Base Load Power Hub (BLPH)

Site acceptance test (SAT) procedure

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HYOSUNG HEAVY INDUSTRIES

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Revision / Change Log

Rev.	Description
00	ISSUE FOR REVIEW (IFR)
01	ISSUE FOR REVIEW (IFR)
02	ISSUE FOR REVIEW (IFR)
03	ISSUE FOR REVIEW (IFR)

HOLDS LIST

No.	Description
1.	
2.	
3.	
4.	

CLASSIFICATION	DESCRIPTION OF TEST / INSPECTION	APPLICABLE STANDARD & SPECIFICATION	INSPECTED BY			TEST PLACE
			HYOSUNG	Customer	Crosswind	
S.A.T (Site Acceptance Test)	1. Visual and Dimension Check	IEC 62271-203:2022 / Approved specification	H	W	W	ON SHORE
	2. Resistance Measurement of Main Circuit	IEC 62271-203:2022	H	W	W	ON SHORE
	3. Test on Auxiliary & Control Circuit	IEC 62271-203:2022	H	W	W	ON SHORE
	4. Functional Test	IEC 62271-203:2022	H	W	W	ON SHORE
	5. Mechanical Operation Test	IEC 62271-203:2022	H	W	W	ON SHORE
	6. Spring motor charging time & current measurment	IEC 62271-203:2022	H	W	W	ON SHORE
	7. Moisture content measurement in Dryair	IEC 62271-203:2022	H	W	W	ON SHORE

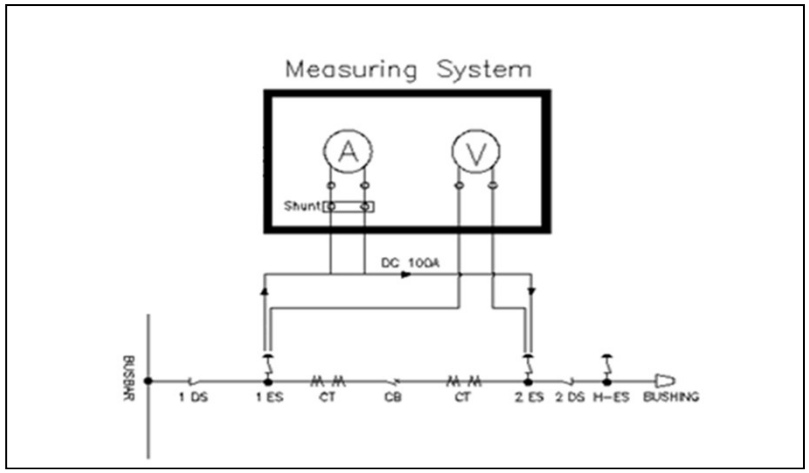
REMARKS

H : HOLDING POINT W/S : WITNESSING OVER SAMPLE

W : WITNESS POINT R : TEST REPORT REVIEW

GIS TEST FOR OFF SHORE IS NOT REQUIRED.

TEST ITEM	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
1. Visual and Dimension Check (IEC 62271-203:2022) (High-voltage switchgear and contolgear)	1) Test purpose The below content will be checked whether the test objects are suitable according to approved specification and relevant standards. 2) Test content a) Measure dimensions by comparing with drawings. Use a tape measure when measuring, and apply ±2% tolerance. b) The nameplate shall be visually inspected compared to the drawing. c) Visually check for defects in construction, indicator, grounding, painting and welding condition d) Check the physical damage or defects during the transportation visually. 3) Test method a) This test is performed by simple tools and visual inspection. b) First, check if there is any damage during transportation. c) Check the dimensions to ensure that the installation is not affected. d) Other contents(Nameplate, painting and grounding..) can be checked during other tests.	* The test results shall be satisfied with approved specification and drawing. * Reference drawing - 1723001595-EL-DA-00006 - 1723001595-MAT-PRO-00026	WITNESS

