



Test Report: ES-HSI-12K

12000W Three Phase Energy Storage Inverter

- **DESIGN VERIFY TEST**

- Output Function Test

- Input Function Test

- Protection Function Test

- Control Function Test

- APPLICATION Test

- Component Stress Test

- **SAFETY & E.M.C. TEST**

- Safety Test

- E.M.C. Test

- **RELIABILITY TEST**

- ENVIRONMENT TEST

DESIGN VERIFY TEST

GRID CONNECTION OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RATED POWER	12000W	BATTERY INPUT IP: 48VDC Ta:25°C	L1: <u>4001</u> W L2: <u>3997</u> W L3: <u>3998</u> W
			PV INPUT IP: 720VDC Ta:25°C	L1: <u>3997</u> W L2: <u>4001</u> W L3: <u>3998</u> W
2	AC VOLTAGE	FOLLOW THE GRID VOLTAGE	BATTERY INPUT IP: 48VDC OP: TESTING LOAD Ta:25°C	L1: <u>230.5</u> V L2: <u>229.3</u> V L3: <u>228.9</u> V
			PV INPUT IP: 720VDC OP: TESTING LOAD Ta:25°C	L1: <u>226.7</u> V L2: <u>224.1</u> V L3: <u>226.7</u> V
3	FREQUENCY	FOLLOW THE GRID VOLTAGE	BATTERY INPUT IP: 48VDC OP: FULL LOAD Ta:25°C	50HZ: <u>50.06</u> HZ 60HZ: <u>59.89</u> HZ
			PV INPUT IP: 720VDC OP: FULL LOAD Ta:25°C	50HZ: <u>50.06</u> HZ 60HZ: <u>59.89</u> HZ
4	WAVEFORM	True sine wave (THD<3%)	BATTERY INPUT IP: 48VDC OP: 3P/400VAC/12000W Ta:25°C	<u>1.98</u> % /12000W
			PV INPUT IP: 720VDC OP: 3P/400VAC/12000W Ta:25°C	<u>1.92</u> % /12000W
5	AC OUT CURRENT	17.4A	BATTERY INPUT IP: 48VDC OP: FULL LOAD Ta:25°C	L1: <u>17.35</u> A L2: <u>17.18</u> A L3: <u>17.21</u> A
			PV INPUT IP: 720VDC OP: FULL LOAD Ta:25°C	L1: <u>17.28</u> A L2: <u>17.38</u> A L3: <u>17.41</u> A

OFF-GRID CONNECTION OUTPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	RATED POWER	12000W	BATTERY INPUT IP: 48VDC Ta:25°C	L1: <u>4003</u> W L2: <u>3998</u> W L3: <u>4002</u> W
			PV INPUT IP: 720VDC Ta:25°C	L1: <u>4005</u> W L2: <u>3995</u> W L3: <u>4003</u> W
2	AC VOLTAGE	L1: 230VAC L2: 230VAC L3: 230VAC	BATTERY INPUT IP: 48VDC OP: TESTING LOAD Ta:25°C	L1: <u>230.5</u> V L2: <u>230.2</u> V L3: <u>230.1</u> V
			PV INPUT IP: 720VDC OP: TESTING LOAD Ta:25°C	L1: <u>229.7</u> V L2: <u>229.3</u> V L3: <u>229.5</u> V
3	FREQUENCY	50HZ	BATTERY INPUT IP: 48VDC OP: FULL LOAD Ta:25°C	50HZ: <u>50.03</u> HZ
			PV INPUT IP: 720VDC OP: FULL LOAD Ta:25°C	50HZ: <u>49.98</u> HZ
4	WAVEFORM	True sine wave (THD<3%)	BATTERY INPUT IP: 48VDC OP: 3P/400VAC/12000W Ta:25°C	<u>1.65</u> % / 12000W
			PV INPUT IP: 720VDC OP: 3P/400VAC/12000W (1) Vo(min) (2) Vo(nor) (3) Vo(max) Ta:25°C	<u>1.62</u> % / 12000W
5	AC OUT CURRENT	17.4A	BATTERY INPUT IP: 48VDC OP: FULL LOAD Ta:25°C	L1: <u>17.35</u> A L2: <u>17.18</u> A L3: <u>17.21</u> A
			PV INPUT IP: 720VDC OP: FULL LOAD Ta:25°C	L1: <u>17.28</u> A L2: <u>17.38</u> A L3: <u>17.41</u> A

