AUTOMATED WOODWASTE COMBUSTION UNIT
Types: AZSD -50
AZSD -100

OPERATION MANUAL

EDITION I/USA

Valid with the order .................../..............

Date ....................... Signature .....................

HAJNÓWKA 2006
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1. GENERAL INFORMATION.

The Automated Woodwaste Combustion unit AZSD is a modern device applicable for burning of comminuted woodwaste with granulation of max. 30 mm and humidity of 30÷60%.(1)

The AZSD can be coupled with properly chosen or adopted boiler and applied for heating of groups of houses, agricultural or forest farms, glasshouses, foil tunnels, workshops etc.

CAUTION!
Taking into consideration a few years lasting co-operation with users, the manufacturer of AZSDs recommends using of boilers with an energetic certificate only.

Application of exhaust/water heat exchangers allows low-cost and versatile use of an AZSD for heating or for technological purposes.

An AZSD should be operated as described in present manual; improper operation makes the warranty void.

Caution!
All data contained in present manual are based on newest manufacturer’s information. Nevertheless, the HAMECH has the right for introduction of changes to the described AZSD version (which have no influence on operation conditions) resulting from development and of design and manufacturing technology.

Present manual should be helpful to enable acquaintance with the device and full evaluation of its operation parameters. We recommend reading the manual carefully before first use.

(1) The term „humidity” means the relation of the weight of water contained in wood to the total weight of humid wood (so-called relative humidity). It is calculated according to following formula.

\[ W_W = \frac{G_W - G_O}{G_W} \cdot 100\% \]

\[ W_W \] – wood humidity in relation to humid wood
\[ G_W \] – weight of humid wood
\[ G_O \] – weight of absolutely dry wood
## 2. TECHNICAL DATA

<table>
<thead>
<tr>
<th>Typ</th>
<th>AZSD</th>
<th>50</th>
<th>100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nominal thermal power</td>
<td></td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>kW</td>
<td>43000</td>
<td>86000</td>
<td></td>
</tr>
<tr>
<td>kcal/h</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>sawdust, bark, refuse of granulation up to 30 mm, humidity 30÷60%, without mineral inclusions*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fuel humidity</td>
<td>%</td>
<td>30÷50*</td>
<td></td>
</tr>
<tr>
<td>Fuel consumption (at full power) **</td>
<td>kg/h</td>
<td>22</td>
<td>43</td>
</tr>
<tr>
<td></td>
<td>kg/h</td>
<td>2,1</td>
<td>4,12</td>
</tr>
<tr>
<td></td>
<td>mp/day</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tank capacity</td>
<td>m³</td>
<td>0,65</td>
<td>0,65</td>
</tr>
<tr>
<td>Power consumption</td>
<td>kW</td>
<td>0,6</td>
<td>0,6</td>
</tr>
<tr>
<td>Power supply voltage</td>
<td>V</td>
<td>220/380</td>
<td></td>
</tr>
<tr>
<td>Average heated habitable surface</td>
<td>m²</td>
<td>320</td>
<td>640</td>
</tr>
<tr>
<td>Outlet gas temperature from AZSD</td>
<td>°C</td>
<td>ca. 1000</td>
<td></td>
</tr>
<tr>
<td>Recommended temperature after heat exchanger</td>
<td>°C</td>
<td>200-250</td>
<td></td>
</tr>
<tr>
<td>Efficiency ratio (with boiler)</td>
<td>%</td>
<td>ca. 75</td>
<td></td>
</tr>
<tr>
<td>Can be coupled with a water boiler of heating surface</td>
<td>m²</td>
<td>6÷8</td>
<td>10÷12</td>
</tr>
<tr>
<td>Combustion process control</td>
<td></td>
<td>automated</td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td>kg</td>
<td>320</td>
<td>450</td>
</tr>
</tbody>
</table>

* If the fuel is of other humidity (e.g. too dry), sprinkle it with water or mix with humid one. Burning of excessive dry fuel causes quick wear of lining, grate and feeder. Furthermore, the Manufacturer does not agree for burning of comminuted wood if the dust content is greater than 5%. Non-observance of above-mentioned principles may cause quick wear of the device and emission of harmful combustion products for what the Manufacturer takes no responsibility.

** fuel of 30% humidity and n.c.v. 11510 kg/kJ.
3. STRUCTURE AND OPERATION OF BASIC ELEMENTS OF AZSD

The Automated Woodwaste Combustion Unit (fig.1) consists of following units:

1. Fuel tank
2. Worm conveyor
3. Pre-furnace (retort)
4. Blow fan
5. Thermostatic valve and anti-fire sensor
6. Water tank
7. Conveyor's drive
8. Controller

3.1. Fuel tank (fig.1.1)

The tank has cylindrical shape. The tank has in its lower portion a rectangular pipe welded-in; the pipe is a part of worm conveyor cover. A movable shield (1) is mounted on a pivot (2) with bearings in tank’s bottom. The shield is driven by the worm. The shield helps to prevent fuel stopping. Each tank should be covered during operation to avoid gas flow and backfire.

3.2. Worm conveyor (fig.1.2)

The conveyor consists of a cover (1) and a worm (2). The housing is made in the form of a rectangular pipe.

3.3. Pre-furnace (fig.1.3, fig.1.4 i fig. 1.5)

The pre-furnace consists of a metallic outer housing (1) and a ceramic, heat-resistant chamber (2). The housing consists of a two-layer coat; between layers there are air channels for airflow adjustment and cooling of an outer coat. The pyrolithic chamber is a thermal incubator, made of heat-resistant brick, joint with a mortar based on “Górkal” cement and “Boss” filler. In the lower portion of the chamber there is a grate (3) applied for fuel gazification and its partial combustion. The pre-furnace should be closed tight during operation. Brackets with threaded openings are welded to the housing’s bottom to enable (after screwing of screws (4)) pre-furnace’s level adjustment. Inside the chamber there is a feeder flap mounted with screws on a tube. All elements are made of creep-resistant steel. The swing-mounted flap protects the pre-furnace chamber from excess fuel. If from any reason excess fuel will be fed to the chamber, it will cause pressure on the lower side of the flap. The feeder’s flap will rise, causing (fig. 1.4) tube’s (5) rotation; at the tube’s end there is a lever (6). The lever pushes the arm of an end switch (7); the switch cuts-off power supply to the engine of the conveyor’s drive.

