APPLICATION FOR LOW VOLTAGE DIRECTIVE
On Behalf of

HengYang Ritar Power Co., Ltd.
Value Regulated Sealed Gel Battery
Model: See remark

Prepared For: **HengYang Ritar Power Co., Ltd.**

No. 1, HuaGong Road, SongMu Industrial Zone, HengYang City, HuNan, China

Prepared By: **Shenzhen ATL Testing Technology Co., Ltd.**

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Date of Test: **Sep. 01, 2015 to Oct. 27, 2015**

Date of Report: **Oct. 28, 2015**

Report Number: **ATL20150901200S**

TEST REPORT

IEC 61427-1

Secondary cells and batteries for renewable energy storage – General requirements and methods of test –

Part 1: Photovoltaic off-grid application

Report Reference No......:	ATL20150901200S
Tested by (name+signature) .....:	Andy Huang
Approved by (name+signature).....:	Xu Peng
Date of issue.....:	Oct. 28, 2015
Testing Laboratory.....:	Shenzhen ATL Testing Technology Co., Ltd.
Address .....:	F/4, Building 10, Da Yuan Industrial Zone, Xili Town, Nanshan District, Shenzhen, Guangdong, China
Applicant's name .....:	HengYang Ritar Power Co., Ltd.
Address .....:	No. 1, HuaGong Road, SongMu Industrial Zone, HengYang City, HuNan, China
Test specification:	
Standard.....:	IEC 61427-1: 2013
Test procedure .....:	IEC produce
Non-standard test method……..:	N/A
Test Report Form No......:	IEC61427-1
Test Report Form(s) Originator .....:	ATL
Master TRF.....:	2015-03

Test item description ..... :	Value Regulated Sealed Gel Battery
Brand .....:	RITAR®
Manufacturer.....:	HengYang Ritar Power Co., Ltd.
Address.....:	No. 1, HuaGong Road, SongMu Industrial Zone, HengYang City, HuNan, China
Model/Type reference.....:	See remark
Ratings.....:	12V90Ah

Possible test case verdicts:

- test case does not apply to the test object.....: N (N/A)
- test object does meet the requirement.....: P (Pass)
- test object does not meet the requirement.....: F (Fail)

General remarks:

The test results presented in this report relate only to the object tested.
This report shall not be reproduced, except in full, without the written approval of the Issuing testing laboratory.
"(See Enclosure #)" refers to additional information appended to the report.
"(See appended table)" refers to a table appended to the report.
Throughout this report a comma (point) is used as the decimal separator.
Clause numbers between brackets refer to clauses in IEC 61427-1

General product information:

N.A.

Copy of marking plate: (For example model DG12-90**)**

Value Regulated Sealed Gel Battery
DG12-90
12V90Ah
HengYang Ritar Power Co., Ltd.

Annes a
DG12-90,RA12-90DG,RA12-90DGS,DG2-100,DG2-200,DG2-250,DG2-300,DG2-350,DG2-400,DG2-450,DG2-500,DG2-600,DG2-650,DG2-750, DG2-800,DG2-1000,DG2-1200,DG2-1500,DG2-2000,DG2-2500,DG2-3000,DG6-100,DG6-150,DG6-180, DG6-200,DG6-200S,DG6-225,DG6-225S,DG6-280,DG6-310,DG6-335,DG12-26,DG12-33,DG12-40,DG12-55,DG12-60,DG12-65,DG12-70S,DG12-70,DG12-75,DG12-80,DG12-85, DG12-100,DG12-120,DG12-134,DG12-145,DG12-150,DG12-160S,DG12-160,DG12-180,DG12-200,DG12-225,DG12-230,DG12-260,

