INDUSTRIAL SOLID FUEL CENTRAL HEATING BOILERS WITH MOVING GRATE

Industrial solid fuel central heating boilers with moving grate, automated fuel supply and automatic processor control are used for the provision of heating and hot water for dwelling, manufacturing and other premises with an installed central heating system, as well as the provision of hot water and heat for commercial purposes and heat processes (e. g. drying grain). The equipment can work automatically with minimum periodic supervision and maintenance. Saw dust or chips up to 50 mm long and up to 45% moisture content are used for fuel. In cases of fuel with a higher moisture content being used, the boiler might not produce the heat capacity needed, which may lead to poorer heat efficiency.

These are shell drum type boilers. On the front side of the double walls of the combustion chamber there are servicing doors. Fuel is supplied on to a moving grate from the rear of the boiler via a hydraulic or auger delivery system. Combustion takes place on the grate. The bottom part of the walls is layered with heat resistant bricks and the bricks arch over the fire grate, which allows maintenance of the optimal combustion mode. Combustion air is supplied through the holes in the front side of the boiler.

Primary and secondary air is supplied by variable speed fans that are controlled by the programmable logic controller (PLC) control system. This alters the air according to load and emission-requirements. Primary air is supplied to the underside of the fire grate and is adjustable to the front or rear of the grate depending on fuel air requirements.

Pre-heated secondary air can be supplied to an optimum location via adjustable nozzles which are situated down the length of the ceramic arch.

In the end of the fire grate there is a channel with an auger transporter used for automatic de-ashing.

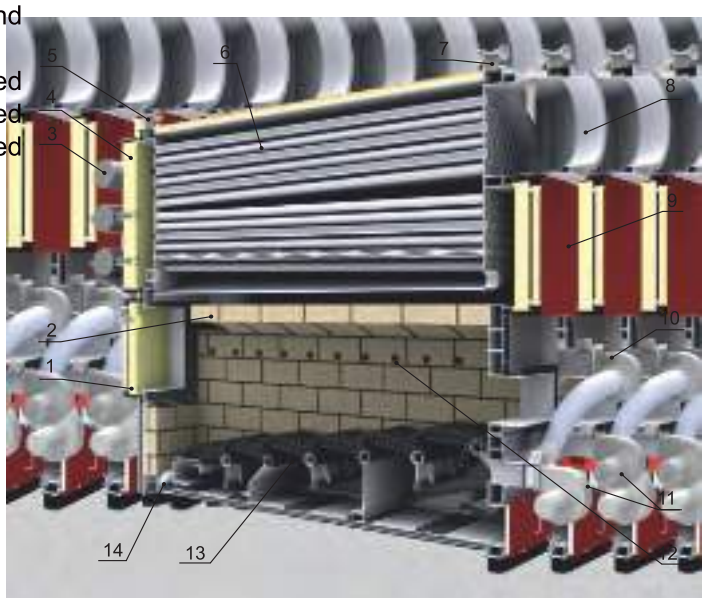
The fuel feeding and control system equipment are designed and manufactured according to individual customer's requirements and depending on installation conditions on site.

Should the expected size of fuel be greater than the designated maximum size, then measures protecting the system from oversized fuel may be installed. Such oversized fuel may then be manually fed into the combustion chamber via a servicing door.

Kalvis 140M-1...
Kalvis 1300M-1

Features of the boiler:

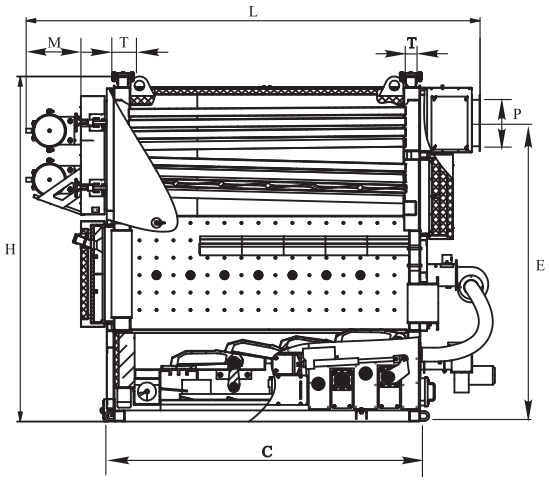
- excellent environmental performance;
- large number of fuel options: saw dust, chips, saw dust pellets, grain, grain waste and other fuel;
- logs may be stoked manually;
- high efficiency;
- 4 fume turns;
- moving fire grate;
- heat resistant arch ensures efficient combustion of fuel;
- automated de-ashing;
- 2 heat exchanger doors which allow for easy cleaning and maintenance;
- inspection glass in the combustion chamber door;
- automatic control of draught in the combustion chamber;
- combustion chamber and heat exchanger are separated for easier transportation and installation;
- automatic cleaning of heat exchanger with compressed air.

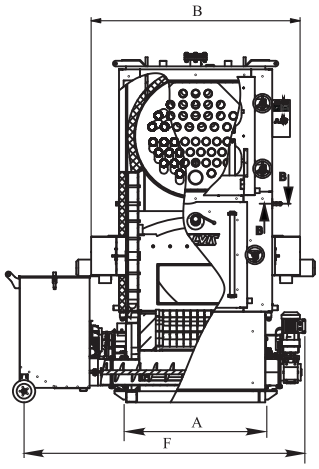


1. Servicing door
2. Heat resistant concrete arch
3. Compressed air receivers
4. Heat exchanger door
5. Return water pipe
6. Shell heat exchanger
7. Hot water pipe
8. Smoke outlet
9. Heat exchanger door
10. Secondary air fan
11. Primary air fan
12. Secondary air supply holes
13. Moving fire grate
14. Ash screw

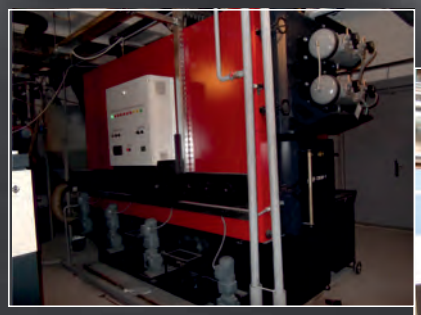
Model			K-140M-1	K-320M-1	K-500M-1	K-720M-1	K-950M-1
Type			water heating, automatically stoked and deashed, shell, drum, 4 fume turns				
Nominal heat output		kW	140	320	495	720	950
Minimal heat output		kW	42	96	149	216	285
Main fuel			saw dust, chips length not more than 50 mm				
Other fuel			saw dust, chips, sunflower pellets and grain				
Moisture main fuel up to			40 % moisture content of shredded wood (2407 kcal/h)				
Fuel consumption		kg/h	62	141	220	317	419
Efficiency		%	85*				
Boiler water temperature control range		^{0}C	60...110				
Maximum water pressure in the boiler		MPa (kg/cm^2)	0,6 (6)				
Water volume in the boiler		m^3	0,58	1,15	1,66	2,2	3
Debit of water (Δt =20 ^{0}C)		m^3/h	6,02	13,76	21,29	30,96	40,85
Hydraulic resistance (Δt =20 ^{0}C)		mm H_2O	0,014	0,134	0,144	0,282	0,43
Aerodynamic resistance (Q_n)		Pa	180	270	300	320	340
Debit of flue gas		m^3/h	750	1714	2677	3856	5087
Loading chamber dimensions, HxBxL		mm	440x400x 1230	570x570x 2000	530x700x 2000	530x700x 2800	560x910x 2800
Connection dimensions	pipes	mm	65(2½")			80(3")	
	pipe flanges	mm	Ø160				
	smoke outlet	mm	Ø240	Ø325	Ø380	Ø380	Ø480
Weight		kg	2500	4900	5820	7300	9700

* When 32% moisture wood chips are used.





