

Notified Body 1880 – Regulation (EU) no305/2011

TEST REPORT n.1880-CPR-077-001-21

Compliance of dust load to European Regulations (Austrian 15a B-VG, German BIMSChv, French Flamme Verte and Swiss LRV)

Residential space heating appliances fired by wood pellets
UNI EN 14785:2006

Manufacturer: CADEL SRL
VIA FORESTO SUD, 7
31025 S. LUCIA DI PIAVE (TV)
ITALY

Trademark - Type designation: CADEL - PRINCE PLUS 11 T1 (tested appliance)

Variants: CADEL - KOBE PLUS 11 T1
CADEL - FENICE PLUS 11 T1
PEGASO - SPARK 11 T1
FREEPOINT - INDACO 11 T1

Type of appliance: Residential space heating appliances fired by wood pellets without
water heat exchanger.

Receipt date: October 18, 2021

Start test date: October 19, 2021

End test date: October 26, 2021

Testing laboratory: ACTECO SRL
via Amman, 41
33084 Cordenons (PN)
Italy

Issue date: December 28, 2021

Head of Test Laboratory
Dr. Claudia Marcuzzi

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Task

ACTECO SRL was instructed to execute initial type testing and AVCP to establish compliance according to the harmonized European standard UNI EN 14785:2006.

The practical tests were performed in the laboratory in Cordenons (PN), via Amman, 41.

Sampling of the appliance

The sampling of the appliance was performed by the manufacturer and was received by the testing laboratory on October 18, 2021.

Description of the appliance

Residential space heating appliances fired by wood pellets.

The combustion air is taken from the test room.

Key data of appliance declared by the manufacturer

Appliance	CADEL - PRINCE PLUS 11 T1 CADEL - KOBE PLUS 11 T1 CADEL - FENICE PLUS 11 T1 PEGASO - SPARK 11 T1 FREEPOINT – INDACO 11 T		
Fuel		Wood pellet	
		nominal	reduced
Fuel throughput	kg/h	2,5	0,7
Total heating output	kW	10,5	3
CO emission based on 13% O ₂	%	0,013	0,018
	mg/m ³	159	230
Dust emission based on 13% O ₂	mg/m ³	15	20
OGC emission based on 13% O ₂	mg/m ³	5	5
NOx emission based on 13% O ₂	mg/m ³	100	120
Efficiency	%	88	90
Flue gas temperature	°C	200	95
Necessary flue draught	Pa	12	10
Flue gas mass flow	g/s	8,0	4.0
Minimum clearance distances from exposed / combustibile materials	from rear wall		200 mm
	from side walls		300 mm
	from bottom		0 mm
	ceiling		750 mm
	front		1000 mm

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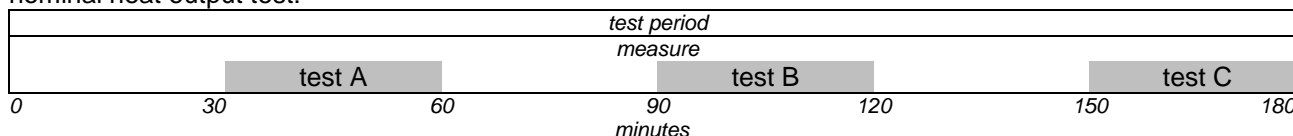
Description of the dust emission test

Measurement of particulate emissions is performed with UNI CEN/TS 15883:2009 (equivalent to VDI 2066:2006 part 1) parallel to CO-measurement during the initial type testing according to the nominal heat output test described in UNI EN 14785:2006 A.4.7.

