

Design review of the boiler “HP 03 / K Flash“ for wood pellets of the company “Hapero Energietechnik GmbH”



Order number	PL-12034/4-E-P
Person responsible for testing	E. Padouvas
Number of pages	4
Number of pages in appendix	6

Report written on: 29.02.2012 of: Padouvas	Report approved on: 09.03.2012 of: Hofbauer
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INSTITUT FÜR VERFAHRENSTECHNIK
UMWELTECHNIK UND
TECHN. BIONOMIE
TECHNISCHE UNIVERSITÄT WIEN
A-1060 WIEN, GETREIDEMARKT 9/166

1 The Client

Hapero Energietechnik GmbH
Gewerbepark Ost 3
5141 Moosdorf

2 Scope of testing

The client applied for testing of heat engineering in accordance with the requirements of the EN 303-5 and of the agreements pursuant to Article 15a B-VG of the Federal Constitution Act on “protective measures related to small scale combustion equipment” and “energy saving” for the fuel wood pellets with the designation:

“HP 03 / K Flash“

3 Supplied documents

The client provided the following documents:

- Technical drawings
- Operating instructions
- Draft of identification plate

4 Product description

The wood pellets boiler “HP 03 / K Flash” (25 kW) is equipped with a fuel hopper, screw conveyor, combustion chamber with a fuel pot, electrical ignition and water heat exchanger. The combustion chamber door has a flushed glass window to avoid deposits.

The integrated stoking device feeds the pellets into the fuel pot via an electronic controlled screw conveyor. The required combustion air is sucked by the flue gas fan via the air inlet. Hot combustion gases are led through the heat exchanger to the flue gas exit.

The ash is transported mechanically into the ash chamber.

The boiler “HP 03 / K Flash”, with a nominal heat output of 25 kW has the same construction characteristics as the boiler “HP 04 / Flash”. For this reason a design review was carried out.

5 Design review

The supplied documents show that the boiler „HP 03 / K Flash“ obtained the same construction details of the combustion chamber, grate, combustion air supply and the same dimensions as the “HP 04 / K Flash“. The output of 25 kW is obtained with a flow restriction of the flue gas fan and a decrease of the fuel amount. The partial load testing of the boiler “HP 04 / Flash” is equivalent to the boiler “HP 03 / Flash”.

6 Results

Due to the type-testing results of the wood pellets boiler „HP 04 / K Flash“, the supplied documents and the design review it can be stated that the boiler „HP 03 / K Flash“ meets the requirements related to EN 303-5. The requirements related to the emissions under the agreement pursuant to Article 15a of the Federal Constitution Act on “protective measures related to small scale combustion equipment” are met. The requirements related to the energy efficiency under the agreement pursuant to Article 15a of the Federal Constitution Act on “energy saving” are met.

The tested partial load of the boiler „HP 04 / K Flash“ (7.9 kW) can be applied also to the boiler with 25 kW (“HP 03 / K Flash”).

Therefore, the following values are to be quoted as type-testing results.

6.1 Output

The rated output of 25 kW indicated by the manufacturer is recognized as correct.

6.2 Energy efficiency

	Efficiency [%]
	“HP 03 / K Flash”
Full load	95,4
Partial load	93,9
EN 303-5 ($67+6\log Q_N$)	76,3
According to Art. 15a B-VG ($68,3+7,7\log Q_N$)	80,2

6.3 Emissions assessment

		Test results "HP 03 / K Flash"			Emission limits	
		[mg/Nm ³] at 10 % O ₂ acc. EN 303-5	[mg/Nm ³] at 13 % O ₂	[mg/MJ]	EN 303-5 cl. 3 [mg/Nm ³] at 10 % O ₂	15a BVG [mg/MJ]
CO	Full load	68	54	35	3000	500 ¹
	Partial load	173	138	88		
NO _x	Full load	173	138	88	-	150
	Partial load	103	82	53	-	
OGC (Org. C)	Full load	<3	<3	<3	100	40
	Partial load	<3	<3	<3		
Dust ²	Full load	15	12	8	150	60
	Partial load	20	16	10		

Person responsible for testing

Supervisor

E. Padouvas

Dipl. Ing. E. Padouvas

INSTITUT FÜR VERFAHRENSTECHNIK
UMWELTECHNIK UND
TECHN. BIOWISSENSCHAFTEN
TECHNISCHE UNIVERSITÄT WIEN
1060 WIEN, GETREIDEMARKT 9/16G

H. Hofbauer
Univ. Prof. Dr. H. Hofbauer

¹ At partial load of 30% of the nominal heat output the emission limits can be exceeded by 50%

² Mean value of six single measurements, out of which each is below the emission limit.

