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Partner of TÜV INTER CERT SAAR

Performance tests

Test report

Test report n° SFY01 14WC031002

Customer	**ROSCH Innovations AG**
Product under test	**Kinetisches Power Plant**
Type - Model	**Prototype 250 W**

The above described product sample is tested to measure his power performance

Tribano, 20/12/2014

The laboratory Manager
Ing. Roberto Bolzonaro

Safety Laboratory
In compliance with UNI CEI EN ISO/IEC 17025

Testing laboratory	WTLAB Srl Via Mantegna 3-5 35020 Tribano (PD) Italy
Customer	ROSCH Innovations AG
Order confirmation nr.	14WC031002
Order confirmation date	27/11/2014
Sample receipt date	Tested in Teknik Zentrum Rosch-tech Troisdorf (DE)
Test execution period	10/12/2014

1. Requirements and Agreements

Request of testing was the efficiency measurement of a special electric central, made by ROSCH Innovations AG, generating electric power using a complex systems of tanks water immersed.

The customer request is related only to verify the performance of the machine, not the quality of the generated power (IEC 50160 requirements). There are not specific standard to do this for this special machine, thus we will follow some applicable parts of the standard:

IEC/ EN 62040-3 Uninterruptible power systems (UPS)
Part 3: Method of specifying the performance and test requirements

The measurements and the performances are considered only in the maximum power generation condition

2. Information about the devices under test (DUT)

The tested product, named Kinetisches Power Plant, is composed by:

Tanks mechanism (18 thanks with valves for air compressed input with 4,8 liter of volume –each tank)

Power generator (GEN): Ametek Lamb electric Division Typ 120587K7 30 V DC nominal @8 A

Motorcompressor: ALITA linear air pumps model AL 120 max power 120W rated power 97W 230V 50Hz. Rated pressure 270 mbar

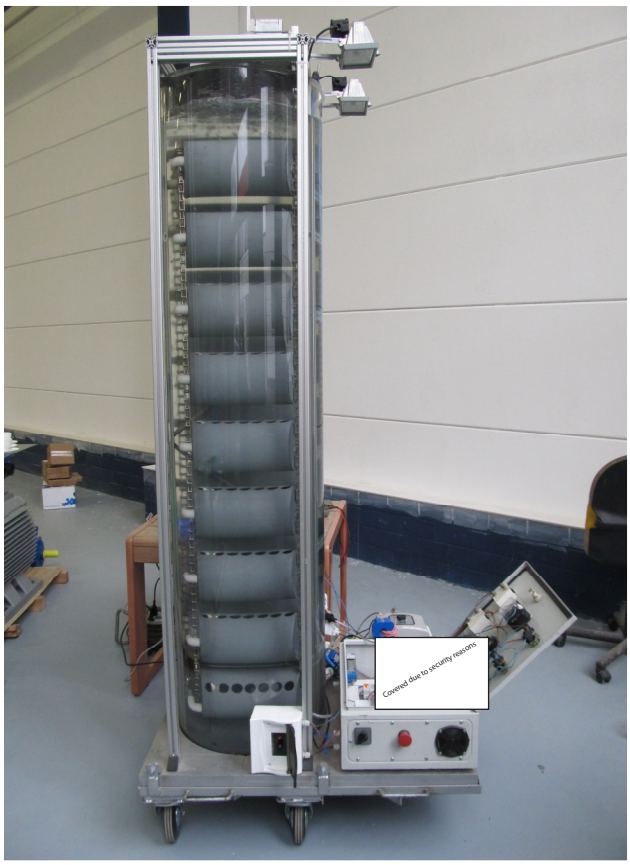
Battery pack for start-up (Start battery - BAT VS) and Battery pack for maintaining stable the system (Working battery - BAT VR):

36 pieces Samsung SDI ICR18650-26F Cells 3.7 V 2600 mAh, associated with nine pieces in a series (9 x 3.7 V = 33.3 V) and in four series of parallel (4 x 2.6 Ah = 10.4 Ah).

