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**Informative R E P O R T**

on efficiency testing  
of gas fired absorption heat pumps  
type E<sup>3</sup> A... and E<sup>3</sup> GS ...  
of Robur S.p.A., I-Verdellino

(This reports includes 9 pages  
and the referred enclosures under Chapter V)

**Customer:**

Robur S.p.A.  
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**Akkreditiertes Prüflabor:**  
Reg.-Nr. DAT-P 047/95-02  
Reg.-Nr. ZLS-P-405/03; ZLS-P-637/05  
Reg.-Nr.: DIN CERTCO PL 019  
Reg.-Nr.: DVGW LV-BN7053  
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## I. General remarks

The appliances presented for efficiency testing are gas fired absorption heat pumps providing gas condensing modulation operation.

### Further data:

Trade mark	E <sup>3</sup> A...; E <sup>3</sup> GS ..., Robur S.p.A., I-Verdellino
Distributor	Robur S.p.A., I-Verdellino
Manufacturer	
Place of production	
DVGW-Product-Code	3672
Application form	(not relevant)
Application-No.	(not relevant)
Test documentation	Installation , use and maintenance manual
Test sample / date of reception of samples	E <sup>3</sup> GS HT , 14.02.08 (DVGW-Nr.2119)
Date of testing	20.02.-21.02.08

The aim of the test is to verify gas utilisation efficiency performance (G.U.E.).

## II. Test references

The tests have been performed according to:

DIN EN 12309-2: June 2000	"Gas-fired absorption air-conditioning and /or heat pump appliances with a max heat input not exceeding 70 kW"
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## III. Description of the test subject

### III.1 Brine-water heat pump

Type E<sup>3</sup> GS...

The introduced heat pump is a condensing modulating ground source heat pump for indoor and outdoor use (no split type). Natural gas or LPG can be used as a power supply for the absorption circuit. The thermodynamic cycle uses a water-ammonia mixture (H<sub>2</sub>O - NH<sub>3</sub>) which flows in a hermetic circuit. This refrigerant works under a max pressure of 35 bar (3.5 MPa). The appliance is able to produce thermal output using the ground as an external energy source. This external energy source temperature ranges from -30 °C to +45 °C for the outdoor application and from 0 to +45 °C for the indoor application.

Two versions are tested under these basic features:

- Version a) is called **E<sup>3</sup> GS HT** for high water temperatures (max 70 °C) and
- version b) is called **E<sup>3</sup> GS LT** for low water temperatures optimized for floor heating purposes.

Version b) is able to produce water temperatures of max. 70 °C.

These two versions differ in the following:

- Different amount of refrigerant
- Different flow rate through the restrictor.

The manufacturer describes 19 working points (see also specific machine description). The schematic drawing in the enclosures shows the thermodynamic cycle.



### III.2 Air-water heat pump

#### Type E<sup>3</sup> A...

The introduced heat pump is a condensing modulating air to water heat pump for outdoor use (no split type). Natural gas or LPG can be used as a power supply for the absorption circuit. The thermodynamic cycle uses a water-ammonia mixture (H<sub>2</sub>O - NH<sub>3</sub>) which flows in a hermetic circuit. This refrigerant works under a max. pressure of 35 bar (3.5 MPa). The appliance is able to produce thermal output using external air as an energy source. This external air temperature ranges from -30 °C to +45 °C.

Two versions are tested under these basic features:

- Version a) is called **E<sup>3</sup> A HT** for high water temperatures (max. 70 °C) and
- version b) is called **E<sup>3</sup> A LT** for low water temperatures optimized for floor heating purposes.

Version b) is able to produce water temperatures of max. 70 °C.

These two versions differ in the following:

- Different amount of refrigerant
- Different flow rate through the restrictor.

The manufacturer describes 20 working points (see also specific machine description). The schematic drawing in the enclosures shows the thermodynamic cycle.

## **IV. Testing**

### **IV.1 General**

The tests were performed according to the standards mentioned under clause II of this report.

The results of this report only refer to the test samples selected and presented by the manufacturer.