BATTERY INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	VOLTAGE RANGE (TYP)	40VDC~60VDC	IP: TESTING OP:NO LOAD/FULL LOAD Ta:25°C	<u>39</u> VDC~ <u>61.5</u> VDC/NO LOAD <u>40</u> VDC~ <u>61</u> VDC/FULL LOAD
2	DC CURRENT (TYP)	250A	IP: 48VDC OP:FULL LOAD Ta:25°C	<u>269</u> A
3	EFFICIENCY(TYP)	12000W /93%	IP:55VDC OP: 12000W Ta:25°C	<u>93.6</u> %
4	NO LOAD DISSIPATION		IP:55VDC OP:NO LOAD Ta:25°C	<u>103</u> W @ Inverter mode
5	STANDBY POWER LOSS		IP:55VDC OP:NO LOAD Ta:25°C	<u>89</u> W @ Inverter mode

PV INPUT FUNCTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	VOLTAGE RANGE (TYP)	150VDC~900VDC	IP: TESTING OP:NO LOAD/FULL LOAD Ta:25°C	<u>145</u> VDC~ <u>912</u> VDC/NO LOAD <u>148</u> VDC~ <u>910</u> VDC/FULL LOAD
2	DC CURRENT (TYP)	PV1: 27A PV2: 18A	IP: 720VDC OP:FULL LOAD Ta:25°C	PV1: <u>10.3</u> A PV2: <u>8.2</u> A
3	EFFICIENCY(TYP)	12000W /96%	IP:720VDC OP: 12000W Ta:25°C	<u>96.2</u> %
4	NO LOAD DISSIPATION		IP:720VDC OP:NO LOAD Ta:25°C	<u>75</u> W @ Grid mode
5	STANDBY POWER LOSS		IP:720VDC OP:NO LOAD Ta:25°C	<u>38</u> W @ Grid mode

PROTECTION TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	BAT. POLARITY	By internal fuse open	IP: BAT +/- (Reverse) OP: FULL LOAD Ta:25°C	TEST: <u>OK</u>
2	PV. POLARITY	By internal fuse open	IP: BAT +/- (Reverse) OP: FULL LOAD Ta:25°C	TEST: <u>OK</u>

3	OVER TEMPERATURE	Shut down o/p voltage	IP: HI LINE/LOW-LINE OP: FULL LOAD Ta:25°C	Shut down o/p voltage
4	OUTPUT SHORT	Shut down o/p voltage	IP:3P/400VAC OP: TESTING Ta:25°C	Shut down o/p voltage
			IP:BAT 48VDC OP: TESTING Ta:25°C	Shut down o/p voltage
			IP:PV 900VDC OP: TESTING Ta:25°C	Shut down o/p voltage
5	ISLAND PROTECTION	When the power grid is disconnected, shut off the output.	IP:PV 900VDC OP: TESTING Ta:25°C	Shut down o/p voltage

APPLICATION TEST

NO	TEST ITEM	TEST CONDITION	RESULT
1	APP CONNECTION	Use the WIFI function to connect	TEST: <u>OK</u>
2	APP SHOWS	Display the data of solar, wind and thermal power generation and electricity consumption for each day, month and year.	TEST: <u>OK</u>
3	OUTPUT PARAMETER SETTINGS	Set the parameters and send them to the inverter.	TEST: <u>OK</u>
4	BATTERY PARAMETER SETTINGS	Set the parameters and send them to the inverter.	TEST: <u>OK</u>
5	GRID PARAMETER SETTINGS	Set the parameters and send them to the inverter.	TEST: <u>OK</u>

