TÜV NORD Systems GmbH & Co. KG
Technical Centre
Testing agency for firing systems

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Hanover, 17th August 2006

Report no. KD 2140 C1

File reference: 1437PF03960

Report on testing a boiler according to DIN EN 303-5

Test report C Testing the technical heating and technical safety requirements

Testing agency: TÜV NORD Systems GmbH & Co. KG
Am TÜV 1,
D 30519 Hanover. Germany.

Specimen: a boiler for solid fuels.
Type: DSU 6
Fuel: pellets.
Fuel feeding: automatic.
Supply of combustion air: with a fan.

Customer: SMEDEGÅRDEN
Industrivej 34, DK-6780 Skærbæk. Danmark

Factory: SMEDEGÅRDEN
Industrivej 34, DK-6780 Skærbæk. Danmark

Extent of the order: Appraisal of the boiler regarding fulfilment of the technical heating requirements (point 4.2) and the technical safety requirements (point 4.1, partial test) in DIN EN 303-5

Testing period: 23rd May 2006 until 02nd August 2006.

Basis for the test: DIN EN 303-5 : 06/99, sections 4.1 and 4.2.

Person in charge: Mr. Kotlarski.

Extent of the report: 7 pages and 6 appendices.

1 General information about the test boiler

Description of the type:	-	DSU 6.	
Design and construction:	-	a boiler made of casting for burning wood (pellets) with a fan and supply of pettets.	
		Combustion principle:	fan with burning hollow.
		Fuel feed:	automatic, laterally.
		Removal of ashes:	manually.
		Fittings:	chains in fireroom .
Rated heat output:	kW:	6.5 to 14.7.	
Versions of the model:	-	-	
Heat transfer:	-	water.	
Class of boiler:	-	3.	
Perm. operating temperature:	°C	85.	
Perm. operating overpressure:	bar	4.0.	
Dimensions:	-	refer to the drawings.	
Drawing number	-	9017	

2 Basis for the test

DIN EN 303-5 entitled

Boilers; part 5: boilers for solid fuels, manually and automatically fed firing, rated heat output up to 300 kW, June 1999 edition, sections 4.1 and 4.2.

was used as the basis for the test.

3 Testing conditions

Construction of the test rig:	-	figure 1. DIN EN 304 : 01/04	
Heat transfer	-	water	water
Testing point	-	minimum load	maximum load
Date of the test		2nd August 2006	01st August 2006
Duration of the test	h	6.2	6.2
Duration of combustion	h	6.1	6.1
Information about analysis of the fuel	-	Dr. E. Weßling GmbH	
Air pressure	hPa	998	1002
Air humidity (relative humidity)	%	52	50

4 Imparted amount of heat

Testing point	-	Minimum load	Maximum load
Type and granulation of the fuel	-	8 mm pellets	8 mm pellets
Proportion of water	% by weight	5.3	5.3
Proportion of ash	% by weight	0.47	0.47
C proportion	% by weight	48.47	48.47
H proportion	% by weight	5.95	5.95
Calorific value	kWh/kg	5.02	5.02
Amount of fuel consumed hourly	kg/h	1.50	3.10
Imparted thermal output	kW	7.53	15.56

5 Usable amount of heat generated

Testing point	-	Minimum load	Maximum load
Amount of water hourly	l/h	277	665
Flow temperature	°C	80.9	78.6
Return temperature	°C	60.0	60.4
Usable amount of heat generated hourly	kW	6.56	13.66
Boiler's direct efficiency	%	87.1	87.8

6 Measured value of heat and heat losses

Testing point		-	Minimum load	Maximum load
Average temperature of the exhaust		°C	105.8	148.1
Temperature of the combustion air		°C	25.9	28.3
O_2 content		% by volume	12.2	11.6
NOx content		ppm (v)	97.4	111.0
CO content		ppm (v)	283.4	265.4
Emission of dust	related to 10 % O2	mg/m³	-	49
OGC content		ppm (v)	2.0	5.4
Feed pressure		hPa	0.13	0.19
Losses or gains by means of:				
- heat released from exhaust gases (q_A)		%	7.0 approx.	9.8 approx.
- incomplete combustion (q_U)		%	0.2	0.2
- combustible residue (q_F)		%	0.7	0.3
- radiation and convection (q_S)		%	5.8 approx.	2.8 approx.

7 Surface temperatures (Max.load)

Testing point	-		Max.load		Max.load		Max.load
Average ambient temperature	°C		27		27		27
		Average value		Highest value		Permissible	
Covering surface	°C		39		41		92
Front	°C		53		83.5		92
Back	°C		46		60.5		92
Right side	°C		33.4		36.6		92
Left side	°C		33.4		36.6		92
Bottom	°C		26.3		26.6		80.0
Control elements	°C		< 35		< 35		87
Cover for cleaning	°C		<56		<56		127
Radiated loss	W		436				

8 Testing the technical safety

8.1 Testing the controls

Manufacturer	-	ETI-1, Danfoss	
Day of the test	-	23rd May 2006	
Tripping temperature	°C	83.0 approx.	
Maximum flow temperature	°C	93.1	
STB responded	-	☐ yes	☑ no
Maximum CO concentration	% by vol.	< 0.2	
Requirement of point 4.1.5.11.2 fulfilled	-	yes	