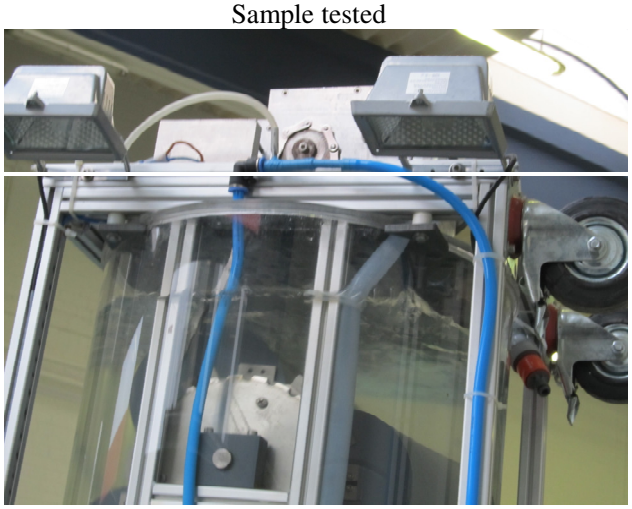
Four power relais (Relay1, Relay 2, Relay 3, Relay 5)

Electrical box

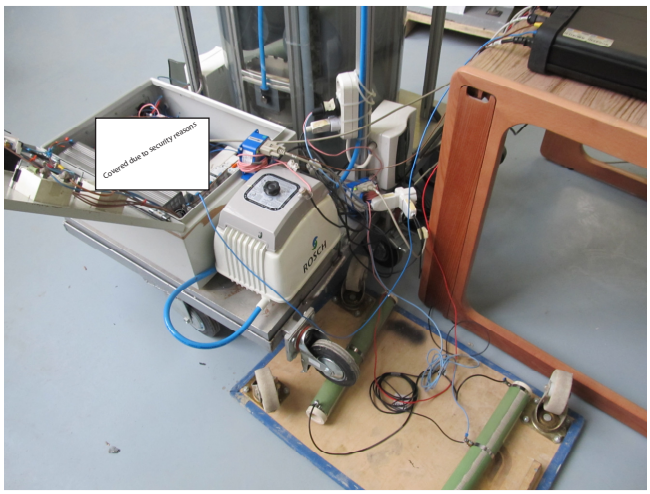
Photo of the tested Kinetics machine.



