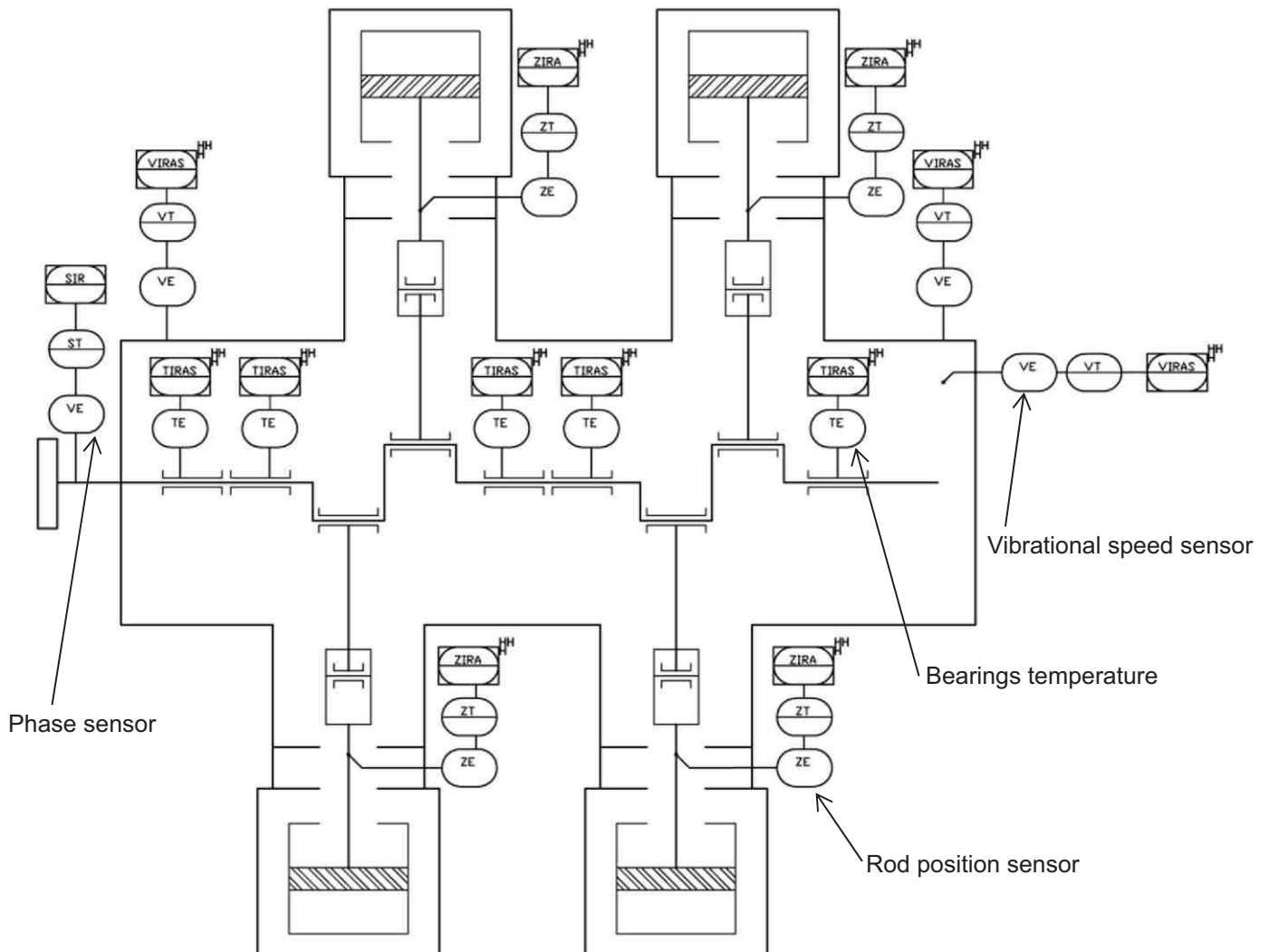
1. Additional dead space.
2. Pressing of plates of suction valves (Hoerbiger, CPI).

Pulsation suppression device

Buffer suction and discharge vessels for each compressor stage.



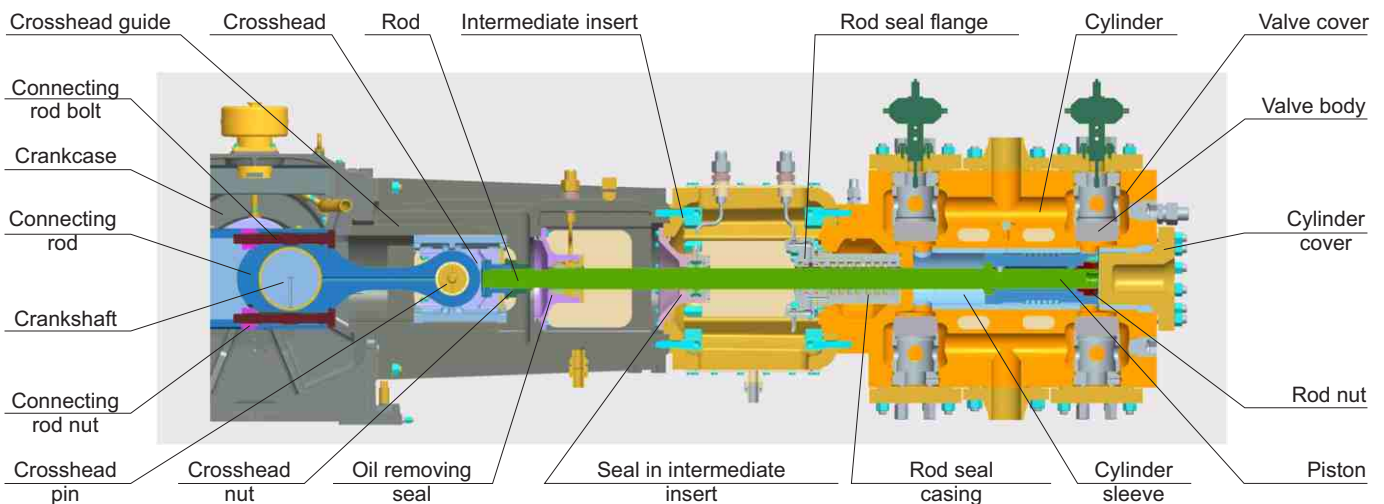
Vibration monitoring typical diagram



Vibration monitoring system provides continuous monitoring of temperature of connection rod bearings and control of wear of piston guide rings per rod vertical displacement (installation of additional sensors for rod horizontal displacement is possible) depending on the turn angle of compressor crankshaft as well as compressor crankcase vibrational speed control including archivation, processing and visualization of information, possessing warnings and alarms.