Caution: Activation of feeder’s flap is an “emergency” situation and requires crew intervention. Such situation occurs in case of improper fire making or time adjustment (work and pause between programs: normal or auxiliary combustion).

Movement of the feeder’s flap in opposite direction (after reduction of fuel quantity in the chamber) is realized through the weight (8) mounted on the opposite lever’s end. To set the optimum air flow to the pre-furnace use the valve gate (9), which tip in the form of threaded rod (10) with a butterfly nut (11) is situated in the upper part of the chamber. Raising and lowering of the valve gate (10) with help of the butterfly nut causes increase or decrease of inlet cross section (12), what will result in increase or decrease of air volume entering into the chamber (fig.1.5).
3.4. Blow fan (fig. 1.6).
The fan is fastened to the stub with special flange. The fan is additionally fitted with an adjustable shutter at the fan inlet. The masking width defines air volume entering the fan.

**Caution!**
The fan inlet must not be completely masked; this may cause burnout of the fan engine.

3.5. Thermostatic valve and anti-fire sensor
The sensor of the thermostatic valve should be fastened on the housing of the worm conveyor, in the distance of a dozen or so centimeters from the pre-furnace. The valve is activated through temperature rise or backfire to the fuel tank. Quick activation causes water supply and fire extinguishing. The sensor should be mounted on clean surface. (see p. 11).

3.6. Conveyor drive (fig. 1.7).
Consists of an engine (1) rated at 0.55kW and a two-stage gear. Total transmission ratio amounts to 1:240.
Power is transmitted to the worm’s shaft through a plastic clutch (2). The clutch is simultaneously a kind of safety device and must not be replaced by any other device connecting engine and gear (3). Power output drives the shaft, which should be coupled with conveyor’s worm tip.

3.7. Automated control system
The combustion control program depends on many variables; before all on humidity of woodwaste, heat demand and boiler type. Proper adjustment is possible after getting some experience during the first operational period.

3.8. General description of AZSD operation (fig. 1)
The fuel contained in the tank (1) is supplied with the worm conveyor (2) to the pre-furnace (retort, 3), where the fuel is gazificated and partially burnt. To ensure proper gazification, the chamber is supplied with air with the blow fan (4).

The conveyor (2) is driven with a reduction gear (7). The operation of the entire device is controlled with a controller (8), which works according to a set program. The program is set by controllers of main and auxiliary combustion and also the water temperature controller at the boiler’s outlet, where two temperature sensors for adjusted and maximum (95°C) temperatures are installed.
The AZSD is equipped additionally with the water anti-fire system. Its structure and operation is shown on fig. 1 and fig. 1.9.
The reliability and life of the device depends on good knowledge of the structure, operation rules, proper maintenance and observance of rules contained in present manual.
Taking into consideration that woodwaste contains certain quantity of silica and sometimes other mineral impurities as e.g. sand, gravel, concrete or stone (when stored on the ground or in a concrete bunker), the chamber (especially inner walls and grate) could be covered with silicate deposits. This effect is very harmful and can reduce combustion effectiveness, but can be avoided by use of pure woodwaste (free of mineral impurities).
Visible symptoms of silicate deposit are: decrease of effectiveness ratio (lower temperature at the boiler) and black smoke at funnel's outlet (during proper combustion only light, white cloud is visible).
With regard to a. m. effects, the chamber must be cleaned (silicate and carbon deposits must be removed). Cleaning frequency depends on fuel purity. The cleaner is the fuel, the scarcer is the cleaning. The cleaning frequency should be set depending on fuel type.

**CAUTION !!!**
Pre-furnace chambers should be cleaned in such a way, that the chamber lining would not be damaged. However, if any damage occurs, repair it with fire-resistant material.
If the fuel is mineral-free, the chamber will be always clean and small quantity of ash (ca. 1\% of burnt fuel) falls into the ashtray. For ash removal use a cover in lower pre-furnace’s portion. The ashtray should be emptied with a ash rake.

**CAUTION !!!:**
After cleaning close the cover tight.

### 4. ASSEMBLY OF THE AZSD, CONNECTION TO THE BOILER, START-UP.

#### 4.1. General information about conditions of connection of the AZSD to the boiler.

**The choice of a boiler depends on its thermal power. The thermal power should be similar to this of the AZSD. Differences of no more than 10\% are permissible.**

The gas/steam mixture from the pre-furnace should be transferred through the connector to the boiler’s combustion chamber, where it is burnt out.

The exhaust gas system (flue, smoke channels and funnel) must be made according to rules given in the manual of the boiler coupled with AZSD.

When both devices are properly matched, the effectiveness of the set is highest.

All adaptation works realizes the user on its cost but with observance of following conditions:

a) place of connection between an AZSD and a boiler must be tighten with e.g. fire-resistant rope and chamotte clay.

b) an AZSD should be connected to a boiler straight (max. distance between the AZSD and the boiler should not be greater than 0.4 m). Permissible deflection angle – 20°. Any greater deflection may cause incorrect working conditions, for which the manufacturer takes no responsibility.

The energetic set boiler – AZSD must work in a closed room with temperature higher than 0°C.

Boiler and AZSD must not be placed in such way, that the gas would flow from the pre-furnace to the boiler downwards.