The tests have been performed at the manufacturers test laboratories in Verdellino (Italy) under witness of test personnel of VDE, Offenbach, in addition the test laboratory has been inspected by personnel of DVGW-Forschungsstelle, Karlsruhe during the test performance.

The test results have been reported with reports of the VDE with reference numbers 5008511-2600-0001/96823A and 5008511-2600-0001/96823B.

In addition tests have been performed in the Test Laboratories Gas of DVGW-Forschungsstelle, Karlsruhe.

The test results are documented in the enclosures of this report.

The tests showed that all values of measured efficiency according to EN 12309-2, table 12, T1 and T4 (air-water) or T1 and T3 (brine-water) are above 1.2. In addition further test points have showed higher values, see also detailed test results.



## IV.2 Test results on type E<sup>3</sup> GS... (brine-water)

Results for: Version a): E <sup>3</sup> GS HT									
Test Condition	P output	Q input	$\eta_h$	CO <sub>2</sub>	electr. consum	Delta -p hot side	Water flow hot side	Delta -p cold side	Water flow cold side
	(kW)	(kW)	(%)	(%)	(W)	(mbar)	(kg/h)	(mbar)	(kg/h)
(*) B0W50 (T1)	38,78	24,82	156	8,85	430	320	2352	---	2722
(**) B0W50	26,40	17,80	148	8,69	420	320	2324	---	2772
(*) B0W65	30,58	24,07	127	8,72	425	320	2366	---	2835

Remark1: measured by DVGW ;

Remark2: cold water side was mixed glycol(25%)-water solution

Remark \*: hot side differential temperature &gt; 10°C

Remark \*\*: same reference condition like at VDE test report (hot side DT=10°C)

Results for: Version a): E <sup>3</sup> GS HT									
Test Condition	P input	Q output	$\eta_h$	CO <sub>2</sub>	electr. consum	Delta -p hot side	Water flow hot side	Delta -p cold side	Water flow cold side
	(kW)	(kW)	(%)	(%)	(W)	(mbar)	(l/h)	(mbar)	(l/h)
B0W50 (T1)	37,631	25,201	149	8,90	471,04	438	3169	510	3022
B-5W50 (T3)	36,410	25,233	144	8,91	472,60	411	3069	567	3022
B5W50	38,826	25,080	155	8,80	475,90	470	3340	478	3022
B0W50	10,378	9,021	115	8,25	432,16	45	862	483	3022
B0W65	31,449	25,212	125	8,77	511,84	306*	2662	492	3022
B0W50	26,482	18,082	146	8,76	452,08	234	2256	501	3022
B0W35	40,574	25,152	161	9,05	435,50	570	3568	492	3022
B0W45	39,274	25,100	156	8,89	460,26	500	3375	504	3022
B0W60	33,729	25,345	133	8,87	503,14	357	2891	511	3022
B5W65	32,865	25,157	131	8,87	523,96	339	2814	485	3022

Remark1: measured by VDE (report nr.:5008511-2600-0001/96823B FG23/stc-ec)

