Base Load Power Hub (BLPH)

AC UPS - SITE ACCEPTANCE TEST PROCEDURE / PRE-COMMISSIONING / COMMISSIONING PROCEDURES

Document Number: 1724000372-QC-PRO-00019

Document Class: 2

01	01/02/2025	Accepted for Construction (AFC)	DA	DA	AD
00	21/10/2024	Issue for Review (IFR)	DA	DA	AD
Rev.	Date	Description	Prepared	Reviewed	Approved

3W power | a company of AEG POWER SOLUTIONS

This document undergoes an issuance cycle within EDMS Fusionlive". Its distribution is electronically controlled. Once printed shall be considered as "NOT CONTROLLED" copy

Revision / Change Log

Rev.	Description
00	Issue for Review (IFR)
01	Accepted for Construction (AFC)

HOLDS LIST

No.	Description
1	
2	
3	
4	

Table of contents

Description	Sheet
COVER	1
REVISION / CHANGE LOG	2
HOLDS LIST	2
TABLE OF CONTENTS	3
AC UPS PAS - TAG: UP-200F3	4
AC UPS F&G - TAG: UP-200F4	36

This document undergoes an issuance cycle within EDMS Fusionlive". Its distribution is electronically controlled. Once printed shall be considered as "NOT CONTROLLED" copy

Base Load Power Hub (BLPH)

AC UPS PAS - TAG: UP-200F3

SITE ACCEPTANCE TEST / PRE-COMMISSIONING / COMMISSIONING PROCEDURE

This document undergoes an issuance cycle within EDMS Fusionlive". Its distribution is electronically controlled. Once printed shall be considered as "NOT CONTROLLED" copy

AEG POWER SOLUTIONS

Site Acceptance Test Report		Document-No.: 14188_SAT_1_00
Type:	**AC UPS System PAS**	**Tag No.: UP-200F3**

Project name: Hollandse Kust Noord (HKN) wind farm	**Order-No.:** 4400007525

Configuration and Serial No.: **Installed:**

BC-200F3-A - UPS Protect 8.33 / 40-400-216-400-RP-IP43 - Serial No.: ..... ☐

BC-200F3-B - UPS Protect 8.33 / 40-400-216-400-RP-IP43 - Serial No.: ..... ☐

BY-200F3 - By-Pass Transformer Cabinet 40 kVA 400/400V - Serial No.: ..... ☐

CB-200F3-A - Battery Fuse Box 200A - Serial No.: ..... ☐

CB-200F3-B - Battery Fuse Box 200A - Serial No.: ..... ☐

BA-200F3-A - Battery 216V-150Ah 18 x FLG12-150 ..... ☐

BA-200F3-B - Battery 216V-150Ah 18 x FLG12-150 ..... ☐

Participants:	Company:	Date / Signature:
1.		
2.		
3.		
4.		
5.		

Remark:

Site Acceptance Test must be performed by a skilled AEG technician.

Josè Cuneo	Rev. 00	Cassina de' Pecchi	21.10.2024

Site Acceptance Test Report		Document-No.: 14188_SAT_1_00
Type:	**AC UPS System PAS**	**Tag No.: UP-200F3**

Content:

1. Informations and Basic Datas: 3
2. Visual Inspection....6
3. Starting 7
4. Functional tests UPS / Load Transfer Tests: 12
5. MODBUS Adapter 22
6. Alarm Test: 28
7. Battery test: 29
8. Black start procedure validation test: 31

Site Acceptance Test Report		Document-No.: 14188_SAT_1_00
Type:	**AC UPS System PAS**	**Tag No.: UP-200F3**

1. Informations and Basic Datas:

SCOPE
This procedure describes the methods for checking the AC UPS system, once installed on site, to ensure that it works correctly and it meets the operational requirements

REFERENCE DOCUMENTS
1724000372-EL-DA-00004 AC UPS - GENERAL ARRANGEMENT
1724000372-EL-DG-00007 AC UPS - SINGLE LINE DIAGRAM
1724000372-EL-DG-00009 AC UPS - WIRING DIAGRAM & TERMINAL SCHEDULE
1724000372-EL-DG-00011 AC UPS - BATTERY LAYOUT AND INTERCONNECTION

TESTING EQUIPMENT & ACCESSORIES
Digital Multimeter, Clamp-meter and Dummy Load

Site Acceptance Test Report		Document-No.: 14188_SAT_1_00
Type:	**AC UPS System PAS**	**Tag No.: UP-200F3**

UPS A

RECTIFIER

Input voltage (V) …… Frequency (Hz) …… Number of phases ……...

Float voltage (V) …… Charge voltage (V) ……

Output current (A) …… Battery current limit (A) …….

INVERTER

DC Input range (V) …… AC Output voltage (V) ……

Output frequency (Hz) ……..…… Number of phases ……..……

Rated power (kVA) …… Power factor ……

ALTERNATIVE LINE

Input voltage (V) …… Frequency (Hz) …… Number of phases ……...

BATTERY

Type ……..…… Capacity (Ah) ……. Number of strings / cells ……...

Autonomy …… @ Load ……..

CONFIGURATION

Single unit ☐ Redundant system ☐ Redundant parallel system ☐

Site Acceptance Test Report		Document-No.: 14188_SAT_1_00
Type:	**AC UPS System PAS**	**Tag No.: UP-200F3**

UPS B

RECTIFIER

Input voltage (V) ..... Frequency (Hz) ..... Number of phases .....

Float voltage (V) ..... Charge voltage (V) .....

Output current (A) ..... Battery current limit (A) .....

INVERTER

DC Input range (V) ..... AC Output voltage (V) .....

Output frequency (Hz) ..... Number of phases .....

Rated power (kVA) ..... Power factor .....

ALTERNATIVE LINE

Input voltage (V) ..... Frequency (Hz) ..... Number of phases .....

BATTERY

Type ..... Capacity (Ah) ..... Number of strings / cells .....

Autonomy ..... @ Load .....

CONFIGURATION

Single unit ☐ Redundant system ☐ Redundant parallel system ☐

Site Acceptance Test Report		Document-No.: 14188_SAT_1_00
Type:	**AC UPS System PAS**	**Tag No.: UP-200F3**

2. Visual Inspection

1) Visual Check	Check
• Equipment installation aspects and details	
• Cleanliness of cabinets (internally and externally)	
• Fuses and Circuit breakers rating and related connection cables	
• Control switches and push-buttons	
• Components identification	
• Alarms identification	
• All connections fully tightened	
• Grounding connection	
• All labels correct	
2) Pre-Energization Check	
• Electronic cards and related connections	
• Relays	
• Cooling fans	
• Wiring and plugs connections	
• Fuses and fuse alarm contacts	
• Instruments	
• Power switches, circuit breakers and contacts	
• Marking of components	
• Cable polarity marking	
• Input phase marking	

3. Starting

Rectifier start	**Result**
Input phase sequence	.....
Float voltage correct setting	.....
High-rate voltage correct setting	.....

Inverter start	**Result**
DC input voltage	.....
AC output voltage	.....
Frequency	.....

Alternate mains start	**Result**
AC output voltage	.....
Frequency	.....

For the starting and shut-down procedure please refer to the following pages.

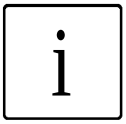
INITIAL START-UP

Prior to starting the unit, check whether the preset unit data complies with the system data by referring to the technical data sheet.

Parallel units are adjusted by the factory with regard to their current distribution. Since the local cabling affects the current distribution of the parallel units (cable cross-sections, cable lengths, cable routing and inductivities of the load distribution board), a new adjustment can be required following installation. The equalizing current of idle parallel units should be less than 5% of the inverter's nominal current. The current distribution must be controlled during start-up. Any adjustment necessary must only be carried out by appropriately trained expert personnel.



ATTENTION:
Improperly adjusted systems can in certain circumstances (individual batteries charged, i.e. 100% capacity and idle inverter) damage the battery.



NOTE:
The start-up instructions of the battery manufacturer must be complied with. Any necessary parameter modifications must be made by our service personnel or via the DOU. If changing the parameters via the DOU, ensure that these changes are applied to all units.

A phase-rotation indicator and a voltmeter are required for the following steps.



CAUTION:
When the mains is connected, potentially fatal voltages are applied to the terminals.

Always observe the safety regulations!

5.1 Preparing Initial Start-Up of a Parallel System

Step	ID No.	Action
1	1 to 2	Input breaker Q1, SBS circuit and battery isolator MCCB (external) to the "**OFF**" position.
2	1 to 2	Open Q71, Q72 inverter output isolators.
3	1 to 2	Distribution breakers to the "OFF" position, Q29 (manual by-pass) to the "OFF" position.
4	1 to 2	Remove connection cover.
5	1 to 2	Check the cable cross sections and fuse protection (refer to the operating instructions of the individual unit). Check the proper earthing of the units (all cubicles must be screwed to one another and earthed).
6	1 to 2	Connect the mains voltage for the rectifier circuit and SBS circuit.
7	1 to 2	Measure the mains voltage at terminals X1 and X4 (X1 phase-to-phase and X4 phase/zero). Refer to the technical data sheet for the nominal voltage.
8	1 to 2	Check the rotating fields at terminals X1 and X4. L1, L2 and L3 clockwise rotation.
9	1 to 2	Switch on input breaker Q1 and wait until the DC nominal voltage is reached.
10	1 to 2	Switch on the inverters.
11	1 to 2	Check the voltage between the parallel units at the inverter output isolators Q71, Q72. The voltage difference of the inverters should not be more than 2 V. (If you measure more than 2 V then adjustment is required which can only be performed by trained expert personnel.)
12	1 to 2	Switch off the inverters.
13	1 to 2	Switch off the mains voltage for the rectifier circuit and SBS circuit.
14	1 to 2	Rectify any errors if necessary and repeat the steps.
15	1 to 2	Replace the connection cover.