#### 4.2. Assembly of the AZSD - fig.1.

An AZSD is delivered partially disassembled. One part make the fuel tank and the conveyor, another – the pre-furnace.

Before both parts will be joint, remove transportation elements and level both parts to prepare them for coupling together.

The connection must be tight – use a sealing putty.

#### 4.3. Connection of the AZSD to the boiler.

Connect the assembled AZSD to a boiler.

All connections must be stress-free. After connection mount the frame and the controller (8) on the conveyor’s housing (as shown on fig. 1) and the anti-fire sensor together with the thermostatic valve (5). On the woodwaste tank install the water tank (11) and connect all parts as shown on figures 1 and 1.8. Wiring must be connected as shown on the wiring diagram enclosed to the controller manual.

Install temperature sensors for adjusted and max. temperatures (95°C) on the boiler. Both sensors should contact with clean collector’s surface. Fasten the sensor with a band in two places and insulate well.

If the unit will work at temperatures higher than 95°C use a SE-P controller. Setting of required temperature is realized with a handwheel on the controller, and the max. temperature is set only once (depending on need) on the thermostatic controller B118. The handwheel of this controller should be removed after temperature setting. The sensors can be installed with contact or submerged – depending on agreement with the user.
CAUTION !!!
Prior to filling the tank with fuel, make sure, that on the tank’s bottom there are not any object, which could be transferred to the worm and block it causing damage.
Check the conveyor’s rotational direction.

4.4. Assembly of the electric system.
The controller and electric devices should work with voltage of 230/115 V, 60 Hz and be earthen according to the system used by the user.
All connections are user – made according to the wiring diagram enclosed to the controller manual; it is recommended to employ for this task an experienced, certified electrician.
It is recommended to make power supply for the controller with a four- or five-conductor cable of no less than 1,5 mm² Cu, considering voltage drop.
Protect cable and devices with proper fuses. Protection an power supply cable are provided by the user.
After all connections are made, check conveyor engine rotation direction and proper working of other adjustment and control devices.

4.5. Start-up and operation of the AZSD.

CAUTION !!!
A. During first start-up of the AZSD coupled with a boiler and during each next one (especially after a longer standstill) be especially careful.
The operator performing start-up should wear heat-resistant gloves (hand protection) and a mask (face protection).
B. Use only fuel of humidity not greater than 50%. The device works reliably in wide range of humidity (30÷50%), but under condition, that the process is continuous, the pre-furnace’s interior is properly warmed and the controlling program is adjusted properly to ensure uniformity of gazification and combustion. During the auxiliary combustion program, adjustment is very important – the end switch in the case of excess fuel will break the pyrolithic process and cause the necessity of making fire again with dry fuel.
C. Before first operational use of the AZSD with full load, it is indispensable to dry-up the pre-furnace’s lining by burning dry fuel (75 hrs) fed by the worm conveyor from the fuel tank. Use the auxiliary program (working time – 5 s, pause time – 100-150 s). In the course of 7 days make 6-8 cycles. After such preliminary drying-up stop operation and cool down the pre-furnace for 8-10 hrs and fire up again according to the described program. The drying of lining can be of other type, according to user’s invention, but the lining must not be overheated to avoid breaks and damages.
1. Check the oil level in the gearbox and proceed as described in p. 9.
2. Pour the grease to the bearing of the rotational shield as described in p. 9.
3. Set the boiler temperature sensor’s handwheel for minimum (left outer position).
4. Switch on power supply on the controller’s panel. The switching on is signaled with a lamp.
5. Check the direction of engine’s rotation (must conform to an arrow on the engine’s fan housing) and operation of the end switch.
6. Switch off power supply on the control panel.
7. If the direction of engine rotation is proper and the worm and the movable shield in tank bottom match properly, the tank can be filled with fuel. First fuel portion should be dry, of humidity not greater than 30% to ensure proper warming of the chamber and good pyrolithic process conditions. Cover the tank tight.
8. Check the boiler’s condition (leakage is not permitted), fill it with water and deaerate heating system.
9. Fill the anti-fire tank with water and cover it.
10. Open the pre-furnace cover.
11. Check the position of the flap in the pre-furnace chamber (45° from the vertical position in the boiler’s direction) and close the pre-furnace cover.
12. Set the MMA temperature sensor’s handwheel to 5 (fig. 1.8).
13. Set the internal aperture (lower gate valves) at 1/2 ÷ 2/3 of full opening with the butterfly nut.

**CAUTION!**

The periods given below are only approximate values and depend on kind and humidity of fuel and funnel thrust.

1. Set work cycle (“work time”) to 3 ÷ 5 seconds and “pause time” to 10 ÷ 15 seconds.
2. Set auxiliary cycle to 5 seconds (“work time”) and “pause time” to 100 seconds.
3. Once again switch on the power supply on the controller’s panel. The worm conveyor will start to transport fuel to the pre-furnace chamber. Switch off the controller when the fuel appears in the chamber.
4. Make small fire of dry wood on the grate. As an incendiary use comminuted spruce wood or small pieces of pine wood. When the fire on the grate burns and the chamber is warm, switch on the sawdust feeding.

**CAUTION !!!**

Do not use inflammable materials like petrol, kerosene, their derivatives or similar materials for making fire – this may cause burns or explosion.

