



HV Switchboard Maintenance for LNG/C



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Specialized Service for LNG Ships

KGS COVERS ALL SWBD MAKERS





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1. Introduction

With the experiences of more than 30 years worked for Hyundai Switchboard commissioning team, Korea Global Service can provide professional & suitable technical supports to our esteemed clients.

2. SWBD Service Scope

- Major Dock service (HV, LV, VCB, ACB, HiMAP, UPS and etc.)
- Additional Dock service (Renew Relay, DG control cable)
- Modification/Retrofit services (Arc Flash protection, ACB, Aconis)
- HiMAP reconditioning service (For HiMAP M/FI/T)

3. Estimation for Dock Service (QGTC LNG/C at NKOM Yard 2019)

Work scope	Working Period	Daily Service Rate	Estimation for service (USD)
VCB 41, VCB 16 HiMAP 6, UPS 6	3 S/E X 8 Days (With 2 yard engineers)	\$800/Person	19,200

- All the required spares to be supplied by shipowner
- The above estimation is an example only.
- Hotel & travel expenses/time to be added as per tariff



35% lower price than original maker

4. Major Dock Service

- 1) VCB Vacuum, Contact test.
- 2) Protection relay check and test.
- 3) ACB inspection and test.
- 4) Main Engine / E&I items general checks.
- 5) Battery Charger / UPS general check & discharge test.
- 6) Emergency Switchboard general inspection




Our service is not limited only for the Hyundai switchboard, but other maker's switchboard. Our team can do dry dock inspection for ACB, VCB, GCB from various makers including protection relay.


5. KGS Standard Procedure (For Electric Service at Dry Dock)

KGS Electric service is conducted based on standard procedure as per Hyundai & other international standard. Each components have a standard check procedure.



KOREA GLOBAL SERVICE CO., LTD



**ELECTRIC SERVICE
STANDARD PROCEDURE**



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KOREA GLOBAL SERVICE


STARNDARD PROCEDURE

(DRY DOCK SERVICE FOR ELETRIC ITEMS)

No.	Items	Page
E-01	HV SWITCHBOARD	1
E-02	HIGH VOLTAGE BREAKER (VCB)	2
E-03	PROTECTION RELAY	3
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E-06	TRANSFORMER	6
E-06-1	HV TRANSFORMER	7
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E-07	EM'CY SWITCHBOARD	9
E-08	ALTERNATOR	10
E-08-1	ALTERNATOR (MV/HV)	11
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E-08-3	EMERGENCY DIESEL GENERATOR	13
E-09	MAIN ENGINE & AUX ENGINE (Electrical Check)	14
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KOREA GLOBAL SERVICE CO., LTD INDEX


CHECK SHEET
E-01

HV SWITCHBOARD

Ship's Name	Item/Tag No
Equipment Description	Manufacturer
Location	Check date

Note: If necessary, use an empty space to add additional check items

NO	ITEMS TO BE CHECKED	STATUS
1	Visual check for any mechanical damage	
2	Switchboard internal clean and free of dust	
3	Confirm all cable connections are tight	
4	Confirm bus-bars connections are correctly torqued	
5	Confirm all removal carriages alignment and removal correct	
6	Confirm all doors aligned correctly and gaskets/seals are not damaged	
7	Confirm shutter operational and lockable	
8	Confirm switchboard protection relay function	
9	Confirm panel splice heater operation	
10	Confirm key interlock and the keys are fitted	
11	Confirm switchboard control and breakers interlock function	
12	Confirm Earthing switches interlock function	
13	Confirm switchboard earthing and bonding is correctly installed	
14	Perform insulation resistance test	

Test Points	Test Voltage	Measured Result
R-S	5 KV DC	MQ
R-T	5 KV DC	MQ
S-T	5 KV DC	MQ
R+S+T to Earth	5 KV DC	MQ

REMARKS


1

2

3

Checked by: _____

KOREA GLOBAL SERVICE CO.,LTD. CHECK SHEET E-01


CHECK SHEET
E-02

HIGH VOLTAGE BREAKER (VCB)

