Base Load Power Hub (BLPH)

Routine Verification Test (FAT) Procedure

Document Number: 1723001595-QC-PRO-00027

Document Class: 2

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Revision / Change Log

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

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TEST ITEM	EXPLANATION	PASS/ACCEPTANCE CRITERIA	TEST RANGE
1. Design and visual check (IEC 62271-203:2022 8.6) (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) Dimension and nameplate will be checked in according to the approved drawings. b) Construction, indicator, painting & welding condition will be inspected visually. c) Other specified items will be checked according to approved specification. 3) Test method This test is performed by simple tools and visual inspection.	* The test results shall be satisfied with approved specification and drawing. * Reference drawing - 1723001595-EL-DA-00006 - 1723001595-MAT-PRO-00026 * The measurement of dimension needs to satisfy the tolerance ±2% compared to specification.	WITNESS

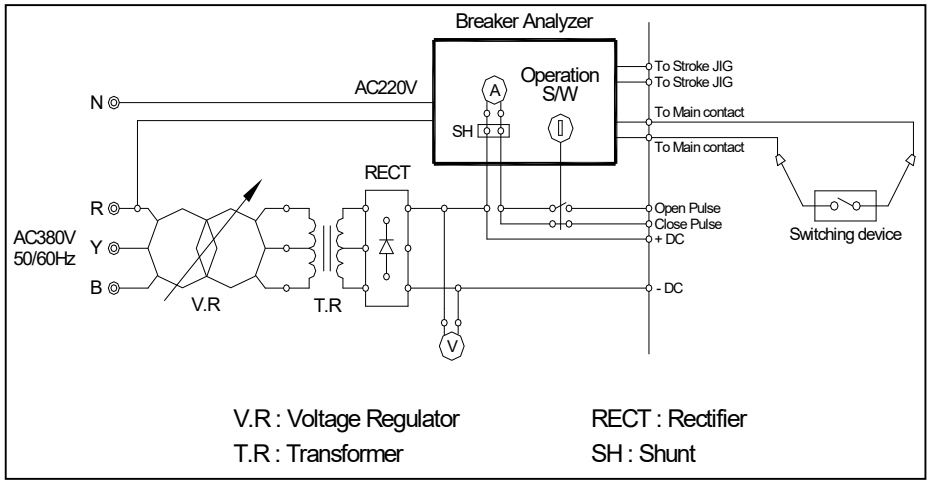
TEST ITEM	EXPLANATION	PASS/ACCEPTANCE CRITERIA	TEST RANGE
2. Mechanical operation test - continuous operating test (IEC 62271-203:2022 8.102) (High-voltage switchgear and contolgear)	1) Test purpose The purpose is to ensure whether the test object endures this test electrically and mechanically. 2) Test content a) CB: ①Closing ②Opening ③CO ④OC ⑤O-CO b) DS, ES : ①Closing ②Opening 3) Test method a) CB: Circuit breaker shall be operated 5 times at each condition of table 1. And 1 time operation of O-CO at rated condition. b) DS, ES : DS, ES shall be operated 5 times at each condition of table 2.	* GIS should be operated without any problem.	WITNESS

ITEM	Operation	Control Voltage	
		(%)	(V)
CB	Closing	110	121
		100	110
		85	93
	Opening	110	121
		100	110
		70	77
	CO	100	110
	OC	100	110

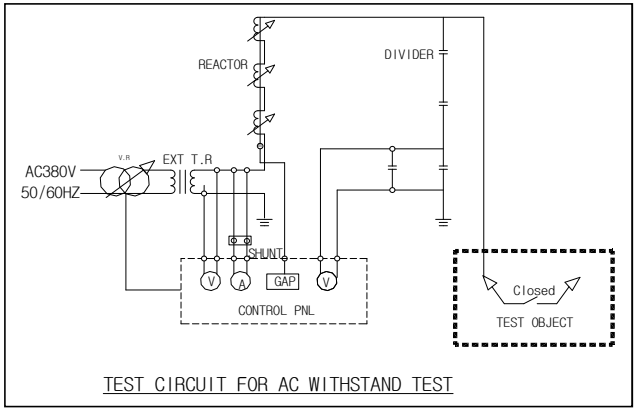
<TABLE 1 - Operation condition for CB>>

Equipment	Operation	Control Voltage	
		%	Vdc
DS, ES	Closing / Opening	110	121
		100	110
		85	93

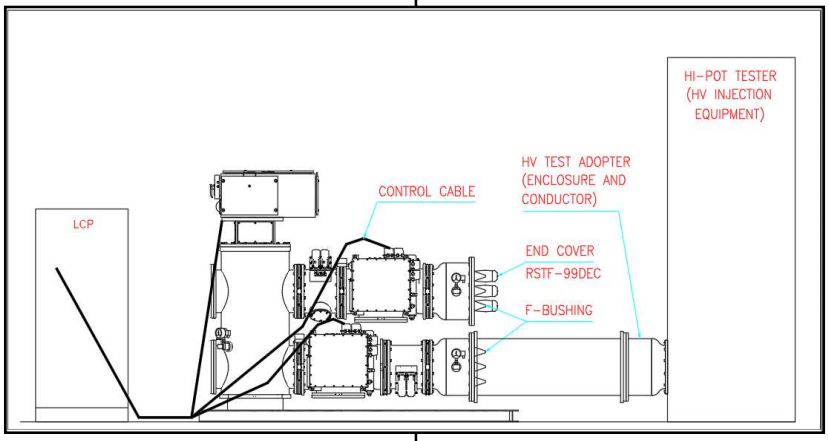
<TABLE 2 - Operation condition for DS,ES>