TEST ITEM	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
2. Resistance Measurement of Main Circuit (IEC 62271-203:2022) (High-voltage switchgear and contolgear)	1) Test purpose The purpose is to observe the status of internal fabrication and dimension of conductors which lie in GIS. 2) Test content Resistance of the main circuit 3) Test method a) Specify the measurement section. (It is recommended to specify the same as the FAT section.) b) Applying DC current of 100 A to ES busing or main conductor in the designated section. c) Measure the voltage at both ends of the resistance measurement section to calculate the resistance using the voltage drop method. (R = V / I) d) Compare the measured value with the expected design value(or FAT measurement value). 4) Test circuit 	* The measured value of GIS shall not exceed 1.2 X Re. Where Re means the expected design value at 20° C. * The Re value will be included in the final Factory Test Report. * Ambient temperature during the test should be considered.	WITNESS

TEST ITEM	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
3. Test on Auxiliary & Control Circuit (IEC 62271-203:2022) (High-voltage switchgear and contolgear)	1) Test purpose The test is performed to ascertain the auxiliary & control circuit. 2) Test content Auxiliary & control circuit 3) Test method Before control voltage applying, all wiring in the control mechanism will be checked with tester or buzzer based on the schematic. a) The schematic wiring shall be checked by buzzer and operation check according to the approved drawing. b) Dielectric test : Inject 1kV for 1sec on the control and auxiliary circuits. In this test, the digital relays and annunciator is disconnected. c) Insulation resistance on the control and auxiliary circuits shall be measured. ** Note. The related to the test for protection, please refer to "1723001595-EL-PRO-00023 Remote Control Simulation test procedure.".	* Shall be complied with the schematic and shall be withstood. * Reference drawing - 1723001595-EL-DG-00015 - 1723001595-EL-DG-00017 * More than 2MΩ	WITNESS

TEST ITEM	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
4. Functional test (IEC 62271-203:2022) (High-voltage switchgear and contolgear)	1) Test purpose This test is to check GIS function which is satisfied with approved schematic drawings. 2) Test content Multi digital meter, Marking pen for marking on each checked schematic line & device 3) Test method a) Before applying control voltage, all wiring in the local control cubicles shall be checked with tester or buzzer based on approved schematic. b) All interface wiring between LCC & GIS shall be checked with tester or buzzer based on approved schematic. c) All kind of devices & wiring shall be checked by operation at site properly. d) Mechanical interlocks shall be proved. e) The operating and the interlock circuits shall be proved. f) Wiring relevant to the alarm and warning circuits shall be checked by buzzer or annunciator of the local control panel. g) Check that final setting is applied to all adjustable devices (e.g. Timers, annunciators, thermostat, humidistat, etc…) h) Manual operation shall be checked for CB, DS, ES.	* Shall be operate in accordance with the approved drawings. * The wiring connection shall match the approved drawing. * Reference drawing - 1723001595-EL-DG-00015 - 1723001595-EL-DG-00017	WITNESS

TEST ITEM	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
5. Mechanical Operation Test (IEC 62271-203:2022) (High-voltage switchgear and contolgear)	1) Test purpose The purpose is to check operating characteristic and to check operation of CB, DS, ES. 2) Test content a) CB: ① Closing ② Opening ③ CO(Trip free) ④ O-CO b) DS & ES: ① Closing ② Opening 3) Test method a) CB The operating time, current and pole discrepancy shall be checked at the rated voltage. Also, it is checked the circuit breaker is capable of performing trip-free(CO operation) and reclosing(O-CO operation). b) DS & ES(H-ES) At the rated voltage, the operating time and motor current shall be checked.	* The test results shall be subject to the following criteria at rated stage. 1) CB - Closing time : less than 70 ms - Opening time : less than 32 ms - Pole discrepancy ① Closing : less than 1/4cycle (5 ms) ② Opening : less than 1/6cycle (3.3 ms) - Trip-free: must be possible - O-C time: less than 300 ms 2) DS & ES(H-ES) - Closing time: less than 10s - Opening time: less than 10s	WITNESS

Equipment	Operation	Control Voltage	
		%	Vdc
CB	Closing	100	110
	Opening	100	110
	CO	100	110
	O-CO	100	110