IEC 61427-1			
Clause	Requirement + Test	Result - Remark	Verdict
4	Conditions of use		P
	This clause specifies the particular operating conditions experienced by secondary batteries in photovoltaic applications during their use.		P
4.1	Photovoltaic energy system		P
	The photovoltaic energy system with secondary batteries referred to in this standard can supply a constant, variable, or intermittent energy to the connected equipment. This system may include hybrid or grid-connected systems. The connected equipments may be pumps, refrigerators, lighting systems, communication systems, etc.		P
4.2	Secondary cells and batteries		P
	Secondary cells and batteries mainly used in photovoltaic energy systems are of the following types:		--
	--vented (flooded);		N/A
	--valve-regulated, including those with partial gas recombination;		P
	--gastight sealed (nickel-cadmium only).		N/A
	The cells and batteries can normally be delivered in the following conditions:		--
	discharged and drained (nickel-cadmium batteries only);		N/A
	--charged and filled;		N/A
	--dry charged and unfilled (lead-acid batteries only);		P
	--discharged and filled (nickel-cadmium batteries only).		N/A
	For optimum service life, the battery manufacturer's instructions for initial charge of the battery shall be followed.	Considered	P
4.3	General operating conditions		P
	Batteries in a typical PV system operating under average site weather conditions may be subjected to the following conditions:		--
4.3.1	Autonomy time		P
	The battery is designed to supply energy under specified conditions for a period of time, typically from 3 days to 15 days, with or without solar irradiation.	Considered	P
4.3.2	Typical charge and discharge currents		P
	The charge current generated by the photovoltaic generator and the discharge current determined by the load are shown in Table 1.	Considered	P
4.3.3	Daily cycle		N/A
	The battery is normally exposed to a daily cycle as follows:		--
	a) charging during daylight hours;		N/A

IEC 61427-1			
Clause	Requirement + Test	Result - Remark	Verdict
	b) discharging during night-time hours.		N/A
4.3.4	Seasonal cycle	Considered by final product	N/A
	The battery may be exposed to a seasonal cycle of state of charge. This arises from varying average-charging conditions as follows:		--
	--periods with low solar irradiation, for instance during winter causing low energy production. The state of charge of the battery (available capacity) can go down to 20 % of the rated capacity or less;		N/A
	--periods with high solar irradiation, e.g. in summer, which will bring the battery up to the fully charged condition, with the possibility that the battery could be overcharged.		N/A
4.3.5	Period of high state of charge	Considered by final product	N/A
	During summer for example, the battery will be operated at a high state of charge (SOC), typically between 80 % and 100 % of rated capacity.		N/A
	A voltage regulator system normally limits the maximum battery voltage during the recharge period.		N/A
4.3.6	Period of sustained low state of charge	Considered by final product	N/A
4.3.7	Electrolyte stratification	Considered	P
4.3.8	Storage		P
	Manufacturers' recommendations for storage shall be observed. In the absence of such information, the storage period may be estimated according to the climatic conditions as shown in Table 2.	-30℃- +50℃, <90%RH	P
4.3.9	Operating temperature	-30℃- +50℃, <90%RH	P
4.3.10	Charge control		P
4.3.11	Physical protection		P
5	General requirements		P
5.1	Mechanical endurance		P
	Batteries for photovoltaic application shall be designed to withstand mechanical stresses during normal transportation and handling. Additional packing or protection shall be used for off-road conditions.	No hazards.	P
	Particular care shall be taken while handling unpacked batteries. Manufacturer's instructions shall be observed.		P
	In case of specific requirements regarding mechanical stresses, such as earthquakes, shock and vibration, these shall be individually specified or referred to the relevant standard.		P
5.2	Charge efficiency		P

