THERMOSTAHL SOLAR
HEATING AND SOLAR SYSTEMS

Oil – Gas boiler

Enersave / Enersave Plus

INSTRUCTION MANUAL

The industry THERMOSTAHL SOLAR thanks you for the confidence you show in its products and assures you that you have made the right choice.
The boiler ENERSAVE is a reliable product and is manufactured with materials of excellent quality by a great factory.
The name THERMOSTAHL SOLAR is a GUARANTEE for the buyer

CONTENTS:

STANDARDS-DIRECTIVES-SPECIFICATIONS

The boilers THERMOSTAHL SOLAR are manufactured according to the European specifications for:

Directive	"Low voltage"	**73/23/CEE**
Directive	"Electromagnetic compatibility"	**89/336/CEE**
Directive	"Gas devices"	**90/396/CEE**
Directive	"Level of performance"	**92/42**
Standard EN 303.1	Heating boilers Heating boilers with burners of forced draught Part 1: Terminology-General requirements-Testing and Marking	
Standard EN 303.2	Heating boilers Heating boilers with burners of forced draught Part 2: Special requirements for boilers with oil burners with mechanical atomization of the fuel	
Standard EN 304	Heating boilers The code for heating boilers for atomic oil burners	
Standard TRD 702	Technical rules for steam boilers	
Standard TRD 305-306	Technical rules for steam boilers	
Standard DIN 4791	Electrical connections between burner and burner	
Standard ELOT 763	Central heating boilers Minimum directions of the combustion chamber	
Standard ELOT 234	Central heating boilers - Terminology nominal power	
Standard ELOT 235	Central heating boilers – Rules of testing	
Standard DIN 4702	Central heating boilers – Rules of construction	

The installation and running in must meet the following standards for:

- **DIN 4755 and 4787** combustion of EL light oil
- **DIN 4756 and 4788** gas combustion
- **DIN 4705** calculation of the chimney
- **DIN 4751** equipment of security plants
- **DIN 51603** liquid fuel of boilers
- **DIN 37116** electrical installation for the connection of the boiler
- **VDE**: standards according to EN 60730 for automations
- **DVGW-G 600** regulations for gas plants
- **EN 267** atomic oil burners, of monoblock type
- **EN 676** gas burners by use of ventilation
- **EN 226** burner connections
- **EN 60335-1** insurance of house and relevant electrical applications
- **EN 60529**: electrical protection levels (IP code).

PREFACE

This booklet contains useful and important information about the correct operation and maintenance of the central heating boiler THERMOSTAHL SOLAR. In addition, important instructions are given for the avoidance of accidents and serious damage, for the installation and operation of the boiler, in order for it to be safe and unimpeded. READ THESE INSTRUCTIONS CAREFULLY, BEFORE YOU PUT THE BOILER INTO OPERATION, FAMILIARISE YOURSELF WITH ITS OPERATIONS NAD CONTROL AND FOLLOW STRICTLY THE INSTRUCTIONS GIVEN.

Keep this booklet in a safe place, so as to be at your disposal when you need it.

If you have any questions or you need more information about particular points concerning the boiler THERMOSTAHL SOLAR, please do not hesitate to contact us. The technical data contained in this booklet are based on the more recent information and are submitted to eventual reviews, since new design improvements require it.

Our company reserves the right to change the design or/and the disposition of our products in any time, without being obliged to adjust in a corresponding manner the previous products, too.

1 DESCRIPTION

The **ENERSAVE** boiler is steel gas tabular, of three of burned gases with counter-pressure in the boiler furnace.

It is suitable with light oil combustion (DIN 51603) and gas combustion. It is available as an independent boiler or as a unit with an integrated burner. In addition, it is available in combination with a vertical hot water storage tank for domestic hot water production, with all the required connection expectations.

Moreover, the boiler disposes of accessories, such as sound absorbent burner cover, instrument table with or without automation, accessory materials for the boiler room (such as burner, circulator, security set, expansion tank, automatic filler, evacuation cock, cleaning brush, descending protection, etc.)

2 DELIVERY OF THE BOILER- TRANSPORT

The boiler ENERSAVE is delivered in a package with a wooden palette and is accompanied with the following parts:

- The steel body of the boiler, which contains also the turbines.
- The box with the metal covers and the insulation (it includes the screws for assembling the boiler, the suspenders with the clamps for the adjustment of the glass fiber, a cleaning brush, a lever for the door opening and a technical manual).
- The instruments table (provided that you have ordered it).

- The accessories (provided that you have ordered it).

BE SURE THAT YOU HAVE RECEIVED THEM!

A forklift, a palette-lift or a crane carries out the transport of the boiler (by the suspension hook). Secure the boiler at the transportation means during the transportation, so as not to slip.

3 FEATURES OF THE BOILER ENERSAVE

MATERIALS OF MANUFACTURE

- Steel St-37.2. DIN 17100.

- Fire tubes St-35, DIN 1629 without seam.

- Readers of burned gases INOX. AISI 304.

- Fire-proof material of minimum weight from inactive ceramic fibers

- Metal covers of 1-mm thickness (iron plate DKP).

- Tempering: electrostatic at 200ºC

- Insulation with glass fiber of 80 mm thickness with aluminum lining.

STEEL: SUPREME MATERIAL FOR HIGH EFFICIENCY

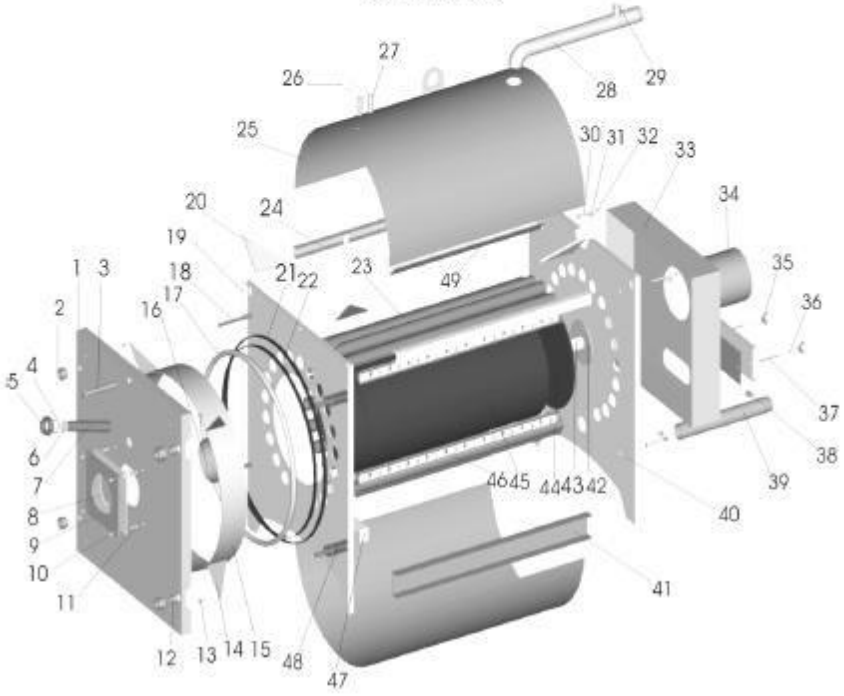
ADVANTAGES:

- Steel offers numerous advantages, which are of a particular importance for the modern heating technique. Some of these advantages are the following: ideal mechanical properties, remarkable formation possibilities, smooth surfaces and low weight.
- The great advantages of the boilers THERMOSTAHL SOLAR is the great water capacity, which allows the precise adjustment of its temperature and no exceptional requirements, are posed on the current of the volume of the water. The interior energy of the boiler contributes considerably to the protection of the environment, because the great volume of water increases the capacity of storage of energy, decreasing the number of combustion starts of the burner.
- Firm construction.
- Reliability.
- Energy savings.
- Friendly to the environment.
- Perfect design.
- Possibility of opening a door left-right.
- Easy maintenance.
- Overpressure combustion chamber.

- Large heating surface.
- Three strokes of burned gases.
- High level of performance ≥91%.
- Uniform thermal charge.
- Low temperature of exhaust gases (180ºC- 200ºC).
- Silent operation without problems.
- Minimal temperature of water return65gradeC.
- Maximal pressure of operation 4 bar.
- Test of boiler: 92/42 EEC, PD 335/16-8-93, FEK 143/A/2-9-93, PD 59/21-2-95, FEK 46/A/27-2-95, and CE 0617

EN 180 – En 3000

EN 15 –EN 160



1. Door head	2. Screw
3. Hole	4. Joint
5. Screw	6. Glass
7. Nozzle	8. Asbestos
9. Flange for the filling of the burner	10. Nut
11. Screw	12. Bushing

13. Nut	14. Angle bracket
15. Circle	16. Burner pipe
17. Asbestos cord	18. Screw
19. Front tube plate	20. Angle bracket
21. Exterior band	22. Interior band
23. Smoke tubes	24. U shape
25. Water chamber	26. Splint
27. Tubes	28. Hot water nozzle
29. Bushing	30. Screw
31. Fixing ear	32. Nut
33. Exhaust gases box	34. Stack connection
35. Arc	36. Washer
37. Screw	38. Blow down discharge
39. Water return nozzle	40. Rear tube plate
41. Tin profile	42. End plate for pipe stays
43. Pipe	44. End plate for furnace
45. Furnace (fire chamber)	46. Turbulators
47. Gusset	48. Hinge
49. Deflector profile	

4 START OF OPERATION

It is based on the counter-pressure that is created by the returnable flame in the combustion chamber and by the transmission of heat with radiation.

The burned gases reverse their course at the bottom of the fire box and in this way they surround the flame does not get into contact with the plates that surround the fire tube. The burned gases at the third stroke are transported towards the smoke box through the fire tubes to which they deposit their heat capacity with conductivity. The readers in the tubes spin the burned gases, so as to get into a continuous contact with the walls of the tubes and to deposit their heat capacity.

4.1 RETURNABLE FLAME

The returnable flame in the combustion chamber constitutes an evolution of the typical boilers of three strokes. To achieve this, an increase of the diameter of the fire box and the blocking of its outlet in the interior part of the boiler. The flame of the central or eccentric placed boiler penetrates deeply in the combustion chamber. The burned gases reverse their course at the bottom of the fire box and in this way they surround the flame over its whole length.

In this way the flame does not get into contact with the plates that surround the fire tub. A part of the heat of the burned gases is used for the evaporation of the drops of the already atomized fuel. Turbines are formed at the surfaces where the flame and burned gases are separated, fact that results in an intense mixing of fuel and air and in a COMPLETE COMBUSTION with a small surplus of air, because even the drops that may have a large diameter and tend to escape from the flame sideways without being

burned return to it because of the spinning created around. Another feature of the returnable flame is the UNIFORM CHARGE of the heated by radiation surface.

Here is a summary of the features of the returnable flame:

~ Uniform charge of the combustion chamber.

~ Reduction of the surplus of air because of transmission of heat from the returning burned gases in the drops of the fuel.

~ No need for building with fire bricks even for mast combustion.

~ Lengthening of the combustion distance.

~ Ideal condition of combustion.

~ Exceptional features of combustion.

5 APPLICATIONS

The boilers THERMOSTAHL SOLAR, according to DIN4751, are intended to produce hot water up to 95^{o}C in the central heating plants, in the plants of heating of hot usage water with converter and of other relevant applications.

THE BOILER MAY BE USED ONLY FOR THE PURPOSE FOR WHICH IT WAS DESIGNED AND MANUFACTURED. It may never be used for other purposes or different uses.

The manufacturer has no responsibility in case that the boiler it used for other purpose.

In case that there is a trouble with the product or the heating plant, you do not allow you to air the trouble.

THE REPAIR AND SERVICE IS A RESPONSIBILITY OF THE HEATING SPECIALIST, who is authorized by the company THERMOSTAHL SOLAR. In case you intervene on your own, you put the safety of the heating system and your personal safety in danger of accidents. IN THIS CASE THE GUARANTEE OF THE FACTORY DOES NOT APPLY.

A responsible mechanical engineer and heat plumber must control old and new plants for their suitability in presence of the owner.