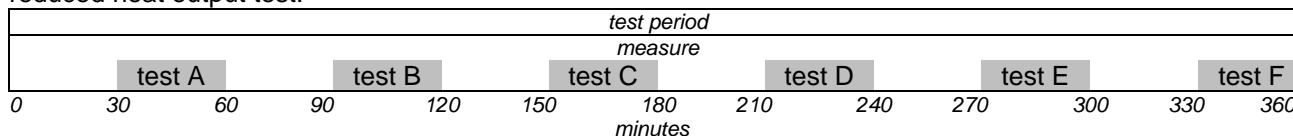
A sample flow of the gas is extracted from the main gas flow at a representative sampling point for the sampling period with a controlled flow rate and the withdrawn volume is measured. The dust entrained in the gas sample is separated by a pre-weighed plain quartz fibre filter, which is dried and re-weighed. The increase of mass of the filter is attributed to the dust collected from the sampled gas.

The measurement position for particle measurement is arranged downstream of measurement positions of CO, CO₂, NO_x and OGC (Organic Gaseous Compounds). Measurement of particulate emissions and duration of measurements are described in the following scheme.

nominal heat output test:



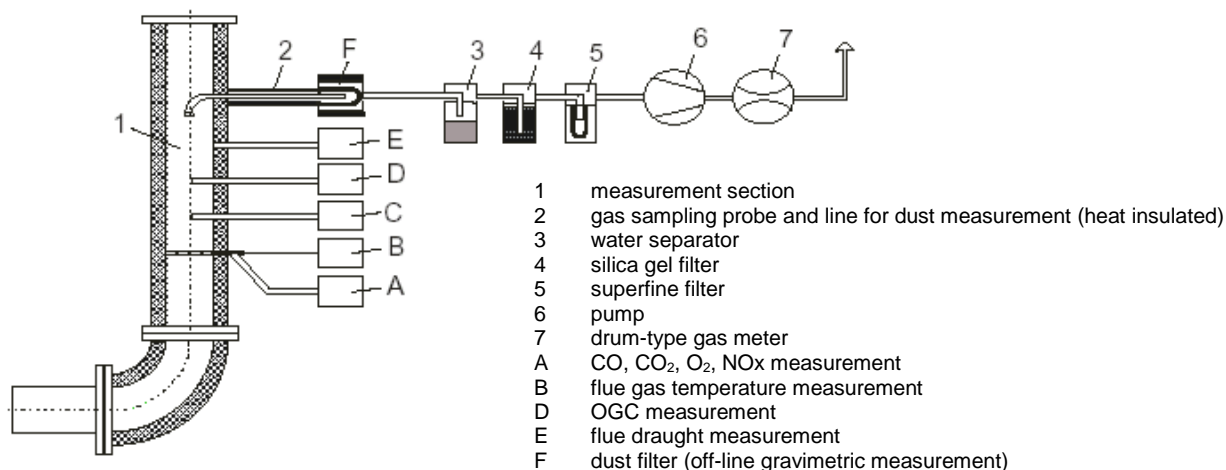
reduced heat output test:



The measuring arrangement is illustrated in the following figure. The sampling tube widens out to 9,74 mm at the specimen inlet. In a sampling period of 30 minutes a waste gas volume of $270 \pm 13,5$ l relative to normal conditions (273 K, 1013 hPa) is sampled, corresponding to a flow rate of $10,0 \pm 0,45$ l/min.

Note: In the interests of simplifying the measuring method, individual measurement of the flow velocity and subsequent matching of the inlet cross-section are dispensed with. In order to carry out the measurement, the sampling probe is centred in the exhaust-gas cross-section..

The measuring filter is inserted in a filter holder at the end of the sampling probe and a controlled probe heating system is adopted to exclude the possibility of the sampled flue gas falling below the dew point in front of or in the filter sleeve.