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Clause	Requirement + Test	Result - Remark	Verdict
	The charge efficiency is the ratio between the quantity of electricity delivered during the discharge of a cell or battery and the quantity of electricity necessary to restore the initial state of charge under specified conditions (see IEV 482-05-39).	See table 5.2	P
	Where no data are available from the battery manufacturer, the following efficiencies as given in Table 4 may be assumed.	See table 5.2	P
5.3	Deep discharge protection		P
	Lead-acid batteries shall be protected against deep discharge to avoid capacity loss due to irreversible sulphation. This could be achieved by using a system which monitors the battery voltage and automatically disconnects the battery before it reaches its maximum depth of discharge (see manufacturer's recommendations).	Considered	P
	Nickel-cadmium batteries do not normally require this type of protection.		N/A
5.4	Marking		P
	Cells or monobloc batteries shall follow the instructions of the applicable standards defined in clause 7.2.		P
5.5	Safety		P
	Refer to applicable local regulations and the manufacturer's instructions for procedures to be observed during installation, commissioning, operation, taking out of service, and disposal.		P
5.6	Documentation		P
	Refer to the manufacturer's documentation for transport and storage, commissioning, putting into service, operation and maintenance.		P
	The manufacturer shall advise if there are special considerations for the initial charging of batteries with only the photovoltaic array available as the power source.		P
6	Functional characteristics		P
	The batteries shall be characterized by their:		--
	– rated capacity (see 8.1);		P
	– endurance in cycling (see 8.2);		P
	– charge retention (see 8.3);		P
	– cycling endurance in photovoltaic application (extreme conditions) (see 8.4).		P

IEC 61427-1			
Clause	Requirement + Test	Result - Remark	Verdict
7	General test conditions		P
7.1	Accuracy of measuring instruments		P
	When testing batteries, the parameters and accuracy values shall be in accordance with relevant clauses of the IEC standards listed in 7.2.		P
	The accuracy of the measuring instruments shall be in compliance with the relevant IEC standard listed in 7.2.		P
7.2	Preparation and maintenance of test samples		P
	Test samples shall be prepared in accordance with the following established procedures in the following standards:		--
	-IEC 60896-11 for stationary lead-acid batteries (vented types);		N/A
	-IEC 60896-21 for stationary lead-acid batteries (valve-regulated types);		P
	-IEC 61056-1 for portable lead-acid batteries (valve-regulated types);		N/A
	-IEC 60622 for sealed nickel-cadmium batteries;		N/A
	-IEC 60623 for vented nickel-cadmium batteries;		N/A
	-IEC 62259 for nickel cadmium prismatic rechargeable single cells with partial gas recombination.		N/A
8	Test method		P
8.1	Capacity test		P
	Test samples shall be set up in accordance with the applicable standards in 7.2. Tests to verify the rated capacity shall be performed using a current of I10 (A) for lead-acid batteries and It/5(A) for nickel-cadmium batteries according to the relevant clauses in the IEC standards listed in 7.2.	I10	P
	For the capacity test using a current of I90 (A) for lead-acid batteries or It/90 for nickelcadmium batteries, the discharge shall be in accordance with parameters stated in Table 5 and the charging procedure shall be carried out according to the relevant clauses in the IEC standards listed in 7.2	I90	N
8.2	Endurance in cycle test		P
	Test samples shall be cycled according to the applicable standards described in 7.2.	After test,No hazards.	P
8.3	Charge retention test		P
	Test samples shall follow the procedures of the applicable standards described in 7.2.	After test,No hazards.	P

IEC 61427-1			
Clause	Requirement + Test	Result - Remark	Verdict
8.4	Cycle endurance test in photovoltaic application (extreme conditions)		P
	In photovoltaic applications the battery will be exposed to a large number of shallow cycles but at different states of charge. The cells or batteries shall therefore comply with the requirements of the test below, which is a simulation of the photovoltaic energy system operation.		P
	The cycle endurance test is an accelerated simulation in extreme conditions of the battery operation in a photovoltaic energy system and shall be conducted by submitting the cells or monobloc batteries to a period of 150 cycles (50 cycles with the phase A and 100 cycles with the phase B).		P
	Test samples shall be set up in accordance with the applicable standards listed in 7.2 after control of the capacity test in 8.1.		P
	Start the test with the battery fully charged. Bring the battery to a temperature of 40 °C ± 3 °C and stabilize for 16 h. Maintain the battery at 40°C ±3 °C throughout the test.		P
8.4.1	Phase A: shallow cycling at low state of charge		P
	Lead-acid batteries		--
	a) Discharge the battery with a current I10 (A) during 9 h or until 1,75 V/cell is reached.		P
	b) Recharge 3 h with a current 1,03 I10 (A)		P
	c) Discharge 3 h with a current I10 (A).		P
	Nickel-cadmium batteries		--
	a) Discharge the battery with a current It /10 (A) during 9 h or until 1,00 V/cell is reached.		N/A
	b) Recharge 3 h with a current 1,03 It /10 (A)		N/A
	c) Discharge 3 h with a current It /10 (A)		N/A
	For both battery types, repeat b) and c) 49 times. Recharge the battery to the fully charged condition according to the manufacturer recommendations and continue the phase B. Phase A is summed up in Table 6.	After test,No hazards.	P
8.4.2	Phase B: shallow cycling at high state of charge		P
	Lead-acid batteries		--
	a) Discharge the battery for 2 h with a current 1,25 I10 (A)		P
	b) Recharge 6 h with a current I10 (A). The charge voltage shall be limited to 2,40 V/cell, unless otherwise specified by the manufacturer.		P
	Nickel-cadmium batteries		--