Boiler	HxBxL, mm	A, mm	C, mm	E, mm	F, mm	M, mm	P, mm	T, mm
K-140M-1	2105x1300x1900	800	1400	1534	1500	304	Ø240	Ø76
K-320M-1	2480x1500x2810	1000	2160	2154	1970	374	Ø325	Ø76
K-500M-1	2610x1630x2840	1400	2620	2370	2400	400	Ø380	Ø89
K-720M-1	2765x1630x3640	1400	2920	2520	2400	400	Ø380	Ø89
K-950M-1	2950x1840x4180	1400	3220	2520	2400	400	Ø480	Ø89



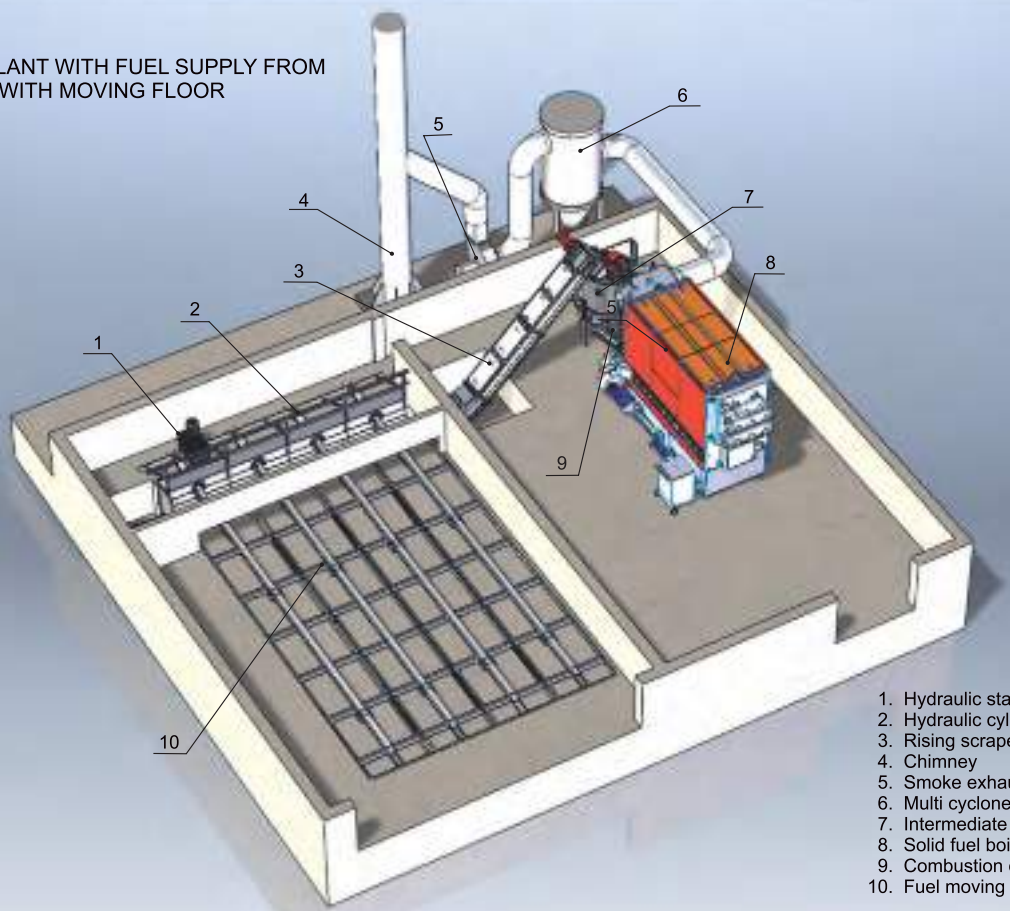
COMPOSITION OF HEATING PLANT EQUIPMENT

Depending on the output of the boiler, type of fuel used and customer preference, different fuel supply systems may be used. For fuel that does not tend to clog supply routes (e.g. pellets, grain) a silo or underground storage, various tanks with inclined floors in adjacent premises may be used. Fuel from such storage units is supplied either directly into the combustion chamber or into intermediate tanks.

However, more often, especially for the high output boilers saw dust, bark, chips, grain waste and other kinds of low calorific value fuels are used. Kalvis haved eveloped various equipment for storing and batching such fuel into the boiler. Each system is adjusted on a case by case basis according to on-site conditions.

Positioning variations and photographs of installed systems are given in the following pictures. A more detailed description of separate parts of such systems is provided below.

HEAT PLANT WITH FUEL SUPPLY FROM STOCK WITH MOVING FLOOR



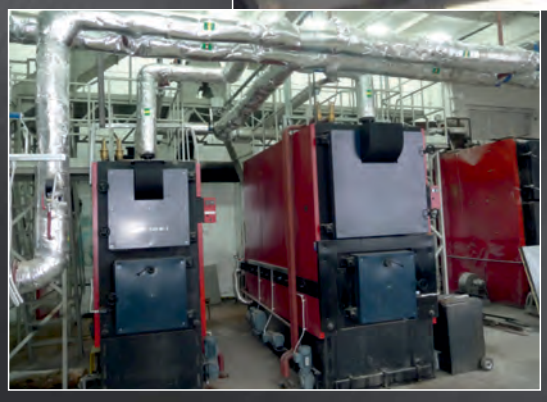
1. Hydraulic station
2. Hydraulic cylinders
3. Rising scraper conveyor
4. Chimney
5. Smoke exhauster
6. Multi cyclone
7. Intermediate tank
8. Solid fuel boiler
9. Combustion chamber auger
10. Fuel moving equipment