SWBD No	Duty
Manufacturer	Model / Type
Rating	Serial No
Operating counter	Control voltage
Manufacture Date	Test date

NO	ITEMS TO BE CHECKED	STATUS	
General check			
1	Clean the insulated surface with a dry cloth to remove dust and moisture		
2	Check the exterior for damage		
3	Check for loose bolts and nuts in the operating mechanism and the external parts		
4	Check stop ring and stop retainer for damage		
5	Check the connections between terminals and conducts		
Operation test			
1	Operate a few times manually and electrically and check for proper operation		
2	Check CLOSE/OPEN indicator and counter		
Insulation resistance measurement			
Phase	Test Points	Test Voltage	Measured Result
	R-S	1,000 VDC	MQ
	R-T	1,000 VDC	MQ
	S-T	1,000 VDC	MQ
	R+S+T to Earth	1,000 VDC	MQ
* Recommended value : >500MQ			
control circuit	Test Points	Test Voltage	Measured Result
	Control circuit to Earth	500 VDC	MQ
* Recommended value : >2MΩ			
Withstand voltage test			
	Test Points	Test Voltage	Leakage current
	R+S+T	28 KV / 1 Min	μA
Vacuum Interrupter			
1	Check the contact erosion (if more than half white mark is visible at closed condition, V.I should be replaced) - Note: Maximum permitted erosion is 3mm		
2	With the circuit opened, check vacuum degree (Use vacuum checker)		
	Result	Result	Result
	R	S	T
Lubrication			
1	Lubricate each part of operating mechanism		
2	Clean disconnection unit with a dry cloth and a small amount of grease (Conductive grease Lithium soap-based grease)		

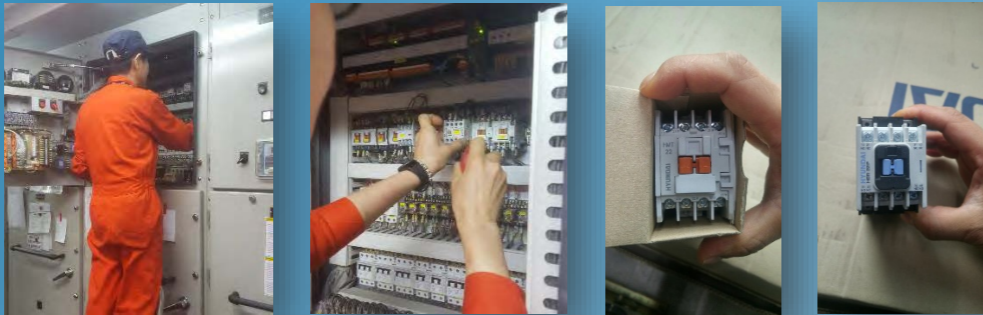
Checked by: _____

KOREA GLOBAL SERVICE CO.,LTD. CHECK SHEET E-02

6. Additional Dock service

1) Aux. Relay replacement

Considering life time 7~8 year, to replace the aux. relay in major panel at every 5 years dry dock would be most economical way to avoid unexpected accident.



KGS Experience: Maersk Container(2018)

Panel: No.1~4 DG, Bus tie, No.1,2 GPT, No.1,2&3 HV TR, Ref TR panel, B/T panel
 Relay Q'ty :125 (For Container)
 Service: 2S/E x 2 days (Rate \$800/day)
 Estimation: Relay \$3,000 + Service \$3,200 = \$6,200

2) DG Control cable replacement

We have previous experiences that there was deterioration of generator engine cable. Some D/G cables were already started deterioration as below photos. We replaced new cable and it was confirmed by ship's staff.