TEST ITEM	EXPLANATION	PASS/ACCEPTANCE CRITERIA	TEST RANGE
3. Mechanical operation test - timing test (IEC 62271-203:2022 8.102) (High-voltage switchgear and contolgear)	1) Test purpose The purpose is to measure operating characteristic and to check operation of CB, DS, ES. 2) Test content a) CB: ①Closing ②Opening ③CO ④OC ⑤O-CO b) DS, ES : ①Closing ②Opening 3) Test method a) CB The operating time, current, pole discrepancy and the mechanical travel curve 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 At the rated voltage, the operating time shall be checked. 4) Test circuit  V.R : Voltage Regulator RECT : Rectifier T.R : Transformer SH : Shunt	* 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(CO) : must be possible - O-C time : less than 300 ms 2) DS, ES - Closing time : less than 10s - Opening time : less than 10s	WITNESS

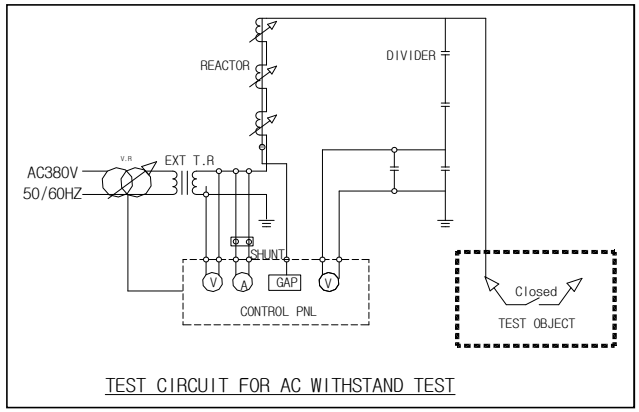
TEST ITEM	EXPLANATION	PASS/ACCEPTANCE CRITERIA	TEST RANGE
4. Power frequency withstand voltage test on the main circuit (IEC 62271-203:2022 8.2.101) (IEC 60840:2011 Table.4) (High-voltage switchgear and contolgear)	1) Test purpose The purpose is to ensure the dielectric strength on the main circuit. 2) Test content a) Phase to earth & Phase to Phase - One phase injection, other two phases earthed together (Each phase injection) b) Across open position (CB & DS) 3) Test method The test shall be made after assembling test object completely, maintaining the minimum functional pressure and connecting CT all secondary terminals commonly. The test voltage shall be raised to 90kVrms and maintained for 1 minute. 4) Test circuit & Layout	* Test item shall be withstood. * Minimum functional pressure - CB : 4.5 bar.G - Others : 4.5 bar.G	WITNESS