Hydraulic cylinders

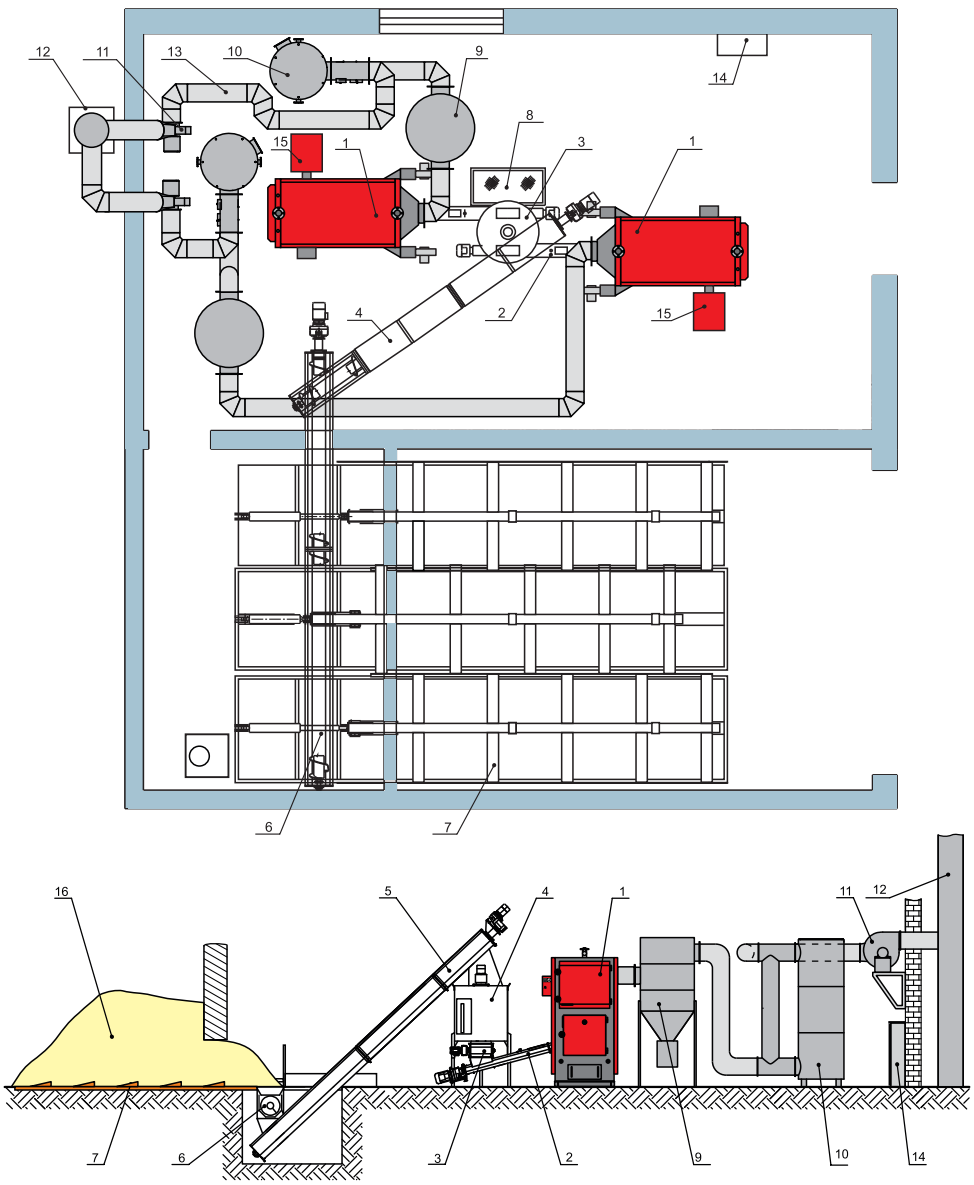
Intermedia tank

Hydraulic station

Rising scraper conveyor



HEAT PLANT WITH TWO BOILERS

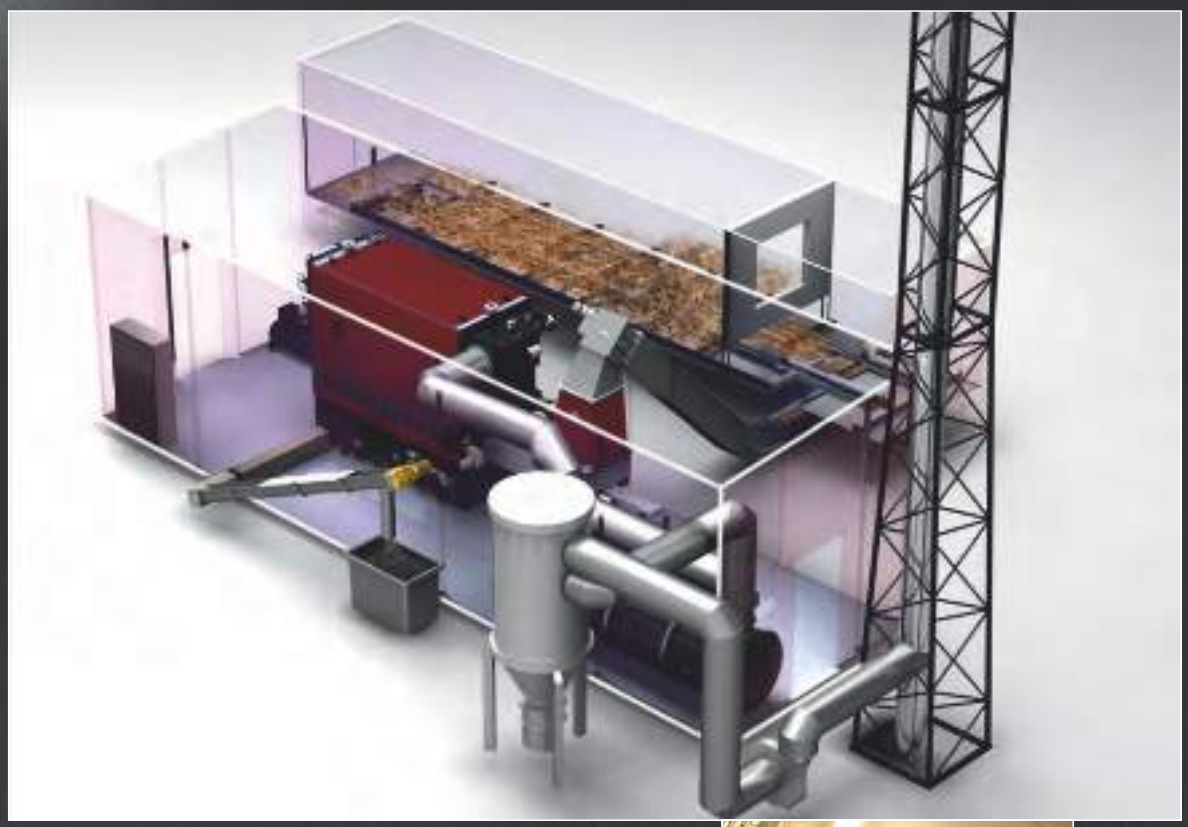


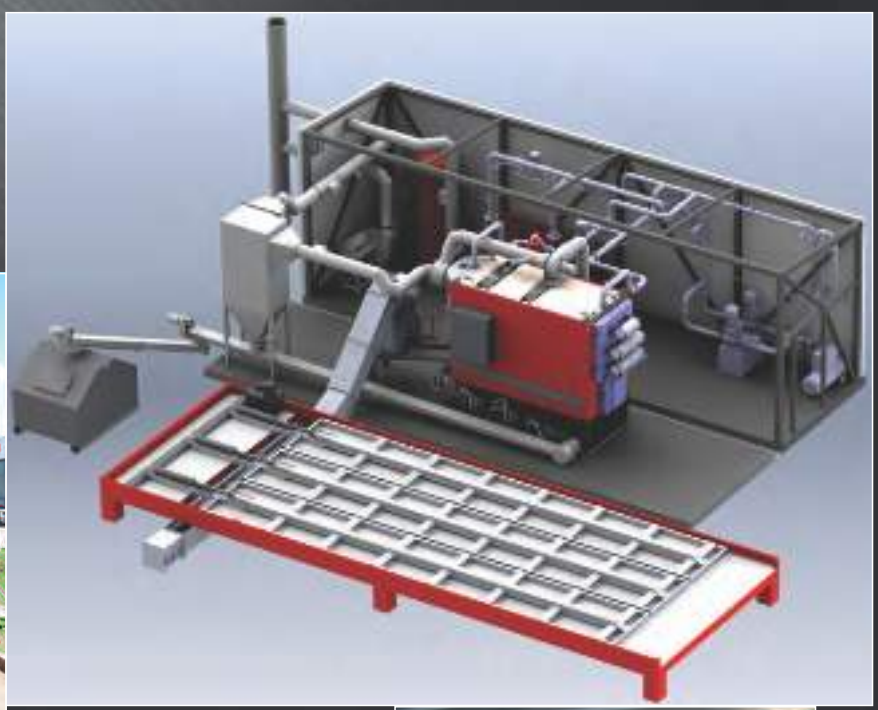
CROSS SECTION OF THE BOILER HOUSE EQUIPMENT POSITIONING:

1. Solid fuel boiler
2. Auger boiler conveyor (KSK)
3. Rotary valve (DZ)
4. Intermediate tank (TT)
5. Lifting auger conveyor (PSK)
6. Warehouse auger conveyor (SSK) or scraper conveyor (SGK)
7. Moving warehouse floor (HKPI) with hydraulic station and cylinders
8. Service platform (TTA)
9. Multi cyclone (MC)
10. Economiser (EK)
11. Smoke exhauster
12. Chimney
13. Boiler house flue channels
14. Control panel
15. Ash bunker
16. Fuel warehouse

COMPOSITION OF EQUIPMENT FOR A MODULAR POWER HEAT PLANT

If there is no power heat plant, it is possible to mount the power heat plant inside one or grouped inside two containers (modules). To select the best fuel storage equipment appropriate to your system, there are various considerations: fuel type, outlet, type of boiler and the volume of the fuel warehouse.

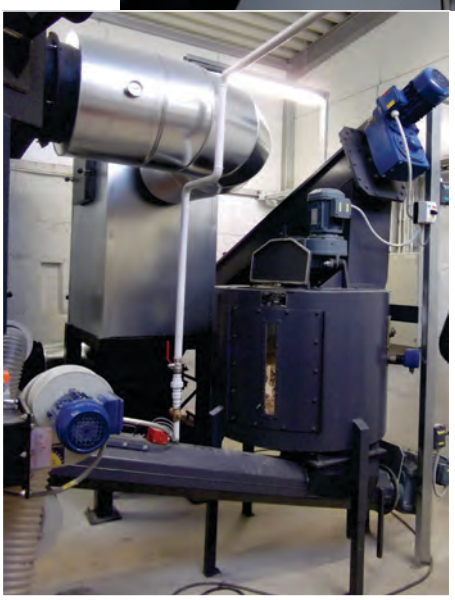




BOILER HOUSE EQUIPMENT

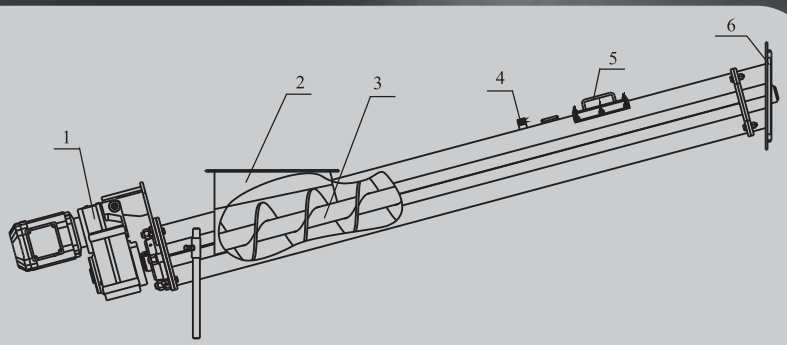
