



# BALLAST WATER MANAGEMENT SYSTEM

Electro-Cleen™ System

## DRAWING FOR FINAL

SHIP YARD	:	K Shipbuilding Co., Ltd.
SHIP OWNER	:	Bank of Communications Financial leasing
SHIP TYPE	:	48.6K DWT, OIL TANKER
HULL NO.	:	S1940
CLASS	:	LR
TOTAL TRC (Treatment Rated Capacity)	:	1200 m³/h X 1SET
ECS MODEL	:	ECS-HYCHLOR 1200 X 1
REV.	:	0

DATE	DRAWN	REVIEWED	CHECKED	APPROVED
2024.04.15	I.S.KIM	J.J.KIM	H.S.JIN	Y.M.KIM

HULL NO.	S-1940	DWG. NO.	V5105000
TITLE	BALLAST WATER TREATMENT SYSTEM		

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## ABBREVIATION

ABBR.	FULL NAME
AFU	Auto Filter Unit
ANU	Auto Neutralization Unit
APU	Air Pump Unit
AV	Air Vent
BL	Blower
CLX	Chlorine Monitor
RDU	Remote Display Unit
CSU	Conductivity Sensor Unit
DMU	Degas Module Unit
DTU	Drain Tank Unit
EM	Electrode Module
Ex-	Explosive Proof type
FCV	Flow Control Valve
FMU	Flow Meter Unit
FS	Flow Switch
GDS	Gas Detection Sensor
GS	Gas Sensor
HMI	Human Machine Interface
HGU	Hypochlorite Generation Unit
HPM	Hypochlorite Power Module
HPU	Hypochlorite Power Unit
HTM	Hypochlorite Terminal Module
LCU	Local Control Unit
LS	Level Switch
PDM	Power Distribution Module

## ABBREVIATION

ABBR.	FULL NAME
PI	Pressure Indicator
PLC	Programmable Logic Controller
PMU	Pump Module Unit
PSU	Per Salinity Unit
PT	Pressure Transmitter
SMU	Static Mixer Unit
STU	Salt Tank Unit
TRO	Total Residual Oxidant
TSU	TRO Sensor Unit

## PLAN HISTORY

REV.	DATE	REVISION DESCRIPTION	PAGE
0	2022.09.23	SUBMITTED DRAWING FOR APPROVAL	-
A	2022.12.20	REVISED PNID / WIRING DIAGRAM	13-33
		DELETED DIMENSION FOR OPERATIONAL CLEARANCE DUE TO IN CASE OF HORIZONTAL TYPE DON'T REQUIRED	49
	2023.01.31	REVISED PNID	17,20,22,25,27
	2023.02.01	REVISED PNID	17,20,22,25,27
		ADDED THE SHORT PIECE DRAWING FOR Ex-DTU	88
B	2023.03.06	REVISED THE MODEL NAME (CPC → RDU)	2,6,8,163-168
		REVISED P&ID	14,16,19,21, 23,24,26
		REVISED WIRING DIAGRAM	29,33
		ADDED THE DRAIN VALVE SIZE OF NO.1 Ex-AFU	49
		REVISED THE POSITION OF J/B,G/B IN NO.1 Ex-FLUSHING PUMP	52,53
		REVISED THE DIMENSION OF I.S. BARRIER PANEL	58
		REVISED THE DIMENSION OF SMU	66
		REVISED THE FLANGE SIZE OF SV01,SV02	80
		ADDED THE HOLE TO PMU BASE PAD	111
		REVISED THE SWH DRAWING	144
		ROTATED NO.3 APU NAME PLATE	157
		ROTATED ACTUATOR OF AC01V VALVE	185
		REVISED WIRING DIAGRAM	28-31,33
C	2023.05.12	SUBMITTED DRAWING FOR WORKING	-
		REVISED P&ID / WIRING DIAGRAM	14,17,20,22, 25,27,32
		ADDED CONNECTION DIAGRAM	5,34-42
		REVISED THE NO.1 Ex-FLUSHING PUMP DRAWING	52
		REVISED THE NO.1 AFU CONTROL PANEL DRAWING	57
		REVISED THE TSU CONTROL PANEL DRAWING	75,76
		REVISED THE NO.2 AFU CONTROL PANEL DRAWING , ADDED THE JUNCTION BOX DRAWING FOR NO.2 AFU	5,102,103
		REVISED THE NO.2 FMU DRAWING	107
		REVISED THE PMU DRAWING, ADDED THE SWAY SUPPORT DRAWING	111,116-118
		ADDED THE NAME PLATE DRAWING	141,142,162
		REVISED THE ANU DRAWING	149,152,153
		REVISED THE LCU DRAWING	171
		REVISED THE AC01V,FCV01/02 DRAWING	183-187,189, 199,201
		REVISED THE MIXING S.W PUMP DRAWING, ADDED THE GAUGE BOAED DRAWING	190,191
		REVISED THE EWU DRAWING, ADDED THE EWU COVER PAGE	205,206,212,213
D	2023.06.19	REVISED P&ID	14,16,19,21, 23,26
		REVISED WIRING / CONNECTION DIAGRAM	32,41
		REVISED BWTS SKID CONCEPT DRAWING	232,233
E	2023.08.18	REVISED THE TEXT IN SAMPLING DETAIL DRAWING	14,18
		ADDED THE DIMENSION IN RDU DRAWING	164
		REVISED BWTS SKID CONCEPT DRAWING	232-235
0	2024.04.15	SUBMITTED DRAWING FOR FINAL	-

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# SYSTEM INFORMATION

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## (INTRODUCTION OF ECS-HYCHLOR™)

### 1.1 GENERAL INFORMATION

The purpose of a ballast water treatment system is to preserve the marine environment by preventing harmful sea organisms from migrating through ship's ballast water. Techcross inc. has developed and manufactured ECS-HYCHLOR™, a Ballast Water Treatment System, and its goal is to sterilize marine bio species that pose potential threats to oceanic ecosystem elsewhere.

The ECS-HYCHLOR™ System adopted disinfection technologies which combined the filtration and the electro chlorination and meets the requirements for approval of complete ballast water management system of USCG.

The ECS-HYCHLOR™ System consists of the filter unit, the electro chlorination unit, the neutralization unit and accessories.

### 1.2 PRINCIPLES OF DISINFECTION.

The ECS-HYCHLOR™ System was developed by TECHCROSS INC. to meet USCG's Requirements for ballast water management system. The ECS-HYCHLOR™ System consists of three main units as follows.

.1 The filter unit is mounted directly in the main ballast pipeline to eliminate the organisms and suspended matters larger than a particular size ( $50 \mu\text{m}$ ). the organisms and suspended matters collected on the filter unit are returned with the back-wash water to the ambient water by auto back-flushing function of the filter unit. During de-ballasting, the filter unit is bypassed.

.2 The electro-chlorination unit generate TRO (sodium hypochlorite) in situ by means of Electro-chlorination process only during ballasting to disinfect the rest of organisms after filtration by the filter unit. The in situ generation of the TRO comprises the following steps.

- The side stream of the ballasting water flows into the electro-chlorination unit to generate the concentrated TRO;
- The concentrated TRO is then injected to the main ballast line maintaining maximum concentration of 5.0 mg/L TRO as  $\text{Cl}_2$  to disinfect the rest of organisms.

The neutralization unit neutralizes the residual TRO by using sodium thiosulfate as the neutralizing agent before discharging to overboard during de-ballasting. The maximum allowable discharge concentration is 0.1 mg/L TRO as  $\text{Cl}_2$ .

# SYSTEM INFORMATION

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## (INTRODUCTION OF ECS-HYCHLOR™)

### 2. Introduction of Components

#### ● PMU

Pump Module sends sea water to the Electrode Module through the main pipeline by the pump. It is composed of pumps, conductivity sensor and pressure transmitter.

#### ● DMU

Degas Module dilutes and discharges H<sub>2</sub> gas, which can be generated during electrolysis, by an air vent valve and a blower.

#### ● HGU

HGU generates oxidants by the electro chlorination.

- Electrode Module : Electrode Module generates TRO by using inflow-sea water by the Electro-chlorination.

HGU, ANU and TSU are controlled and monitored by RS-485. If the system is out of control due to the communication failure during the operation, it is shut down after 1 min.

#### ● RDU

RDU helps to control and to monitor the system remotely.

#### ● LCU

LCU distributes the power and controls the system by HMI

HMI controls and monitors the ECS-HYCHLOR™ System. It controls other units (ex. ANU, TSH) by the communication of modbus RS-485.

The electric current of HPU as well as dosing rates of ANU and STU are controlled by following the control logic below. Please refer to 4.1.4 Ballast Flowchart and 4.2.4 De-ballast Flowchart for detailed control logic.

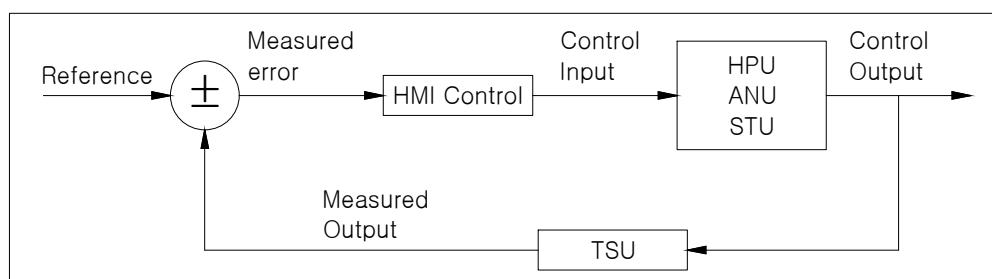


FIG.1 Closed control loop

# SYSTEM INFORMATION

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## (INTRODUCTION OF ECS-HYCHLOR™)

### **2. Introduction of Components**

#### **● ANU**

ANU doses neutralizing agent to maintain TRO concentration below 0.1mg/L during de-ballasting.

There are two tanks of neutralizing agent in case of emergency. Neutralizing agent is contained as 50% dissolved liquid. Dosing rate can be adjusted by using a metering pump (Max. 800ml/min)

PCL in ANU Controls the level of neutralizing agent tank, dosing rate of metering pump and Sol V/.

The control of metering pump and Sol V/V by PLC is controlled by LCU by the communication of RS-485.

If there is a communication failure with HMI, the operation stops after 1 min. automatically by PLC.

#### **● TSU**

TSU measures TRO concentration during ballasting and de-ballasting. PLC in TSU controls the power of CLX and Sol V/V select sampling port. It also monitors measurement reading of CLX.

TSU is controlled by HMI. HMI and PLC are connected with modbus RS-485. If there is a communication failure with HMI, the operation stops after 1 min. automatically by PLC.

#### **● STU**

Adding salt water to increase the conductivity to facilitate electrolysis during fresh water treatment.

#### **● AFU**

Removing particles >50µm during ballasting, The head loss by filter is below 0.1 bar, which is negligible.

## GENERAL INFORMATION

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(SPECIFICATION OF ECS-HYCHLOR™)

ITEM	SPECIFICATION
Biological Efficacy	Compliance with D-2 performance standard regulated by IMO & USCG
Operation Performance	Less than TRO 5.0 mg/L
Neutralization Performance	Less than TRO 0.1 mg/L after neutralization before discharging
Neutralization Method	Automatic input of Neutralization solution
Neutralizing Agent	Sodium Thiosulfate
Operation Method	Automatic (Remote / Local) operation by LCU / RDU
Operation S/W	HMI(Human Machine Interface)
TRC	1200 m³/hr
Salinity	No Limit (If salinity is below 8PSU, sea water contained in the APT tank of vessel is used for the electrolysis, or highly concentrated electrolyte is injected from STU or mixing solution to maintain 8PSU for the operation.)
Temperature (Amb.)	0°C ~ +55°C
Humidity	Max. 95%
Temperature (water)	Above 2.5°C
Power consumption	HGU : Max 5.2kW/100m³ (sea water: 4kW/100m³) Total : Abt. 82 kW

## SYSTEM INFORMATION

(DIMENSION & SCOPE OF SUPPLY)

ITEM	COMPONENT	SPECIFICATION	DIMENSION (mm)			WEIGHT UNIT(kg)	Q'TY (SET)	WEIGHT TOTAL(kg)	MAKER SUPPLY	SHIPYARD SUPPLY
			W	D	H					
1	Ex-AFU (Ex-Auto Filter Unit)		3478	1331	1300	1255	1	1255	0	-
2	Ex-FLUSHING P/P		440	416	838.5	63	1	63	0	-
3	EX-AFU LOCAL CONTROL PANEL		580	210.5	740	49	1	49	0	-
4	Ex-FMU (Ex- Flow Meter Unit)	JIS 5K 300A	500	430	632	55	1	55	0	-
5	SMU (Static Mixer Unit)		766	369	794	126	1	126	0	-
	Ex-TSU 1.1 (Ex-TRO Sensor Unit)		-	-	-	-	-	-	0	-
	- TSU CONTROL PANEL		570	279	885	50	1	50	0	-
	- CLX-Ex2 (Ex-CLX ONLINE RESIDUAL CHLORINE MONITOR)		434	242	623	28	2	56	0	-
6	- REGULATOR & SEPARATOR BOARD		218	300	89	1	1	1	0	-
	- SOLENOID VALVE ASSY		80	80	280	2	2	4	0	-
	- Ex-APU (Ex-Air Pump Unit)	JIS 10K 15A	410	180	277	8	2	16	0	-
	- FILTER REGULATOR BOARD		190	116	180	2	2	4	0	-
	- Ex-DTU (Ex-Drain Tank Unit)		700	630	760	60	1	60	0	-
7	Diaphragm Valve	JIS 5K 50A	192	130	228	-	2	-	0	-
8	AFU (Auto Filter Unit)		804	617	1199	270	1	270	0	-
9	AFU CONTROL PANEL		300	120	300	-	1	-	0	-
10	IS-BARRIER PANEL		460	153.4	445	22	1	22	0	-
	- APU (Air Pump Unit)	JIS 10K 15A	410	180	277	8	1	8	0	-
11	- FILTER REGULATOR BOARD		190	116	180	2	1	2	0	-
12	FMU (Flow Meter Unit)	JIS 10K 40A	200	201	327	7	1	7	0	-
13	PMU(Pump Module Unit)		1336.5	743	1333	91	1	91	0	-
14	S.V. HEATER		1524	354	450	125	1	125	0	-
15	HGU (Hypochlorite Generation Unit)		1670	1519	1545	1120	1	1120	0	-
16	DMU(Degas Module Unit)		2016	1016	2331.5	1050	1	1050	0	-
17	ANU-05T 1.1 (Auto Neutralization Unit)		800	733	1655	220	1	220	0	-
	PIPING BETWEEN NEUTRALIZATION SYSTEM TO BALLAST PIPE LINE		-	-	-	-	1	-	-	-
18	GDS (Gas Detection Sensor)		164	99	225	2	3	6	0	-

**SYSTEM INFORMATION**  
**(DIMENSION & SCOPE OF SUPPLY)**

ITEM	COMPONENT	SPECIFICATION	DIMENSION (mm)			WEIGHT UNIT(kg)	Q'TY (SET)	WEIGHT TOTAL(kg)	MAKER SUPPLY	SHIPYARD SUPPLY
			W	D	H					
19	CPC 2.0 (Control PC)		480	119	660	30	1	30	0	-
20	LCU (Local Control Unit)		900	324	1500	200	1	200	0	-
21	HTM (Hypochlorite Terminal Module)		970	300	1650	250	1	250	0	-
22	PDM-A (Power Distribution Module)		750	200	805	50	1	50	0	-
23	HPU (Hypochlorite Power Unit)		720	870	1600	320	1	320	0	-
24	Mixing Sea Water Pump		250	210	686	39	1	39	0	-
25	FOV01 (Flow Control Valve)	JIS 10K 50A	-	-	-	28.2	1	28.2	0	-
26	FOV02 (Flow Control Valve)	JIS 10K 50A	-	-	-	28.2	1	28.2	0	-
27	AC01V	JIS 10K 50A	-	-	-	1	-	0	-	-
28	EWU (Electrode module Washing Unit)		620	790	1550	84	1	84	0	-
29	SPARE PART		-	-	-	-	-	-	0	-
30	ALL INSTALLATION WORKS		-	-	-	-	-	-	0	-
31	TEST OPERATION ONBOARD		-	-	-	-	-	-	0	-
32	CABLE TRAY FOR ECS		-	-	-	-	-	-	0	-
33	INTERFACE CABLE FOR ECS		-	-	-	-	-	-	0	-
34	CABLE WIRING WORK FOR ECS		-	-	-	-	-	-	0	-
35	ECS MANUAL		-	-	-	-	-	-	0	-
						TOTAL		5691 kg		

## ECS COMPONENTS LIST

LOCATION	ITEM	DESCRIPTION	CONNECTION SIZE
PUMP ROOM	Ex	Explosive proof Type	
	Ex-AFU	Ex-Auto Filter Unit	INLET/OUTLET DIN PN10-DN400, DRAIN : Ø25
	Ex-APU	Ex-Air Pump Unit	INLET/OUTLET FLANGE JIS 10K-15A (AIR LINE Ø12/Ø10)
	DTU	Drain Tank Unit	INLET/OUTLET FLANGE JIS 5K-15A
	Ex-FMU	Ex-Flow Meter Unit	INLET/OUTLET FLANGE JIS 5K-300A
	SMU	Static Mixer Unit	INLET/OUTLET FLANGE JIS 5K-400A
	Ex-TSU	Ex-TRO Sensor Unit	INLET/OUTLET SUS TUBE Ø12 (DRAIN SUS316L TUBE Ø10)
	AFU	Auto Filter Unit	INLET/OUTLET DIN PN10-DN180, DRAIN : Ø25
	ANU	Auto Neutralization Unit	INLET/OUTLET SUS TUBE Ø12 (DRAIN SUS316L TUBE Ø10)
	APU	Air Pump Unit	INLET/OUTLET FLANGE JIS 10K-15A (AIR LINE Ø12/Ø10)
ENGINE ROOM	AV	Air Vent	NON PIPE CONNECTION
	BL	Blower	NON PIPE CONNECTION
	DMU	Degas Module Unit	INLET/OUTLET FLANGE JIS 10K-50A
	DTU	Drain Tank Unit	INLET/OUTLET FLANGE JIS 5K-15A
	FMU	Flow Meter Unit	INLET/OUTLET FLANGE JIS 10K-40A
	FS	Flow Switch	NON PIPE CONNECTION
	GDS	Gas Detection Sensor	NON PIPE CONNECTION
	GS	Gas Sensor	NON PIPE CONNECTION
	HGU	Hypochlorite Generation Unit	INLET/OUTLET FLANGE JIS 10K-50A
	HPU	Hypochlorite Power Unit	NON PIPE CONNECTION
	HTM	Hypochlorite Terminal Module	NON PIPE CONNECTION
	LCU	Local Control Unit	NON PIPE CONNECTION
	LS	Level Switch	NON PIPE CONNECTION
	PDM	Power Distribution Module	NON PIPE CONNECTION
	PMU	Pump Module Unit	INLET/OUTLET FLANGE JIS 10K-40A
	RDU	Remote Display Unit or Control PC	NON PIPE CONNECTION
	SMU	Static Mixer Unit	INLET/OUTLET FLANGE JIS 5K/10K-200A
	TSU	TRO Sensor Unit	INLET/OUTLET SUS TUBE Ø12 (DRAIN SUS316L TUBE Ø10)
	MIXING	Mixing S.W. Pump	INLET/OUTLET FLANGE JIS 16K-25A
	SWH	Flow Control Valve	INLET/OUTLET FLANGE JIS 10K-50A
	SWH	Sea Water Heater	INLET/OUTLET FLANGE JIS 10K-65A (STEAM LINE 10K-50A)

## SYMBOL

ITEM	DESCRIPTION	ITEM	DESCRIPTION
★	MAKER (TECHCROSS) SUPPLY	Y	SCUPPER
☒	BUTTERFLY VALVE	☒	PRESS REGULATOR
☒(OPEN/SHUT)	REMOTE BUTTERFLY VALVE	☒	LIMIT SWITCH
☒(THROTTLING)	REMOTE BUTTERFLY VALVE	☒	BLOWER
☒	GLOBE VALVE	☒	PRESSURE TRANSMITTER
☒	CHECK VALVE	☒	COMPOUND INDICATOR
☒	CHECK VALVE WITHOUT HANDLE	☒	LEVEL SWITCH
☒	BALL VALVE	☒	LOCKING DEVICE
☒	DIAPHRAGM VALVE	☒	PRESSURE INDICATOR
☒	ANGLE VALVE	☒	PRESSURE SWITCH
☒	SOLENOID VALVE	☒	AIR VENT VALVE
☒	QUICK-CLOSING VALVE	☒	HOPPER
☒	PRESSURE REDUCING VALVE	☒	MOTOR
☒	FILTER FLUSHING VALVE	☒	AIR VENT
☒	AIR RELEASE VALVE	☒	CPVC PIPE LINE
+	CROSSING PIPES CONNECTED	---	PE COATING PIPE LINE
☒	CROSSING PIPES NOT CONNECTED	---	PIPE LINE WITH INSULATION
—	BRANCH PIPES	☒	STEAM TRAP
—	TEE PIECE (FLANGE END)		
—	REDUCER		
☒	EDUCTOR		
—	BLIND FLANGE		
—	CLOSED PIPE CONNECTION		
—	BOSS WITH BLANK FLANGE		
○	PUMP		
☒	STRAINER		
↑	Y-STRAINER		
↑	SIGNAL		

**⚠** THE DRAWING IS BASED ON THE POS AND MAKER STANDARD,  
IF ANY ADDITIONAL EQUIPMENT IS REQUIRED BY SHIPYARD OR SHIP'S OWNER REQUIREMENTS  
THE EXTRA COST CAN BE OCCURED.

## HISTORY OF P&ID FOR BWTS

DATE	REV.	REVISION DESCRIPTION	DSGN	CHKD	APPD
24.04.11	0	PREPARED FOR APPROVAL.	M.H.LEE	E.K.OH	S.J.LEE

# NOTE OF P&ID FOR BWTS

## 1. SYSTEM

1) VALVE SIGNAL IS USED TO OPERATE ECS-HYCHLOR SYSTEM.

## 2. G-2 SAMPLING PORT

1) G-2 SAMPLING PORT SHALL BE COMPLIED WITH IMO REGULATION.  
2) G2 SAMPLING PORT(S) MUST BE PLACED AT HORIZONTAL OR UP-STREAM OF VERTICAL MAIN BALLAST WATER PIPE. IT SHALL NOT BE INSTALLED AT THE DOWN-STREAM OF VERTICAL MAIN BALLAST WATER PIPE.

## 3. TSU

1) TSU SAMPLING PIPE(BETWEEN TSU AND SAMPLING PORT) TO BE ARRANGED AS SHORT AS POSSIBLE(WITHIN 10M).  
2) TSU SAMPLING PORT(S) MUST BE PLACED AT HORIZONTAL OR UP-STREAM OF VERTICAL MAIN BALLAST WATER PIPE. IT SHALL NOT BE INSTALLED AT THE DOWN-STREAM OF VERTICAL MAIN BALLAST WATER PIPE.  
3) KEEP MIN' 5D INSTALLATION POSITION DISTANCE BETWEEN TSU PORT AND ANU PORT.  
4) THE LEVEL OF AIR PUMP UNIT OF TSU SHOULD BE SAME AS OR LOWER THAN TSU SAMPLING PORT(S) FOR PROPER SAMPLING.  
5) THE VALVE OF TSU SAMPLING LINE SHOULD BE ARRANGED NEAR TSU FOR EFFICIENT OPERATION. (THE POSITION FOR CHECKING EASY WHEN SHIP'S CREW OPERATE)  
6) THE MATERIAL FOR PIPE AND VALVE OF TSU SAMPLING LINE SHOULD BE SUS316L.

## 4. ANU

1) IF ANU DOSING LINE IS FAR(ABT.10M) FROM THE ANU, THE "PREPARATION" BUTTON IN ANU ICON OF HMI SHALL BE CLICKED BY THE CREW TO FILL THE NEUTRALIZING AGENT IN THE DOSING LINE.  
2) ANU INJECTION PORT(S) MUST BE PLACED AT HORIZONTAL OR UP-STREAM OF VERTICAL MAIN BALLAST WATER PIPE. IT SHALL NOT BE INSTALLED AT THE DOWN-STREAM OF VERTICAL MAIN BALLAST WATER PIPE.  
3) KEEP MIN' 5D INSTALLATION POSITION DISTANCE BETWEEN TSU PORT AND ANU PORT.  
4) THE VALVE (AN05V) OF ANU INJECTION PIPE SHOULD BE ARRANGED NEAR ANU FOR EFFICIENT OPERATION. (THE POSITION FOR CHECKING EASY WHEN SHIP'S CREW OPERATE)  
5) IN CASE OF EACH OF THE ANU INJECTION PIPE IS CONNECTED TO ONE, THIS SHOULD BE INCLINED AS SHOWN IN THE DETAIL "D". (IF NECESSARY)  
6) F.W.TEMPERATURE TEMP' : MIN.15 °C, H.W.TEMPERATURE : MIN.50 °C.  
7) THE MATERIAL FOR PIPE AND VALVE OF ANU SUPPLY LINE SHOULD BE SUS316L.

## 5. GDS

1) GDS SHOULD BE INSTALLED ABOVE HGU OUTLET FLANGE AND DMU OUTLET FLANGE.  
2) GDS SHALL BE PROVIDED BY MAKER, BUT THE INSTALLATION WORK SHALL BE CARRIED OUT BY YARD.

## 6. DO NOT USE RUBBER GASKET(Ex : NBR) WHEN THE EQUIPMENT INSTALL . (ONLY FOR PE COATING LINE)

## 7. DTU, DMU

1) THE AREA WITHIN 3 METERS (10 FEET) AROUND THE VENT OUTLET IS TO BE HAZARDOUS AREA.  
2) FLANGE JOINT SHALL BE APPLIED ON MAIN BRANCH CONNECTION ONLY AND WELDING JOINT (e.g. BUTT WELDING OR SLEEVE WELDING) SHALL BE APPLIED. (SPECIALLY, DMU VENT : BUTT WELDING)  
3) ARRANGEMENT OF VENT PIPES SHALL BE ASCENDING.

## 8. AUTO FILTER UNIT(AFU)

1) FILTER OUTLET PIPE SHOULD BE ARRANGED HIGHER THAN FILTER IN ORDER TO KEEP FULL WATER INSIDE FILTER.  
2) FILTER OUTLET PRESSURE SHOULD BE APPLIED MIN.1.5BAR.  
  
3) FILTER INLET V/V SHOULD BE APPLIED FOR REMOTE CONTROL V/V. (AT LEAST 3 SECONDS PER INCH OF VALVE OUT DIAMETER.)

## 9. EWU

1) FRESH WATER SUPPLY LINE AND DRAIN CONNECTION LINE FOR EWU(EM WASHING UNIT) SHOULD BE ARRANGED WITHIN APPROXIMATELY 3 METER AROUND HGU.  
2) THE USED EM CLEANING WATER CONTAINING CHEMICAL AGENT SHOULD BE STORED IN EWU TANK AND DISCHARGED AT SEA MORE THAN 12 NAUTICAL MILES AND 25M IN DEPTH.

## 10. SMU

1) SMU MUST BE PLACED AT HORIZONTAL OR UP-STREAM OF VERTICAL MAIN BALLAST WATER PIPE.  
IT SHALL NOT BE INSTALLED AT THE DOWN-STREAM OF VERTICAL MAIN BALLAST WATER PIPE.

## 11. SIDE STREAM LINE

FMU SHALL BE IMMERSSED AT ALL IN ALL CONDITIONS.

## 12. [SEA WATER HEATING SOLUTION]

IF SEA WATER IS BELOW 2.5 DEGREE CELSIUS,  
HGU FEED WATER CAN BE SUPPLIED

13. THE CAPACITY & CONNECTION SIZE OF FMU AND SMU WILL BE ADJUSTED ACCORDING TO THE FLOW RATE CONDITION OF SHIP'S SPECIFICATION.

14. IF THE EX-TYPE HYCHLOR IS INSTALLED UNDER THE CONDITION THAT THE A.P.TK IS VOID, THE OPTIONAL FILTER WILL BE APPLIED TO THE DEDICATED S.W.HOLDING TANK(NOT W.B.TK) USED FOR MIXING SOLUTION. (FOR OPERATION OF BELOW 8PSU WATER)

## [MIXING OPERATION]

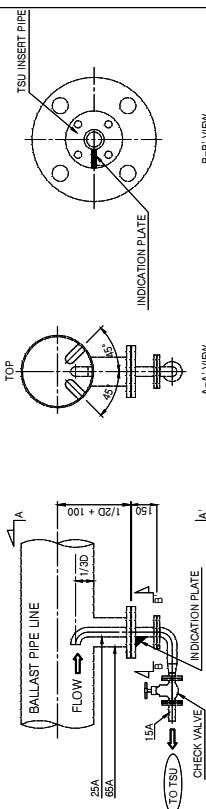
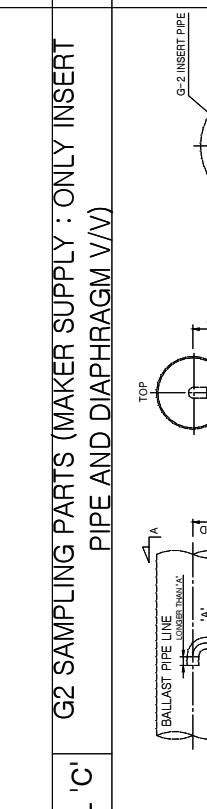
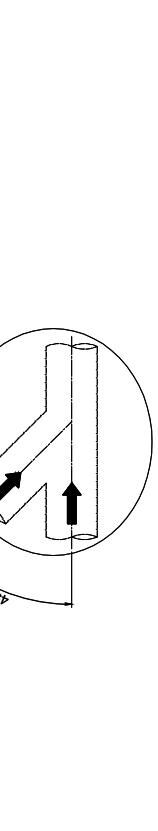
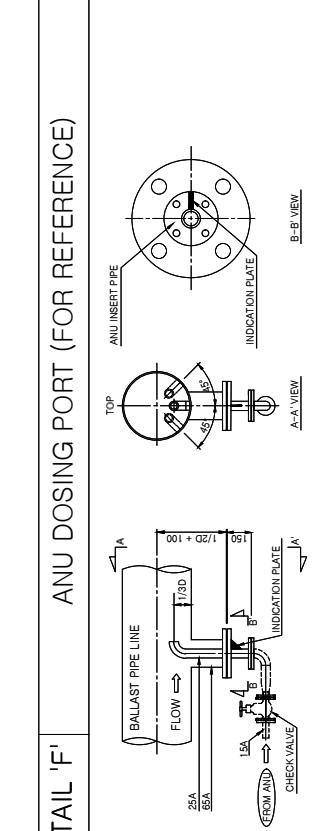
1) THE VOLUME OF SEA WATER HOLDING TANK SHALL BE MINIMUM 0.25% OF TOTAL BALLASTING CAPACITY.  
[S.W.(34.7 PSU):0.25% + F.W.(0 PSU):0.75 % = MIXING (8.5 PSU):1%]  
2) IF A.P.TK IS USED FOR MIXING SEA WATER HOLDING TANK,  
· IN VIEW OF SUCTION CAPABILITY AT RATED FLOW RATE,  
THE SUCTION CENTER OF MIXING PUMP SHOULD BE POSITIONED LOWER THAN THE LEVEL OF BOTTOM PLATE OF A.P.TK.  
3) IF ONE OF W.B.TK IS USED FOR MIXING SEA WATER HOLDING TANK,  
· AIR EJECTOR AT MIXING S.W.PUMP SHALL BE ADDITIONALLY APPLIED. (MAKER SCOPE)  
4) IN SEA WATER HOLDING TANK, THE SEA WATER SHOULD BE FILLED WITH FILTERED WATER THROUGH AFU IN ADVANCE.  
IN CASE OF THAT E/R BALLAST LINE DOESN'T HAVE FILTER(NON EX-TYPE), ADDITIONAL SMALL FILTER (No.2 AFU) SHOULD BE APPLIED TO HOLD THE FILTERED SEA WATER.

## [CONSIDERATIONS FOR ON-DECK ROOM.]

1) IF THE AMBIENT TEMPERATURE IS BELOW 0°C, THE TEMPERATURE OF THE ON-DECK ROOM SHOULD BE MAINTAINED BETWEEN 0°C AND 55°C USING THE SHIP'S HEATING SYSTEM.  
2) INSTALL EXHAUST FAN(EX-TYPE) ACCORDING TO CLASS RULES, AND AIR SHOULD BE EXCHANGED FOLLOWING CLASS RULE.