5.2 Initial Start-Up of a Parallel System

Step	ID No. 1 to n	Action	DOU	
			LED	Display
1	1 to 2	Input breaker Q1, SBS circuit and battery isolator MCCB (external) to the **"OFF"** position. INV output isolators Q71 and Q72 set to **"ON"**.	None	OFF
2	1 to 2	Load breakers to the "OFF" position, Q29 (manual by-pass) to the "OFF" position.		
3	1 to 2	Connect the mains voltage for the rectifier circuit and SBS circuit.		
4	1 to 2	Move Q1 to the **"ON"** position. The rectifier starts automatically. In systems with a central battery it only starts when the necessary number of rectifiers for the required capacity are switched on. The DC voltage increases.	Red/yellow/ green changing	Self-test
5	1 to 2	The DC voltage reaches its final value and the inverter is supplied with power. (In systems with a central battery the voltage of 2V/Pb cell or 1.2V/NiCd can be present at the output terminals of the individual RECs (safety operation), as the battery isolators are not yet closed).	Yellow flashing	Current flow symbol via REC to INV ON (black)
6	1 to 2	When the polarity on the battery isolator (REC voltage – battery voltage) has been checked, the battery isolator MCCB (external) in the **"ON"** position. The batteries are charged.		
7	1 to 2	Connect the SBS circuit. The SBS only fire when the necessary number for the required capacity are supplied with power.	Green, flashing	Current flow symbol via SBS to loads ON (black)
8	1 to 2	Switch on inverter.		INV symbol flashes
9	1 to 2	The respective AC voltage reaches its final value. As soon as the necessary number of INVs for the required capacity are switched on, the INV output contactors close.	Green ON	Current flow symbol via INV to loads ON (black), via SBS OFF
		There is no fault indication.		
11	1 to 2	Compare equalizing currents of the INVs. The equalizing currents of the INVs when idle should be less than 5% of the INV nominal current.		
12	1 to 2	Switch off INV.		
13	1 to 2	Load breakers to the "ON" position, Q29 (manual by-pass) to the "OFF" position.		
14	1 to 2	Switch on the INV and supply the loads.		



NOTE:
For all additional functions and operating modes please refer to the operating instructions of the individual units.

6 DISCONNECTING

6.1 Disconnecting the Parallel System

In order to extend, service or repair a parallel system, it may be necessary to disconnect this entire parallel system. dDuring this time the loads can be supplied via the manual bypass. The switchover of the loads from the parallel system to the manual bypass and back takes place without any interruption.



NOTE:
Maintenance and repair work must only be performed by authorised expert personnel.

6.1.1 Disconnecting a Parallel System

Step	ID No. 1 to n	Action	DOU	
			LED	Display
1	1 to 2	Control availability of the SBS (SBS ready).	Green	SBS symbol static
2	1 to 2	Switch off the inverter with the **"~0"** key on the DOU and confirm with "yes". As soon as the remaining number of INVs falls below the specified redundancy, the entire parallel system is switched over to the SBS.	Green, flashing	Current flow symbol via SBS
3		Manual bypass switch Q29 to the "ON" position		
4		Load breakers to the **"OFF"** position.		
5	1 to 2	Switch off the rectifier using the **"=0"** key on the DOU and confirm with "yes".	Yellow, green flashing	
6	1 to 2	Rectifier input breaker Q1 to the **"OFF"** position.		
7	1 to 2	Battery isolator MCCB (external) to the **"OFF"** position.	Red, yellow, green flashing	
8	1 to 2	SBS circuit "OFF"	None	OFF



CAUTION:

Even when disconnected, capacitors in the unit can still carry voltage. **Always observe the safety regulations!**

Site Acceptance Test Report		Document-No.: 14188_SAT_1_00
Type:	**AC UPS System PAS**	**Tag No.: UP-200F3**

4. Functional tests UPS / Load Transfer Tests:

Incorporates Tests for:

Rectifier Mains Failure – continued Inverter operation via Battery
Rectifier Mains Return – auto start of the rectifier
Inverter Failure – transfer of load from Inverter to Bypass Mains
Inverter Restoration – transfer of load from Bypass Mains to Inverter
Manual Bypass Switch – transfer of load directly to Bypass Mains

The tests are performed with dummy load.

Acceptance Criteria:

Rectifier Mains Failure:	No disruption to the Inverter operation.
Rectifier Mains Return:	Auto start of the rectifier and charging of the Battery
Transfer Inverter to Static Bypass:	No-break transfers

Site Acceptance Test Report		Document-No.: 14188_SAT_1_00
Type:	**AC UPS System PAS**	**Tag No.: UP-200F3**

A) Rectifier Mains Failure

Switch OFF rectifier Mains via Rectifier input isolator Q1

Recording of Rectifier AC current at X1 and AC load voltage and AC load current at X3

Result

B) Rectifier Mains Return

Switch ON rectifier mains via Rectifier input isolator Q1

Recording of Rectifier AC current at X1 and AC load voltage and AC load current at X3

Result

Site Acceptance Test Report		Document-No.: 14188_SAT_1_00
Type:	**AC UPS System PAS**	**Tag No.: UP-200F3**

C) Transfer inverter-SBS mains

Switch OFF Inverter via Display

Recording of AC load voltage and AC load current at X3 and Bypass current at X4

Result:

Site Acceptance Test Report		Document-No.: 14188_SAT_1_00
Type:	**AC UPS System PAS**	**Tag No.: UP-200F3**

D) Transfer SBS mains-inverter

Switch ON Inverter via Display

Recording of AC load voltage and AC load current at X3 and Bypass current at X4

Result:

Site Acceptance Test Report		Document-No.: 14188_SAT_1_00
Type:	**AC UPS System PAS**	**Tag No.: UP-200F3**

E) Parallel Operation (load transfer test)

Parallel operation UPS n.1 and UPS n.2 - Switching OFF UPS n.2 via Display A18 on the door of the UPS

UPS n.1 takes over 100% Load

and in addition repeat the test as following indicated:

Parallel operation UPS n.1 and UPS n.2

Switching OFF UPS n.2 via de-energization of its upstream power supply

UPS n.1 takes over 100% Load

Result

Site Acceptance Test Report		Document-No.: 14188_SAT_1_00
Type:	**AC UPS System PAS**	**Tag No.: UP-200F3**

Switching OFF UPS n.1 via Display A18 on the door of the UPS

Transfer to Bypass operation

and in addition repeat the test as following indicated:

Switching OFF UPS n.1 via de-energization of its upstream power supply

Transfer to Bypass operation

Result

.

Site Acceptance Test Report		Document-No.: 14188_SAT_1_00
Type:	**AC UPS System PAS**	**Tag No.: UP-200F3**

Bypass operation - Switching ON UPS n.2 via Display A18 on the door of of the UPS

UPS n.2 takes over 100% load

and in addition repeat the test as following indicated:

Bypass operation - Switching ON UPS n.2 via re-energization of its upstream power supply

UPS n.2 takes over 100% load

Result

Site Acceptance Test Report		Document-No.: 14188_SAT_1_00
Type:	**AC UPS System PAS**	**Tag No.: UP-200F3**

Switching ON UPS n.1 via Display A18 on the door of of the UPS
Load sharing 50%

Parallel operation with load sharing 50% of UPS n.1 and UPS n.2

and in addition repeat the test as following indicated:

Switching ON UPS n.1 via re-energization of its upstream power supply
Load sharing 50%

Parallel operation with load sharing 50% of UPS n.1 and UPS n.2

Result:

Site Acceptance Test Report		Document-No.: 14188_SAT_1_00
Type:	**AC UPS System PAS**	**Tag No.: UP-200F3**

F) Parallel Operation (functional sequence test)

Starting condition: UPS redundant system working in normal operation with By-Pass input and both Rectifier inputs n.1 and n.2 all energized. UPS n.1 and UPS n.2 synchronized with the By-Pass

1. De-energize upstream power supply to Rectifier input n.2
2. De-energize upstream power supply to By-Pass
3. Confirm the normal operation of UPS n.1 at the correct load
4. Re-energize upstream power supply to Rectifier input n.2
5. Confirm the correct synchronization and normal operation of both UPS n.1 and n.2 with load sharing activated
6. Re-energize upstream power supply to By-Pass
7. Confirm reinstatement and normal operation of all UPS unit functions.
8. At each test step, validate correct functioning of hardwired I/O signals

G) Parallel Operation (functional sequence test)

Starting condition: UPS redundant system working in normal operation with By-Pass input and both Rectifier inputs n.1 and n.2 all energized. UPS n.1 and UPS n.2 synchronized with the By-Pass

1. De-energize upstream power supply to Rectifier input n.1
2. De-energize upstream power supply to By-Pass
3. Confirm the normal operation of UPS n.2 at the correct load
4. Re-energize upstream power supply to Rectifier input n.1
5. Confirm the correct synchronization and normal operation of both UPS n.1 and n.2 with load sharing activated
6. Re-energize upstream power supply to By-Pass
7. Confirm reinstatement and normal operation of all UPS unit functions.
8. At each test step, validate correct functioning of hardwired I/O signals

Result:

5. MODBUS Adapter

Incorporates Tests for:
A29.1 MODBUS Adapter

Test to be performed for chosen failure messages, status messages and measuring values.