Appendix

1. Data sheets	2 Pages
2. Technical drawings	3 Pages
3. Marking	1 Page

Order number:	PL-11055-P
Marking	HP 04

Date of test:	23.03.2011
Fuel:	Wood pellets

Elementary analysis		
Carbon content	[%]	47,56
Hydrogen content	[%]	5,44
Nitrogen content	[%]	0,11
Sulphur content	[%]	0,01
Ash content	[%]	0,31
Oxygen content	[%]	40,25
Water content	[%]	6,32

Load	[min]	Full Load
Start	[hh:mm]	09:20
End	[hh:mm]	15:44
Combustion time	[min]	385
Fuel quantity	[kg]	49,0
Thermal output from fuel	[kW]	37,6
Conversion	[kg/h]	7,6
Average negative pressure in the interceptor	[Pa]	11,8

Air ratio (Lamda)	[-]	1,8
Flue gas volume, dry	[Nm ³ /kg]	7,6
Flue gas volume, wet	[Nm ³ /kg]	8,3
Flue gas flow	[Nm ³ /h]	63,1
Flue gas mass flow rate	[g/s]	21,0
c _{p,av} water vapour	[kJ/Nm ³ K]	1,50
c _{p,av} dry flue gas	[kJ/Nm ³ K]	1,31
Loss of sensible heat in the flue gas	[kJ/kg]	661,4
	[%]	3,7
Loss through CO in the flue gas	[kJ/kg]	6,4
	[%]	0,0
Heat losses due to combustible constituents in	[kJ/kg]	11,3
	[%]	0,1
Loss through radiation, convection and conduction	[kJ/kg]	141,7
	[%]	0,4
Combustion efficiency	[%]	95,8

Calculated values		
O ₂ -demand	[m ³ /kg]	0,91
Air consumption	[m ³ /kg]	4,32
Flue gas volume, dry	[m ³ /kg]	4,30
Water vapour	[m ³ /kg]	0,69
Flue gas volume, wet	[m ³ /kg]	4,99
CO ₂ maximum	[%]	20,63
Net calorific value	[kJ/kg]	17719

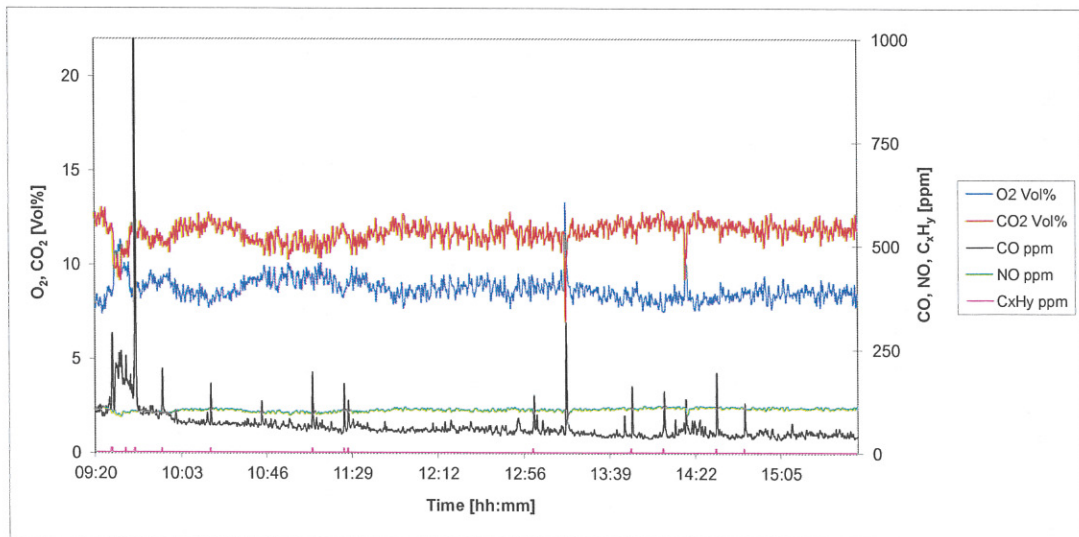
Ambient conditions		
Atmospheric Pressure	[hPa]	1005,5
Atmospheric humidity	[%]	22,2
Room temp.	[°C]	24,1

Flue gas temperature in measurement section		
Maximum	[°C]	93,3
Average	[°C]	81,4

Average boiler surface temperatures		
Boiler cover	[°C]	26,8
Boiler surface left	[°C]	26,2
Boiler surface right	[°C]	27,8
Boiler surface front	[°C]	27,4
Boiler surface back	[°C]	28,5
Boiler base	[°C]	25,3
Fuel hopper	[°C]	24,3
Door handle		n.a.