BOILER STOKER AUGER

The boiler stoker auger KSK-130 or KSK-190 feeds the fuel into a burning chamber according to the control system program. The stoker auger consists of the housing, the auger and the gearbox. Two types of auger are produced: KSK-130 for boilers up to 320 kW; and KSK - 190 for boilers up to 1000 kW.



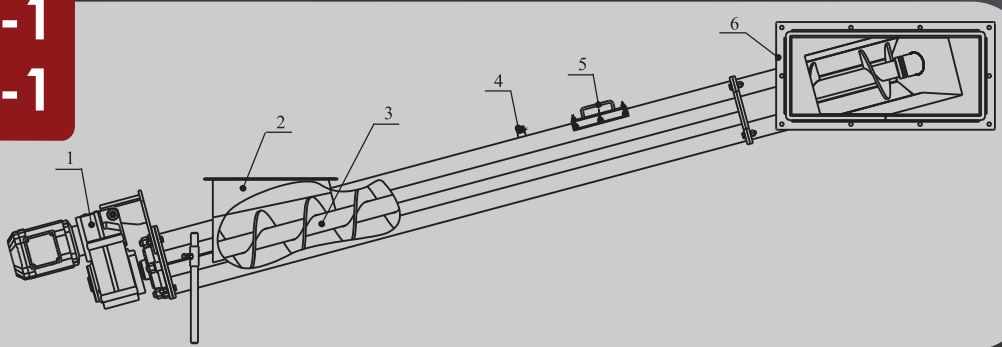
KSK-130 M1
KSK-190 M1

1. Gearbox
2. Opening for fuel supply
3. Auger
4. Emergency extinguishing system connection
5. Service cover
6. Intermediate flange



KSK-130 M1-1
KSK-190 M1-1

1. Gearbox
2. Opening for fuel supply
3. Auger
4. Emergency extinguishing system connection
5. Service cover
6. Intermediate flange



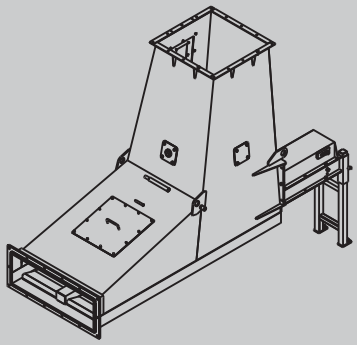
HYDRAULIC EQUIPMENT FOR FUEL FEEDING

HMĮ-01, HMĮ-02, HMĮ-03

If fuel fraction is courser than normal, hydraulic fuel feeding can be used for bulk fuel feeding into the M - 1 type boiler's burning chamber. The equipment's hydraulic cylinder is connected to the hydraulic station of the boiler.

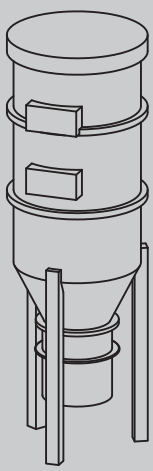
Fuel feeding systems are adapted according to the boiler's output:

HMĮ-01 - 140 ... 320 kW,
HMĮ-02 - 500 ... 720 kW,
HMĮ-03 - 950 ... 1500 kW.