5. Turn right the chamber temperature adjustment wheel to the point of the required boiler outlet temperature (ca. 75% of the adjustment range).
6. Together with increase of the chamber temperature (heat cumulating) change work cycle adjustment: “work time” to 25 ÷ 30 seconds and “pause time” to 5 ÷ 7 seconds.
7. Continue making fire. Pay attention to continuous fuel feeding. The total time for adaptation of the pre-furnace for efficient pyrolytic process takes 4 ÷ 6 hrs. Proper pyrolytic (gazification) process results in continuous flame of uniform, intensive color and quick temperature increase at boiler’s outlet up to required value. When the required temperature is reached the auxiliary program starts. During this phase the blow fan is stopped and the fuel is fed in the quantity of 1/3 ÷ 1/5 of normal consumption. The gate valves at the flue should be closed.
8. Increase the boiler’s set temperature. When the conditions in the chamber will be proper for good pyrolytic process (continuous flame of uniform color), normal fuel (of 30 ÷ 50% humidity) can be fed, under condition, that the control program settings will be changed (work and pause times). In the first phase decrease the “work time” to 15 ÷ 20 seconds and increase the “pause time” to 8 ÷ 10 seconds. Watch the process carefully and do not allow the chamber to cool down, what results in stopping the pyrolytic process. Proper adjustment of “work time”, “pause time” and primary air flow – throttle – fan valve gates, allows the process to run without disturbance.

4.6. Fuel completion.

The fuel in the tank should be completed periodically, depending on temporary heat requirement.

It is recommended to sieve the fuel through a 3 mm screen.

**Caution!**

If the fuel loading is not automated do not empty the tank completely. If the tank would be completely emptied and the cover open, such situation may cause so-called reverse thrust and ignition of fuel remains in the tank.

Close the tank after each fuel completion.
5. INDUSTRIAL SAFETY & ANTI-FIRE RULES.

Read carefully the present manual before the assembly, start-up and operation of the device. For request the buyer can be also trained by manufacturer’s service personnel.

- Take special precautions during first start-up of the AZSD coupled with a boiler and during each next one (especially after a longer standstill).
- The operator performing start-up should wear heat-resistant gloves (hand protection) and a mask (face protection).
- Any modifications of wiring and control system are prohibited.
- Do not open the pre-furnace’s cover – risk of burns.
- Be sure, that the end switch at the furnace and temperature controller at the boiler work properly. Malfunction of these devices may cause stopping of gazification process in the pre-furnace or boiler damage.
- The device’s earthing must be proved and certified. The terms of earthing reliability measurement should be as prescribed in the anti-fire regulations.
- All connections should be tight – emission of carbon monoxide or smoke is inadmissible.
- The room, where the AZSD is located should be dry, well illuminated and ventilated with natural airflow. Round about the device wooden grate or rubber insulation carpets should be laid. In the boiler room with natural (gravity) airflow funnel application of mechanical, force ventilation is prohibited.
- The device should be operated only with efficient automated anti-fire system (tank filled with water, reliable sensor and thermostatic valve).
- In the AZSD’s room there must be an industrial safety and anti-fire instruction elaborated by the user; the instruction must mention all dangers possible during device’s operation.

5.1. Description and evaluation of residual risk

5.1.1. Description of residual risk

Although the MACHINERY WORKS „HAMECH” in Hajnówka take responsibility for design and structure of the device with regard to its safety, certain risk level during operation of the AZSD cannot be avoided. Usually, the residual risk results from improper behavior of an AZSD operator. The greatest risk appears during execution of following prohibited actions:

- presence of unauthorized persons in the vicinity of the device during its operation,
- during manipulation in the area of drive units during operation
- operation with opened covers
- cleaning of ash chamber without protection clothes

When presenting the residual risk the AZSD is treated as a device, which until the moment of its start-up is designed and manufactured according to the state-of-art.

5.1.2. Evaluation of the residual risk

If following recommendations are observed:
- careful acquaintance with the manual
- execution of all repairs of the electric system by an authorized electrician,
- inspection of the earthing system after repair of the electric system prior to operation,
- no unauthorized persons in the vicinity of operating machine,
- operation, maintenance and repair of the device only by properly trained personnel, who are acquainted with the manual,
- use of personal protection means: tight clothing, protection gloves, face protection etc.

the residual risk can be eliminated during operation of the AZSD without risk to people and environment.
### 5.2. List of warning and information signs for the AZSD.

The signs are permanently put onto the housing of the device; their location is shown on the fig.1. In the case of destruction / damage new signs can be delivered by the ZM HAMECH; together with the order give the description of the sign as in the table below:

<table>
<thead>
<tr>
<th>No.</th>
<th>Sign</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Type plate</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Plate HAMECH</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Black letters, orange background</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>White sign, blue background</td>
<td>Prior to operation read the manual.</td>
</tr>
<tr>
<td>5.</td>
<td>Black letters, yellow background</td>
<td>Caution! Nie zamknięcie pokrywy może być przyczyną pożaru</td>
</tr>
<tr>
<td>6.</td>
<td>Black symbols, yellow background</td>
<td>Sticker on the tank. Caution! Opened cover may cause fire.</td>
</tr>
<tr>
<td>7.</td>
<td>White sign, blue background</td>
<td>Face protection</td>
</tr>
</tbody>
</table>

**Tabliczka AZSD - 100**

**Prior to operation read the manual.**

**Caution!**

**Sticker on the tank. Caution! Opened cover may cause fire.**

**Face protection**
8. White sign, blue background

Hand protection

9. Black lines and letters, white background

Sticker „Energetic efficiency‟.

10. Type plate of the energetic unit

6. INDEX OF QUICK-WEARING PARTS.

<table>
<thead>
<tr>
<th>No.</th>
<th>Unit</th>
<th>Part</th>
<th>Drawing No.</th>
<th>Quantity</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Drive unit</td>
<td>Clutch-safety device</td>
<td>ZS-01.14.00.00</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Pre-furnace (retort)</td>
<td>Excess fuel flap</td>
<td>ZS-04.17.00.00</td>
<td>1</td>
<td>AZSD-50</td>
</tr>
<tr>
<td>3.</td>
<td></td>
<td>Tube</td>
<td>ZS-04.21.00.00</td>
<td>1</td>
<td>AZSD-50</td>
</tr>
<tr>
<td>4.</td>
<td></td>
<td>Heat-resistant screw</td>
<td></td>
<td>1</td>
<td>M12x38</td>
</tr>
<tr>
<td>5.</td>
<td></td>
<td>Heat-resistant nut</td>
<td></td>
<td>1</td>
<td>M12</td>
</tr>
<tr>
<td>6.</td>
<td></td>
<td>Feeding channel section</td>
<td>ZS.04.23.00.00</td>
<td>1</td>
<td>AZSD-100</td>
</tr>
<tr>
<td>7.</td>
<td></td>
<td>Tube</td>
<td>ZS.04.22.00.00</td>
<td>1</td>
<td>AZSD-100</td>
</tr>
</tbody>
</table>

CAUTION !!!
The grate is not subject of warranty. The manufacturer, dealers or service dept can replace the grate for user’s cost.