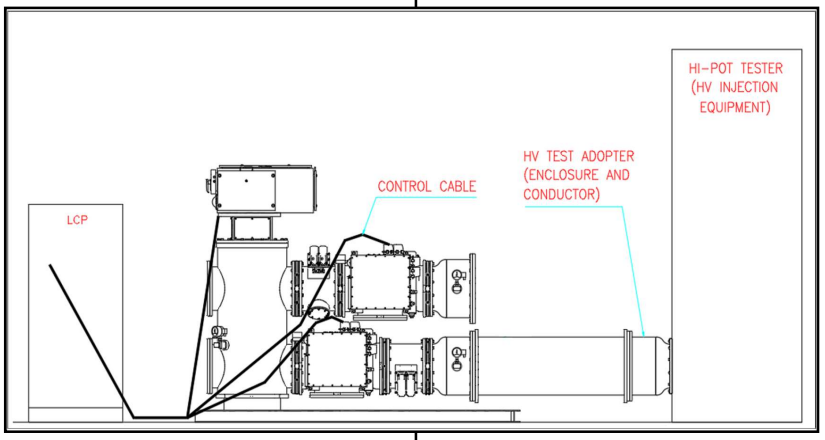
TEST CIRCUIT FOR AC WITHSTAND TEST

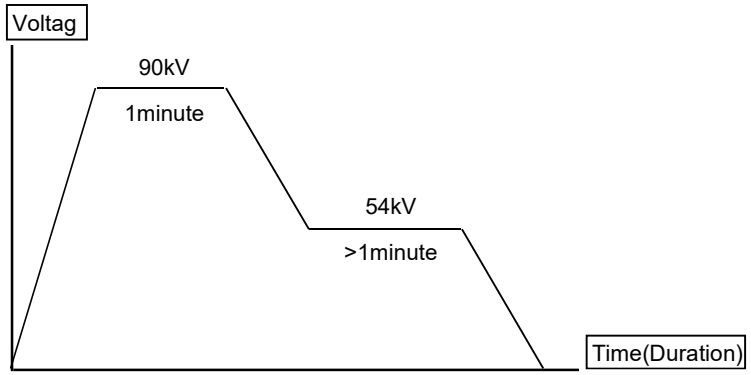


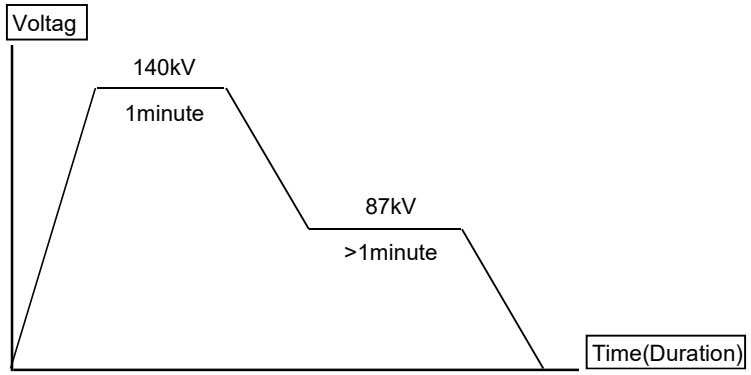
TEST ITEM	EXPLANATION	PASS/ACCEPTANCE CRITERIA	TEST RANGE
4. Power frequency withstand voltage test on the main circuit (without F-Bushing) (IEC 62271-203:2022 8.2.101) (High-voltage switchgear and contolgear)	1) Test purpose The purpose is to ensure the dielectric strength on the main circuit. 2) Test content a) Phase to earth & Phase to Phase - One phase injection, other two phases earthed together (Each phase injection) b) Across open position (CB & DS) 3) Test method The test shall be made after assembling test object completely, maintaining the minimum functional pressure and connecting CT all secondary terminals commonly. The test voltage shall be raised to 140kVrms and maintained for 1 minute. 4) Test circuit & Layout	* Test item shall be withstood. * Minimum functional pressure - CB : 4.5 bar.G - Others : 4.5 bar.G	Review test report



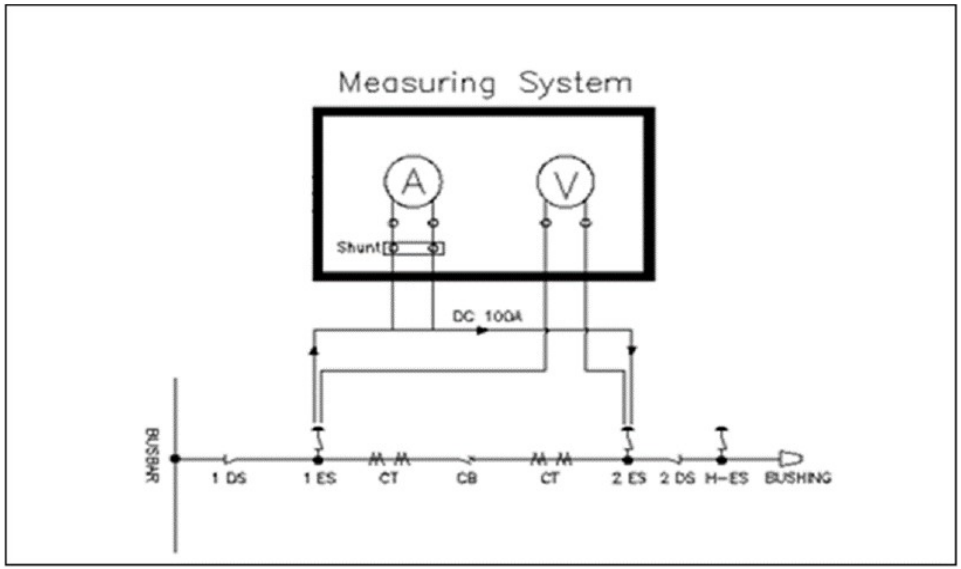
TEST CIRCUIT FOR AC WITHSTAND TEST



TEST ITEM	EXPLANATION	PASS/ACCEPTANCE CRITERIA	TEST RANGE
5. Partial discharge measurement (IEC 62271-203:2022 8.2.102) (IEC 60840:2011 Table.4) (High-voltage switchgear and contolgear)	1) Test purpose The purpose is to detect possible materials and manufacturing defects and to ensure the dielectric strength of long term in test object. 2) Test content - Phase to earth & Phase to Phase 3) Test method At the same condition as line to earth of power frequency withstand voltage test on main circuit, the quantity of partial discharges shall be measured according to the following procedures. At first, the applied voltage shall be raised to the power frequency withstand voltage and maintained for 60 seconds. Partial discharges occurring during this period shall be disregarded. Then, the voltage is decreased to the PD test voltage without interruption. Partial discharges shall be measured. Where, ① U means rated voltage. ② PD test voltage : 1.5Uo = 54kV 4) Test voltage  	* The partial discharge level shall be not exceed 5 pC.	WITNESS

TEST ITEM	EXPLANATION	PASS/ACCEPTANCE CRITERIA	TEST RANGE
5. Partial discharge measurement (without F-Bushing) (IEC 62271-203:2022 8.2.102) (High-voltage switchgear and contolgear)	1) Test purpose The purpose is to detect possible materials and manufacturing defects and to ensure the dielectric strength of long term in test object. 2) Test content - Line(Phase) to earth 3) Test method At the same condition as line to earth of power frequency withstand voltage test on main circuit, the quantity of partial discharges shall be measured according to the following procedures. At first, the applied voltage shall be raised to the power frequency withstand voltage and maintained for 60 seconds. Partial discharges occurring during this period shall be disregarded. Then, the voltage is decreased to the PD test voltage without interruption. Partial discharges shall be measured. Where, ① U means rated voltage. ② PD test voltage : 1.5U = 87kV 4) Test voltage  	* The partial discharge level shall be not exceed 5 pC.	Review test report