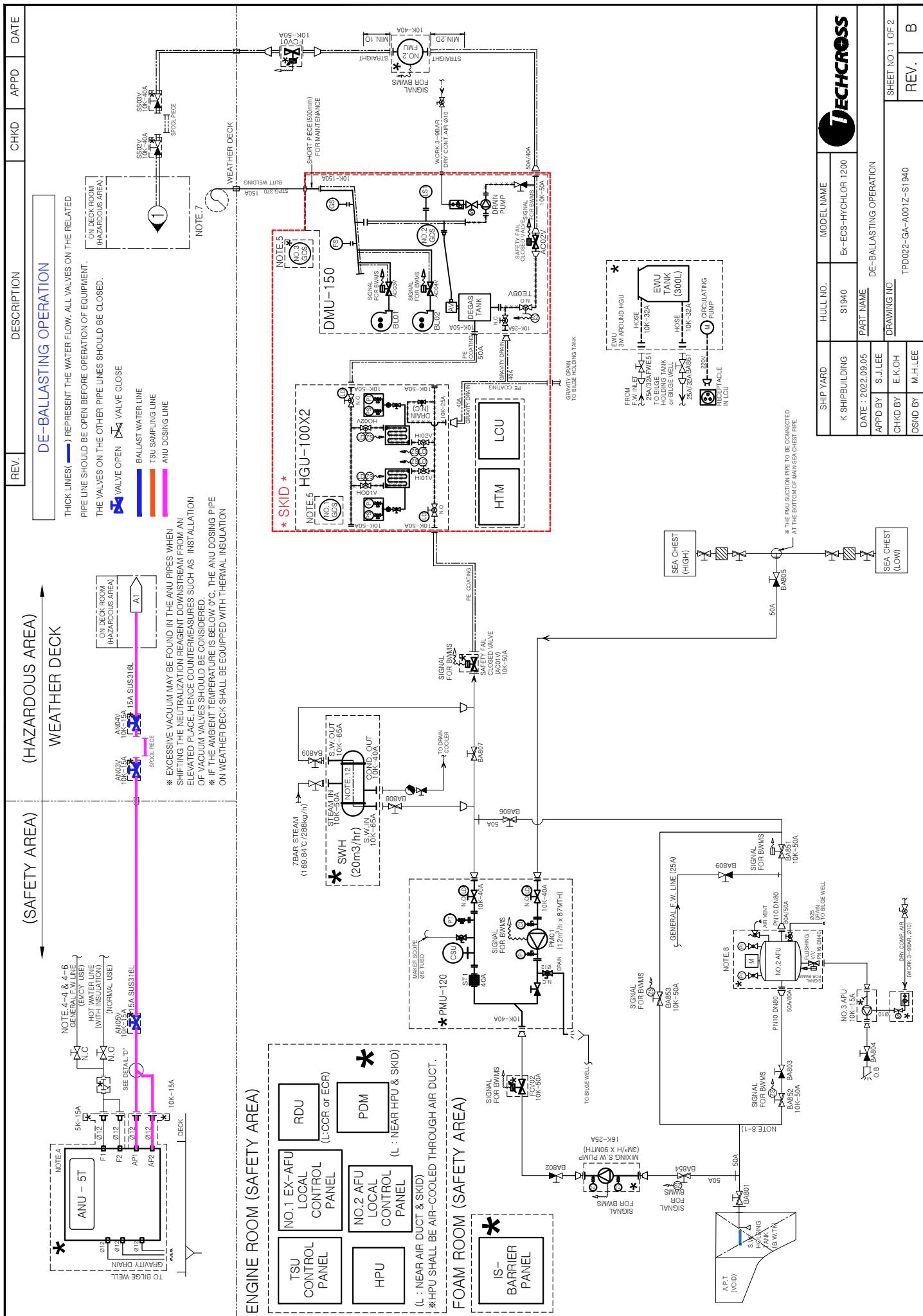




DETAIL 'A'	TSU(TRO) SAMPLING PARTS (MAKER SUPPLY : ONLY INSERT PIPE)	DETAIL 'B'	HGU INJECTION PARTS (MAKER SCOPE)																																
	 <p><b>DETAIL 'A'</b></p> <p>TSU SAMPLING PORT SHOULD BE INSTALLED AT THE BOTTOM OF BALLAST PIPE LINE. * INDICATION PLATE AND 'INSERT PIPE' SHOULD BE INSTALLED IN THE SAME DIRECTION.</p>	 <p><b>DETAIL 'B'</b></p> <p>* SUU MUST BE PLACED AT HORIZONTAL OR UP-STREAM OF VERTICAL MAIN BALLAST WATER PIPE. IT SHALL BE NOT BE INSTALLED AT THE DOWN-STREAM OF VERTICAL MAIN BALLAST WATER PIPE.</p>	 <p><b>DETAIL 'C'</b></p> <p>* WHEN THE SIZE OF G-2 SAMPLING PORT PIPE IS 50A, THE SIZE OF BRANCH PIPE FROM BALLAST PIPE LINE SHOULD BE MORE THAN 150A. * MAIN PIPE OF UNDERSIDE CONNECTION. * 'INDICATION PLATE AND 'INSERT PIPE' SHOULD BE INSTALLED IN THE SAME DIRECTION.</p>																																
		 <p><b>DETAIL 'D'</b></p> <p>PIPE CONNECTION PARTS</p>	 <p><b>DETAIL 'F'</b></p> <p>ANU DOSING PORT (FOR REFERENCE)</p>																																
			<table border="1"> <tr> <td>SHIP YARD</td> <td>HULL NO.</td> <td>MODEL NAME</td> <td><b>TECHCROSS</b></td> </tr> <tr> <td>K SHIPBUILDING</td> <td>S1940</td> <td>EX-ECS-HYCHLOR 1200</td> <td></td> </tr> <tr> <td>DATE / 2022/09/05</td> <td>PART NAME</td> <td>SAMPLING DETAIL DRAWING</td> <td></td> </tr> <tr> <td>APPD BY S.J.LEE</td> <td>DRAWING NO.</td> <td></td> <td></td> </tr> <tr> <td>CHRD BY E.KOH</td> <td></td> <td></td> <td></td> </tr> <tr> <td>DSND BY M.H.LEE</td> <td>TPD022-GA-A001Z-SAMPLING DWG-HYCHLOR</td> <td></td> <td></td> </tr> <tr> <td></td> <td>REV. A</td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td>SHEET NO. 1 OF 1</td> <td></td> </tr> </table>	SHIP YARD	HULL NO.	MODEL NAME	<b>TECHCROSS</b>	K SHIPBUILDING	S1940	EX-ECS-HYCHLOR 1200		DATE / 2022/09/05	PART NAME	SAMPLING DETAIL DRAWING		APPD BY S.J.LEE	DRAWING NO.			CHRD BY E.KOH				DSND BY M.H.LEE	TPD022-GA-A001Z-SAMPLING DWG-HYCHLOR				REV. A					SHEET NO. 1 OF 1	
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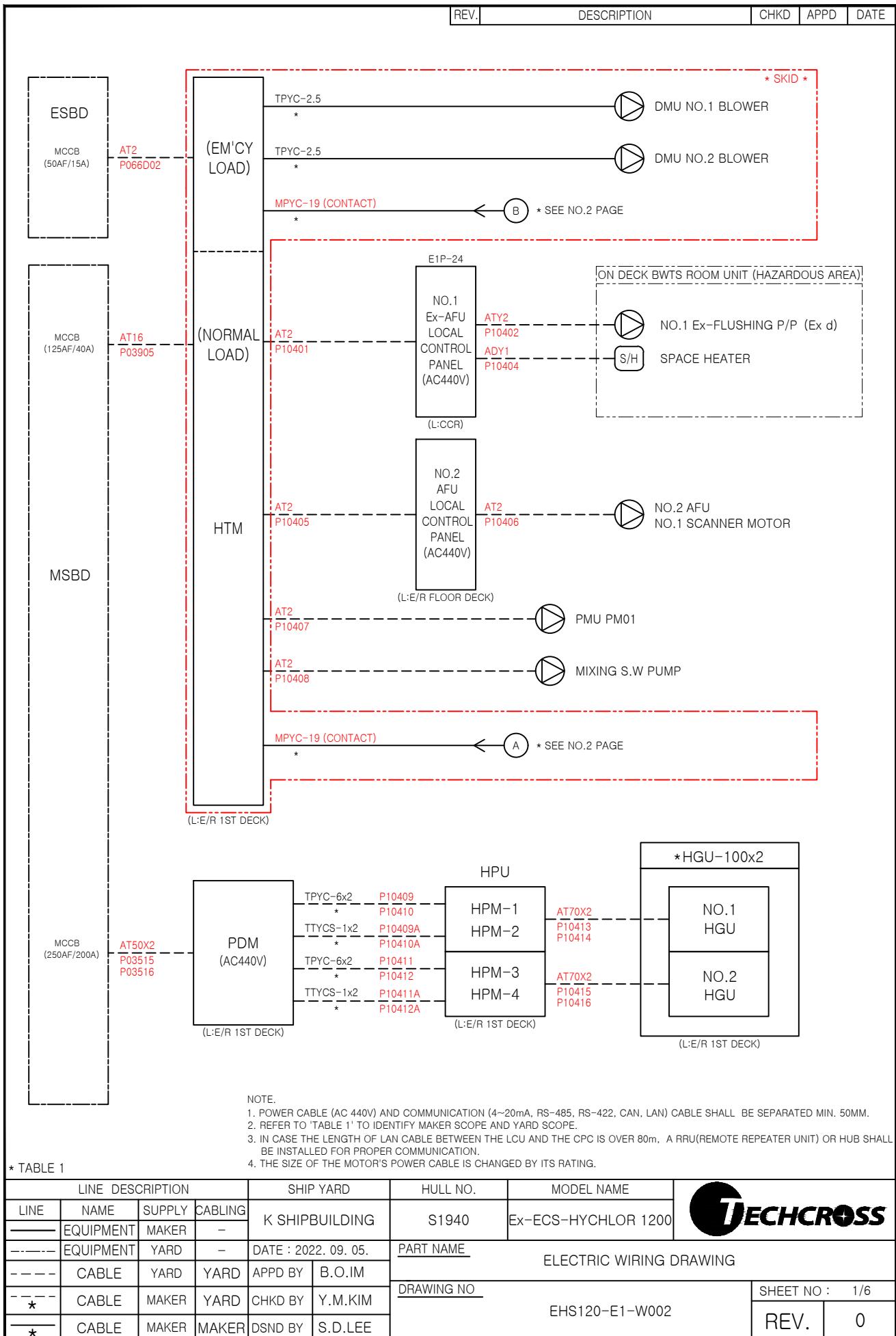


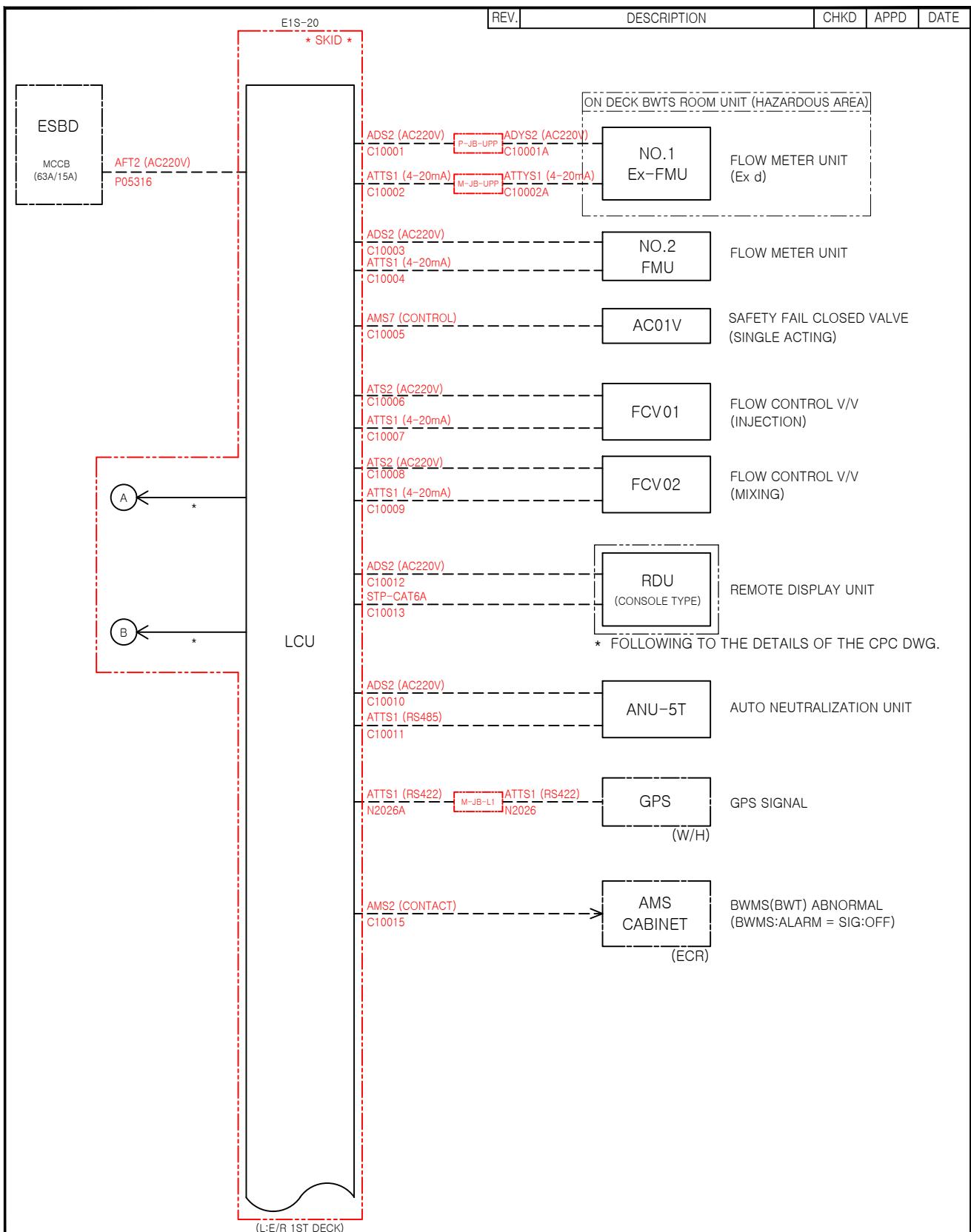




REV.	DESCRIPTION	CHKD	APPD	DATE
	<b>STRIPPING OPERATION</b>			
<p>THICK LINES (—) REPRESENT THE WATER FLOW, ALL VALVES ON THE RELATED PIPE LINE SHOULD BE OPEN BEFORE OPERATION OF EQUIPMENT. THE VALVES ON THE OTHER PIPE LINES SHOULD BE CLOSED.</p> <p> VALVE OPEN     VALVE CLOSE</p> <p> BALLAST WATER LINE     TSU SAMPLING LINE     ANU DOSING LINE     DRIVING WATER LINE(FOR EDUCTOR)</p> <p>NOTE 7</p>				
<p>* EXCESSIVE VACUUM MAY BE FOUND IN THE ANU PIPES WHEN SHIFTING THE NEUTRALIZATION REAGENT DOWNTWIST FROM AN ELEVATED PLACE, HENCE COUNTERMEASURES SUCH AS INSTALLATION OF VACUUM VALVES SHOULD BE CONSIDERED.</p> <p>* IF THE AMBIENT TEMPERATURE IS BELOW 0°C, THE ANU DOSING PIPE ON WEATHER DECK SHALL BE EQUIPPED WITH THERMAL INSULATION</p>				
<p>(SAFETY AREA)</p>				
<p>(HAZARDOUS AREA)</p>				
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<p><b>ENGINE ROOM (SAFETY AREA)</b></p>				
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<p><b>WEATHER DECK (HAZARDOUS AREA)</b></p> <img alt="Schematic diagram of the weather deck hazardous area showing connections between ANU-5T, RDU, PDM, TSU, HPU,				

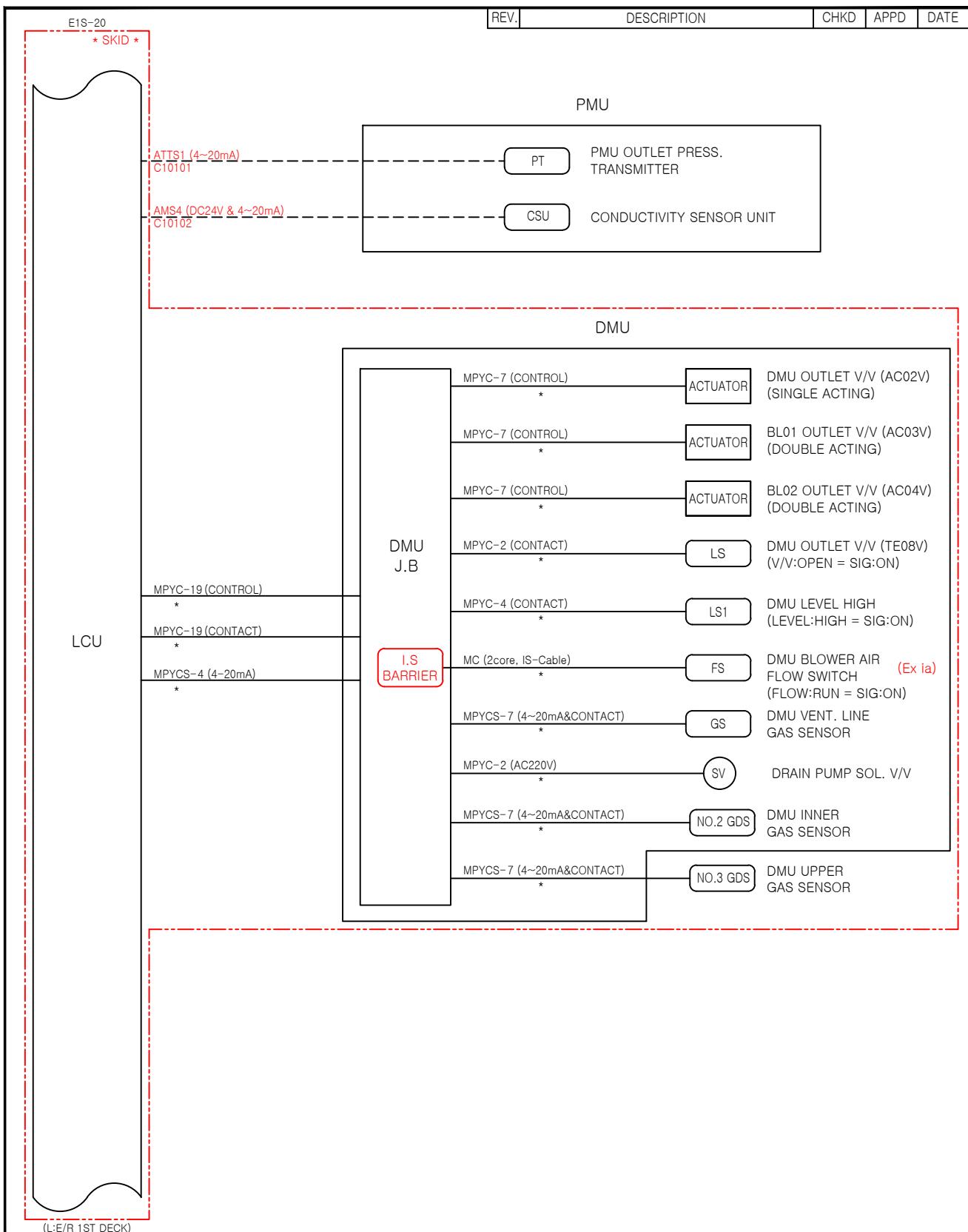






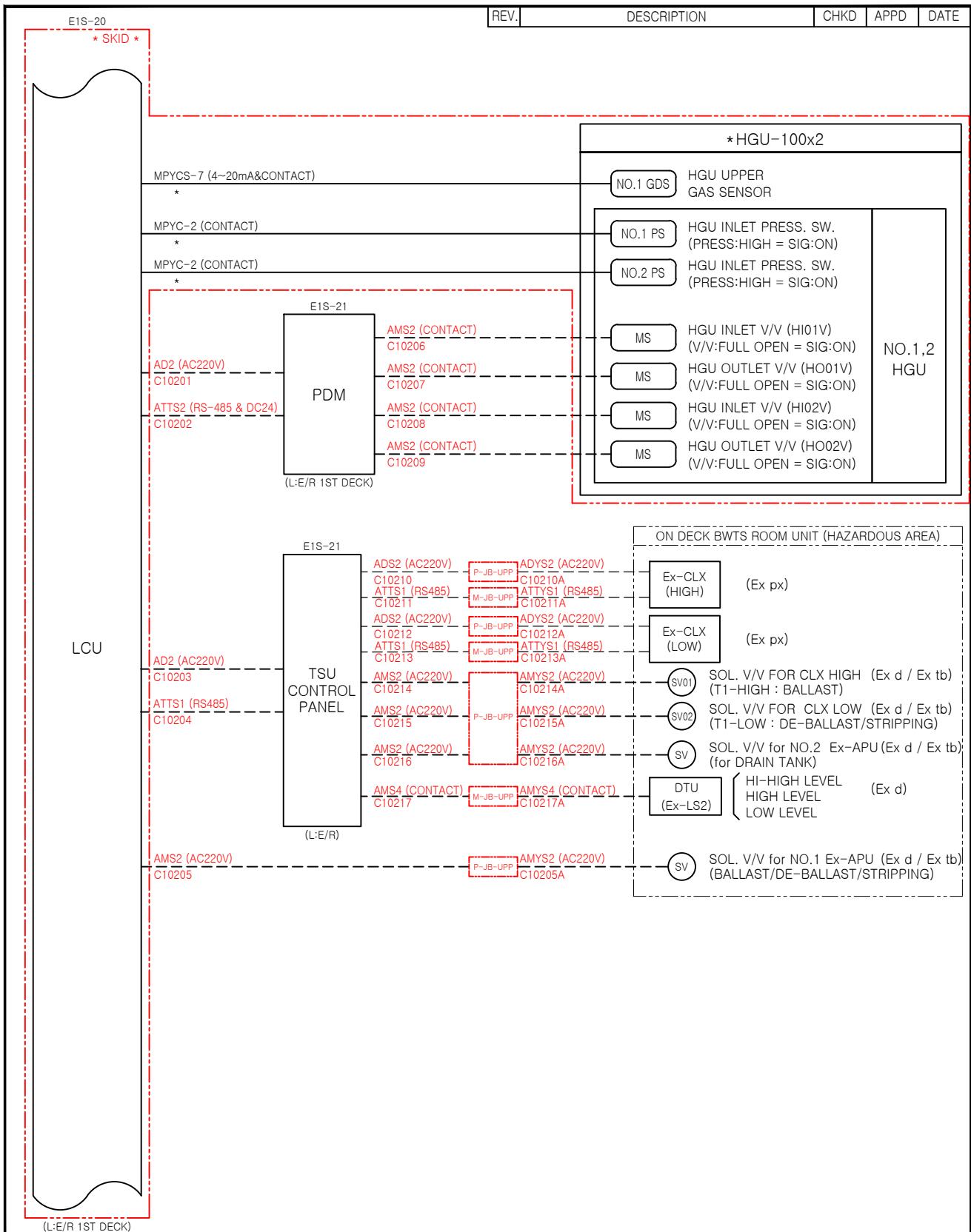
\* TABLE 1

LINE DESCRIPTION				SHIP YARD		HULL NO.	MODEL NAME		
LINE	NAME	SUPPLY	CABLING	K SHIPBUILDING		S1940	Ex-ECS-HYCHLOR 1200		
EQUIPMENT	MAKER	-	-	DATE : 2022. 09. 05.		PART NAME ELECTRIC WIRING DRAWING			
EQUIPMENT	YARD	-	-	APPD BY B.O.I.M		DRAWING NO EHS120-E1-W002			
---	---	---	---			SHEET NO : 2/6			
*	CABLE	MAKER	YARD	CHKD BY	Y.M.KIM	REV. 0			
*	CABLE	MAKER	MAKER	DSND BY	S.D.LEE				



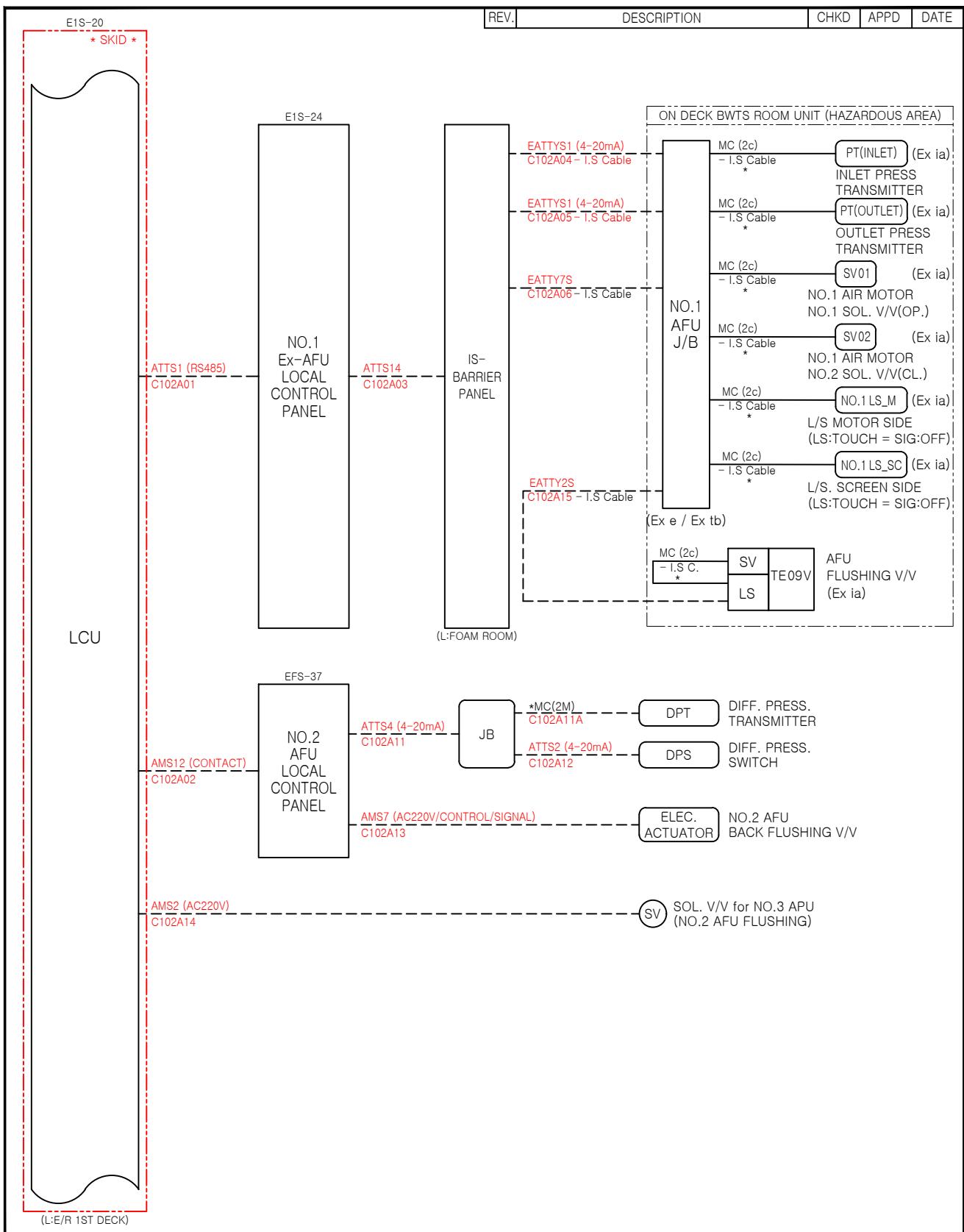
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EQUIPMENT	MAKER	—	—	DATE : 2022. 09. 05.		PART NAME ELECTRIC WIRING DRAWING			
EQUIPMENT	YARD	—	—	APPD BY	B.O.IM	DRAWING NO EHS120-E1-W002			
CABLE	YARD	YARD	YARD	CHKD BY	Y.M.KIM	SHEET NO : 3/6			
CABLE	MAKER	MAKER	MAKER	DSND BY	S.D.LEE	REV. 0			



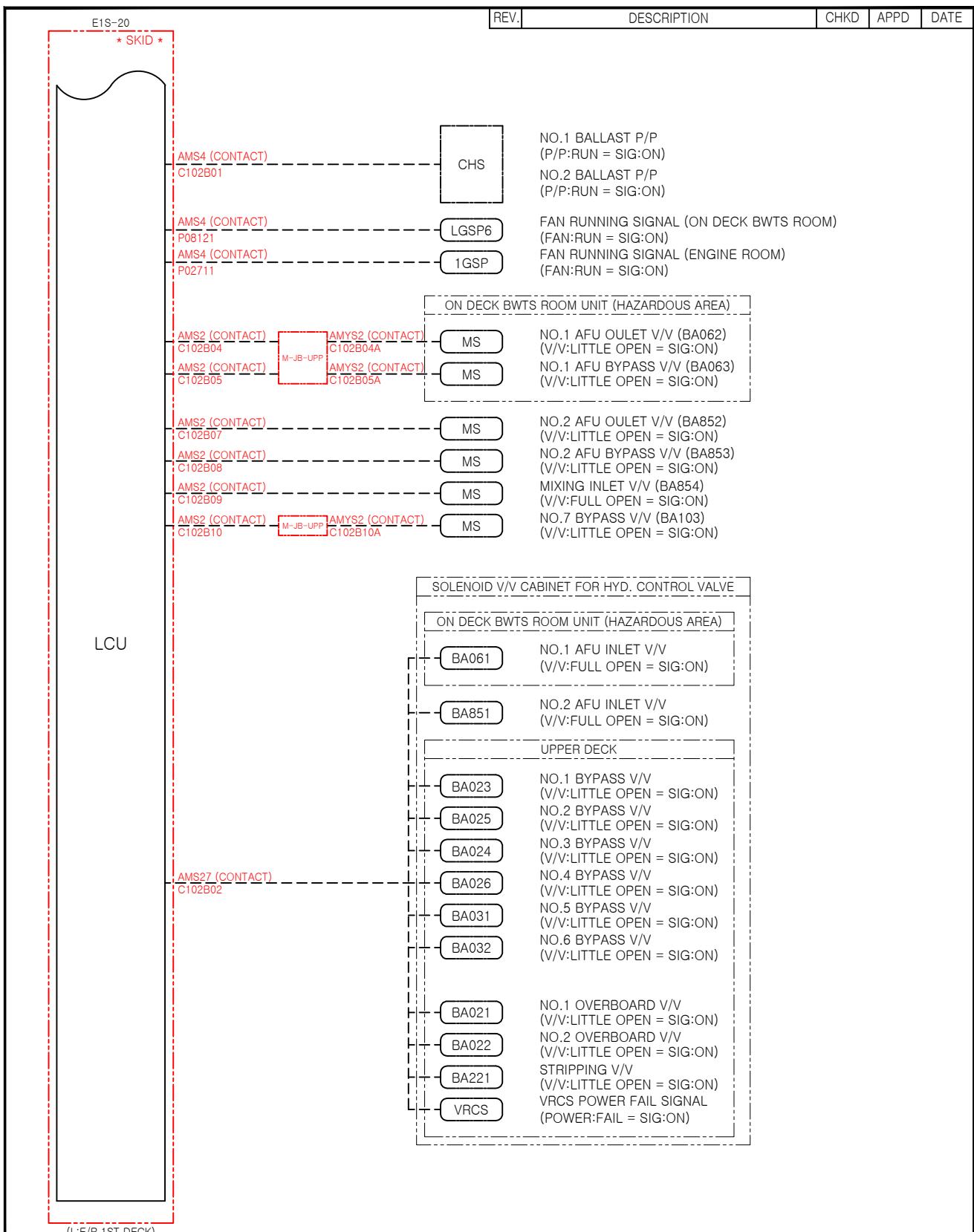
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LINE	NAME	SUPPLY	CABLING	K SHIPBUILDING		S1940	Ex-ECS-HYCHLOR 1200		
EQUIPMENT	MAKER	-	-	DATE : 2022. 09. 05.		PART NAME			
EQUIPMENT	YARD	-	-	ELECTRIC WIRING DRAWING					
CABLE	YARD	YARD	APPD BY	B.O.I.M	DRAWING NO			SHEET NO : 4/6	
* CABLE	MAKER	YARD	CHKD BY	Y.M.KIM	EHS120-E1-W002			REV. 0	
* CABLE	MAKER	MAKER	DSND BY	S.D.LEE					