TEST ITEM	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
6. Spring motor charging time & current measurement (IEC 62271-203:2022) (High-voltage switchgear and contolgear)	1) Test purpose To ensure the healthy operation of CB mechanism 2) Test content Spring motor 3) Test method a) Count the charging time with the stopwatch while CB spring is charging. b) Measure the motor current with the clamp meter or multi meter while CB spring is charging.	* Charging time shall be less than 15 sec. Motor current is for the reference.	WITNESS

TEST ITEM	EXPLANATION	PASS / ACCEPTANCE CRITERIA	TEST RANGE
7 Moisture content measure-ment in Dryair (IEC 62271-203:2022) (High-voltage switchgear and contolgear)	1) Test purpose This test is performed to ascertain moisture & percentage O_2 contents in Dryair. 2) Test content Dryair 3) Test method a) After filling the inside of the GIS with dryair above the rated pressure, proceed with the test. b) Inlet valve will be connected to the GIS and outlet valve will be connected to the test equipment. c) Measure the moisture and O2 contents using the test equipment.	* The moisture content and dew point temperature in dryair shall have the following criteria. - CB gas section : Less than -10℃ (≤432ppm) - Other gas section : Less than -10℃ (≤ 432ppm) - O_2 content in Dryair : 20.5 ± 0.5%	WITNESS

HYOSUNG HEAVY INDUSTRIES

SITE TEST REPORT FOR GIS

Document Number :

Customer / Country	:	ROSETTI / ITALY
Project	:	BASE LOAD POWER HUB (BLPH) 66kV SWITCH GEAR (GIS)
Substation Name	:	BLPH 66kV

Technical Data

Gas Insulated Switchgear Type	:	HSGE-074B
Rated voltage	:	72 kV
Rated current	:	1250 A
Rated short-circuit breaking current	:	31.5 kA
Rated frequency	:	50 Hz
PJT No.	:	10248074_0002
Date of issue	:	

General

This is to certify that tests have been completed on the site as per the attached test results and all of the results meet the criteria.

HYOSUNG HEAVY INDUSTRIES	-	ROSETTI MARINO
Name : K. R. BAEK		Name :

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1. Visual and Dimension Check

The below contents are checked whether the test objects are suitable according to approved specification and relevant standards.

Bay Name	Test Item	Result
All Bays	Dimension and Nameplate are checked in according to the approved drawings.	
	Construction, indicator, grounding, painting & welding condition are inspected visually.	
	Other specified items are checked in approved specification.	
	Physical damage or defects during transportation were identified.	

2. Measurement of the Resistance of the Main Circuit

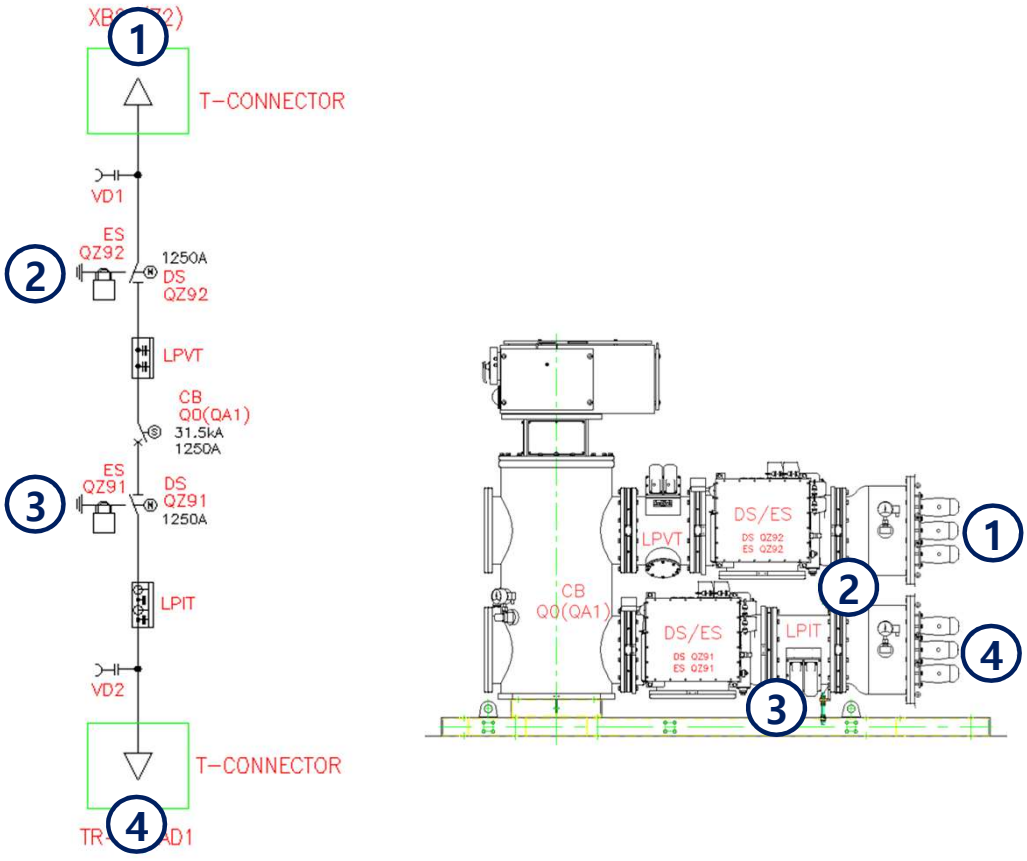
Applying DC current of 100A to the main circuit, the resistance of GIS has been measured by voltage drop method.