TEST ITEM	EXPLANATION	PASS/ACCEPTANCE CRITERIA	TEST RANGE
6. Measurement of insulation resistance (ES 6110-0002:2022 6.3.17) (Gas-Insulated Switchgears)	1) Test purpose The purpose is to check the main circuit condition before and after HV test. 2) Test content a) Main Circuit 3) Test method The insulation resistance between main circuit and earth shall be measured by using 10000V Megger.	* Insulation resistance : More than 1000MΩ	WITNESS

TEST ITEM	EXPLANATION	PASS/ACCEPTANCE CRITERIA	TEST RANGE
7. Measurement of the resistance of the main circuit (IEC 62271-203:2022 8.4) (High-voltage switchgear and contolgear)	1) Test purpose The purpose is to appreciate the state of internal fabrication and dimension of conductors which lie in GIS indirectly. 2) Test content Main circuit 3) Test method Applying DC current of 100 A to main circuit normally, the entire resistance of GIS shall be measured by voltage drop method. 4) Test circuit 	* The measured value of GIS shall not exceed 1.2 X Re. Where Re means the design value. * design value will be submitted before the test execution.	WITNESS

TEST ITEM	EXPLANATION	PASS/ACCEPTANCE CRITERIA	TEST RANGE
8. Tightness test (IEC 62271-203:2022 8.5) (High-voltage switchgear and contolgear)	1) Test purpose The purpose is to ensure whether there is any leakage of Gas in test object. 2) Test content SF6 Gas leakage rate (SF6 gas is used for leakage tracking.) 3) Test method After filling the test object to rated gas pressure with SF6 Gas and wrapping all connection part with vinyl, it is checked whether there is any leak in the envelopment by using the gas detector. The checking time shall be at least 6 hours later, after wrapping the test object. After this test is finished, SF6 gas is removed and dry air is filled to proceed with other tests.	* The SF6 Gas leakage rate per year shall be less than 0.5%. * Leakage rate/6hr : 42.6 [ppm] ie) Rated pressure - CB : 5 bar.G - Others : 5 bar.G	WITNESS

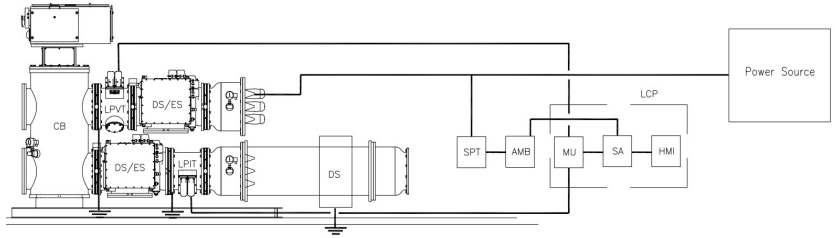
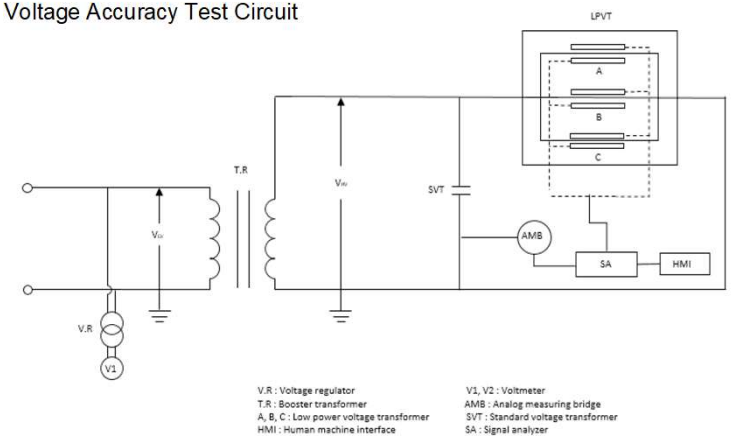
TEST ITEM	EXPLANATION	PASS/ACCEPTANCE CRITERIA	TEST RANGE
9. Gas density switch test	1) Test purpose The purpose is to ensure whether these switches are set to alarm and lock-out pressure correctly according to approved specification. 2) Test content Alarm and lock-out pressure 3) Test method Controlling gas pressure of each section, alarm and lock-out pressure contacts shall be checked with gas gauge and alarm on the LCP. * Depending on factory conditions, test wires may be used for LCP and GD connections. 4) Test Pressure	* The pressure switch contacts shall operate according to the alarm and reset pressures. * The tolerance is ±0.2 bar.G	WITNESS