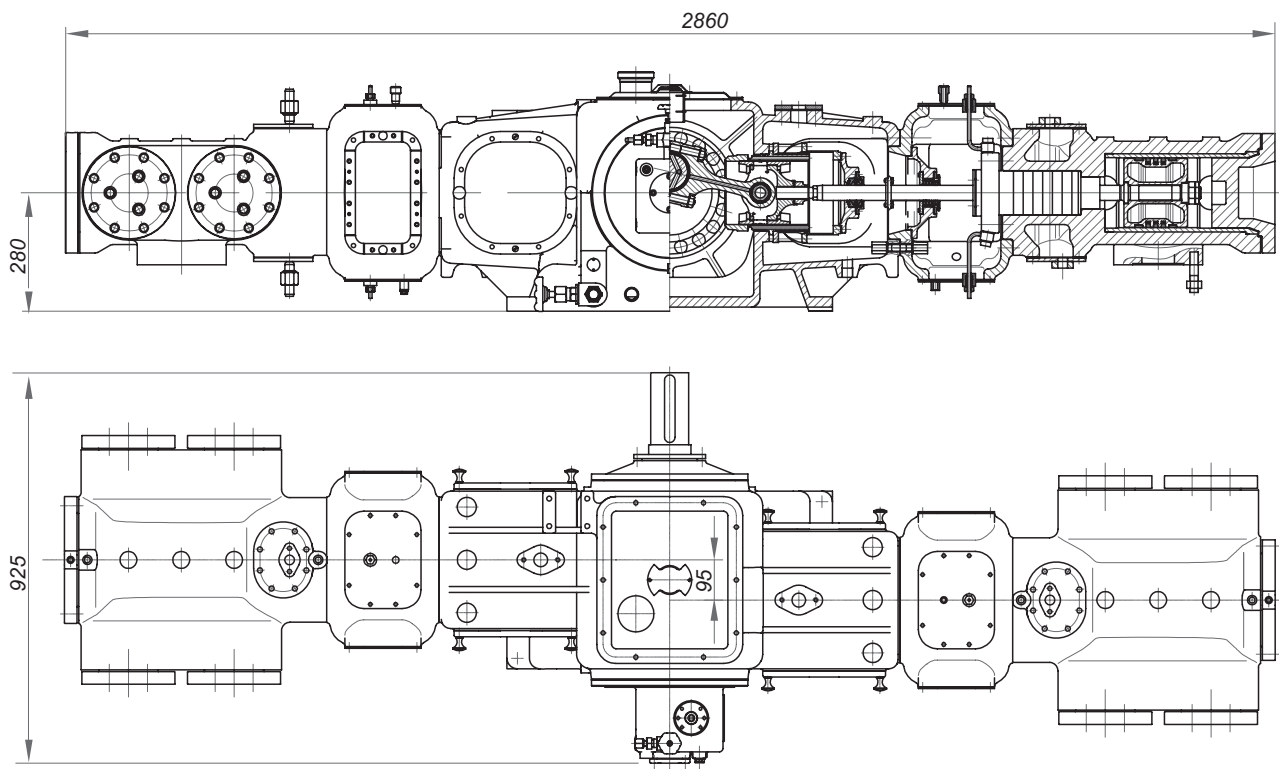
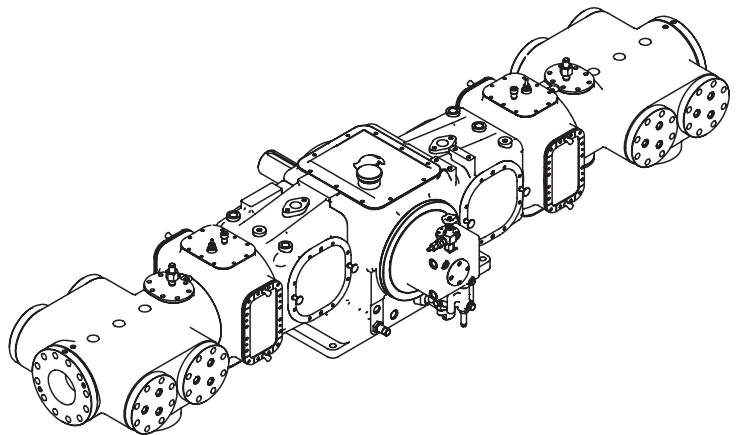
Part/component	Marking method	Marking data
Compressor	on nameplate	According to API 618
Crankcase	impact	Designation as per drawing, material grade, product No.
Main bearings covers	impact	Designation as per drawing, material grade, bearing consecutive number
Main and connecting-rod bearings bushings	impact	Thickness, distance of joints undercut, melting No. of babbit filling
Crankshaft	impact	Designation as per drawing, material grade, melting No., product No.
Connecting rod	impact	Designation as per drawing, compressor row No., material grade, sample No.
Connecting rod bolt	impact	Designation as per drawing, material grade, sample No.
Connecting rod nut	impact	Designation as per drawing, material grade
Crosshead	impact	Designation as per drawing, material grade, melting No., product No., row No.
Crosshead pin	impact	Designation as per drawing, material grade, melting No.
Crosshead nut	impact	Designation as per drawing, material grade
Cylinder group	on nameplate	According to API 618
Guide	impact	Designation as per drawing, material grade
Intermediate insert (distance piece)	impact	Designation as per drawing, material grade
Cylinders	impact	Designation as per drawing, material grade, product No., melting No.
Rod	impact	Designation as per drawing, material grade, product No.
Piston	impact	Designation as per drawing, material grade, product No.
Piston nut	impact	Designation as per drawing, material grade, product No.



Part	Material as per GOST	Material analogue as per ASME/AISI
Crankcase	C420	A48-No.30B
Crankshaft	40, 40XH, 45, 38X2MЮA	A105, 3140, A107, J24056 (K24065)
Connecting rod	40, 45, 40XH, 30XMA-Ш	A105, A107, 3140, 4130
Connecting rod bolt	40XH2MA-Ш	4340 (9840)
Connecting rod nut	40X, 40XH, 38XA	5140, 3140, 5140H
Crosshead	20ГЛ, 38X2MЮA	A352GrLCC, J24056
Crosshead pin	20, 20X	A105, 5120
Crosshead nut	40, 40X	1040, 5140
Intermediate insert	C420, C425, C430, 12X18H9ТЛ	A48-No.30B, No.35B, No.45B
Cylinder	C420, C425, C430, C435, 20, 35, 40, 20ГЛ, 20ГМЛ, 20ЮЧ, 40X, 12X18H9ТЛ, 08X18H10Т, 03X17H14M3	A48-No.30B, No.35B, No.45B, No.50B; A105, 1035, 1040, A352GrLCC, 5140, J92630, 321, 316L
Cylinder sleeve	C425, C430, C435, 20X13, 30X13, 40X13, 38X2MЮA-Ш	A48-No.35B, No.45B, No.50B; A420, J24056 (K24065)
Cylinder cover	C420, C425, C430, C435, 20, 35, 40, 40X, 20ГЛ, 20ГМЛ, 20ЮЧ, 12X18H9ТЛ, 08X18H10Т, 03X17H14M3	A48-No.30B, No.35B, No.45B, No.50B; A105, 1035, 1040, 5140 A352GrLCC, J92630, 321H, 321, 316L
Piston	C420, C425, C430, 20, 35, 40, 45, 38XA, 38X2MЮA, 38XH3MΦA-Ш, 20X13, 12X18H10Т, 08X17H15M3Т	A48-No.30B, No.35B, No.45B; A105, 1035, 1040, A107, 5140H, J24056 (K24065), 4330, A420, 321H, 316Ti
Rod	38X2MЮA-Ш, 40XH2MA-Ш, 20X13-Ш, 30X13, 40X13	J24056 (K24065), 4340, A420
Rod nut	35, 40, 40X, 38XA, 12X13, 20X13, 30X13	1035, 1040, 5140, 5140H, A403, A420
Valve cover	35, 40, 40X, 38XA, 20ЮЧ, 30X13, 10X17H13M3Т	1035, 1040, 5140, 5140H, SA-333 Gr3, A420, 316Ti
Rod seal casing and flange	35, 40, 45, 40X, 40XH, 20X13, 08X17H15M3Т	1035, 1040, 5140, 3140H, A420, 316Ti
Valve body	20X13	A420
Valve plate	30X13, purchased Lange Consulting	A420
Valve spring	12X18H10Т	321H