Sample tested

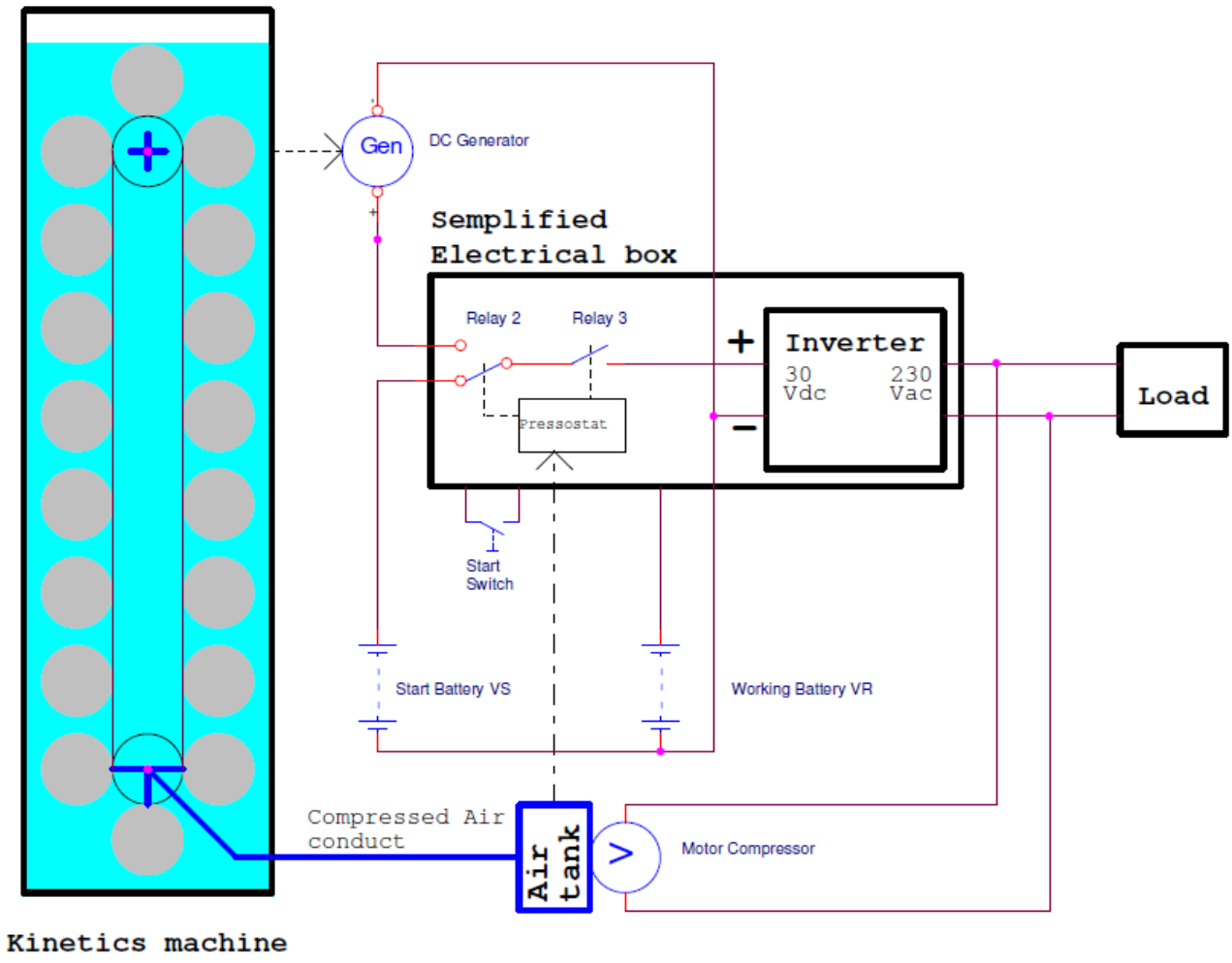


Generator view

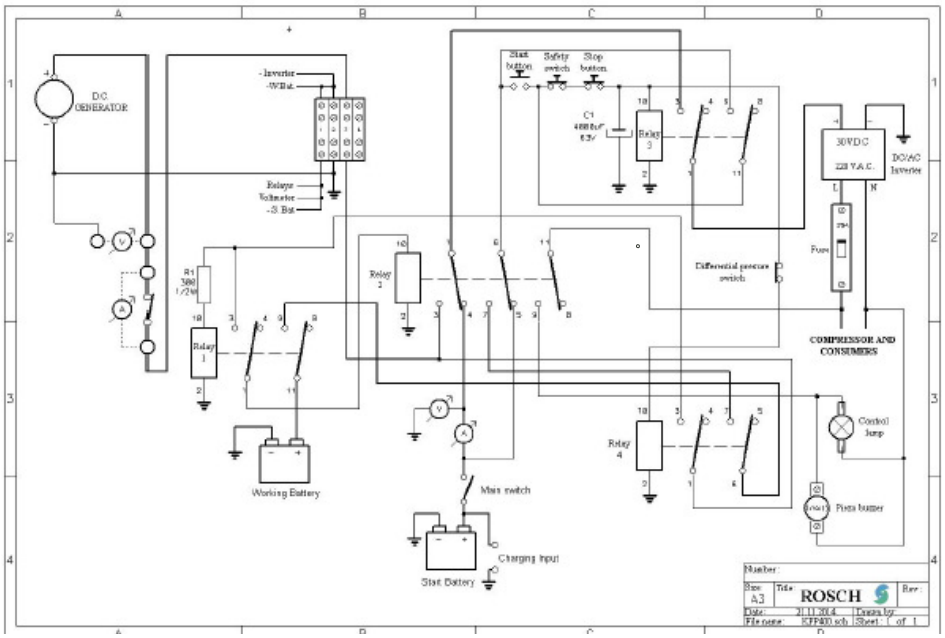


Electrical box during test

3. Semplified schematic design of the "Kinetisches Power Plant"

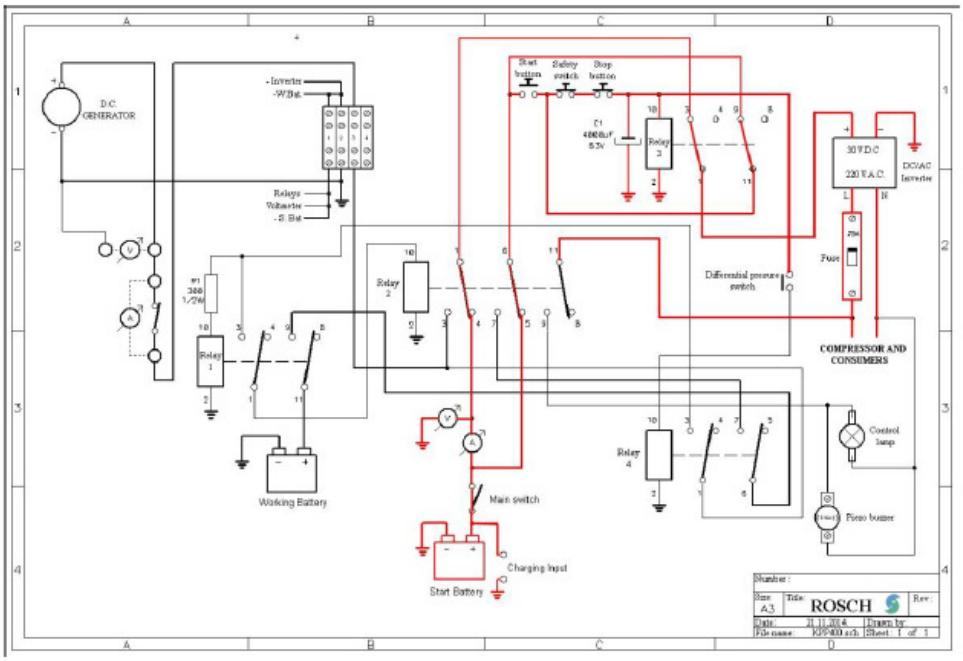