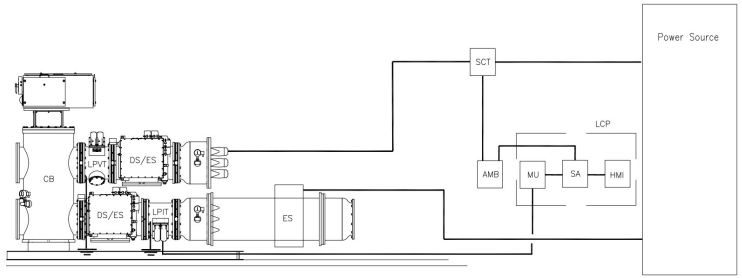
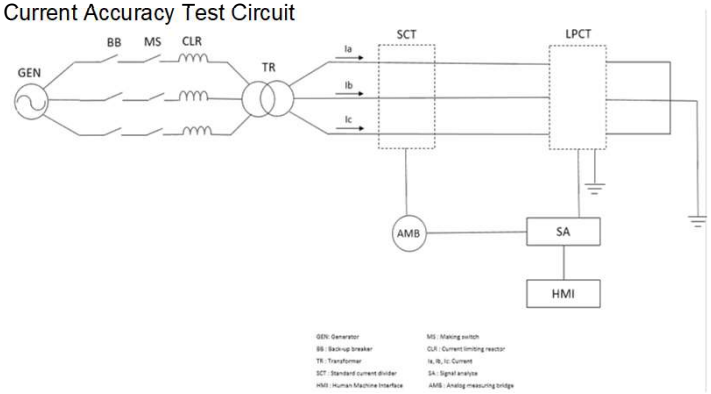
		PRESSURE SETTINGS : bar.G at 20°C		
		RATED	ALARM ON	RESET
CB	LOW 1'ST STAGE	5	4.7	4.9
	LOW 2'ND STAGE		4.5	4.7
OTHERS	LOW 1'ST STAGE	5	4.7	4.9
	LOW 2'ND STAGE		4.5	4.7

TEST ITEM	EXPLANATION	PASS/ACCEPTANCE CRITERIA	TEST RANGE
10. Test on auxiliary & control circuit(Including LCP test) (IEC 62271-203:2022 8.103, 8.3) (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 Auxiliary & control circuit, Local control panel 3) Test method This test shall be checked below items whether test objects are subject to the approved specification and drawing during in-process. a) Dimension and nameplate check b) Painting and wiring color check c) The resistance values of the closing/tripping coils and heaters check d) Function test for switching device and indicator e) Interlock test f) Dielectric test and insulation resistance measurement on control and auxiliary circuits ** Note. The related to the test for protection, please refer to "1723001595-EL-PRO-00023 Remote Control Simulation test Procedure.".	* The test results shall be satisfied with approved specification and drawing. * Reference drawing - 1723001595-EL-DG-00015 - 1723001595-EL-DG-00017 * Test wires may be used for LCP and GIS connections. * 1kV for 1sec, More than 2MΩ	WITNESS

TEST ITEM	EXPLANATION	PASS/ACCEPTANCE CRITERIA	TEST RANGE
11. Pressure test for enclosure (IEC 62271-203:2022 8.101) (High-voltage switchgear and contolgear)	1) Test purpose The purpose is to confirm whether the test object endures the testing pressure. 2) Test content Enclosure 3) Test method a) Testing pressure shall be according with the designated values of design drawings or technical specification. Unless otherwise specified in the design drawings or technical specification, the test pressure shall be k times the design pressure, where the factor k - 1.5 for welded aluminium and welded steel enclosure - 2 for cast aluminium enclosures * The IEC standard refers to 1.3 times for welded aluminum and welded steel enclosure. But test pressure shall be 1.5 times the design pressure according to KS (Korea Standard). b) Pressure test for enclosure shall be made below procedure during in-process. ① Water will be supplied by using the booster pump. ② Two pressure gauge, one located in high point and the other located in low point, shall be used for the test. Pressure gauge is indicated regulation pressure and it shall be confirmed. ③ The test pressure shall be maintained for at least 1minute and it's confirmed the leakage and transformation.	* The weld or cast production shall be withstood without any leakage, transformation. * Design pressure for enclosure - CB : 7 bar.G - 3PDS : 6.5 bar.G - LPIT/LPVT : 7 bar.G - CSE : 7 bar.G	Review test report

TEST ITEM	EXPLANATION	PASS/ACCEPTANCE CRITERIA	TEST RANGE
12. Pressure test on partition (IEC 62271-203:2022 8.104) (High-voltage switchgear and contolgear)	1) Test purpose The purpose to confirm whether the partition endures the test pressure. 2) Test content Partition 3) Test method Each partition shall be subjected to a pressure test at twice the design pressure for 1 minute.	* The partition shall be withstood without any leakage and cracks. * Design pressure : 8kgf/cm^2	Review test report

TEST ITEM	EXPLANATION	PASS/ACCEPTANCE CRITERIA	TEST RANGE
13. Low Power Voltage Transformer (IEC 60044-7:1999) (Electronic voltage transformers)	* Test report will be submitted for below test items. 1) Visual inspection 2) Tightness Test 3) Power-frequency voltage withstand tests on primary terminals and partial discharge measurement 4) Power frequency withstand voltage test of low-voltage device 5) Voltage accuracy test * Voltage Accuracy Test Layout  * Voltage Accuracy Test Circuit 	* Test item 1) result shall be satisfied with approved specification and drawing. * Reference drawing - 1723001595-EL-DA-00006 - 1723001595-MAT-PRO-00026 * The measurement of dimension needs to satisfy the tolerance ±2% compared to specification. * Test item 2), 3) will be proceeded included in GIS test. * Accuracy test voltage will be applied up to 20% of rated voltage(7.62kV). * Pass criteria is that satisfied client's require specification(0.5/3P). * Test item 1), 2), 3), 5) will be witnessed during FAT.	WITNESS & Review test report