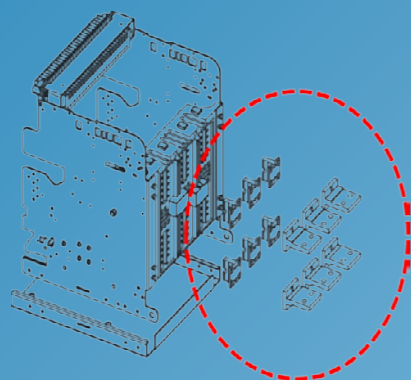
KGS Experience: Maersk Container(2018)

MAN 32/40 DG 4 sets Control Cable
 Cable Q'ty: 2Cx0.75SQ 250m, 3Cx0.75SQ 300m
 2Cx1.55SQ 150m, 5Cx0.75SQ 40m
 Service: 3S/E x 8days (Rate \$800/day)
 Estimation: Cable \$2,700 + \$19,200 = \$21,900

7. Modification & Retrofit service (I)

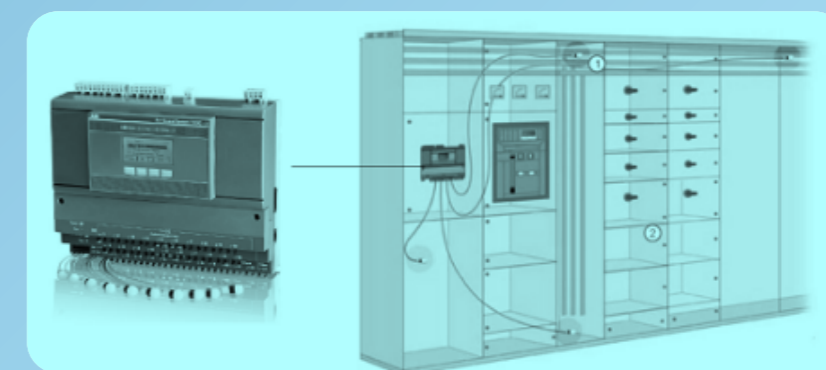
1) Old ACB(HiAN) retrofit to New type(HGN)

KGS has launched new retrofit service of HiAN to HGN type, without changing bus-bars within a day. This retrofit service extends to other maker's ACB, such as ABB, Terasaki & Schneider.



2) Arc Flash Protection Retrofit

KGS conducted retrofit project of Arc Flash Protection for LV Switchboard LNG vessels. By technical cooperation with ABB, KGS has completed project 8 vessels successfully. This retrofit prevents any possible fire accident derived from arc flash inside panel.



8. Modification & Retrofit service (II)

3) ACONIS Dock Maintenance, Retrofit

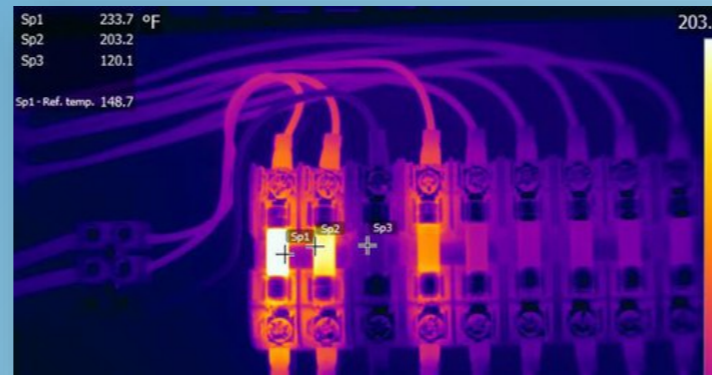
Dry dock maintenance: 1 S/E x 1 day (Rate: \$1,100/day)

- PC configuration, Inspection of workstation, data setting, function test BWTS, Scrubber Modification: 1 S/E x 2 days

- Add power request and PMS function, AMS display modification

4) SWBD Thermography Inspection

KGS engineer has trained by FLIR official program and can provide special inspection for maintenance. Thermographic inspections are conducted while the electrical system is on load. (Rate: \$1,100/day)