4. Design of Electrical box.

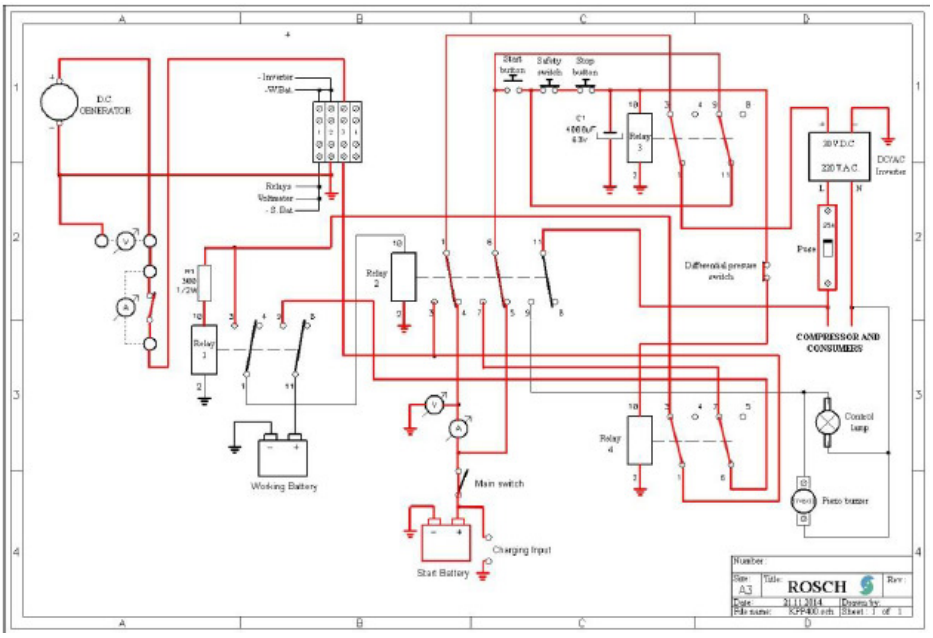


5. Functional sequence

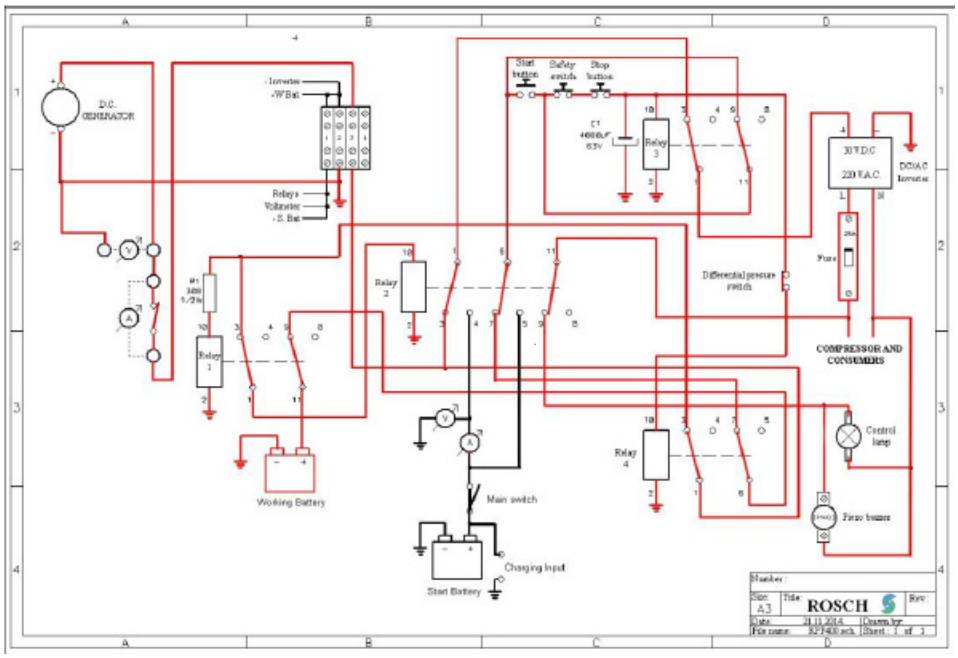
When the main switch is turned on, pressing the Start button includes the (self-holding relays) RL-3 and begins operation. RL-3 activates the air compressor and consumers.



When the compressor air pressure is reached, differential pressure switch is activated. Differential pressure switch activates RL-4 and gives a condition for the start of the generator.