TEST ITEM	EXPLANATION	PASS/ACCEPTANCE CRITERIA	TEST RANGE
14. Low Power Instrument Transformer (IEC 60044-7:1999) (Electronic voltage transformers) (IEC 60044-8:2002) (Electronic current transformers)	* Test report will be submitted for below test items. 1) Visual inspection 2) Tightness Test 3) Power-frequency voltage withstand tests on primary terminals and partial discharge measurement 4) Power frequency withstand voltage test of low-voltage device 5) Voltage accuracy test 6) Current accuracy test * Current Accuracy Test Layout  * Current Accuracy Test Circuit  	* Test item 1) result shall be satisfied with approved specification and drawing. * Reference drawing - 1723001595-EL-DA-00006 - 1723001595-MAT-PRO-00026 * The measurement of dimension needs to satisfy the tolerance ±2% compared to specification. * Test item 2), 3) will be proceeded included in GIS test. * Accuracy test voltage will be applied up to 20% of rated voltage(7.62kV). * Pass criteria is that satisfied client's require specification(0.5/3P). * Accuracy test current will be applied up to 20% of rated current(250A). * Pass criteria is that satisfied client's require specification(0.5/5P20) * Test item 1), 2), 3), 5) will be witnessed during FAT.	WITNESS & Review test report

ROUTINE TEST REPORT FOR GIS

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	:	4000 A
Rated short-circuit breaking current	:	40 kA
Rated frequency	:	50 Hz
PJT No.	:	10248704_0002
Bay(CB) Name	:	Q0(QA1) CB
Date of Tests	:	

Factory Information

Place of Test	:	HYOSUNG Changwon Factory
Address	:	171, Yeonduk-ro, Seongsan-gu, Changwon-si, Gyeongsangnam-do, South-Korea

General

We certify that the above items have been inspected in compliance with the requirements of the customer.

Prepared by :	Checked by :	Approved by :

C O N T E N T S

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10	Pressure Test for Enclosure ----------	10
11	Pressure Test on Partition ----------	10
12	Current Transformer Test ----------	10

1. Design and Visual Check

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

Test Item	Result
Dimension and Nameplate are checked in according to the approved drawings.	
Construction, indicator, painting & welding condition are inspected visually.	
Other specified items are checked in approved specification.	

2. Power Frequency Withstand Voltage Test on the Main circuit

The power frequency withstand voltage tests is performed after mechanical operation tests.

The specified power frequency withstand voltage test has been performed successfully.

2.1 Test condition

Dryair Gas pressure [bar.G] CB : 4.5 Others : 4.5

Test Item	Test Voltage [kV]	Test Duration [s]	Result
Phase to Earth	140	60	
Across Open Pole (CB, DS)	140	60	

2.2 Measurement of insulation resistance

Test sequence	Test Voltage [V]	Acceptance criteria [MΩ]	Measured Value [MΩ]	Resule
Before H.V test	10,000	≤1,000		
After H.V test	10,000	≤1,000		

3. Partial Discharge Measurement

After line to earth condition of the power frequency withstand voltage test, the quantity of partial discharges has been measured successfully.

Test Item	Test Voltage [kV]	Acceptance criteria [pC]	Measured Value [pC]	Result
Phase to Earth	87	≤5		

4. Mechanical Operation Test - Continuous Operating Test

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

4.1 Continuous Operating Test (CB)

Sequence	Control Voltage [Vdc]		Control Pressure [bar.G]		Operating Times	Result
Close	Max	121	Max	N/A	5	
	Rated	110	Rated	N/A	5	
	Min	94	Min	N/A	5	
Open	Max	121	Max	N/A	5	
	Rated	110	Rated	N/A	5	
	Min	77	Min	N/A	5	
C-O	Rated	110	Rated	N/A	5	
O-C	Rated	110	Rated	N/A	5	
O-CO	Rated	110	Rated	N/A	1	
Manual Operation	-				5	

4.2 Continuous Operating Test(DS, ES)

Sequence	Control Voltage [Vdc]		Operating Times	Result
Close / Open	Max	121	5	
	Rated	110	5	
	Min	94	5	
Manual Operation	-		5	

4.3 Spring Charge Time

Test Item	CB [s]	Result
Spring charge time		

*Acceptance criteria : Less than 15sec

5. Mechanical Operation Test - Timing Test

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

5.1 Timing Test (CB)

Sequence		Control Voltage [Vdc]	Control Pressure [bar.G]	Phase 8 [ms]	Phase 12 [ms]	Phase 4 [ms]	Pole discrepancy [ms]	Page No. (Annex. A)	Result
Close	C1	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
	C2	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
Open	T1	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
	T2	-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
		-	-	-	-	-	-	-	-
C-O	C1,T1	-	-	-	-	-	-	-	-
	C1,T2	-	-	-	-	-	-	-	-
O-C	C1,T1	-	-	-	-	-	-	-	-
	C1,T2	-	-	-	-	-	-	-	-
O-C-O	C1,T1	-	-	-	-	-	-	-	-

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

(At rated condition) Open time (less than 32ms), Pole discrepancy (less than 3.3ms)

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

* Refer to the attached <Annex A>

5.2 Timing Test (DS, ES)

Test Item	Sequence	Control Voltage [Vdc]	Phase 8 [ms]	Phase 12 [ms]	Phase 4 [ms]	Page No. (Annex. A)	Result
-	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
	-	-	-	-	-	-	-
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	-	-	-	-	-	-	-
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	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
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* Acceptance criteria : Close Time (Less than 10000ms), Open Time (Less than 10000ms)