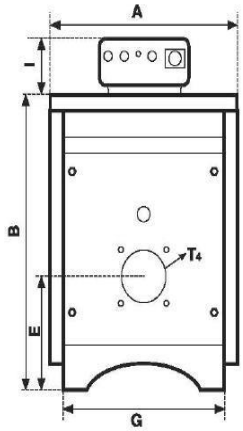
ENERSAVE

EN	Heating Power kW	Heating Power Mcal/h	Power Range Mcal/h	Back pressure mm H2O	Combustion chamber volume lt	Heating surface m2	Internal pressure fall (Δt=15oC) mm H2O	Water capacity lt	Maximum working pressure bar
23	23.2	20	15-20	2-4	24	0.9	20	36	4
35	34.9	30	20-30	2-4	24	1.0	20	41	4
47	46.5	40	30-40	2-4	32	1.4	20	51	4
58	58.1	50	40-50	4-6	40	1.6	30	61	4
69	68.8	60	50-60	4-6	48	2.0	30	71	4
81	81.4	70	60-70	4-6	52	2.2	40	102	4
93	93.0	80	70-80	6-10	65	2.6	50	112	4
116	116.3	100	80-100	7-12	78	3.1	60	122	4
140	139.5	120	100-120	7-12	91	3.6	70	134	4
160	162.8	140	120-140	8-16	144	4.1	80	214	4
190	186.0	160	140-160	8-16	161	4.6	90	246	4
210	209.3	180	160-180	10-20	174	5.1	100	266	4
230	233	200	180-200	10-20	205	6.0	120	284	4
260	256	220	200-220	10-20	206	6.2	130	372	4
290	291	250	220-250	10-20	263	7.4	150	455	4
350	349	300	250-300	20-30	320	8.7	180	528	4
400	407	350	300-350	20-30	370	10.0	180	601	4
460	465	400	350-400	20-30	444	12.0	220	580	4
520	523	450	400-450	20-30	518	12.7	230	729	4
580	581	500	450-500	20-30	518	13.2	230	704	4
700	698	600	500-600	20-30	555	15.3	250	763	4
800	814	700	600-700	30-40	665	17.3	300	824	4
930	930	800	700-800	30-40	775	19.3	320	885	4
1050	1047	900	800-900	30-40	986	21.2	350	1235	5
1160	1163	1000	900-1000	30-40	986	22.5	370	1180	5
1500	1453	1300	1000-1300	30-40	1182	27.3	400	1330	5
1750	1745	1500	1300-1500	40-60	1360	33.5	400	1640	5
1900	1919	1650	1500-1650	40-60	1585	36.3	420	1790	5
2100	2093	1800	1650-1800	40-60	1810	39.1	450	1950	5
2300	2326	2000	1800-2000	40-60	2185	48.14	470	2590	5
2700	2675	2300	2000-2300	40-60	2785	50.5	490	2710	5
2900	2887	2500	2300-2500	50-70	3273	59.5	500	2950	5
3500	3486	3000	2500-3000	50-70	3273	61.8	500	2870	5
4000	4070	3500	3000-3500	50-70	3767	70.2	520	3110	5
4650	4652	4000	3500-4000	50-70	4298	78.5	520	3350	5

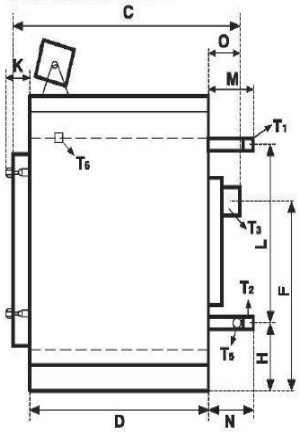
ENERSAVE PLUS

EN PLUS	Heating Power		Power Range	Back pressure	Combustion chamber volume	Heating surface	Internal pressure fall	Water capacity	Maximum working pressure
	kW	Mcal/h	Mcal/h	mm H2O	lt	m2	(Δt=15oC) mm H2O	lt	bar
23	23.2	20	15-20	2-4	32	1.4	20	51	4
35	34.9	30	20-30	2-4	40	1.6	20	61	4
47	46.5	40	30-40	4-6	48	2.0	20	71	4
58	58.1	50	40-50	4-6	56	2.4	30	79	4
69	68.8	60	50-60	5-7	52	2.4	30	96	4
81	81.4	70	60-70	5-7	65	2.8	40	106	4
93	93.0	80	70-80	6-10	78	3.3	50	116	4
116	116.3	100	80-100	7-12	91	3.8	60	126	4
140	139.5	120	100-120	8-16	144	4.4	70	202	4
160	162.8	140	120-140	8-16	161	4.9	80	234	4
190	186.0	160	140-160	10-20	174	5.4	90	254	4
210	209.3	180	160-180	10-20	205	6.4	100	270	4
230	233	200	180-200	10-20	218	6.6	120	288	4
260	256	220	200-220	15-25	206	6.7	130	350	4
290	291	250	220-250	15-25	263	7.9	150	435	4
350	349	300	250-300	25-35	320	9.3	180	505	4
400	407	350	300-350	25-35	370	10.5	180	572	4
460	465	400	350-400	25-35	444	12.7	220	551	4
520	523	450	400-450	25-35	518	13.4	230	696	4
580	581	500	450-500	25-35	518	14.1	230	668	4
700	698	600	500-600	25-35	555	16.2	250	724	4
800	814	700	600-700	40-50	665	18.5	300	780	4
930	930	800	700-800	40-50	775	20.5	320	845	4
1050	1047	900	800-900	40-50	986	22.4	350	1180	5
1160	1163	1000	900-1000	40-50	986	24.1	370	1130	5
1500	1453	1300	1000-1300	40-50	1182	29.0	400	1270	5
1750	1745	1500	1300-1500	50-60	1360	35.6	400	1590	5
1900	1919	1650	1500-1650	50-60	1585	38.9	420	1740	5
2100	2093	1800	1650-1800	50-60	1810	42.7	450	1900	5
2300	2326	2000	1800-2000	50-60	2185	50.3	470	2490	5
2700	2675	2300	2000-2300	50-60	2785	53.4	490	2600	5
2900	2887	2500	2300-2500	60-70	3273	62.2	500	2850	5
3500	3486	3000	2500-3000	60-70	3273	66.7	500	2750	5
4000	4070	3500	3000-3500	60-70	3767	75.0	520	2980	5
4650	4652	4000	3500-4000	60-70	4298	83.9	520	3230	5

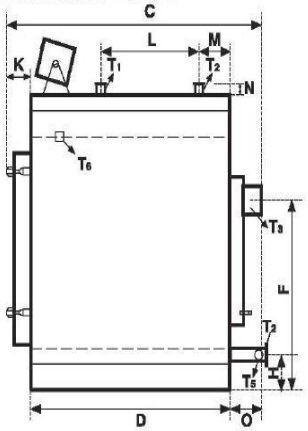
Dimensions



Boiler EN 23 - 230



Boiler EN 260 - 4.650



Dimensions ENERSAVE

	A	B	C	D	E	F	G	H	I	K	L	M	N	O
EN	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
23	700	875	700	410	425	530	595	190	163	150	560	190	220	170
35	700	875	700	410	425	530	595	190	163	150	560	190	220	170
47	700	875	800	510	425	530	595	190	163	150	560	190	220	170
58	700	875	900	610	425	530	595	190	163	150	560	190	220	170
69	700	875	1000	710	425	530	595	190	163	150	560	190	220	170
81	790	1015	1010	660	495	635	685	250	163	150	650	190	220	180
93	790	1015	1110	760	495	635	685	250	163	150	650	190	220	180
116	790	1015	1210	860	495	635	685	250	163	150	650	190	220	180
140	790	1015	1310	960	495	635	685	250	163	150	650	190	220	180
160	900	1110	1350	965	540	655	795	230	163	170	730	250	240	240
190	900	1110	1450	1065	540	655	795	230	163	170	730	250	240	240
210	900	1110	1550	1165	540	655	795	230	163	170	730	250	240	240
230	900	1110	1700	1315	540	655	795	230	163	170	730	250	240	240
260	1040	1240	1600	1060	640	790	950	220	163	250	680	190	160	270
290	1040	1240	1850	1310	640	790	950	220	163	250	930	190	160	270
350	1040	1240	2100	1560	640	790	950	220	163	250	1180	190	160	270
400	1040	1240	2350	1810	640	790	950	220	163	250	1430	190	160	270
460	1290	1545	2050	1340	750	980	1170	290	163	330	750	300	120	450
520	1290	1545	2300	1590	750	980	1170	290	163	330	1000	300	120	450
580	1290	1545	2300	1590	750	980	1170	290	163	330	1000	300	120	450
700	1290	1545	2550	1840	750	980	1170	290	163	330	1250	300	120	450
800	1290	1545	2800	2090	750	980	1170	290	163	330	1500	300	120	450
930	1290	1545	3050	2340	750	980	1170	290	163	330	1750	300	120	450
1050	1540	1935	2850	1850	960	1000	1420	340	163	400	1050	400	140	640
1160	1540	1935	2850	1850	960	1000	1420	340	163	400	1050	400	140	640
1500	1540	1935	3100	2100	960	1000	1420	340	163	400	1300	400	140	640
1750	1540	1935	3600	2600	960	1000	1420	340	163	400	1800	400	140	640
1900	1540	1935	3850	2850	960	1000	1420	340	163	400	2050	400	140	640
2100	1540	1935	4100	3100	960	1000	1420	340	163	400	2300	400	140	640
2300	1940	2235	3700	2600	1250	1500	1850	420	163	360	1800	450	160	780
2700	1940	2235	3700	2600	1250	1500	1850	420	163	360	1800	450	160	780
2900	1940	2235	4200	3100	1250	1500	1850	420	163	420	2300	450	160	780
3500	1940	2235	4200	3100	1250	1500	1850	420	163	420	2300	450	160	780
4000	1940	2235	4700	3600	1250	1500	1850	420	163	420	2800	450	160	780
4650	1940	2235	5200	4100	1250	1500	1850	420	163	420	3300	450	160	780

	T1-T2	T3	T4	T5	T6
EN	in	Ø mm	Ø mm	Ø mm	Ø mm
23	1 ¼"	139	106	½"	½"
35	1 ¼"	139	106	½"	½"
47	1 ¼"	139	106	½"	½"
58	1 ½"	139	132	½"	½"
69	1 ½"	139	132	½"	½"
81	1 ½"	159	132	½"	½"
93	1 ½"	159	132	½"	½"
116	2"	159	132	½"	½"
140	2"	159	132	½"	½"
160	2"	193	151	½"	½"
190	2"	193	151	½"	½"
210	2 ½"	193	151	½"	½"
230	2 ½"	193	151	½"	½"
260	2 ½"	244	185	1 ¼"	½"
290	2 ½"	244	185	1 ¼"	½"
350	3"	293	185	1 ¼"	½"
400	3"	293	185	1 ¼"	½"

460	DN 100	343	260	1 ¼"	½"
520	DN 100	343	260	1 ¼"	½"
580	DN 100	343	260	1 ¼"	½"
700	DN 100	343	260	1 ¼"	½"
800	DN 125	343	260	1 ¼"	½"
930	DN 125	343	260	1 ¼"	½"
1050	DN 125	395	340	1 ¼"	½"
1160	DN 125	395	340	1 ¼"	½"
1500	DN 150	483	340	1 ¼"	½"
1750	DN 150	483	340	1 ¼"	½"
1900	DN 150	483	340	1 ¼"	½"
2100	DN 150	483	340	1 ¼"	½"
2300	DN 200	581	380	1 ¼"	½"
2700	DN 200	581	380	1 ¼"	½"
2900	DN 200	645	380	1 ¼"	½"
3500	DN 200	645	380	1 ¼"	½"
4000	DN 200	645	380	1 ¼"	½"
4650	DN 200	645	380	1 ¼"	½"

Dimensions ENERSAVE PLUS

	A	B	C	D	E	F	G	H	I	K	L	M	N	O
EN	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**
23	**700**	**875**	**800**	**510**	**425**	**530**	**595**	**190**	**163**	**150**	**560**	**190**	**220**	**170**
35	**700**	**875**	**900**	**610**	**425**	**530**	**595**	**190**	**163**	**150**	**560**	**190**	**220**	**170**
47	**700**	**875**	**1000**	**710**	**425**	**530**	**595**	**190**	**163**	**150**	**560**	**190**	**220**	**170**
58	**700**	**875**	**1100**	**810**	**425**	**530**	**595**	**190**	**163**	**150**	**560**	**190**	**220**	**170**
69	**790**	**1015**	**1010**	**660**	**495**	**635**	**685**	**250**	**163**	**150**	**650**	**190**	**220**	**180**
81	**790**	**1015**	**1110**	**760**	**495**	**635**	**685**	**250**	**163**	**150**	**650**	**190**	**220**	**180**
93	**790**	**1015**	**1210**	**860**	**495**	**635**	**685**	**250**	**163**	**150**	**650**	**190**	**220**	**180**
116	**790**	**1015**	**1310**	**960**	**495**	**635**	**685**	**250**	**163**	**150**	**650**	**190**	**220**	**180**
140	**790**	**1015**	**1350**	**965**	**495**	**635**	**685**	**250**	**163**	**150**	**650**	**190**	**220**	**180**
160	**900**	**1110**	**1450**	**1065**	**540**	**655**	**795**	**230**	**163**	**170**	**730**	**250**	**240**	**240**
190	**900**	**1110**	**1550**	**1165**	**540**	**655**	**795**	**230**	**163**	**170**	**730**	**250**	**240**	**240**
210	**900**	**1110**	**1700**	**1315**	**540**	**655**	**795**	**230**	**163**	**170**	**730**	**250**	**240**	**240**
230	**900**	**1110**	**1800**	**1415**	**540**	**655**	**795**	**230**	**163**	**170**	**730**	**250**	**240**	**240**
260	**1040**	**1240**	**1600**	**1060**	**640**	**790**	**950**	**220**	**163**	**250**	**680**	**190**	**160**	**270**
290	**1040**	**1240**	**1850**	**1310**	**640**	**790**	**950**	**220**	**163**	**250**	**930**	**190**	**160**	**270**
350	**1040**	**1240**	**2100**	**1560**	**640**	**790**	**950**	**220**	**163**	**250**	**1180**	**190**	**160**	**270**
400	**1040**	**1240**	**2350**	**1810**	**640**	**790**	**950**	**220**	**163**	**250**	**1430**	**190**	**160**	**270**
460	**1290**	**1545**	**2050**	**1340**	**750**	**980**	**1170**	**290**	**163**	**330**	**750**	**300**	**120**	**450**
520	**1290**	**1545**	**2300**	**1590**	**750**	**980**	**1170**	**290**	**163**	**330**	**1000**	**300**	**120**	**450**
580	**1290**	**1545**	**2300**	**1590**	**750**	**980**	**1170**	**290**	**163**	**330**	**1000**	**300**	**120**	**450**
700	**1290**	**1545**	**2550**	**1840**	**750**	**980**	**1170**	**290**	**163**	**330**	**1250**	**300**	**120**	**450**
800	**1290**	**1545**	**2800**	**2090**	**750**	**980**	**1170**	**290**	**163**	**330**	**1500**	**300**	**120**	**450**
930	**1290**	**1545**	**3050**	**2340**	**750**	**980**	**1170**	**290**	**163**	**330**	**1750**	**300**	**120**	**450**
1050	**1540**	**1935**	**2850**	**1850**	**960**	**1000**	**1420**	**340**	**163**	**400**	**1050**	**400**	**140**	**640**
1160	**1540**	**1935**	**2850**	**1850**	**960**	**1000**	**1420**	**340**	**163**	**400**	**1050**	**400**	**140**	**640**
1500	**1540**	**1935**	**3100**	**2100**	**960**	**1000**	**1420**	**340**	**163**	**400**	**1300**	**400**	**140**	**640**
1750	**1540**	**1935**	**3600**	**2600**	**960**	**1000**	**1420**	**340**	**163**	**400**	**1800**	**400**	**140**	**640**
1900	**1540**	**1935**	**3850**	**2850**	**960**	**1000**	**1420**	**340**	**163**	**400**	**2050**	**400**	**140**	**640**
2100	**1540**	**1935**	**4100**	**3100**	**960**	**1000**	**1420**	**340**	**163**	**400**	**2300**	**400**	**140**	**640**
2300	**1940**	**2235**	**3700**	**2600**	**1250**	**1500**	**1850**	**420**	**163**	**360**	**1800**	**450**	**160**	**780**
2700	**1940**	**2235**	**3700**	**2600**	**1250**	**1500**	**1850**	**420**	**163**	**360**	**1800**	**450**	**160**	**780**
2900	**1940**	**2235**	**4200**	**3100**	**1250**	**1500**	**1850**	**420**	**163**	**420**	**2300**	**450**	**160**	**780**
3500	**1940**	**2235**	**4200**	**3100**	**1250**	**1500**	**1850**	**420**	**163**	**420**	**2300**	**450**	**160**	**780**
4000	**1940**	**2235**	**4700**	**3600**	**1250**	**1500**	**1850**	**420**	**163**	**420**	**2800**	**450**	**160**	**780**
4650	**1940**	**2235**	**5200**	**4100**	**1250**	**1500**	**1850**	**420**	**163**	**420**	**3300**	**450**	**160**	**780**