Designation	Source	Terminals	Checked
MODBUS Adapter	A29.1	A29.1	

For the Modbus Registers please refer to the following pages.

Unit profile of a three-phase UPS

Status: Read: Fct.-Code 3 (Read Holding Register) or Fct.-Code 4 (Read Input Register)

Reg.	Bit no.	Type	Name	Description
1	3-0	WORD	UPSStatus	UPS status: 1=Normal mode 2=Bypass mode 3=Battery mode 4=Eco mode "**O**" 6=Deactivation is imminent 7=Off

Alarms:
Read: Fct.-Code 3 (Read Holding Register) or Fct.-Code 4 (Read Input Register)

Reg.	Bit no.	Type	Name	Description (1=active)
2	0	WORD	NonCriticalFault	W: Collective warning
3	0	WORD	CriticalFault	A: Collective alarm
4	0	WORD	Userdef_DigIn1Active	W: **"O"**
5	0	WORD	Userdef_DigIn2Active	W: **"O"**
6	0	WORD	Userdef_DigIn3Active	W: **"O"**
7	0	WORD	EmergencySwitchOff	A: UPS output off "**O**"
8	0	WORD	DouCanFault	W: DOU CAN fault
9	0	WORD	MainsFault	W: Rectifier/bypass mains fault
10	0	WORD	RectifierWarning	W: Rectifier warning
11	0	WORD	RectifierFault	A: Rectifier fault
12	0	WORD	BatteryAlarm	A: Battery fault
13	0	WORD	InverterWarning	W: Inverter warning
14	0	WORD	InverterFault	W: Inverter fault
15	0	WORD	SBSWarning	W: Bypass warning
16	0	WORD	SBSFault	A: Bypass fault
17	0	WORD	EqualisingCharge	I: Charger status – equalising charging
18	0	WORD	Charge	I: Charger status – charging
19	0	WORD	TrickleCharge	I: Charger status – trickle charging
20	0	WORD	GenSetOperation	I: Charger status: Em. power supply "**O**"
21	0	WORD	BattTemp.SensFault	W: Battery temp. sensor "**O**"
22	0	WORD	BatteryTemp.ToHigh	W: Battery temp. too high "**O**"
23	0	WORD	CircuitBreaker	W: Circuit-breaker tripped "**O**"
24	0	WORD	BatteryWarning	W: Battery warning
25	0	WORD	BatteryLow	W: Battery undervoltage
26	0	WORD	Overload	W: Inverter overload
27	0	WORD	FanFault	W: Fan fault
28	0	WORD	Overload	A: Inverter overload
29	0	WORD	ShortCircuit	A: Inverter short-circuit
30	0	WORD	DcUnderVoltage	A: Inverter DC undervoltage
31	0	WORD	DcOverVoltage	A: Inverter DC overvoltage
32	0	WORD	PowerStackOverTemp	A: Inverter stack fault
33	0	WORD	SBSReady	I: Bypass ready
34	0	WORD	SBSMainsFault	W: Bypass mains fault
35	0	WORD	SBSBlocked	W: Bypass blocked
36	0	WORD	RectifierOn	I: Rectifier on
37	0	WORD	InverterOn	I: Inverter on
38	0	WORD	SBSOn	I: Bypass on

- **Unit profile of a three-phase UPS**

Measured values:

Read: Fct.-Code 3 (Read Holding Register) or Fct.-Code 4 (Read Input Register)

Rectifier mains:

Register	Bit no.	Type	Name	Value range
39	15-0	WORD10	RectMainsFreq.	0.0 - 99.0 Hz
40	15-0	WORD	RectMainsVoltL1	0 - 999 V
41	15-0	WORD	RectMainsVoltL2	0 - 999 V
42	15-0	WORD	RectMainsVoltL3	0 - 999 V

Bypass mains:

Register	Bit no.	Type	Name	Value range
43	15-0	WORD10	SBSMainsFreq.	0.0 – 99.9 Hz
44	15-0	WORD	SBSMainsVoltL1	0 – 999 V
45	15-0	WORD	SBSMainsVoltL2	0 – 999 V
46	15-0	WORD	SBSMainsVoltL3	0 – 999 V

Battery values:

Register	Bit no.	Type	Name	Value range
47	15-0	WORD	BatteryVoltage	0 - 999 V
48	15-0	INT10	BatteryCurrent	+- 0.0 - 3000.0 A
49	15-0	WORD10	AutonomyTime	0.0 – 999.0 min
50	15-0	WORD	BatteryCapacity	0 - 100%
51	15-0	INT10	BatteryTemperature	+- 0.0 - 99.9 °C "**O**"

UPS output:

Register	Bit no.	Type	Name	Value range
52	15-0	WORD10	OutputFreq.	0.0 – 99.0 Hz
53	15-0	WORD	OutputVoltageL1	0 – 999 V
54	15-0	WORD	OutputLoadL1	0 – 100 %
55	15-0	WORD	OutputCurrentL1	0 – 9999 A
56	15-0	WORD10	OutputPowerL1	0.0 – 1000.0 kW
57	15-0	WORD	OutputVoltageL2	0 – 999 V
58	15-0	WORD	OutputLoadL2	0 – 100 %
59	15-0	WORD	OutputCurrentL2	0 – 9999 A
60	15-0	WORD10	OutputPowerL2	0.0 – 1000.0 kW
61	15-0	WORD	OutputVoltageL3	0 – 999 V
62	15-0	WORD	OutputLoadL3	0 – 100 %
63	15-0	WORD	OutputCurrentL3	0 – 9999 A
64	15-0	WORD10	OutputPowerL3	0.0 – 1000.0 kW

LifeCheck:

Register	Bit no.	Type	Name	Value range
65	0	WORD	LifeCheck	Bit 0-1 toggled 1x per minute

- **Unit profile of a three-phase UPS**

Auxiliary signals (for units with user-definable signals):

Reg.	Bit no.	Type	Name	Description
66	0	WORD	Userdef_AUX1 – Rect.	"**O**"
67	0	WORD	Userdef_AUX2 – Rect.	"**O**"
68	0	WORD	Userdef_AUX3 – Rect.	"**O**"
69	0	WORD	Userdef_AUX4 – Rect.	"**O**"
70	0	WORD	Userdef_AUX5 – Rect.	"**O**"
71	0	WORD	Userdef_AUX6 – Rect.	"**O**"
72	0	WORD	Userdef_AUX7– Rect.	"**O**"
73	0	WORD	Userdef_AUX1 – Inv.	"**O**"
74	0	WORD	Userdef_AUX2 – Inv.	"**O**"
75	0	WORD	Userdef_AUX3 – Inv.	"**O**"
76	0	WORD	Userdef_AUX4 – Inv.	"**O**"
77	0	WORD	Userdef_AUX5 – Inv.	"**O**"
78	0	WORD	Userdef_AUX6 – Inv.	"**O**"
79	0	WORD	Userdef_AUX7 – Inv.	"**O**"
80	0	WORD	Userdef_AUX1 – SBS	"**O**"
81	0	WORD	Userdef_AUX2 – SBS	"**O**"
82	0	WORD	Userdef_AUX3 – SBS	"**O**"
83	0	WORD	Userdef_AUX4 – SBS	"**O**"
84	0	WORD	Userdef_AUX5 – SBS	"**O**"
85	0	WORD	Userdef_AUX6 – SBS	"**O**"
86	0	WORD	Userdef_AUX7 – SBS	"**O**"

Date/time:

Read: Fct.-Code 3 (Read Holding Register) or Fct.-Code 4 (Read Input Register)

Write: Fct.-Code 6 (Write single Holding Register) or Fct.-Code 16 (Write multiple Holding Register)

Reg.	Bit no.	Type	Name	Description
150	15-0	WORD	Real time (decimal)	Year (20xx)
151	15-0	WORD		Day (0-31)
152	15-0	WORD		Month (1-12)
153	15-0	WORD		Hour (0-23)
154	15-0	WORD		Minute (0-59)
155	15-0	WORD		Second (0-59)
156	15-0	WORD		Millisecond (0-999)
157	15-0	WORD		Weekday 1 = Monday, 2 = Tuesday, …

- **Unit profile of a three-phase UPS**

Unit control:

Read: Fct.-Code 3 (Read Holding Register) or Fct.-Code 4 (Read Input Register)

Write: Fct.-Code 6 (Write single Holding Register)

Reg.	Bit no.	Type	Name	Description
1000	15-0	WORD	Rectifier Control	0 = - 1 = ON 2 = OFF 9 = acknowledge fault 10 = equalising charging 11 = charge 12 = trickle charging
1001	15-0	WORD	Inverter Control	0 = - 1 = ON 2 = OFF 3 = Eco mode "**O**" 9 = acknowledge fault
1002	15-0	WORD	SBS Control	0 = - 9 = acknowledge fault
1003	15-0	WORD	**Battery Quick Test** – Control (LB) | Status (HB)	Control (LB) : 0x__00 = - 0x__01 = Start test 0x__02 = Cancel test Status (HB) : 0x00__ = Test not implemented 0x01__ = Test impl., waiting for approval 0x02__ = Test approved 0x03__ = Test running 0x04__ = Test successful 0x05__ = Test cancelled 0x06__ = Test warning 0x07__ = Test error
1004	15-0	WORD	**Battery Capacity Test** (with current load or constant current) – Control (LB) | Status (HB)	Control (LB) : 0x__00 = - 0x__01 = Start test 0x__02 = Cancel test Status (HB) : 0x00__ = Test not implemented 0x01__ = Test impl., waiting for approval 0x02__ = Test approved 0x03__ = Test running 0x04__ = Test successful 0x05__ = Test cancelled 0x06__ = Test warning 0x07__ = Test error
1005	15-0	WORD10	**Battery Capacity Test - RemainingTime**	0.0-6553.0 min

Control: The last accepted control command is read out; if the command failed, the read-out is 0.