6.A. Index of bearings:

- reduction gear 6208 2Z, 6305, 6203 2 RS, 6205 2RS
- fuel tank: (AZSD-100/1,5) 32208

6.B. The device is powered with a Skf-80 4a2 motor, 0,55kW, 1400 rpm.
## 7. STANDARD EQUIPMENT.

<table>
<thead>
<tr>
<th>No.</th>
<th>Unit or part</th>
<th>Quantity</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Set of quick-wearing parts as described in p. 6</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2.</td>
<td>Ash rake</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>3.</td>
<td>Operation manual</td>
<td>1</td>
<td></td>
</tr>
</tbody>
</table>

## 8. TYPICAL DEFECTS AND THEIR REMOVAL

<table>
<thead>
<tr>
<th>No.</th>
<th>Defect</th>
<th>Cause</th>
<th>Removal</th>
</tr>
</thead>
<tbody>
<tr>
<td>I.1</td>
<td>Fuel tank</td>
<td>movable shield does not rotate</td>
<td>- one shield tooth bent or broken. Remove the shield, weld new tooth in the place of the previous one</td>
</tr>
<tr>
<td></td>
<td>Fuel stops</td>
<td>break or damage; the aerator is bent</td>
<td>- weld new aerator or repair the damaged one (upper aerator wall should be distanced max. 10 mm from the tank wall)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>too humid fuel (freezes to walls in winter)</td>
<td>- add portion of dry fuel and mix well, do not ram</td>
</tr>
<tr>
<td>II.1</td>
<td>Worm conveyor</td>
<td>no power supply to the motor</td>
<td>- find out the cause: blown fuse, damaged thermal safety device or controller – replace or repair damaged part</td>
</tr>
<tr>
<td></td>
<td>Does not rotate</td>
<td></td>
<td>- screw off the motor and replace the clutch</td>
</tr>
<tr>
<td></td>
<td></td>
<td>clutch/safety device damaged</td>
<td>- repair the gear (replace damaged tooth wheel)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>reduction gear damaged</td>
<td>- remove the gear from the motor and repair the connection (protect the screw against falling down from the reduction gear shaft)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>connection worm/reduction gear shaft damaged</td>
<td>- repair or replace the motor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>motor burnt</td>
<td>- unlock or replace the motor</td>
</tr>
<tr>
<td></td>
<td></td>
<td>end switch pressed or damaged</td>
<td>- unlock (release) the switch lever or replace the switch.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>end switch pushed or damaged</td>
<td>- replace damaged cables.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>wiring damaged</td>
<td>- remove cause of overload and check operation of the thermal safety device.</td>
</tr>
<tr>
<td>2</td>
<td>No fuel feeding</td>
<td>- no fuel in the tank</td>
<td>- worm damaged feather</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- worm tip broken or damaged</td>
<td>- outlet clogged</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- complete the fuel</td>
<td>- remove the worm, repair damaged tip</td>
</tr>
</tbody>
</table>

### III1. Reduction gear

#### Overheated

| - drive overload | - oil level too low |
| - bearings damaged | - toothed wheel damaged |
| - improper oil | - worn oil |

| - unlock the worm (clean the channel and the outlet) | - complete the oil (Hipol 15) to the level of the overflow plug (total capacity 1,7 l) |
| - find out, which bearing is damaged and replace it | - replace damaged wheel (worn wheels replace pairwise) |
| - pour proper oil | - remove worn oil, rinse the gearbox and pour new oil |

### 2. Too loud operation

| - bearing damaged | - toothed wheel damaged | - lack of oil or level too low |

| - replace | - replace |
| - complete or pour new oil |

### IV1. Pre-furnace

#### Quick growing up of the coal deposit on the grate and chamber walls; flue channel throttled

| - improper combustion process | - too many impurities in the fuel | - improper fuel |

| - adjust the process with controllers for optimum values | - remove fuel and replace with pure one |
| - do not burn coal, coke, plastic etc. | - remove coal deposits, clean the pre-furnace chamber (do not damage the lining) |

### 2. The lining worn too quick

| - improper preliminary heating of the chamber | - lining damaged mechanically (e.g. during cleanup) | - improper fuel |

| - repair the lining or make the new one with heat-resistant bricks laid on the mortar made of fire-resistant cement and “Boss” type filler |
# The whole AZSD unit

## 1. Smoke sensed

- untight flange connections
- untight cover or cover seal damaged
- lining damaged
- untight fuel tank cover
- improper thrust in the funnel.
- untight flue and smoke channels.