	T1-T2	T3	T4	T5	T6
EN	**in**	**Ø mm**	**Ø mm**	**Ø mm**	**Ø mm**
23	1 ¼"	139	106	½"	½"
35	1 ¼"	139	106	½"	½"
47	1 ¼"	139	132	½"	½"
58	1 ½"	139	132	½"	½"
69	1 ½"	139	132	½"	½"
81	1 ½"	159	132	½"	½"
93	1 ½"	159	132	½"	½"
116	2"	159	132	½"	½"
140	2"	159	151	½"	½"
160	2"	193	151	½"	½"
190	2"	193	151	½"	½"
210	2 ½"	193	151	½"	½"
230	2 ½"	193	151	½"	½"
260	2 ½"	244	185	1 ¼"	½"
290	2 ½"	244	185	1 ¼"	½"
350	3"	293	185	1 ¼"	½"
400	3"	293	185	1 ¼"	½"
460	DN 100	343	260	1 ¼"	½"
520	DN 100	343	260	1 ¼"	½"
580	DN 100	343	260	1 ¼"	½"
700	DN 100	343	260	1 ¼"	½"
800	DN 125	343	260	1 ¼"	½"
930	DN 125	343	260	1 ¼"	½"
1050	DN 125	395	340	1 ¼"	½"
1160	DN 125	395	340	1 ¼"	½"
1500	DN 150	483	340	1 ¼"	½"
1750	DN 150	483	340	1 ¼"	½"
1900	DN 150	483	340	1 ¼"	½"
2100	DN 150	483	340	1 ¼"	½"
2300	DN 200	581	380	1 ¼"	½"
2700	DN 200	581	380	1 ¼"	½"
2900	DN 200	645	380	1 ¼"	½"
3500	DN 200	645	380	1 ¼"	½"
4000	DN 200	645	380	1 ¼"	½"
4650	DN 200	645	380	1 ¼"	½"

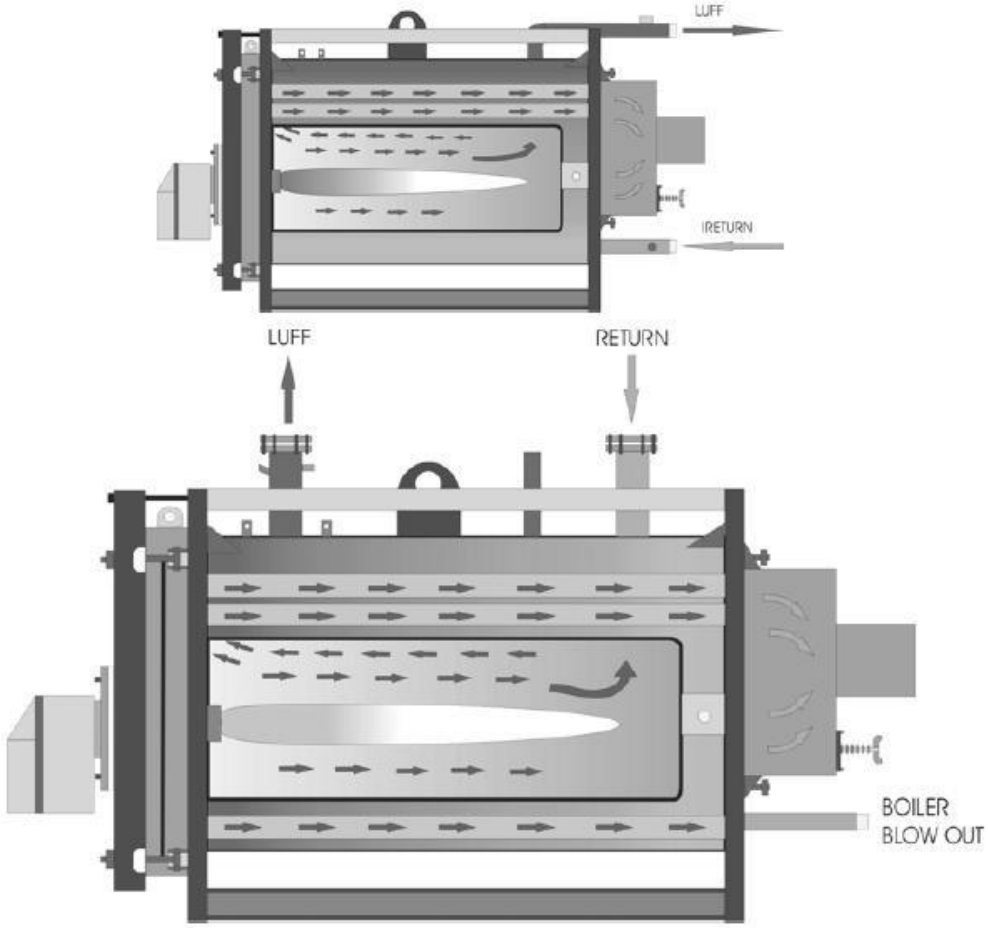
6. CONSTRUCTION

6.1 BOILER BODY

The boiler ENERSAVE is horizontal, air tubular with overpressure in the combustion box.

The main body of the boiler is manufactured from hot rolling inapprehensive steel sheets St 37-2 in conformity with DIN 17100.

The cutting is done with a high technology LASER machine. The designing of the boiler THERMOSTAHL SOLAR is made so as all the affected from fire parts to be water-cooled. The cross section, the joint and the length of the air tube are specially studied, in order to accelerate the maximum exploitation of the burned gases. The mirror of the firebox has a special configuration (a hollow), for noiseless running without vibration. The wildings are made according to standards 288-1 and 288-3 and DIN 50120, 50121-50145 by robots by using electric welding devices (MIG-MAG) with the oscillatory current method so as for the welding material to penetrate deeply the plate.



The quality of the wildings is controlled according to DIN 8563. The procedure of the wildings is carried out according to 131-ISO4063.The smoke-box is screwed and has a special cleaning hatch, which functions also as an expanding part against the explosions.

In the interior part of the boiler on the reversion of the water there is a specially formed plate, which forces the water to disperse for a faster heating and a uniform thermal strain of the boiler. The stroke of the water is opposite and converse to the stroke of the combustible gases.

Each boiler is separately tested at a hydraulic pressure of 6-8 bar (depending on the type) for strength and tightness control. A strong insulation surrounds the whole of the boiler's water space.

6.2 DOOR

The fireproof material of great thickness for high protection and heat insulation from the flame lines the door of the boiler. It is designed in such a way so as to open to the left and to the right, and it is easily accessible for maintenance and cleaning.

For the appropriate adjustment of the door, it is necessary that the door is tightly mounted on the ceramic line. In this manner the risk of combustible gases leak is avoided. You must screw tightly the exterior bolt.

If the door is not mounted on the ceramic line, shift the inner bolt (lock out).

The door bears a flange for the adjustment of the burner and a glazed flame inspection hole. For limitation of heat lasses due to radiation a metallic cover with glass fiber insulation covers the door.

Special hinges with conical nuts in combination with a door snap gear hold it in a horizontal position.

6.3 COVERS

The covers are metallic, electrostatic dyed, and buckled up to be fitted and fast and easily removable, giving and perfect aesthetics to the boiler. The smoke box bears a cover with glass fiber insulation limiting heat lasses due to radiation at the minimum.

7 LEVEL OF PERFORMANCE

The level of performance exceeds 90% in a complete load. The complete combustion that takes place assures minimal emissions of wastes and fuel saving.

8 TECHNICAL DATA

8.1 WATER TEMPERATURE

The maximal temperature of water is 100ºC. The minimal temperature of the return water is 65ºC for nominal decrease of temperature Δt=20ºC in a device of heat performance. In order to protect the boiler from creation of liquefaction in the fire box and in the fire tubes we recommend the use of a system which would be capable of preserving temperature above 60ºC. The figure below shows a typical system which is used for this purpose.

A circulator, which is connected with both supplies (luff and return), circulates again the glow of hot water, in order to keep the boiler in a temperature, which is placed in the return tube near the boiler, controls the operation of the circulator.

The supply of the circulator can be calculated as follows:

SUPPLY (lit/h) = BOILER POWER (Kcal/h) /40

In order to achieve a desired temperature in the boiler, the burner must be adjusted in such a way, so as to use the supply that corresponds to the graduated outlet.

8.2 WATER PRESSURE

The boiler is appropriate for open and closed heating systems with maximal operation pressure 4 bars.

The maximal operation pressure of the standard power boilers more than 800 KW is 5 bar.

8.3 WATER QUALITY

The quality of the heating plant water is an important element for the performance of the system. The water that enters the heating plant must be clean, transparent and free from salts and chemical substances. It must be filtered, so as no quantity of sand or mud from the water supply comes into the boiler.

The hardness of the water must be within permissible limits. In these regions, where the water is hard, it is necessary to use water softeners.

Properties of the water for use:

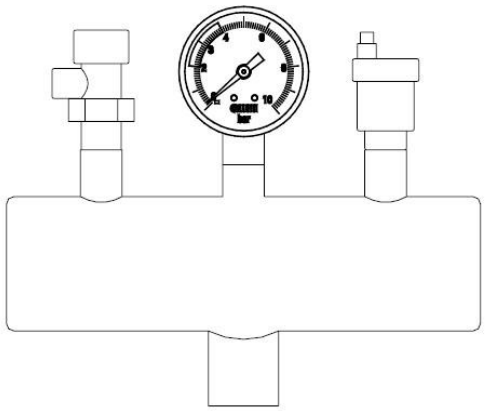
- Appearance: clean-transparent
- Total hardness: Max 20ºf Free
- oxygen: Max 0,05 mg/lit Organic
- substances: Max 0,5 mg/lit ph: min
- 8,5

8.4 SECURITY TECHNICAL EQUIPAMENT

The boilers must be equipped according to DIN 4751-2 for plants with luff temperature up to 100ºC.

The security thermostat interrupts the operation of the burner as soon as the water temperature reaches 95ºC. The security set is connected to the luff and consists of collectors, a safety valve that opens at 3bar or 4bar (depending on the boiler power), a manometer and a network gas with a back-firing valve.

Boiler power	Safety valve
50 kW	½''
100 kW	¾''
200 kW	1''
350 kW	1 ¼''
580 kW	1 ½''
870 kW	2''



8.5 FLOOR HEATING

In the floor heating we recommend the use of synthetic tubes with oxygen dam, according to DIN 4726, so as to avoid the penetration of oxygen into the tubes through the walls.

9. INSTRUCTIONS FOR INSTALLATION

9.1.1 INSULATION

The boiler is accompanied with glass fiber insulation with aluminum lining of 80 mm thickness. The door of the boiler has an interior insulation of fire-proof material of ceramic fibers of resistance at 1.300ºC, of 90 mm thickness in the boiler up to 210 KW and 180 mm in the boilers up to 407 KW. In addition, it has an outside insulation of glass wool and a metal casing.

The boiler smoke box has also insulation.

9.1.2 ASSEMBLING OF COVERS

The assembling of the covers in the body of the boiler can be made easily and rapidly, if you follow the following instructions and the relevant plan.

Here is the sequence you have to follow for the assembling:

a) First you place the side sliding cups in a direction from the top towards the bottom at the respective guides which are formed by the front and the back tube plate.