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PERFORMANCE AT THE NOMINAL HEAT OUTPUT TEST

test n°	1		2		average
Test data		20/11/2021	20/11/2021		
Start time		09:10	12:51		
End time		12:10	15:51		

Combustion:					
fuel load		kg	7,7	7,4	7,6
test period		min	180	180	180
fuel load	B	kg/h	2,550	2,470	2,510
average flue draught		Pa	12,0	11,6	11,8

Ventilation circuit:					
average ambient room temperature	tr	°C	23,3	24,2	23,8

Flue gas:					
carbon dioxide	CO ₂	%	11,4	11,3	11,4
oxygen	O ₂	%	9,5	9,5	9,5
carbon monoxide	CO	%	0,005	0,005	0,005
average flue gas temperature	ta	°C	199	198	199
maximum flue gas temperature		°C	208	208	208
flue gas mass flow	m	g/s	7,8	7,6	7,7

Maximum surface temperatures:					
internal fuel hopper		°C	65,7	67,2	66,5
pellet loading motor		°C	60,3	61,6	61,0
takeoff chute		°C	35,3	36,8	36,1
conveyor system where there is pellet		°C	43,2	45,1	44,2

Maximum trihedron surface temperatures:					
hearth		°C	34,8	35,7	35,3
side wall		°C	36,7	38,0	37,4
back wall		°C	33,6	35,5	34,6

Electrical power consumption:					
at nominal heat output		kW	0,110		
in standby mode		kW	0,0025		

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test n°			1	2	average
Results:					
thermal losses in flue gas	q_a	%	11,8	11,7	11,8
thermal losses in flue gas	Q_a	kJ/kg	2033	2023	2028
chemical losses in flue gas	q_b	%	0,03	0,03	0,003
chemical losses in flue gas	Q_b	kJ/kg	4,5	4,8	4,7
heat losses due to combustible through the grate	q_r	%	0,2	0,2	0,2
efficiency	η	%	88,0	88,0	88,0
carbon monoxide [at 13% O ₂]		%	0,003	0,003	0,003
carbon monoxide		mg/MJ	27	28	27
carbon monoxide [at 13% O ₂]		mg/m^3	40	42	41
total heat output	P	kW	10,8	10,4	10,6

Dust emission: test A		mg/MJ	10	10	10
test B		mg/MJ	10	10	10
test C		mg/MJ	10	10	10
average		mg/MJ	10	10	10
Dust emission (at 13% O ₂): test A		mg/m^3	16	14	15
test B		mg/m^3	15	14	15
test C		mg/m^3	15	15	15
average		mg/m^3	15	14	15
NOx		ppm	68	68	68
NOx (as NO ₂)		mg/MJ	64	65	64
NOx (as NO ₂ at 13% O ₂)		mg/m^3	97	97	97
THC (as propane)		ppm	4	5	5
OGC (as C)		mg/MJ	3	4	3
OGC (as C at 13% O ₂)		mg/m^3	5	6	5

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PERFORMANCE AT REDUCED HEAT OUTPUT TEST

test n°		1
Test data		22/10/2021
Start time		09:31
End time		15:31

Combustion:			
fuel load		kg	4,0
test period		min	360
fuel load	B	kg/h	0,670
average flue draught		Pa	9,4

Ventilation circuit:			
average ambient room temperature	tr	°C	22,7

Flue gas:			
carbon dioxide	CO ₂	%	6,3
oxygen	O ₂	%	14,5
carbon monoxide	CO	%	0,006
average flue gas temperature	ta	°C	95,2
maximum flue gas temperature		°C	111
flue gas mass flow	m	g/s	3,6

Maximum surface temperatures:			
internal fuel hopper		°C	39,3
pellet loading motor		°C	41,0
takeoff chute		°C	31,5

Maximum trihedron surface temperatures:			
hearth		°C	27,2
side wall		°C	31,1
back wall		°C	26,8

Electrical power consumption:			
at minimum heat output		kW	0,015

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test n°			1
Results:			
thermal losses in flue gas	q_a	%	8,3
thermal losses in flue gas	Q_a	kJ/kg	1423
chemical losses in flue gas	q_b	%	0,06
chemical losses in flue gas	Q_b	kJ/kg	10,5
heat losses due to combustible through the grate	q_r	%	0,20
efficiency	η	%	91,5
carbon monoxide [at 13% O ₂]		%	0,007
carbon monoxide [at 13% O ₂]		mg/m^3	91
carbon monoxide		mg/MJ	61
total heat output	P	kW	3,0