In order to guarantee high availability of the load supply, some control commands are only executed if the system meets certain requirements:

Rectifier off => inverter must be off

Inverter off => switching to bypass must be guaranteed

Battery test => the entire system must be in a normal state

- Unit profile of a three-phase UPS

Battery tests:

In low byte, the battery test registers contain the control commands and in high byte, the associated statuses of the battery tests. Depending on the unit configuration, different battery tests can be initiated:

The **Battery Quick Test** consists of briefly testing the battery charging circuit. This test is also performed cyclically by the unit.

The **Battery Capacity Test** consists of testing the battery capacity. For this purpose, the battery is discharged with the connected load or by a constant current and the battery status is evaluated.
The remaining time of the capacity test can be read in the **Remaining Time** register.

Control battery test (LB):
0x00: The test has never been started via Modbus.
0x01/2: The test has been started/cancelled (the control command remains in place until the next command).
Battery test status (HB):
0x00: The test is not implemented in the unit.
0x01: The test is implemented, but is presently not approved, or the start conditions to execute the test are lacking.
0x02: The test is approved and can be started.
0x03-7: The test result remains in place for a short time until another test is approved.

Example of battery cap. test 1004/1005:
0x0000 0000 Test not implemented, no cap. test approved
0x0100 1000 Test is implemented, not approved, waiting for approval, max. runtime 100.0min
0x0200 1000 Test is approved, max. runtime 100.0min
0x0301 805 Test running; max. remaining runtime 80.5min
0x0401 0000 Test successful, new test not possible
0x0201 1000 Test is re-approved (after approx. 30s)

For further information on the battery tests, see the unit operating instructions.

Site Acceptance Test Report		Document-No.: 14188_SAT_1_00
Type:	**AC UPS System PAS**	**Tag No.: UP-200F3**

6. Alarm Test:

Incorporates Tests for:

Remote Alarm signalling on Boards A12/A13
System Operational Check

Acceptance Criteria:

Technical datasheet (TD)

Designation	Terminals	Relay/Opto	Result
Inverter operation 1)	UPS A12-X3: 1, 2, 3	**A12K21**	
SBS operation 1)	UPS A12-X3: 4, 5, 6	**A12K22**	
Rec Fault / Rec mains fault 1)	UPS A12-X3: 7, 8, 9	**A12K23**	
Battery undervoltage 1)	UPS A12-X3: 10, 11, 12	**A12K24**	
Common fault 2)	UPS A12-X4: 1, 2, 3	**A12K25**	
SBS blocked 1)	UPS A13-X3: 1, 2, 3	**A13K26**	
Fan fault 1)	UPS A13-X3: 4, 5, 6	**A13K27**	
BAT room fan on 1)	UPS A13-X3: 7, 8, 9	**A13K28**	
INV remote off 3)	UPS A12-X5: 1, 2	**A12Opto1**	
BAT room fan fault 3)	UPS A13-X4: 1, 2	**A13Opto2**	
Not parameterised 3)	UPS A13-X4: 3, 4	**A13Opto3**	
Fan fault 1)	Bypass X12: 7, 8, 9	**N/A**	
Common fault 1)	Bypass X12: 10, 11, 12	**N/A**	

1) Remote signal / close on the terminals with the lower number
2) Remote signal / close on the terminals with the higher number

OPTO Input test

Check battery boost charge inhibit (external signal) in case of high battery temperature

Result:

Site Acceptance Test Report		Document-No.: 14188_SAT_1_00
Type:	AC UPS System PAS	Tag No.: UP-200F3

7. Battery test:

BATTERY UPS A	UP-200F3	SHEET 1 / NR.:	REV.	OUR. RIF.:
CUSTOMER: Rosetti Marino	DISCHARGE TEST (Capacity test)	BATTERY TYPE:		CAPACITY Ah
		ELECTROLYTE TYPE:		DENSITY:
Nr. of blocks	Type :			

TIME (hour : min)	00:00	00:20	00:40	01:00	01:20	01:40	02:00	02:20	02:40	03:00	03:20	03:40	04:00	04:20	04:40	05:00
BLOCK N°	BLOCK / VOLTAGE															
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
TEMP. ELE. °C																

TIME (hour : min)	05:00	05:20	05:40	06:00	06:20	06:40	07:00	07:20	07:40	08:00	08:20	08:40	09:00	09:20	09:40	10:00
BLOCK N°	BLOCK / VOLTAGE															
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
TEMP. ELE. °C																

Site Acceptance Test Report		Document-No.: 14188_SAT_1_00
Type:	AC UPS System PAS	Tag No.: UP-200F3

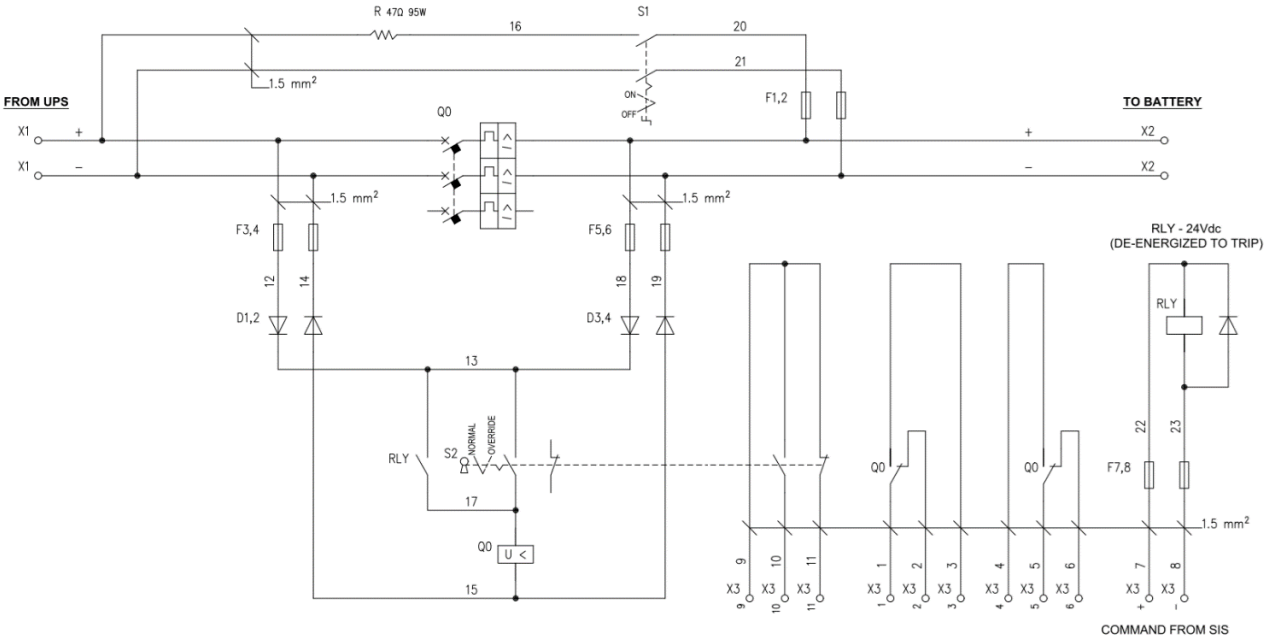
BATTERY UPS B	UP-200F3	SHEET 1 REV. NR.:	OUR. RIF.:
CUSTOMER: Rosetti Marino	DISCHARGE TEST (Capacity test)	BATTERY TYPE:	CAPACITY Ah
		ELECTROLYTE TYPE:	DENSITY:
Nr. of blocks	Type :		

TIME (hour : min)	00:00	00:20	00:40	01:00	01:20	01:40	02:00	02:20	02:40	03:00	03:20	03:40	04:00	04:20	04:40	05:00
BLOCK N°	BLOCK / VOLTAGE															
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
TEMP. ELE. °C																

TIME (hour : min)	05:00	05:20	05:40	06:00	06:20	06:40	07:00	07:20	07:40	08:00	08:20	08:40	09:00	09:20	09:40	10:00
BLOCK N°	BLOCK / VOLTAGE															
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
TEMP. ELE. °C																

Site Acceptance Test Report		Document-No.: 14188_SAT_1_00
Type:	**AC UPS System PAS**	**Tag No.: UP-200F3**

8. Black start procedure validation test:



Black Start procedure

The target is to allow the energization of the loads from the battery, while the battery charger being still de-energized.