Water heating output		
Temperature of inlet water	[°C]	54,9
Temperature of outlet water	[°C]	71,5
Water flow	[m ³ /h]	1,9
Water heating output	[kW]	35,9
Thermal efficiency	[%]	95,4

Emissions, measured					Dust					
O ₂	CO ₂	CO	NO	C _x H _y	09:46 - 10:46	10:50 - 11:50	11:55 - 12:56	13:00 - 14:00	14:03 - 15:03	15:05 16:00
[%]	[%]	[ppm]	[ppm]	[ppm]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]
8,7	11,7	67	104	1	20	22	20	17	16	19
					O ₂ in %					
					8,8	9,1	8,7	8,8	8,3	8,5
Emissions, related to 10 vol % O ₂ and standard reference conditions										
	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]
	68	173	1	16	18	16	14	12	15	
Emissions, related to 13 vol % O ₂ and standard reference conditions										
	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]
	54	138	1	13	15	13	11	10	12	
Emissions related to the energy content of the fuel										
	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]
	35	88	1	8	9	8	7	6	8	



Order number:	PL-11055-P
Marking	HP 04

Date of test:	22.03.2011
Fuel:	Wood pellets

Elementary analysis		
Carbon content	[%]	47,56
Hydrogen content	[%]	5,44
Nitrogen content	[%]	0,11
Sulphur content	[%]	0,01
Ash content	[%]	0,31
Oxygen content	[%]	40,25
Water content	[%]	6,32

Load	[min]	Partial Load
Start	[hh:mm]	09:45
End	[hh:mm]	16:04
Combustion time	[min]	379
Fuel quantity	[kg]	10,7
Thermal output from fuel	[kW]	8,3
Conversion	[kg/h]	1,7
Average negative pressure in the interceptor	[Pa]	11,6

Air ratio (Lamda)	[-]	2,7
Flue gas volume, dry	[Nm ³ /kg]	11,6
Flue gas volume, wet	[Nm ³ /kg]	12,3
Flue gas flow	[Nm ³ /h]	20,8
Flue gas mass flow rate	[g/s]	7,2
c _{p,av} water vapour	[kJ/Nm ³ K]	1,50
c _{p,av} dry flue gas	[kJ/Nm ³ K]	1,31
Loss of sensible heat in the flue gas	[kJ/kg]	535,2
	[%]	3,0
Loss through CO in the flue gas	[kJ/kg]	16,3
	[%]	0,1
Heat losses due to combustible constituents in	[kJ/kg]	108,8
	[%]	0,6
Loss through radiation, convection and conduction	[kJ/kg]	98,4
	[%]	1,2
Combustion efficiency	[%]	95,1

Calculated values		
O ₂ -demand	[m ³ /kg]	0,91
Air consumption	[m ³ /kg]	4,32
Flue gas volume, dry	[m ³ /kg]	4,30
Water vapour	[m ³ /kg]	0,69
Flue gas volume, wet	[m ³ /kg]	4,99
CO ₂ maximum	[%]	20,63
Net calorific value	[kJ/kg]	17719