SAFETY & EMC TEST

SAFETY TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	WITHSTAND VOLTAGE	AC I/P-AC O/P: 3 KVAC/min BAT I/P-AC I/P: 3 KVAC/min AC O/P-FG: 1.5 KVAC/min	I/P-AC O/P 3.6 KVAC/min I/P-AC I/P: 3.6 KVAC/min AC O/P-FG:1.8 KVAC/min Ta:25°C	NO DAMAGE

2	TOUCH CURRENT MEASUREMENT	< 3.5 mA	(1) L/N to metal enclosure (2) LCD panel with metal foil to earth (3) SELV terminal to earth Ta:25°C	(1) Measured: <u>1.1</u> mA (2) Measured: <u>0.005</u> mA (3) Measured: <u>0.005</u> mA
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E.M.C TEST

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT
1	CONDUCTION	 CE CLASS A	I/P: DC 48 V+PV 600V O/P: Grid mode Ta:25°C	PASS
2	RADIATION	 CE CLASS A	I/P: DC 48 V+PV 600V O/P: Grid mode Ta:25°C	PASS
3	HARMONIC	EN 61000-3-12 CLASS A	I/P: DC 48 V+PV 600V O/P: FULL LOAD Ta:25°C	PASS
4	E.S.D	IEC 61000-4-2 AIR : 8KV / Contact : 4KV	I/P: DC 48 V+PV 600V O/P:FULL LOAD Ta:25°C	CRITERIA B
5	E.F.T	IEC 61000-4-3 INPUT: 1KV	I/P: DC 48 V+PV 600V O/P:FULL LOAD Ta:25°C	CRITERIA A
6	SURGE	IEC 61000-4-5 L-N :1KV L,N-PE:2KV	I/P: DC 48 V+PV 600V O/P:FULL LOAD Ta:25°C	CRITERIA A
7	Test by certified Lab & Test Report Prepare Any contradictions of the test results, please refer to the latest EMC test report			

Reliability Test

NO	TEST ITEM	SPECIFICATION	TEST CONDITION	RESULT	
1	TEMPERATURE RISE TEST	MODEL : ES-HSI-12K			
		1. MINIMUM PV VOLTAGE INPUT : 2 HRS I/P : PV 150VDC O/P : FULL LOAD Ta= 50 °C			
		2. MAXIMUM PV VOLTAGE INPUT : 2 HRS I/P : PV 850VDC O/P : FULL LOAD Ta= 50 °C			
		NO	Position	PV=150VDC Ta= 50 °C	PV=850VDC Ta= 50 °C
		1	C5	64°C	62.3°C
		2	C56	60.8°C	61°C
		3	C4	62°C	62°C
		4	C1	66.5°C	68.6°C
		5	C44	59.6°C	60.3°C
		6	TX1 coil	63.1°C	63.4°C
		7	TX2 coil	62.1°C	61.1°C
		8	C42	58.7°C	60.1°C
		9	C12	64.2°C	61.5°C
		10	C1	63.4°C	63.7°C
		11	C6	60.5°C	59.8°C
		12	LCD panel	50.1°C	50.2°C
		13	Mounting surface	54.8°C	55.6°C
		14	AC input terminal	53.6°C	54.4°C
		15	AC output terminal	51°C	53.2°C
		16	PV input terminal	52.1°C	52.1°C
		17	PCB near battery (+)	61.5°C	61.6°C
		20	PV wire	59.9°C	57.4°C
		21	MOV1	60.9°C	60.2°C
		22	C13	61.4°C	60.8°C
		23	TX2 coil	63.2°C	63.4°C
		24	CT3 coil	64.9°C	65.5°C
		25	RY13 coil	76.5°C	77.7°C
		26	RY11 coil	70.5°C	71.9°C
		27	CT2 coil	68.4°C	69.8°C
		28	CT1 coil	69.9°C	71.1°C
29	RY4 coil	74.6°C	75.8°C		