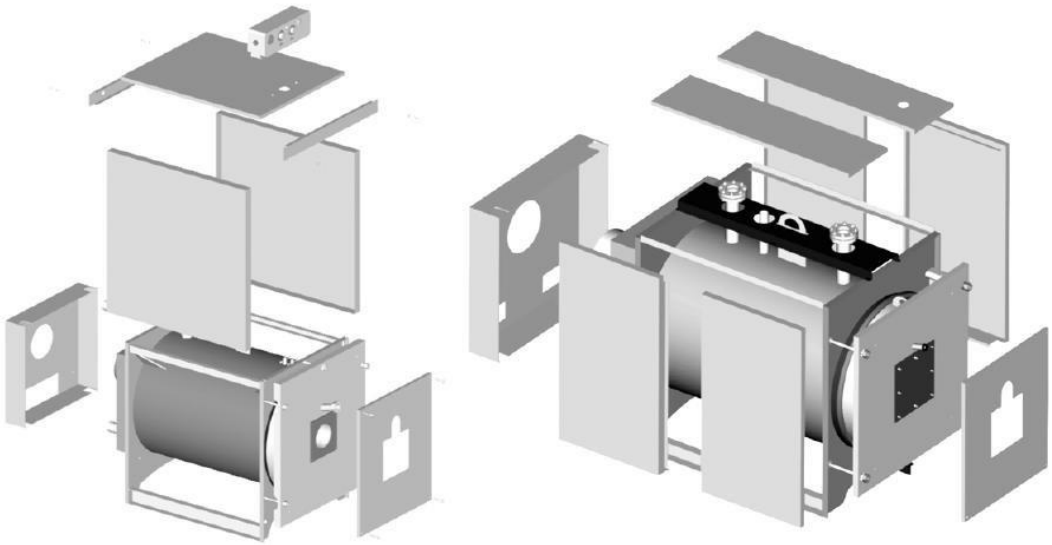
b) The front and the back leading edges are screwed at the respective positions by means of two iron plate screws for each one.

c) The above cover is placed on them and it locks thanks to the special joints (clips).

d) Finally, you put the front and the back cover of the boiler, which covers the door and the smoke box respectively, by fitting them at the corresponding sockets.

e) For boilers of more than 230 KW you follow the same procedure; the only difference is that the cups are placed from the side and not by moving them from the top towards the bottom.

f) Attach the type plate and the operating instructions at the side, where they will be better seen.



9.2 POSITION IN THE BOILER ROOM

9.2.1 DIMENSIONS OF SPACE

We suggest that you make the installation of the boiler room according to the following plan, so as to have enough space for an easy maintenance and cleaning.

The boiler must be in a horizontal position and must be accessible from all sides, if possible.

9.2.2 DISTANCE BETWEEN THE BOILER AND THE FRONT WALL

For boilers up to 300 kW minimum 1,5m.

For bigger boilers minimum 2 m.

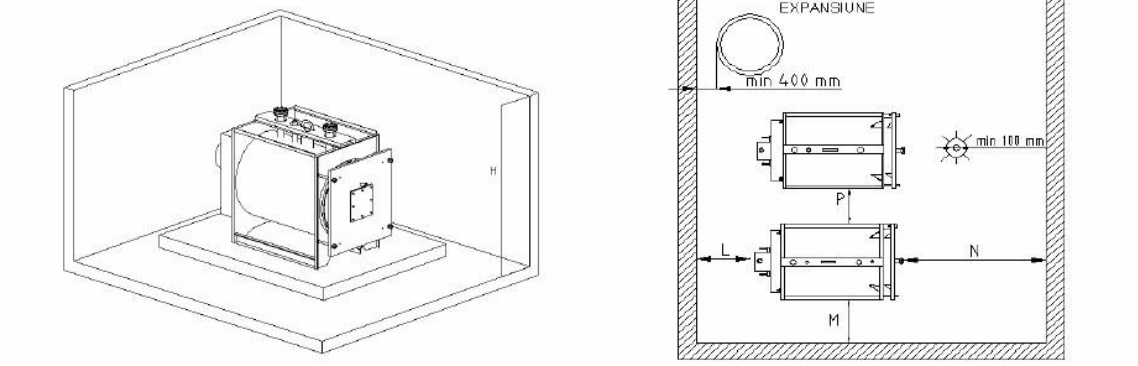
9.2.3 DISTANCE BETWEEN THE BOILER AND THE BACK WALL

The suitable distance is the one that allows an easy access for control and maintenance.

9.2.4 DISTANCE BETWEEN THE BOILER AND THE SIDE WALL

At least 0,6 m for boilers up to 300 KW.

At least 1 m for greater boilers.



9.2.5 HEIGHT OF THE BOILER ROOM

For boilers up to 70 KW at least 2,2m

For boilers of more than 70 kW at least 2,4m.

For boilers of more than 230 kW at least 3m.

9.2.6 LUFF OF COMBUSTUION AIR

The cross section of the opening for the luff is determined by the following formula:

F=Q*8 /1000

Where F= Surface of the opening in cm² (with grid)

(without grid by receiving 2/3 of the F)

Q=Heating power of the boiler in Kcal/h

9.2.7 NOTES

In the boiler room:

a) there must be cleanness,

b) the inflammable objects must be taken away,

c) there must be a sewage system,

d) there must be sufficient ventilation,

e) the fuel tanks must be placed in a separate ventilated space out of the boiler room. If they are within the boiler room, there must a partition wall, on the basis of safety regulation in force,

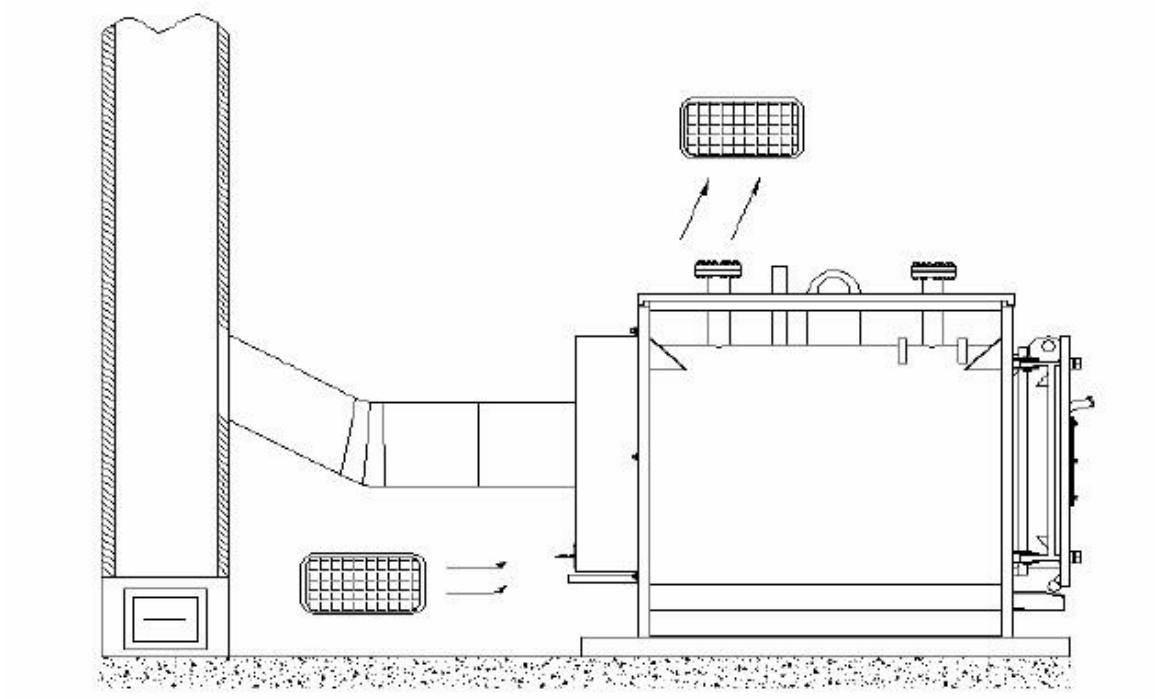
f) a dry dust fire extinguisher and a portable fire extinguisher must be placed at the ceiling of the boiler room, above the burner, next to the door,

g) the chimney must be safe and have appropriate cross section,

h) it is recommended that the tank is placed in a space that is not exposed to the sun, rain and fire,

i) a detector of smoke ionization is placed at the ceiling of the boiler room, when an alarm installation is provided for the building

j) the door must be metal without Venetian blinds or window panes and must be open towards the outside part of the boiler room.



ATTENTION: It is forbidden to install the boiler in spaces with dense dust, dangerous gases, as well as in wet spaces, such as bathrooms with a high level of moisture.

10. SELECTION OF BURNER

The boiler THERMOSTAHL SOLAR is over pressing for combustion of oil diesel (light oil) of EL type according to the norm DIN 51603-1 (maximum viscosity at 20ºC: 1,5 E-6 cS (41˝R) or gas (natural gas or LPG) with the corresponding in each case burner.

The selection of burner is related not only to the boiler power, but also to its possibility to overcome the counter pressure of the boiler. So, the exact determination of the boiler must be made on the basis of the operation curves given by its manufacturer.

All ATOMISATION BURNERS are APPROPRIATE FOR USE WITH THE BOILER, if there is a prior suitable selection on the basis of the power and the manufacture data of the boiler. The selected burner must meet all the safety and performance requirements for central heating boilers, according to DIN 4787 and 4788. The boiler EN operates with the principle of triple stroke.

The burner that will be used must have such features, so as for the produced flame to have the appropriate size, but not bigger than normal size. A specialist carries out the adjustment of the burner, and it is of exceptional importance for the economic operation of the boiler, as well as for the limitation of dangerous wastes that can be provoked by a wrong adjustment.

For every work of assembling or repair in the burner or in the boiler panel we must switch off the main switch of power supply to the device of heating.

The oil burner must be controlled according to EN 267. The gas burner must be controlled according to EN 676 and to have the sign of the European Union CE according to the directive 90/396.

The draught of the chimney must be as defined by the manufacturer of the burner. Burners with automatic air damper should be preferable, in order for the boiler not to cool during the breaks of operation of the burner. As far as low powers are concerned (up to 70 kW) burners with oil warming up should be preferable for the improvement of the level of performance.

In this way:

- You assure the even start of the burner during very cold periods and after a long stay out of operation.
- The level of atomization of oil increases, reducing the risk of blocks in the very small fuel supplies.

- It is possible to use a larger atomizer, reducing the risk of blocks in the very small fuel supplies.

10.1 SETTING OF BURNER

The boilers THERMOSTAHL SOLAR are overpressure boilers and it is necessary to take into account the static pressure of counter-pressure in the combustion chamber and to select the proper burner. THE DISTANCE d OF THE PENETRATION OF THE BOILER PORT MUST BE IN ANY CASE OBSERVED and it must be controlled if the length is sufficient for the adjustment of the burner, the support of which is made with flange. The dimensions of the port in the boiler door for the passing of the burner mouth as well as of the support screws are according to DIN 4789. The part of the oil pipes, which is connected with the burner must have sufficient length and must be flexible, so as to allow opening the boiler door, which rotates at 90ºC.

The gap around the boiler port is filled by fireproof ceramic material.

The supply of oil burner gas must be adjusted at the nominal power of the boiler, by selection of the appropriate atomizer (see table, page33).

INSTRUCTIONS FOR THE MOUNTING OF THE BURNER

For the mounting of the burner on the boiler, you must take care of the following:

A) The burner must be well fixed on the special flange of the boiler. The four screws must be fastened well, so that the burner is not loose on the boiler.

B) The sealing flange of the burner ensures the insulation from combustion gas leaks. Take care that it does not break.

C) The injection neck of the burner must be deep enough in the boiler, so that its edge reaches deeper than the plate that carries the tubes. The burners with long injection neck are more proper for boilers made of steel.

D) The burner must be positioned horizontally and parallel to the combustion chamber.

E) The position of the burner must be correctly aligned in connection with the center of the combustion chamber. In this way the uniform flame is developed and a better distribution of the thermal loads is ensured.

F) The door must fit well on the asbestos cord in order not to have combustion gas leaks.

G) The space between the injection neck of the burner and the door of the boiler must be fillet with fireproof material.

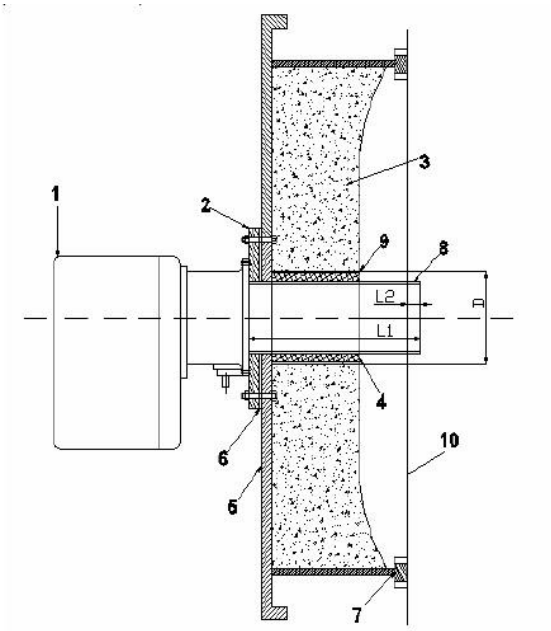
H) The fireproof material of the door of the boiler must be replaced with new material, if it gets damaged during the use.

I) The correct function of the burner ensures smooth combustion and harmonic co-operation with the boiler.

J) If above mentioned instructions are not followed, then the guarantee of the boiler is not valid.

K) We recommend that no inexperienced and untrained persons perform any works on the burner. A special technician is necessary (with license).

1. Burner
2. Flange for the filling of the burner
3. Door insulation with fire proof material
4. Insulation that must be placed around the injection neck of burner.
5. Door
6. Asbestos plate
7. Asbestos cord
8. Burner injection neck
9. Tube
10. Front plate



10.2 SELECTION OF CIRCULATOR

For the calculation of the circulator, it is necessary that a study of the plant is carried out by a mechanical engineer, and that the internal frictions, the manometer and the supply are calculated.