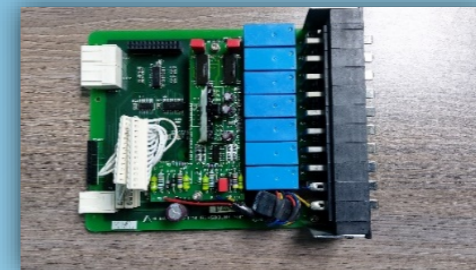


SERVICE REPORT		FORM NO.	
THERMOGRAPHIC SURVEY		KGS-E-30	
Ship's Name	Surveyor	Survey Date	
Thermography detailed exception report	Severity	Exceeds Fault Condition	
Location	Bridge Control Console	Fault Description	Localised Internal Heating
Equipment	Section 8	Fault Location	MCB 45Q2 - Main Body
Thermal Image		Digital Image	
Recorded Ambient: 22°C Recorded Reference: 37°C Recorded Anomaly: 78.7°C Recommendations: As a precaution please schedule to replace the MCB due to the increase in temperature.		Observation Notes: An increase in the temperature of the MCB.	
Thermography detailed exception report	Severity	Exceeds Fault Condition	
Location	Engine Room	Fault Description	Overheating Transformer
Equipment	Air Compressor Control Panel	Fault Location	Control Power Transformer
Thermal Image		Digital Image	
Recorded Ambient: 24°C Recorded Reference: 37°C Recorded Anomaly: 106°C Recommendations: Please schedule to replace the transformer.		Observation Notes: The temperature of the transformer continues to increase evident on the left side coil.	

9. HiMAP Maintenance Service

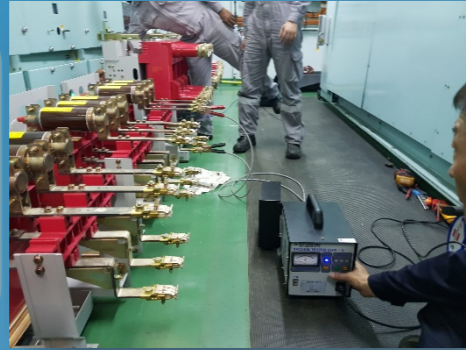
- HiMAP-M, T & FI: 6600V high voltage switchboard in Hyundai built LNG/C
- Customers Demands: High requests for repairing of HiMAP-M, T & FI and spare supply
- KGS service team: Rich service experience for HiMAP with competitive price
- SYMAP-BC/BCG complete: KGS provides SYMAP-BC/BCG as competitive price

- Spare Card List (HiMAP-M,T & FI)
 - Power Supply Unit: PWRM PCB (USD 550~)
 - Display Unit: VDF PCB (USD 200~)
 - Communication Card: CPM514 PCB
 - Main Board: RICM PCB Card & RPM PCB Card
 - Red Mark: Major spares requested by customers
 - Lead Time: 4~5 weeks

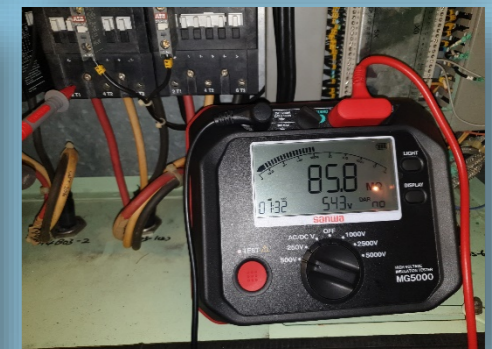
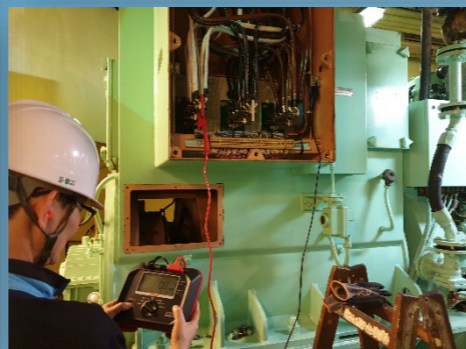


10. Service Experience (Sample Photos)

Mar.2019
NKOM Dock
Owner: QGTC
SWBD
Maintenance



June.2019
Keppel Dock
Owner: Maersk
SWBD
Maintenance



Apr.2019
NKOM Dock
Owner: QGTC
SWBD
Maintenance



11. Service Experience (Sample Report)

KOREA INTEGRATED MAINTENANCE PROVIDER
 • MAIN ENGINE : ME & MC TYPE MAN HYUNDAI, DOOSAN, STX
 • ELECTRIC SWITCHBOARD: 660V, LOW VOLT, HIMAP/SYMAP
 • DIG ENGINE : HISEN, MAN HOLEBY, WARTSILA
 • RCS/BMS : NABTESCO, KONGSBERG, ACONIS AMS/PMs
 • KOREA MKR : PUSNES DECK MC, HI-AIR A/C, KANGRIM BOILER
 • GENERAL REPAIRS : HULL, OUTFITTING, VDR, GYRO, GMDSS