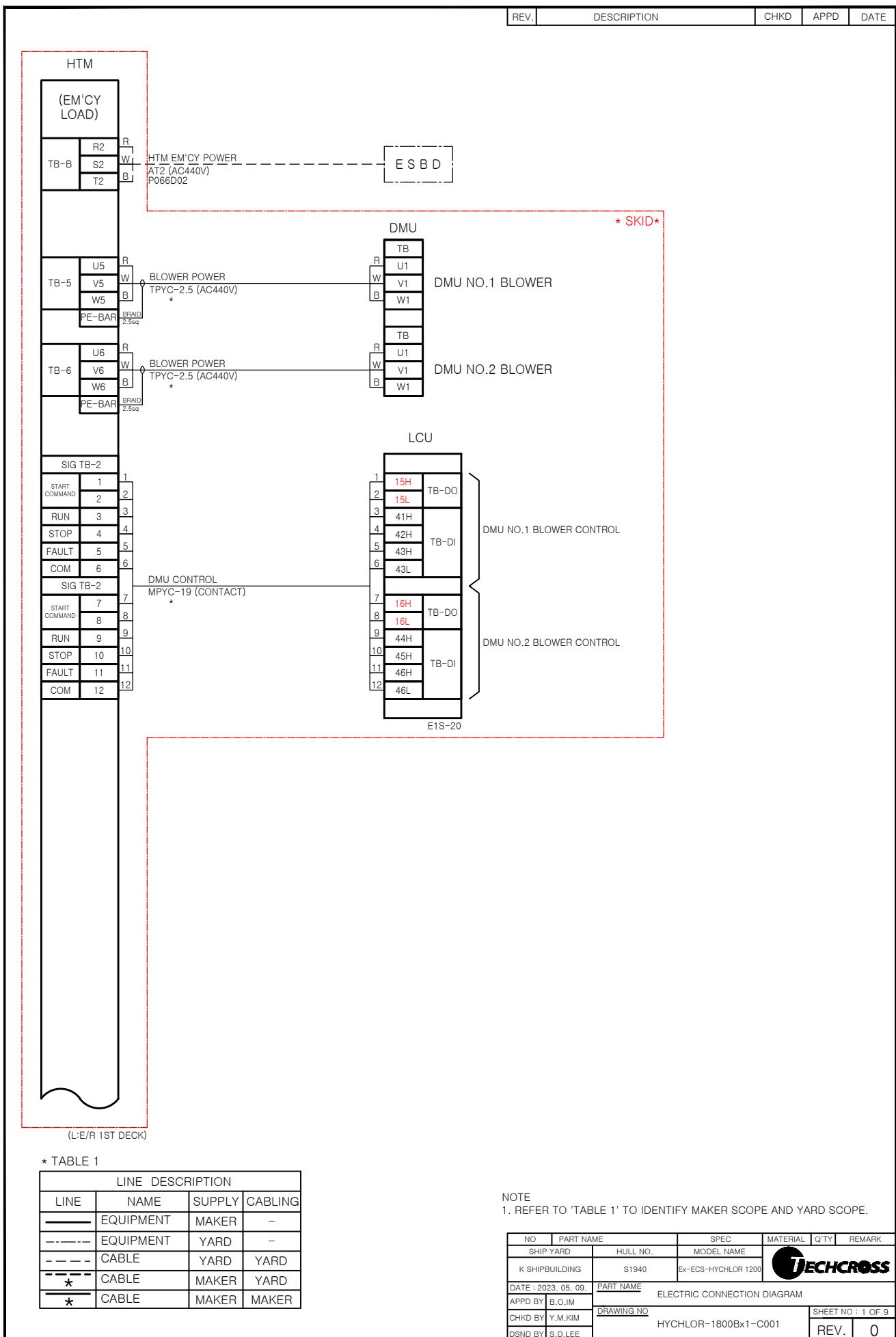
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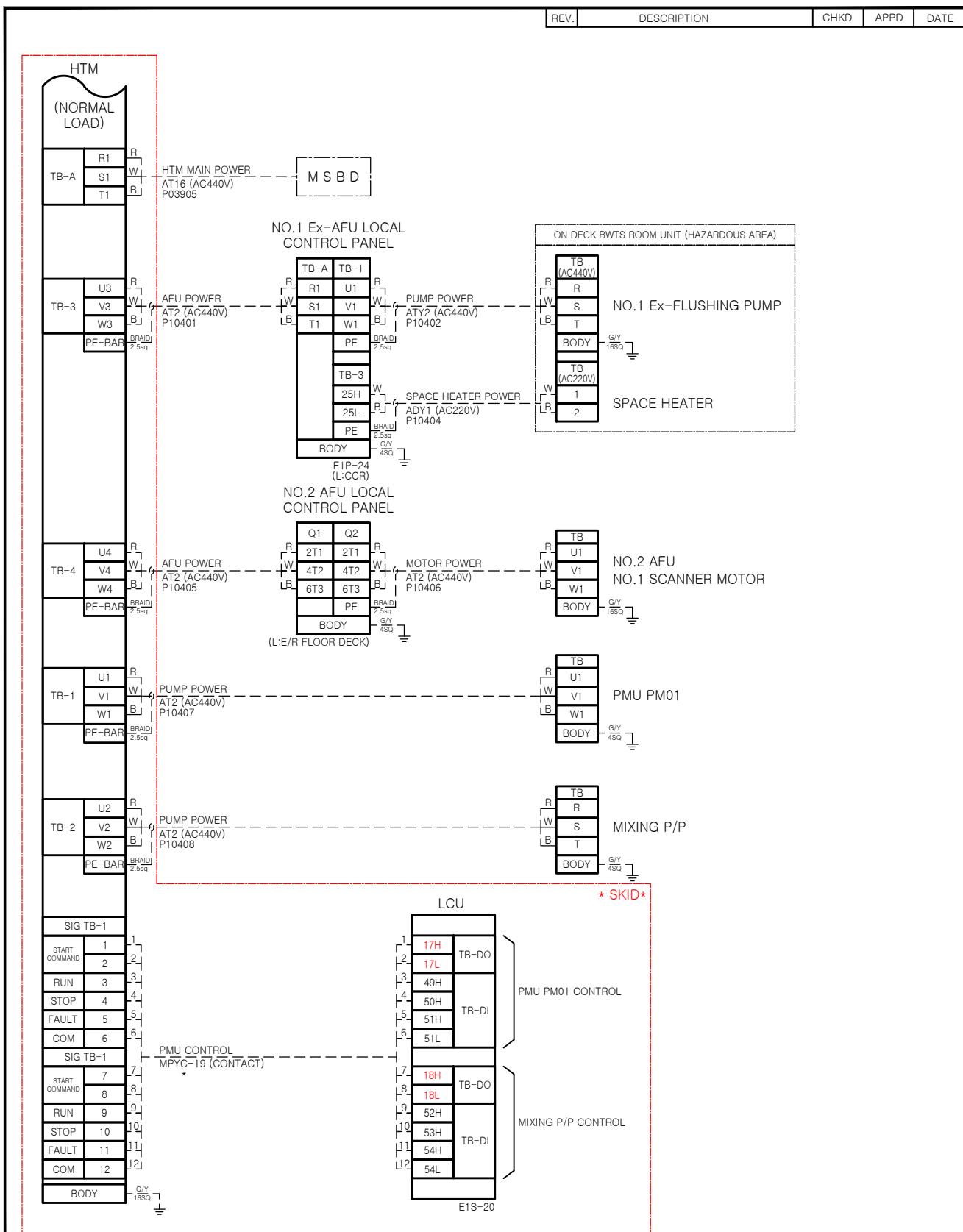
LINE DESCRIPTION				SHIP YARD		HULL NO.	MODEL NAME		
LINE	NAME	SUPPLY	CABLING	K SHIPBUILDING		S1940	Ex-ECS-HYCHLOR 1200		
EQUIPMENT	MAKER	-	-	DATE : 2022. 09. 05.		PART NAME ELECTRIC WIRING DRAWING			
CABLE	YARD	YARD	YARD	APPD BY	B.O.IM	DRAWING NO EHS120-E1-W002			
* CABLE	MAKER	YARD	YARD	CHKD BY	Y.M.KIM	SHEET NO : 5/6			
* CABLE	MAKER	MAKER	DSND BY	S.D.LEE		REV. 0			



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EQUIPMENT	YARD	-	-	APPD BY		ELECTRIC WIRING DRAWING			
CABLE	YARD	YARD	YARD	B.O.I.M	-	DRAWING NO		SHEET NO : 6/6	
* CABLE	MAKER	YARD	CHKD BY	Y.M.KIM	S.D.LEE			REV. 0	
* CABLE	MAKER	MAKER	DSND BY	S.D.LEE		EHS120-E1-W002			





\* TABLE 1

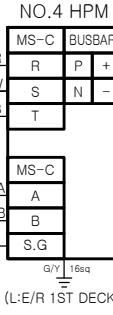
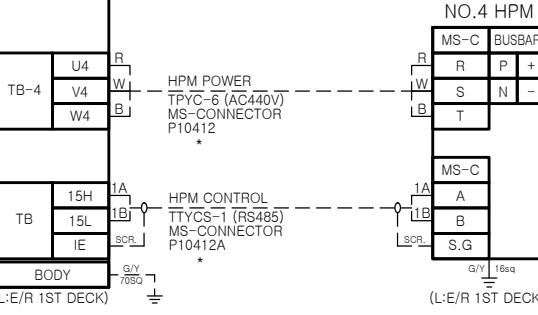
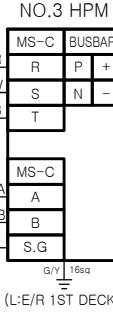
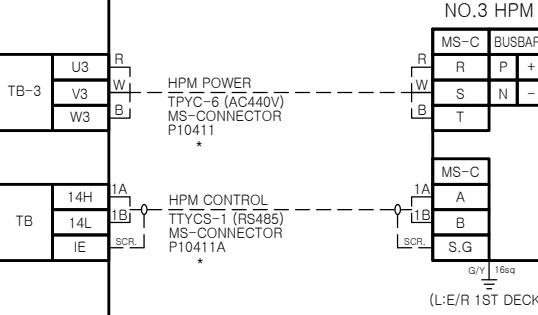
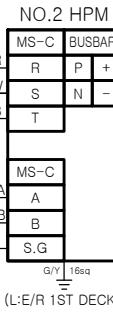
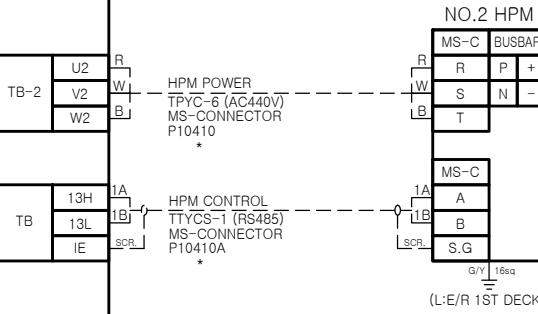
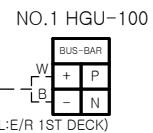
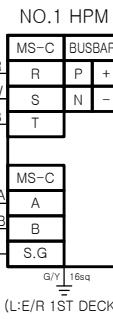
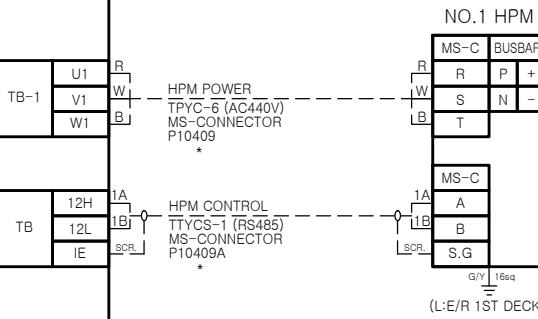
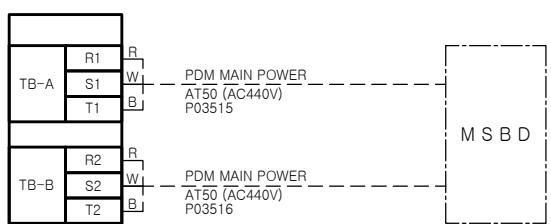
LINE DESCRIPTION			
LINE	NAME	SUPPLY	CABLING
—	EQUIPMENT	MAKER	—
---	EQUIPMENT	YARD	—
- - -	CABLE	YARD	YARD
---	CABLE	MAKER	YARD
★	CABLE	MAKER	MAKER

NOTE

1. REFER TO 'TABLE 1' TO IDENTIFY MAKER SCOPE AND YARD SCOPE.

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME			
K SHIPBUILDING	S1940	Ex-ECS-HYCHLOR 1200			
DATE : 2023. 05. 09.	PART NAME	ELECTRIC CONNECTION DIAGRAM			
APPD BY : B.O.I.M					
CHKD BY : Y.M.KIM	DRAWING NO				
DSND BY : S.D.LEE	HYCHLOR-1800Bx1-C002	SHEET NO : 2 OF 9			
		REV. 0			

## PDM



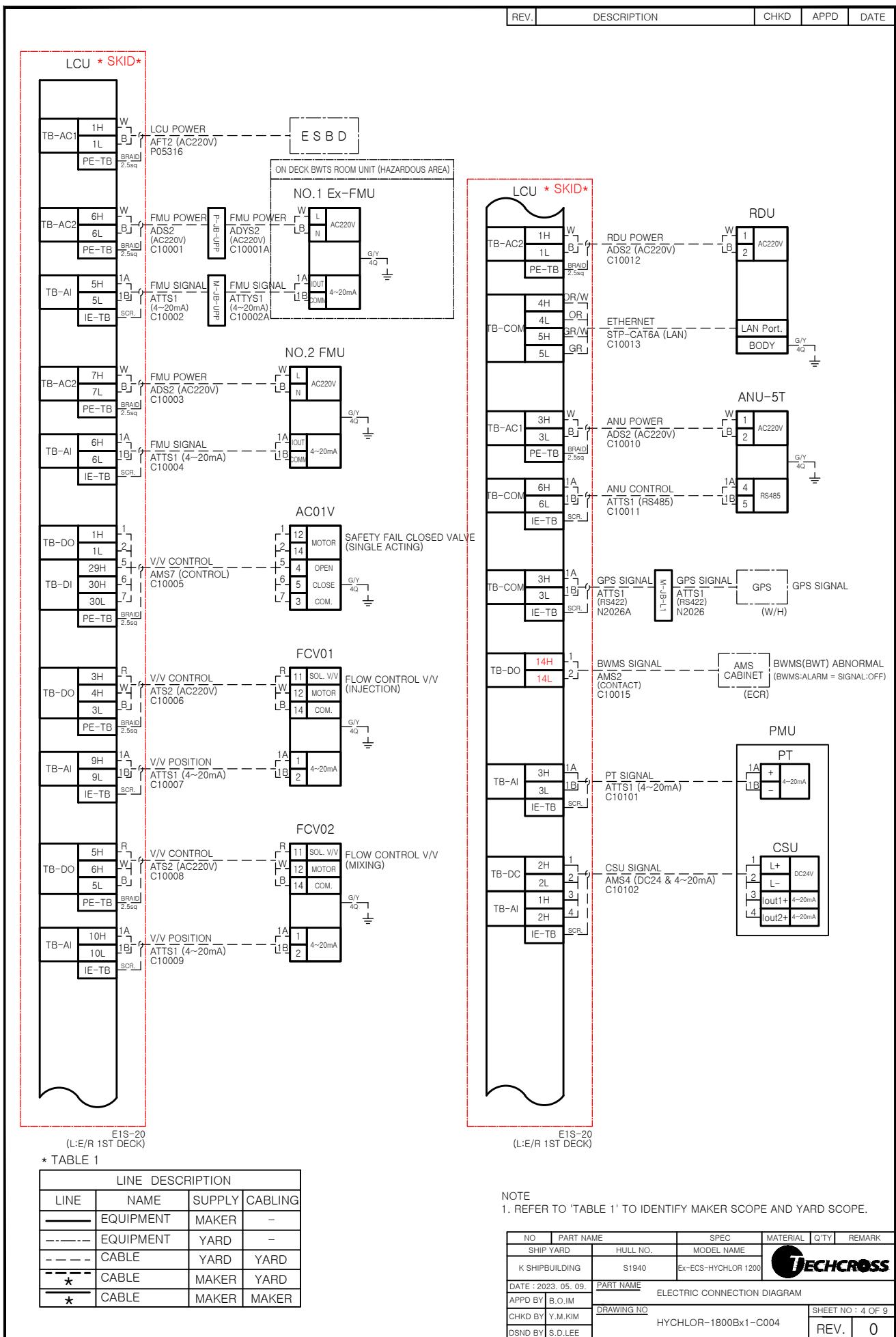
\* TABLE 1

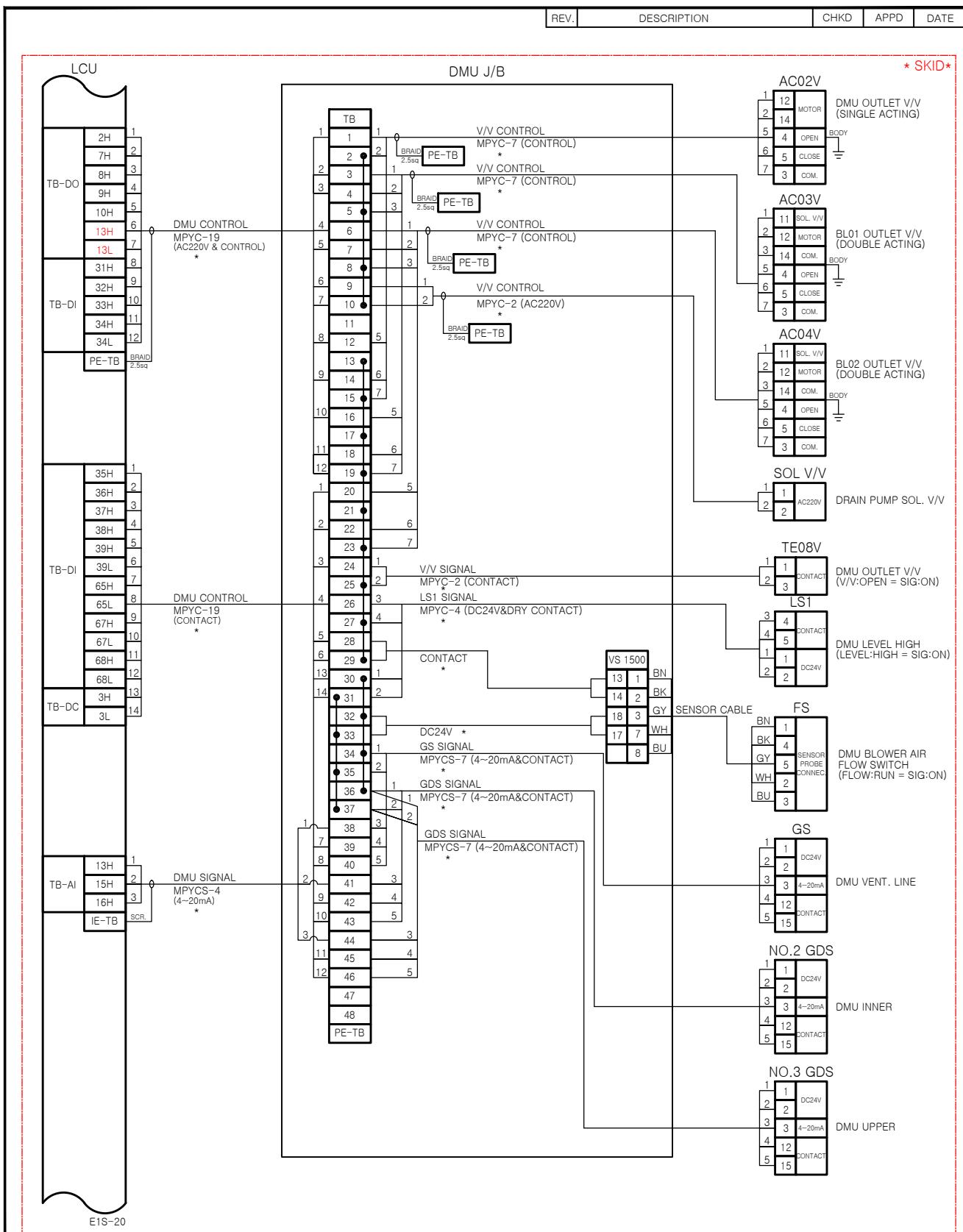
LINE DESCRIPTION			
LINE	NAME	SUPPLY	CABLING
—	EQUIPMENT	MAKER	—
—	EQUIPMENT	YARD	—
—	CABLE	YARD	YARD
★	CABLE	MAKER	YARD
★	CABLE	MAKER	MAKER

## NOTE

1. REFER TO 'TABLE 1' TO IDENTIFY MAKER SCOPE AND YARD SCOPE.

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME			
K SHIPBUILDING	S1940	Ex-ECS-HYCHLOR 1200			
DATE : 2023. 05. 09.	PART NAME	ELECTRIC CONNECTION DIAGRAM			
APPD BY : B.O.I.M					
CHKD BY : Y.M.KIM	DRAWING NO				
DSND BY : S.D.LEE		HYCHLOR-1800Bx1-C003			
					SHEET NO : 3 OF 9
					REV. 0





\* TABLE 1

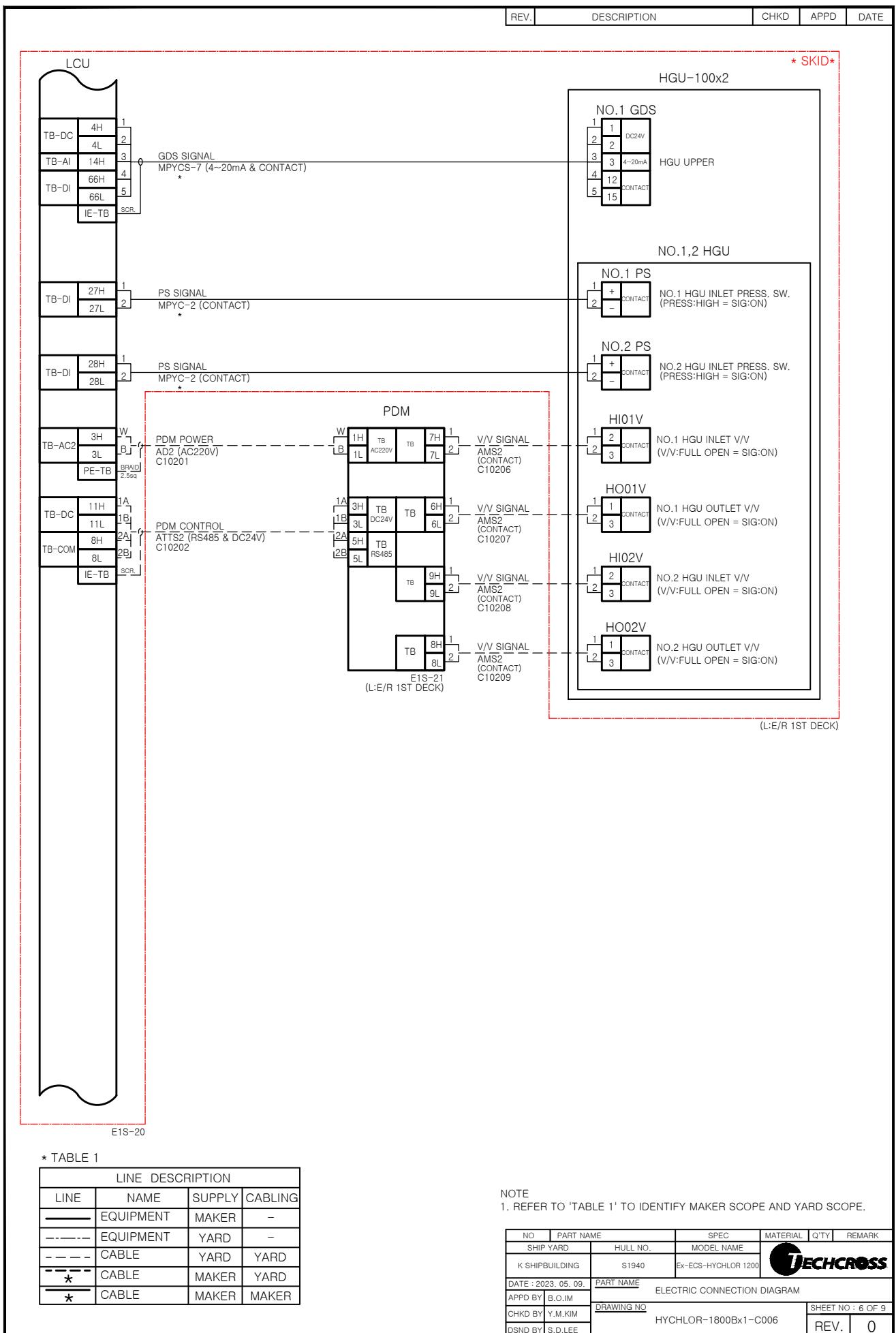
LINE DESCRIPTION			
LINE	NAME	SUPPLY	CABLING
—	EQUIPMENT	MAKER	—
---	EQUIPMENT	YARD	—
- - -	CABLE	YARD	YARD
* —	CABLE	MAKER	YARD
* ---	CABLE	MAKER	MAKER

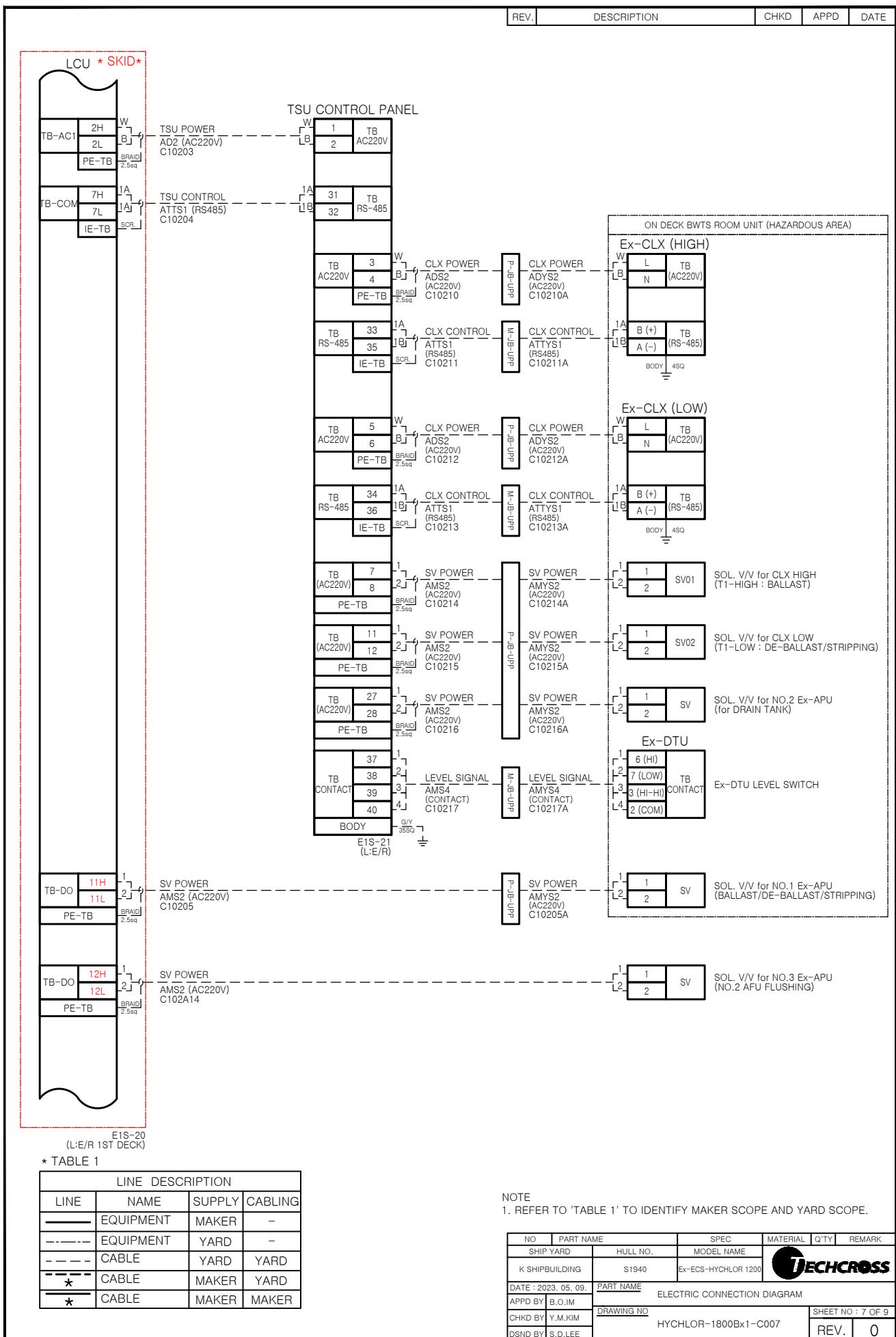
## NOTE

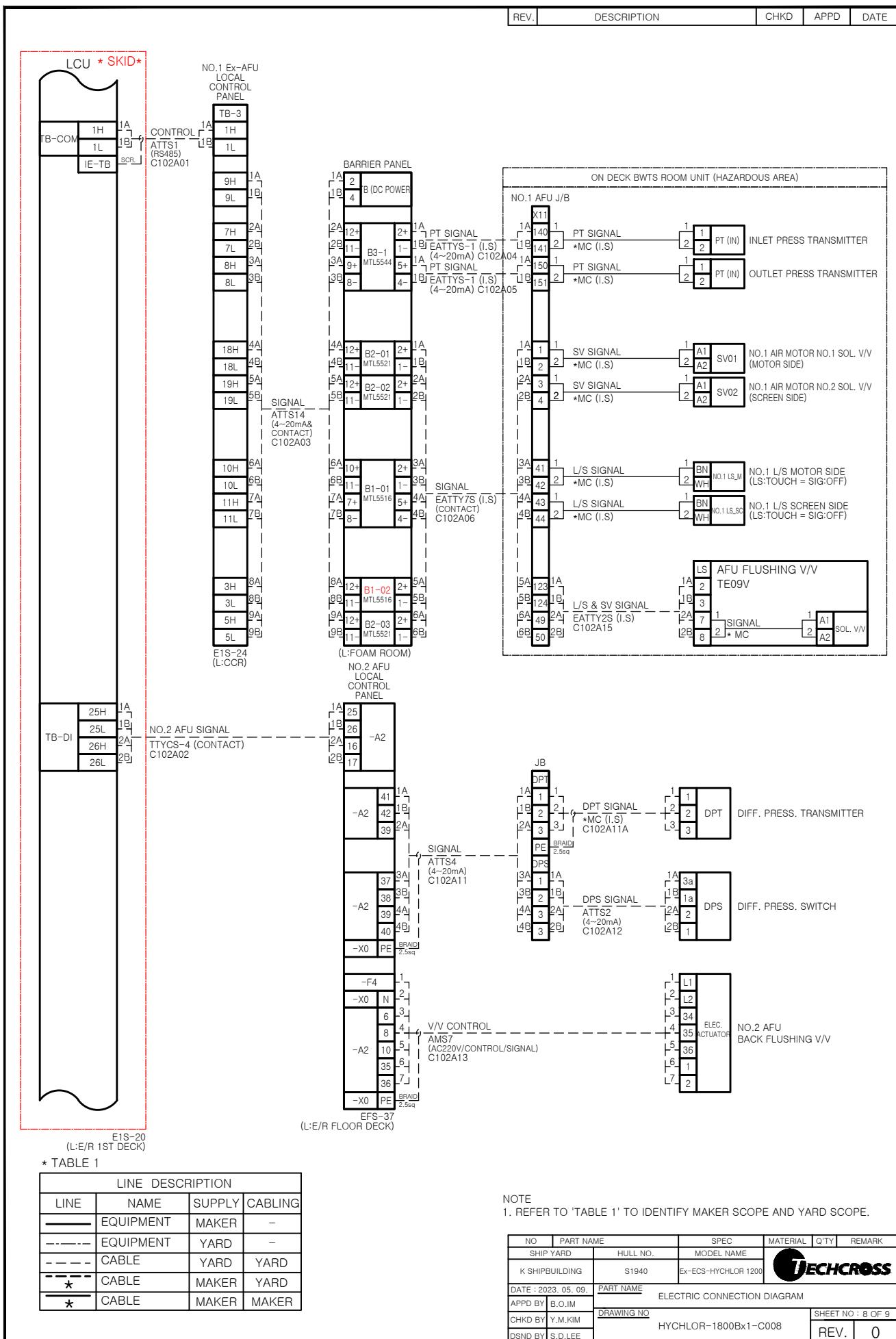
1. REFER TO 'TABLE 1' TO IDENTIFY MAKER SCOPE AND YARD SCOPE.