Dust emission: test A	mg/MJ	16
test B	mg/MJ	11
test C	mg/MJ	12
test D	mg/MJ	14
test E	mg/MJ	15
test F	mg/MJ	10
average	mg/MJ	13
Dust emission (at 13% O ₂): test A	mg/m^3	24
test B	mg/m^3	16
test C	mg/m^3	18
test D	mg/m^3	22
test E	mg/m^3	23
test F	mg/m^3	15
average	mg/m^3	20
NOx	ppm	37
NOx (as NO ₂)	mg/MJ	61
NOx (as NO ₂ at 13% O ₂)	mg/m^3	92
THC (as propane)	ppm	2
OGC (as C)	mg/MJ	3
OGC (as C at 13% O ₂)	mg/m^3	4

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STATEMENTS OF THE TEST RESULTS

The requirements for CO, NO_x, OGC and dust emissions and for efficiency of Ecodesign regulation, Austrian 15a B-VG, German BIMSChv, French Flamme Verte and Swiss LRV for appliances fired by pellet are the following.

Austrian 15a B-VG

	Nominal heat output	Reduced heat output
	[mg/MJ]	[mg/MJ]
CO	500	750
NO _x	100	
OGC	30	30
dust	25	
efficiency	80	80

		Ecodesign Regulation	German BIMSChv	Swiss LRV	Flamme Verte	
					6 stars	7 stars
		at nominal heat output				
CO	mg/m ³ (13% O ₂)	300	250	500	375	250
dust	mg/m ³ (13% O ₂)	20	30	40	40	30
OGC	mg/m ³ (13% O ₂)	60				
NO _x	mg/m ³ (13% O ₂)	200				
efficiency	%		85		87	90
seasonal efficiency	%	79				

The appliances

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fulfill the requirements of

- Austrian 15a BV-G
- German BIMSChv
- Swiss LRV limits

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MEASURING DEVICES

The requirements of the measuring instruments are fulfilled.

Before each qualified measuring analysers were calibrated with zero gas and calibration gas.

Parameter measured	principle	Company	range	uncertainty	Calibration gas
O ₂	paramagnetic	MRU	0 – 21%	±0.1%	0 – 2,5 – 9,0- - 21%
CO ₂	infra-red	MRU	0 – 20 %	±1%	0 – 9 – 18 %
CO	infra-red	MRU	0 – 2000 ppm	±2%	0 – 880 ppm
NO _x	infra-red	MRU	0 – 500 ppm	±2%	0 – 50 – 250 – 450 ppm
OGC	FID	Ratfish	0 -100 ppm	±2%	0 – 90 ppm propane
static pressure	--	MRU	0 – 25 Pa	±0,25 Pa	0 – 20 Pa
temperature: ambient room	K thermocouple	National Instruments	10 – 50°C	±0.5°C	--
flue gas	K thermocouple		20 – 1000°C	±2°C	--
surface	T thermocouple		20 – 250°C	±1°C	--
touchable areas	K thermocouple		20 – 250 °C	±1°C	--
cross-draught	heated thermistor	Schmidt Feintechnik	0 – 20 m/s	±0.1 m/s	--
mass: fuel consumption	balance	SBP	0 – 1500 kg	±20 g	--
fuel load	balance	SBP	0 – 10 kg	±0,5 g	--

All data were continuously recorded with data logger at intervals of 5 seconds. All raw data is stored for 10 years.