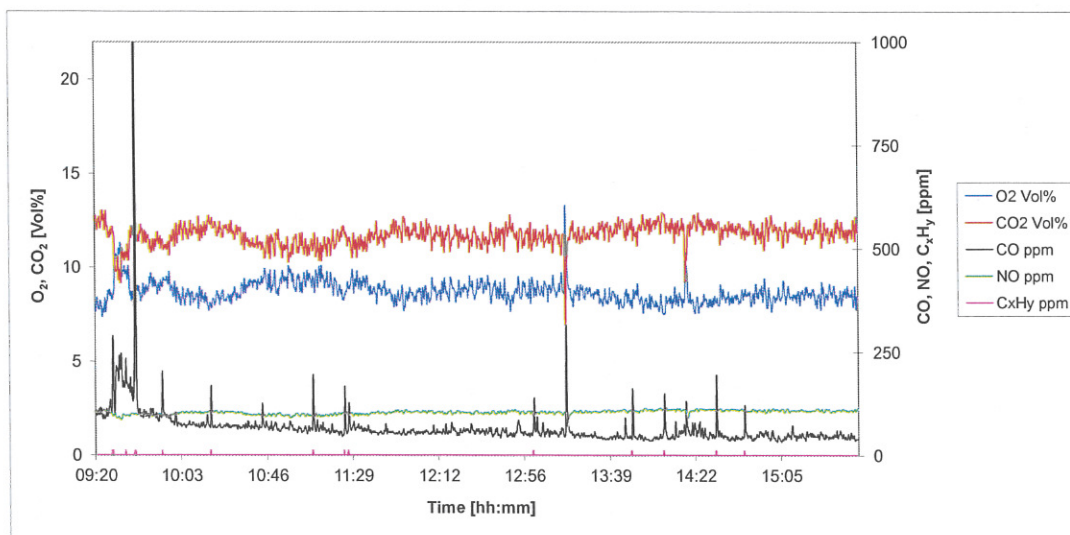
Ambient conditions		
Atmospheric Pressure	[%]	1008,7
Atmospheric humidity	[%]	17,9
Room temp.	[°C]	23,1

Flue gas temperature		
Maximum	[°C]	67,1
Average	[°C]	55,1

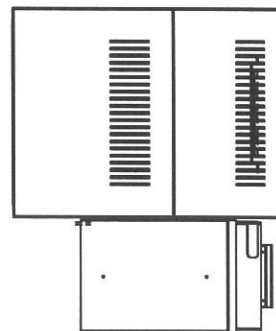
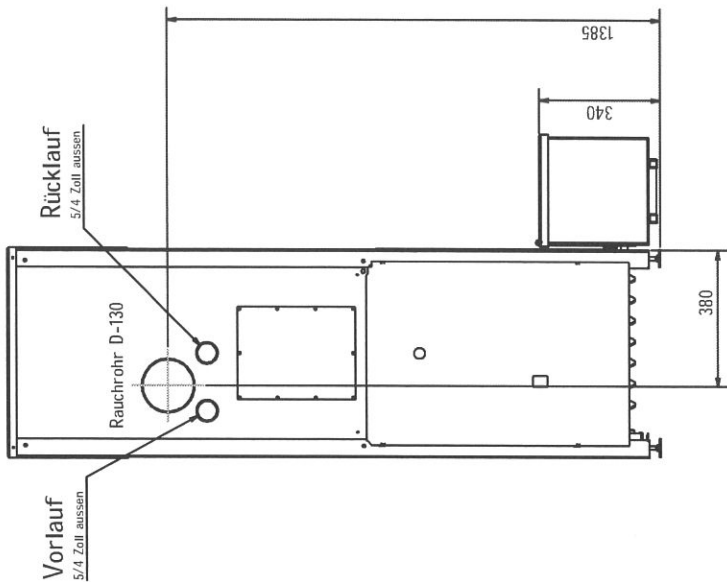
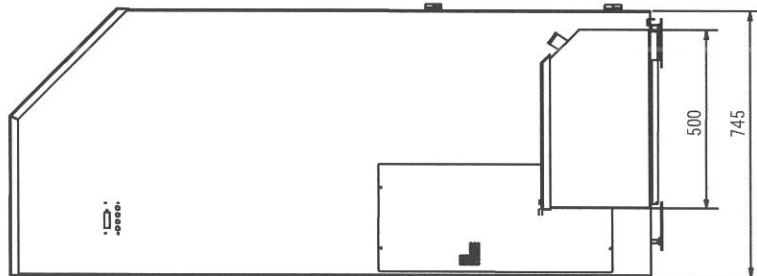
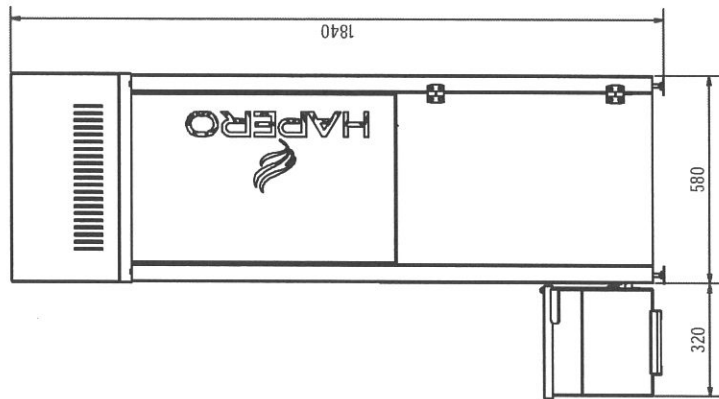
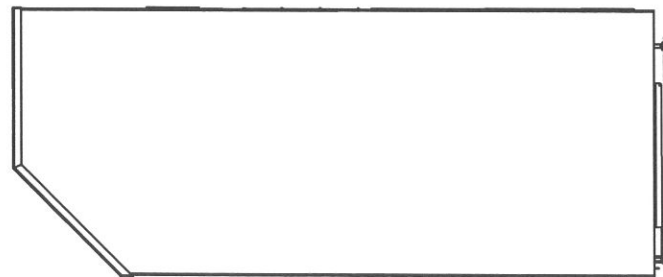
Average boiler surface temperatures		
Boiler cover	[°C]	24,7
Boiler surface left	[°C]	24,3
Boiler surface right	[°C]	26,4
Boiler surface front	[°C]	24,8
Boiler surface back	[°C]	27,6
Boiler base	[°C]	21,6
Fuel hopper	[°C]	21,1
Door handle		n.a.