In any case, during the operation of the boiler there must be water circulation, which must be greater than:

Liters/hour= boiler power (K/cal) /16

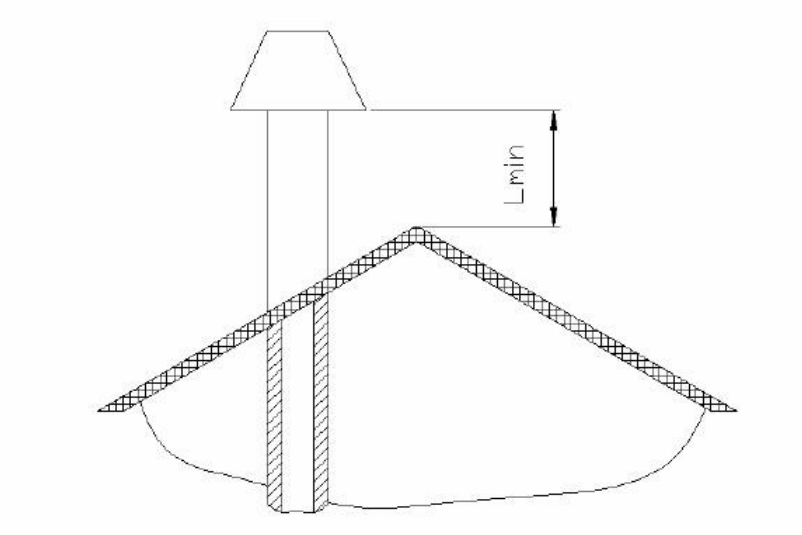
11. SETTING OF CHIMNEY

You must pay attention to the following points.

According to DIN 4705 and DIN 18160, the emission of the burned gases at the atmosphere as well as the decrease of their temperature during the stroke must be made in such a way, so as to avoid the liquefaction and its adverse effects.

The proper operation of the chimney is very important for the operation of the boiler.

L=min 1m



● TIGHTNESS OF CHIMNEY: No cold air must penetrate from cracks or gates, because as the burned gases rise, they are cooled and condensed. There is a risk that the condensed burned bases penetrate in the boiler and that they provoke corrosion. In addition, penetration of rainwater in the chimney should be avoided.

● there must be a FREE OUTLET OF THE BURNED GASES, without intervention of other objects (bricks, plaster bird nests, wood, grass, etc.)

● CLEANNESS OF THE CHIMNEY, especially at the points where the exit from the boiler is made, and at the curves where the burned gases change direction. A clean chimney means that there is a right draught.

● INSULATION OF THE CHIMNEY is necessary.

● A NON TIGHT CHIMNEY MAY CAUSE MANY PROBLEMS to the boiler, e.g. stoppage and a lot of residue of combustion, noise, malfunction of the burner, etc. Another great problem is the creation of draught and turbulence that do not allow the easy outlet of the burned gases.

● the chimney must be placed at least one meter HIGHER than the building.

● the residue of combustion must not influence the material of manufacture of the chimney.

For all these reasons mentioned below, the regular inspection of the chimney is imperative, especially after the beginning of the winter season.

ATTENTION:

A very small chimney becomes dirty and blocks up quickly. A very big chimney cools the burned gases too much and subsequently there is liquefaction. Consequently, the chimney must not be smaller or bigger than normal:

NOTE: Characteristic surfaces of a round chimney:

F min= (1000*P)/ (93/ √h)

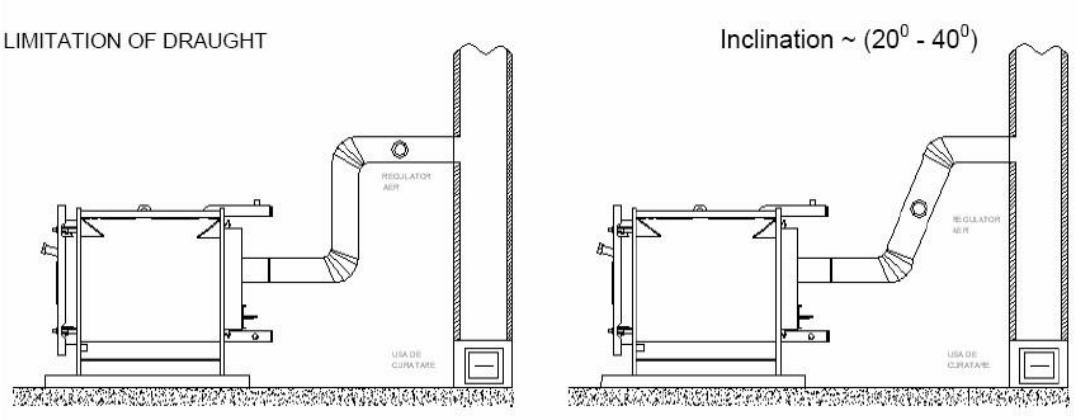
F max= 2*F min 21

where: F…. the interior surface (cm²)

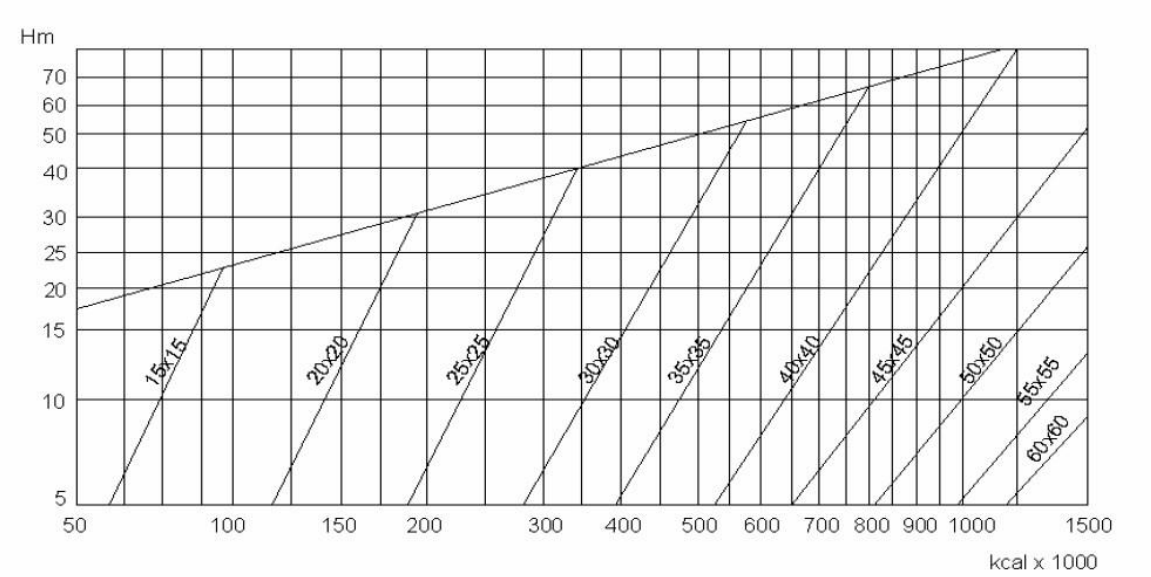
P….the boiler power (kW)

h….the height of the chimney (m)

For square chimneys the minimal surface increases per 10%.



If at measuring of the dimensions of the chimney the diameter is found between two values of the table, we must choose the higher one.



12. PROPOSED EXTENSION OF THE PLANT OF BURNED GASES EMISSION

The boiler, the burner and the chimney must have a coordinated operation, in order to have an economical operation of the plant.

By means of a powerful draught, the wrong air may penetrate through the boiler door or through flanges that have not been taken care of or in old boilers.

Because this wrong air will not be burned with the rest of the elements of the combustion, there is the phenomenon of alteration of the carbon dioxide values, and consequently there is a difficulty in finding an economical operation.

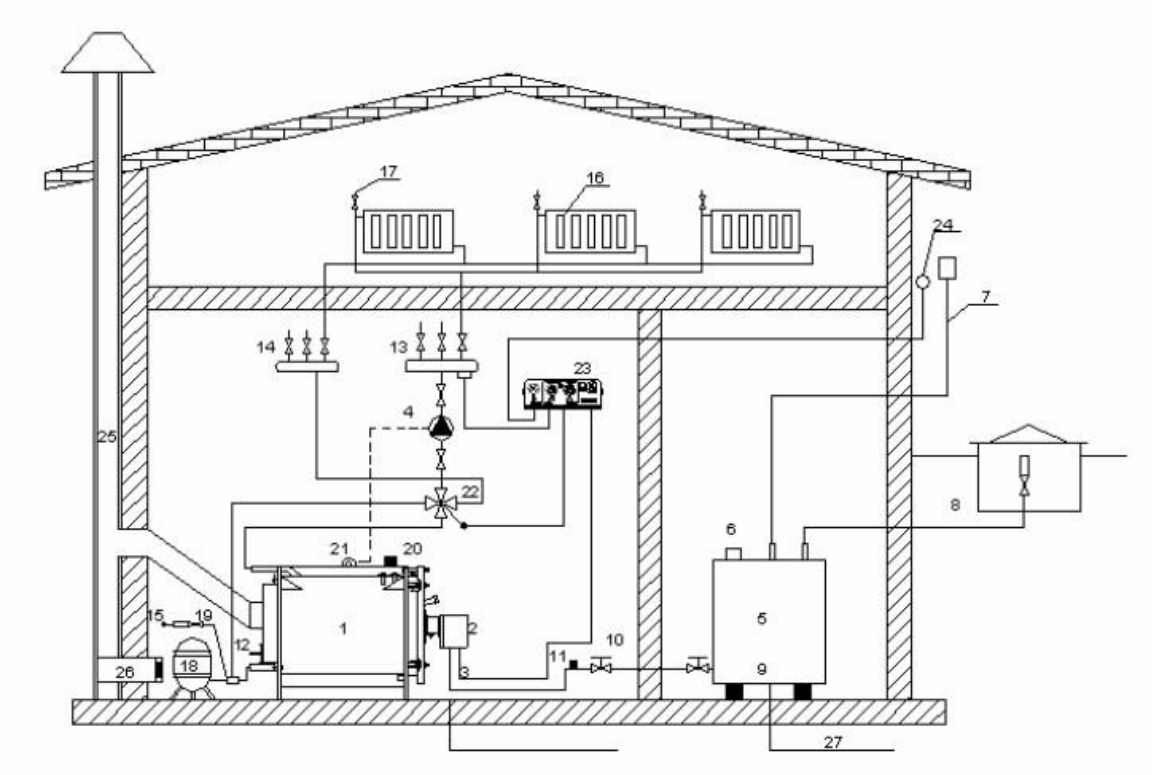
In addition, the existence of a powerful draught causes a decrease in the flame temperature; this means that the boiler heat is not fully taken advantage of and there is a meaningless heat escape to the environment.

We can find a satisfactory solution to all these problems, if we place a draught regulator (damper), which apart from the fuel saving, offers a good and uniform combustion in the boiler.

Another important fact with the use of draught regulator is the avoidance of liquefaction in the chimney and subsequently the avoidance of damage in the chimney.

The setting of a burned gases damper is required in chimneys with thermal resistance of class II and III, according to DIN 10160-1.

13. INSTALLATION OF CENTRAL HEATING

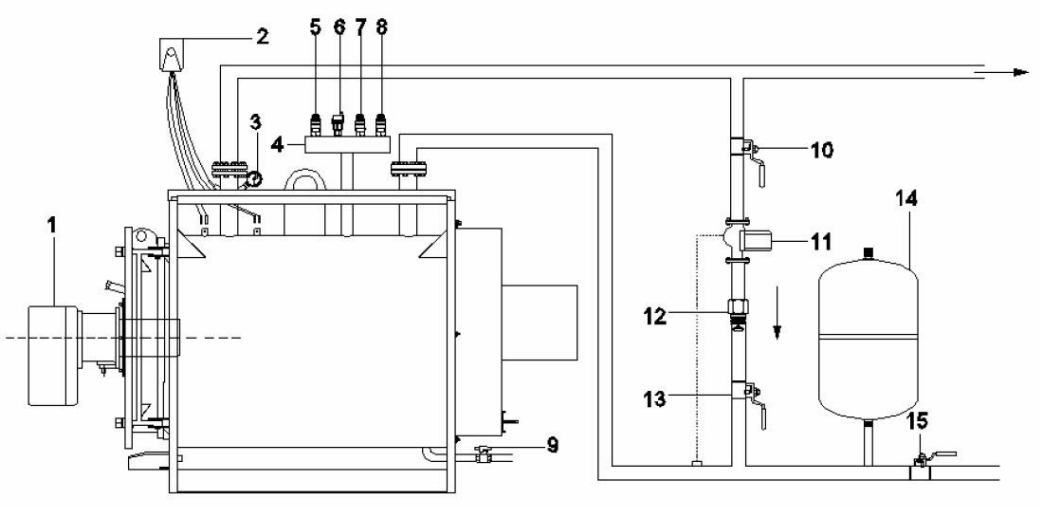


1. BOILER	2. BURNER
3. BURNER FILTER	4. CIRCULATOR
5. OIL TANK	6. WATER-LEVEL INDICATOR
7. TANK VENTILATION	8. FEED OF THE TANK
9. TANK PLUG	10. FUEL FEEDING SWITCH FOR THE BURNER
11. ELECTROMAGNETIC OIL VALVE	12. WATER RETURN
13. LUFF WATER COLLECTOR	14. RETURN WATER COLLECTOR
15. WATER FILTER	16. RADIATORS
17. SWITCHES RADIATORS	18. EXPANSION TANK
19. AUTOMATIC WATER FILLER	20. BURNER THERMOSTAT
21. CIRCULATOR HYDROSTAT	22. FOUR ELECTRODES MIXTURE GATE VALVE

23. ELECTRONIC PANEL	24. EXTERIOR TEMPERATURE SENSOR
25. CHIMNEY	26. DOOR OF CHIMNEY CLEANING
27. SEWAGE SYSTEM	

14. CONNECTION OF BOILERS PIPE SYSTEM

In the closed circuit plants it is necessary that you put a closed expansion tank and a safety valve. In the open circuit plants it is necessary that you put an open expansion tank and a safety tube.