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME			
K SHIPBUILDING	S1940	Ex-ECS-HYCHLOR 1200			
DATE : 2023. 05. 09.	PART NAME	ELECTRIC CONNECTION DIAGRAM			
APPD BY	B.O.I.M				
CHKD BY	Y.M.KIM	DRAWING NO			
DSND BY	S.D.LEE	HYCHLOR-1800Bx1-C005			
			SHEET NO : 5 OF 9		
				REV. 0	

**TECHCROSS**



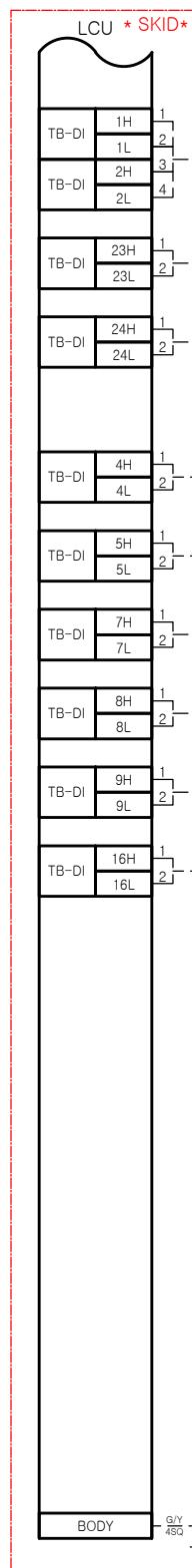




NOTE

1. REFER TO 'TABLE 1' TO IDENTIFY MAKER SCOPE AND YARD SCOPE.

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
K SHIPBUILDING	S1940	Ex-ECS-HYCHLOR 1200			
DATE : 2023. 05. 09.	PART NAME				
APPD BY : B.O.I.M		ELECTRIC CONNECTION DIAGRAM			
CHKD BY : Y.M.KIM	DRAWING NO				
DSND BY : S.D.LEE		HYCHLOR-1800Bx1-C008			SHEET NO : 8 OF 9
					REV. 0



NO.1 BALLAST P/P  
(P/P:RUN = SIGNAL:ON)  
NO.2 BALLAST P/P  
(P/P:RUN = SIGNAL:ON)

FAN SIGNAL  
AMS4 (CONTACT) P08121  
FAN RUNNING SIGNAL (ON DECK BWTS ROOM)  
(FAN:RUN = SIG:ON)

FAN SIGNAL  
AMS4 (CONTACT) P02711  
FAN RUNNING SIGNAL (ENGINE ROOM)  
(FAN:RUN = SIG:ON)

ON DECK BWTS ROOM UNIT (HAZARDOUS AREA)

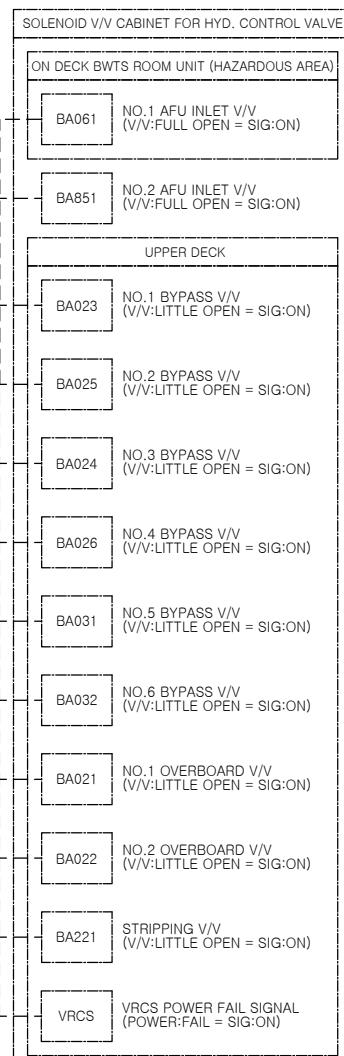
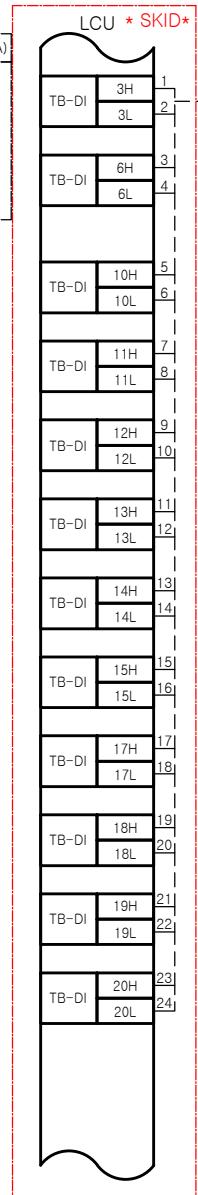
BA062 NO.1 AFU OULET V/V  
(V/V:LITTLE OPEN = SIG:ON)  
BA063 NO.1 AFU BYPASS V/V  
(V/V:LITTLE OPEN = SIG:ON)

BA852 NO.2 AFU OULET V/V  
(V/V:LITTLE OPEN = SIG:ON)

BA853 NO.2 AFU BYPASS V/V  
(V/V:LITTLE OPEN = SIG:ON)

BA854 MIXING INLET V/V  
(V/V:FULL OPEN = SIG:ON)

BA103 NO.7 BYPASS V/V  
(V/V:LITTLE OPEN = SIG:ON)



\* TABLE 1

LINE DESCRIPTION			
LINE	NAME	SUPPLY	CABLING
—	EQUIPMENT	MAKER	—
—	EQUIPMENT	YARD	—
—	CABLE	YARD	YARD
★	CABLE	MAKER	YARD
★	CABLE	MAKER	MAKER

## NOTE

1. REFER TO 'TABLE 1' TO IDENTIFY MAKER SCOPE AND YARD SCOPE.

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME			
K SHIPBUILDING	S1940	Ex-ECS-HYCHLOR 1200			
DATE : 2023. 05. 09.	PART NAME	ELECTRIC CONNECTION DIAGRAM			
APPD BY : B.O.I.M	DRAWING NO				
CHKD BY : Y.M.KIM					
DSND BY : S.D.LEE					
					SHEET NO : 9 OF 9
					REV. 0



## ECS-HYCHLOR GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

HULL NO. : S1940

MODEL : ECS-HYCHLOR 1200

### DETAIL OF THE Ex-AFU

#### 1. MAIN COMPONENT

- FILTER
- Ex 'i' CONTROL PANEL
- REDUCTION GEAR+MOTOR (WITH PNEUMATIC)
- PRESSURE TRANSMITTER
- BACKWASH FLUSHING PUMP+MOTOR
- BACKWASH VALVE+ACTUATOR (WITH PNEUMATIC)
- PROXIMITY SENSOR

#### 2. FILTER

DIVISION	SPECIFICATION
MATERIAL	ELEMENT : SS904L
	HOUSING : CARBON STEEL (PAINT COLOR : MUNSELL 7.5BG 7/2)
TYPE	BUCKET TYPE
FILTRATION GRADE	50um
TOTAL SIZE OF SCREEN	40,000cm <sup>2</sup>
TRC(m <sup>3</sup> /hr)	1,300m <sup>3</sup> /hr
MAX. FLOW(m <sup>3</sup> /hr)	1,707m <sup>3</sup> /hr
BACK-FLUSHING FLOW RATE	57m <sup>3</sup> /hr
DESIGN PRESSURE	10bar
PRESSURE DROP	<0.1bar (BETWEEN INLET TO OULET)
MIN. OUTLET PRESSURE	1.2bar: WITH FLUSHING PUMP (50um)
	1.6bar: WITHOUT FLUSHING PUMP (50um)
BACK-FLUSHING SET POINT	0.4bar
BACK-FLUSHING TIME	85sec/1cycle
FILTER BODY WEIGHT	HORIZONTAL : DRY : 1,255Kg / WET : 2,205Kg
	VERTICAL : DRY : 1,315Kg / WET : 2,565Kg
SCREEN WEIGHT	63Kg



## ECS-HYCHLOR GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

HULL NO. : S1940

MODEL : ECS-HYCHLOR 1200

### 3. SCREEN MOTOR+SOLENOID VALVE(WITH PNEUMATIC)+REDUCTION GEAR

#### 3.1 REDUCTION GEAR

DIVISION	SPECIFICATION
MATERIAL	CASTING : ALDC
	WORM SHAFT : STEEL
TYPE	HELICAL WORM GEAR
GEARBOX RATIO	80/1
TYPE OF Ex CODE	II 2 GD ck IP66 Tmax=135 °C

#### 3.2 SOLENOID VALVE (WITH PNEUMATIC)

DIVISION	SPECIFICATION
TYPE	3/2-WAY
MATERIAL	BODY : 316 STAINLESS STEEL
POWER INPUT	24V DC
PROCESS TEMP"	-25°C ~ 60°C
AIR CONSUMPTION	1,500Liter/min
CERTIFICATE	IECEx BAS 09.0092X

#### 3.3 MOTOR (WITH PNEUMATIC)

DIVISION	SPECIFICATION
MATERIAL	ALDC
TYPE	AIR MOTOR
MAX PRESSURE	7 Bar
MAX SPEED	3,000 RPM
HP / kW	1.7 / 1.25
AMBIENT TEMP"	1°C ~ 40°C



## ECS-HYCHLOR GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

HULL NO. : S1940

MODEL : ECS-HYCHLOR 1200

### 4. BACKFLUSHING VALVE+ACTUATOR(WITH PNEUMATIC)

#### 4.1 VALVE

DIVISION	SPECIFICATION
TYPE	BUTTERFLY
MATERIAL	BODY: CAST IRON, SEAT: SUS420, DISK: AL BRONZE
FLANGE	Dia 80 (3") DIN FF

#### 4.2 ACTUATOR (WITH PNEUMATIC)

DIVISION	SPECIFICATION
TYPE	PNEUMATIC / DOUBLE ACTING
MAX WORKING PRESSURE	8.4Bar
AMBIENT TEMP"	-20°C ~ 80°C

#### 4.3 PROXIMITY SENSOR

DIVISION	SPECIFICATION
TYPE	INDUCTIVE TYPE
MATERIAL	MILD STEEL
SIGNAL OUTPUT	4-WIRE CONNECTION
AMBIENT TEMP"	-20°C ~ 70°C
IP GRADE	IP67
CERTIFICATE	IECEx BVS 06.0003

#### 4.4 SOLENOID VALVE FOR BACKFLUSHING

DIVISION	SPECIFICATION
TYPE	5/2-WAY
MATERIAL	BODY : ALDC
	SEAL : NBR + PUR
POWER INPUT	24V DC
PROCESS TEMP"	-25°C ~ 60°C
AIR CONSUMPTION	860Liter/min
CERTIFICATE	IECEx DEK 11.0038X



**ECS-HYCHLOR**  
**GENERAL SPECIFICATION**

SHIP YARD : K SHIPBUILDING

HULL NO. : S1940

MODEL : ECS-HYCHLOR 1200

**5. PRESSURE TRANSMITTER**

DIVISION	SPECIFICATION
MATERIAL	HOUSING : AL / ISOLATING DIAPHRAGM : SUS316L
PROCESS CONNECTION	1/2-14 NPT FEMALE
POWER INPUT	DC 24V
SIGNAL OUTPUT	4~20mA
MEASURING PRESSURE RANGE	0~10bar
AMBIENT TEMP"	-20°C ~60°C
IP GRADE	IP67
CERTIFICATE	BV, LR, ABS, DNV
TYPE OF Ex CODE	II2G Ex d IIC T6...T4 Gb
CERTIFICATE	IECEEx DEK 15.0071X / KEMA 07ATEX0103X

**6. AFU CONTROL PANEL**

DIVISION	SPECIFICATION
WEIGHT	49 Kg
CONTROL SYSTEM	CONTROLLED BY PLC
POWER INPUT	AC 440V, 60Hz
INSTALL TYPE	WALL MOUNTING
IP CLASS	IP44



# ECS-HYCHLOR

## GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

HULL NO. : S1940

MODEL : ECS-HYCHLOR 1200

### 7. INSTALL GUIDELINES

#### 7.1 VERTICAL TYPE FILTERS SHOULD BE INSTALLED THE WORKING PLATFORM

#### 7.2 CHARACTERISTICS OF FLOW INFLUENCING BACK-FLUSHING

- OUTLET PRESS OF 1.2 bar WITH FLUSHING PUMP OR 1.6 bar WITHOUT FLUSHING PUMP (DURING FLUSHING) FOR EFFECITIVE CLEANING.

#### 7.3 MINIMUM WORING PRESSURE FOR FILTER INLET, OUTLET AND FLUSHING PUMPS

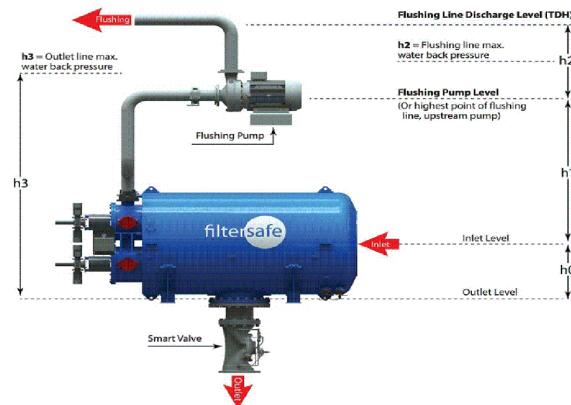
MIN INLET OPERATING PRESSURE DURING FLUSHING, WTIHOUT FLUSHING PUMP INSTALLED

- FILTER SCREEN (50um) = 2.0 bar + THE HIGHEST BETWEEN ( $h_0+h_3$ ) AND ( $h_1+h_2$ )

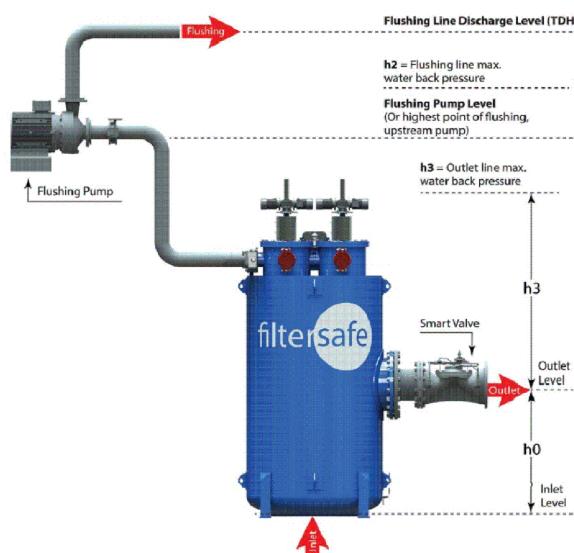
MIN INLET OPERATING PRESSURE DURING FLUSHING, WTIH FLUSHING PUMP INSTALLED

- FILTER SCREEN (50um) = 1.6 bar + THE HIGHEST BETWEEN ( $h_0+h_3$ ) AND ( $h_1$ )

#### HORIZONTAL FILTER MIN. WORKING PRESSURE



#### VERTICAL FILTER MIN. WORKING PRESSURE





## ECS-HYCHLOR

### GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

HULL NO. : S1940

MODEL : ECS-HYCHLOR 1200

#### 8. SERVICE CLEARANCE GUIDELINES

SERVICE CLEARANCE IS THE ADDITIONAL SPACE SURROUNDING THE FILTER THAT IS REQUIRED TO SERVICE THE FILTER ELEMENTS IN AN EASY AND SAFE WAY

##### 8.1 MAINTAIN SERVICE CLEARANCE TO ENABLE COMFORTABLE AND SAFE ACCESSIBILITY TO:

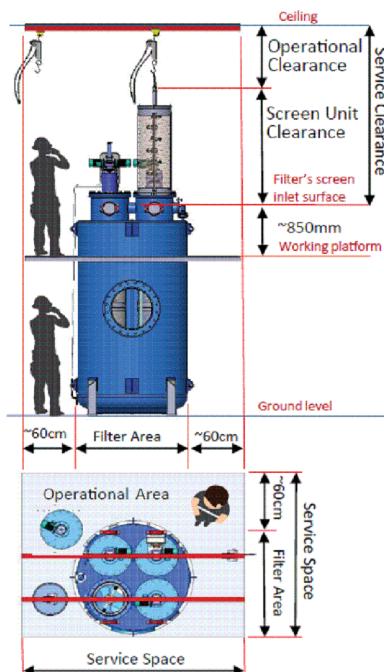
- ACCESS DRAINING OUTLETS
- SERVICE THE DRIVING UNITS AND THE FRONT LID THE COMPONENTS
- PULL OUT THE SCREEN UNIT
- IN ORDER TO CLEAN THE SCREEN, A MAINTANCE SPACE SHOULD BE SECURED IN THE BOTTOM PLACE

##### 8.2 SERVICE CELARANCE FORMULA (SCREEN UNIT CLEARANCE + OPERATIONAL CLEARANCE)

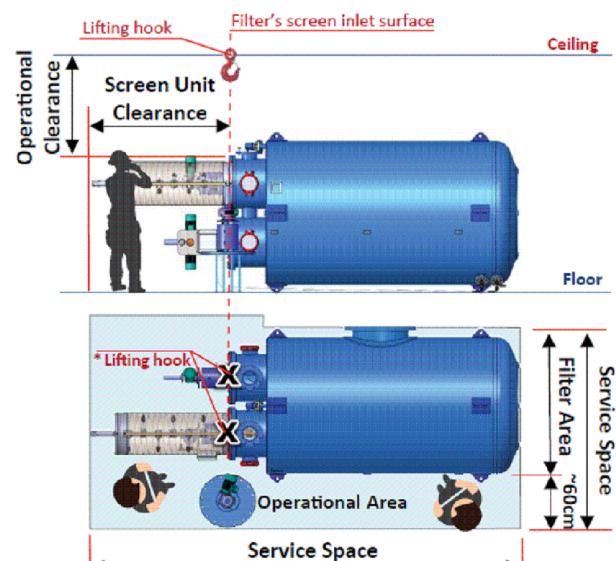
TOTAL SERVICE CLEARANCE IS CALCULATED BY ADDING THE FOLLOWING TWO AREAS:

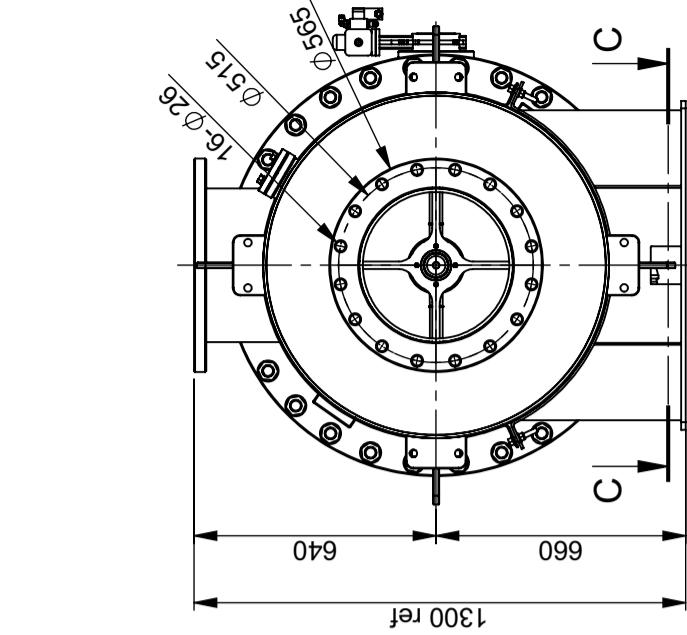
- SCREEN UNIT CLEARANCE – THE LENGTH OF THE COMPLETE SCREEN & SCANNER UNIT
- OPERATIONAL CLEARANCE – THE REQUIRED LENGTH FOR HANGING POINTS AND LIFTING EQUIPMENT

#### VERTICAL FILTER SERVICE CLEARANCE

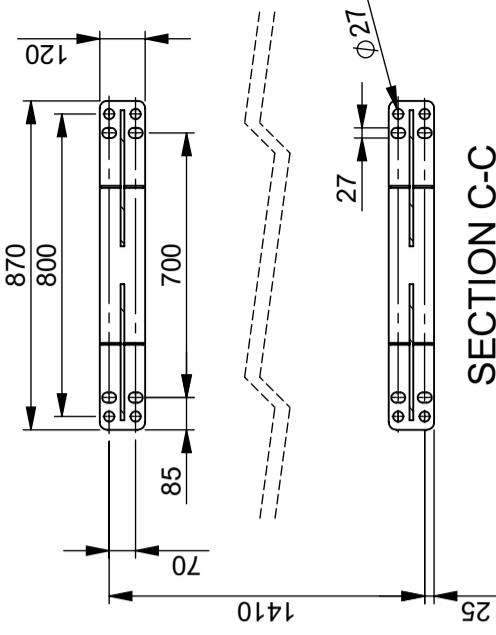


#### HORIZONTAL FILTER SERVICE CLEARANCE

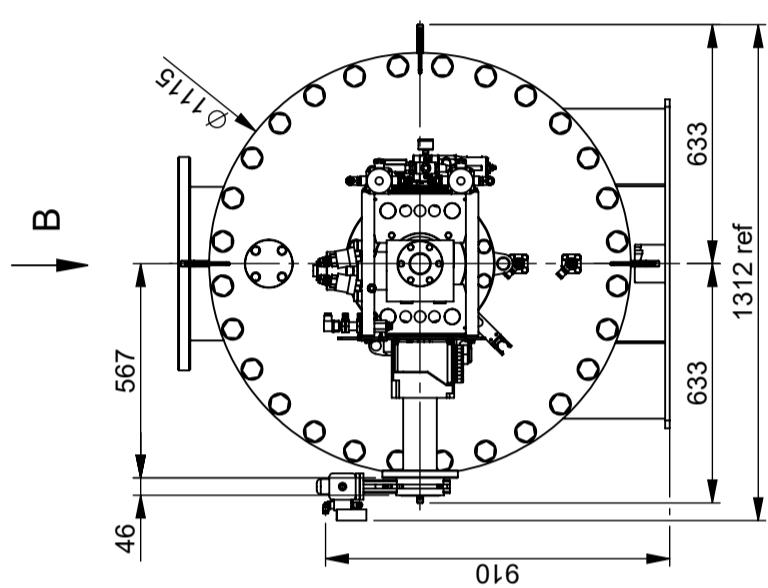




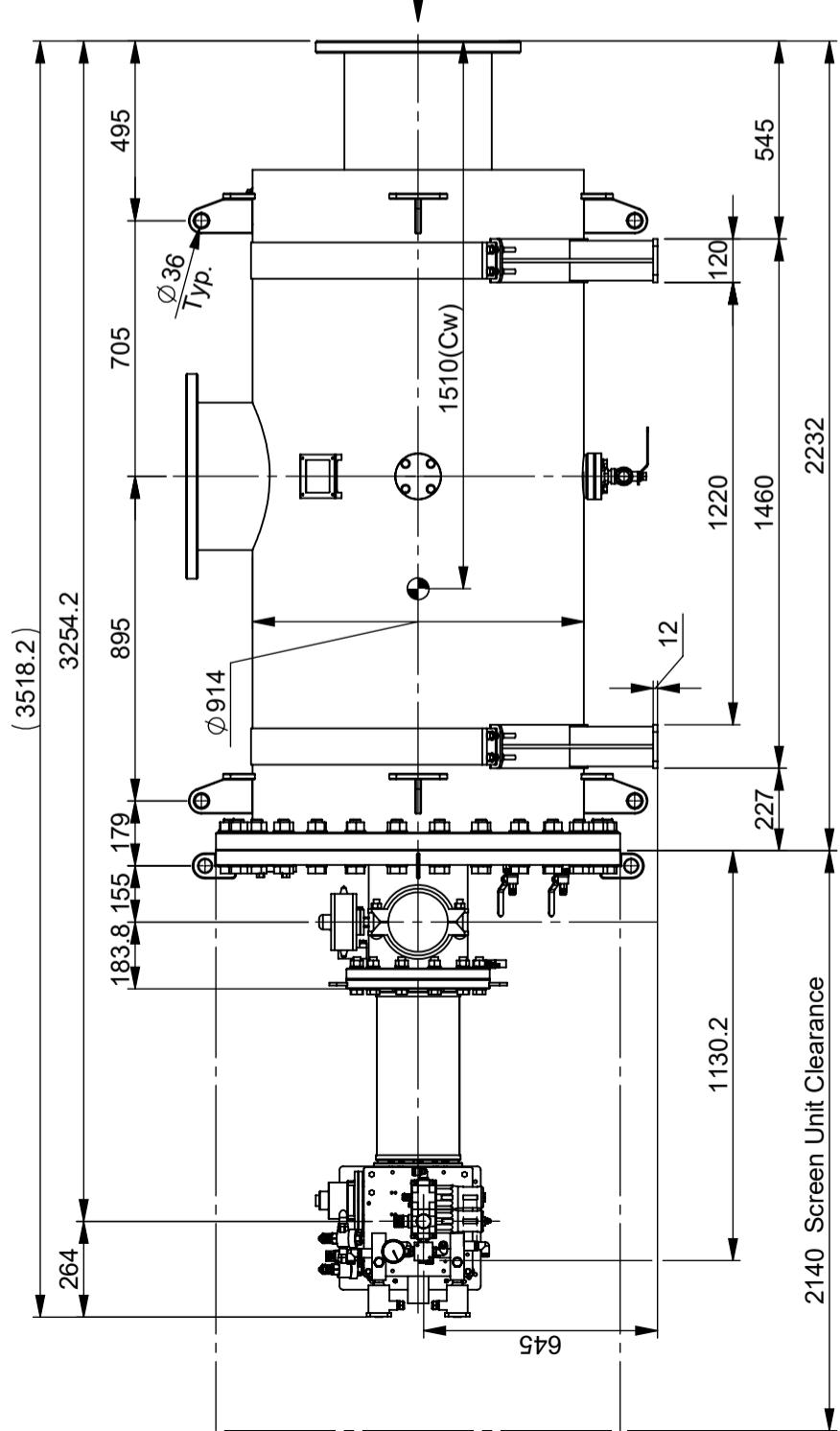
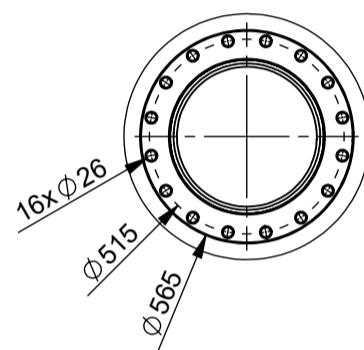
VIEW A



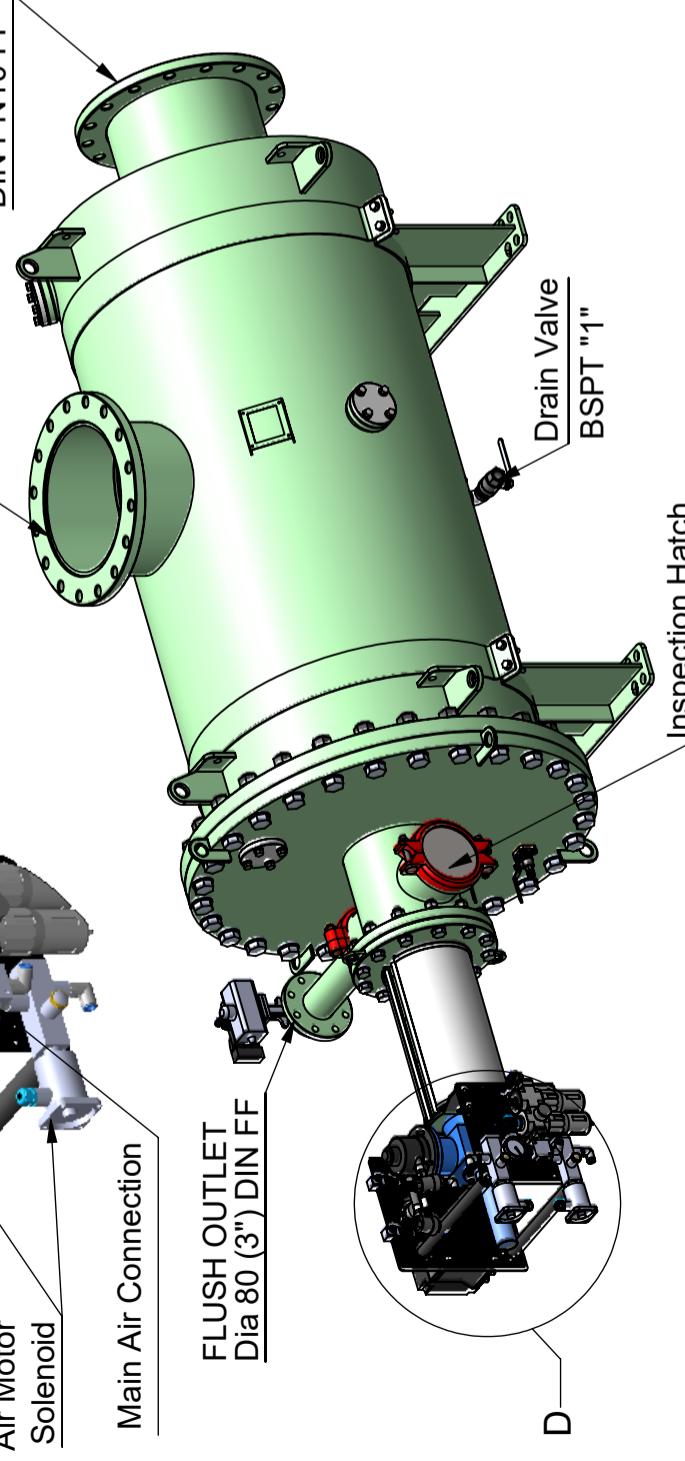
SECTION C-C



VIEW B

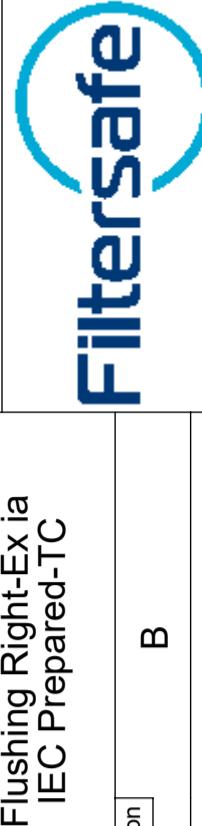


Outlet Pressure Transmitter

Inlet Pressure Transmitter  
Junction BoxDETAIL D  
SCALE 1 : 10OUTLET  
Dia 400 (16")  
DIN PN10 FFINLET  
Dia 400 (16")  
DIN PN10 FFFLUSH OUTLET  
Dia 80 (3") DIN FFMain Air Connection  
Air Motor Solenoid

- Note:**
- Screen unit Clearance Is the length of complete Screen & Scanner unit, out of the filter screen inlet surface.
  - Service space is the additional area and space that surrounds the filter, and which is required in order to service the filter elements, in an easy and safe way.
  - Estimated Weight: Dry- 1440 Kg, Wet- 2840 Kg.

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Rev	Date	Chan
B	05/12/22	MOH.K
-	-	-
Approved	DIMAG	06/12/22
Designed	IGRAF	18/10/22 Revision
Drew	MOH.K	18/10/22
THIS DRAWING IS FOR ILLUSTRATION ONLY		
File/Dwg name:	BSE0400-0015	
Dimens. in mm		Scale 1:20
		Sheet 1 of 1



## Technical Specification

Pos. 1 ESL65-180M/D12

### General Information

<b>Pump Type</b>	Vertical Inline Centrifugal Pump	<b>Pump</b>	ESL65-180M/D12
<b>Description</b>	The ESL pump is a single suction, single stage centrifugal pump		

### Pump Data

Pump Media	Seawater
Density	1,025 kg/l
Viscosity	1 cSt
Capacity	57,00 m3/h
Pressure / Head	25,00 mLC
Pump Speed	3505 rpm
Power Consumption	5,64 kW
NPSH <sub>r</sub>	3,89 mLC
Non-Overload Power	5,98 kW
Eta / Efficiency	71,33 %
Max. Working Pressure	15,00 Bar
Test Pressure	3,77 Bar
Liquid Temperature	0 - 32 °C
Ambient Temperature	- °C

### Motor Data

Brand	Hoyer
Motor	HMCX 132 S2-2
Motor Size	132
Efficiency Class	IE1
Performance	8,25 kW
Number of Poles	2
Power Supply	3 x 440V, 60 Hz
Motor Speed	3505 rpm
Insulation Class	F
Motor Enclosure	IP55
Rated Current	12,9 A
Starting Current Ratio	7,10
Cos Phi	0,94
Motor Options	Heating element, rain canopy

Max. working pressure; being the pressure at the suction branch and the maximum generated head at zero flow.

If higher working pressure is required, other materials are available upon request.