MULTI CYCLONE

MC-2, MC-3, MC-4, MC-6, MC-8, MC-10

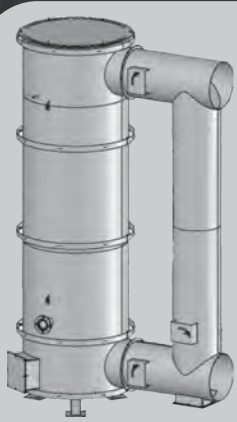


Multi cyclones are used to clean the exhaust gases. The cleaned hard particles of soot are then deposited on the bottom of the multi cyclone. On request, the rotary valve DZ could be mounted on to the bottom of the tank, for the purposes of automatic soot transferal to the boiler house's general ash removal system, instead of being at the bottom of the tank.

ECONOMISER

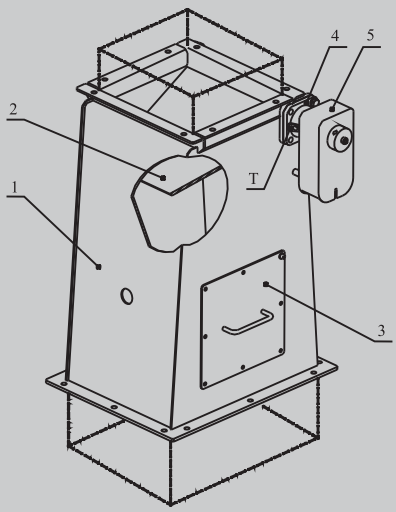
For more efficient heat generation, the economiser may be mounted into the flue system directly behind the boiler. This is an additional heat exchanger, which helps to extract the heat from passing exhaust gases, resulting in the saving of 5 - 10 % of fuel. To avoid condensation forming, an adjustable smoke bypass channel should be mounted close to the heat exchanger.

EK-80
EK-140
EK-190
EK-240



FLAME DAMPER

LSK-1

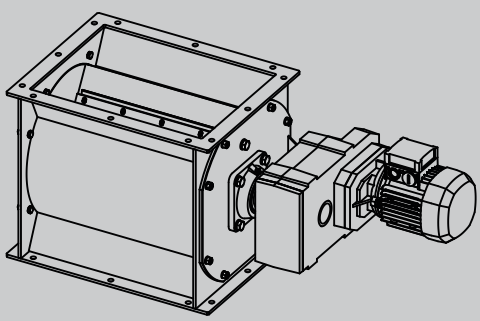


1. Housing
2. Damper
3. Monitoring window
4. Bearing (lubrication point)
5. Damper's drive

The flame damper can be installed instead of the intermediate tank. This prevents fire from burning back into the fuel store.

ROTARY VALVE

DZ-1



The rotary valve is used as a rotary damper for bulk and dry fuel or for automatic ash removal from the bottom of the multi cyclone.

INTERMEDIATE TANKS

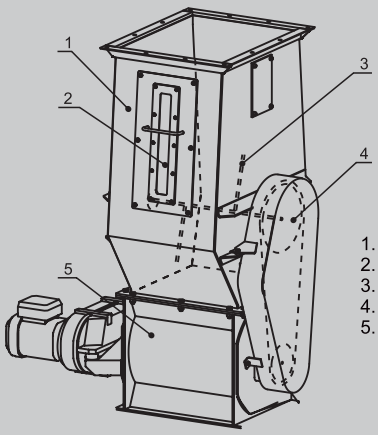
Depending on specific conditions the equipment of the boiler house could be equipped with various types of intermediate tanks: TT-0,27 (0,27 m³), TT-0,7 (0,7 m³) or TT-1,5 (1,5 m³). Intermediate tanks are used for collection of required fuel volume prior to feeding into the burning chamber and to ensure sustained operation of boiler.

Intermediate tanks TT-0,7 and TT-1,5 consist of a bunker and drive unit fastened to the bunker hood and a mixer mounted inside of the bunker. The bearing unit is fastened to the bottom of the bunker. The mixer's blades ensure that an 'arc' is not formed above the stoker auger.

The TT-0,7 or TT-1,5 can feed one or two boilers. In certain cases, when specific fuel is being used, the rotary valve can be mounted between the bunker and auger conveyor.

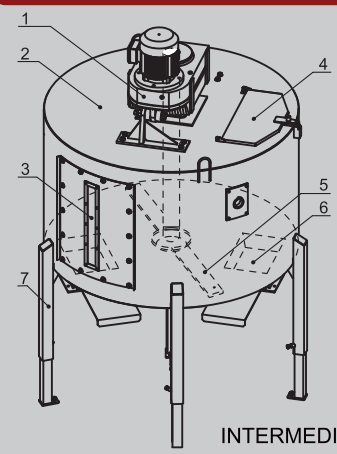
Tank TT-0,27 is used for the collection of the required fuel volume prior to feeding into the burning chamber and ensures sustained operation of the boiler and protects the air entering from the fuel bunker when mounted with rotary valve DZ-1.