1. Burner, 2. Control panel, 3. Manometer, 4. Safety collector, 5, 7, 8. Safety valve, 6. Automatic air vent, 9. Drain valve, 10. Valve,11. Pump, 12. One way valve, 13. Valve, 14. Expansion vessel, 15. Valve.

Before the filling of the plant, the plastic cups of the pipe system must be removed.

The automatic filler must be adjusted according to the hydrostatic pressure of the network (in boilers up to 100 kW it is usually 1-2bar). When the circulator is paced in the luff, it has to send the water towards the radiators, while if it placed in the return, it has to send the water towards the boiler. In both cases, we have to check the arrow of the circulator flow.

The shaft of the circulator must always be in a horizontal position in all the fluid lubricated circulators.

ATTENTION:

If during the removal of plastic cups you ascertain that there is water, this means that a small quantity of it was trapped after the hydraulic test of the boiler.

After the tight connection of the boiler with the network and after the installation of a manometer in the appropriate position, the network must be filled and subjected to a hydraulic test at a maximum pressure of 4bar for the tightness control.

15. EXPANSION TANK

The closed expansion tank is recommended by the tables of the manufactures according to the geometrical height of the installation and the size (power) of the boiler.

FOR THE CHOICE OF THE TANK WE SHOULD NOT SET A MARGINAL SIZE, BUT A SIZE GREATER THAN THE LATTER. THIS IS PARTICULARLY RECOMMENDED, WHEN THE INSTALLATION IS AUTONOMOUS.

Before the placement of the expansion tank, the pressure should be exerted on it according to its geometrical height from the point of its position up to the highest point of the installation. If this height is lower than 8 m, then the pressure is adjusted at 0,8 bar. If the boiler-room is on a rooftop, the pressure on the tank is adjusted at 0,5 bar.

The self-filling regulator is placed next to the expansion tank and it is adjusted so that, when the installation is cool, there is a pressure equal to the geometrical height mentioned above plus 2 m.

In areas where high-pressure distributing networks are present, a pressure reducing gear must be placed.

16. CONTROL PANEL

16.1 Control panel for 1- stage burner

The control panel of the boiler includes all switches and measuring instruments that are required for the control of the operation of the boiler.

All necessary wiring is already connected. The layout of the control panel is shown in the plan on the next page, where also the single instruments are explained.

The instruments (thermometer, thermostats and safety thermostat) are impregnated in coppery cup which has direct contact to the boiler’s water. For a better transmission of orders there must be safety on the cup. In this way we can eliminate any deviation. The bulbs of the instruments must be well fitted within the cup and fasten with the safety lock which is placed in its slot.

Placed the spare length of the capillary tubes of the instruments on the insulation of the boiler’s body.

DO NOT FOLD THE CAPILLARY TUBES.

a. The thermometer shows the instant temperature of the boiler’s water.

b. The thermostat of the burner interrupts instantaneous the function of the burner, when the temperature of the water rises at the desired level. It is recommended that the temperature of the water shall not be under 65ºC. Recommended temperature is between 70-90ºC.

c. The hydrostat of the circulator turns the circulator on. The range operation for the hydrostat is usually between 40-45ºC.

d. The safety thermostat is activated, when it is necessary for the burner to stop immediately. This means that there is a risk of vaporization over 100ºC and for this reason the operation of the burner is automatically ceased. In order for the system to return to its initial operation, we should allow 5 minutes to go by and the water of the boiler to circulate. When the temperature drops, press the button of the safety thermostat to restart the operation.

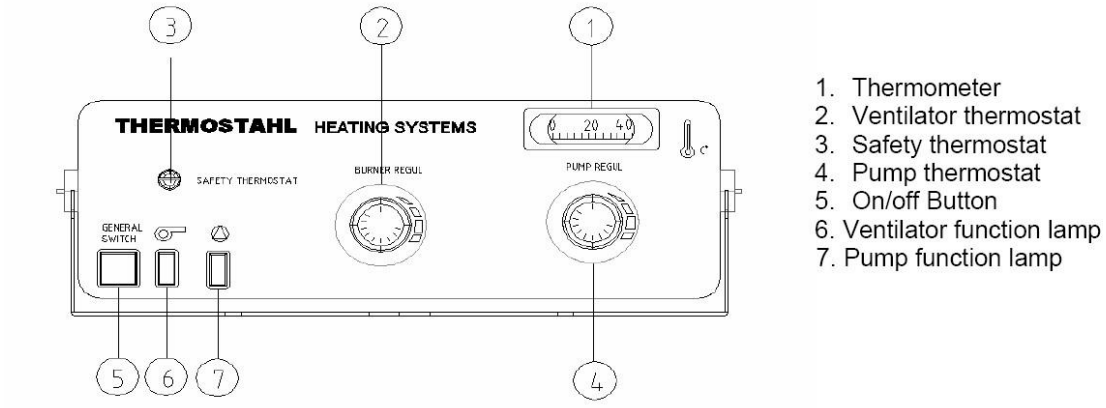
e. The main switch ON-OFF sets the installation into operation.

f. The switch with the mark… Is intended for the test operation by the maintainer.

g. The pilot lamps turn on when the respective apparatus are in operation.

h. The lamp of the safety thermostat turns on in case of blockage.

i. Automatic counterbalance device.



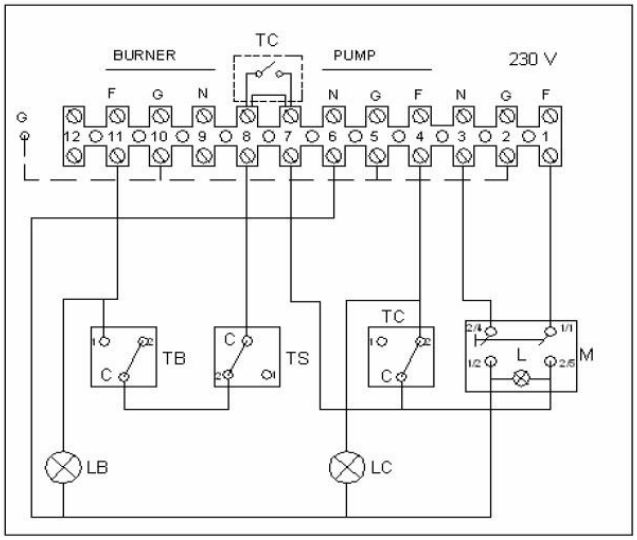
1. Thermometer
2. Ventilator thermostat
3. Safety thermostat
4. Pump thermostat
5. On/off Button
6. Ventilator function lamp
7. Pump function lamp

16.1.2 ELECTRIC INSTALLATION

The electric installations must be performed by a specialized approved electrician according to valid regulations EN 60529 and EN 60335-1, and protection rate IP 40 and IP 44. The electrical installation of the boiler-room is consisted of an electrical panel, which is placed on the wall and distributes the required electric power. This must be watertight, and the wires must run through metallic wire ways!

For protection against wear. The power supply for the illumination and the main switch of illumination must be on an independent line. The illumination lamps must be placed on the roof and covered by closed type lighting. The wiring must be protected by max 16 A.

IMPORTANT: The manufacturer bears no liability for nay personal damage and wear of material, apparatus, etc. which may be caused due to insufficient ground system.



COMPONENTS

M -Main on/off switch
TS -Overheat thermostat
TB -Burner thermostat
TC -Pump thermostat
L -Boiler run lamp
LB -Burner function lamp
LC -Pump function lamp
TR -Room thermostat

TERMINALS

1,2,3 -Power supply 230 V
4,5,6 -Pump connection
7,8 -Room thermostat connection
9,10 -Burner connection

CONTROL CIRCUIT DESCRIPTION

Before you set the power on to the control panel for the first time, be sure that the thermostat sensors are placed correctly into the boiler pipe coupling. If you want to connect an external room thermostat to the available terminal 7-8, remove the link between 7-8.

Switch M provides the ON/OFF facility for the control panel and burner control box. When ON, 230 V indication is available via the lamp L.

Boiler pump overrun

Pump thermostat TC enables the boiler pump connected between terminals 4-5-6. Once a power ON signal indicated to pump thermostat, and boiler flow water temperature exceeds the pre-selected temperature, (recommended as 40^0C), thermostat TC transfers the pump run directly to the power supply and activates the red lamp LC.(C-2, closed).

The pump continues to run until the flow water temperature falls bellow the pre-selected temperature to dissipate residual heat from the boiler. Below that temperature, lamp LC and pump are not activated to avoid aimless flow of cold water to the panels and to conserve energy.

Room thermostat control loop

Switch M enables, if it is in position ON, the room thermostat connected between terminals 7-8. Once there is a demand for heat, the room thermostat switch on the power supply signal to the rest of the circuit.

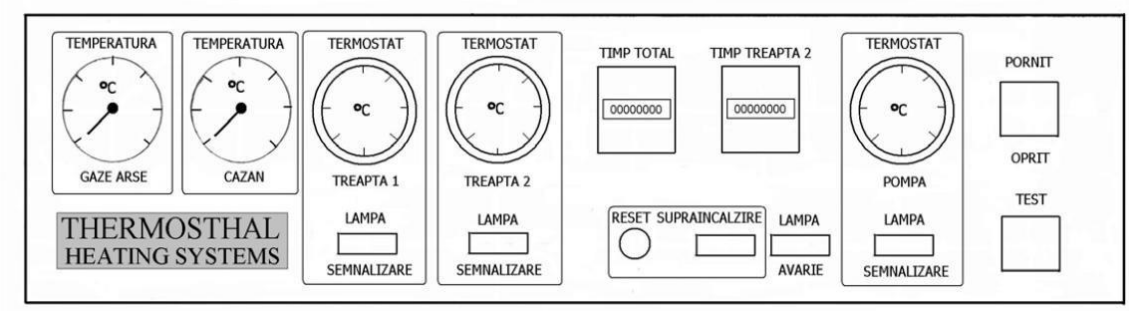
System integrity

If system integrity is proved (boiler temperature below 100^0C), a power supply is provided from safety thermostat to burner control system(C-2, closed).

Burner control system

The control of the burner is provided by a thermostat witch enables the burner connected between terminals 9-10-11. Once there is a demand for heat, system integrity is proved, and the water temperature inside the boiler is below the pre-selected temperature (recommended as 80^0C), thermostat TB transfers the burner run to the power supply and activates the red lamp LB (C1, closed). The burner continues to run until the water temperature inside the boiler approach the pre-selected temperature to provide boiler hot flow water for the panels. If the temperature exceeds the pre-set limit, burner stops and lamp LC is not activated any more (C-1, open).

16.2 Control panel for 2-stage burner



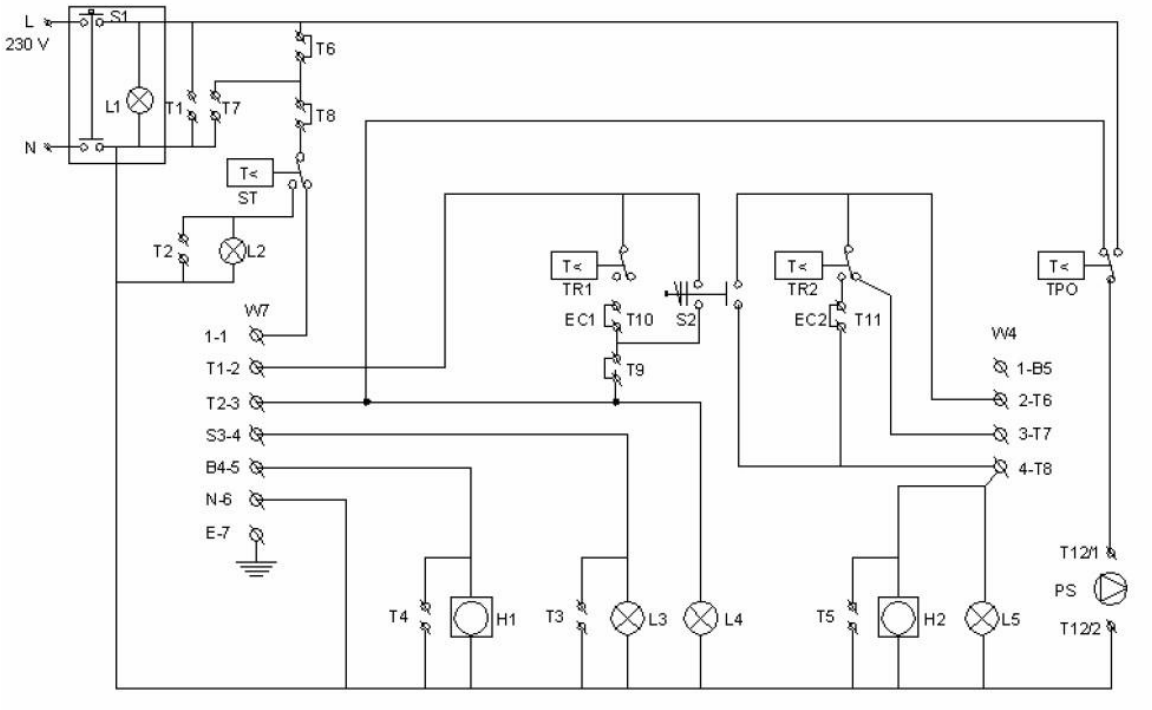
This panel provides 2-stage burner control for high/low operation. Within the control panel the minimum essential control items are enhanced whit extra indicators and terminal facilities to meet the majority of foreseeable needs. This module provides signals for remote monitoring of boiler function, boiler overheats, and burner lockout, total hours run and stage-2 hours run which are available via terminals T1 to T5.