10 Compressor on 2GM2.5 base

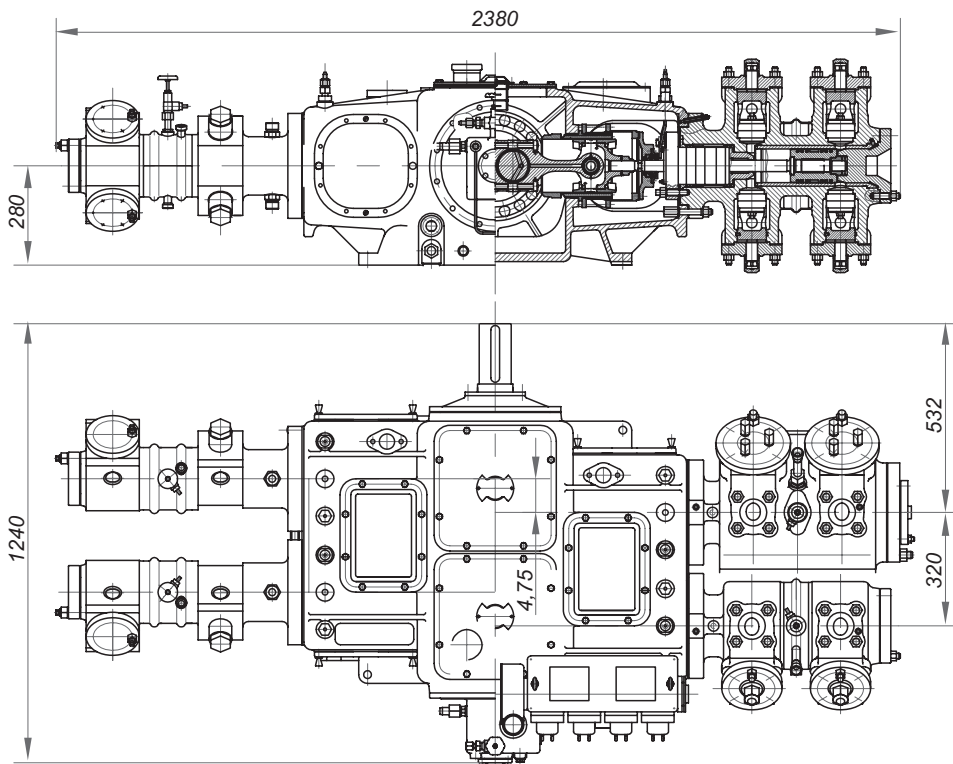
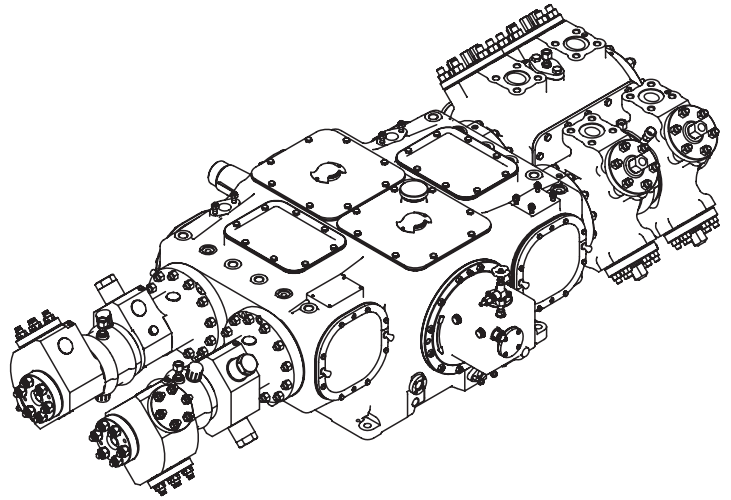


Specifications

Type of compressor		reciprocating, double row on opposite base 2GM2.5
Reciprocating force	t	2.5
Number of rows		2
Piston stroke	mm	100
Maximum rotational speed of crankshaft	rpm	1000
Maximum capacity at compressor shaft	kW	130
Type of bearings		roller bearings



11 Compressor on 4GM2.5 base

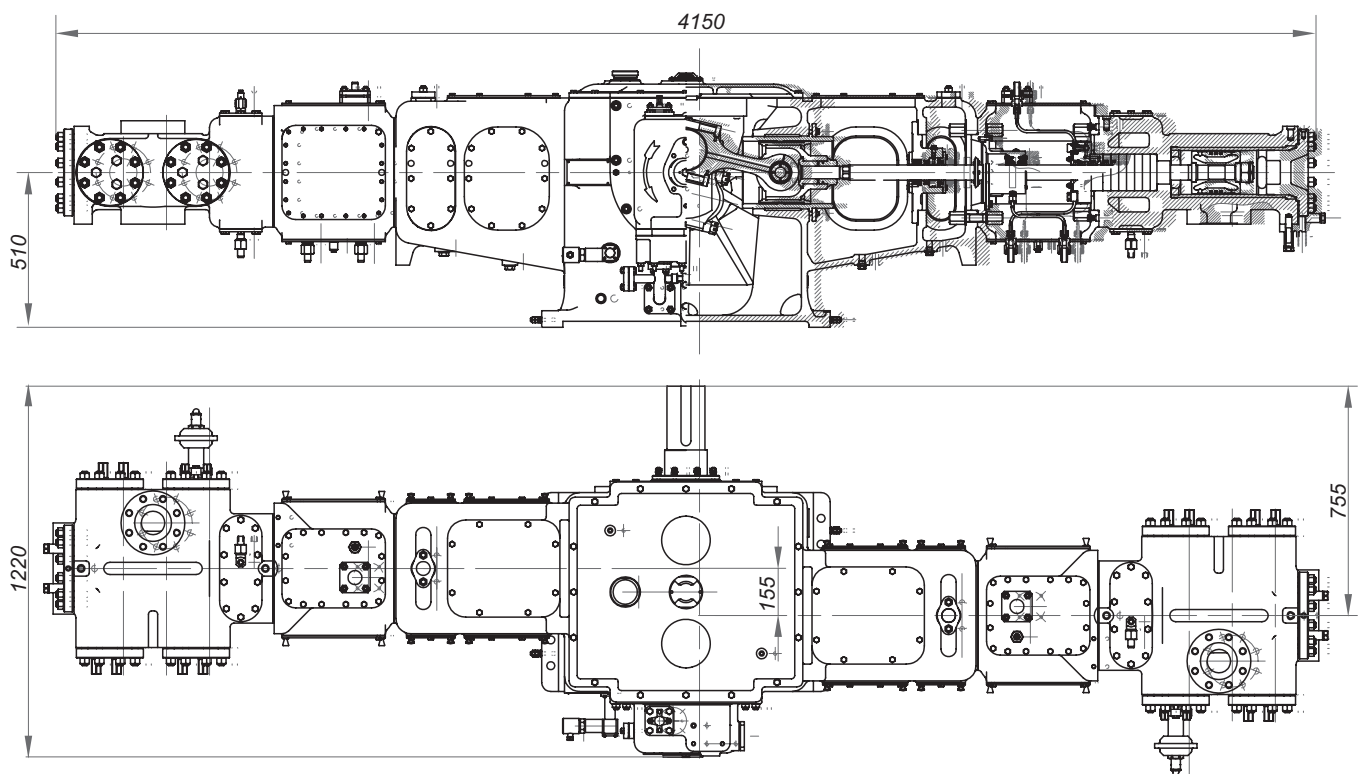
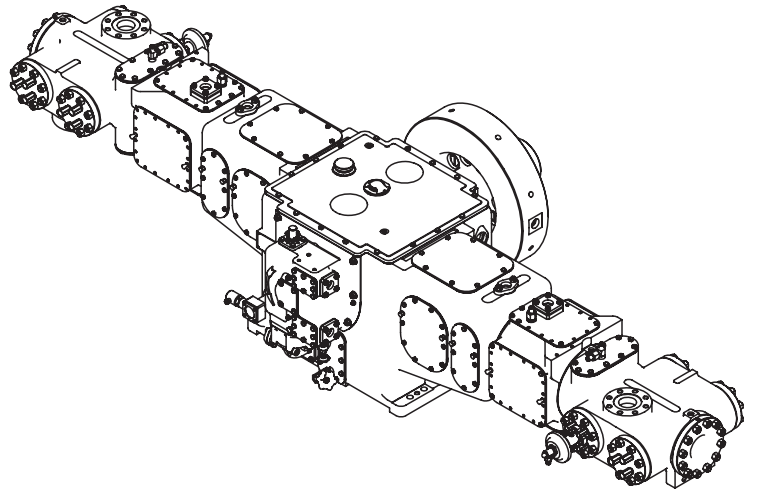
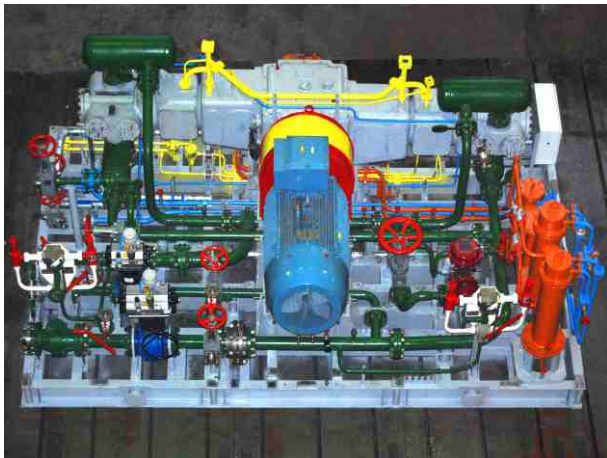


Specifications

Type of compressor		reciprocating, four row on opposite base 4GM2.5
Reciprocating force	t	2,5
Number of rows		4
Piston stroke	mm	100
Maximum rotational speed of crankshaft	rpm	1000
Maximum capacity at compressor shaft	kW	260
Type of bearings		roller bearings