- repair the connections using new seals (tightly with screws).
- Tighten boiler inlet with fire-resistant mortar
- lay down the cover and fasten the butterfly nut. Replace the fire-resistant seal if necessary
- repair or make a new one of materials as in p. IV. 2.
- Close the tank with clamps.
- Replace the seal if necessary
- Clean up the funnel or flues, heighten the funnel or apply forced airflow
- seal up boiler flue and smoke channels

## 2. Improper woodwaste gazification process in the chamber

- chamber temperature too low (should amount to 850-1000°C)
- fuel too humid (more than 60%)
- the end switch switches off conveyor’s drive too soon
- fuel humidified from untight anti-fire tank valve

- improper process of making fire. Making fire should be conducted so as chamber lining had light color. For this purpose burn dry fuel (humidity lower than 30%) during 6÷12 hrs. Continuously adjust times: pause and feeding - if the fuel quantity is too low, adjust the feeding time
- mix the fuel with portion of dry one
- excess fuel flap in the chamber improperly adjusted. Cool down the chamber and position the flap 45° from vertical in the gas exhaust direction
- chamber air inlet throttled. Rise the gate with the butterfly nut
- check valve tightness. Replace untight valve. To make sure, that there is no leakage, prove the water level continuously.
| 3. | Boiler does not reach the set temperature | - improper combustion process in the pre-furnace chamber  
- temperature set to lower value than required  
- too great funnel thrust  
- excess of secondary air.  
- damaged temperature sensor switches combustion process to auxiliary cycle too soon  
- damaged controller – controls combustion process improperly (puts out of order, switches auxiliary cycle) | - see p. V. 2  
- set the sensor to higher value.  
- decrease the thrust using flap mounted in the funnel flue.  
- throttle back flaps for secondary air adjustment.  
- replace the sensor.  
- adjust the sensor (certified service personnel only) or replace it. |
| 4. | Damp emission in the boiler (water boils) | - adjustable temperature sensor does not work  
- maximum temperature sensor does not work | - check if the sensor is fastened properly  
- check the contact with the pipe  
- check sensor’s electrical connection, repair if necessary, replace sensor if damaged  
- check the controller’s answer for sensor signal (through a measurement bridge) |
| 5. | The program set is not realized properly | - power supply fading  
- controller damaged | - adjust programs: main and auxiliary on the control panel  
- repair or replace the controller |
| 6. | Backfire goes to the fuel tank | - fuel is not fed (worm conveyor does not work)  
- no fuel or fuel stopped | - find out the cause and remove it  
- shake the fuel or complete it |
| 7. | Continuous backfire to the fuel tank | - conveyor damaged  
- no power supply for the longer time  
- sensor and anti-fire valve damaged  
- no water in the tank | - find out the cause and remove it  
- if the anti-fire sensor does not work, empty the fuel tank and extinguish fire in the conveyor’s housing with water  
- replace the sensor and the valve  
- pour water to the tank |

9. LUBRICATION MANUAL (fig.2)
The unit has number of lubrication points and a unit, which requires constant oil bath.
Lubrication points:
the bearing in the movable shield mounted in the tank bottom; for AZSD-50,-100/0,65
In the tank of AZSD-100/1,5 the movable shield is supported with conical bearings. Pour the grease with a nipple (once a 10 days).
Elements of the worm gear (toothed wheels) require oil bath.
- oil type – Hipol 15
- oil capacity – 1,7 l, number of gears - 2
- replacement frequency – each 1000 hrs, first after 1000 hrs  
- oil level – up to the overflow plug

CAUTION !!!
The worm gear is delivered after running-in and filled with oil protecting from corrosion. The buyer should check the oil level (and replenish to the overflow plug, if necessary) before first use.

10. CURRENT MAINTENANCE, REPAIR AND OVERHAUL.

The AZSD is an energetic device for long-term operation. Device’s long life is possible only through observance of rules given in present manual and execution of inspections, repairs and overhauls as described below.

Current inspections and maintenance.

- Because the device is fed with fuel in the form of small, granulated woodwaste, there is a risk of dust deposition on various parts of the device.
- The blow fan rotor is the part mostly exposed to the dust, thus stop the fan once a week and clean rotor blades.
- Polluted rotor works unequally (vibrates and makes noise) what may cause its damage; simultaneously fan efficiency drops thus combustion process is improper, regarding to the lack of indispensable air.
- During current maintenance do not forget to grease the movable shield bearing and complete the oil in the gearbox.
- During combustion process rest of the fuel (impurities + ash) will fall to the ashtray, thus clean up the ashtray once a day or more frequent depending to the used fuel.
- Additionally, during current inspection (which should take place every day) check if the set parameters are realized, wiring – not damaged (sparkling etc.), water temperature sensors and end switch work properly.
- It is indispensable to ensure that all connections are tight to avoid carbon oxide emission and fire propagation.
- Once a week check if the sensor with anti-fire valve works properly, check the water flow in the worm housing (e.g. with pressurized air). The water level should be at the upper edge of the tank and should be checked daily (replenish the water immediately).
- Once a week check the valve and thermostat; the way of making it is described in p. 11.

Repairs

Repairs are performed only if necessary. If during inspection any defect or damage will be found, repair or replace damaged part or unit.

Overhaul

Overhaul is a planned activity of the maintenance crew. It is recommended to conduct each type of the overhaul in following cycle:

- P – periodical inspection every 200 hrs
- B – current overhaul every 600 hrs
- S – medium overhaul every 6000 hrs
- K – general overhaul every 30000 hrs

- During periodical inspection check chamber and burner linings, condition of the furnace – mounted flap and its arm.
- Additionally, clean up deposits in the chamber.
- Check the drive gear, worm and movable shield in the fuel tank.
During current overhaul perform all works resulting from periodical inspections, e.g. repair lining defects, adjust the worm or movable shield teeth, replace safety flap in the furnace.

Medium overhaul should comprise, besides of all works as for the of current overhaul, replacement of bearings in the drive gear.

General overhaul comprises such works as: exchange of chamber lining, channels’ sealing cover, regeneration or replacement of the worm, replacement of bearings in the drive gear, replacement of gear teeth if necessary.

CAUTION !!!
1. Each time the scope of works should be settled with regard to wear of parts or units.
2. All works (inspections, repairs and overhaul of boiler and controller) should be performed as described in appropriate manuals.