* Refer to the attached <Annex A>

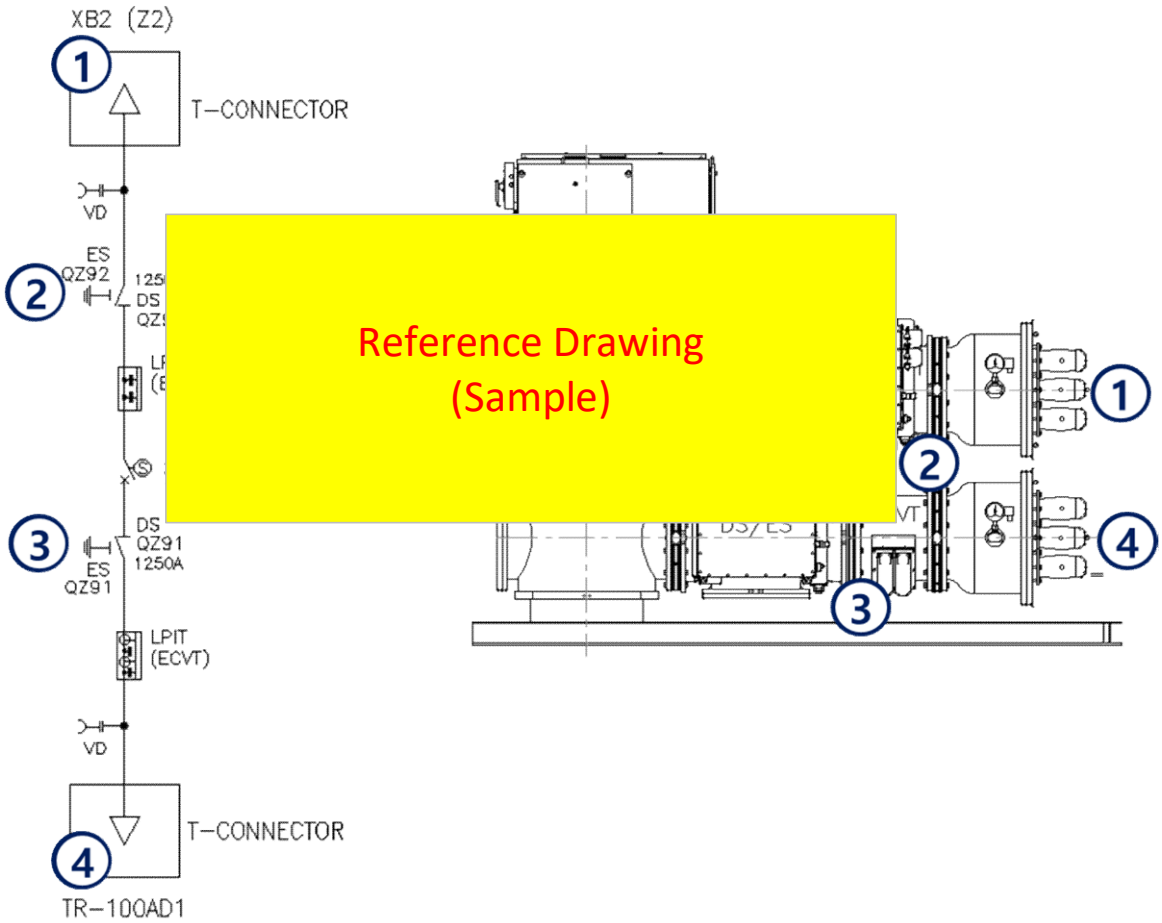
6. Measurement of the Resistance of the Main Circuit

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

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

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

< Reference Drawing >



7. Tightness test

After filling the test object to rated gas pressure with SF6 gas and wrapping all connection part with vinyl.

At least 6 hour later, it has been checked with gas detector.

SF6 Gas pressure [bar.G] CB : 5 Others : 5

Test Duration [hr]	Acceptance Criteria	Measured	Result
6	Less than 0.5% per year		

8. Gas Density Switch Test

Alarm contacts of gas density switch have been checked successfully.

Test Item	Standard Gas Pressure [bar.G]				Result
	1'st Alarm	2'nd Alarm	High pressure	-	
GD-1	4.7±0.2	4.5±0.2	-	-	
GD-2	4.7±0.2	4.5±0.2	-	-	
GD-3	4.7±0.2	4.5±0.2	-	-	
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-
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-	-	-	-	-	-
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-	-	-	-	-	-
-	-	-	-	-	-

9. Test on auxiliary & control circuit(Including LCP test)

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

Test Item	Result
Dimension and nameplate check	
Painting and wiring color check	
Interlock test	
Functional Test	

9.1 Aux. Device Resistance Measurement

9.1.1 Coil & Resistor

Test Item	Acceptance Criteria [Ω]	Measured Value [Ω]			Result
		Phase 8	Phase 12	Phase 4	
Open Coil (T1)					
Open Coil (T2)					
Close Coil (C1)					
Close Coil (C2)	-	-	-	-	-

9.1.2 Heater

Test Item	Acceptance Criteria [Ω]	Measured Value [Ω]			Result
		Phase 8	Phase 12	Phase 4	
LCP					
QA1					
QZ92 DS		-		-	
QZ92 ES		-		-	
QZ91 DS		-		-	
QZ91 ES		-		-	
-	-	-	-	-	-
-	-	-	-	-	-
-	-	-	-	-	-

9.2 Dielectric Test and Insulation Resistance Measurement on Auxiliary and Control Circuits

Test Item	Test Voltage [V]	Test Duration [s]	Measured Value [MΩ]	Result
Auxiliary and Control Circuits to Earth	1000 Vac	1		
	500 Vdc (Megger)	-		

* Acceptance criteria of Insulation Resistance : ≥2 MΩ

10. Pressure Test for Enclosure

- Refer to the attached <Appendix A>

11. Pressure Test on Partition

- Refer to the attached <Appendix B>

(END)

Customer / Country	:	ROSETTI / ITALY
Project	:	BASE LOAD POWER HUB (BLPH) 66kV SWITCH GEAR (GIS)
Substation Name	:	BLPH 66kV
PJT No.		10248704
Date of Tests		. . . ~ . . .