Test pressure; pump approved by classification societies have been pressure tested according to the requirements of these societies, i. a test pressure of 1.5 x working pressure. "The test pressure is stated in the test certificate and stamped on the discharge flange of the pump. Cast iron material for pump body might be acceptable in applications of sea water pumping if following conditions being complied with. - Sea water temperature is less than 15 degree Celsius - Without cavitation or turbulence corosions happened - Without abrasive particles in pumping liquid- Other general requirements to pump operation- Otherwise please change material to bronze or stainless steel. "

### Specification

Pump Casing	NiAlBz (CC333)
Suction/Discharge Flanges	65/65 mm. drilled to JIS10K
Impeller	NiAlBz (CC333)
Impeller Diameter	135 - 137 mm
Wear Ring	NiAlBz (CC333)
Shaft	Duplex Stainless Steel (AISI329)
Mechanical Shaft Seal	NITRILE Ø28
Bearing	Without bearing
Coupling	Rigid close Coupled

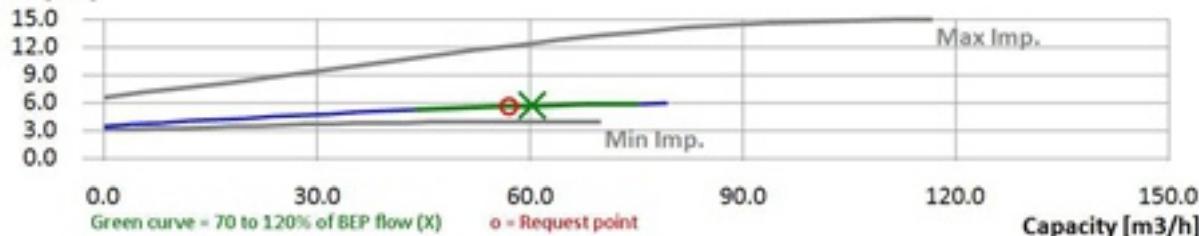
Rotation	Clockwise (Seen from drive end)
Priming Unit	-
Manometer	MAN. -1/+5 BAR W. VALVE
Max Grain Size	11,00 mm
Color Specification	Green. Munsell 7.5BG/7.2
Paint Procedure	DESMI Standard
Class Society Test	DESMI Test
Test Grade	ISO 9906 Grade 2B
Variable-frequency drive	-

Marine & Offshore	Industry	Enviro-Clean	Defence & Fuel	Utility
DESMI Pumping Technology (Suzhou) Co., Ltd. No. 10# Houdai Street Suzhou Industrial Park 215121 Suzhou Jiangsu, China Phone: +86 512 6274 0400	中国江苏省苏州工业园区 后戴街10号，215121 Web: <a href="http://www.desmi.com">www.desmi.com</a>	Bank details (USD): DESMI Pumping Technology (Suzhou) Co., Ltd SWIFT CODE: ABOCCNBJ03 Bank: Agricultural Bank of China Suzhou Branch A/C No: 10-5513 1404 0004 176	Bank details (EURO): DESMI Pumping Technology (Suzhou) Co., Ltd SWIFT CODE: ABOCCNBJ03 Bank: Agricultural Bank of China Suzhou Branch A/C No: 10-5513 3804 0004 829	

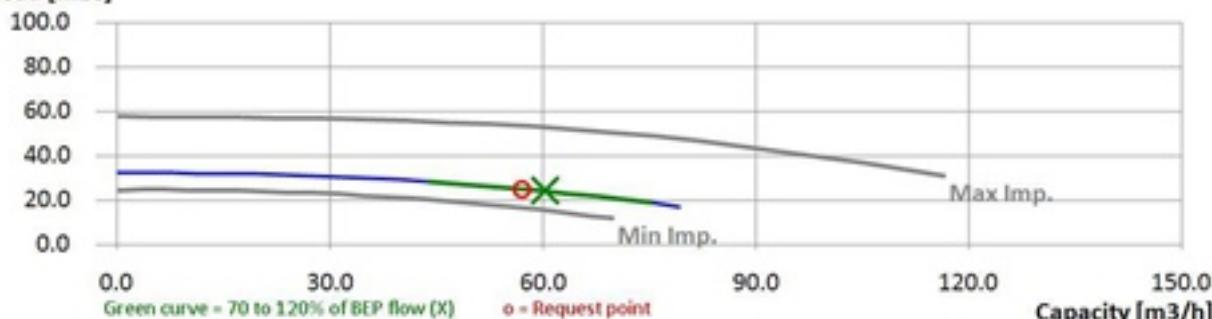
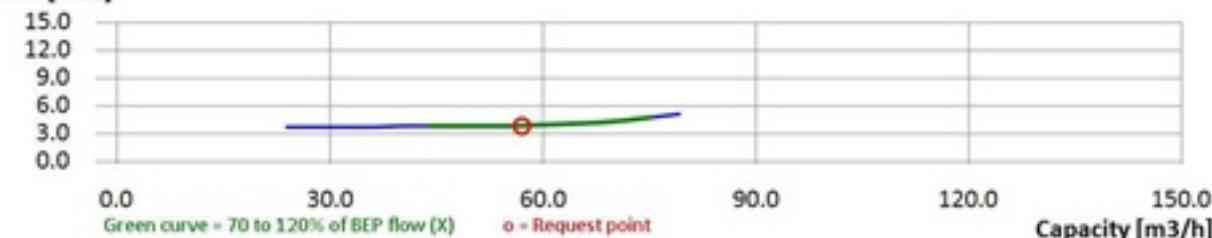
## Pos. 1 ESL65-180M/D12 - Pump Curves

According to ISO 9906 Grade 2B CF

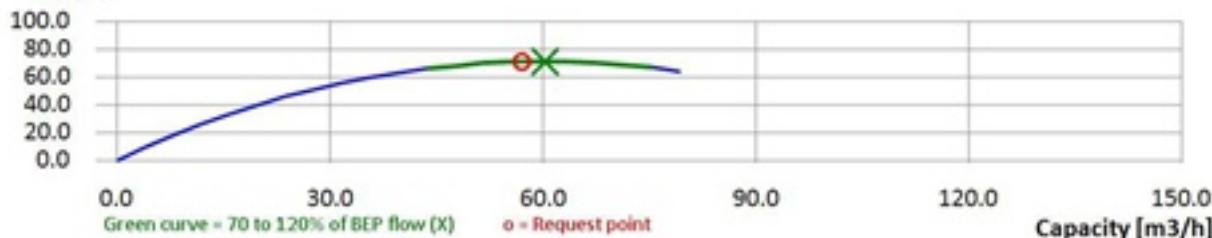
Power [kW]



Head [mLC]

NPSH<sub>r</sub> [mLC]

ETA %



Duty 1) ESL65-180M, Q: 57.00 m³/h, H: 25.26 mLC, Power: 5.64 kW, NPSH<sub>r</sub>: 3.89 mLC, Eta/Eff.: 71.32 % , Imp. Dia: 136.00 mm, Speed: 3480 rpm, Density: 1.025 kg/l  
 BEP 1) ESL65-180M Q: 60.35 m³/h, H: 24.26 mLC, Power: 5.71 kW, NPSH<sub>r</sub>: 3.96 mLC, Eta/Eff.: 71.58 %, shut off pressure: 32.34 mLC

## MARINE &amp; OFFSHORE

DESMI Pumping Technology (Suzhou) Co., Ltd.  
 No. 10# Houdai Street  
 Suzhou Industrial Park  
 215121 Suzhou Jiangsu, China  
 Phone: +86 512 6274 0400

## INDUSTRY

中国江苏省苏州工业园区  
 后戴街10号, 215121  
 Web: www.desmi.com

## ENVIRO-CLEAN

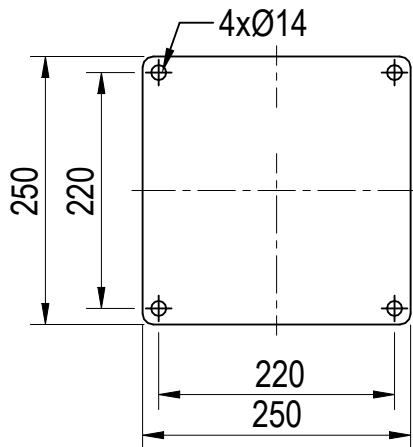
Bank details (USD):  
 DESMI Pumping Technology (Suzhou) Co., Ltd  
 SWIFT CODE: ABOCCNBUT03  
 Bank: Agricultural Bank of China Suzhou Branch  
 A/C No: 10-5513 1404 0004 176

## DEFENCE &amp; FUEL

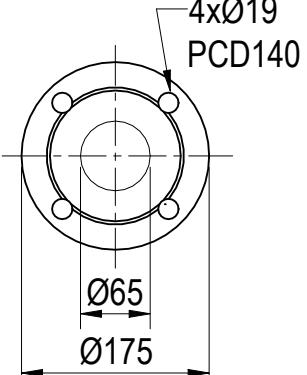
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 DESMI Pumping Technology (Suzhou) Co., Ltd  
 SWIFT CODE: ABOCCNBUT03  
 Bank: Agricultural Bank of China Suzhou Branch  
 A/C No: 10-5513 3804 0004 829

# NO.1 EX - AFU FLUSHING PUMP

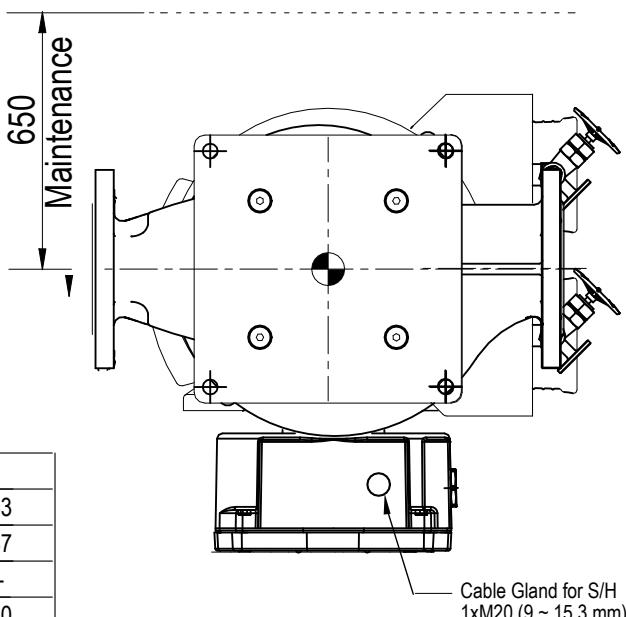
## BASE-FOOT



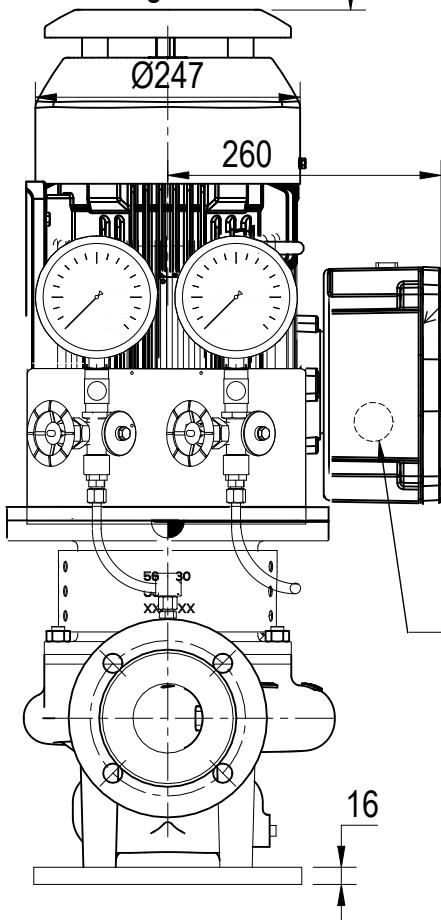
## SUCTION & DELIVERY



## BOTTOM VIEW



Min Distance 100mm For Dismantling Motor



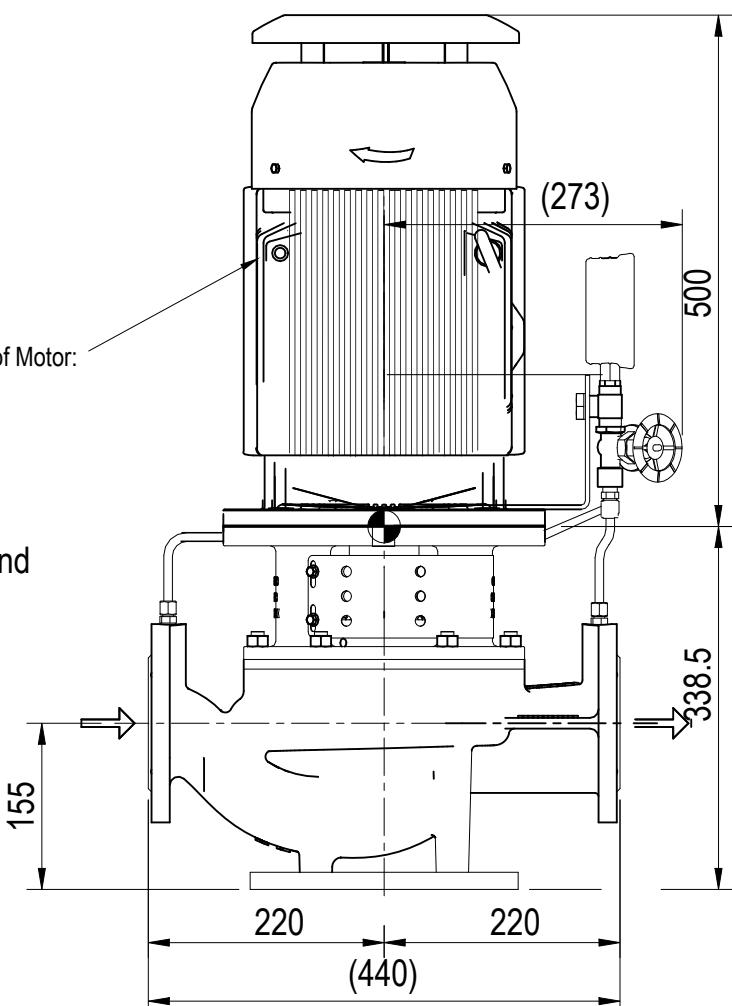
Weight (Kg)	
Pump	63
Motor	87
Base Plate	-
Others	10
Total	160

JUNCTION BOX  
(220x220x120)

Earth Bolt of Motor:  
M5 x 8

Main Cable Gland

Cable gland size	
Main cable gland	1xM25x1.5
(O.D 13 ~ 20 mm)	



Hist.Rev.	Description of Revision		Released date
CO No.	-	Date	-

NOTES:FLANGES" Drilled according to JIS10K"

Dimensional Sketch

ESL65-180M/D12-Q  
WITH MOTOR HMCX 132 S2-2



Scale

1:7

Drawing no.

ELEX65A-S

Quot. No.	-	Date	-
Drawn	SDA	Date	2021.03.29
Approved	BRHE	Date	2020.03.29

**DESMI**

www.desmi.com

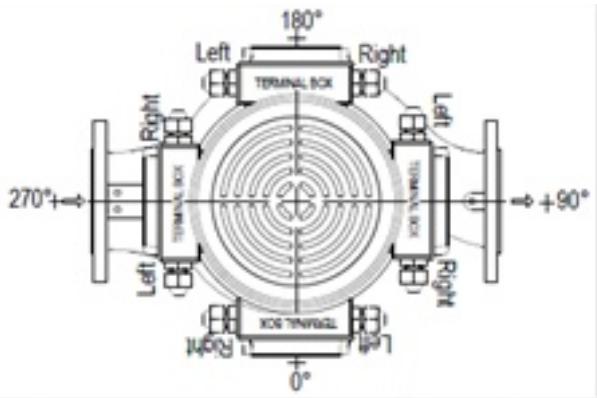
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## Comment Sheet

< J/B and G/B Position & Cable gland direction>

- Top view -



\* Maker Standard : F

\* Please select position and direction :

A (A ~ P)

(A) Terminal Box & Cable direction : 180 degree – Left Air Ejector : 0 degree Gauge Board : 90 degree	(B) Terminal Box & Cable direction : 180 degree – Left Air Ejector : 0 degree Gauge Board : 270 degree
(C) Terminal Box & Cable direction : 180 degree – Right Air Ejector : 0 degree Gauge Board : 90 degree	(D) Terminal Box & Cable direction : 180 degree – Right Air Ejector : 0 degree Gauge Board : 270 degree
(E) Terminal Box & Cable direction : 0 degree – Left Air Ejector : 180 degree Gauge Board : 90 degree	(F) Terminal Box & Cable direction : 0 degree – Left Air Ejector : 180 degree Gauge Board : 270 degree
(G) Terminal Box & Cable direction : 0 degree – Right Air Ejector : 180 degree Gauge Board : 90 degree	(H) Terminal Box & Cable direction : 0 degree – Right Air Ejector : 180 degree Gauge Board : 270 degree
(I) Terminal Box & Cable direction : 90 degree – Left Air Ejector : 270 degree Gauge Board : 180 degree	(J) Terminal Box & Cable direction : 90 degree – Left Air Ejector : 270 degree Gauge Board : 0 degree
(K) Terminal Box & Cable direction : 90 degree – Right Air Ejector : 270 degree Gauge Board : 180 degree	(L) Terminal Box & Cable direction : 90 degree – Right Air Ejector : 270 degree Gauge Board : 0 degree
(M) Terminal Box & Cable direction : 270 degree – Left Air Ejector : 90 degree Gauge Board : 180 degree	(N) Terminal Box & Cable direction : 270 degree – Left Air Ejector : 90 degree Gauge Board : 0 degree
(O) Terminal Box & Cable direction : 270 degree – Right Air Ejector : 90 degree Gauge Board : 180 degree	(P) Terminal Box & Cable direction : 270 degree – Right Air Ejector : 90 degree Gauge Board : 0 degree

<= Maker standard

< Cable O.D >

- Main : M25

is shaft displacement and abnormal noise.

**8.4** Check whether the fastening bolts of the motor are secured firmly, bearings well lubricated and enclosure firmly grounded.

**8.5** Check whether the protective devices conform to the requirements and installed securely.

**8.6** Check whether the connection is correct, starting device in good condition with good contacts and firmly grounded.

**8.7** Check the three-phase power supply with no abnormal voltage reduction or increase and without three phase voltage unbalance.

**8.8** Check the bearing and lubrication system. When necessary, grease must be added properly, or clean up and replace the grease.

## 9. Motor connection with power supply

**9.1** The terminal box is located on the top of the motor. The cable entry (for the rubber-insulated cable, it is bell-shaped hole; while for conduit cable entry, it is a pipe-threaded hole and for armored cable also pipe-threaded hole) and the bottom section of junction box are joined together with cable entry facing RHS horizontally. The T/B is designed to be capable of 180 degree rotation to allow cable entry from the opposite direction.

### 9.2 Connection method

#### 9.2.1 Connection diagram of single-speed motors

**a)** For the junction box with three terminals, the terminals are marked separately with U, V and W. Pls see figure. 4 for its connection diagram.

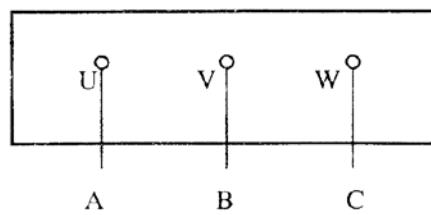


Figure 4 Wiring diagram of three terminals

**b)** For the terminal box designed with six terminals, connection strips are fitted and used to change the connection to suit for two different supply voltages. The marks of the terminal are separately

## NO.1 EX - AFU FLUSHING PUMP

U<sub>1</sub>, U<sub>2</sub>, V<sub>1</sub>, V<sub>2</sub>, W<sub>1</sub> and W<sub>2</sub>. They are connected according to the voltage specified on the nameplate. The wiring diagram is shown in figure. 5:

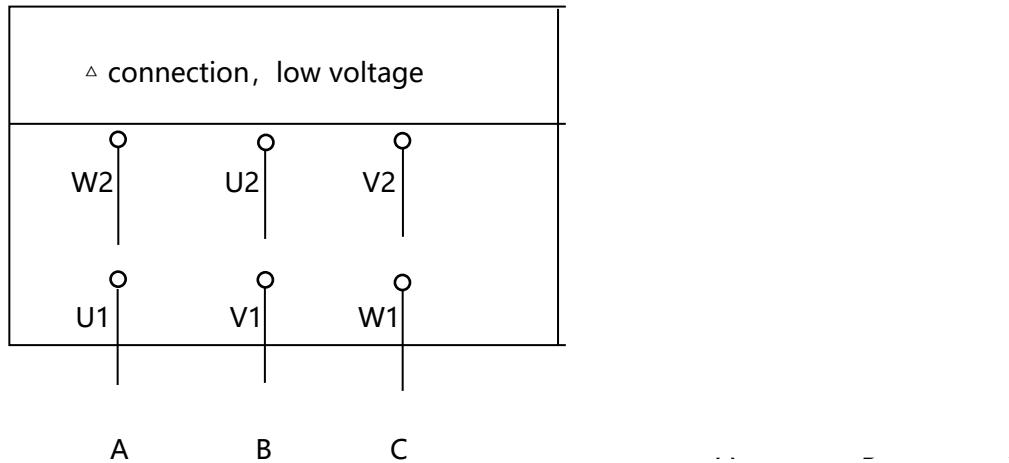
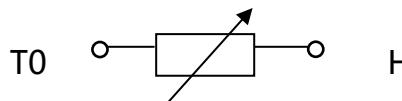
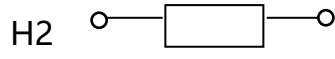


Figure 5 Wiring diagram of three terminals

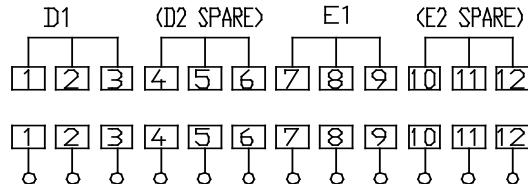
c) For motors designed with winding temperature-detector and space heater, their leads can be brought out into the main terminal box or a separate terminal box. Pls refer to figure. 6 for the wiring diagram:



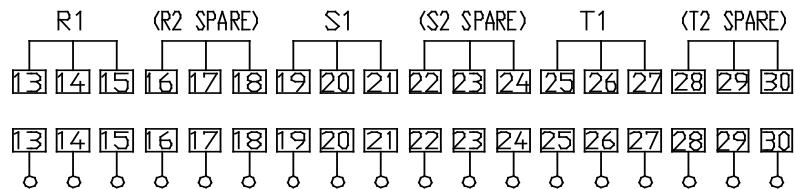
Connection diagram of thermal resistor



Connection diagram of space heater



1-12 for connecting bearing temperature measurement resistor



13-30 for connecting stator temperature measurement resistor

Figure 6 Wiring diagram of temperature sensor and heater

**9.3** The motor rotation of direction is clockwise viewed from the drive end when the motor's phase sequence U, V, W is in accordance with the phase sequence A, B, C of power supply, otherwise it

**NO.1 EX - AFU FLUSHING PUMP  
SPARE PART**

**STANDARD SPARE PART LIST**

● PUMP SPARE PART LIST [ESL40/50-180N/12]

NO	ITEM	PICTURE	SPEC	UNIT	QTY	REMARK
1	MECH. SHAFT SEAL (712095)		DS Ø28	EA	1	PUMP
2	O-RING (721416)		Ø190X3,55 NBR SH.70	EA	1	PUMP

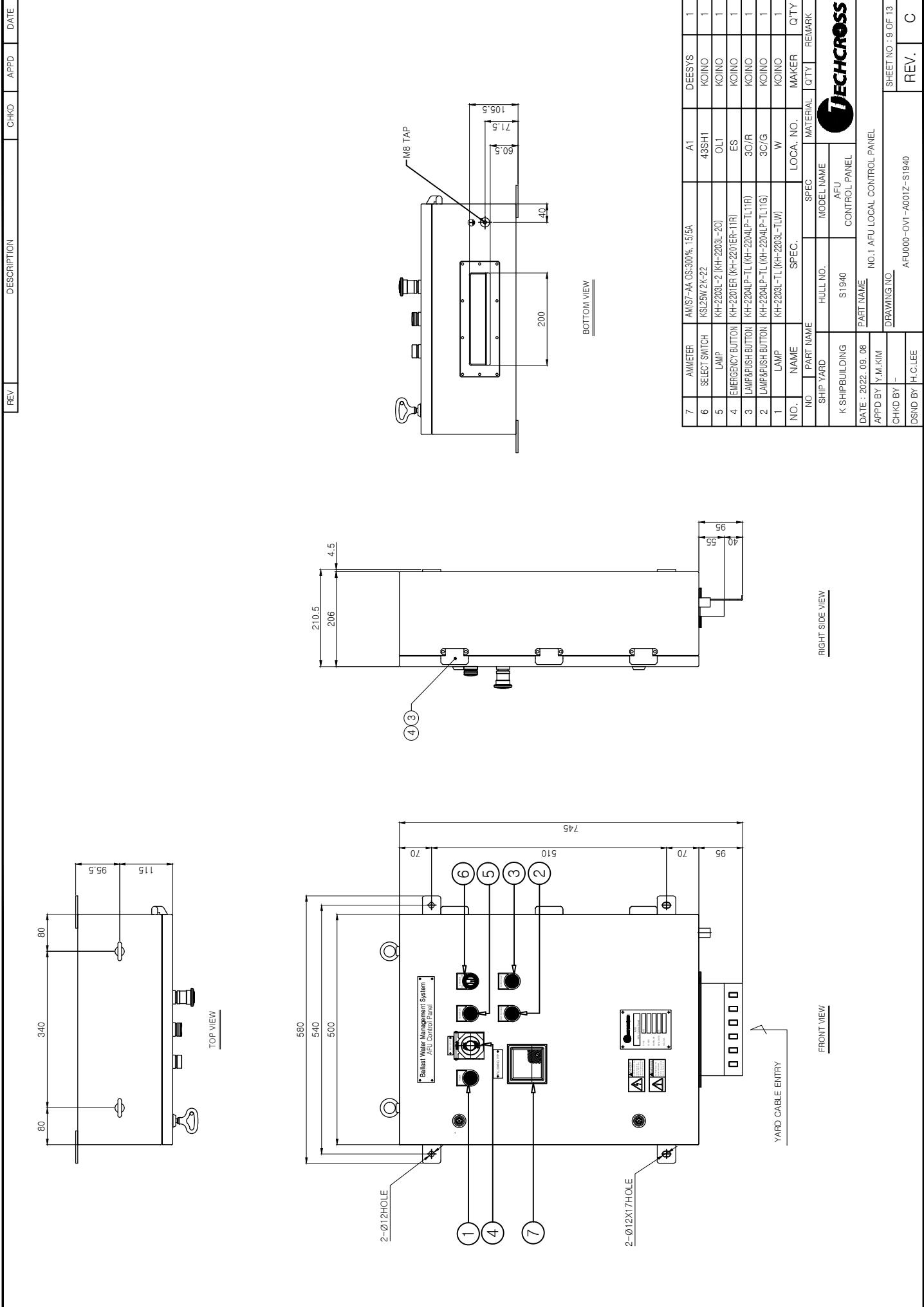
**NOTE:**

- #.1 Above two parts are packed as spare part kit (spare part kit no. 659829)  
#.2 Tool for Mech.Shaft Seal is included in spare part kit.

< Spare part kit >

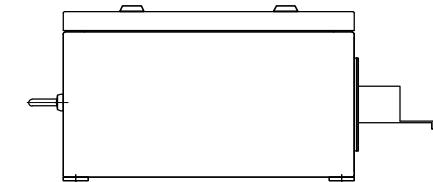
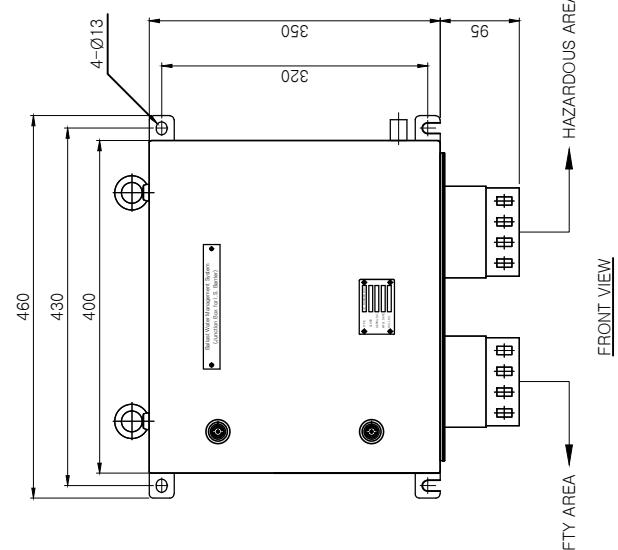
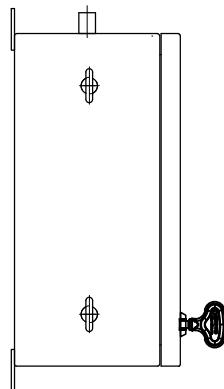


# NO.1 AFU CONTROL PANEL

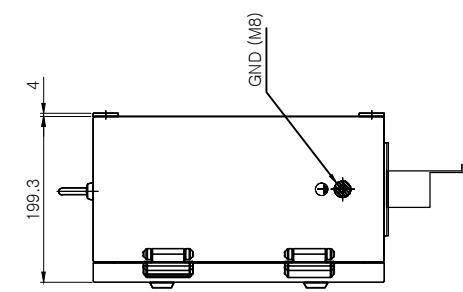
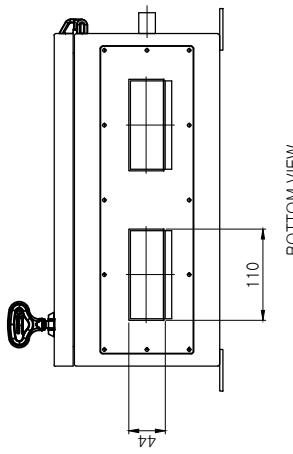


# I.S BARRIER PANEL

REV.	DESCRIPTION	CHKD	APPD	DATE
------	-------------	------	------	------



LEFT SIDE VIEW



NOTE  
1. Q'TY : 1EA/SET

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
K SHIPBUILDING	HULL NO.	MODEL NAME			
	S1940	-			
DATE : 2022.09.08	PART NAME				
APPD BY Y.M.KIM	I.S. BARRIER PANEL				
CHKD BY -	DRAWING NO				
DSND BY H.C.LEE	JB000-GB-OV1-S1940				
	REV.	B			
					SHEET NO : 4 OF 6



## ECS-HYCHLOR GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING  
HULL NO. : S1940  
MODEL : ECS-HYCHLOR-1200

### DETAIL OF THE Ex-FMU

#### 1. Ex-Flow Meter Unit (NO.1 Ex-FMU)

DIVISION	SPECIFICATION
WEIGHT	55Kg
CONNECTION	JIS 5K-300A FLANGE TYPE
FLUID TEMPERATURE	0 °C ~ 60 °C
AMBIENT TEMP"	-10°C ~ +60°C
POWER INPUT	AC 220V
SIGNAL OUTPUT	4~20mA
IP GRADE	IP66
PROTECTION	Ex d IIC T5 Gb, Tamb : -20°C~+55°C
CERTIFICATE	IECEx KGS 13.0001X
MATERIAL	FLANGE : STEEL LINING : HARD RUBBER ELECTRODES : TITANIUM

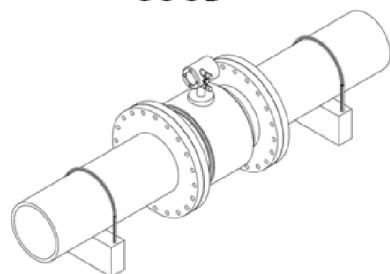
#### 2. INSTALLATION GUIDE

Notice : When installing FMU, FMU power should be turn off before starting any work(welding...etc)

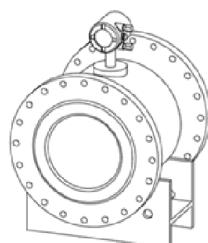
When installing a flow meter larger than 400A, housing bending and damage of internal electric coil may occur.

It is recommended to install support at the end of housing as in the picture below.

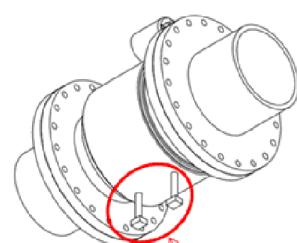
GOOD



GOOD



WRONG



SUPPORT BAR



## ECS-HYCHLOR

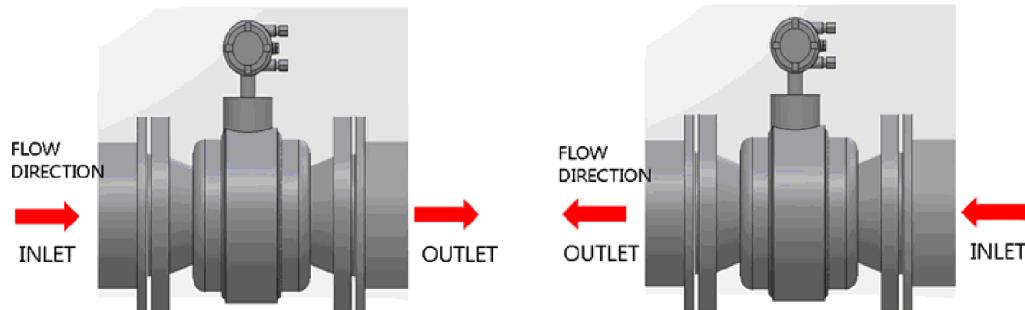
### GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

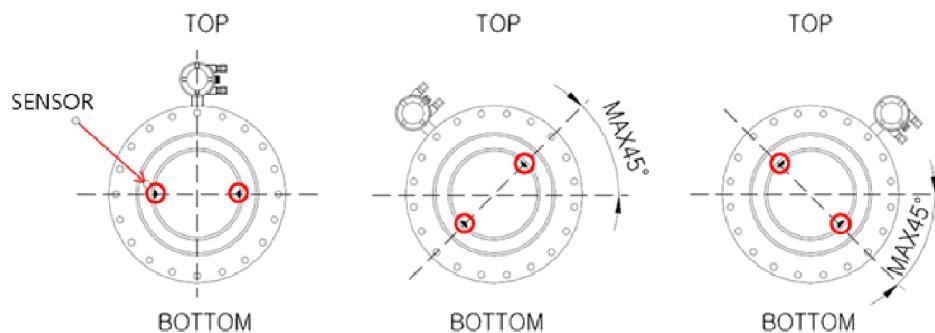
HULL NO. : S1940

MODEL : ECS-HYCHLOR-1200

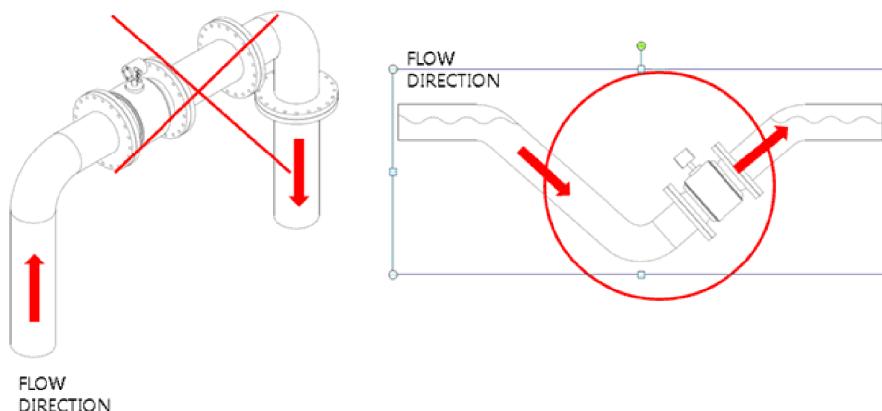
Flow meter can be used for both directions.



It is necessary to keep elec. rod's position horizontally, If it is hard to maintain it horizontally, it shpould not tilt more than 45 degrees from horizontal line.



When installing FMU on the highest point or downstream point, inaccurate value may be measured as full water condition is not fulfilled. In this case, install it as shown in the right picture so full water condition can be fulfilled.