11. INSTALLATION OF THE ANTI-FIRE SYSTEM

Installation of the anti-fire system with a valve and a MMA thermostat (made in Sweden)
The valve with thermostat should be fastened to the connector of distribution pipes. Supply pipe should be screwed to the valve, then a hose put onto it (detail A on the fig. 1.8).
The range of set temperatures is as follows:

<table>
<thead>
<tr>
<th></th>
<th>°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>-50</td>
</tr>
<tr>
<td>2</td>
<td>-53</td>
</tr>
<tr>
<td>3</td>
<td>-56</td>
</tr>
<tr>
<td>4</td>
<td>-59</td>
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<tr>
<td>5</td>
<td>-62</td>
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<td>6</td>
<td>-64</td>
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<tr>
<td>7</td>
<td>-66</td>
</tr>
<tr>
<td>8</td>
<td>-68</td>
</tr>
<tr>
<td>9</td>
<td>-70</td>
</tr>
</tbody>
</table>

To set the temperature just turn the handwheel to one of a.m. numbers.
For normal operation set the handwheel to 5.
To check the valve and the thermostat:
- empty the tank
- remove the valve from the anti-fire system
- set the handwheel to 1
- put the thermostat tip (sensor) into hot water (previously boiled)
- check the air flow in the valve blowing the air through it
The valve is efficient if the air flows free through it.
Check also the valve at various settings.
If at any of settings the valve is clogged (no air flow), replace it.

CAUTION !!!
Remove plastic cover before sensor will be fastened to the worm conveyor housing.
Unit AZSD-50, AZSD-100
DIMENSIONS
Fig. 1. AZSD – general view
(location of warning & information stickers is also shown)
a-sign No.1,
b-sign No.2,
c-sign No.3,
d-sign No.4,
e-sign No.5,
f-sign No.6,
g-sign No.7,
h-sign No.8,
i-sign No.9,
k-sign No.10,
Description of signs is given on pp. 11 and 12
Fig. 1.1 Fuel tank

Fig. 1.2 Worm conveyor
Fig. 1.3 Pre-furnace
  a-feeder flap

Fig. 1.4 End switch

Fig. 1.5 Air adjustment
Fig. 1.6 Blow fan

Fig. 1.7 Conveyor drive
Fig. 1.8. Anti-fire system

a – water tank
b – unscrew the screw every 10 days, check the flow
c – prior to installation of the sensor remove the plastic cap
d – sensor
1. Inlet pipe          2. Thermostat MMA
2. Valve MMA          4. Water distribution
Fig. 2 Lubrication plan.

- grease LT4S
- oil Hipol 15
## Reducer AZSD-50, 100  \( n=6 \) rpm

<table>
<thead>
<tr>
<th>No.</th>
<th>Part</th>
<th>Qty</th>
<th>Material</th>
<th>Size</th>
<th>Standard No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Upper housing</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Lower housing</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Worm</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Worm wheel</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Shaft + screw-toothed wheel</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Screw-toothed wheel</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Outlet shaft</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Cover I</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Cover II</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Flange connection</td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>11</td>
<td>Motor connection</td>
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<tr>
<td>12</td>
<td>Driver I</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>13</td>
<td>Driver II</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>Clutch</td>
<td>1</td>
<td></td>
<td></td>
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<tr>
<td>15</td>
<td>Space ring</td>
<td>1</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Space washer</td>
<td>1</td>
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<tr>
<td>17</td>
<td>Electric motor</td>
<td>1</td>
<td>0.55kW 1440</td>
<td>6203 2RS</td>
<td>M-86960</td>
</tr>
<tr>
<td>18</td>
<td>Bearing</td>
<td>2</td>
<td>6208 2Z</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Bearing</td>
<td>2</td>
<td>6305</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Bearing</td>
<td>1</td>
<td>6205 2RS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Bearing</td>
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<td>6203 2RS</td>
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<td></td>
</tr>
<tr>
<td>22</td>
<td>Sealing ring</td>
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<td>PN-M-85111</td>
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<tr>
<td>26</td>
<td>Plug</td>
<td>2</td>
<td>M16x1.5</td>
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<td></td>
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<tr>
<td>27</td>
<td>Prismatic key</td>
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<tr>
<td>30</td>
<td>Screw</td>
<td>12</td>
<td>8,8-B M8x25</td>
<td>PN-M-8205</td>
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<td>31</td>
<td>Screw</td>
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<td>8,8-B M8x20</td>
<td>PN-M-8205</td>
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<tr>
<td>32</td>
<td>Screw</td>
<td>4</td>
<td>8,8-B M6x20</td>
<td>PN-M-82105</td>
<td></td>
</tr>
</tbody>
</table>
Controller SH-2/K – operation manual

The controller SH-2/K is designed for programming of operation of ovens AZSD- 50, 100. It makes possible reaching and keeping (within certain limits) the set temperature of heating media leaving the boiler. The controller ensures safe operation of the AZSD through:

- stopping of fuel feed if the pre-furnace is clogged,
- stopping of fuel feed and blow if the heating media temperature exceeds 95°C,
- turning off of the entire AZSD unit if long-term overload of the worm conveyor engine appears

Installation of the temperature sensor.
During start-up of the AZSD the proper installation of the temperature sensor is the thing of great importance. The sensor should have possibly best contact with the heating element. In the case of the AZSD unit coupled with the KWH boiler (made by ZM “HAMECH”) the sensor should be installed on the side wall of the water collector of the boiler (see fig. 1S). Prior to installation clean the contact surface thoroughly. Now, unscrew 4 screws and remove the sensor cover and fasten the sensor housing to the boiler collector with two M4 screws. Finally screw the cover to the housing.
If the AZSD is supplied without the boiler, the sensor should be fastened to the supply pipe with two clamp bands as on the fig.2S; do not forget to clean the contact surface thoroughly.