12 Compressor on 2GM4 base

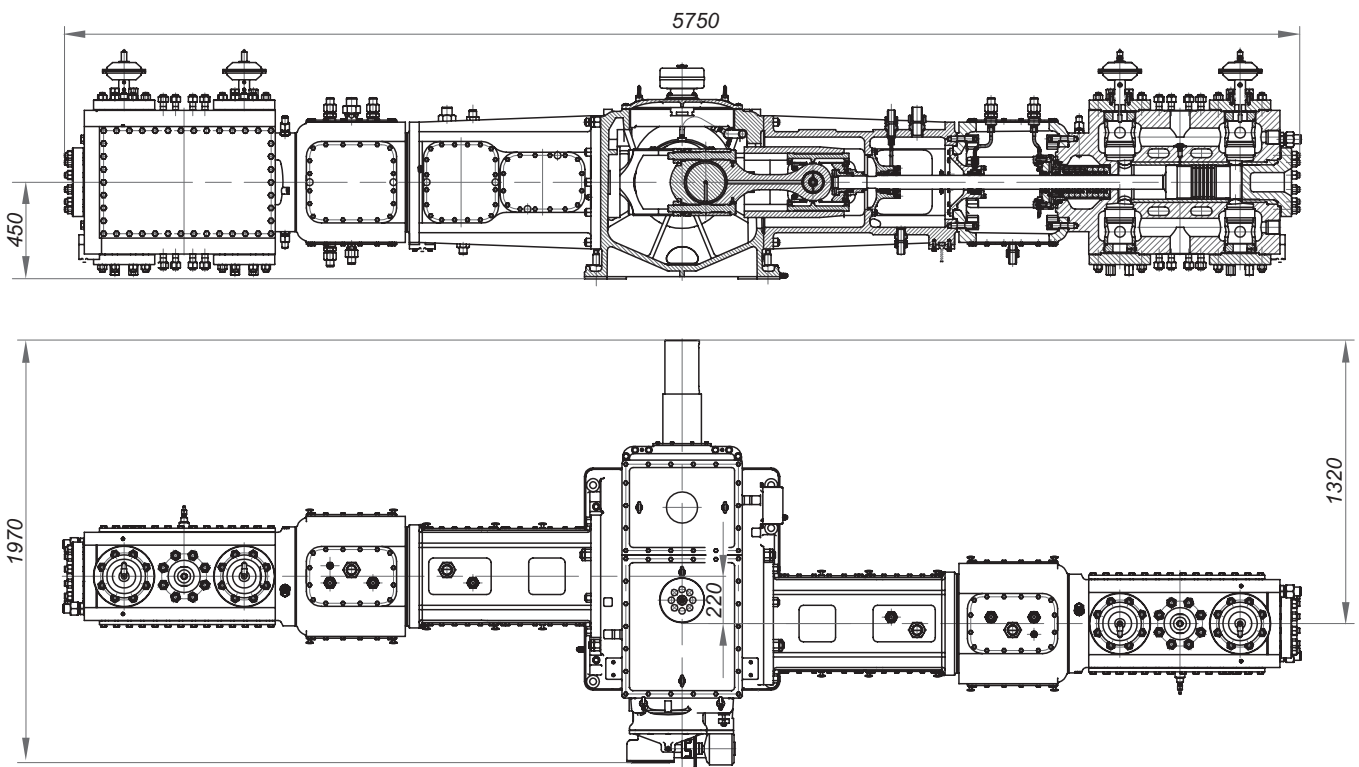
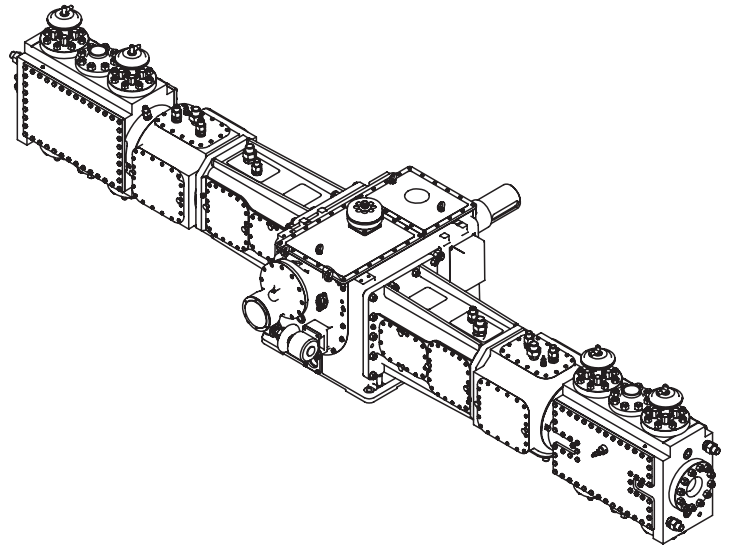


Specifications

Type of compressor		reciprocating, double row on opposite base 2GM4
Reciprocating force	t	4
Number of rows		2
Piston stroke	mm	150
Maximum rotational speed of crankshaft	rpm	750
Maximum capacity at compressor shaft	kW	200
Type of bearings		sliding bearings



13 Compressor on 2GM10 base

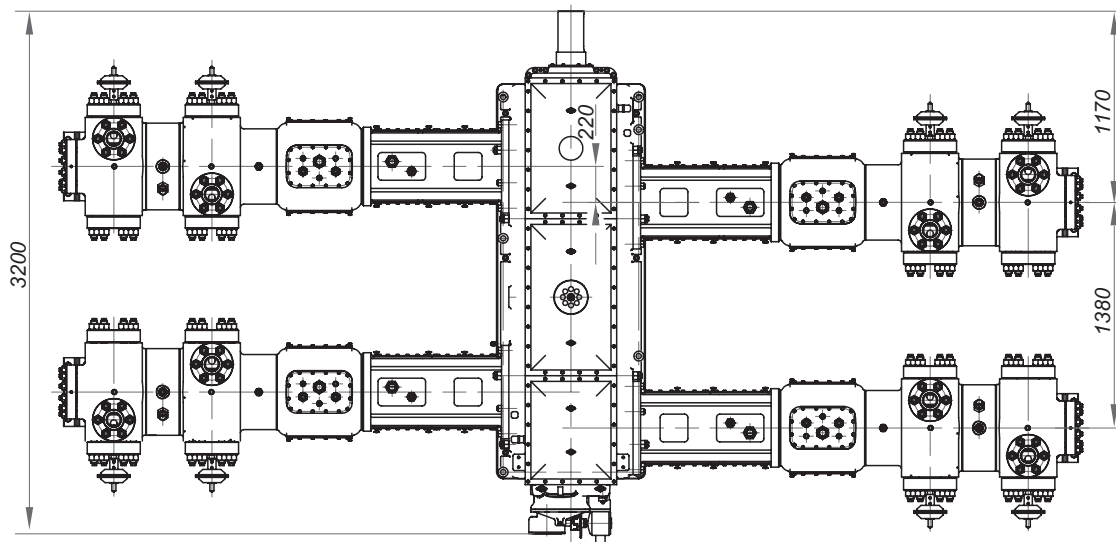
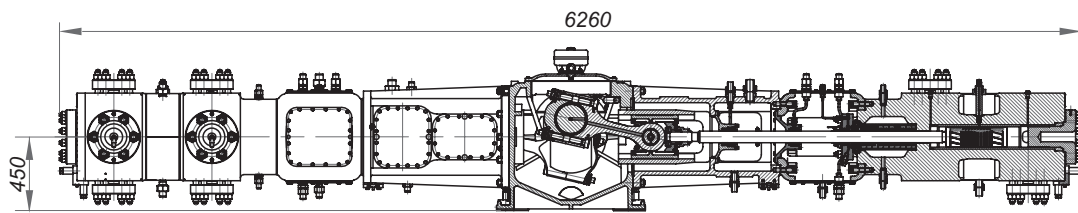
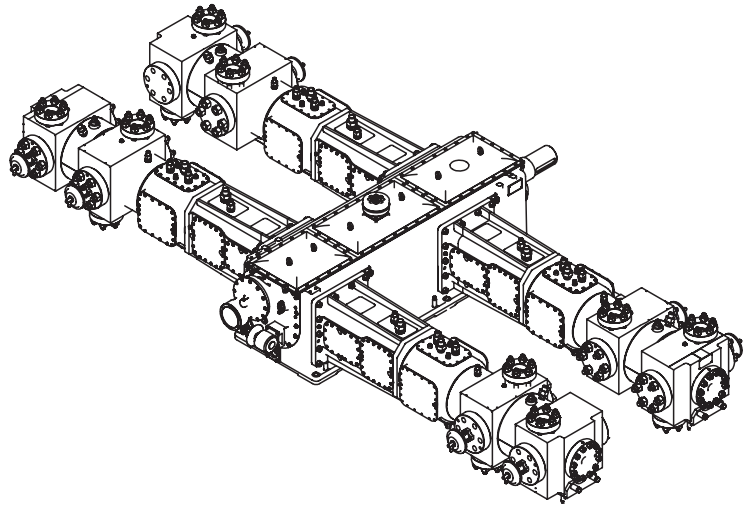