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SERVICE REPORT

Ship Name	Al Mafyar	Date of report	30, Mar. 2019
Place	NKOM Shipyard	Reported by	Jaden Kim
Customer	QGTC (NAKILAT)	Work period	Mar.18~Mar.30
Subject	Dry Dock Maintenance	Reference No	

As requested by the ship-owner of QGTC (NAKILAT), Korea Global Service team attended the mentioned vessel for maintenance of the ship's electrical parts during vessel's dry docking at NKOM Shipyard in Quarter from Mar. 18. To Mar. 29, 2019.

All related scopes for maintenance and inspection were well carried out according to KGS standard maintenance procedure. For the detail service information, please refer to enclosed reports.

Scope of work

1. VCB and Vacuum Contactor inspection and test; 43ea
2. HIMAP check and test; 38ea
3. ACB inspection and test; 11ea
4. Main Engine / E&I items general checks included ECS UPS power supply.
5. Battery Charger / UPS general check & test; 7 sets
6. Emergency Switchboard general inspection

Work Period

18, Mar.~30, Mar. 2019

Note: Due to frequent changes in the ship's docking schedule, the waiting time longer, which delayed initial plan

Details of the work

Please refer to the enclosed check sheet for detailed results of each work.
 Pictures associated with each task were inserted in the report.

1.VCB & Vacuum Contactor inspection and test: 43 ea. (Refer to the attached report for more information).

1. Visual inspection and cleaning
2. Mechanical & electrical operation check.
3. Measurement of main contact resistance.
4. Insulation resistance test.
5. Vacuum Interrupter test.
6. Greasing for main contact.



5. Emergency Switchboard



CHECK SHEET				FORM NO.
HIGH VOLTAGE BREAKER (VCS)				KGS-E-04
SWBD Name	NO.1 HV CSBD(A-BUS)	Duty	NO.1 SOFT STARTER	
Manufacturer	HYUNDAI	Model / Type	HCA64CD	
Manufacture Date	2008	Serial No.	V508-02138	
Control Voltage	110V DC	Operating counter	842	
ITEMS TO BE CHECKED				STATUS
General check				
1.Clean the insulated surface with a dry cloth to remove dust and moisture.				OK
2.Check the exterior for damage.				OK
3.Check for loose bolts & nuts in the operating mechanism and the external parts.				OK
4.Check stop ring and stop retainer for damage.				OK
5 Check the connections between terminals and conducts.				OK
Operation test				
1.Operate a few times manually and electrically and check for proper operation.				OK
2.Check CLOSE/OPEN indicator and counter.				OK
Main contact resistance measurement				
R	S	T		
2.16 μΩ	2.12μΩ	2.16 μΩ		
Insulation resistance measurement				
Test Points	Test Voltage	Measured Result		
R-S	1000V DC	>4000 MΩ		
R-T	1000V DC	>4000 MΩ		
S-T	1000V DC	>4000 MΩ		
R+S+T to Earth	1000V DC	>4000 MΩ		
* Recommended value : >500MΩ				
Test Points	Test Voltage	Measured Result		
Control circuit to Earth	500V DC	>2000 MΩ		
* Recommended value : >2MΩ				
Vacuum Interrupter				
With the circuit opened, check vacuum degree. (Use vacuum checker)				
R	S	T		
Result: OK	Result: OK	Result: OK		
Lubrication				
1.Lubricate each part of operating mechanism.				OK
2.Clean disconnection unit with a dry cloth and a small amount of grease.				OK
Remarks : The VCS fuse installing 200A.				
Checked by : Jong-uk Shin				



12. KGS Technical Support

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MC/ME engine, general spares

PROMPT & POSITIVE SUPPORT