Water heating output		
Temperature of inlet water	[°C]	55,7
Temperature of outlet water	[°C]	72,3
Water flow	[m ³ /h]	0,4
Water heating output	[kW]	7,8
Thermal efficiency	[%]	93,9

Emissions, measured					Dust measured					
O ₂	CO ₂	CO	NO	C _x H _y	09:46 - 10:46	10:50 - 11:50	11:55 - 12:56	13:00 - 14:00	14:03 - 15:03	15:05 16:00
[%]	[%]	[ppm]	[ppm]	[ppm]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]
12,9	7,7	112	40	1	14	16	18	14	17	18
					O ₂ in %					
					13,5	13,4	13,1	12,9	12,4	12,3
Emissions, related to 10 vol % O ₂ and standard reference conditions										
	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]
	173	103	2	19	21	23	17	20	21	
Emissions, related to 13 vol % O ₂ and standard reference conditions										
	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]	[mg/Nm ³]
	138	82	2	15	17	18	14	16	17	
Emissions related to the energy content of the fuel										
	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]	[mg/MJ]
	88	53	1	10	11	12	9	10	11	



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Sie darf ohne unsere Genehmigung weder vervielfältigt,
noch dritten Personen zugänglich gemacht werden.

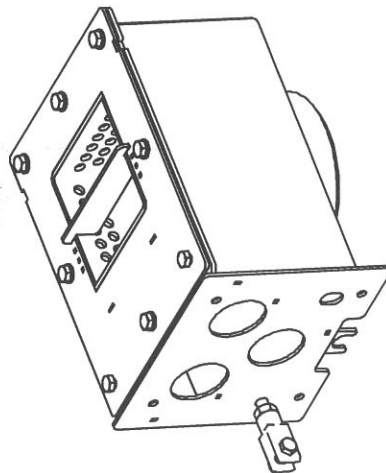
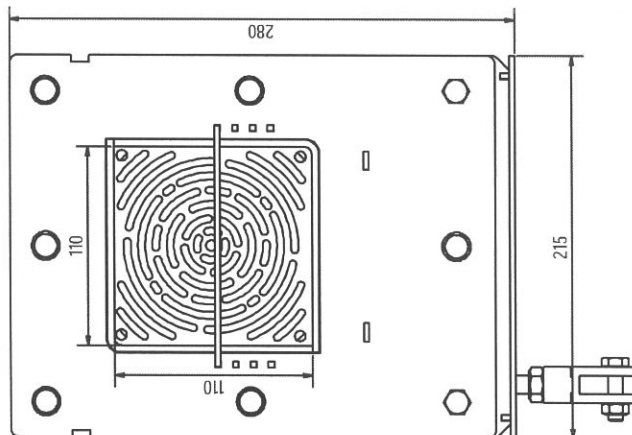
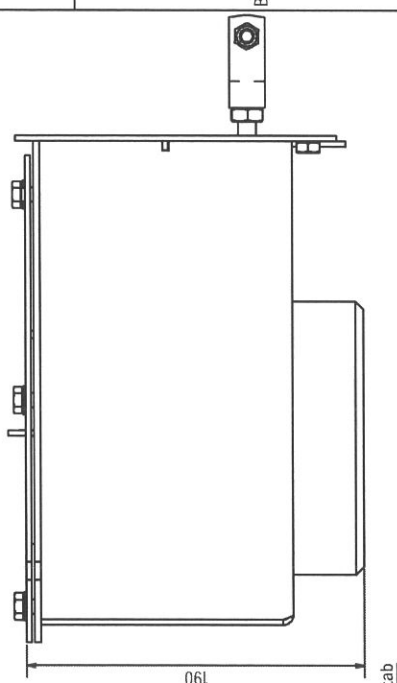