Specifications

Type of compressor		reciprocating, double row on opposite base 2GM10
Reciprocating force	t	10
Number of rows		2
Piston stroke	mm	220
Maximum rotational speed of crankshaft	rpm	600
Maximum capacity at compressor shaft	kW	580
Type of bearings		sliding bearings



14 Compressor on 4GM10 base

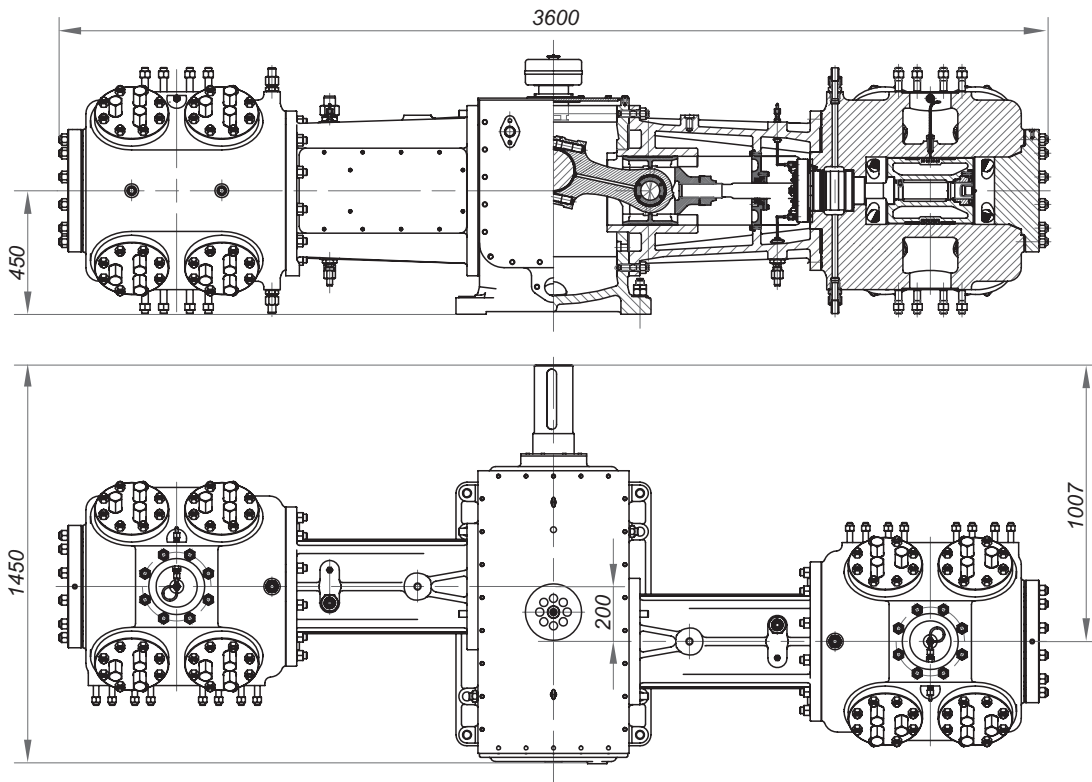
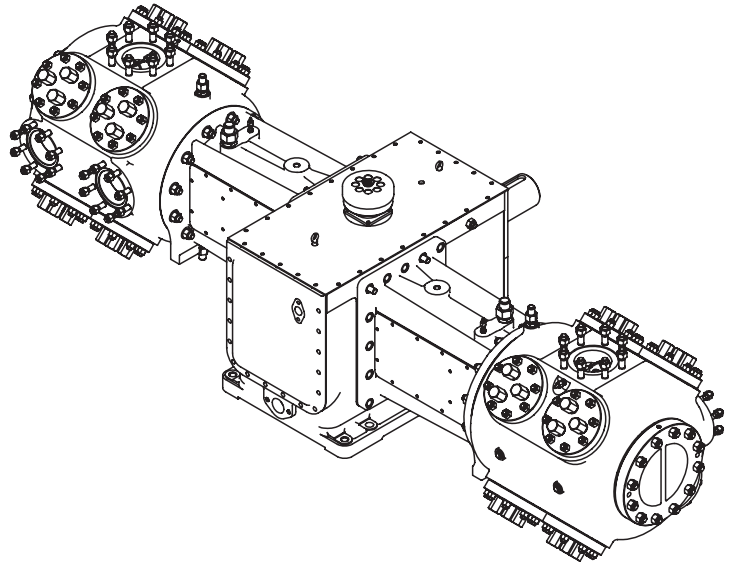


Specifications

Type of compressor		reciprocating, double row on opposite base 4GM10
Reciprocating force	t	10
Number of rows		4
Piston stroke	mm	220
Maximum rotational speed of crankshaft	rpm	600
Maximum capacity at compressor shaft	kW	1000
Type of bearings		sliding bearings



15 Compressor on 2GM10A base

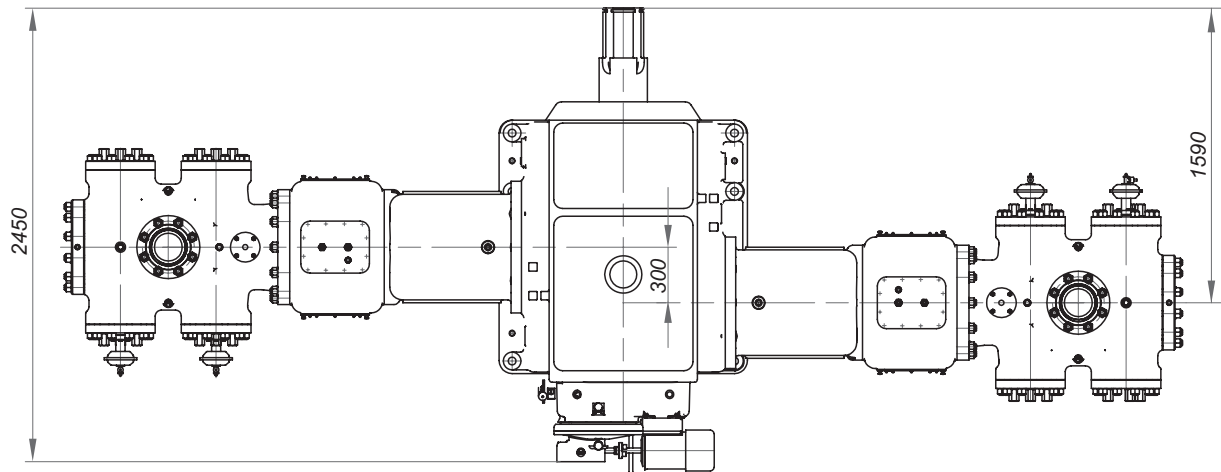
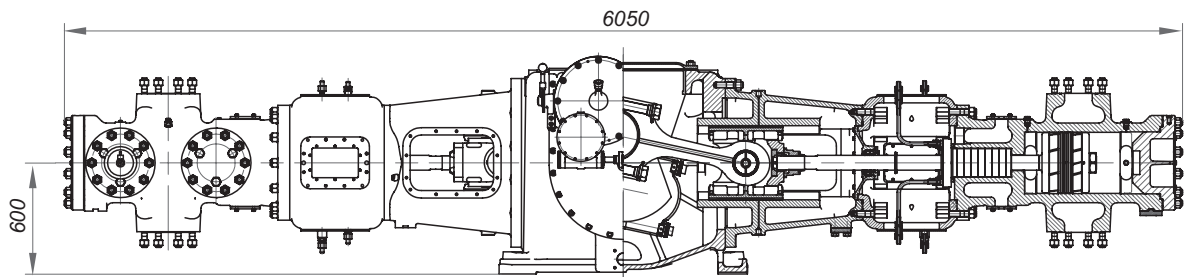
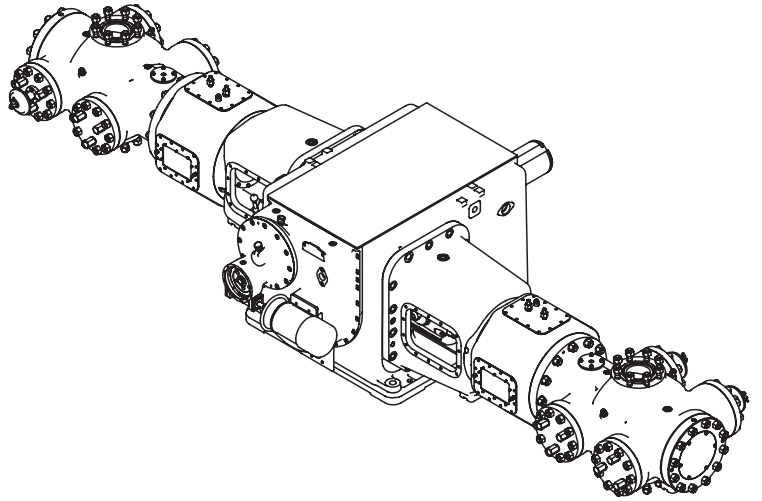