Controller operational elements
On the front panel situated behind the deflectable transparent cover of the upper cabinet there are handwheels for setting of feed and pause times for intensive and auxiliary combustion. The figures on scales do not mean seconds – they are just conventional values. The LEDs signal:

- running program (intensive / auxiliary)
- operation of the worm conveyor
- excessive temperature of the heating medium - above 95°C

On the right side of the cabinet there is the power supply switch for the controller. Under the cover there are a contactor and a thermal relay protecting the motor.
Temperature setting is realized with a handwheel on the controller’s front plate.

Connection of the controller
The connection bar is situated in the lower part of the controller. Power supply should be connected to terminals L1, L2, L3, N, PE. It is recommended to install protection against phase fading. The conveyor motor should be connected to terminals U, V, W, PE. Fan cables should be connected to terminals U1, N1, and to terminals 5, 6 - cables for the end switch installed on the pre-furnace. Terminals 1, 2, 3, 4 should be connected to proper cables of the temperature sensor.

Installation of the controller

- set the sensor of the temperature controller parallel to the pipe axis and fasten to the pipe with bands

Caution:
The controller should be connected and installed by authorized and properly trained personnel.

Any arbitrary alteration of the controller or use of fuses inconsistent with markings or improper setting of the controller may cause damage of the controller or a AZSD defect, which may led to fire or endanger human’s life.

Possible repairs (performed by authorized personnel) should be made only when the 3-phase power supply is off.
The design of the SH-2/K controller is the property of the ZM HAMECH in Hajnówka and is protected with copyright.
Controller SH-2/K
SH-2/K Controller scheme

Feeding time controller

Potentiometer plate
R1, R2 - 2M2
R3, R4 - 220k

Temp. sensor

End switch

Fan

Feeder

Tr1-TSZZ 25/30061
KM1-8C6-30-10-2.4
F1-M250 2.5-4A
K1, K2-F40, 52.7, 012.0000
F2-S301C1
Q1-4G16-10LUS1-S25
Fig. 1S. Fastening of the temperature sensor to the water collector
a- temperature sensor
b- screw M4x12

Fig. 2S. Fastening of the temperature sensor to the supply pipe
a- temperature sensor
b- clamp band
WARRANTY CARD No. ............

Product **Zespół Spalania Rozdrobnionego Drewna**

Type AZSD..............................
Serial.................................
Controller serial & type..............................
Reduction gear motor serial..........................
Manufacturing date .................................................................
Dispatch date .................................................................
Sale date .................................................................


stamp & signature Quality
Dept

point of sale – signature & stamp

COMPLAINT FORM

Mr (Mrs) ........................................................................................................
Address........................................................................................................
..................................................................................................................
Warranty card No. ...........................................................................................
Product type & serial ...........................................................................................
Purchase date ...................................................................................................
Start-up date ....................................................................................................

Short description of the defect........................................................................
..................................................................................................................
..................................................................................................................
..................................................................................................................
..................................................................................................................
..................................................................................................................
WARRANTY CONDITIONS

1. The manufacturer is obliged to repair for his own cost any physical defect revealed during warranty period.
2. The warranty period lasts 12 months from the sale date.
3. The manufacturer ensures the warranty service term of 14 days from the complaint date.
4. The warranty period will be lengthened by the time of repair, counting from the complaint date to the date of the repair’s finish, if the defect has made the device out of order.
5. The manufacturer takes no responsibility resulted from the warranty in following cases:
   a) mechanical damages arisen after commissioning of the device to the user,
   b) improper assembling, maintenance and operation (not conformable with the operation manual),
   c) repairs conducted by unauthorized personnel without manufacturer’s agreement,
   d) introduction of structure changes without written manufacturer’s agreement,
   e) defects resulted from force majeure
   f) if the buyer has not informed the manufacturer in the 14-days term, that the device is not complete.
6. All adjustment and maintenance works, as well as replacement of parts, which should be performed by the user as described in the manual, are not warranty repairs.
7. Following parts are not the subject of warranty: sawdust feeder, cast iron grate, PVC clutch
8. The warranty card is valid if contains dealer’s sign, stamp and date of sale.
9. A copy of the warranty card can be issued if the buyer submits any document of purchase.
10. If the complaint was groundless all costs bears the buyer.
11. The complaint should contain:
    a) warranty card number
    b) product name, type and serial
    c) sale date
    d) address and place of installation of the product
    e) type of defect and probable cause. Lack of a.m. data causes the complaint void. As the date of complaint acceptance recognized will be date of completion of data
12. Complaint should be submitted in written according to enclosed complaint form. In urgency the complaint may be submitted by phone. User should record the time of the talk and the name of the person, which accepted the complaint. The phone complaint should be confirmed in written a.s.a.p.
13. Any contention not regulated in present warranty card is subject of The Civil Code regulations, Art. 577-581.

Caution!

Be acquainted with the operation manual before operation,
In the case of lack of the warranty card user has no right to repairs for manufacturer’s cost.
CONFORMITY DECLARATION

No. 1/AZSD/04

Nazwa wyrobu: WOODWASTE COMBUSTION UNIT.
Type: AZSD: -50, -100.

Serial.............................. Manufacturing year..............................

Thereby we responsively declare that the product being the subject of present declaration is conformable with following standards and other normative regulations:

• Directive 98/37/EU /Decree of the Ministry of Economy, Labor and Social Policy dated on 10.04.2003r. for basic requirements for machinery and safety elements (Dz.U.Nr 91, pos. 858 dated on 23.05.2003r.)
  including the standard:

• Directive 73/23/EU/ Decree of the Ministry of Economy, Labor and Social Policy dated on 12.03.2003r. for basic requirements for electrical devices (Dz.U.Nr 49, pos. 414 dated on 24.03.2003r.)
  including the standard:

The present conformity declaration becomes void if the woodwaste combustion unit AZSD will be modified or rebuilt without our consent.

Hajnówka, 21.06.2004r.

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