Pelletöfen: Typenbezeichnung HP-03 / Entwurfleistung / 3-zügiger Wärmetauscher			
Nennwärmeleistung: 25 kW			
Maximal zulässiger Betriebsdruck: 3 bar			
Prüfdruck des Wasserkreislaufes: 6 bar			
Schweißnahtnorm: Kehl- und Stumpfnaht			
Werkstoff: Stahl / Wandstärke - 3 / 4 / 5 mm / Qualität - S 235 JR			
Maximal zulässige Betriebstemperatur des Wasserkreislaufes: 80°C			
		Toleranzen nach DIN 7168 mittel	
		Erstellt am	27.09.2010
		Konstrukteur	P.R.
		Gewicht ca.	k.A.
Index		Änderung	Datum
		Benennung	
		HP-03 Abmessungen	
		Zeichnungsnummer: HP-03 Abmessungen	
		Blatt von 1	
		alle Zeichnungen	
		A2	
		6	

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UMWELTECHNIK UND
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A-1060 WIEN, GETREIDEMARKT 9/168

[illegible]

Schnittansicht A



INSTITUT FÜR VERFAHRENTECHNIK
UMWELTELEKTRONIK
TECHN. BOWEN UND
TECHNISCHE UNIVERSITÄT
4.1000 WIEN, GETTEPLATZ 13

[illegible]

Flash max. output 25 kW

Type: HP 03 / K Flash

Hersteller: Hapero Energietechnik GmbH (AUSTRIA)

Manufacturer: <http://www.hapero.com>



office@hapero.com

Seriennummer:

Serialnumber: 04.12.00043.2040



KENNUNG



Automatischer Holzpelletskessel:

Automatic wood pellet boiler,

Automatisk træpillefyr, Chaudière automatique à granulés de bois,

Caldaia a pellets automatica,

Wärmeleistung:

Nominal output,

Varmeydelse, Puissance nominale, Potenza nominale,

7,6 - 35 kW

25-121 BTU

Kesselklasse:

Boiler class,

Kedelklasse, Chaudière de classe, Classe caldaia,

3

Max. Betriebsdruck:

Maximum operating pressure,

Max driftryk, Pression de service maximum, Pressione massima ammessa,

3 bar

Max. Kesseltemperatur:

Maximum boiler temperature,

Max kedeltryk, Température maximale de chaudière, Massima temperatura di caldaia,

85° C

185° F

Wasserinhalt:

Water capacity,

Vandinhold, Contenance en eau, Contenuto d'acqua,

60 Liter

Stromanschluss:

Electricity supply,

Strømtilslutning, Raccordement électrique, Allacciamento elettrico,

230 V / 1400 W

50 HZ / >= 13 A

Vor Inbetriebnahme des Pelletskessels ist die Bedienungsanleitung vollinhaltlich zur Kenntnis zu nehmen.

Before commencement of operation the manual should be read over carefully.

Før igangsætning af kedlen skal monteringsvejledning læses og overholdes.

Prière de lire attentivement la notice technique d'utilisation avant la mise en service.