8.2 Testing of STB

Manufacturer	-	Danfoss	
Type	-	EBST-5-1221	
Considering Standard	-	EN 60730-2-9, EN 14597	
Day of the test	-	23rd May 2006	
Tripping temperature	°C	92.0	
Maximum flow temperature	°C	99.9	
Interlocking function fulfilled	-	☑ yes	☐ no
Maximum CO concentration	% by vol.	< 02	
Requirement of point 4.1.5.11.2 fulfilled	-	yes	

8.3 Testing of power failure

Day of the test	-	23rd May 2006
Boiler temperature when power switched off	°C	< 80
maximum flow temperature	°C	< 90
Maximum CO concentration	% by vol.	0.2 (peak)
Requirement of point 4.1.5.14.2 fulfilled	-	yes

8.4 Testing of back burning for the feeding system

Day of the test	-	23rd May 2006
Temperature of the burner's downpipe	°C	< 40
Temperature of the feed screw	°C	<25
Temperature of the silo	°C	<25
Requirement of point 4.1.5.14.2 fulfilled	-	yes

8.5 Testing of water pressure

Day of the test	-	31st July 2006
Permissible pressure of working	bar	4.0
Test pressure	bar	8.0
Time of test	min	30
Requirement of point 5.5.1.2 fulfilled	-	yes

8.6 Testing requirements of design

Testobject	Requirement of DIN EN 303-5, point	Requirement
Ventilation of the waterroom and rooms with exhaust	4.1.5.1	fulfilled
Cleaning the heating surfaces	4.1.5.2	fulfilled
Recognition of the flames	4.1.5.3	fulfilled
Closeness from the waterside	4.1.5.4	fulfilled
Conections from the waterside	4.1.5.6	fulfilled
Heat insulation	4.1.5.8	fulfilled
The room of ashes	4.1.5.13	fulfilled

8.7 Testing ignition system with oil EL

Day of the test	-	31st July 2006
Oil-fired automat with photounit	-	BHO 64, Fa. Danfoss
Ignition unit	-	Type EBI, Fa. Danfoss
Oil-burning pump	-	Type BFP 20/21, Fa. Danfoss
Oil-burnig nozzle	-	Type OD, Fa. Danfoss
Time of ventilation	sec	30
Ignition on	-	after time of ventilation
duration of burning	sec	60
Content of oil tank	l	2
Max. number of ignitions	-	70 approx.

The burner for ignition is designed on the basic of EN 267. The times of ventilation are high enough.

9 Comparison of the decisive values:

9.1 with the requirements according to DIN EN 303-5, June 1999 edition

Testing point		Minimum load	Maximum load	
Thermal output	kW	6.6	13.7	-
		reached	**reached**	**permissible**
Boiler's (direct) efficiency	%	87.1	87.8	≥71.9 (min) ≥73.8 (max) according to Class 3
Exhaust temperature	°C	105,8	148,1	≥160 *
Feed pressure	hPa	0.13	0.19	≤0.24
Duration of burning at nominal and weak loads	h	6.1	6.1	≥6.0
CO emission (related to 10 % O2)	mg/m3	441	387	≤ 3000 (Cl. 3)
OGC emission (related to 10 % O2)	mg/m3	4.2	10.3	≤100 (Cl. 3)
Emission of dust (related to 10 % O2)	mg/m3	-	49	≤150 (Cl. 3)

*) The boiler manufacturer must give information about the chimney's design and construction for the purpose of avoiding any sooting when the temperature is less than 160°C.

9.2 with the requirements for Germany according to Addendum A.2 of DIN EN 303-5, June 1999 edition and 1. BImSchV

Testing point		Min. load	Max. load	
		reached	reached	permissible
CO- emission (related to 13 % O2)	mg/m3	321	282	≤ 4000
Emission of dust (related to 13 % O2)	mg/m3	-	36	≤ 150

9.3 with the requirements for Switzerland according to Addendum A.5 of DIN EN 303-5, June 1999 edition and the Swiss Ordinance on Air Pollution

Testing point		Min. load	Max. load	
		reached	reached	reached
CO emission (related to 13 % O2)	mg/m3	321	282	≤ 4000

9.4 with the requirements for Austria according to Addendum A.1 of DIN EN 303-5, June 1999 edition and the Austrian law, Art. 15a 'Agreement about protective measures regarding small firings' and 'Agreement about saving energy'

Testing point		Minimum load	Maximum load	
		reached	reached	permissible
Boiler's (direct) efficiency	%	87.1	87.8	≥74.6 (min.) ≥77.1 (max).
CO emission	mg/MJ	168	147	≤ 500
Emission of dust	mg/MJ	-	19	≤ 60
NOx emission	mg/MJ	95	101	≤150
OGC emission	mg/MJ	2	4	≤ 40

10 Concluding appraisal

The DSU 6 boiler that was supplied by Fa. SMEDEGÅRDEN, DK-6780 Skærbæk, Danmark has been tested on a test rig – which was equipped according to DIN EN 304 : 01/04 – by the testing agency for firing systems of TÜV NORD Systems GmbH & Co. KG, regarding the technical heating and technical safety requirements of DIN EN 303-5 : 06/99, sections 4.2 and 4.1 (partial test).

The testing showed that the technical heating requirements for boilers according to DIN EN 303-5 : 06/99, section 4.2 and the technical safety requirements according to section 4.1 as well as the additional requirements for the countries of destination, namely Austria, Germany and Switzerland, have been fulfilled according to Addenda A, A.1, A.2 and A.5.

Hanover, 17th August 2006

TÜV NORD Systems

The tester

signed Butzke

Butzke

The testing agency manager

Kotlarski