Ambient Temp. [℃] : .0

Measuring Parts	Measured Value / Acceptance criteria [μΩ]			Result
	Phase 8	Phase 12	Phase 4	
1 ~ 4	/	/	/	
1 ~ 2	/	/	/	
3 ~ 4	/	/	/	

* Acceptance criteria : Measuring Value is less than 120% of the Design Value.

< Reference Drawing >



3. Test on auxiliary & control circuit

Before control voltage applying, all wiring in the control mechanism have been checked with multi-tester orbuzzer based on the schematic.

Bay(CB) Name	Test Item	Result
QA1	The schematic wiring has been checked.	
	Insulation resistance measurement on the control and auxiliary circuits.	

4. Functional Test

The below contents are checked whether the test objects are suitable according to approved specification and relevant standards.

Bay(CB) Name	Test Item	Result
QA1	All interface wiring between LCC & GIS is checked with buzzer based on approved schematic.	
	All kind of devices & wiring are checked by operation at site properly.	
	Mechanical interlock is proven.	
	The operating and interlock circuits are proven.	
	Wiring relevant to the alarm and warning circuits are checked by buzzer or announciator of LCP	
	Checked that the final setting was applied to all adjustable devices. (Timers, thermostat, etc..)	
	Manual operation is checked for CB, DS, ES.	

5. Mechanical Operation Test

All operating test required by the standards have been carried out successfully.

5.1 Timing Test (CB)

* Acceptance criteria : Close time (less than 70ms), Pole discrepancy (less than 5ms) / Open time (less than 32ms), Pole discrepancy (less than 3.3ms)

(At 110Vdc) CO (must be possible), O-C time (Less than 300ms)

Bay(CB) Name	Sequence		Phase 8 [ms]	Phase 12 [ms]	Phase 4 [ms]	Pole discrepancy [ms]	Test Criteria	Result
QA1	Close	C1					< 70ms	
	Open	T1					< 32ms	
		T2						
	C-O (Trip free)	T1				-	must be possible	
		T2				-		
	O-CO	T1				-	< 300ms	
		T2				-		

5.2 DS&ES Operation test

Bay(CB) Name	Test Item	Close time(ms)			Open time(ms)			Test Criteria	Result
		Phase 8	Phase 12	Phase 4	Phase 8	Phase 12	Phase 4		
QA1	QZ91 DS							< 10000ms	
	QZ91 ES								
	QZ92 DS								
	QZ92 ES								

6. Spring motor charging time & current measurement

Bay(CB) Name	Motor Charging Time (sec)		Motor Current (A)	Result
	Measured Value	Criteria	Measured Value	
QA1		< 15		

7. Moisture content measurement in SF6 Gas

Measured date :

Bay(CB) Name	Test Item	Measured moisture content	Dryair Gas pressure [bar.G]	O_2 content in Dryair	Result
QA1	GD-1				
	GD-2				
	GD-3				

(END)