TT-0,27; TT-0,7; TT-1,5



1. Bunker
2. Monitoring window
3. Mixer
4. Chain drive
5. Rotary valve

INTERMEDIATE TANK TT-0,27
WITH ROTARY VALVE



1. Gearbox
2. Bunker
3. Monitoring window
4. Service cover
5. Mixer
6. Discharge duct with damper
7. Adjustable legs

INTERMEDIATE TANK TT-0,7; TT-1,5

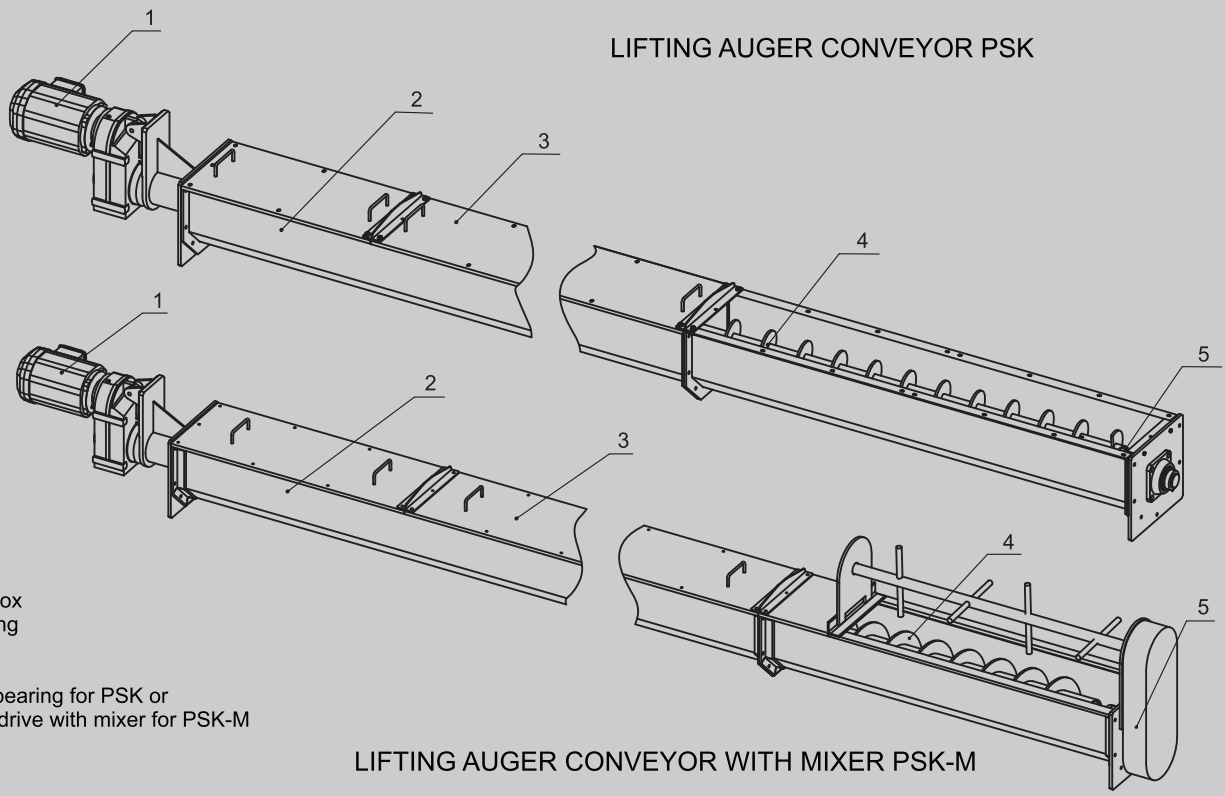
LIFTING AUGER CONVEYOR

The lifting auger conveyor is used for bulk fuel feeding into the intermediate tank. The conveyor consists of: housing with cover, an auger, a gearbox and a rear bearing. The conveyor is to be mounted at an angle and connects the warehouse auger conveyor with the intermediate tank. The fuel from the warehouse auger conveyor is fed into the lower part of the conveyor and is then lifted and discharged into the intermediate tank. When the intermediate tank is full, the sensor generates a signal to switch off the conveyor. When the fuel level decreases, the conveyor is automatically switched on again and the cycle repeats. Fuel levels are maintained automatically by the control system.

Drive output 3.0 kW.

The PSK auger conveyor may be equipped with a mixer mounted above the fuel intake opening (PSK-M).

PSK, PSK-M



LIFTING AUGER CONVEYOR PSK

1. Gearbox
2. Housing
3. Cover
4. Auger
5. Rear bearing for PSK or chain drive with mixer for PSK-M

LIFTING AUGER CONVEYOR WITH MIXER PSK-M

WAREHOUSE AUGER CONVEYOR

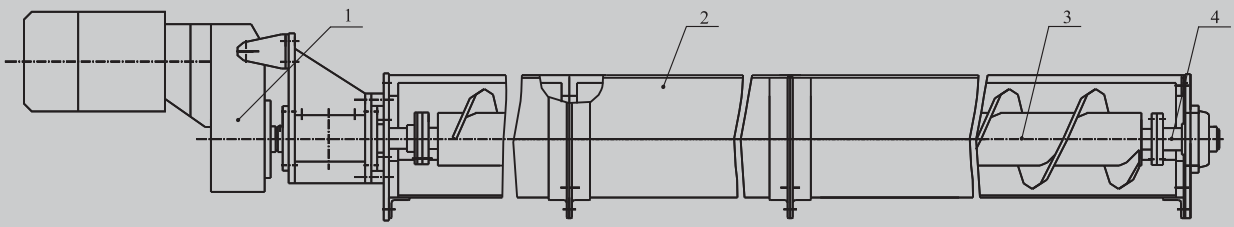
Warehouse auger conveyor is used for bulk fuel feeding from the warehouse into the lifting auger conveyor PSK or scraper conveyor PGK.

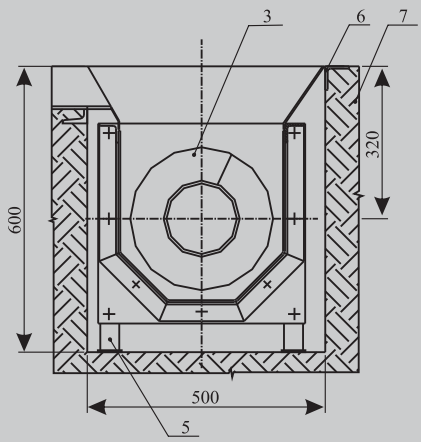
The conveyor consists of: housing, drive unit, bearings and auger. The drive unit and rear bearing are fastened to the ends of the housing. The conveyor must be installed into a concrete trough under the hydraulic fuel moving cylinders.

Drive output 0.75 kW.

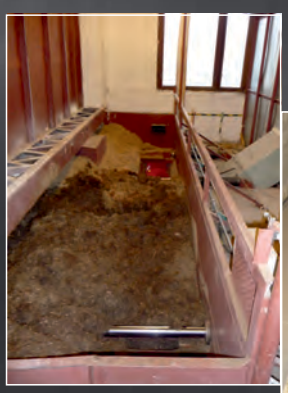
If there is a risk of forming a "fuel arc" above the auger then the warehouse auger conveyor can be equipped with a special mixer SP.

SSK-300





1. Drive unit
2. Conveyor housing
3. Auger
4. Rear bearing
5. Protection
6. Metal structures of trough
7. Trough



LIFTING SCRAPER CONVEYOR

The lifting scraper conveyor is used for shredded or lump fuel transportation from the warehouse or warehouse auger conveyor into the intermediate tank or other fuel equipment.

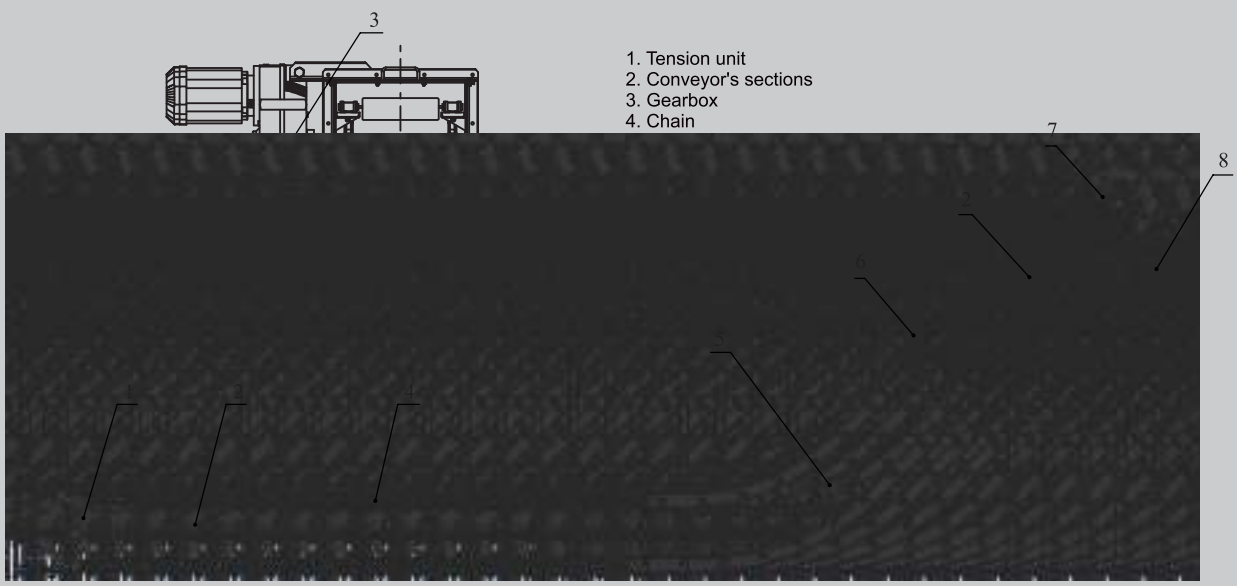
The conveyor consists of: tension unit, horizontal section, angle section and chain with scrapers.