Specifications

Type of compressor		reciprocating, double row on opposite base 2GM10A
Reciprocating force	t	10
Number of rows		2
Piston stroke	mm	150
Maximum rotational speed of crankshaft	rpm	1000
Maximum capacity at compressor shaft	kW	580
Type of bearings		sliding bearings



16 Compressor on 2GM16 base

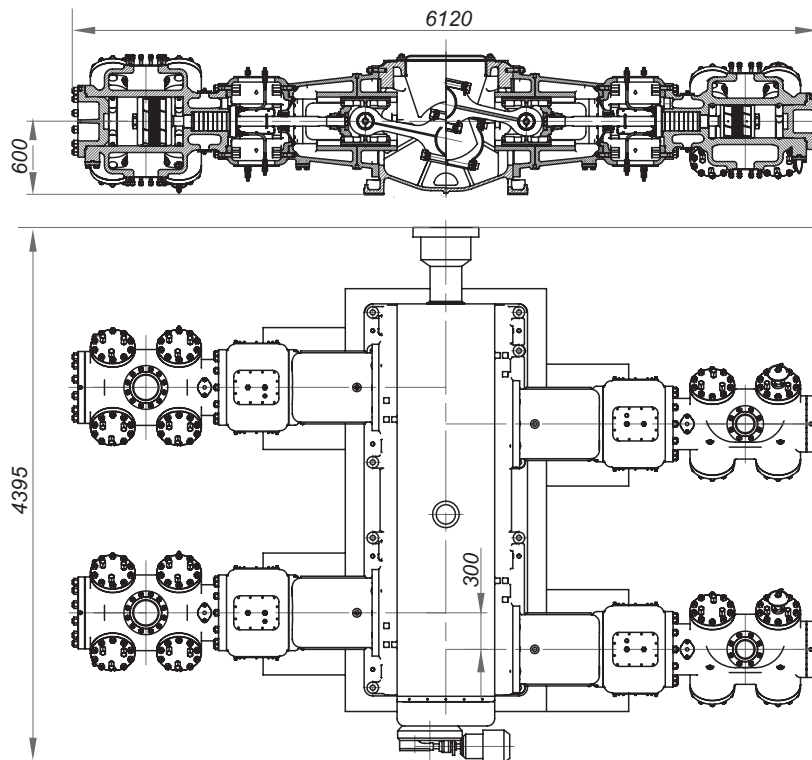
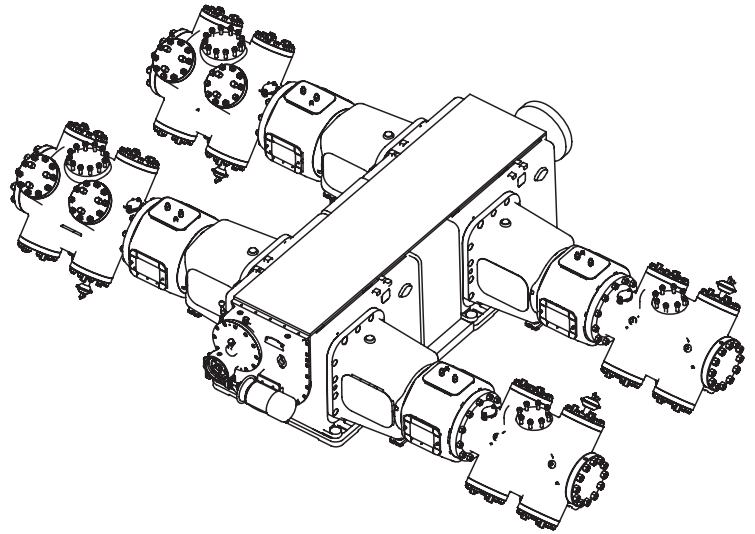
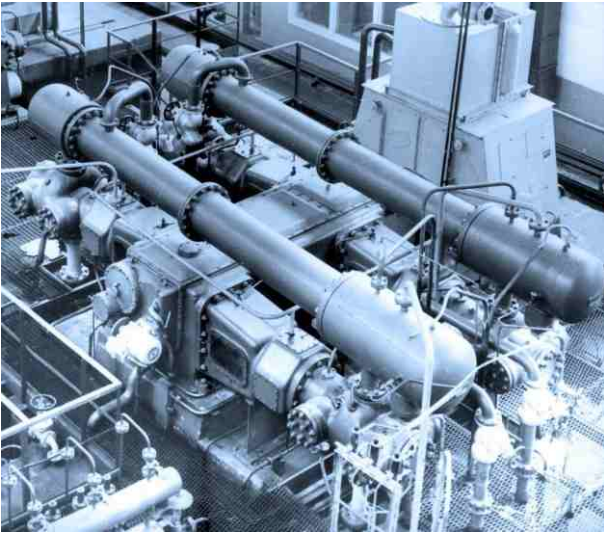


Specifications

Type of compressor		1.reciprocating, double row on opposite base 2GM16
Reciprocating force	t	16
Number of rows		2
Piston stroke	mm	320
Maximum rotational speed of crankshaft	rpm	375
Maximum capacity at compressor shaft	kW	1110
Type of bearings		sliding bearings



17 Compressor on 4GM16 base

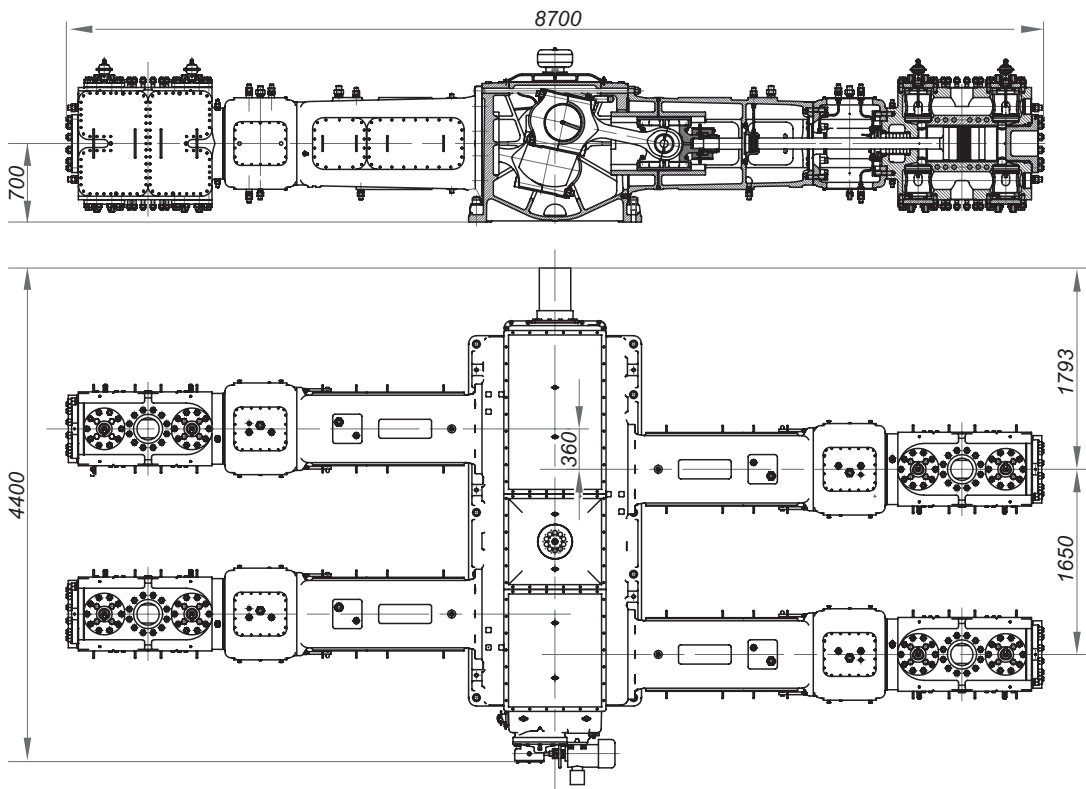
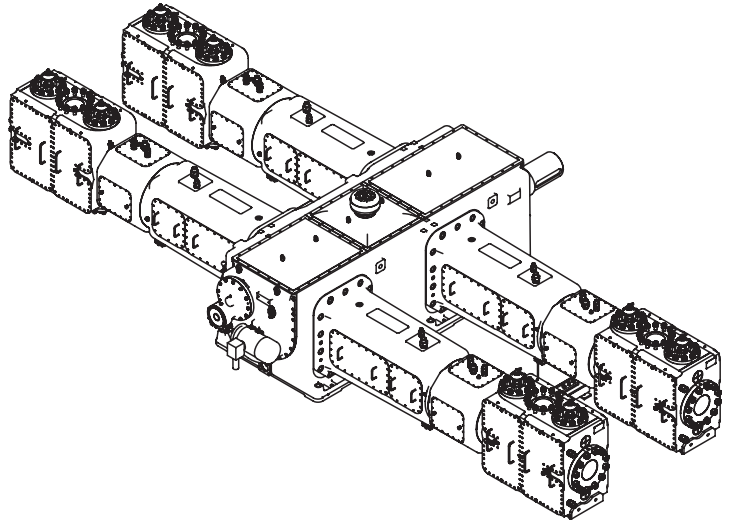