## ECS-HYCHLOR

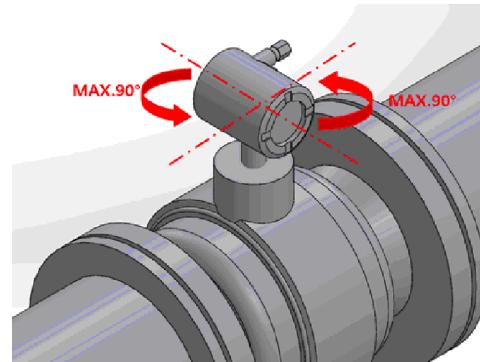
### GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

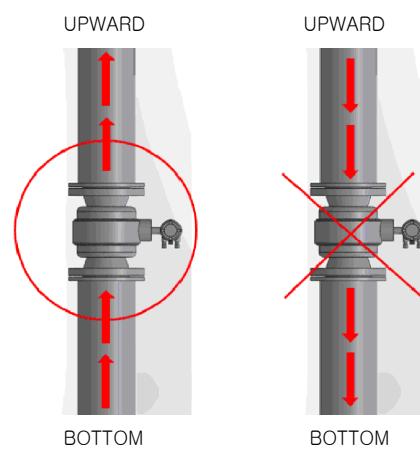
HULL NO. : S1940

MODEL : ECS-HYCHLOR-1200

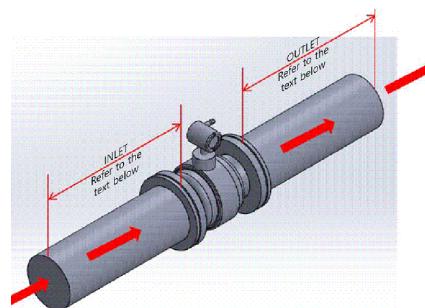
Display can be turned into 4 directions, 90 Degrees(Total of 360 Degrees)



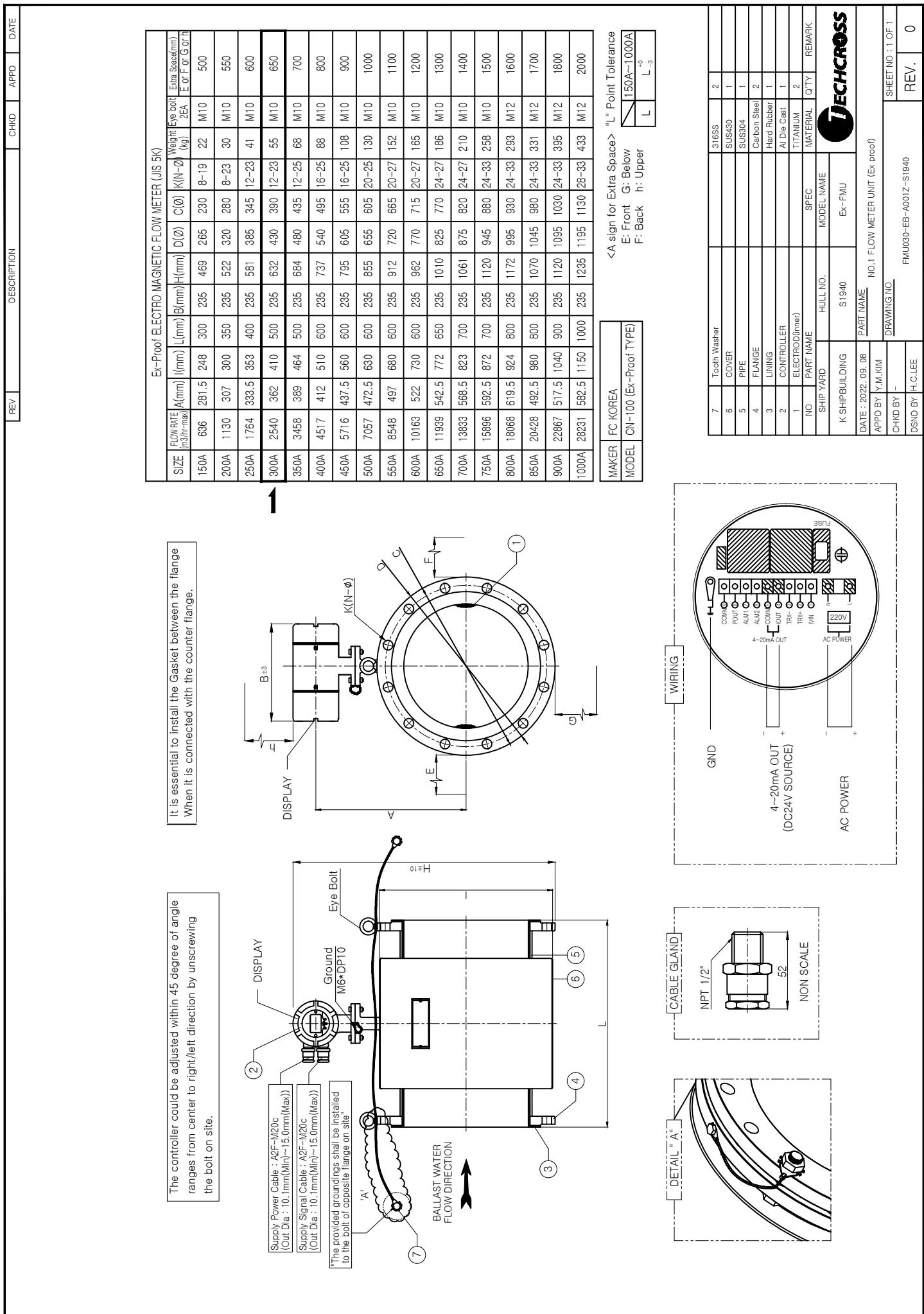
When installing FMU vertically, the ballast water should flow from bottom to upward



Check the pipe length of FMU inlet & outlet as shown in the picture below to ensure FMU's accuracy



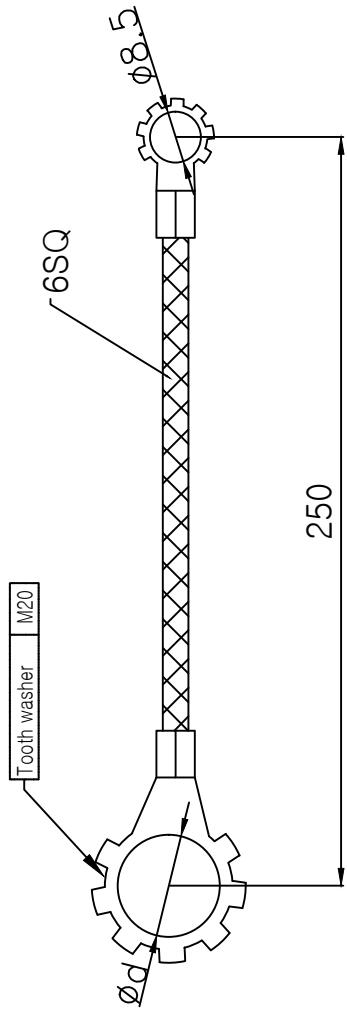
(Inlet side : Min 2D, Outlet side : Min 1D D: pipe diameter)



REV	DESCRIPTION		CHKD	APPD	DATE
Pipe diameter	Earth Wire (Tooth washer)				
5K 40A	User bolt	Thick (t)	d		
5K 50A	M12		12.6		
5K 65A					
10K 40A					
10K 50A					
10K 65A					
10K 80A	M16		17		
10K 100A					
5K 80A					
5K 100A					
5K 125A					
5K 150A					
10K 125A					
10K 150A					
10K 200A	M20		21		
5K 200A					
5K 250A					
5K 300A					
10K 250A					
10K 300A					
10K 350A					
5K 350A	M22		2		
5K 400A					
5K 450A					
5K 500A					
10K 400A					
10K 450A					
10K 500A					
5K 550A	M24		25		
5K 600A					
5K 650A					
5K 700A					
10K 550A					
10K 600A					
10K 650A					
10K 700A					
10K 750A					
10K 800A	M30		31		
5K 750A					
5K 800A					

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME			
K SHIPBUILDING	S1940	FMU			
DATE : 2022. 09. 08	PART NAME	FMU EARTH WIRE			
APPD BY Y.M.KIM	DRAWING NO				
CHKD BY -	-				
DSND BY H.C.LEE	-				
					REV. 0
					SHEET NO : 1 OF 1





ECS-HYCHLOR  
GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

HULL NO. : S1940

MODEL : SMU-040

## DETAIL OF THE SMU

- Static Mixer Unit (SMU-040)

### 1. GENERAL SPECIFICATION

DIVISION	SPECIFICATION
MATERIAL	BODY : STPG 370_PE COATING
	INSERT PIPE : SUS316L
	STATIC MIXER PLATE : SUS316L
CONNECTION	BODY : JIS 5K 400A FLANGE TYPE
	HGU INJECTION : JIS 10K 40A FLANGE TYPE
	ANU INJECTION : JIS 10K 25A FLANGE TYPE
	SPARE : JIS 5K 80A FLANGE TYPE
TYPE	STRAIGHT TYPE



## ECS-HYCHLOR

### GENERAL SPECIFICATION

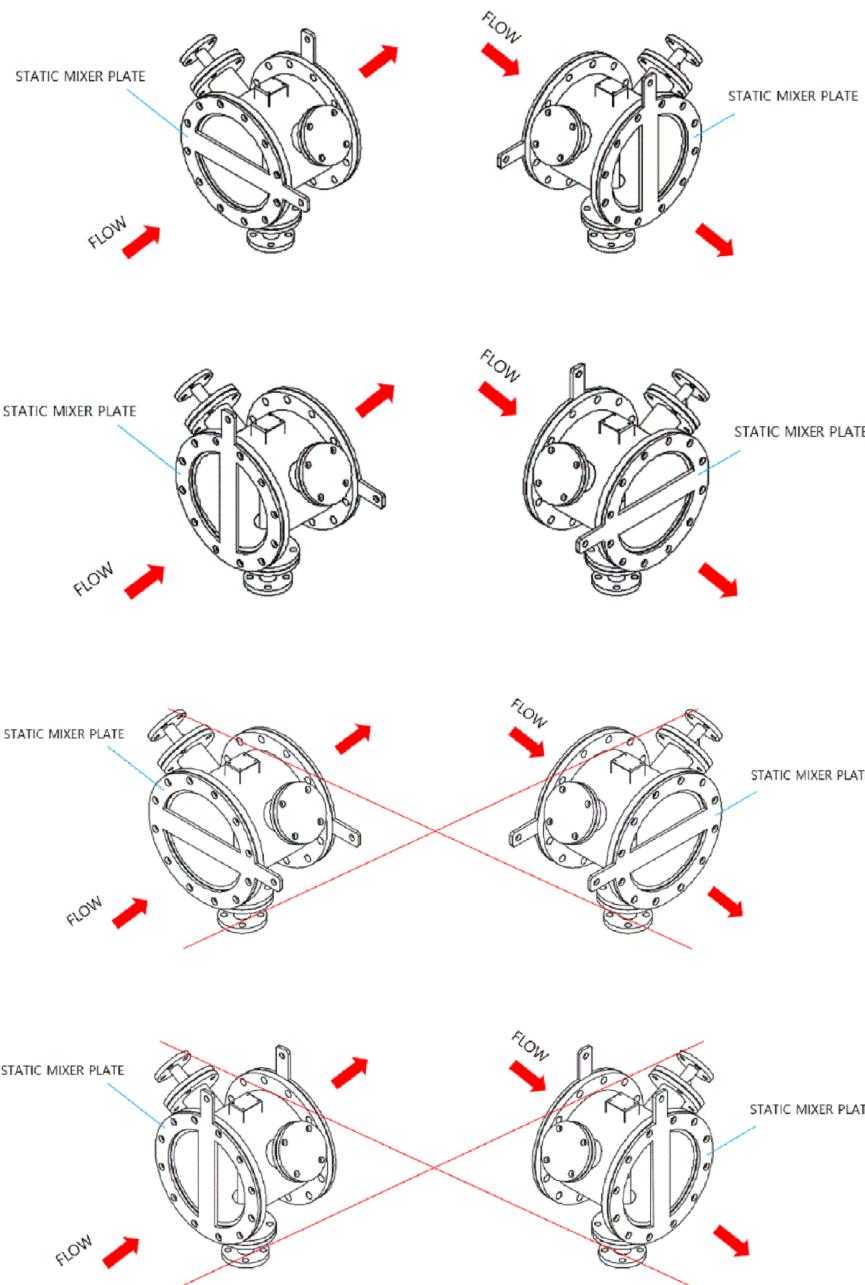
SHIP YARD : K SHIPBUILDING

HULL NO. : S1940

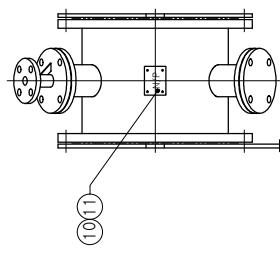
MODEL : SMU-040

## DETAIL OF THE SMU

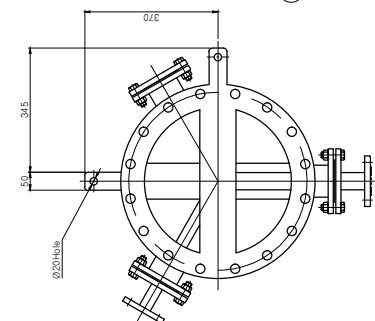
### 1. INSTALLATION GUIDE



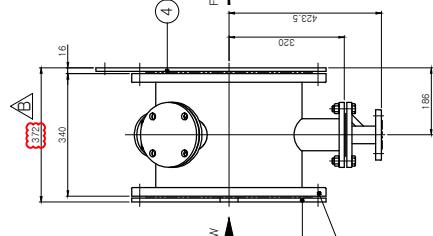
REV	DESCRIPTION	CHKD	APPD	DATE
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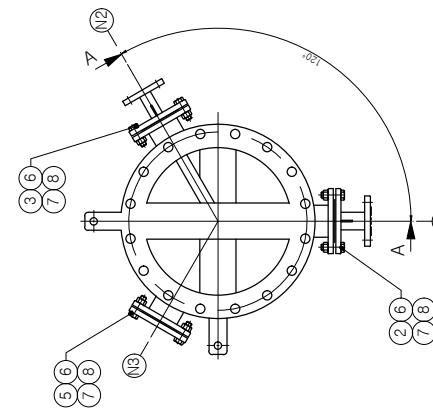
SMU PLAN VIEW



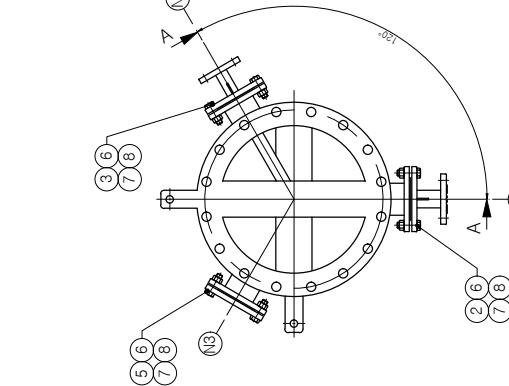
SMU LEFT SIDE VIEW



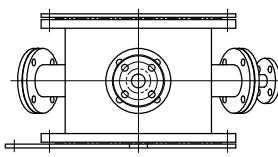
SMU FRONT VIEW



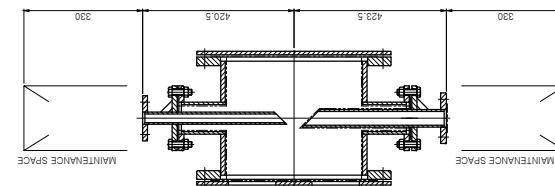
SMU RIGHT SIDE VIEW



SECTION A-A'



SMU REAR VIEW



NOTE  
1. WEIGHT : ABT. 126KG

N3	SPARE PORT	JIS 5K 80A	SUS316L	L
N2	AN INJECTION PORT	JIS 10K 25A	SUS316L	1
N1	HGU INJECTION PORT	JIS 10K 40A	SUS316L	L

11	BUND RIVET	Ø3.2	AL	4
10	MFF NAME PLATE	-	AL	1
9	GASKET	JIS 5K 400A, T=3.0, RF	NON ASBESTOS	2
8	GASKET	JIS 5K 80A, T=1.5, RF	NON ASBESTOS	3
7	HEXAGON NUT	M16	SUS304	24
6	HEXAGON HEAD BOLT	M16x1.55	SUS304	24
5	BUND FLANGE	JIS 5K 80A	SUS316L	1
4	STATIC MIXER PLATE	T=10.0	SUS316L	2
3	INSERT PIPE-2	JIS 5K 80A-B0 - 10K 25A-B0	SUS316L	1
2	INSERT PIPE-1	JIS 5K 80A-B0 - 10K 20A-B0	SUS316L	1
1	STATIC MIXER PIPE	JIS 5K 400A, #40, EFW	STPG-370	1
NO	PART NAME	SPEC	MATERIAL	Q'TY
			REMARK	

K SHIPBUILDING	HULL NO.	MODEL NAME
	S1940	SMU-040

DATE : 2022.09.08	PART NAME	SMU-040
APPD BY Y.M.KIM		
CHKD BY -		
DSND BY H.C.LEE		
	DRAWING NO	SMU040-GA-A001Z-S1940
	REV.	B



SHEET NO : 1 OF 1
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ECS-HYCHLOR  
GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING  
HULL NO. : S1940  
MODEL : ECS-HYCHLOR-1200

## DETAIL OF THE Ex-TSU

### 1. TSU CONTROL PANEL (SAFETY AREA)

DIVISION	SPECIFICATION
WEIGHT	50Kg
SIZE	570(W) X 279(D) X 885(H)
CONTROL SYSTEM	AUTOMATIC CONTROL BY PLC
POWER INPUT	AC 220V, 60Hz
INSTALL TYPE	WALL MOUNTING
MATERIAL	STEEL
ENCLOSURE CLASS	IP44

### 2. TRO SENSOR(CLX-Ex2) (HAZARDOUS AREA)

DIVISION	SPECIFICATION
RANGE	0 ~ 10mg/l
ACCURACY	0 ~ 6mg/l : ±5% OR 0.03 mg/l of CL2 whichever is greater 6 ~ 10mg/l : ±10%
RESOLUTION	0.01mg/l
METHOD	USEPA accepted DPD method of analysis for measuring Total Residual Oxidant
POWER INPUT	AC 220V
OUTPUT SIGNAL	RS-485, D.O
OPERATION TEMP"	0 ~ 55°C
AIR PRESSURE	5.5~7bar
AIR VOLUME	35 SLPM
WEIGHT	27.2Kg
IP GRADE	IP56
PROTECTION	Ex px IIC T4 Gb
CERTIFICATE	IECEx LC14.0006 DNV-GL class : TAA000005K KR class : NOS34999-AE001



## ECS-HYCHLOR GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

HULL NO. : S1940

MODEL : ECS-HYCHLOR-1200

### 3. Drain Tank Unit (Ex-DTU)

#### 3.1 Tank

DIVISION	SPECIFICATION
WEIGHT	100 Kg
CAPACITY	85Liter
MATERIAL	SUS304

#### 3.2 Ex-Level Switch

DIVISION	SPECIFICATION
MAX'OPERATING PRESSURE	10bar
MAX' OPERATING TEMP"	100°C
AMBIENT TEMP"	-10°C~ 80°C
MATERIAL	HOUSING : ALDC, OTHERS : SUS316
SWITCH TYPE	MAGNETIC FLOAT SWITCH / SPDT
IP GRADE	IP65
PROTECTION	-40°C<=ta<=+55°C Ex d IIC T6 Ex tD A21 IP65 T80°C
CERTIFICATE	IECEx TUR 09.0002X

### 4 Air Pump Unit(APU)

DIVISION	SPECIFICATION
MAXIMUM FLUID WORKING PRESSURE	8BAR / 0.8MPa / 116 psi
MAXIMUM FREE FLOW DELIVERY	35 lpm : 2.1m3/h
MAXIMUM SUCTION LIFT (DRY / WET)	5m / 9.8m
DIAPHRAGM OPERATING TEMP"	95°C
TYPICAL SOUND LEVEL AT 4.8BAR AIR @ 60CPM	65 dBA
MAXIMUM AIR CONSUMPTION	6.36scfm(0.18 m3/min)
AIR PRESSURE OPERATING RANGE	2 ~ 8 BAR / 0.2 ~ 0.8 MPa
WEIGHT	2.4kg ONLY PUMP / UNIT TOTAL 8kg 2.0kg FILTER REGULATOR BOARD



## ECS-HYCHLOR GENERAL SPECIFICATION

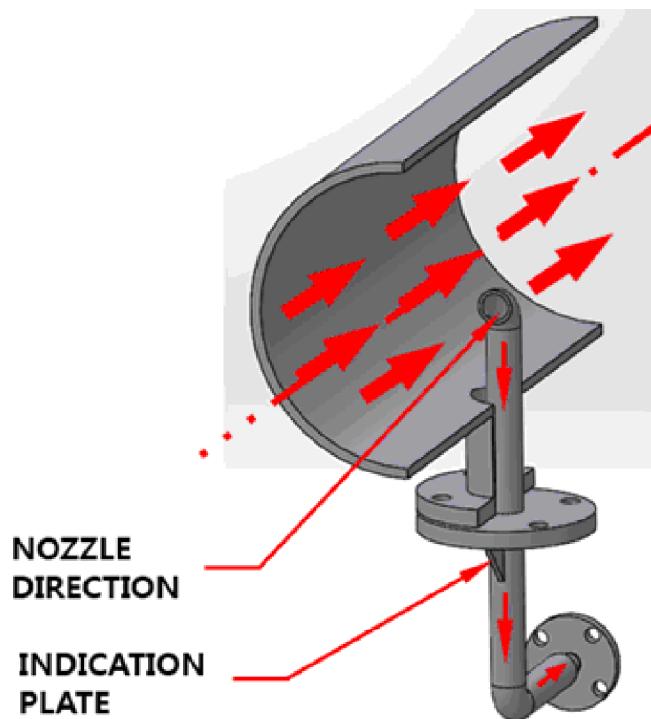
SHIP YARD : K SHIPBUILDING  
HULL NO. : S1940  
MODEL : ECS-HYCHLOR-1200

### 5. Ex-SOLENOID VALVE

DIVISION	SPECIFICATION
WEIGHT	0.5 Kg
PRESSURE RANGE	0.3bar ~ 12bar
POWER INPUT	AC 220V
AMBIENT TEMP"	0°C ~ 65°C
IP GRADE	IP65
PROTECTION	Ex d mb IIC T4 Gb / Ex d mb IIC T4
CERTIFICATE	IECEx LCI 06.0004X / LCIE 03 ATEX 6451 X /03

### 6. INSTALLATION GUIDE

Refer to the detailed drawing when installing HIGH, LOW sampling port



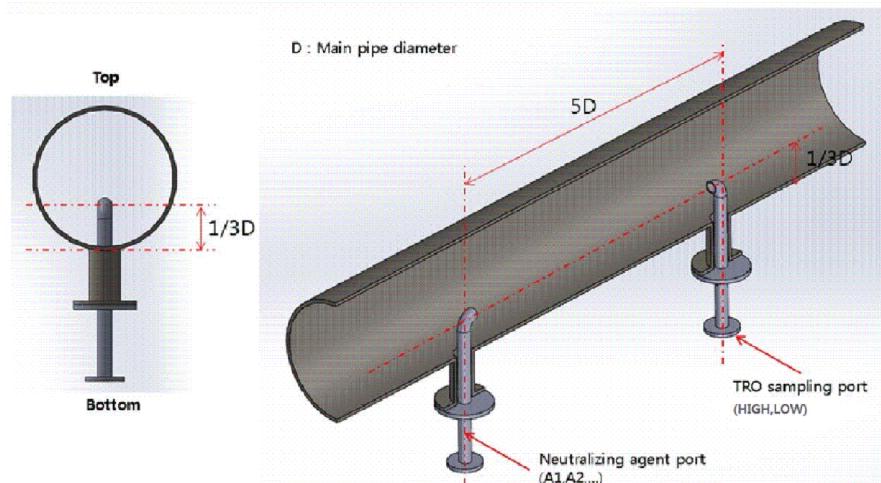


## ECS-HYCHLOR

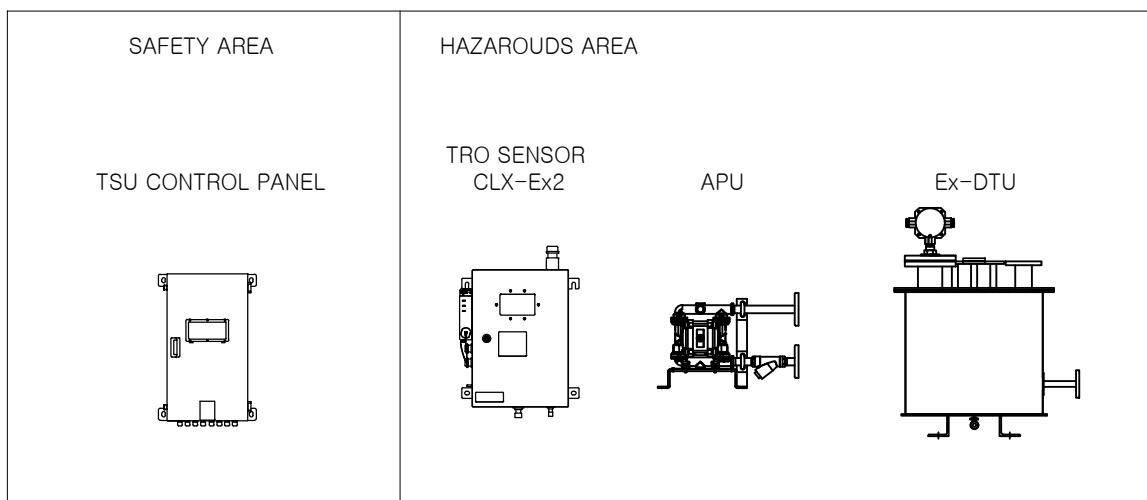
### GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING  
HULL NO. : S1940  
MODEL : ECS-HYCHLOR-1200

For diffusion of neutralization agent, the ANU dosing port and TRO sampling port should be apart from each other at least 5D. (D : Main ballast pipe diameter)



Refer to the drawing when installing Ex-TSU



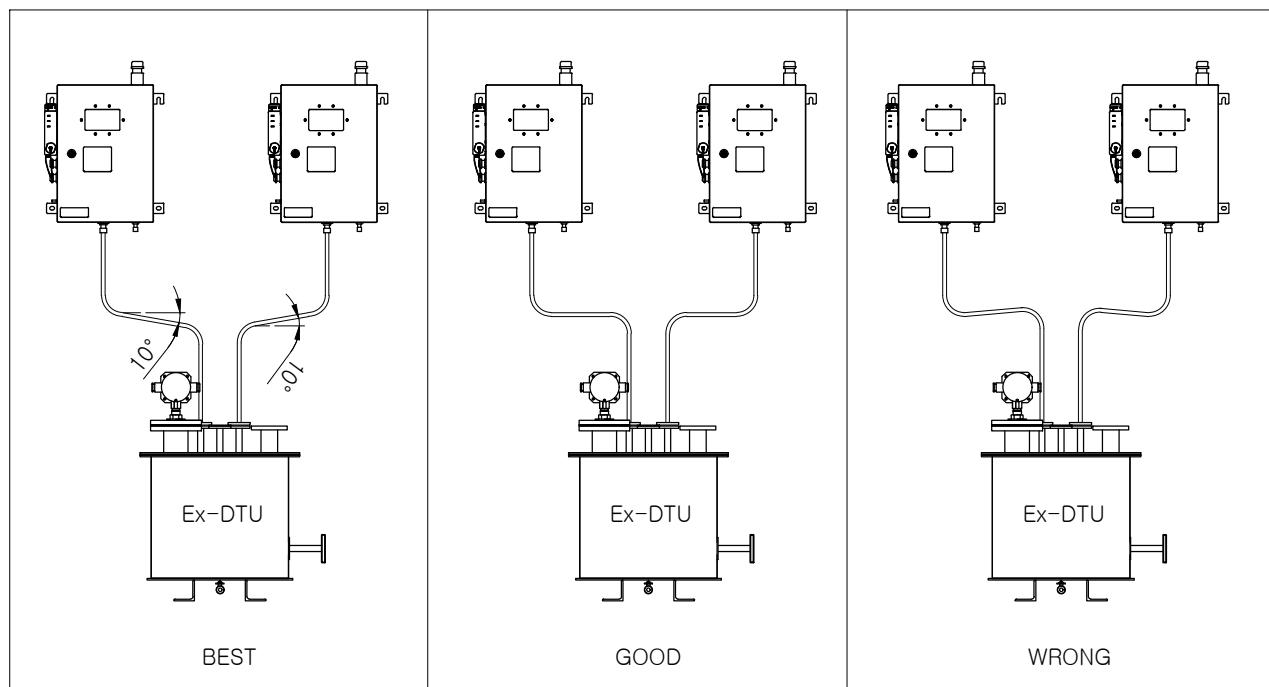


## ECS-HYCHLOR

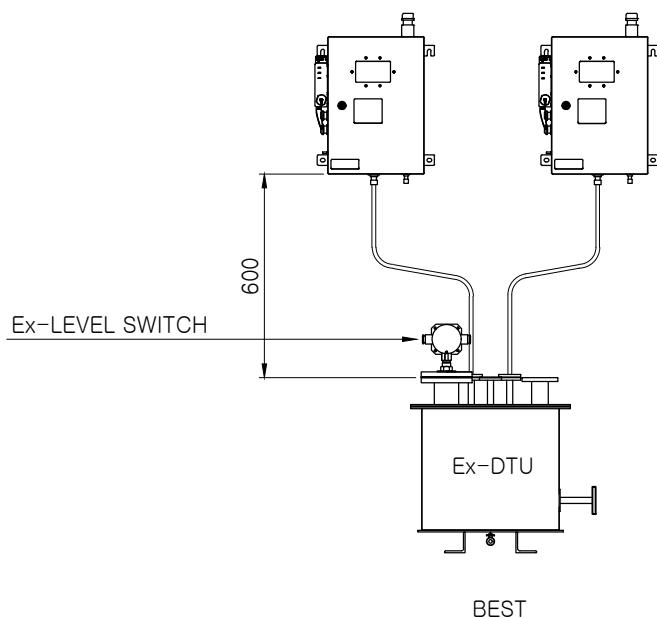
### GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING
HULL NO. : S1940
MODEL : ECS-HYCHLOR-1200

Refer to the drawing when installing drain port of TRO SENSOR(CLX-Ex2)



Secure maintenance space to remove level switch (MIN" 600mm)





## ECS-HYCHLOR

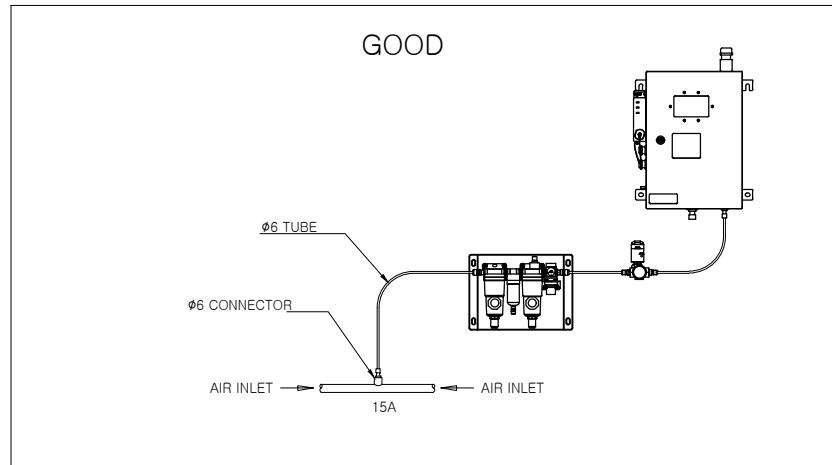
### GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

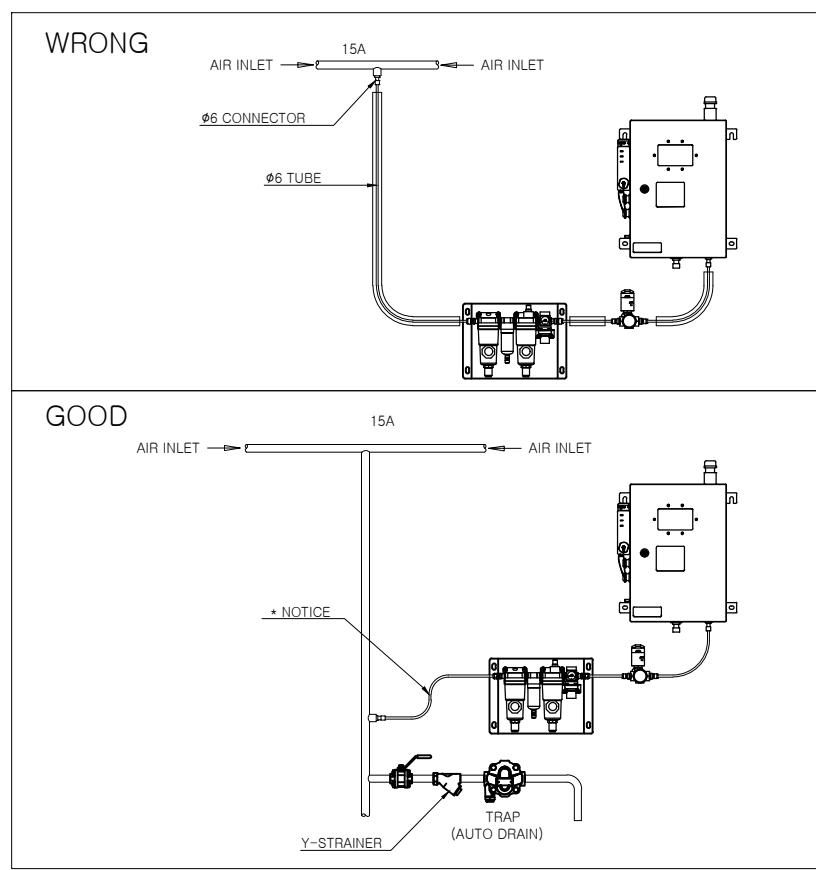
HULL NO. : S1940

MODEL : ECS-HYCHLOR-1200

The CLX-Ex2(TRO sensor) air inlet line should be supplied with dry air, but if the service air line is supplied, it should be installed referring to the drawing below.