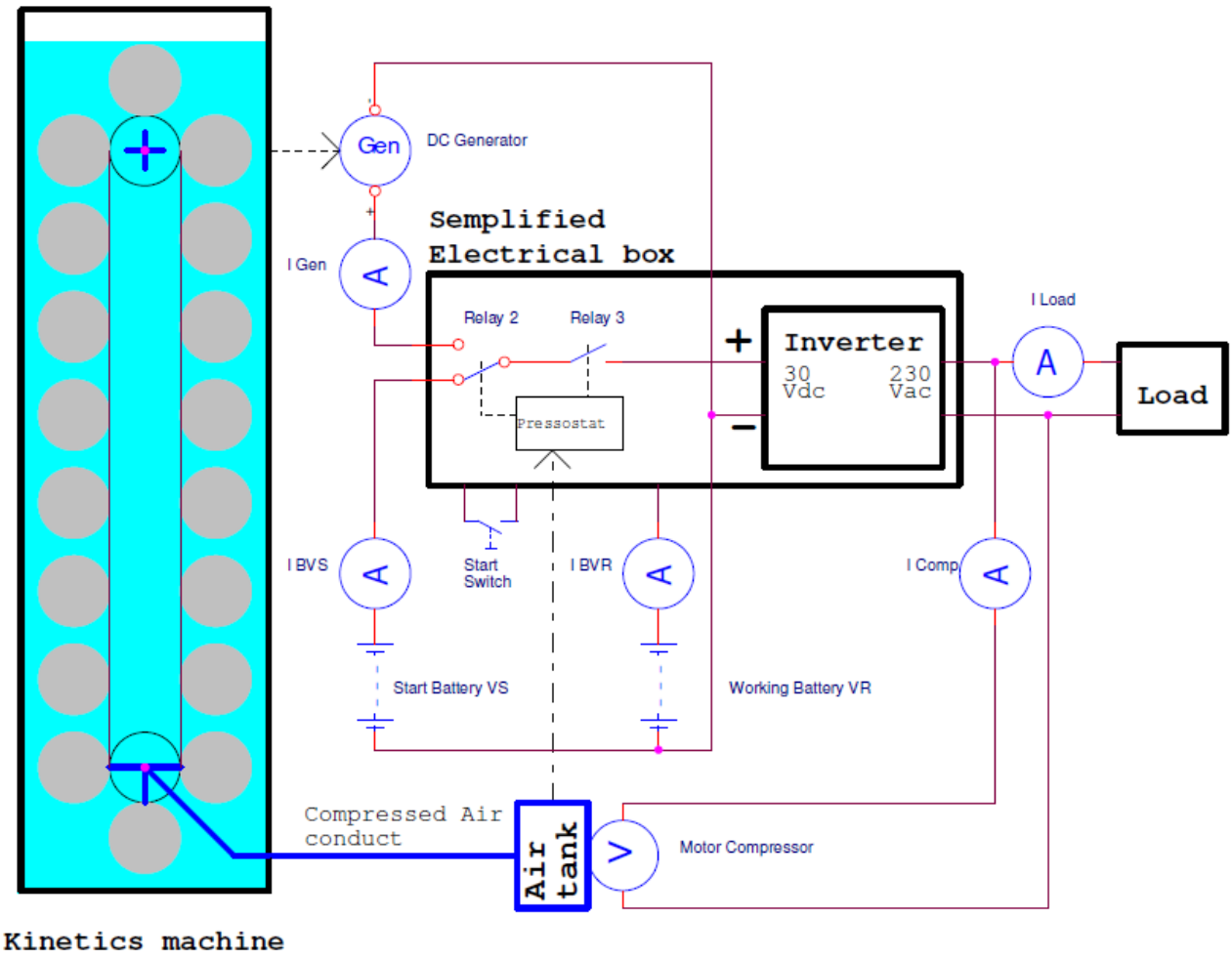
When generator reach the defined voltage (>24V.D.C.) through resistor R1 is activate RL-1. Relay RL-1 through reley RL-2 deactivates the starting battery and at the same time activates the working battery. In this way, the device is placed in the operating mode.



6. Description of the Test Set-up

The test results contained in this test report relate to the tested samples only.
It is forbidden to partially reproduce the test report without WTlab Srl authorization.
Tests were requested by the customer

Semplified schematic of measure circuit



Total Measurements

Note

	Description	*Current (A)*	*Type of current*	*Voltage (V)*	*Power factor Cos φ*	*Power (W)*	*Type of power*	
I Load	*Load (resistive)*	*-1,47*	*ac*	*232*	*1*	*-341,04*	*Passive*	Mesured in the 1st method
I Comp	*Motor compressor*	*-1,18*	*ac*	*232,2*	*0,35*	*-95,8986*	*Passive*	Mesured in the 1st method
I Gen	*DC Generator*	*9,5*	*dc*	*29,4*	*1*	*279,3*	*Generated*	Mesured in the 2nd method
I BVS	*Start battery*	*18,5*	*dc*	*29,9*	*1*	*553,15*	*Generated*	Only during start period (for about 5 s). Normally I_{BVS} = 0A
I BVR	*Working battery*	*5,5*	*dc*	*29,45*	*1*	*161,975*	*Generated*	Mesured in the 1st method
I lamp	*Load lamps*	*-1,07*	*ac*	*232*	*1*	*-248,24*	*Passive*	Mesured in the 2nd method