A pump-overrun thermostat is provided as standard to facilitate the dissipation of residual heat from the boiler via system pump or a dedicated boiler pump.

Components supplied in control panel

- Exhaust gas thermometer, ºC
- Boiler thermometer, ºC
- Boiler thermostat adjustable 30…90ºC stage-1, on/off
- Boiler thermostat adjustable 30…90ºC stage-2, high/low
- Stage-1 function lamp
- Stage-2 function lamp
- Hours run meter – total
- Hours run meter – stage-2
- Boiler overheat thermostat adjustable 95-100-110ºC with manual reset button
- Boiler overheat warning lamp (red)
- Burner lockout warning lamp (red)
- Pump overrun thermostat
- Pump function lamp
- Boiler on/off switch with lamp included
- Boiler overheat test switch

SCHEMATIC WIRING DIAGRAM



COMPONENTS TERMINALS

EC1 External control stage-1
EC2 External control stage-2
H1 Hours run, total
H2 Hours run, stage-2
L1 Boiler run lamp
L2 Boiler overheat warning
L3 Burner lockout warning
L4 Boiler run stage-1 lamp
L5 Boiler run stage-2 lamp
PS Boiler or system pump
S1 Main on/off switch
S2 Overheat test switch
ST Overheat thermostat W7 – 7-wire loom
TPO Thermostat pump overrun L1 Line to burner control
TR1 Thermostat, stage-1
TR1 Thermostat, stage-2
S3 Total hours run signal
B4 Burner lockout signal
N Neutral
E Earth
W4 – 4-wire loom
B5 Not used
T6 Control loop stage-2 out
T7 Stage-2 dumper close signal
T8 Stage-2 dumper open signal

T1 External indicator, power ON
T2 External warning, boiler overheat
T3 External warning boiler lockout
T4 External indicator, total hours run
T5 External indicator, stage-2 hours run
T6 Plant room safety link
T7 Plant room ventilation fan
T8 Ventilation fan proving link
T9 Flue fan proving link
T10 Eternal energy control stage-1
T11 External energy control stage-2
T12 Boiler or system pump

T1 Control loop stage-1
T2 Control loop stage-2

Control circuit description
System integrity

Switch S1 provides the ON/OFF facility for the control panel and burner control box. When ON, the lamp L1 is red and external 230v indication is available via terminals T1/1&2.

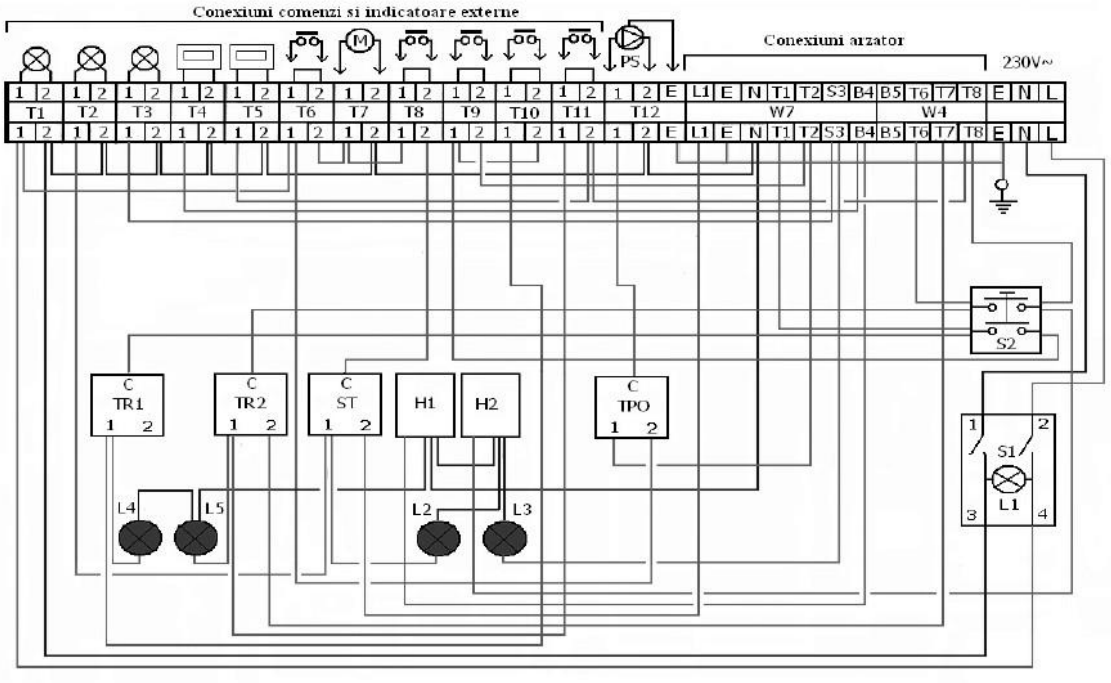
A plant room fire link, smoke detector, or similar safety device may be connected at terminals T6/1&2.An output signal for a plant room ventilator, or similar device which must be in operation whilst the boiler is switched on, is provided at terminals T7/1&2.The proving link for this device is between terminals T8/1&2.If the plant room fire link (safety device) is broken the ventilation fan supply signal is switched off.

A boiler overheat signal is indicated by lamp L2 in response to the boiler overheat thermostat ST when the boiler temperature is up to 100ºC and is available as an external 230V signal at terminals T2/1&2.If system integrity is proved, a power supply is provided for the burner control system via terminal W7-L1 of the 7-wire burner loom.

Warning! When the boiler overheat lamp (L2) is red and after the boiler temperature falls below 95ºC, must push the manual reset button for restart the boiler.

Stage-1 control loop

The control loop of the burner control box is provided via the 7-wire loom on terminals W7-T1/T2.The boiler stage-1 thermostat TR1 is in series with terminals T10/1&2 which provide facilities for connecting space heating thermostat, frost thermostat, time switch and/or external building management system, EC1.If a flue(chimney) fan or flue dilution system is installed, the run signal should be taken from T9/1 and the proving link made between T9/1&2.(NB Fan overrun facility must be provided after the burner has switched off to purge the boiler exhaust gases).A burner lockout activates the red warning lamp L3 with an external 230v indicator facility on terminals T/1&2.Total hours burner firing are displayed on counter H1 whit an external 230V counter or indicator facility on terminals T4/1&2.



Stage-2 control loop

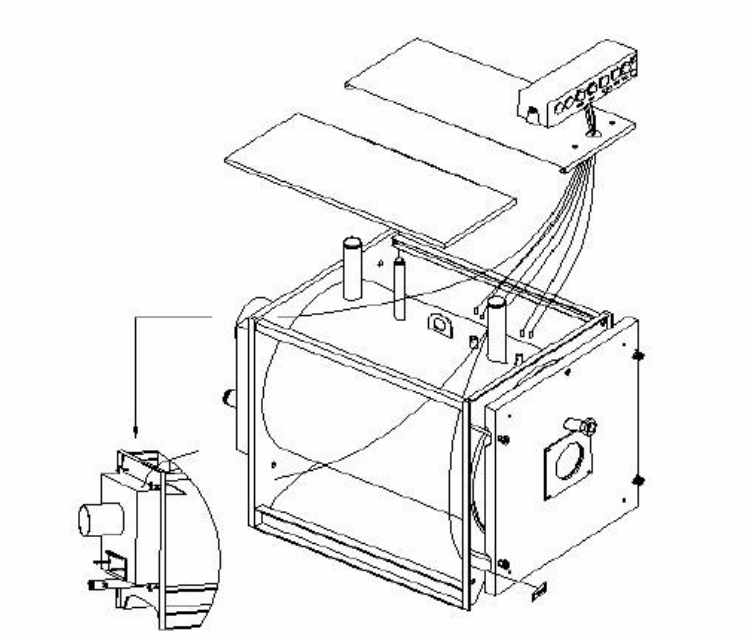
The stage-2 burner control is provided by the 4-wire loom on terminals W4/T6-T8.Boiler thermostat TR2 is in series with terminal T11/1&2 which provides connection for the external building management system, EC2. Counter H2 displays stage-2 hours burner firing with an external 230V counter or external indicator facility on terminals T5/1&2.

Boiler pump overrun

Pump overrun thermostat TPO enables the boiler pump PS connected between terminals T12/1&2 once a demand for heat is made by the external control EC1 and the boiler thermostat TR1. When the boiler flow water temperature exceeds a pre-selected temperature, recommended as 70ºC, thermostat TPO transfers the pump run directly to the power supply. At the end of the heating cycle when burner firing is terminated by either EC1 or TR1 the pump continues to run until the flow temperature falls below approx. 65ºC to dissipate residual heat from the boiler.

Boiler overheat test switch

This` push & hold `switch (S2) is provided only for commissioning and service engineers to test the operation of the boiler overheat thermostat ST.



17. GENERAL INSTRUCTIONS

17.1 OPERATING INSTRUCTIONS

The manufacturer of the installation must hang at the boiler-room a printed matter, where it should be noted all actions for setting the installation into operation as well as information on maintenance.

17.2 INSTRUCTION ON SETTING UP THE INSTALLATION

The installation must be operated for first time by specialized personnel, which shall check the following:

1) Sufficient ventilation of the boiler-room and protection of the installation area against frost.

2) Control and removal of any foreign materials from the boiler furnace and the stroke of burned gases (fire tubes).

3) Filling of the boiler with water before starting.

4) Water-tightness of connection pipes. The pipes on the top of the boiler's space should not exhibit any leakage, because in the course of time this may cause damage on the external casing due to oxidation. A water-tightness control shall be performed in the entire network of the installation under 4-bar pressure.

5) Water-tightness of the chimney connection.

6) Proper adjustment of the burner.

7) Operation of the circulator.

8) If all sluice valves are open for the circulation of the water.

9) If the safety valve functions properly without any switch or sluice valve being interfered.

10) If the expansion tank functions properly and no switch or sluice valve being interfered. On the points of the installation where air is enclosed, an automatic network gas vent must be placed.

11) If the electrical connection of the boiler is properly installed. In order the instruments to work correctly they must be impregnated in the coppery cup. The hydrostats must be correctly regulated (40ºC of the circulator and 80ºC of the boiler). The room thermostat must be between 18-20ºC.

12) Fuel supply installation: there should not be any leakage.

13) The placing of nay-flammable subjects near the boiler is not allowed.

14) In case of frost the boiler must always be in operation and during the night (in lower temperatures) or a sufficient amount of antifreeze must be placed within the installation.

15) In case the water supply network is of high pressure (over 4 bar), a pressure reducer must be interfered.

16) For precautionary reasons it is necessary to have a fire extinguisher in the boiler-room.

17) The water-tightness of the central heating network must be carefully ensured in order to avoid the possibility of new quantity of water being entered, which may result in forming a big amount of salts inside the boiler, and early wear of the installation due to oxidation.

18) Particularly care must be given to the good operation of the burner.

19) When the ambient temperature of placing the fuel tank is below 0ºC it is recommended to use a supplementary amount of paraffin oil or special admixtures for avoidance of generating paraffin.

20) During the filling of the fuel tank, it should be paid special care to avoid the entry of water or dust.

21) The level of the fuel oil tank should not be lower than the burner.

22) Attention to the filling of the tank before it is completely empty. In that case air will enter the circuit and this will result in inability of ignition.

WARNING: the above mentioned points must be taken seriously into account.

THE BOILER'S GUARANTEE IS NOT VALID IN CASE OF DAMAGE THAT HAS BEEN CAUSED DUE TO THE ABOVE-MENTIONED REASONS.

18. CONTROL OF THE BURNED

In order to set the burner into operation, we should check the following:

a) Check and regulation of the air damper.

b) Volatilization of the oil pomp.

c) Check of the atomizer and regulation of the flame on the fire box.

d) Adjustment of the pins according to instructions of the manufacturer.

e) Installation of the proper atomizer.

f) Regulation of thermostat at 70-90^{o}C.

g) Regulation of room thermostat at 20^{o}C.

18.1 REGULATION OF BURNING

During the regulation of the burner on THERMOSTAHL SOLAR boiler EN type the following values must be reached:

a) Burning of light oil: CO2= 12-13%, maximum temperature of burned gases outlet=220ºC up to 180 kW and for boilers of bigger size v 240ºC, soot rate=0-1 Bacharach.

b) Gas burning: CO2max=0.05 %, maximum temperature of burned gases outlet =240ºC

c) Burning of heavy crude oil; temperature of burned gases outlet 220-260ºC, soot rate=0-1 Bacharach.

d) The measurements are carried out after the temperature of the water of the boiler has been increased to 80-90ºC. For built chimneys the temperature of burned gases outlet must be at least 150-170ºC.

THE BASIC PRINCIPLES WHICH MUST BE KEPT IN MIND ARE THE FOLLOWING:

■ CO: This indicates the spare air by which the burning is performed. The more the air increases, the CO% value reduces and the more the air reduces the CO% value increases.

■SOOT RATE (ACCORDING TO BACHARACH): The number indicates that in the burned gases there are solid particles from the burning. If this exceeds number 2 of BH

scale, we should check the atomizer for possible defects or unsuitability for the burner and the boiler (make, type, and diffusion angle).

Generally, the BH number reduces by increasing the pressure of the valve. In this case we should be careful because the fuel supply increases.

■TEMPERATURE OF BURNED GASES: This is a value that expresses the heat losses through the chimney to the environment. The higher the temperature is, the greater the heat loss is and therefore the lower the performance. If the temperature is very high, we should reduce the quantity of the consumed oil.