Leggere attentamente il libretto di istruzioni prima della messa in funzione della caldaia

Flash max. output 25 kW

Type: HP 03 / K Flash

Hersteller: Hapero Energietechnik GmbH (AUSTRIA)

Manufacturer: <http://www.hapero.com>



office@hapero.com

Seriennummer:

Serialnumber: 04.12.00044.2040



KENNUNG



Automatischer Holzpelletskessel:

Automatic wood pellet boiler,

Automatisk træpillefyr, Chaudière automatique à granulés de bois,

Caldaia a pellets automatica,

Wärmeleistung:

Nominal output,

Varmeydelse, Puissance nominale, Potenza nominale,

7,6 - 35 kW

25-121 BTU

Kesselklasse:

Boiler class,

Kedelklasse, Chaudière de classe, Classe caldaia,

3

Max. Betriebsdruck:

Maximum operating pressure,

Max driftryk, Pression de service maximum, Pressione massima ammessa,

3 bar

Max. Kesseltemperatur:

Maximum boiler temperature,

Max kedeltryk, Température maximale de chaudière, Massima temperatura di caldaia,

85° C

185° F

Wasserinhalt:

Water capacity,

Vandinhold, Contenance en eau, Contenuto d'acqua,

60 Liter

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Strømtilslutning, Raccordement électrique, Allacciamento elettrico,

230 V / 1400 W

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Leggere attentamente il libretto di istruzioni prima della messa in funzione della caldaia

Flash max. output 25 kW

Type: HP 03 / K Flash

Hersteller: Hapero Energietechnik GmbH (AUSTRIA)

Manufacturer: <http://www.hapero.com>



office@hapero.com

Seriennummer:

Serialnumber: 04.12.00041.2040



KENNUNG



Automatischer Holzpelletskessel:

Automatic wood pellet boiler,

Automatisk træpillefyr, Chaudière automatique à granulés de bois,

Caldaia a pellets automatica,

Wärmeleistung:

Nominal output,

Varmeydelse, Puissance nominale, Potenza nominale,

7,6 - 35 kW

25-121 BTU

Kesselklasse:

Boiler class,

Kedelklasse, Chaudière de classe, Classe caldaia,

3

Max. Betriebsdruck:

Maximum operating pressure,

Max driftryk, Pression de service maximum, Pressione massima ammessa,

3 bar

Max. Kesseltemperatur:

Maximum boiler temperature,

Max kedeltryk, Température maximale de chaudière, Massima temperatura di caldaia,

85° C

185° F

Wasserinhalt:

Water capacity,

Vandinhold, Contenance en eau, Contenuto d'acqua,

60 Liter

Stromanschluss:

Electricity supply,

Strømtilslutning, Raccordement électrique, Allacciamento elettrico,

230 V / 1400 W

50 HZ / >= 13 A

Vor Inbetriebnahme des Pelletskessels ist die Bedienungsanleitung vollinhaltlich zur Kenntnis zu nehmen.

Before commencement of operation the manual should be read over carefully.

Før igangsætning af kedlen skal monteringsvejledning læses og overholdes.

Prière de lire attentivement la notice technique d'utilisation avant la mise en service.

Leggere attentamente il libretto di istruzioni prima della messa in funzione della caldaia

Flash max. output 25 kW

Type: HP 03 / K Flash

Hersteller: Hapero Energietechnik GmbH (AUSTRIA)

Manufacturer: <http://www.hapero.com>



office@hapero.com

Seriennummer:

Serialnumber: 04.12.00042.2040



KENNUNG



Automatischer Holzpelletskessel:

Automatic wood pellet boiler,

Automatisk træpillefyr, Chaudière automatique à granulés de bois,

Caldaia a pellets automatica,

Wärmeleistung:

Nominal output,

Varmeydelse, Puissance nominale, Potenza nominale,

7,6 - 35 kW

25-121 BTU

Kesselklasse:

Boiler class,

Kedelklasse, Chaudière de classe, Classe caldaia,

3

Max. Betriebsdruck:

Maximum operating pressure,

Max driftryk, Pression de service maximum, Pressione massima ammessa,

3 bar

Max. Kesseltemperatur:

Maximum boiler temperature,

Max kedeltryk, Température maximale de chaudière, Massima temperatura di caldaia,

85° C

185° F

Wasserinhalt:

Water capacity,

Vandinhold, Contenance en eau, Contenuto d'acqua,

60 Liter

Stromanschluss:

Electricity supply,

Strømtilslutning, Raccordement électrique, Allacciamento elettrico,

230 V / 1400 W

50 HZ / >= 13 A

Vor Inbetriebnahme des Pelletskessels ist die Bedienungsanleitung vollinhaltlich zur Kenntnis zu nehmen.

Before commencement of operation the manual should be read over carefully.

Før igangsætning af kedlen skal monteringsvejledning læses og overholdes.

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Leggere attentamente il libretto di istruzioni prima della messa in funzione della caldaia