Specifications

Type of compressor		reciprocating, double row on opposite base 4GM16
Reciprocating force	t	16
Number of rows		4
Piston stroke	mm	320
Maximum rotational speed of crankshaft	rpm	375
Maximum capacity at compressor shaft	kW	2200
Type of bearings		sliding bearings



18 Compressor on 4GM25 base

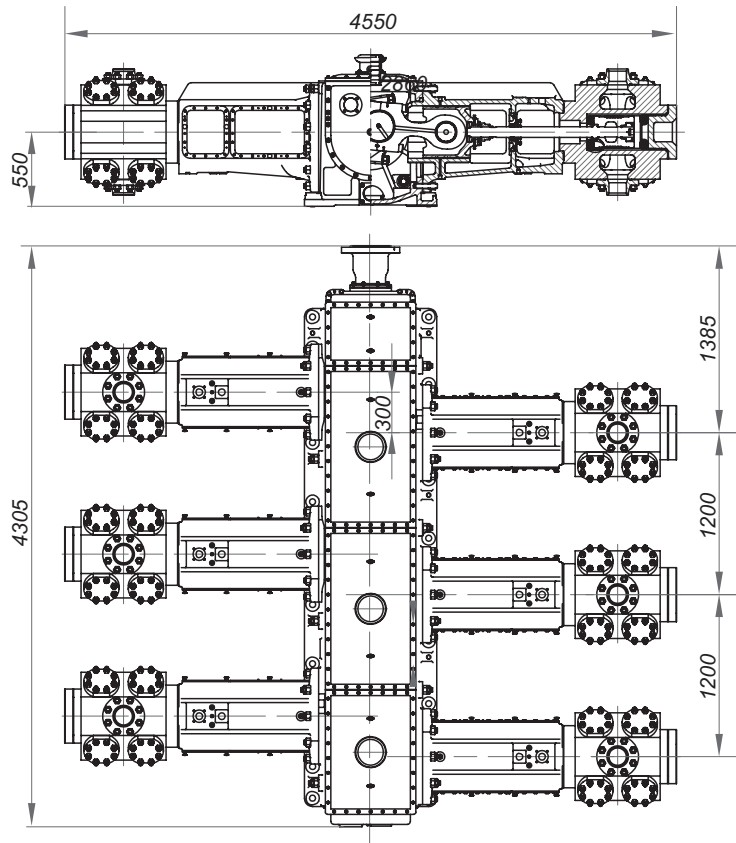
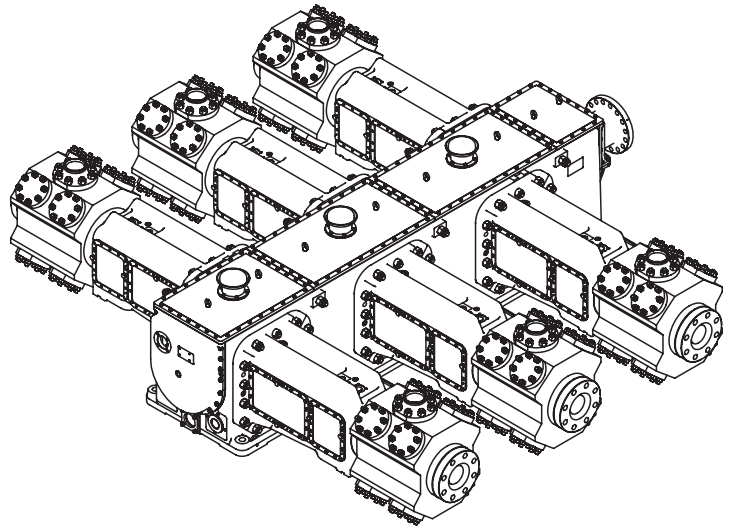


Specifications

Type of compressor		reciprocating, double row on opposite base 4GM25
Reciprocating force	t	25
Number of rows		4
Piston stroke	mm	400
Maximum rotational speed of crankshaft	rpm	325
Maximum capacity at compressor shaft	kW	3100
Type of bearings		sliding bearings



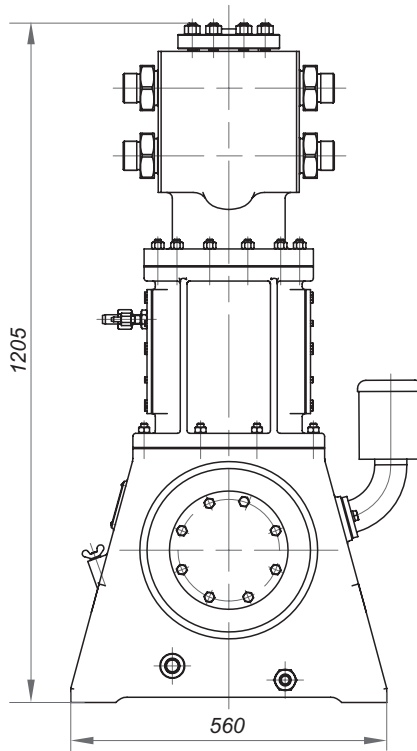
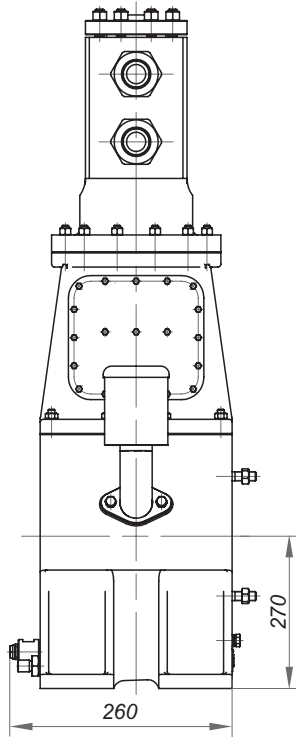
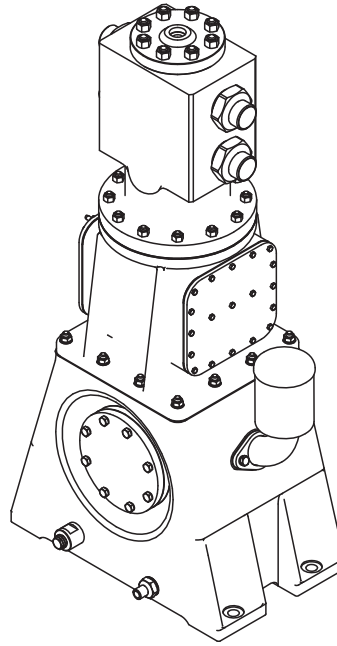
19 Compressor on 6GM25A base