NOTE: The current regulations of each country may require different adjustments from those that have already been done and this requires observance of other parameters.

WARNING: The pipe of the burner (mouth) must be entered within the combustion chamber in a way that the entire exchange surface of the fire box is scanned uniformly by the burned gas. If the pipe of the burner is of very small size, the flame goes directly to the fire tubes, a fact that results in excessive increase of the thermal strain of the boiler.

18.2 THE ROOM OF THE FLAME

For THERMOSTAHL SOLAR boilers the flame must be thin and longitudinal and should not reach the side walls of the fire box (nozzle projection angle=60ºC, possibly 45ºC for power over 140 Mcal/h.

The loading of the boiler with an atomizer smaller than the one that corresponds to the normal heat value supply of the boiler is not recommended. The function of THERMOSTAHL SOLAR boilers is possible up to 70% of their nominal heating performance without any significant reduction on the outlet temperature of the burned gases given that below 70% there may be caused harmful corrosions due formation of condensations of burned gases.

If during the measurements for the protocol of setting into operation we note that the temperature of burned gases is very low (risk of formation of water vapor and condensation), there is the capability of increasing the temperature of the burned gases. For this reason you should remove two or more turbines (as required), from the fire tubes that are placed on the bottom of the front tube plate.

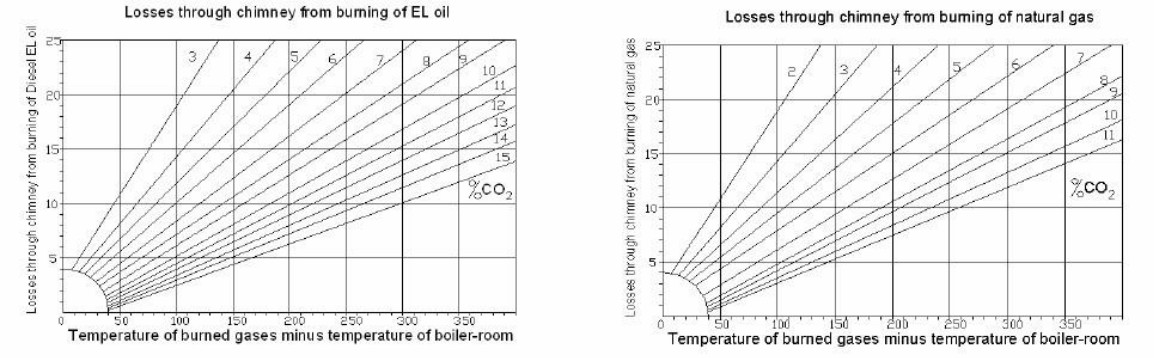
19. MEASURING OF EFFICIENCY

The measurements, which will be conducted for the control of the burning, must give the final results:

SOOT RATE: 0-1

CO2 GREATER THAN 12%

TEMPERATURE OF BURNED GASES: 180:220ºC



PUTTING OUT OF OPERATION

-Switch off main switch of the boiler panel.

-Switch off the main of the electricity distribution panel of the boiler room.

-Shut all the gate valves of the heating water network.

-Shut all the fuel gate valves.

20. GENERAL INSTRUCTIONS OF MAINTENANCE

According to the regulations DIN 4575 and 4756 IT IS NECESSARY THAT THE BOILER AND THE BURNER ARE CLEANED YEARLY by a SPECIALISED PERSONNEL. In order to offer a guarantee for economical and ecological operation

The boiler must be maintained in the end of the winter period. A special care must be given to the CLEANING OF TUBES, in order to avoid the creation of stone and salts that may destroy them. The residue of combustion should therefore be removed. Then all parts that are infected by flame are greased with an oil and petroleum mixture. This greasing contributes to the PROTECTION OF METALS and more specifically of the wildings and assures a high level of performance for your boiler, fuel saving, longer service life, and, the most important, a clean environment.

If there is not a correct maintenance, then problems appear, like:

● Decrease of the level of performance

● Increase of the fuel consumption

● Increase of the temperature of burned gases

● Noisy operation

20.1 INSTRUCTIONS OF MAINTENANCE

20.1.1 Cleaning of the boiler

-The maintenance is carried out when the boiler is hot.

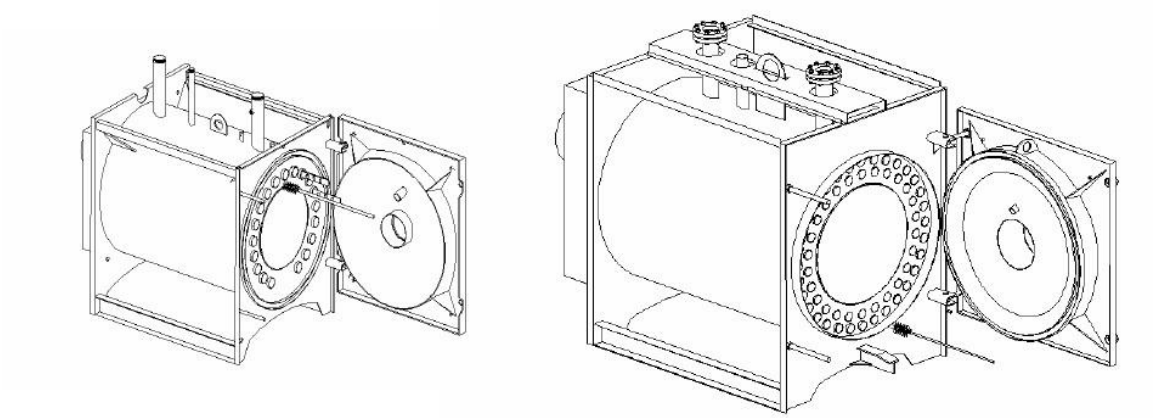
-Switch off the main switch in the boiler panel.

-Disconnect the burner (if necessary).

-Open the door.

-Remove the flow retarder from the fire tubes.

-Clean the combustion box and the fire tubes by using a proper brush.



-Clean the floe retarder (turbines).

-Clean the combustion box with a vacuum cleaner.

-Check the insulation lines and the glass fibre and replace them in case of damage.

-Check the door fireproof material.

-Assemble the pieces again and close the door.

-Connect the burner again (if you had disconnected it).

-The boiler safety valve must be inspected and replaced, if damaged.

-Check the water connections.

-Check the descending protection (magnesium anodic) in the plants that have copper pipe systems. Replace it every year.

-Check the automatic filling and the pressure restrictor (if there is one).

In addition, you must give a special importance to the following:

-COMBUSTION INSPECTION GATE: It is located is located on the boiler's door (above the burner). It consists of a fire-proof pane with two flanges of burned gases tightness. It has to be clean. It has cracks, it must be placed.

-CLEANING GATE: It is located in the back part of the boiler, at the low part of chimney. It used for cleaning the residue of combustion, which is usually accumulated in the back tube plate of the boiler. When the cleaning of the boiler is completed, you open the cleaning gate to remove the residue of combustion. The gate closes with two springs and special screws with washers. This gate is also used as a gas expansion. For this reason the extension of the screws in the chimney must be avoided.

Thermostats and the bulbs of the instruments must be in the cup and their holding safety must be active. Do not change the adjustment of the instruments pointlessly.

20.1.2 BURNER

-Control of the good operation by a specialized person.

-Replacement of the atomizer.

-Check the pins.

-Check the operation with burned gases analysis.

-It is allowed that only an authorized specialized person executes works in the gas pipe.

20.1.3 INSTALLATION

-Switch off the main switch of power supplies in the boiler room in summer, because the circulator may work creating a high temperature in the house.

Do not clear off the plant from water because you accelerate the oxidation of the pipe system. If necessary, fill the network immediately after the repair of the damage. The radiators need volatilization in order to have a better performance and a noiseless operation.

21. BASIC INSTRUCTIONS FOR ENERGY ECONOMY

The company THERMOSTAHL SOLAR with the manufacture of the steel boiler ENERSAVE offers a product that will heat the consumer without problem and without spending a lot of money for many years.

But in parallel, in order to contribute to energy saving, the company recommends that:
- Very good insulation is made in the new buildings.
- The opening northwards are reduced as far as possible.
- Old buildings which were constructed without the necessary insulation, are also insulated, if possible.
- Double window panes are placed in tight window frames.
- Pipes of hot water distribution are insulated when they pass from non heated spaces.
- Independent heating systems are preferable in order to control the temperature of spaces.

● Radiators are not covered by any coverage means.
● Temperature is a residence is up to 20ºC.
● Boilers or a combination of boilers and solar heaters are placed instead of the simple electric heaters.

22. References for fast diagnosis of troubleshooting

OIL BURNERS

THE BURNER DOES NOT FUNCTION DURING THE SET-UP PROCESS

Problem	Possible cause, notes	Remedy
• The burner does not start its function	-Indication of breakdown(blocking) -The thermostat of the burner is not connected -The thermostat is connected with the contacts	-Press the disengagement button -Connect the thermostat with contact T and T -Bridge contacts T and T
• The burner starts functioning 10 sec pre-ventilation, 10 sec flame. Blocking.	-Unstable flame with interrupts -Unstable flame, inappropriate ignition -Color of flame blue, small length	-After 2 sec, press the disengagement button. Check the pump pressure an adjust -Atomizer by choice (check the type an the angle) -Pre-regulate the air (reduce)
• Burner starts functioning without any flame. Blocking	Non safe supply flow. The supply pipe is not full. Contacts not watertight. Entry of air in the pump and the filter -The burning space of the boiler is full of vaporized oil Problem with ignition	Fill the oil filter, volatilize the pump, check the suction with a vacuum gauge. Suction from another oil tank. -Ventilate carefully the boiler furnace. Check the electrodes -Porcelain, high voltage wires, metal plugs. -Check the distance of the pins according to instructions.

THE BURNER DOES NOT FUNCTION AFTER NORMAL OPERATION

Problem	Possible cause, notes	Remedy
• The luminous indication of operation of the burner is not on	-Power failure	-The safety thermostat (STB) is on. Check the phase and the neutral on the electronic circuit. Check the supply lines of: the control panel, the boiler, the burner and the counter-balance

• The burner cannot be disengaged	-The electronic circuit is out of order	-Change the electronic circuit or repair it
• The burner is blocked after the circle of pre-ventilation and igniting	-The electronic circuit is out of order -The photocells is out of order or sordid or insufficient lighting is extended on it -The magnetic valve does not close resulting in igniting the pre-ventilation	-Change the electronic circuit or repair it -Check the resistance, min current 30μA -Check the bottom of the valve. Change the valve

• The burner is blocked after the circle of pre-ventilation without being turned on	-The oil supply line is out of order -The oil filter is blocked -The atomizer or the filter of the atomizer is blocked -Damage of the pump's comber. Pump without movement -Damaged pump -Steamed oil in the combustion box, damaged converter -Damage in initiation	-Control with a manometer and vacuum indicator -Vacuum greater than 0,4 bar -Change -Control, repair. Change the comber -There is neither pressure nor vacuum, no volatilization take place, for this reason change the pump -Control according to the manufacture's tech. Booklet
• Burner remains blocked. It will not start	-Damage engine or engine blocked by impeller of pump or by pump or by other action	Change of engine
• Start of the burner with retarded initiation	-The initiation electrodes are not in good position -Too much air supply -Dirty or damaged atomizer	-Adjust them according to the instructions -Adjust the air supply as it is shown in the present -Replace it

GAS BURNERS

Problem	Possible cause, notes	Remedy
• The burner will not start by shutting down the adjustment thermostat	-Lack of power supply	-Check the voltage presence in the contacts L1-N of the polar jack -Check the fuses -Check if the maximal thermostat is blocked or not.
	-Lack of gas	-Check if the manual gas supply switch is switched on -Check if the electric valves of the gas line (ramp) are open and not short-circuited
	-The gas pressure gauge does not stop its contact	-Adjust it
	-Connections in the electronic control panel are wrong	-Check
	-The air pressure gauge has transported its contact into an operation position	-Replace it
• The burner carries out regularly the pre-soak and initiation phase and then blocks the passage during 3 sec	-Phase and neutral are connected in the opposite way	-Change them
	-Lack of ground or bad ground	-Repair it
	-The ionization electrode is grounded or not properly adjusted or the wire joining with the control panel is cut or its insulation id broken	-Check the position of the electrode ionization in relation with the instructions of the present manual -Check its electric connection -Replace it
• Start of the burner with retardation of the initiation	-Bad setting of the initiation electrode	-Adjust it
	-Too much air supply	-Adjust it
	-The brake of the operation electric valve is too close and consequently there is little gas supply	-Adjust it

• Blocked burner after the pre-soak phase with air because of flame lack	-The electric valves let a small quantity of air to pass	-Check the pressure in the network and adjust the electric valve
	-Defective gas electric valves	-Replace them
	-Lack of initiation spark -Presence of air in the gas supply conductor	-Check the electric linkage of the initiation electrode -Check the right setting of the initiation electrode -Volatilize correctly the gas supply conductor
• The burner blocks during the pre-soak phase	-The air pressure gauge does not transpose its contact in the operation position	-The pressure gauge is defective, replace it -The air pressure is too low. Adjust correctly the combustion head
	-Presence of flame	-Defective electric valves, replace them
	-The jack for receiving the pressure is placed in a wrong way	-Place it correctly on the basis of the technical manual
• The burner repeats the start phase without blocking	-The gas pressure in the gas supply network is close to the value adjusted for the pressure gauge of minimum gas pressure. So, as soon as the operation and safety electric valves open, the pressure falls and the gas pressure gauge opens. The burner stops without blocking and repeats constantly the start phase	-Reduce the minimum value of adjustment of the gas pressure gauge