- The operator shall put the selector S2 on "override" position (contact closed)
- The operator shall close the selector S1 to pre-charge the charger output DC capacitors
- Once the charger DC capacitors are charged and the voltage across Q0 power contacts is close to 0V (and at least >80% of the system DC nominal voltage), the operator shall close the breaker Q0
- The operator shall open the selector S1
- The site safety and SCADA systems restart and the RLY relay is automatically energized when all safety conditions are fulfilled. The charger is energized through its AC supply and then it can restart
- The operator shall put the selector S2 on "normal" position (contact open)
- The system returns to normal working conditions

Designation	Checked
BLACK START procedure UPS-A	
BLACK START procedure UPS-B	

Base Load Power Hub (BLPH)

AC UPS F&G - TAG: UP-200F4

SITE ACCEPTANCE TEST / PRE-COMMISSIONING / COMMISSIONING PROCEDURE

This document undergoes an issuance cycle within EDMS Fusionlive". Its distribution is electronically controlled. Once printed shall be considered as "NOT CONTROLLED" copy

AEG POWER SOLUTIONS

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	**AC UPS System F&G**	**Tag No.: UP-200F4**

Project name: Hollandse Kust Noord (HKN) wind farm	**Order-No.:** 4400007525

Configuration and Serial No.: **Installed:**

BC-200F4-A - UPS Protect 8.33 / 20-400-216-400-RP-IP43 - Serial No.: …….. ☐

BC-200F4-B - UPS Protect 8.33 / 20-400-216-400-RP-IP43 - Serial No.: …….. ☐

BY-200F4 - By-Pass Transformer Cabinet 20 kVA 400/400V - Serial No.: …….. ☐

CB-200F4-A - Battery Fuse Box 200A - Serial No.: …….. ☐

CB-200F4-B - Battery Fuse Box 200A - Serial No.: …….. ☐

BA-200F4-A - Battery 216V-360Ah 3 x 18 x FLG12-150 …….. ☐

BA-200F4-B - Battery 216V-360Ah 3 x 18 x FLG12-150 …….. ☐

Participants:	Company:	Date / Signature:
1.		
2.		
3.		
4.		
5.		

Remark:

Site Acceptance Test must be performed by a skilled AEG technician.

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	**AC UPS System F&G**	**Tag No.: UP-200F4**

Content:

1. Informations and Basic Datas: 3
2. Visual Inspection....6
3. Starting 7
4. Functional tests UPS / Load Transfer Tests: 12
5. MODBUS Adapter 22
6. Alarm Test: 28
7. Battery test: 29
8. Black start procedure validation test: 33

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	**AC UPS System F&G**	**Tag No.: UP-200F4**

1. Informations and Basic Datas:

SCOPE
This procedure describes the methods for checking the AC UPS system, once installed on site, to ensure that it works correctly and it meets the operational requirements

REFERENCE DOCUMENTS
1724000372-EL-DA-00004 AC UPS - GENERAL ARRANGEMENT
1724000372-EL-DG-00007 AC UPS - SINGLE LINE DIAGRAM
1724000372-EL-DG-00009 AC UPS - WIRING DIAGRAM & TERMINAL SCHEDULE
1724000372-EL-DG-00011 AC UPS - BATTERY LAYOUT AND INTERCONNECTION

TESTING EQUIPMENT & ACCESSORIES
Digital Multimeter, Clamp-meter and Dummy Load

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	**AC UPS System F&G**	**Tag No.: UP-200F4**

UPS A

RECTIFIER

Input voltage (V) …… Frequency (Hz) …… Number of phases ……...

Float voltage (V) …… Charge voltage (V) ……

Output current (A) …… Battery current limit (A) ……

INVERTER

DC Input range (V) …… AC Output voltage (V) ……

Output frequency (Hz) ……..…… Number of phases ……..……

Rated power (kVA) …… Power factor ……

ALTERNATIVE LINE

Input voltage (V) …… Frequency (Hz) …… Number of phases ……...

BATTERY

Type ……..…… Capacity (Ah) …… Number of strings / cells ……...

Autonomy …… @ Load ……..

CONFIGURATION

Single unit ☐ Redundant system ☐ Redundant parallel system ☐

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	**AC UPS System F&G**	**Tag No.: UP-200F4**

UPS B

RECTIFIER

Input voltage (V) ..... Frequency (Hz) ..... Number of phases .....

Float voltage (V) ..... Charge voltage (V) .....

Output current (A) ..... Battery current limit (A) .....

INVERTER

DC Input range (V) ..... AC Output voltage (V) .....

Output frequency (Hz) ..... Number of phases .....

Rated power (kVA) ..... Power factor .....

ALTERNATIVE LINE

Input voltage (V) ..... Frequency (Hz) ..... Number of phases .....

BATTERY

Type ..... Capacity (Ah) ..... Number of strings / cells .....

Autonomy ..... @ Load .....

CONFIGURATION

Single unit ☐ Redundant system ☐ Redundant parallel system ☐

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	**AC UPS System F&G**	**Tag No.: UP-200F4**

2. Visual Inspection

1) Visual Check	Check
• Equipment installation aspects and details	
• Cleanliness of cabinets (internally and externally)	
• Fuses and Circuit breakers rating and related connection cables	
• Control switches and push-buttons	
• Components identification	
• Alarms identification	
• All connections fully tightened	
• Grounding connection	
• All labels correct	
2) Pre-Energization Check	
• Electronic cards and related connections	
• Relays	
• Cooling fans	
• Wiring and plugs connections	
• Fuses and fuse alarm contacts	
• Instruments	
• Power switches, circuit breakers and contacts	
• Marking of components	
• Cable polarity marking	
• Input phase marking	

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	**AC UPS System F&G**	**Tag No.: UP-200F4**

3. Starting

Rectifier start	**Result**
Input phase sequence	.....
Float voltage correct setting	.....
High-rate voltage correct setting	.....

Inverter start	**Result**
DC input voltage	.....
AC output voltage	.....
Frequency	.....

Alternate mains start	**Result**
AC output voltage	.....
Frequency	.....

For the starting and shut-down procedure please refer to the following pages.

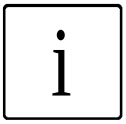
INITIAL START-UP

Prior to starting the unit, check whether the preset unit data complies with the system data by referring to the technical data sheet.

Parallel units are adjusted by the factory with regard to their current distribution. Since the local cabling affects the current distribution of the parallel units (cable cross-sections, cable lengths, cable routing and inductivities of the load distribution board), a new adjustment can be required following installation. The equalizing current of idle parallel units should be less than 5% of the inverter's nominal current. The current distribution must be controlled during start-up. Any adjustment necessary must only be carried out by appropriately trained expert personnel.



ATTENTION:
Improperly adjusted systems can in certain circumstances (individual batteries charged, i.e. 100% capacity and idle inverter) damage the battery.



NOTE:
The start-up instructions of the battery manufacturer must be complied with. Any necessary parameter modifications must be made by our service personnel or via the DOU. If changing the parameters via the DOU, ensure that these changes are applied to all units.

A phase-rotation indicator and a voltmeter are required for the following steps.



CAUTION:
When the mains is connected, potentially fatal voltages are applied to the terminals.

Always observe the safety regulations!

5.1 Preparing Initial Start-Up of a Parallel System

Step	ID No.	Action
1	1 to 2	Input breaker Q1, SBS circuit and battery isolator MCCB (external) to the "**OFF**" position.
2	1 to 2	Open Q71, Q72 inverter output isolators.
3	1 to 2	Distribution breakers to the "OFF" position, Q29 (manual by-pass) to the "OFF" position.
4	1 to 2	Remove connection cover.
5	1 to 2	Check the cable cross sections and fuse protection (refer to the operating instructions of the individual unit). Check the proper earthing of the units (all cubicles must be screwed to one another and earthed).
6	1 to 2	Connect the mains voltage for the rectifier circuit and SBS circuit.
7	1 to 2	Measure the mains voltage at terminals X1 and X4 (X1 phase-to-phase and X4 phase/zero). Refer to the technical data sheet for the nominal voltage.
8	1 to 2	Check the rotating fields at terminals X1 and X4. L1, L2 and L3 clockwise rotation.
9	1 to 2	Switch on input breaker Q1 and wait until the DC nominal voltage is reached.
10	1 to 2	Switch on the inverters.
11	1 to 2	Check the voltage between the parallel units at the inverter output isolators Q71, Q72. The voltage difference of the inverters should not be more than 2 V. (If you measure more than 2 V then adjustment is required which can only be performed by trained expert personnel.)
12	1 to 2	Switch off the inverters.
13	1 to 2	Switch off the mains voltage for the rectifier circuit and SBS circuit.
14	1 to 2	Rectify any errors if necessary and repeat the steps.
15	1 to 2	Replace the connection cover.