Refer to the drawing, If it is installed the CLX-Ex2(TRO sensor) below air line and trap(Auto drain) must be installed



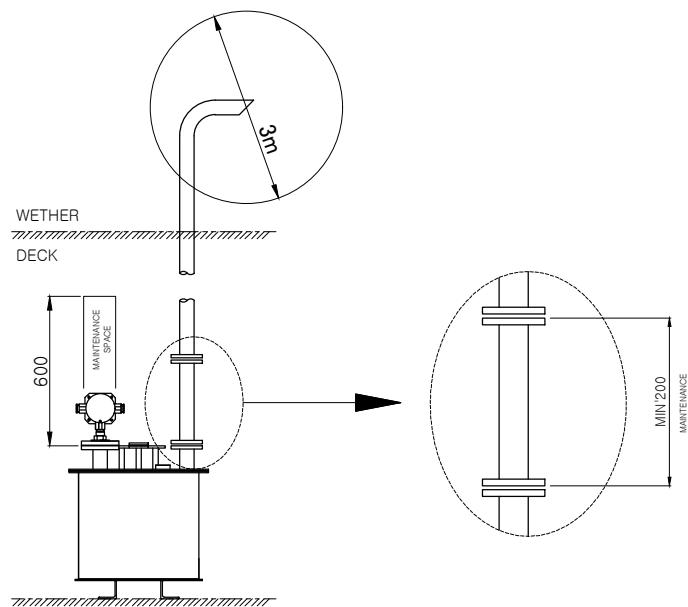


## ECS-HYCHLOR

### GENERAL SPECIFICATION

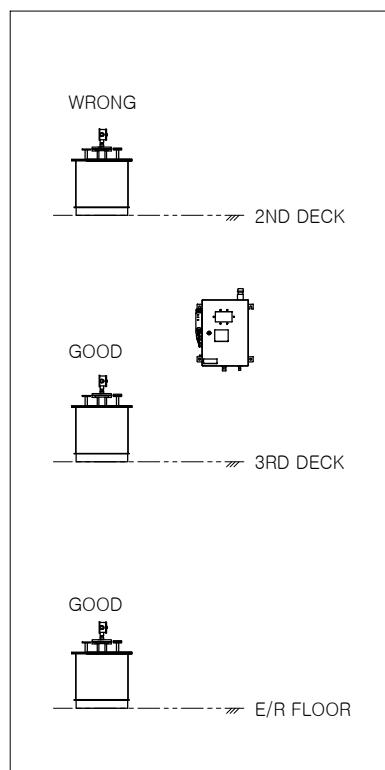
SHIP YARD : K SHIPBUILDING  
HULL NO. : S1940  
MODEL : ECS-HYCHLOR-1200

Area within 3 meters in diameter of Ex-DTU air vent outlet so considered as a hazardous area.  
If electric equipment is installed within this area, Ex-type has to be installed

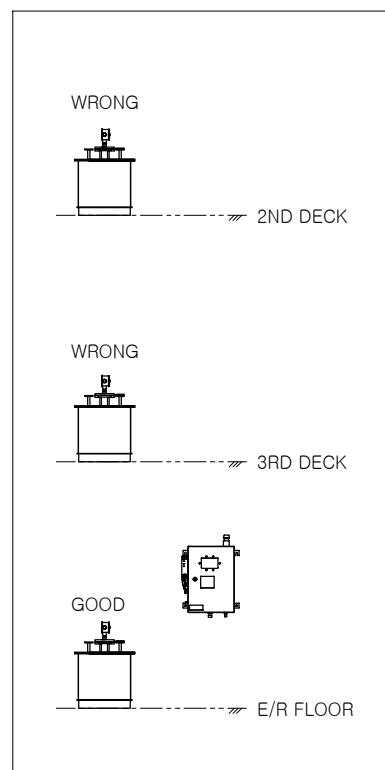


For installation of the TRO SENSOR(CLX-Ex2) and Ex-DTU, please refer to the drawing below.

NO.1 CASE



NO.2 CASE

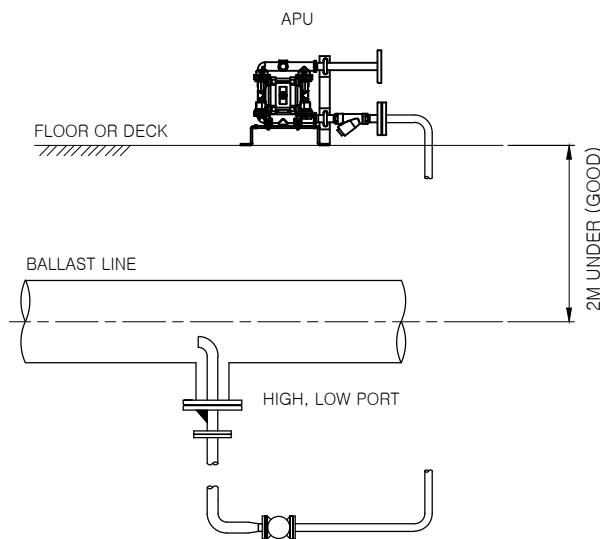




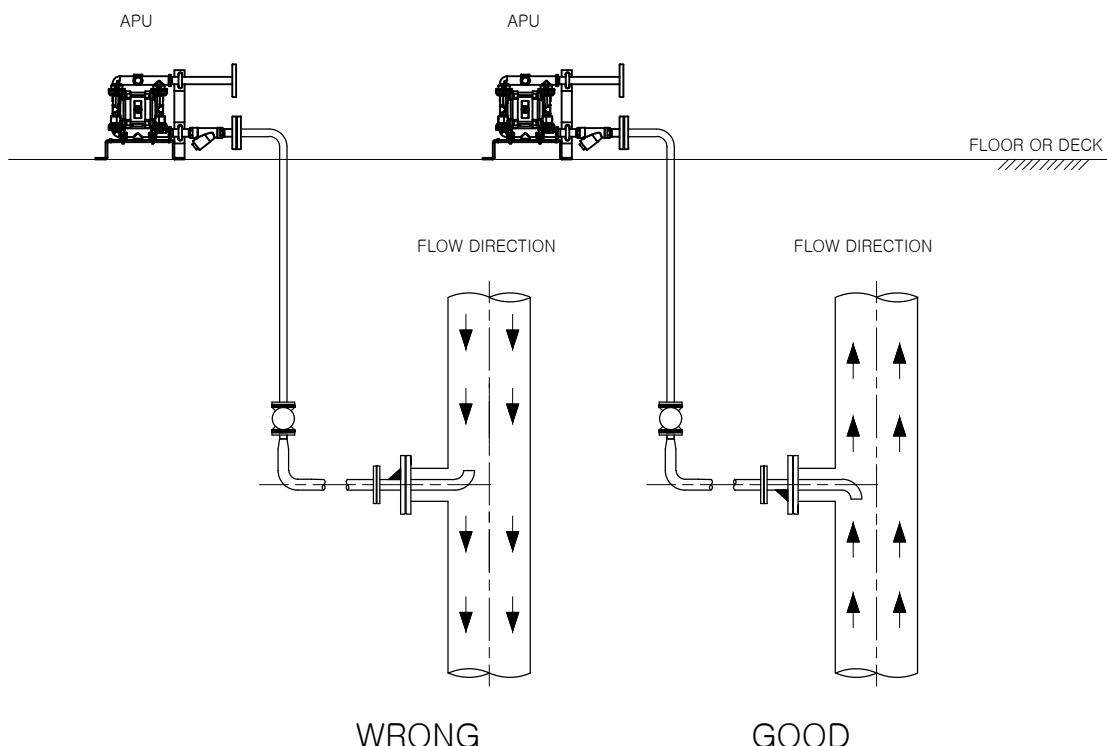
ECS-HYCHLOR  
GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING  
HULL NO. : S1940  
MODEL : ECS-HYCHLOR-1200

When installing APU sunction line, the height should be 2m from the sampling port



When vertical installing APU sunction line, refer to the drawing below for installing APU sunction line.



## TSU CONTROL PANEL

REV	DESCRIPTION	CHKD	APPD	DATE
-----	-------------	------	------	------

**NOTE**

1. PAINT : POWDER COAT'G (60μm OVER)
2. COLOR : SHIPBUILDER STANDARD
3. INSTALLATION AREA : SAFETY

**TECHCROSS**

NO	PART NAME	HULL NO.	SPEC	MATERIAL	Q.TY	REMARK
K SHIPBUILDING	\$190	Ex-TSU				

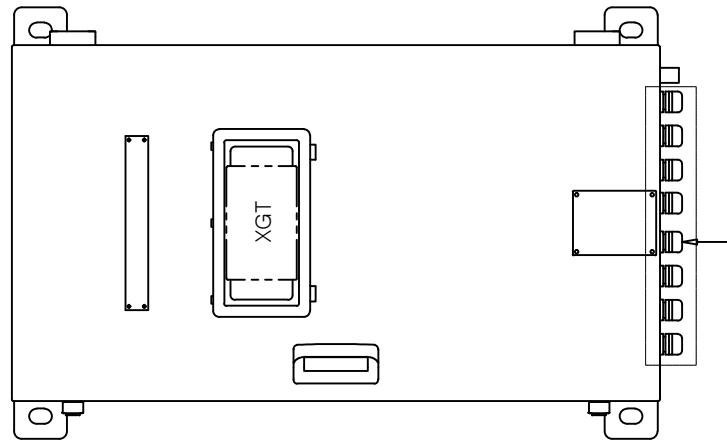
SHEET NO : 1 OF 1

# TSU CONTROL PANEL

REV	DESCRIPTION	CHKD	APPD	DATE
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RIGHT SIDE VIEW



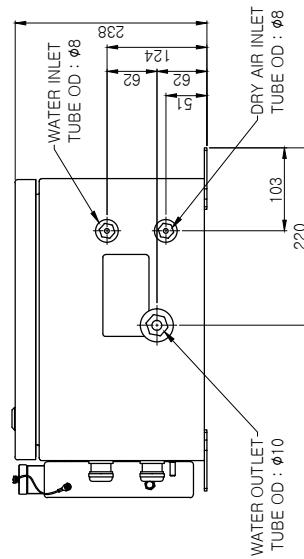
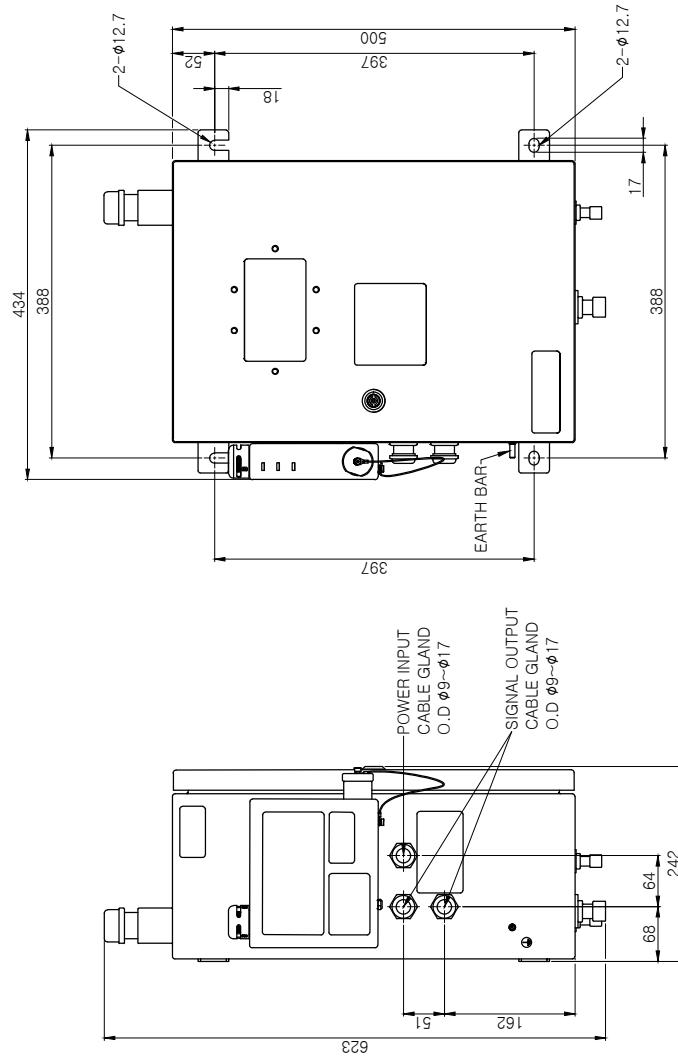
FRONT VIEW



LEFT SIDE VIEW

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME			
K SHIPBUILDING	S1940	Ex-TSU			
DATE : 2022. 09. 08	PART NAME	TSU CONTROL PANEL			
APPD BY Y.M.KIM	DRAWING NO	TSU000-EA-A001A-S1940			
CHKD BY -					SHEET NO : 2 OF 2
DSND BY H.C.LEE					REV. C

REV	DESCRIPTION	CHKD	APPD	DATE
<b>SPECIFICATION</b>				
DIVISION	0 ~ 10mg/l			
RANGE	0 ~ 8mg/l : $\pm 5\%$ OR 0.03 mg/l of Cl2 whichever is greater			
ACCURACY	6 ~ 10mg/l : $\pm 10\%$			
RESOLUTION	0.01mg/l			
METHOD	USEPA accepted DPD method of analysis for measuring Total Residual Oxidant			
POWER INPUT	AC 220V			
OUTPUT SIGNAL	RS-485, D.O			
OPERATION TEMP <sup>o</sup>	0 ~ 55°C			
AIR PRESSURE	5.5 ~ 7bar			
AIR VOLUME	35 SLPM			
WEIGHT	27.2kg			
IP GRADE	IP66			
PROTECTION	Ex p: IIC T4 Gb			
CERTIFICATE	IECEx LC14.0096 DNV-GL Class : ATEX000005K KR class : NIOSH999-AE001			
<b>NOTE</b>				
1. MODEL : CLX-Ex2 (TRO sensor)				
2. MAKER : HF SCIENTIFIC				
3. INSTALLATION AREA : HAZARDOUS				
NO	PART NAME	HULL NO.	SPEC	MATERIAL Q'TY REMARK
K SHIPBUILDING	S1940		Ex-TSU	<b>TECHCROSS</b>
APPD BY Y.M.KIM				
CHKD BY -				
DSND BY H.C.LEE				
DRAWING NO ECS009-00-E0092-S1940				REV. 0
				SHEET NO : 1 OF 1



REV CHKO APPD DATE

DESCRIPTION OF LINE TYPE

LINE	DESCRIPTION
—	WATER
- - -	COMP. AIR
— — —	BOUNDARY OF EQUIPMENT

SYMBOL LIST

	SOLENOID VALVE
	REGULATOR
	FILTER (NO DRAIN)
	BALL VALVE
	CHECK VALVE
	3WAY SOLENOID VALVE

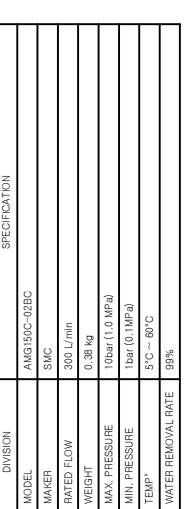
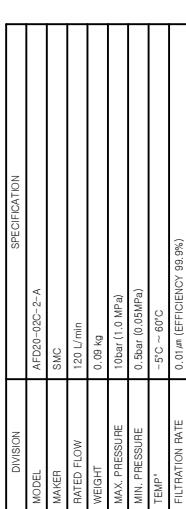
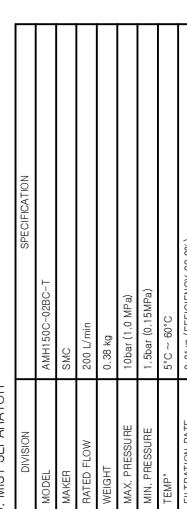
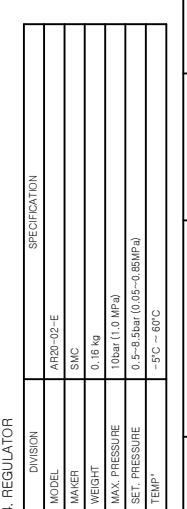
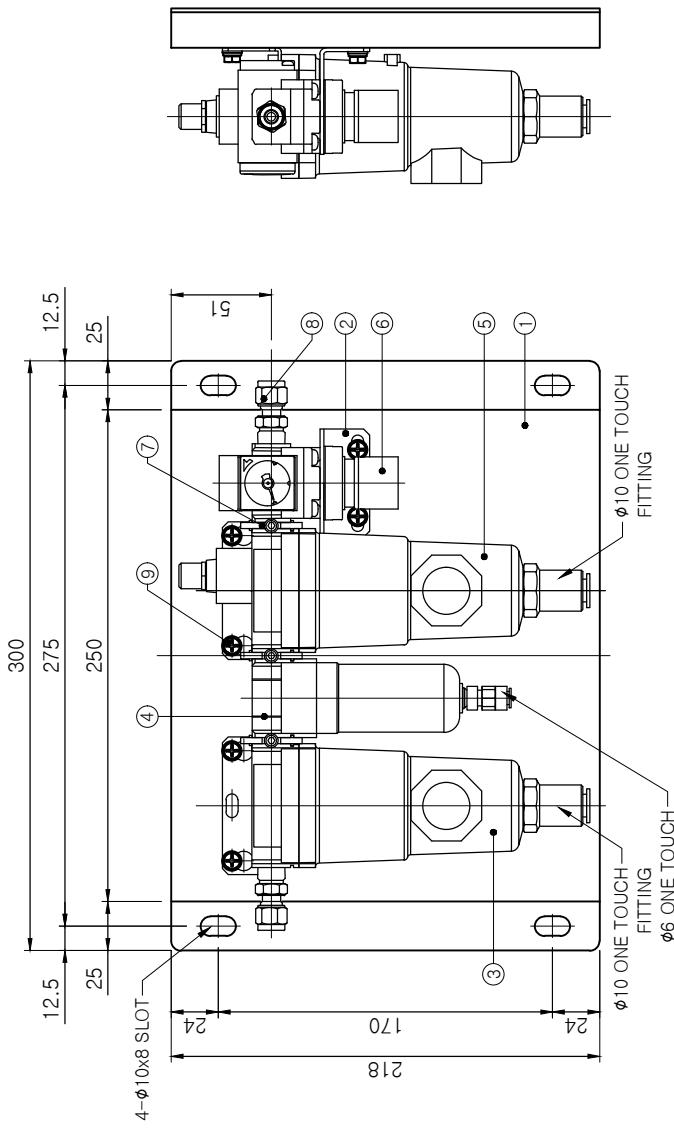
DATE : 2022. 09. 08 PART NAME : TSU TRO SENSOR (CLX-Ex2) INNER P&I SHEET NO : 1 OF 1

DRAWING NO : TSU000-EB-A001B-S1940 REV. 0

APPD BY Y.M.KIM CHKO BY - DSND BY H.C.LEE

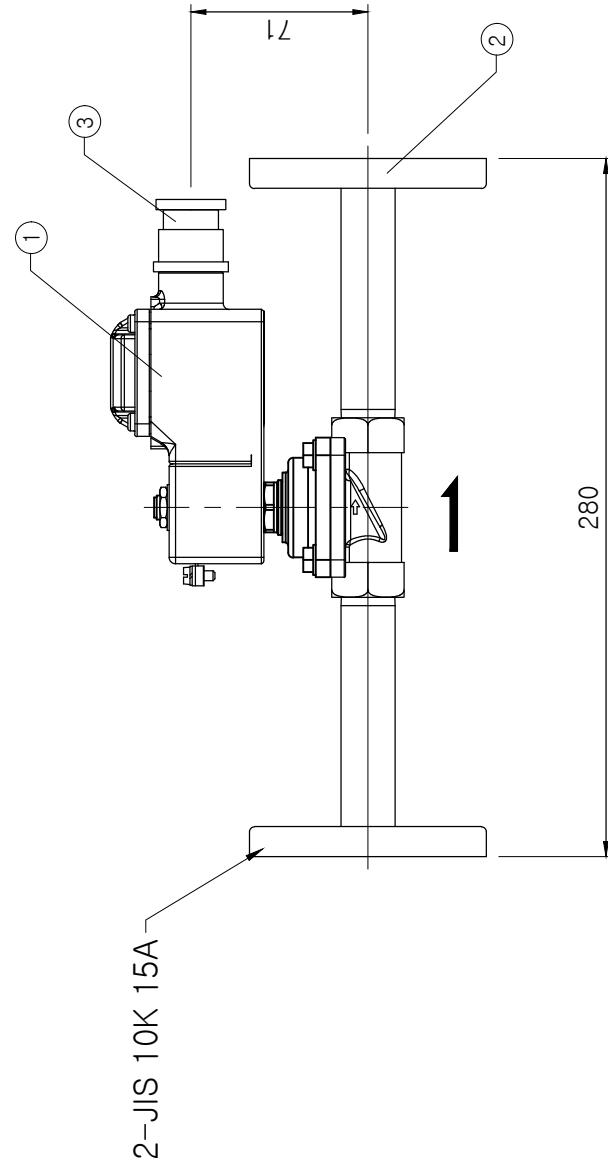
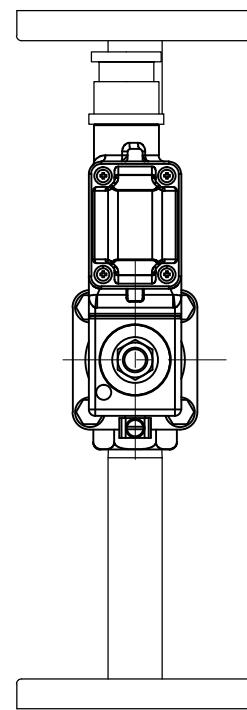
TECHCROSS

## **REGULATOR & SEPARATOR BOARD**

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		Ex-TSU																																																																																			
							SHEET NO : 1 OF 1																																																																														
							REV. 0																																																																														

**TECHCROSS**

REV	DESCRIPTION	CHKD	APPD	DATE
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NOTE  
1. GENERAL SPECIFICATION

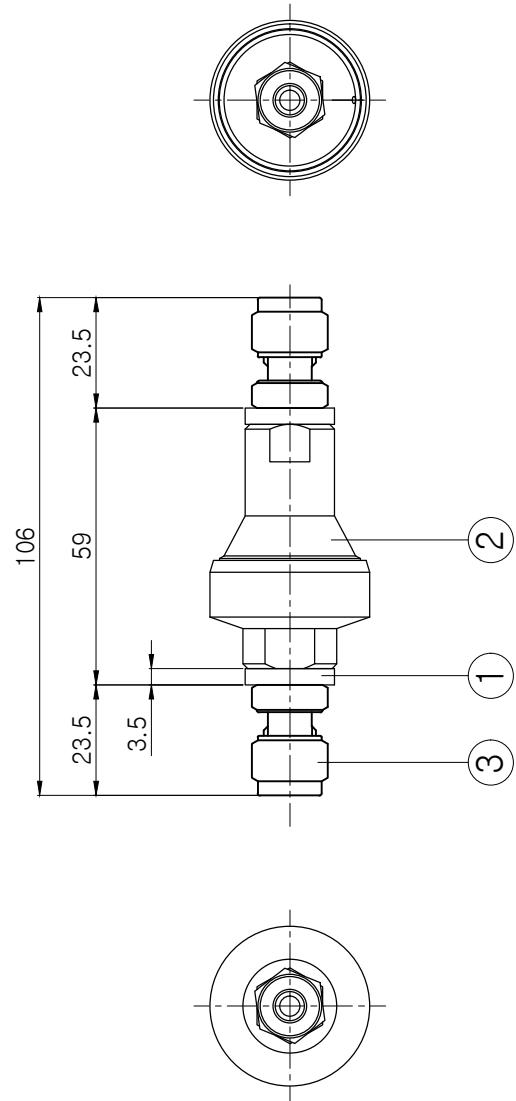
DIVISION	SPECIFICATION
MODEL	221S15F-495050BB
MAKER	PARKER LUCIFER
WEIGHT	TOTAL 2 kg
PRESSURE RANGE	0.3 Bar ~ 10bar
TEMPERATURE	0°C ~ 65°C
ENCLOSURE CLASS	IP65
PROTECTION & ZONE	Ex d mb IC T4 Gb
EX CERTIFICATE	IECEx LD 06.0004X

2. VALVE NO. : SV01, SV02

PART NAME		SOLENOID VALVE ASSY (Ex proof)-FLANGE TYPE		
APPD BY	Y.M.KIM	REF. Dwg	1	DONGABESTECH
CHKD BY	-	SPEC	2	-
DSND BY	H.C.LEE	MODEL NAME	1	PARKER LUCIFER
K SHIPBUILDING	S1940	HULL NO.		REMARK
DATE : 2022. 09. 08				
DRAWING NO	SVU015-EA-A001Z-S1940			
REV.	B			SHEET NO : 1 OF 1

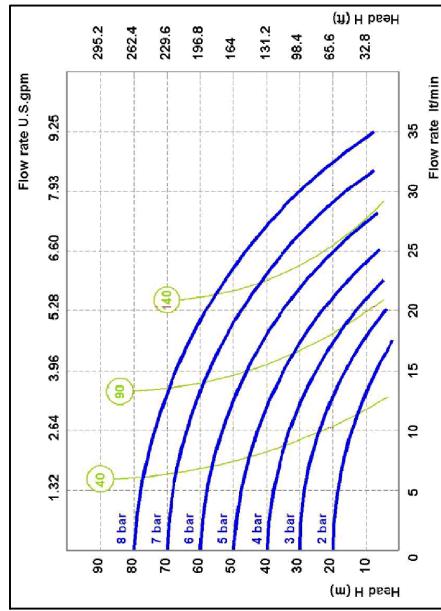
# IN LINE TYPE REGULATOR ASSY

REV	DESCRIPTION	CHKD	APPD	DATE
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3	MALE CONNECTOR	SMC BH-4FL, Ø32x7T 1/4"	SUS316L	2	SUPER LOK
2	IN LINE TYPE REGULATOR	PVC/UPEGI (Ø 1.5mm) PT1/4"	-	1	-
1	SPACE RING	O.D Ø19, D Ø18.5, T-3.5mm	Polyacetal	2	-
NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME			
K SHIPBUILDING	S1940	Ex-TSU			
DATE : 2022. 09. 08		PART NAME	IN LINE TYPE REGULATOR ASSY		
APPD BY Y.M.KIM		DRAWING NO	TSU000-EO-A006Z-S1940		
CHKD BY -			SHEET NO : 1 OF 1		
DSND BY H.C.LEE			REV.	0	

REV	DESCRIPTION	CHKD	APPD	DATE
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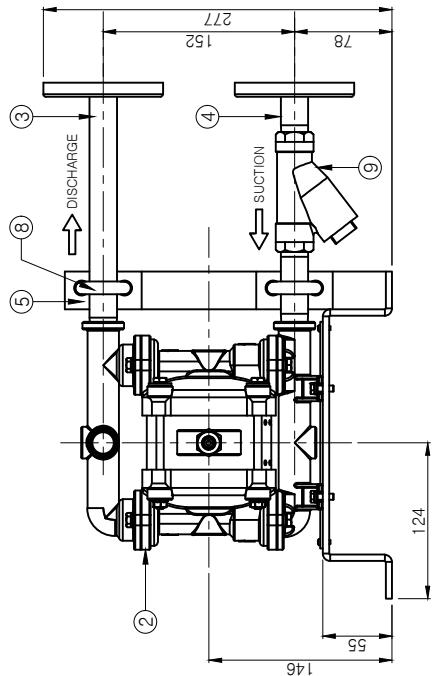
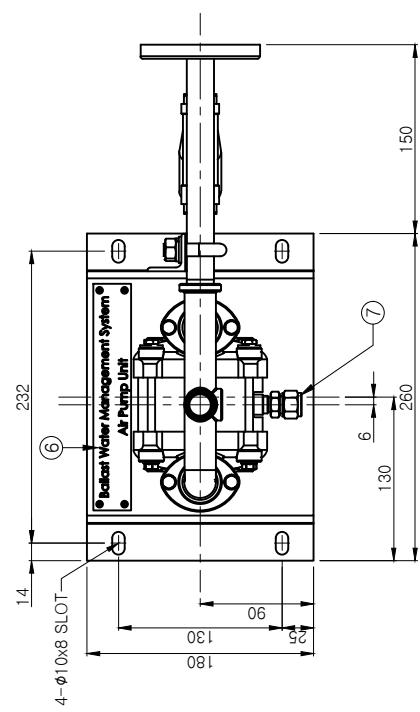
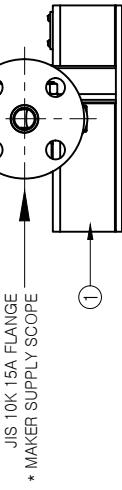
## NOTE

## 1. GENERAL SPECIFICATION

DIVISION	SPECIFICATION
MAXIMUM FLUID WORKING PRESSURE	8BAR / 0.8MPa / 116 psi
MAXIMUM FREE FLOW DELIVERY	35 lpm : 2.1m <sup>3</sup> /h
MAXIMUM SUCTION LIFT (DRY / WET)	5m / 9.8m
DIAPHRAGM OPERATING TEMP <sup>o</sup>	95°C
TYPICAL SOUND LEVEL AT 4.8BAR AIR @ 60CPM	65 dBA
MAXIMUM AIR CONSUMPTION	6.36scfm(0.18 m <sup>3</sup> /min)
AIR PRESSURE OPERATING RANGE	2~8 BAR / 0.2~0.8 MPa
WEIGHT	2.4kg ONLY PUMP / UNIT TOTAL 8kg

## 2. PAINT : POWDER COAT G (60μm OVER)

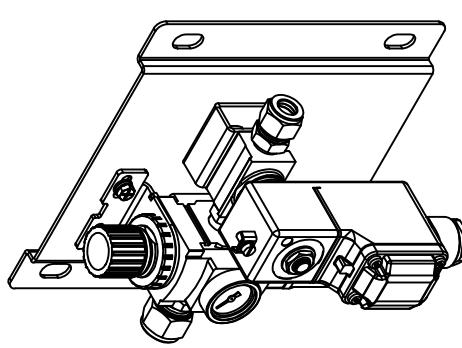
## 3. COLOR : SHIPBUILDER STANDARD



## NO.1,2 EX - FILTER REGULATOR

REV	DESCRIPTION	CHKD	APPD	DATE

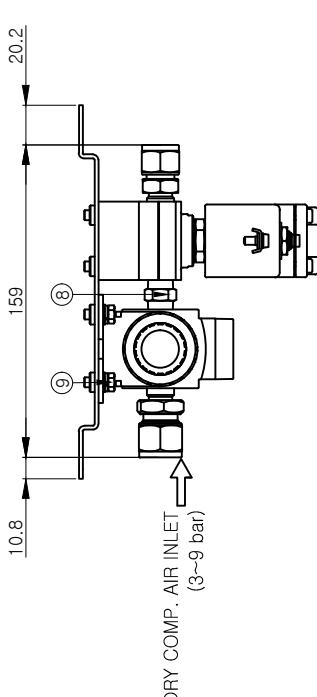
  

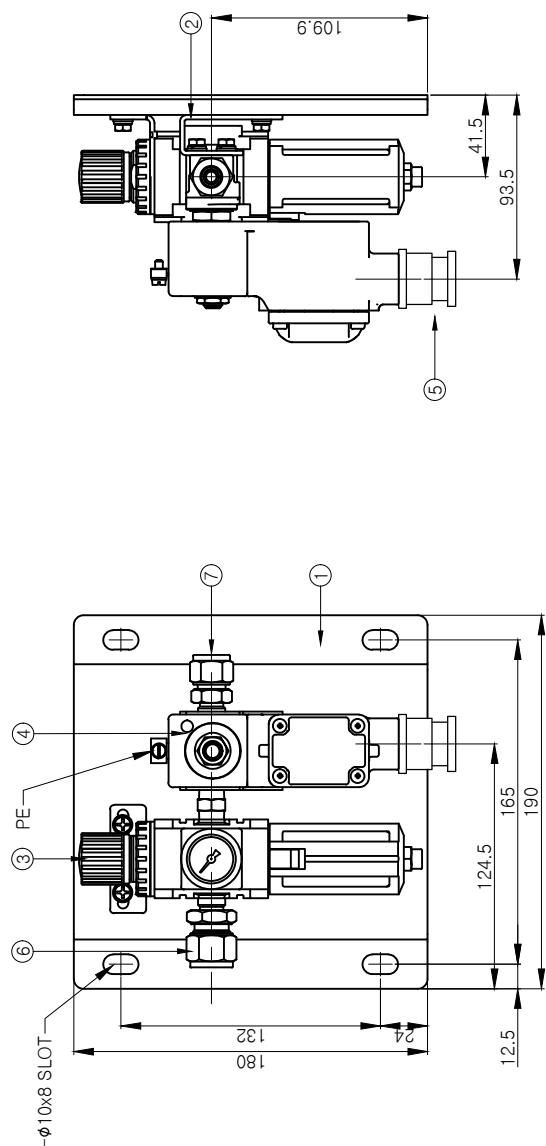


**NOTE**  
1. WEIGHT : 2kg

9	HEXAGON HEAD SENS BOLT	M5xL1.2	SUS304	6
8	NIPPLE	PT 1/4"	BRASS	1
7	MALE CONNECTOR	Ø10. PT 1/4"	BRASS	1
6	CABLE GLAND	Ø10. PT 1/4"	BRASS	1
5	A2F-N120C	A2F-N120C	BRASS	1
4	SOLENOID VALVE	12VDC23VDC-4959056B	-	1
3	FILTER REGULATOR	PP2-S02BDG	-	1
2	SOLENOID VALVE BRACKET	-	SPCC	1
1	FILTER REGULATOR BASE PLATE	-	SPCC	1
NO	PART NAME	HULL NO.	MODEL NAME	REMARK
K SHIPBUILDING	S1940		Ex-APU	