FUEL DATA

Specifications of the test fuel used (supplied by the manufacturer):

	nominal heat output test
Fuel	wood pellet
Moisture content [%]	7,7
Lower calorific value [KJ/Kg]	17244
Carbon content [% on dry basis]	47,3
Nitrogen content [% on dry basis]	0,10
Hydrogen [% on dry basis]	5,7
Size: length [mm] diameter [mm]	12 – 30 (at the origin) 6,0

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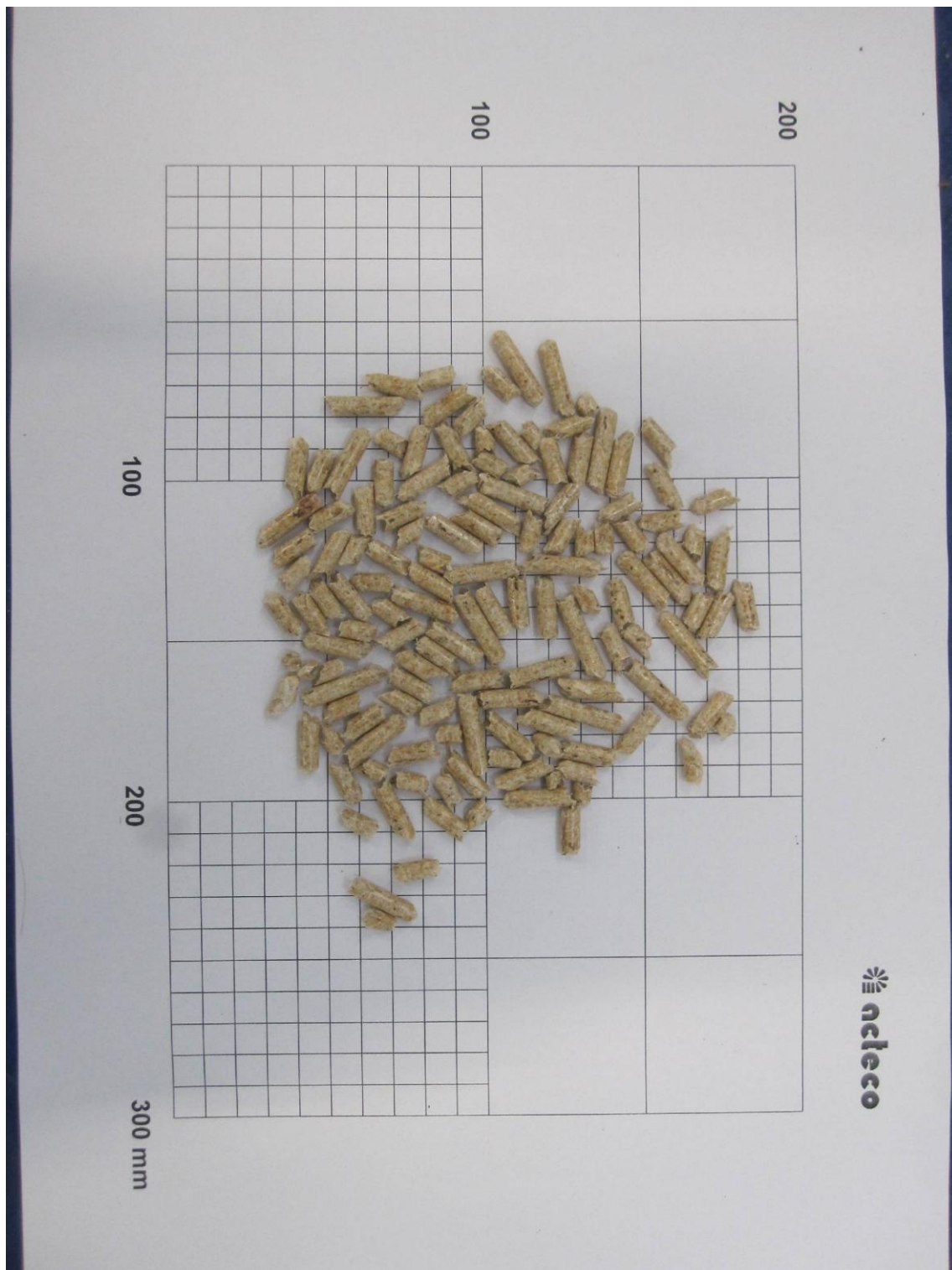
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