Technical Data

LPIT Type	XM1
Rated voltage	66/√3kV
Rated current	250A
Rated short-circuit breaking current	31.5kA
Rated frequency	50 Hz
Accuracy class for LPVT	0.5/3P
Accuracy class for LPCT	0.2S/5TPE

Factory Information

Place of Test	:	HYOSUNG Changwon Factory
Address	:	171, Yeonduk-ro, Seongsan-gu, Changwon-si, Gyeongsangnam-do, South-Korea

General

We certify that the above items have been inspected in compliance with the requirements of the customer.

Prepared by : M.S.KIM	Checked by : Y.C.YU	Approved by : Y.M.KIM

Applied Product

Bay Name	Serial Number			Test Date
	LPIT(convertor)		Merging Unit	
	main			
	back up			
	main			
	back up			
	main			
	back up			
	main			
	back up			
	main			
	back up			
	main			
	back up			
	main			
	back up			
	main			
	back up			

1. Design and Visual Check

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

Test Item	Result
Dimension is checked according to the approved drawings.	
Construction, indicator, painting & welding condition are inspected visually.	

2. Verification of markings

The below test items satisfied with approved specification and relevant standards.

Test Item	Result
Nameplate is checked according to the approved drawings.	
Terminal markings are checked according to the approved drawings.	

3. Power-frequency voltage withstand tests on primary terminals (With GIS)

The specified power frequency withstand voltage test has been performed successfully.

Test Item	Test Voltage [kV]	Test Duration [s]	Result
Primary terminals to Earth	140	60	

4. Partial Discharge Measurement (With GIS)

After the power frequency withstand voltage test, the quantity of partial discharges has been measured successfully.

Test Item	Test Voltage [kV]	Acceptance criteria [pC]	Measured Value [pC]	Result
Primary terminals to Earth	87	≤5		

5. Enclosure tightness test at ambient temperature (With GIS)

The LPIT is fully assembled with the GIS and tested simultaneously.

At least 6 hour later, it has been checked with gas detector.

SF6 Gas pressure [MPa.G] LPIT : 0.5

Test Duration [hr]	Acceptance Criteria	Measured	Result
6	Less than 0.5% per year		

6. MU test

- The below contents are checked whether the test objects are suitable according to approved specification and relevant standards.
- Refer to the attached <Appendix A>

6.1 Sampled value check

Test Item	Result
The Sampled Value checked that there were no errors in the data sets.	

6.2 Alarm check

Test Item	Result
Alarm, LED statue etc. condition are inspected visually.	

7. Power-frequency voltage withstand tests on secondary terminals & low-voltage components

- Refer to the attached <Appendix B>

8. Pressure Test for Enclosure

- Refer to the GIS test report.

9. Test for accuracy with MU

- Refer to the attached <Appendix C>

(END)

ROUTINE TEST REPORT FOR LPIT

Appendix C

Project Name : BASE LOAD POWER HUB (BLPH)

Rated Current : 250A Rated voltage : 66/√3kV

Bay Name : TEST DATE :

Result	Good/Fail	Reviewed by	

1. MAIN

App.	I/Ipr %	± ε Limit in %	Ratio error (ε) in %			± φe Limit in °	Phase error (φe) in °			Result	Remark
			L1	L2	L3		L1	L2	L3		
Metering	1	0.75				0.9					
	5	0.35				0.45					
	20	0.2				0.3					
	100	0.2				0.3					
	120	0.2				0.3					
Protection	100	1				1.8					

App.	U/Upr %	± ε Limit in %	Ratio error (ε) in %			± φe Limit in °	Phase error (φe) in °			Result	Remark
			L1	L2	L3		L1	L2	L3		
Metering	2	0.5				2.4					
	20	0.5				1.2					
Protection	2	0.5				2.4					
	20	0.5				1.2					

2. BACK UP

App.	I/Ipr %	± ε Limit in %	Ratio error (ε) in %			± φe Limit in °	Phase error (φe) in °			Result	Remark
			L1	L2	L3		L1	L2	L3		
Metering	1	0.75				0.9					
	5	0.35				0.45					
	20	0.2				0.3					
	100	0.2				0.3					
	120	0.2				0.3					
Protection	100	0.2				1.8					

App.	U/Upr %	± ε Limit in %	Ratio error (ε) in %			± φe Limit in °	Phase error (φe) in °			Result	Remark
			L1	L2	L3		L1	L2	L3		
Metering	2	0.5				2.4					
	20	0.5				1.2					
Protection	2	0.5				2.4					
	20	0.5				1.2					

Remark

I/Ipr : Test current / Rated primary current

U/Upr : Test voltage / Rated primary voltage