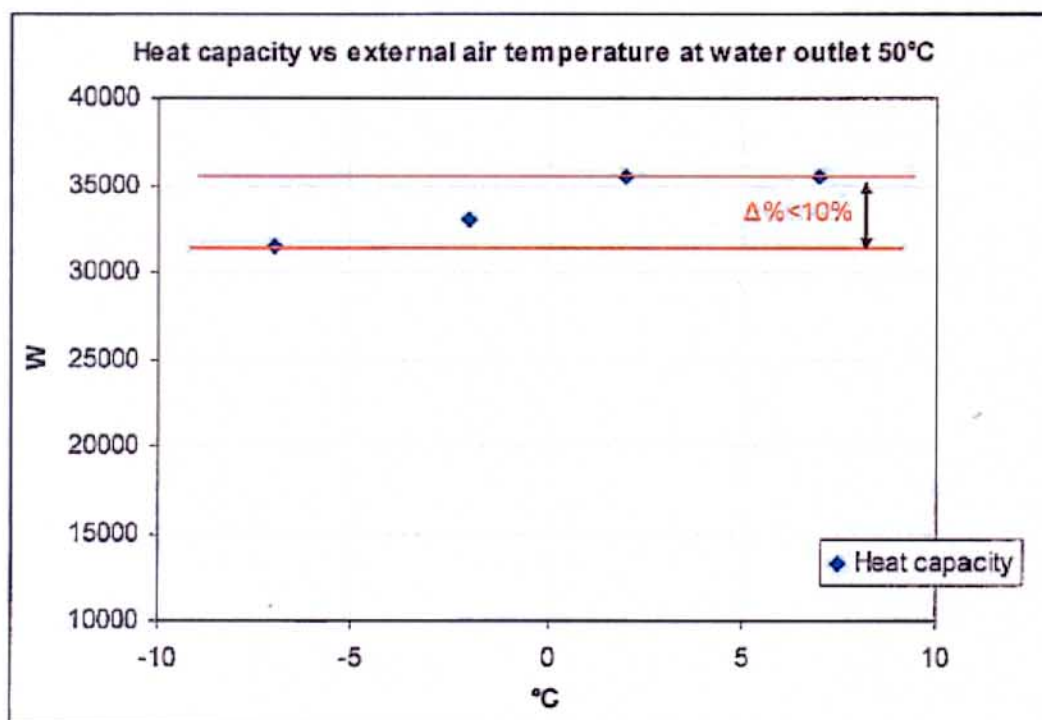
Results for: Version a): E <sup>3</sup> GS LT									
Test Condition	P input	Q output	$\eta_h$	CO <sub>2</sub>	electr. consum	Delta -p hot side	Water flow hot side	Delta -p cold side	Water flow cold side
	(kW)	(kW)	(%)	(%)	(W)	(mbar)	(l/h)	(mbar)	(l/h)
B0W35 (T2)	42,613	25,107	169,7	8,94	445,08	611	3634	525	3022
B0W45	39,013	25,211	154,7	8,92	456,26	507	3385	524	3022
B0W35	13,495	9,089	148,5	8,11	403,14	81	1160	494	3022
B0W35 (T2)	30,948	17,993	172,0	8,79	420,32	355	2730	520	3022
B5W60	23,000	17,839	128,9	8,79	473,98	691	4143	477	3022
B0W50 (T1)	37,688	25,200	149,6	8,79	467,40	458	3254	511	3022
B5W35	42,632	25,232	169,0	8,79	466,58	623	3703	477	3022
B-5W35	39,798	25,197	158,0	8,79	434,80	511	3407	568	3022
B5W70	14,396	13,534	106,4	8,25	484,94	83	1228	465	3022

Remark1: measured by VDE (report nr.:5008511-2600-0001/96823B FG23/stc-ec)

### IV.3 Test results of type E<sup>3</sup> A... (air-water)

Results for: Version a): E <sup>3</sup> A HT				
Test Condition	P <sub>input</sub>	Q <sub>output</sub>	η <sub>h</sub>	CO <sub>2</sub>
	(kW)	(kW)	(%)	(%)
A7W50 (T1)	35,433	23,328	152	8,70
A-7W50 (T4)	31,496	25,188	125	9,50
A-2W50	33,059	25,015	132	9,53
A2W50	35,446	24,479	145	8,70
A2W50	25,747	17,916	144	9,22
A7W50	10,572	8,977	118	8,60
A7W65	28,542	23,098	124	9,35
A7W65	27,530	23,188	119	9,44
A2W60	29,526	24,361	121	9,25
A7W60	30,694	23,413	131	9,40

Remark1: measured by VDE (report nr.:5008511-2600-0001/96823A FG23/stc-ec)