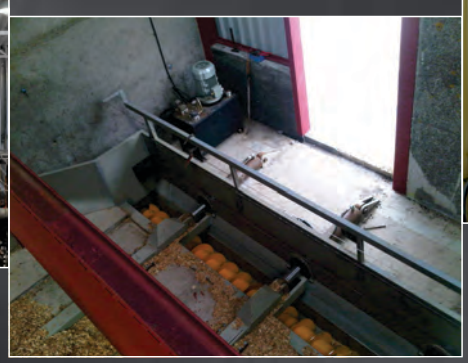
The lifting part of the conveyor is closed by a cover and the horizontal part is mostly open. The horizontal part should be mounted into a concrete trough under the hydraulic cylinders in the hydraulic fuel feeding system. Fuel is fed over to the opened conveyor part, lifted by scrapers and discharged into intermediate tank close to the drive unit.

The conveyor may transport various types of fuel.

The drive output will depends on the conveyor length.

PGK, PGK-K

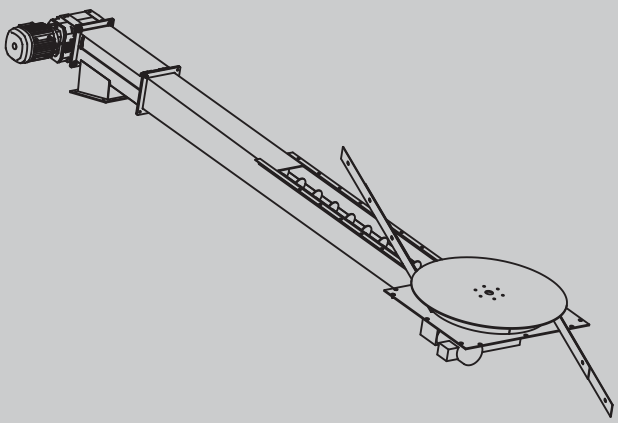




WAREHOUSE AUGER CONVEYOR WITH ROTARY SWEEP AGITATOR AUGER

SSK-M

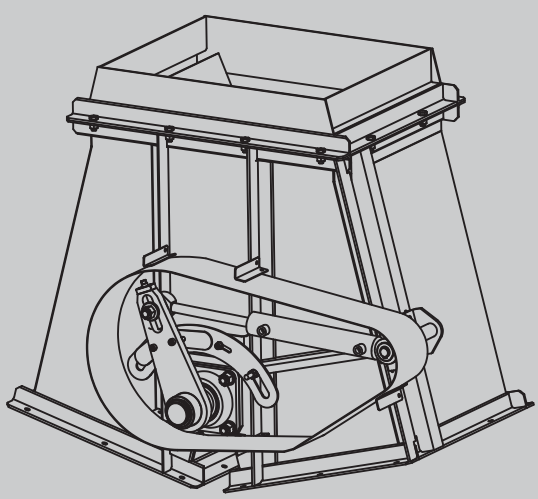
The conveyor is mounted between the boiler house and the fuel bunker floor. The sweep agitator mechanism pushes the fuel onto the conveyor auger using rotating spring blades.



FUEL HYDRAULIC DISTRIBUTOR

HPKM-1

A hydraulic distributor can be fitted to allow the warehouse to feed into two separate boilers or intermediate tanks etc.



HYDRAULIC FUEL FEEDING EQUIPMENT (MOVING FLOOR WAREHOUSE)

The hydraulic fuel feeding equipment is used for feeding fuel from the warehouse into the auger conveyor SSK-300 or PGK (PGK-K).

Equipment consists of: hydraulic station, hydraulic cylinders, hydraulic fittings, graders and frame of graders mechanism.

The frame is concreted into the warehouse floor to obtain a reliable support for mounting the hydraulic cylinders. Fuel feeding takes place when the grader's blades crawl along the warehouse floor. The blades slide backwards and upon return push fuel into the warehouse conveyor. When the warehouse conveyor is full then the optical sensor switches off the fuel feeding. When the warehouse conveyor becomes empty the optical sensor switches fuel feeding back on.

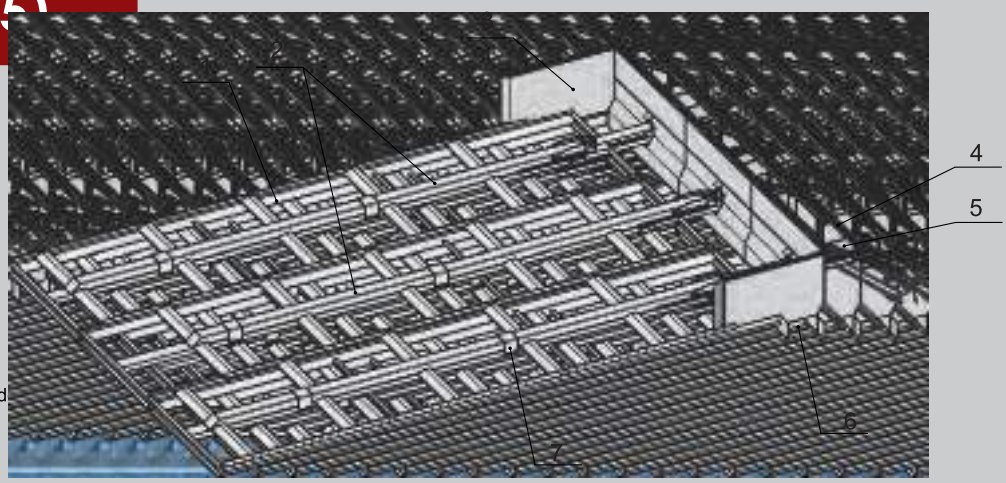
Depending on your warehouse's floor space / layout there are various options available:

- grader lengths (from 5 m up to 12 m);
- quantity of hydraulic cylinders (from 2 up to 5 pc);
- grader widths (from 1000 mm up to 1500 mm).

One hydraulic station can serve up to 5 hydraulic cylinders. To increase the warehouse width it is necessary to apply an additional hydraulic station. The height of the fuel level on the grader should be no more than 2.5 m.

Depending on the particular conditions, hydraulic cylinders of different diameters and strokes will be supplied.