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Clause	Requirement + Test	Result - Remark	Verdict
	a) Discharge the battery for 2 h with a current 1,25 It /10 (A)		N/A
	b) Recharge for 6 h with a current It /10 (A). The charge voltage shall be limited to 1,55 V/cell unless otherwise specified by the manufacturer.		N/A
	For both batteries, repeat a) and b) 99 times and then perform a capacity determination according to 8.4.3. Phase B is summed up in Table 7.	Repeat b) and c) 99 times.	P
8.4.3	Capacity check		P
	After the phase B, the battery is cooled down to the temperature defined in the relevant standard as described in 7.2 and stabilized at this value for 16 h. The capacity test (C10 for lead-acid batteries and C5 for nickel-cadmium batteries) is carried out according to the relevant standard as described in 7.2.	C10 comply with requirement.	P
8.4.4	End of test condition		P
	Capacity is checked after each period of 150 cycles (phases A + B).		P
	The value of actual capacity determined in 8.4.3 shall be recorded.		P
	The cycle life shall be expressed in number of 150 cycle (A+B) sequences completed.		P
	The test is finished:		--
	-During the phase A: when the cell voltage measured in discharge is lower than 1,5 V/cell for lead acid batteries and 0,8 V/cell for nickel-cadmium batteries.		P
	-After the phase B: when the checked capacity measured in 8.4.3 is lower than 80 % of the rated capacity.		P
8.4.5	Water consumption of flooded battery types and cells with partial gas recombination		N/A
	During the cycle endurance test, vented type cells or monoblocs may be topped up with water. The amount of water added shall be measured and reported.		N/A
8.4.6	Requirements		P
	The number of complete cycle sequences (150 cycles) achieved at the end of the test shall be not less than the value stated by the manufacturer.		P
9	Recommended use of tests		P
9.1	Type test		P
	Type tests are:		P

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Clause	Requirement + Test	Result - Remark	Verdict
	– the rated capacity test and the charge retention test;		P
	– the endurance test in cycling;		P
	– the cycling endurance test in photovoltaic application (extreme conditions).		P
	The minimum number of cells or monobloc batteries shall be as specified in the relevant standards listed in 7.2.		P
	The cycling endurance test in photovoltaic application shall be performed with a minimum of six cells or 2 monobloc batteries.		P
9.2	Acceptance test		P
9.2.1	Factory test	Considered	P
	The acceptance test shall be agreed between the customer and the supplier. Compliance to marking, labelling or to the rated capacity may be verified.		P
9.2.2	Commissioning test	Considered	P
	A commissioning test is recommended to prove the integrity of the installed battery system by means of a capacity test.		P

Table 5.2	Charge efficiency		P
State of charge（SOC ％）	Efficiency lead-acid cells％ (Measurement)	Efficiency lead-acid cells％ (Limit)	
90	89.0	>85	
75	95.2	>90	
<50	99.0	>95	

Appendix 1
Photo documentation

Fig.1 Side View

Fig.2 Front View

******END OF REPORT******