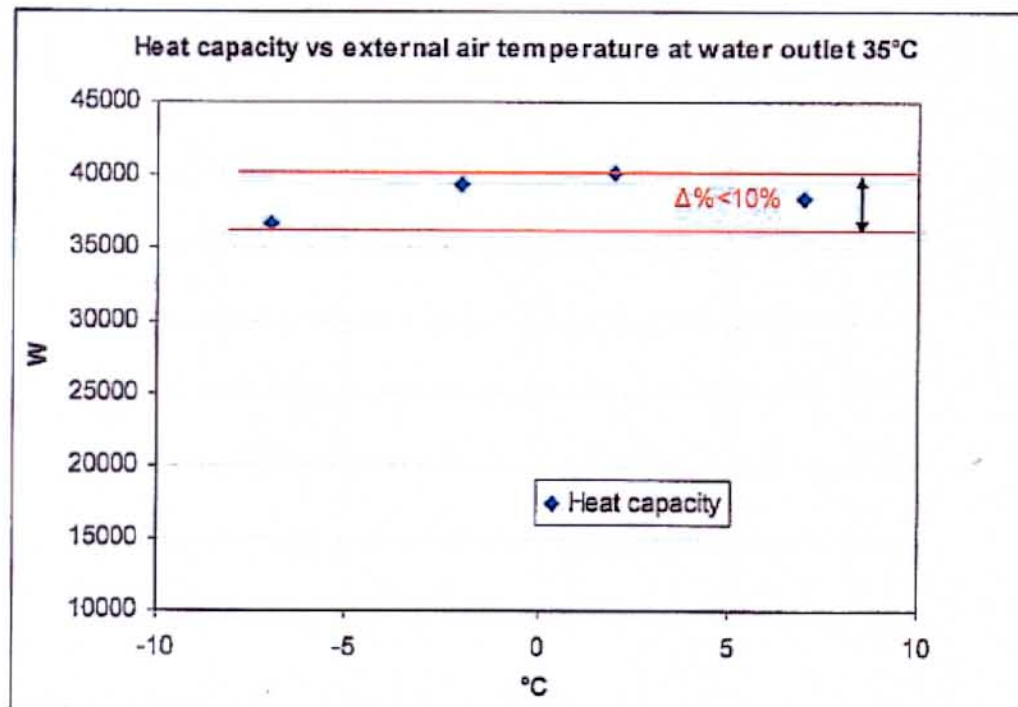


As reported in the above graph, from -7°C ambient temperature up to +7°C at 50°C hot water outlet temperature, E<sup>3</sup> A HT heating capacity varies less than 10%, demonstrating a constant performance across a wide range of ambient temperatures.



Results for: Version a): E <sup>3</sup> A LT				
Test Condition	P <sub>input</sub>	Q <sub>output</sub>	η <sub>h</sub>	CO <sub>2</sub>
	(kW)	(kW)	(%)	(%)
A7W35 (T3)	38,377	23,219	165,3	8,51
A7W50 (T1)	34,918	23,129	151,0	8,31
A7W60	28,521	23,002	124,0	7,95
A2W60	28,091	24,379	115,2	8,08
A2W35	40,129	24,461	164,1	7,85
A7W35	12,933	9,029	143,2	9,40
A2W35	29,009	18,079	160,5	8,50
A-2W35	39,298	25,313	155,2	8,37
A-7W35	36,583	25,297	144,6	8,50
A7W70	21,703	20,616	105,3	8,50

Remark1: measured by VDE (report nr.:5008511-2600-0001/96823A FG23/stc-ec)



As reported in the above graph, from -7°C ambient temperature up to +7°C at 35°C hot water outlet temperature, E<sup>3</sup> A LT heating capacity varies less than 10%, demonstrating a constant performance across a wide range of ambient temperatures.



## V. Enclosures

No.	Subject	pages
1	Appliance Data type E <sup>3</sup> A...	1
2	Appliance Data type E <sup>3</sup> GS...	17
3	Datasheet DVGW	1
4	Measuring Equipment	1
5	VDE report	17
6	Installation , use and maintenance manual	62

## VI. Summary

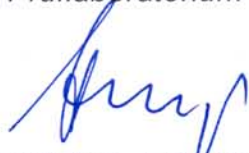
The performed test of the gas fired heat pumps based on the standard EN 12309-2 showed that the appliances shows gas utilisation efficiency values above 1.2 at the tests points required by EN12309-2, in addition further test points show also higher values.

This report may only be copied and be passed with the entire text. The report is only valid together with the enclosures mentioned under clause V.

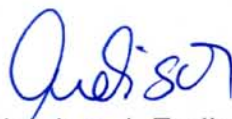
Copying of the report without enclosure 4 to 6 is admitted to the responsibility of the applicant.

Karlsruhe, 05.03.2008

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