Specifications

Type of compressor		reciprocating, six row on opposite base 6GM25A
Reciprocating force	t	25
Number of rows		6
Piston stroke	mm	150
Maximum rotational speed of crankshaft	rpm	1000
Maximum capacity at compressor shaft	kW	4700
Type of bearings		sliding bearings



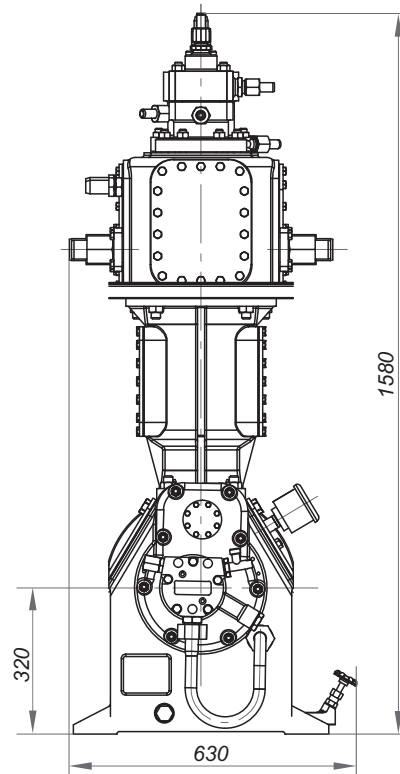
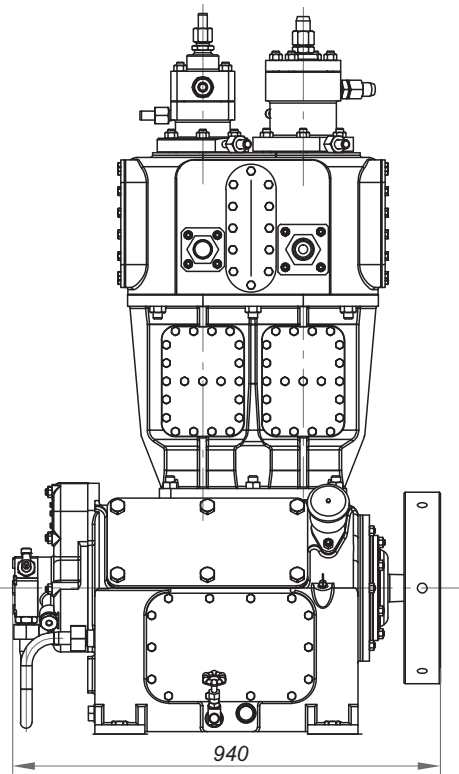
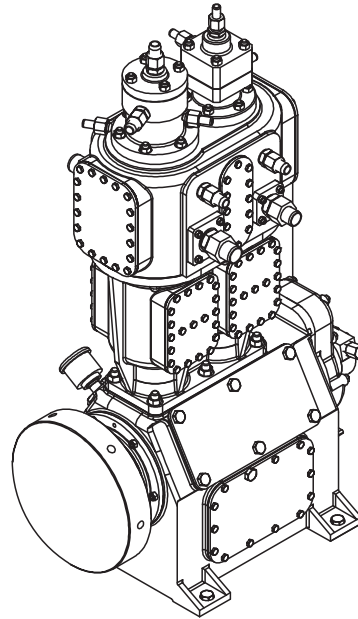


Specifications

Type of compressor		reciprocating, vertical, crosshead, based on GT1
Reciprocating force	t	1.0
Number of rows		1
Piston stroke	mm	60
Maximum rotational speed of crankshaft	rpm	1000
Maximum capacity at compressor shaft	kW	20
Type of bearings		roller bearings



21 Compressor on 2GT1.6 base

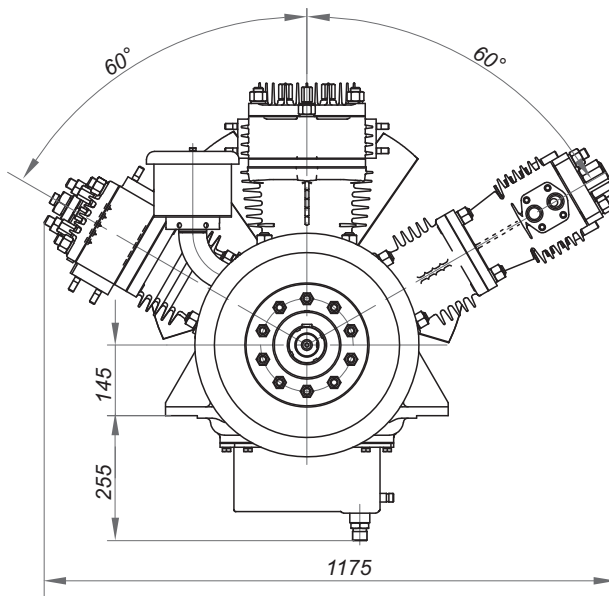
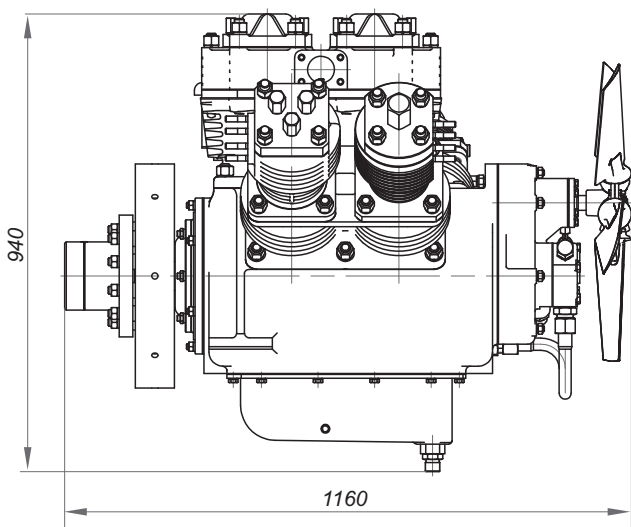
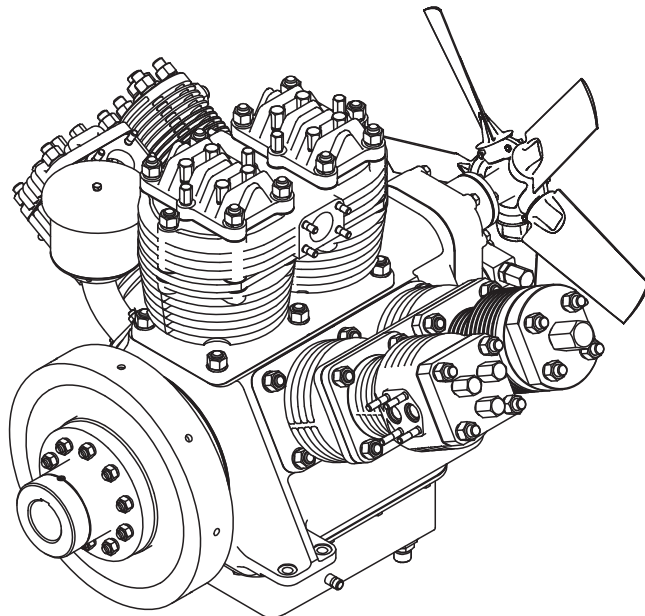


Specifications

Type of compressor		reciprocating, vertical, crosshead, based on 2GT 1.6
Reciprocating force	t	1.6
Number of rows		2
Piston stroke	mm	60
Maximum rotational speed of crankshaft	rpm	1000
Maximum capacity at compressor shaft	kW	45
Type of bearings		roller bearings



22 Compressor on 6W base



Specifications

		Specifications	
Type of compressor		reciprocating, crosshead, W-shaped, with cylinders' air cooling	
Reciprocating force	t	1.6	
Number of rows		6	
Piston stroke	mm	60	
Maximum rotational speed of crankshaft	rpm	1500	
Maximum capacity at compressor shaft	kW	75	
Type of bearings		roller bearings	



Certificates of compliance:

- Certificate of quality management system compliance with ISO 9001:2008 standard;
- Certificate of compliance of industrial health and safety management system with OHSAS 18001-2007 standard;
- Certificate of compliance of environmental protection management system with ISO 14001-2004 standard;
- Certificates of conformity with API 618 for reciprocating compressors on opposite base with piston load of 2.5, 4, 10, 16 and 25 tons per one row;
- ASME Manufacture Approval Certificate.