		<table><tr><th>NO</th><th>Position</th><th>PV=150VDC Ta= 50 °C</th><th>PV=850VDC Ta= 50 °C</th></tr><tr><td>30</td><td>RY1 coil</td><td>71.1°C</td><td>72.1°C</td></tr><tr><td>31</td><td>RY9 coil</td><td>75.2°C</td><td>79.1°C</td></tr><tr><td>32</td><td>RY7 coil</td><td>74°C</td><td>77.4°C</td></tr><tr><td>33</td><td>L1 coil</td><td>71.1°C</td><td>79.1°C</td></tr><tr><td>34</td><td>C161</td><td>64.1°C</td><td>65.2°C</td></tr><tr><td>35</td><td>C142</td><td>63.1°C</td><td>63.8°C</td></tr><tr><td>36</td><td>C169</td><td>64.4°C</td><td>65.5°C</td></tr><tr><td>37</td><td>HCT1</td><td>70.1°C</td><td>72.8°C</td></tr><tr><td>38</td><td>L6 coil</td><td>67.9°C</td><td>68.8°C</td></tr><tr><td>39</td><td>TX6 coil</td><td>67.7°C</td><td>68.5°C</td></tr><tr><td>40</td><td>TX4 coil</td><td>86.5°C</td><td>87.8°C</td></tr><tr><td>41</td><td>L3 coil</td><td>64°C</td><td>63.8°C</td></tr><tr><td>42</td><td>TX5 coil</td><td>63.6°C</td><td>64°C</td></tr><tr><td>43</td><td>TX2 coil</td><td>62°C</td><td>62.3°C</td></tr><tr><td>44</td><td>TX7 coil</td><td>61.1°C</td><td>61.5°C</td></tr><tr><td>45</td><td>L2 coil</td><td>64.9°C</td><td>66.6°C</td></tr><tr><td>46</td><td>CT4</td><td>65.9°C</td><td>67°C</td></tr><tr><td>47</td><td>RY3 coil</td><td>74.5°C</td><td>75.7°C</td></tr></table>				NO	Position	PV=150VDC Ta= 50 °C	PV=850VDC Ta= 50 °C	30	RY1 coil	71.1°C	72.1°C	31	RY9 coil	75.2°C	79.1°C	32	RY7 coil	74°C	77.4°C	33	L1 coil	71.1°C	79.1°C	34	C161	64.1°C	65.2°C	35	C142	63.1°C	63.8°C	36	C169	64.4°C	65.5°C	37	HCT1	70.1°C	72.8°C	38	L6 coil	67.9°C	68.8°C	39	TX6 coil	67.7°C	68.5°C	40	TX4 coil	86.5°C	87.8°C	41	L3 coil	64°C	63.8°C	42	TX5 coil	63.6°C	64°C	43	TX2 coil	62°C	62.3°C	44	TX7 coil	61.1°C	61.5°C	45	L2 coil	64.9°C	66.6°C	46	CT4	65.9°C	67°C	47	RY3 coil	74.5°C	75.7°C
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46	CT4	65.9°C	67°C																																																																														
47	RY3 coil	74.5°C	75.7°C																																																																														
2	OVER LOAD BURN-IN TEST	NO DAMAGE 1 HOUR (MIN)	I/P : 60VDC O/P : 102%LOAD Ta : 25°C	TEST : OK																																																																													
3	LOW TEMPERATURE TURN ON TEST	TURN ON AFTER 2 HOUR	I/P : 60VDC O/P : 100%LOAD Ta= -10 °C	TEST : OK																																																																													
4	HIGH HUMIDITY HIGH TEMPERATURE HIGH VOLTAGE TURN ON TEST	AFTER 12 HOURS IN CHAMBER ON CONTROL 50 °C NO DAMAGE	I/P : 60VDC O/P : FULL LOAD Ta= 50 °C HUMIDITY= 95 %R.H	TEST : OK																																																																													

TEST RESULT	TESTER	REVIEW	APPROVAL
PASS	Jinkj		Chenhm

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