5.2 Initial Start-Up of a Parallel System

Step	ID No. 1 to n	Action	DOU	
			LED	Display
1	1 to 2	Input breaker Q1, SBS circuit and battery isolator MCCB (external) to the **"OFF"** position. INV output isolators Q71 and Q72 set to **"ON"**.	None	OFF
2	1 to 2	Load breakers to the "OFF" position, Q29 (manual by-pass) to the "OFF" position.		
3	1 to 2	Connect the mains voltage for the rectifier circuit and SBS circuit.		
4	1 to 2	Move Q1 to the **"ON"** position. The rectifier starts automatically. In systems with a central battery it only starts when the necessary number of rectifiers for the required capacity are switched on. The DC voltage increases.	Red/yellow/ green changing	Self-test
5	1 to 2	The DC voltage reaches its final value and the inverter is supplied with power. (In systems with a central battery the voltage of 2V/Pb cell or 1.2V/NiCd can be present at the output terminals of the individual RECs (safety operation), as the battery isolators are not yet closed).	Yellow flashing	Current flow symbol via REC to INV ON (black)
6	1 to 2	When the polarity on the battery isolator (REC voltage – battery voltage) has been checked, the battery isolator MCCB (external) in the **"ON"** position. The batteries are charged.		
7	1 to 2	Connect the SBS circuit. The SBS only fire when the necessary number for the required capacity are supplied with power.	Green, flashing	Current flow symbol via SBS to loads ON (black)
8	1 to 2	Switch on inverter.		INV symbol flashes
9	1 to 2	The respective AC voltage reaches its final value. As soon as the necessary number of INVs for the required capacity are switched on, the INV output contactors close.	Green ON	Current flow symbol via INV to loads ON (black), via SBS OFF
		There is no fault indication.		
11	1 to 2	Compare equalizing currents of the INVs. The equalizing currents of the INVs when idle should be less than 5% of the INV nominal current.		
12	1 to 2	Switch off INV.		
13	1 to 2	Load breakers to the "ON" position, Q29 (manual by-pass) to the "OFF" position.		
14	1 to 2	Switch on the INV and supply the loads.		



NOTE:
For all additional functions and operating modes please refer to the operating instructions of the individual units.

6 DISCONNECTING

6.1 Disconnecting the Parallel System

In order to extend, service or repair a parallel system, it may be necessary to disconnect this entire parallel system. dDuring this time the loads can be supplied via the manual bypass. The switchover of the loads from the parallel system to the manual bypass and back takes place without any interruption.



NOTE:
Maintenance and repair work must only be performed by authorised expert personnel.

6.1.1 Disconnecting a Parallel System

Step	ID No. 1 to n	Action	DOU	
			LED	Display
1	1 to 2	Control availability of the SBS (SBS ready).	Green	SBS symbol static
2	1 to 2	Switch off the inverter with the **"~0"** key on the DOU and confirm with "yes". As soon as the remaining number of INVs falls below the specified redundancy, the entire parallel system is switched over to the SBS.	Green, flashing	Current flow symbol via SBS
3		Manual bypass switch Q29 to the "ON" position		
4		Load breakers to the **"OFF"** position.		
5	1 to 2	Switch off the rectifier using the **"=0"** key on the DOU and confirm with "yes".	Yellow, green flashing	
6	1 to 2	Rectifier input breaker Q1 to the **"OFF"** position.		
7	1 to 2	Battery isolator MCCB (external) to the **"OFF"** position.	Red, yellow, green flashing	
8	1 to 2	SBS circuit "OFF"	None	OFF



CAUTION:

Even when disconnected, capacitors in the unit can still carry voltage. **Always observe the safety regulations!**

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	**AC UPS System F&G**	**Tag No.: UP-200F4**

4. Functional tests UPS / Load Transfer Tests:

Incorporates Tests for:

Rectifier Mains Failure – continued Inverter operation via Battery
Rectifier Mains Return – auto start of the rectifier
Inverter Failure – transfer of load from Inverter to Bypass Mains
Inverter Restoration – transfer of load from Bypass Mains to Inverter
Manual Bypass Switch – transfer of load directly to Bypass Mains

The tests are performed with dummy load.

Acceptance Criteria:

Rectifier Mains Failure:	No disruption to the Inverter operation.
Rectifier Mains Return:	Auto start of the rectifier and charging of the Battery
Transfer Inverter to Static Bypass:	No-break transfers

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	**AC UPS System F&G**	**Tag No.: UP-200F4**

A) Rectifier Mains Failure

Switch OFF rectifier Mains via Rectifier input isolator Q1

Recording of Rectifier AC current at X1 and AC load voltage and AC load current at X3

Result

B) Rectifier Mains Return

Switch ON rectifier mains via Rectifier input isolator Q1

Recording of Rectifier AC current at X1 and AC load voltage and AC load current at X3

Result

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	**AC UPS System F&G**	**Tag No.: UP-200F4**

C) Transfer inverter-SBS mains

Switch OFF Inverter via Display

Recording of AC load voltage and AC load current at X3 and Bypass current at X4

Result:

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	**AC UPS System F&G**	**Tag No.: UP-200F4**

D) Transfer SBS mains-inverter

Switch ON Inverter via Display

Recording of AC load voltage and AC load current at X3 and Bypass current at X4

Result:

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	**AC UPS System F&G**	**Tag No.: UP-200F4**

E) Parallel Operation (load transfer test)

Parallel operation UPS n.1 and UPS n.2 - Switching OFF UPS n.2 via Display A18 on the door of the UPS

UPS n.1 takes over 100% Load

and in addition repeat the test as following indicated:

Parallel operation UPS n.1 and UPS n.2

Switching OFF UPS n.2 via de-energization of its upstream power supply

UPS n.1 takes over 100% Load

Result

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	**AC UPS System F&G**	**Tag No.: UP-200F4**

Switching OFF UPS n.1 via Display A18 on the door of the UPS

Transfer to Bypass operation

and in addition repeat the test as following indicated:

Switching OFF UPS n.1 via de-energization of its upstream power supply

Transfer to Bypass operation

Result

.

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	**AC UPS System F&G**	**Tag No.: UP-200F4**

Bypass operation - Switching ON UPS n.2 via Display A18 on the door of of the UPS

UPS n.2 takes over 100% load

and in addition repeat the test as following indicated:

Bypass operation - Switching ON UPS n.2 via re-energization of its upstream power supply

UPS n.2 takes over 100% load

Result

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	**AC UPS System F&G**	**Tag No.: UP-200F4**

Switching ON UPS n.1 via Display A18 on the door of of the UPS
Load sharing 50%

Parallel operation with load sharing 50% of UPS n.1 and UPS n.2

and in addition repeat the test as following indicated:

Switching ON UPS n.1 via re-energization of its upstream power supply
Load sharing 50%

Parallel operation with load sharing 50% of UPS n.1 and UPS n.2

Result:

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	**AC UPS System F&G**	**Tag No.: UP-200F4**

F) Parallel Operation (functional sequence test)

Starting condition: UPS redundant system working in normal operation with By-Pass input and both Rectifier inputs n.1 and n.2 all energized. UPS n.1 and UPS n.2 synchronized with the By-Pass

1. De-energize upstream power supply to Rectifier input n.2
2. De-energize upstream power supply to By-Pass
3. Confirm the normal operation of UPS n.1 at the correct load
4. Re-energize upstream power supply to Rectifier input n.2
5. Confirm the correct synchronization and normal operation of both UPS n.1 and n.2 with load sharing activated
6. Re-energize upstream power supply to By-Pass
7. Confirm reinstatement and normal operation of all UPS unit functions.
8. At each test step, validate correct functioning of hardwired I/O signals

G) Parallel Operation (functional sequence test)

Starting condition: UPS redundant system working in normal operation with By-Pass input and both Rectifier inputs n.1 and n.2 all energized. UPS n.1 and UPS n.2 synchronized with the By-Pass

1. De-energize upstream power supply to Rectifier input n.1
2. De-energize upstream power supply to By-Pass
3. Confirm the normal operation of UPS n.2 at the correct load
4. Re-energize upstream power supply to Rectifier input n.1
5. Confirm the correct synchronization and normal operation of both UPS n.1 and n.2 with load sharing activated
6. Re-energize upstream power supply to By-Pass
7. Confirm reinstatement and normal operation of all UPS unit functions.
8. At each test step, validate correct functioning of hardwired I/O signals

Result:

5. MODBUS Adapter

Incorporates Tests for:
A29.1 MODBUS Adapter

Test to be performed for chosen failure messages, status messages and measuring values.

Designation	Source	Terminals	Checked
MODBUS Adapter	A29.1	A29.1	

For the Modbus Registers please refer to the following pages.