HKPĮ (2, 3, 4, 5)

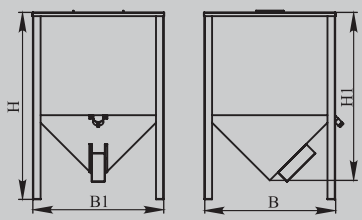


1. Base frame
2. Grader with blades
3. Protection fence
4. Hydraulic station
5. Hydraulic cylinders
6. Angle bars (concreted into pit ed
7. Clamp

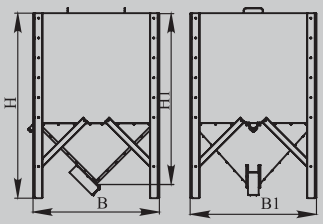
FUEL STORAGE TANKS AND CONVEYORS FOR BULK FUEL FEEDING

For boilers fired with pellets or grains, tanks of various volumes may be used. The fuel is fed into the boiler by auger conveyor SGK-1,8 (1,8 m) or SGK2-2,5 (2,5 m). For larger tanks or appropriate premises, the fuel could be fed by curvilinear transporter KSGK.

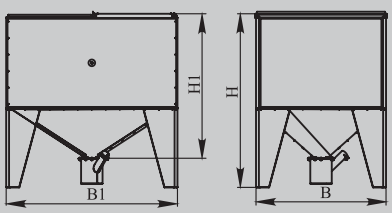
BG2-1



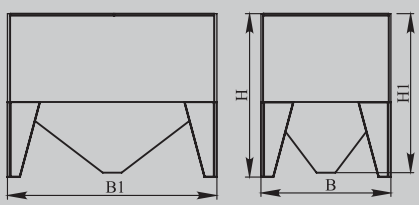
BG2-2



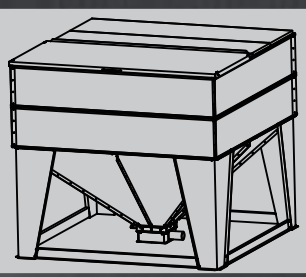
BG2-4



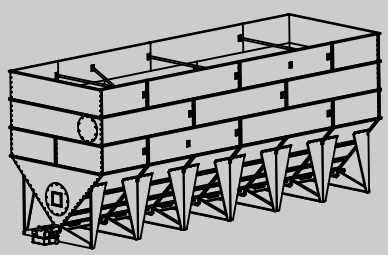
BG2-6



BG2-8



BG2-36



Bunker	Volume, m^3	H1, mm	H, mm	B, mm	B1, mm
BG2-1	1	1345	1497	1048	1048
BG2-2	2	1720	1862	1272	1272
BG2-4	4	2103	1750	1575	2075
BG2-6	6	2025	2081	1655	2668
BG2-8	8	2105	2256	1620	3165
BG2-36	36	2965	2965	2400	4580

HEAT PLANT CONTROL SYSTEM

Siemens or Omron based control equipment controls all of the heat plant equipment. Programming and monitoring of the performance of the equipment takes place on a touch screen LCD. All of the drives are protected against overload. Primary and secondary air and boiler draught is maintained by variable fans which are controlled by the boiler PLC. Self-diagnostics allow quick and easy malfunction identification and remedy.

GSM modem, enables data transfer to a cell phone which may be installed as an added extra. Such heat plant equipment with the control system provides you with minimum servicing and supervision.

A local wireless network is also set up allowing local maintaining and control.

INSTALLATION OF THE HEAT PLANT EQUIPMENT

Heat plant equipment installation is performed by the manufacturer's employees, by manufacturer's partners' employees who had been trained for installation or by the installation company under supervision of the manufacturer. All preparatory works, construction works etc., unless contracted otherwise, are performed by the customer.

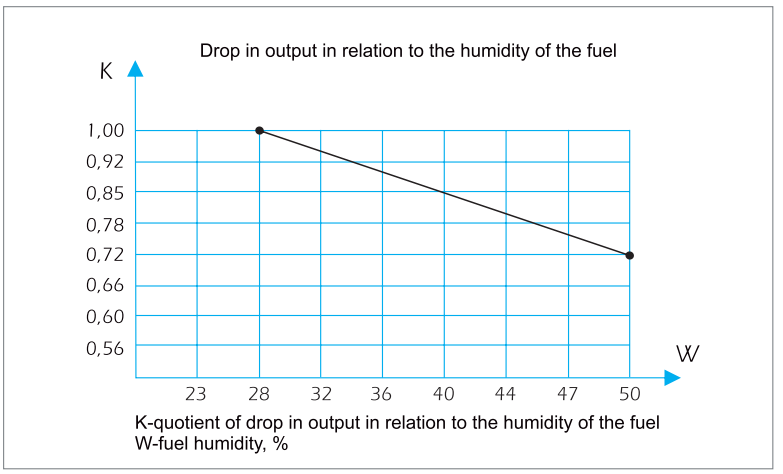
Installation of the heat plant (construction works, heat plant building, power, water preparation, installation and connection of plumbing equipment, piping mounting and insulation, flue and flue channel connections) is performed by a general contractor according to a prepared and approved heat plant project plan. General contractor, together with the manufacturer organises customer's personnel training and prepares paperwork for approval of completion of works by governmental authorities according to local legislation.

Guarantee and post guarantee servicing of equipment is performed by the manufacturer or his representatives according to the manuals and technical passports of the equipment.

TYPES OF FUEL

The M-1 series of boilers are fired with firewood, waste wood, and sawdust briquettes. Chips and sawdust may be mixed with other fuel. Poor quality fuel and moisture content can effect boiler output, maintenance and emissions.

The table below shows the drop in output in relation to the humidity of the fuel.



STANDART FUELS

Natural and granulated fuel is used for automatically stoked boilers. These and bark pellets are used to fire high output boilers with a movable grate and automated de-ashing.

Wood chips

Wood chips

Wood shavings

Wood pellets

ALTERNATIVE FUELS

At the request of the customer we may recommend necessary equipment and after obtaining the necessary amount of fuel we can help set the optimum mode of combustion.

Wood logs (manual stocked, manual control of burning process);
Wood briquettes (manual stocked, manual control of burning process);
Saw dust (we recommend to apply fuel composite 30 % saw dust and 70 % wood chips, requires the modification of burning process settings);
Boon waste material (we recommend to apply fuel composite 30 % boon waste and 70 % wood chips, requires the modification of burning process settings);
Straw pellets also used as fuel, but due to a high content of cellulose they produce a lot of slag and we do not recommend firing our boilers with them. Such pellets, after adjusting the combustion process may be used with other types of fuel, but the overall content of straw pellets in such mixture should not exceed 10-30%. (we recommend to apply fuel composite 30 % straw pellets and 70 % wood chips or wood pellets, requires the modification of burning process settings);
Grain and grain waste is a fuel of high calorific value, but it also tends to slag. Should only be used in certain boiler types (requires the modification of burning process settings);
Sunflower seed husk, fined corn, nut husk and other „nontraditional“ fuel types may be used in certain types of boilers (requires the modification of burning process settings).

Wood logs

Wood briquettes

Saw dust

Boon

Straw pellets

Grain waste

Nut husk