1st method: with resistive load, calculating the Output power of DC power generator

	Description	*Current (A)*	*Type of current*	*Voltage (V)*	*Power factor Cos φ*	*Power (W)*	*Type of power*
I Load	*Load (resistive)*	*-1,47*	*ac*	*232,2*	*1*	*-341,33*	*Passive (measured)*
I Comp	*Motor compressor*	*-1,18*	*ac*	*232,2*	*0,35*	*-95,90*	*Passive (measured)*
I BVS	*Start battery*	*0*	*dc*	*29,45*	*1*	*0*	*Generated (measured After start time, about 5 s)*
I BVR	*Working battery*	*5,5*	*dc*	*29,45*	*1*	*161,98*	***Working battery output power (measured)***
I Gen	***DC Generator***					***275,26***	*DC Generator output power (Calculated)*

Power of DC Generator used for load	**Efficiency**
179,36	**65,2%**

2nd method: with lamps as load, calculating the external power (from system battery) needed to maintain the system

	Description	*Current (A)*	*Type of current*	*Voltage (V)*	*Power factor Cos φ*	*Power (W)*	*Type of power*
I lamp	*Load lamps*	*-1,07*	*ac*	*232*	*1*	*-248,24*	*Passive (measured)*
I Comp	*Motor compressor*	*-1,18*	*ac*	*232,2*	*0,35*	*-95,90*	*Passive (measured)*
I Gen	***DC Generator***	*9,5*	*dc*	*29,4*	*1*	***279,3***	***DC Generator output power (Measured)***
I BVS	*Start battery*	*0*	*dc*	*29,9*	*1*	*0*	*Generated (measured After start time, about 5 s)*
I BVR	*Working battery*					*64,84*	*Working battery output power (Calculated)*

Power of DC Generator used for load	**Efficiency**
183,40	**65,7%**

T amb. during test: 15,9 °C
T water: during test: 14,8 °C

ENERGY/POWER GENERATION

Being the control circuit is not well defined, the generation of energy can be estimated by the following formula:

$E_{out} = E_{load} - E_{BVS} - E_{BFR}$

Where:
E_{out} = Energy measured on the load
E_{BVS} = Energy generated by Start battery after the start event.
E_{BFR} = Energy generated by Working battery

Considering that the plant fully operational after the start time (few seconds) runs without changing voltage and current, the energy generated can be considered equal to the:

$Eout = (P_{load} - P_{BVS} - P_{BFR}) \times t = P_{out} \times t$

Where:
P_{out} = Power measured on the load
P_{BVS} = Power generated by Start battery after the start event.
P_{BFR} = Power generated by Working battery
t = time

thus:
$Pout = P_{load} - P_{BVS} - P_{BFR} =$ 179 W for the first method (resistive load)
$Pout = P_{load} - P_{BVS} - P_{BFR} =$ 183 W for the second method (lamps load)

The Kinetics machine examinated can generate about 180 W

Test equipment and uncertainty of measurement			
Tests	**Equipment**		**Uncertainty of measurement**
	Elspec Blackbox G4500 + Current probes: LEM IT-200S Ultrstb	ELSPW001 SLEMW001-2-3	0,1A 1,5 V 1,5 W
Temperature measurement	Multilogger CHy 502A11 Thermocouple (K)	MLTHW001 TRCPW001	1,5°C

Responsabile del Laboratorio
/Laboratory Manager

Roberto Bolzonaro

Operatore
/Technician

Andrea Sartorato

Tribano, 20/12/2014

End of test report