Unit profile of a three-phase UPS

Status: Read: Fct.-Code 3 (Read Holding Register) or Fct.-Code 4 (Read Input Register)

Reg.	Bit no.	Type	Name	Description
1	3-0	WORD	UPSStatus	UPS status: 1=Normal mode 2=Bypass mode 3=Battery mode 4=Eco mode "**O**" 6=Deactivation is imminent 7=Off

Alarms:
Read: Fct.-Code 3 (Read Holding Register) or Fct.-Code 4 (Read Input Register)

Reg.	Bit no.	Type	Name	Description (1=active)
2	0	WORD	NonCriticalFault	W: Collective warning
3	0	WORD	CriticalFault	A: Collective alarm
4	0	WORD	Userdef_DigIn1Active	W: **"O"**
5	0	WORD	Userdef_DigIn2Active	W: **"O"**
6	0	WORD	Userdef_DigIn3Active	W: **"O"**
7	0	WORD	EmergencySwitchOff	A: UPS output off "**O**"
8	0	WORD	DouCanFault	W: DOU CAN fault
9	0	WORD	MainsFault	W: Rectifier/bypass mains fault
10	0	WORD	RectifierWarning	W: Rectifier warning
11	0	WORD	RectifierFault	A: Rectifier fault
12	0	WORD	BatteryAlarm	A: Battery fault
13	0	WORD	InverterWarning	W: Inverter warning
14	0	WORD	InverterFault	W: Inverter fault
15	0	WORD	SBSWarning	W: Bypass warning
16	0	WORD	SBSFault	A: Bypass fault
17	0	WORD	EqualisingCharge	I: Charger status – equalising charging
18	0	WORD	Charge	I: Charger status – charging
19	0	WORD	TrickleCharge	I: Charger status – trickle charging
20	0	WORD	GenSetOperation	I: Charger status: Em. power supply "**O**"
21	0	WORD	BattTemp.SensFault	W: Battery temp. sensor "**O**"
22	0	WORD	BatteryTemp.ToHigh	W: Battery temp. too high "**O**"
23	0	WORD	CircuitBreaker	W: Circuit-breaker tripped "**O**"
24	0	WORD	BatteryWarning	W: Battery warning
25	0	WORD	BatteryLow	W: Battery undervoltage
26	0	WORD	Overload	W: Inverter overload
27	0	WORD	FanFault	W: Fan fault
28	0	WORD	Overload	A: Inverter overload
29	0	WORD	ShortCircuit	A: Inverter short-circuit
30	0	WORD	DcUnderVoltage	A: Inverter DC undervoltage
31	0	WORD	DcOverVoltage	A: Inverter DC overvoltage
32	0	WORD	PowerStackOverTemp	A: Inverter stack fault
33	0	WORD	SBSReady	I: Bypass ready
34	0	WORD	SBSMainsFault	W: Bypass mains fault
35	0	WORD	SBSBlocked	W: Bypass blocked
36	0	WORD	RectifierOn	I: Rectifier on
37	0	WORD	InverterOn	I: Inverter on
38	0	WORD	SBSOn	I: Bypass on

- **Unit profile of a three-phase UPS**

Measured values:

Read: Fct.-Code 3 (Read Holding Register) or Fct.-Code 4 (Read Input Register)

Rectifier mains:

Register	Bit no.	Type	Name	Value range
39	15-0	WORD10	RectMainsFreq.	0.0 - 99.0 Hz
40	15-0	WORD	RectMainsVoltL1	0 - 999 V
41	15-0	WORD	RectMainsVoltL2	0 - 999 V
42	15-0	WORD	RectMainsVoltL3	0 - 999 V

Bypass mains:

Register	Bit no.	Type	Name	Value range
43	15-0	WORD10	SBSMainsFreq.	0.0 – 99.9 Hz
44	15-0	WORD	SBSMainsVoltL1	0 – 999 V
45	15-0	WORD	SBSMainsVoltL2	0 – 999 V
46	15-0	WORD	SBSMainsVoltL3	0 – 999 V

Battery values:

Register	Bit no.	Type	Name	Value range
47	15-0	WORD	BatteryVoltage	0 - 999 V
48	15-0	INT10	BatteryCurrent	+- 0.0 - 3000.0 A
49	15-0	WORD10	AutonomyTime	0.0 – 999.0 min
50	15-0	WORD	BatteryCapacity	0 - 100%
51	15-0	INT10	BatteryTemperature	+- 0.0 - 99.9 °C "**O**"

UPS output:

Register	Bit no.	Type	Name	Value range
52	15-0	WORD10	OutputFreq.	0.0 – 99.0 Hz
53	15-0	WORD	OutputVoltageL1	0 – 999 V
54	15-0	WORD	OutputLoadL1	0 – 100 %
55	15-0	WORD	OutputCurrentL1	0 – 9999 A
56	15-0	WORD10	OutputPowerL1	0.0 – 1000.0 kW
57	15-0	WORD	OutputVoltageL2	0 – 999 V
58	15-0	WORD	OutputLoadL2	0 – 100 %
59	15-0	WORD	OutputCurrentL2	0 – 9999 A
60	15-0	WORD10	OutputPowerL2	0.0 – 1000.0 kW
61	15-0	WORD	OutputVoltageL3	0 – 999 V
62	15-0	WORD	OutputLoadL3	0 – 100 %
63	15-0	WORD	OutputCurrentL3	0 – 9999 A
64	15-0	WORD10	OutputPowerL3	0.0 – 1000.0 kW

LifeCheck:

Register	Bit no.	Type	Name	Value range
65	0	WORD	LifeCheck	Bit 0-1 toggled 1x per minute

- **Unit profile of a three-phase UPS**

Auxiliary signals (for units with user-definable signals):

Reg.	Bit no.	Type	Name	Description
66	0	WORD	Userdef_AUX1 – Rect.	"**O**"
67	0	WORD	Userdef_AUX2 – Rect.	"**O**"
68	0	WORD	Userdef_AUX3 – Rect.	"**O**"
69	0	WORD	Userdef_AUX4 – Rect.	"**O**"
70	0	WORD	Userdef_AUX5 – Rect.	"**O**"
71	0	WORD	Userdef_AUX6 – Rect.	"**O**"
72	0	WORD	Userdef_AUX7– Rect.	"**O**"
73	0	WORD	Userdef_AUX1 – Inv.	"**O**"
74	0	WORD	Userdef_AUX2 – Inv.	"**O**"
75	0	WORD	Userdef_AUX3 – Inv.	"**O**"
76	0	WORD	Userdef_AUX4 – Inv.	"**O**"
77	0	WORD	Userdef_AUX5 – Inv.	"**O**"
78	0	WORD	Userdef_AUX6 – Inv.	"**O**"
79	0	WORD	Userdef_AUX7 – Inv.	"**O**"
80	0	WORD	Userdef_AUX1 – SBS	"**O**"
81	0	WORD	Userdef_AUX2 – SBS	"**O**"
82	0	WORD	Userdef_AUX3 – SBS	"**O**"
83	0	WORD	Userdef_AUX4 – SBS	"**O**"
84	0	WORD	Userdef_AUX5 – SBS	"**O**"
85	0	WORD	Userdef_AUX6 – SBS	"**O**"
86	0	WORD	Userdef_AUX7 – SBS	"**O**"

Date/time:

Read: Fct.-Code 3 (Read Holding Register) or Fct.-Code 4 (Read Input Register)

Write: Fct.-Code 6 (Write single Holding Register) or Fct.-Code 16 (Write multiple Holding Register)

Reg.	Bit no.	Type	Name	Description
150	15-0	WORD	Real time (decimal)	Year (20xx)
151	15-0	WORD		Day (0-31)
152	15-0	WORD		Month (1-12)
153	15-0	WORD		Hour (0-23)
154	15-0	WORD		Minute (0-59)
155	15-0	WORD		Second (0-59)
156	15-0	WORD		Millisecond (0-999)
157	15-0	WORD		Weekday 1 = Monday, 2 = Tuesday, …

- **Unit profile of a three-phase UPS**

Unit control:

Read: Fct.-Code 3 (Read Holding Register) or Fct.-Code 4 (Read Input Register)

Write: Fct.-Code 6 (Write single Holding Register)

Reg.	Bit no.	Type	Name	Description
1000	15-0	WORD	Rectifier Control	0 = - 1 = ON 2 = OFF 9 = acknowledge fault 10 = equalising charging 11 = charge 12 = trickle charging
1001	15-0	WORD	Inverter Control	0 = - 1 = ON 2 = OFF 3 = Eco mode "**O**" 9 = acknowledge fault
1002	15-0	WORD	SBS Control	0 = - 9 = acknowledge fault
1003	15-0	WORD	**Battery Quick Test** – Control (LB) | Status (HB)	Control (LB) : 0x__00 = - 0x__01 = Start test 0x__02 = Cancel test Status (HB) : 0x00__ = Test not implemented 0x01__ = Test impl., waiting for approval 0x02__ = Test approved 0x03__ = Test running 0x04__ = Test successful 0x05__ = Test cancelled 0x06__ = Test warning 0x07__ = Test error
1004	15-0	WORD	**Battery Capacity Test** (with current load or constant current) – Control (LB) | Status (HB)	Control (LB) : 0x__00 = - 0x__01 = Start test 0x__02 = Cancel test Status (HB) : 0x00__ = Test not implemented 0x01__ = Test impl., waiting for approval 0x02__ = Test approved 0x03__ = Test running 0x04__ = Test successful 0x05__ = Test cancelled 0x06__ = Test warning 0x07__ = Test error
1005	15-0	WORD10	**Battery Capacity Test - RemainingTime**	0.0-6553.0 min

Control: The last accepted control command is read out; if the command failed, the read-out is 0.



In order to guarantee high availability of the load supply, some control commands are only executed if the system meets certain requirements:

Rectifier off => inverter must be off

Inverter off => switching to bypass must be guaranteed

Battery test => the entire system must be in a normal state

- Unit profile of a three-phase UPS

Battery tests:

In low byte, the battery test registers contain the control commands and in high byte, the associated statuses of the battery tests. Depending on the unit configuration, different battery tests can be initiated:

The **Battery Quick Test** consists of briefly testing the battery charging circuit. This test is also performed cyclically by the unit.

The **Battery Capacity Test** consists of testing the battery capacity. For this purpose, the battery is discharged with the connected load or by a constant current and the battery status is evaluated.
The remaining time of the capacity test can be read in the **Remaining Time** register.

Control battery test (LB):
0x00: The test has never been started via Modbus.
0x01/2: The test has been started/cancelled (the control command remains in place until the next command).
Battery test status (HB):
0x00: The test is not implemented in the unit.
0x01: The test is implemented, but is presently not approved, or the start conditions to execute the test are lacking.
0x02: The test is approved and can be started.
0x03-7: The test result remains in place for a short time until another test is approved.

Example of battery cap. test 1004/1005:
0x0000 0000 Test not implemented, no cap. test approved
0x0100 1000 Test is implemented, not approved, waiting for approval, max. runtime 100.0min
0x0200 1000 Test is approved, max. runtime 100.0min
0x0301 805 Test running; max. remaining runtime 80.5min
0x0401 0000 Test successful, new test not possible
0x0201 1000 Test is re-approved (after approx. 30s)

For further information on the battery tests, see the unit operating instructions.

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	**AC UPS System F&G**	**Tag No.: UP-200F4**

6. Alarm Test:

Incorporates Tests for:

Remote Alarm signalling on Boards A12/A13
System Operational Check

Acceptance Criteria:

Technical datasheet (TD)

Designation	Terminals	Relay/Opto	Result
Inverter operation 1)	UPS A12-X3: 1, 2, 3	**A12K21**	
SBS operation 1)	UPS A12-X3: 4, 5, 6	**A12K22**	
Rec Fault / Rec mains fault 1)	UPS A12-X3: 7, 8, 9	**A12K23**	
Battery undervoltage 1)	UPS A12-X3: 10, 11, 12	**A12K24**	
Common fault 2)	UPS A12-X4: 1, 2, 3	**A12K25**	
SBS blocked 1)	UPS A13-X3: 1, 2, 3	**A13K26**	
Fan fault 1)	UPS A13-X3: 4, 5, 6	**A13K27**	
BAT room fan on 1)	UPS A13-X3: 7, 8, 9	**A13K28**	
INV remote off 3)	UPS A12-X5: 1, 2	**A12Opto1**	
BAT room fan fault 3)	UPS A13-X4: 1, 2	**A13Opto2**	
Not parameterised 3)	UPS A13-X4: 3, 4	**A13Opto3**	
Fan fault 1)	Bypass X12: 7, 8, 9	**N/A**	
Common fault 1)	Bypass X12: 10, 11, 12	**N/A**	

1) Remote signal / close on the terminals with the lower number
2) Remote signal / close on the terminals with the higher number

OPTO Input test

Check battery boost charge inhibit (external signal) in case of high battery temperature

Result:

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	AC UPS System F&G	Tag No.: UP-200F4

7. Battery test:

BATTERY UPS A	UP-200F4	SHEET NR.: 1	REV.	OUR. RIF.:
CUSTOMER: Rosetti Marino	DISCHARGE TEST (Capacity test)	BATTERY TYPE:		CAPACITY Ah
		ELECTROLYTE TYPE:		DENSITY:
Nr. of blocks	Type :			

TIME (hour : min)	00:00	00:20	00:40	01:00	01:20	01:40	02:00	02:20	02:40	03:00	03:20	03:40	04:00	04:20	04:40	05:00
BLOCK N°	BLOCK / VOLTAGE															
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22																
23																
24																
25																
26																
27																
28																
29																
30																
31																
32																
33																
34																
35																
36																
37																
38																
39																
40																
41																
42																
43																
44																
45																
46																
47																
48																
49																
50																
51																
52																
53																
54																
TEMP. ELE. °C																

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	AC UPS System F&G	Tag No.: UP-200F4

TIME (hour : min)	05:00	05:20	05:40	06:00	06:20	06:40	07:00	07:20	07:40	08:00	08:20	08:40	09:00	09:20	09:40	10:00
BLOCK N°	BLOCK / VOLTAGE															
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22																
23																
24																
25																
26																
27																
28																
29																
30																
31																
32																
33																
34																
35																
36																
37																
38																
39																
40																
41																
42																
43																
44																
45																
46																
47																
48																
49																
50																
51																
52																
53																
54																
TEMP. ELE. °C																

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	AC UPS System F&G	Tag No.: UP-200F4

BATTERY UPS B	UP-200F4	SHEET 1	REV.	OUR. RIF.:
		NR.:		
CUSTOMER: Rosetti Marino	DISCHARGE TEST (Capacity test)	BATTERY TYPE:		CAPACITY Ah
		ELECTROLYTE TYPE:		DENSITY:
Nr. of blocks	Type :			

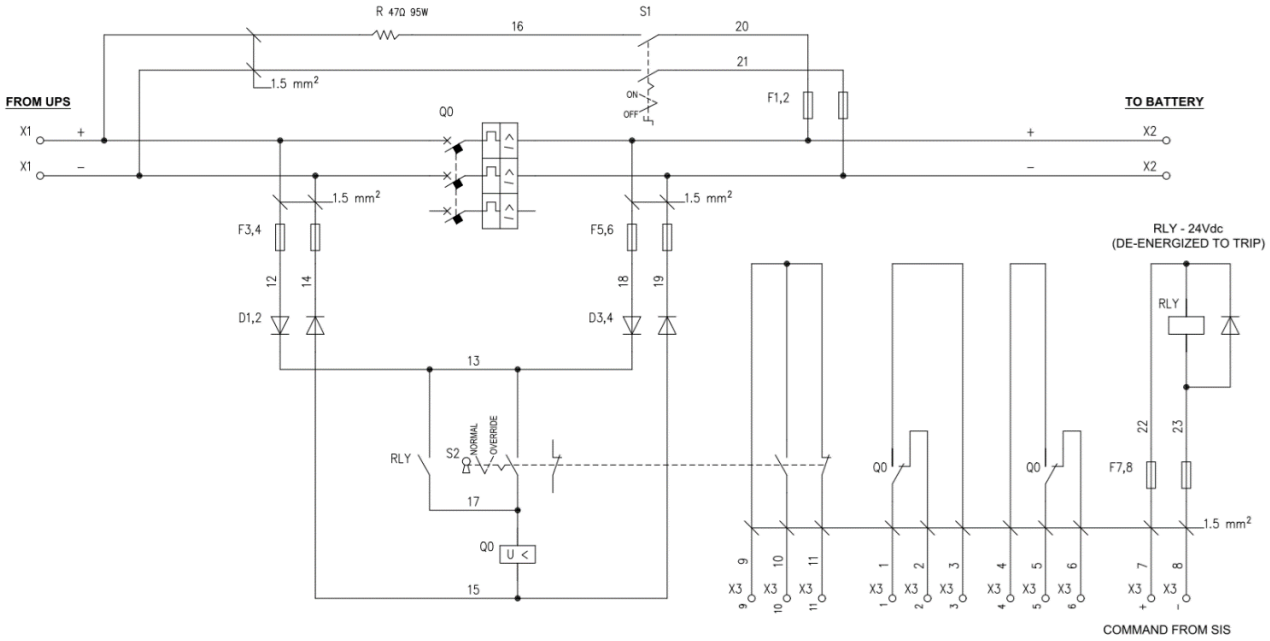
TIME (hour : min)	00:00	00:20	00:40	01:00	01:20	01:40	02:00	02:20	02:40	03:00	03:20	03:40	04:00	04:20	04:40	05:00
BLOCK N°	BLOCK / VOLTAGE															
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22																
23																
24																
25																
26																
27																
28																
29																
30																
31																
32																
33																
34																
35																
36																
37																
38																
39																
40																
41																
42																
43																
44																
45																
46																
47																
48																
49																
50																
51																
52																
53																
54																
TEMP. ELE. °C																

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	**AC UPS System F&G**	**Tag No.: UP-200F4**

TIME (hour : min)	05:00	05:20	05:40	06:00	06:20	06:40	07:00	07:20	07:40	08:00	08:20	08:40	09:00	09:20	09:40	10:00
BLOCK N°	BLOCK / VOLTAGE															
1																
2																
3																
4																
5																
6																
7																
8																
9																
10																
11																
12																
13																
14																
15																
16																
17																
18																
19																
20																
21																
22																
23																
24																
25																
26																
27																
28																
29																
30																
31																
32																
33																
34																
35																
36																
37																
38																
39																
40																
41																
42																
43																
44																
45																
46																
47																
48																
49																
50																
51																
52																
53																
54																
TEMP. ELE. °C																

Site Acceptance Test Report		Document-No.: 14188_SAT_2_00
Type:	**AC UPS System F&G**	**Tag No.: UP-200F4**

8. Black start procedure validation test:



Black Start procedure

The target is to allow the energization of the loads from the battery, while the battery charger being still de-energized.

- The operator shall put the selector S2 on "override" position (contact closed)
- The operator shall close the selector S1 to pre-charge the charger output DC capacitors
- Once the charger DC capacitors are charged and the voltage across Q0 power contacts is close to 0V (and at least >80% of the system DC nominal voltage), the operator shall close the breaker Q0
- The operator shall open the selector S1
- The site safety and SCADA systems restart and the RLY relay is automatically energized when all safety conditions are fulfilled. The charger is energized through its AC supply and then it can restart
- The operator shall put the selector S2 on "normal" position (contact open)
- The system returns to normal working conditions

Designation	Checked
BLACK START procedure UPS-A	
BLACK START procedure UPS-B	