DATE : 2022. 09. 08 PART NAME : NO. 1/2 FILTER REGULATOR BOARD

APPD BY : Y.M.KIM DRAWING NO. : AP000-EB-A002A-S1940

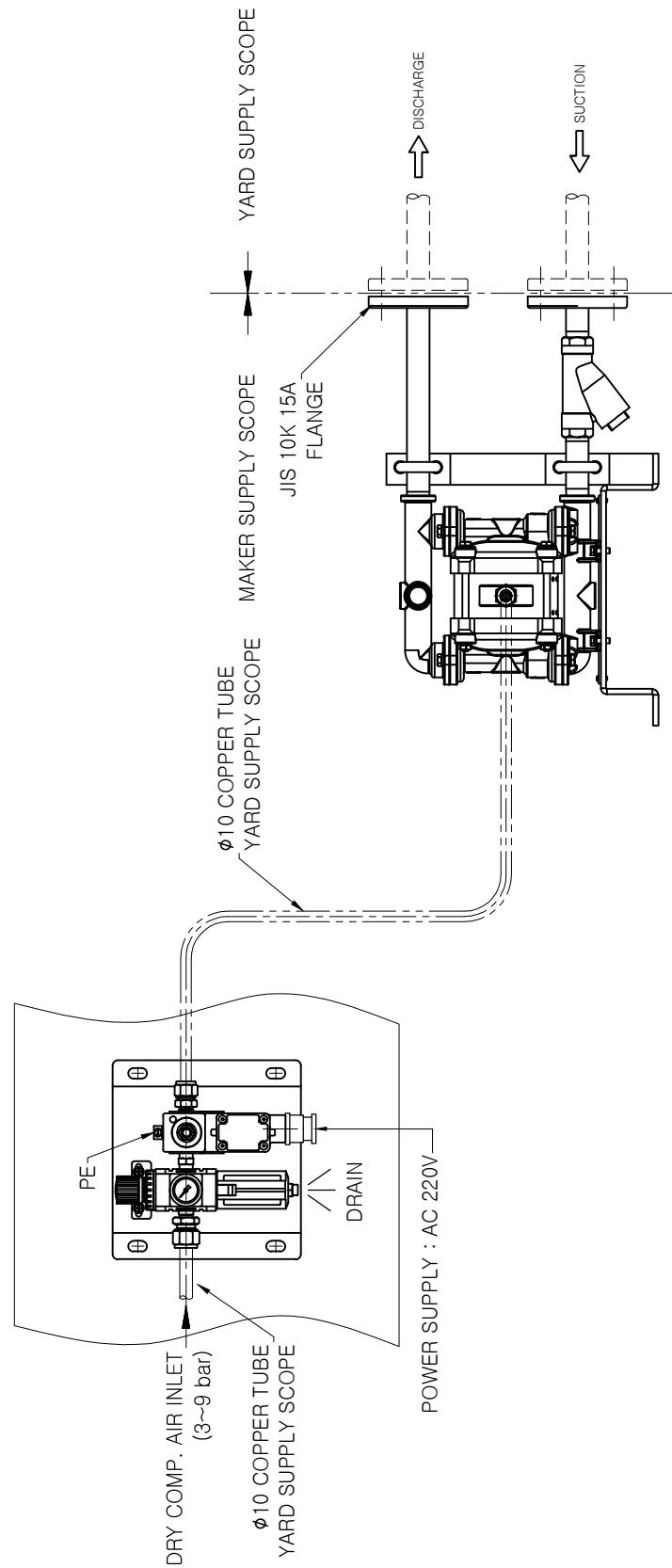
CHKD BY : -

DSND BY : H.C.LEE

SHEET NO : 2 OF 3

REV. : 0

**TECHCROSS**

FLOW LINE VIEW

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME			
K SHIPBUILDING	S1940	Ex-APU			
DATE : 2022. 09. 08	PART NAME	AIR PUMP DIAGRAM			
APPD BY Y.M.KIM	DRAWING NO	APU000-EB-A032-S1940			
CHKD BY -	DSND BY H.C.LEE				
					SHEET NO : 3 OF 3
					REV. 0

REV CHKD APPD DATE

REV	DESCRIPTION	CHKD	APPD	DATE

**DETAIL "A"**

**DETAIL "B"**

**NOTE**

1. TANK CAPACITY : APPROX. 85 LITER
2. TREATMENT : PICKLING & PASSIVATION
3. PAINT : NO PAINT
4. WEIGHT (DRY) : ABT.60kg

SPEC	MATERIAL	REMARK
N5	FILLING LINE	JIS 5K 15A SUS304 SLIP ON
N4	AIR VENT	JIS 5K 50A SUS304 SLIP ON
N3	SAMSUNG WATER SUCTION	JIS 5K 15A SUS304 SLIP ON
N2	NO.2 TRO SENSOR SAMPLING DRAIN	JIS 5K 15A SUS304 SLIP ON
N1	NO.1 TRO SENSOR SAMPLING DRAIN	JIS 5K 15A SUS304 SLIP ON
SYMBOL NAME		

**VIEW B-B**

**PLAN VIEW**

**VIEW C-C**

**VIEW A-A**

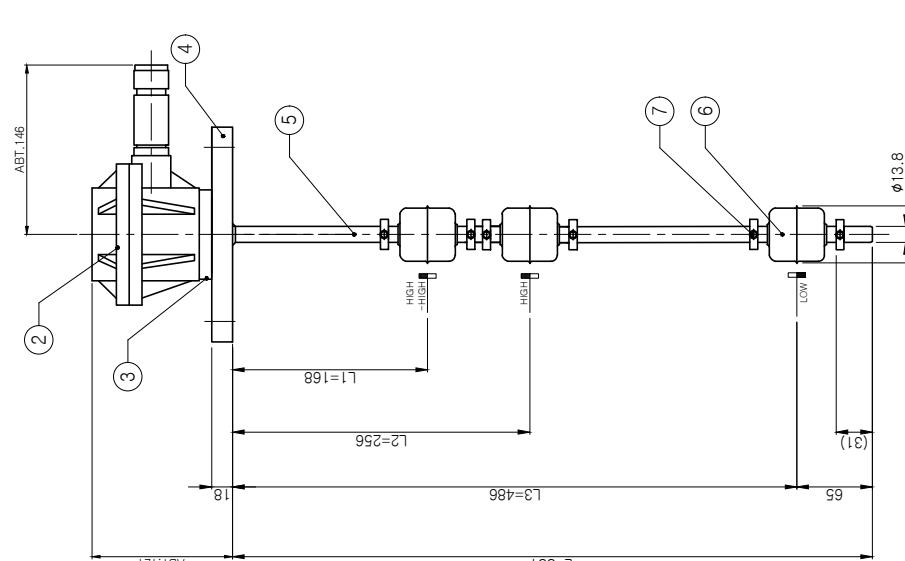
**DATE : 2022. 09. 08** **PART NAME : DRAIN TANK UNIT**

APPD BY	DRAWING NO.	REMARK
Y.M.KIM	DTU000-EA-A001C-S1940	
CHKD BY		
DSND BY	H.C.LEE	

**TECHCROSS**

**SHEET NO : 1 OF 2** **REV. 0**

REV	DESCRIPTION	CHKD	APPD	DATE



**CONTACT FORM**

```

    graph TD
      01[01 LOW] --- 02[02 COM]
      02 --- 03[03 HIGH]
      04[04 LOW] --- 05[05 COM]
      05 --- 06[06 HIGH]
      07[07 LOW] --- 08[08 COM]
      08 --- 09[09 HIGH]
      09 --- 01
  
```

**TECHNICAL DATA**

- MAX WORKING PRESSURE : 10kg per sq cm
- MAX WORKING TEMP. : MAX. 80°C
- PERMISSIBLE SP GR. : 0.65~1.3
- PERMISSIBLE AMB. TEMP. : -20°C ≤ Ta ≤ +60°C
- SWITCH TYPE : REED SWITCH
- ENCLOSURE: Ex db IIC T6 Gb, IP67
- CONTACT FORM & RATING : 3xSPDT, 250VAC, 0.5A/ 24VDC, 1A

\*SELECT THE Ex CABLE GLAND MODEL.

**NOTE**

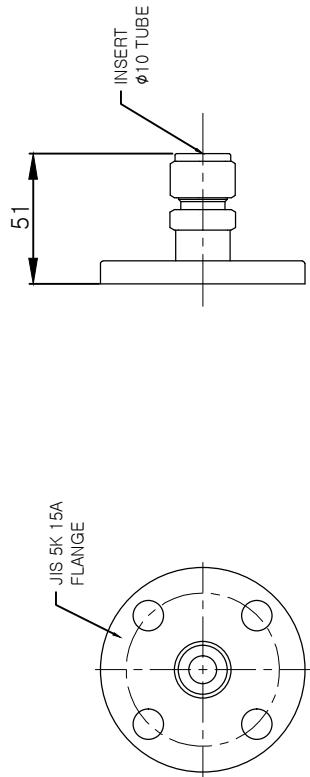
- MODEL : REED SWITCH TYPE FLOAT LEVEL SWITCH (EXPLOSION PROOF TYPE)
- MODEL NO. : TMR-E-S19403A6S-GE
- MAKER : HANLA IMS

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
8	NAME PLATE	-	SUS316	1	=
7	STOPPER	-	SUS316	6	=
6	FLOAT	Ø49x47.5L	SUS316	3	=
5	GUIDE PIPE	Ø13.8x1.0L	SUS316	1	=
4	CONN. FLANGE	JIS OK BOA FF TYPE	SUS316	1	=
3	CONNECTOR	Ø75	SUS316	1	=
2	HOUSING	-	SCS4	1	=
1	CABLE GLAND	-	BS	1	=
NO	SHIP YARD	HULL NO.	MODEL NAME		
K SHIPBUILDING	S1940		Ex-DTU		

**TECHCROSS**

DATE : 2022.09.08 PART NAME LEVEL SWITCH  
 APPD BY Y.M.KIM DRAWING NO ECS000-00-E0702-S1940  
 CHKD BY -  
 DSNID BY H.C.LEE SHEET NO : 2 OF 2  
 REV. 0

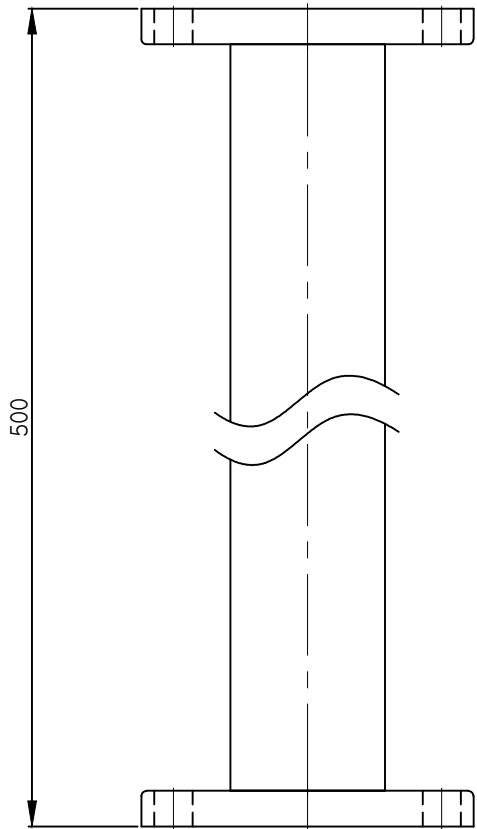
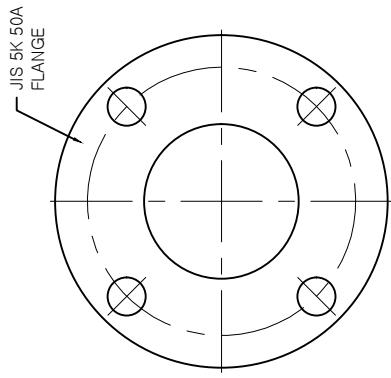
REV	DESCRIPTION	CHKD	APPD	DATE
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NOTE  
1. MATERIAL : SUS316L

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME			
K SHIPBUILDING	S1940	DTU			
DATE : 2022. 09. 08	PART NAME				
APPD BY Y.M.KIM	FLANGE ASSY				
CHKD BY -	DRAWING NO				
DSND BY H.C.LEE	FLG000-00-A0072-S1940				
				REV.	0
				SHEET NO : 1 OF 1	

REV	DESCRIPTION	CHKD	APPD	DATE
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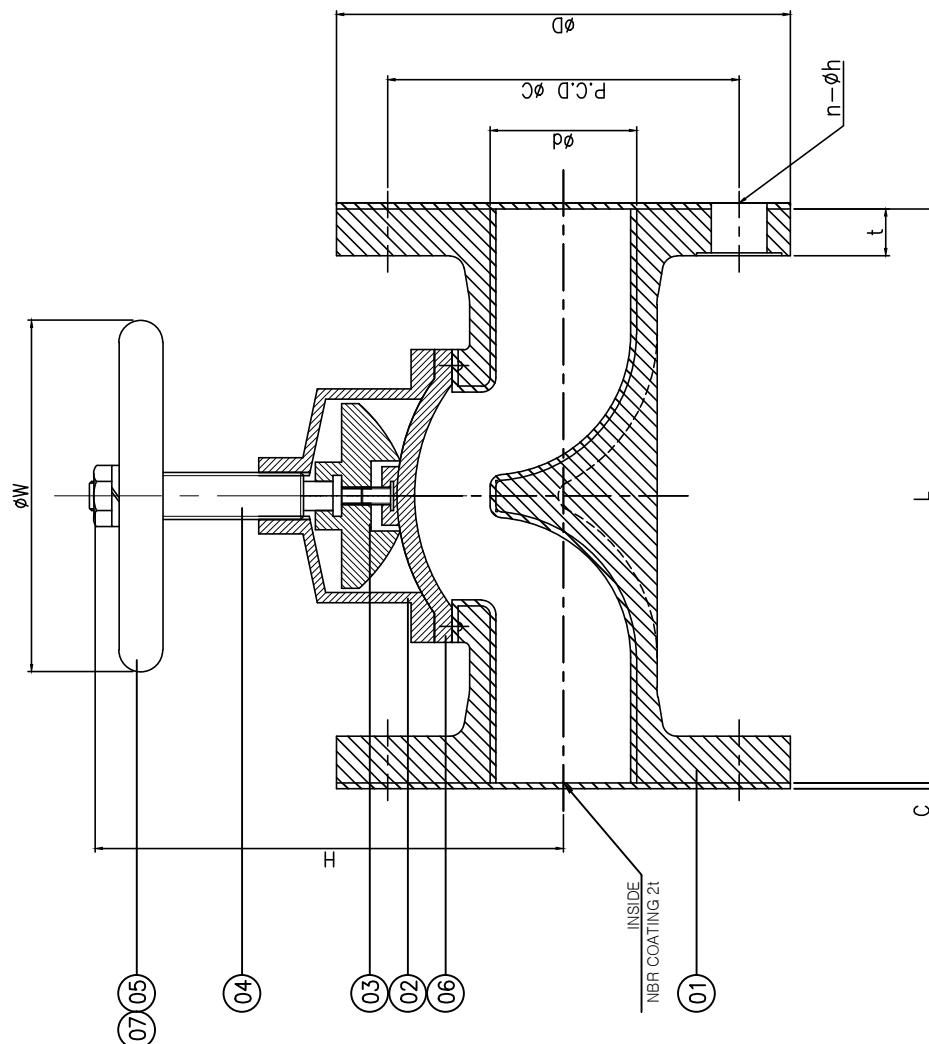
NOTE  
1. MATERIAL : SUS316L

NO	PART NAME	HULL NO.	MODEL NAME	MATERIAL	Q'TY	REMARK
K SHIPBUILDING	S1940	DTU				<b>TECHCROSS</b>
DATE : 2022. 09. 08	PART NAME	SHORT PIECE				
APPD BY Y.M.KIM	DRAWING NO					
CHKD BY -	-					
DSND BY H.C.LEE	-					
					REV.	0
						SHEET NO : 1 OF 1

## G2 SAMPLING VALVE

NO.	REVISION	DATE	CHK.	APP.
Δ				

- \* SPECIFICATION
1. APPLICABLE FLUID :  AIR  LIQUID  OIL  WATER
  2. MAX. WORKING TEMPERATURE : 120°
  3. HYDRO. TEST PRESSURE : WORKING PRESSURE x 1.5
  4. END CONNECTION : JIS B 2220 FLANGE



* MATERIAL	
SELECT	<input type="checkbox"/>
BODY	FCD450 SUS316
BONNET	SCS13
INSIDE COATING	NBR 2T

NO.	PART NAME	Q'TY	MATERIAL	REMARK						
				TITLE	TYPE	DIAPHRAGM	SIZE	UNIT	SCALE	MODEL NO.
7	NAME PLATE	1	SUS304							
6	PACKING	1	SILICONE							
5	HANDLE	1	SS400							
4	HANDLE STEM	1	SUS304							
3	DISC	1	SCS13							
2	BONNET	1	SEE MAT'L TABLE							
1	BODY	1	SEE MAT'L TABLE							

VALVE NO.	SIZE (mm)	RATE	FLANGE JIS 2220				UNIT : mm	Q'TY	WEIGHT (kg)	REMARK
			Ød	ØD	ØC	t				
50A	50	5K	130	105	17	120	4-15	163	2	7.2
	50	10K	155	120	17	120	4-19	163	2	8.7

DIMENSION										
VALVE NO.	SIZE (mm)	RATE	Ød	ØD	ØC	t	ØW	n-Øh	H	C

 DH Controls Co., Ltd.

REV	DESCRIPTION	CHKD	APPD	DATE

"A"- "A" VIEW  
JIS 5K 50A

"B"- "B" VIEW  
JIS 5K 150A

SHORT ELBOW  
50A(SCH40)

50A(SCH40)

JIS 5K 50A X 50A

JIS 5K 50A

A-A

NOTE.  
Q'TY : 2EA/SHIP  
MATERIAL : SUS316L  
PAINT : NO PAINT

NO	PART NAME	HULL NO.	MODEL NAME	SPEC	MATERIAL	Q'TY	REMARK
K SHIPBUILDING	S1940	G2					<b>TECHCROSS</b>
APPD BY Y.M.KIM							
CHKD BY -							
DSND BY H.C.LEE							

DATE : 2022.09.08 PART NAME G2 SANPLNG PORT (350A)  
DRAWING NO.

SHEET NO : 1 OF 1

REV. 0

REV	DESCRIPTION	CHKD	APPD	DATE

**SHORT ELBOW**  
25A(SCH40)

**JIS 5K 65A X 25A**

**INDICATION PLATE**

**JIS 10K 25A**

"A" - "B" VIEW

**JIS 10K 25A**

"B" - "B" VIEW

**JIS 5K 65A**

**INDICATION PLATE**

**JIS 10K 25A**

**Ø155**

**Ø130**

**Ø34.5**

(25A PIPE HOLE)

**NOTE.**

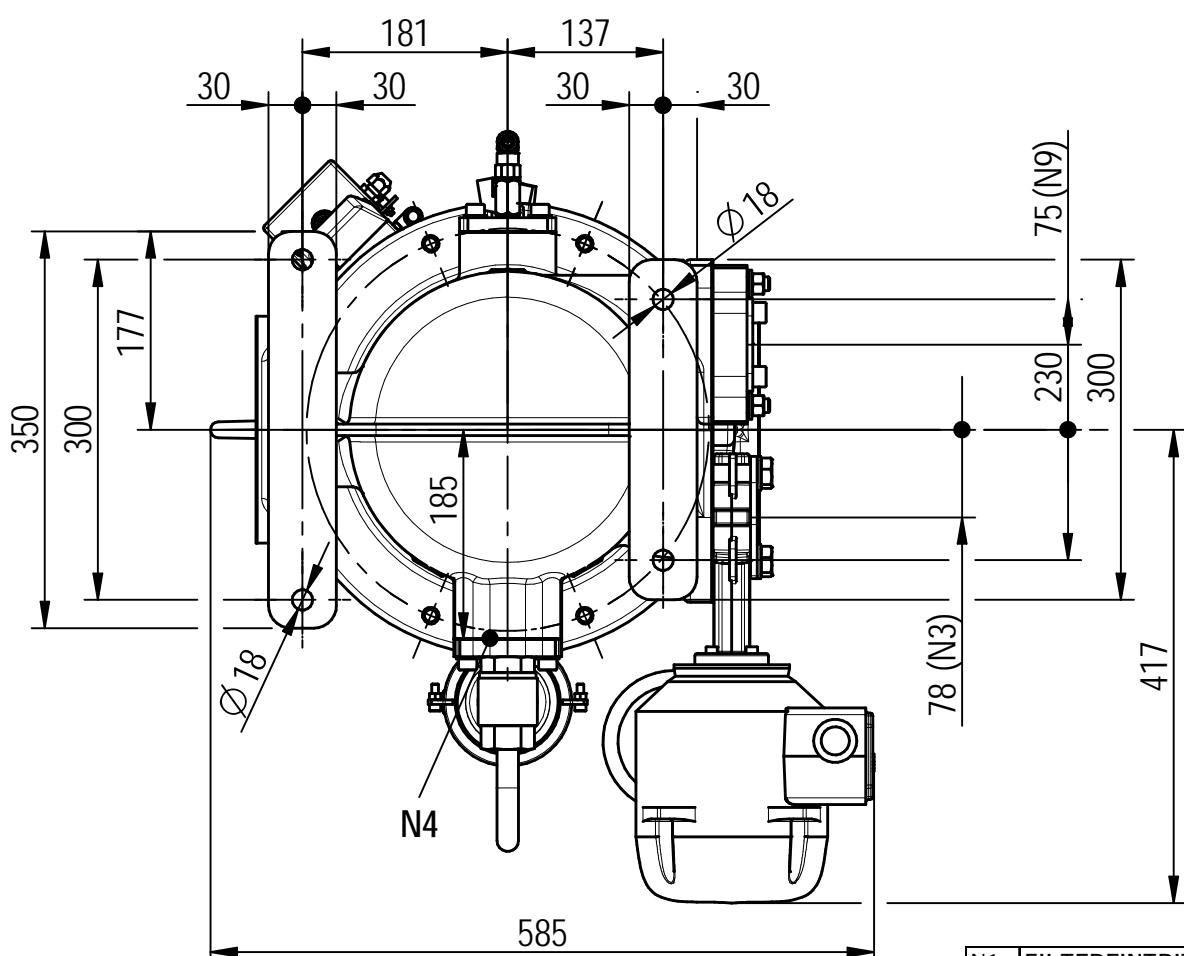
Q'TY : 1EA/SHIP

MATERIAL : SUS316L

PAINT : NO PAINT

**TECHCROSS**

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME			
K SHIPBUILDING	S190	TSU			
DATE : 2022. 09. 06		PART NAME	TSU SAMPLING PORT (400A)		
APPD BY	Y.M.KIM	DRAWING NO	SHEET NO : 1 OF 1		
CHKD BY	-		REV. 0		
DSND BY	H.C.LEE				



BETRIEBSDRUCK MAX. 16BAR  
WORKING PRESSURE

BETRIEBSTEMPERATUR MAX. 60°C  
WORKING TEMPERATURE

VOLUMEN ~ 35 LITER  
VOLUME

GEWICHT ~ 270 KG  
WEIGHT

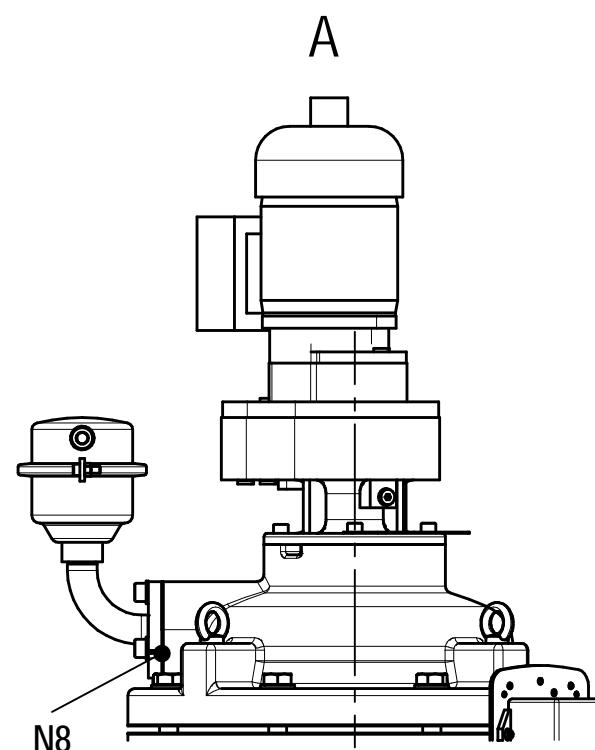
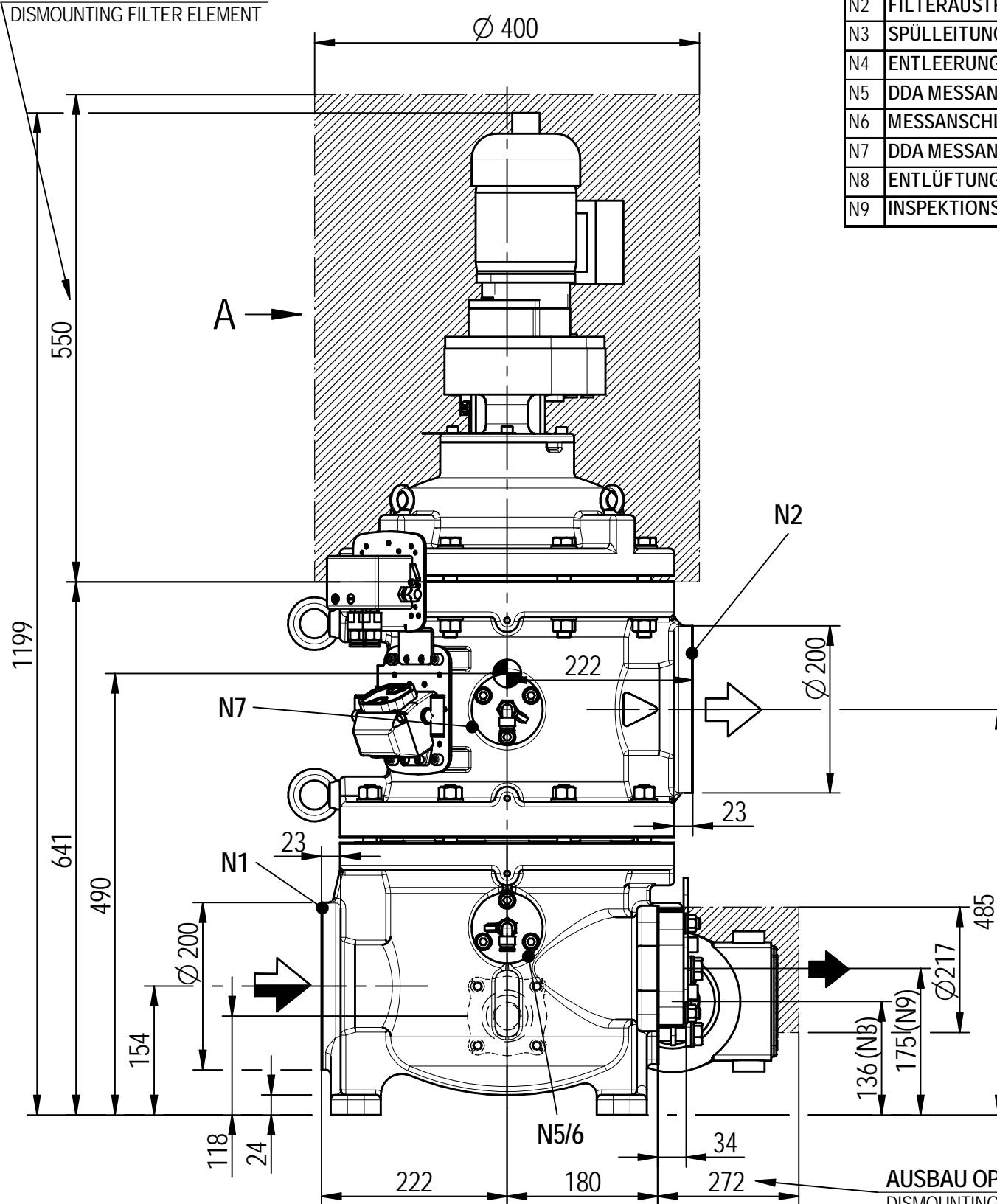
MONTAGECODE S3D2  
ASSEMBLY CODE

ANSCHLUSSMASSE  
(LOCHBILD DER  
ANSCHLUSSFLANSCHE)  
CONNECTION DIMENSIONS  
(HOLE PATTERN OF  
FLANGE CONNECTION)

ANSCHLUSSMÖGLICHKEIT N1-N9  
POSSIBILITÉ FOR CONNECTION

N1	FILTEREINTRITT / FILTER INLET - DN80 PN16
N2	FILTERAUSTRITT / FILTER OUTLET - DN80 PN16
N3	SPÜLLEITUNG / FLUSHING LINE - DN40 PN16
N4	ENTLEERUNG + BEFÜLLUNG / DRAIN + FILLING - G1"
N5	DDA MESSANSCHLUSS (EINTRITT) + / DPI MEASUREMENT (INLET) +
N6	MESSANSCHLUSS (EINTRITT) + / MEASUREMENT NOZZLE (INLET) +
N7	DDA MESSANSCHLUSS (AUSTRITT) - / DPI MEASUREMENT (OUTLET) -
N8	ENTLÜFTUNG / VENT
N9	INSPEKTIONSOFFNUNG / INSPECTION PORT

SIEBAUSBAU  
DISMOUNTING FILTER ELEMENT



SCHWERPUNKT  
CENTRE OF GRAVITY

AUSBAURAUM  
MAINTENANCE SPACE

FILTEREINTRITT N1  
FILTER INLET

FILTERAUSTRITT N2  
FILTER OUTLET

SPÜLLEITUNG N3  
FLUSHING LINE

Subject to alterations

Änderungen vorbehalten!

Automatikfilter

aquaBoll 6.18.3 Guss Gr. 273 DN80 - PN16

automatic filter

Z187968 00

Zust.  
index

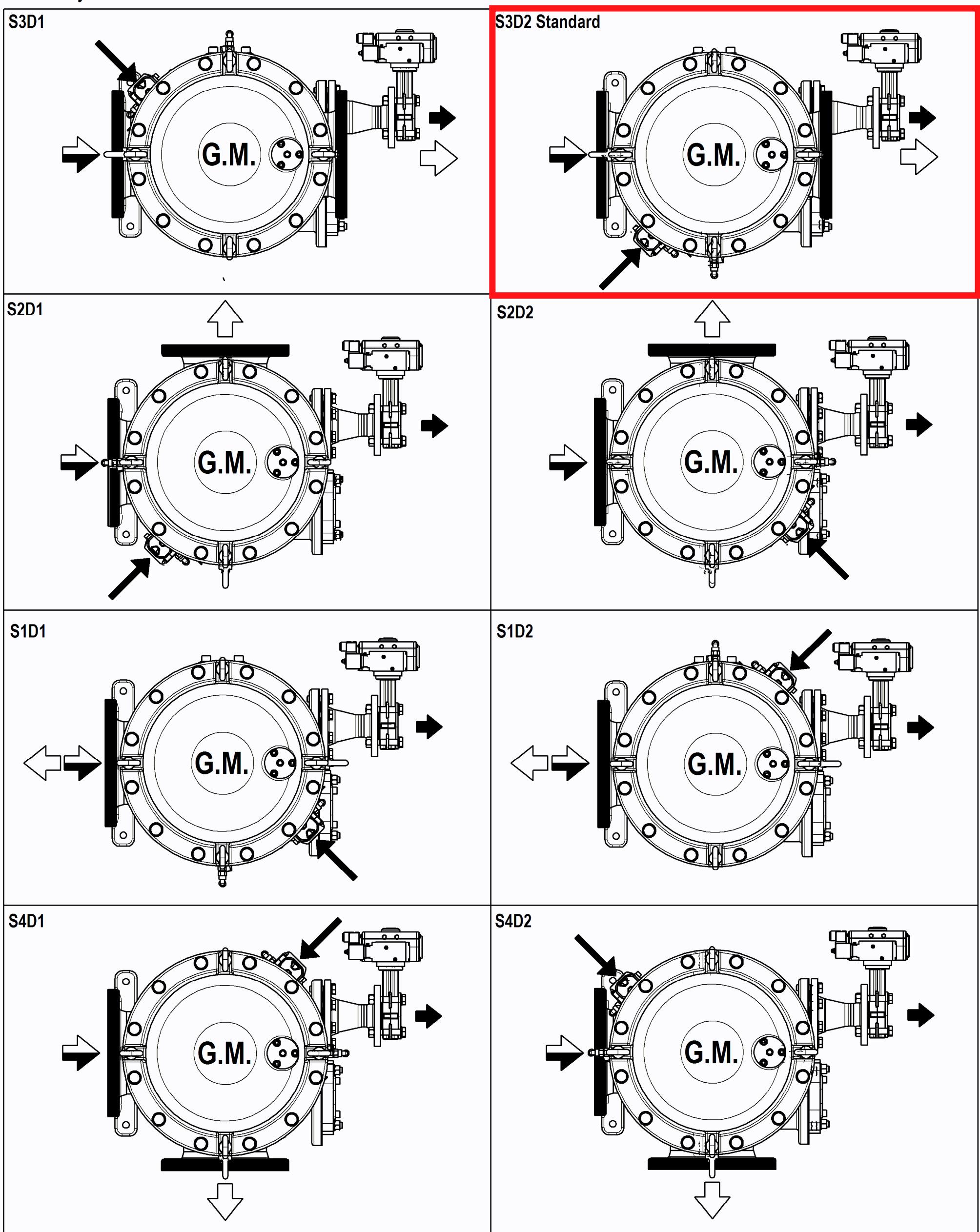
Blatt  
sheet

1/1

Datum  
date

14.10.2022

Montagecode  
assembly code



→ Filtereintritt N1  
filter inlet

→ Filteraustritt N2  
filter outlet

→ Rückspülventil Optional, N3, Blatt 4  
flushing line optional, N3, sheet 4

→ DDA Anschluss  
ddi connection

Automatikfilter aquaBoll Guss

automatic filter aquaBoll casted

6.18.3 273-750 DN50 - DN500

Z154933 Zust. index 09

Blatt sheet 2/5

Datum date 10.01.2018

# Elektrodokumentation

## Electrical documentation

**Hersteller:** Boll & Kirch Filterbau GmbH  
**Manufacturer:** Boll & Kirch Filterbau GmbH  
 Siemensstraße 10-14  
 50170 Kerpen

### Technische Kenngrößen

#### Technical characteristics

##### Gehäuse: Housings:

##### Spannungen: Voltages:

##### weitere Hinweise: other notes:

Bezeichnung: Designation:	EB 1555.500	Betriebsspannung: Operating voltage:	230-575V +/- 5%	3~/PE	Kableinführung: Cable entry:
Materialtyp: Material:	Stahlblech Carbon steel	Frequenz: Frequency:	50/60Hz	<input type="checkbox"/> Oben top <input checked="" type="checkbox"/> unten bottom	
Abmessungen: Dimensions:	300 x 300 x 120mm	Steuerspannung: Control voltage:	230V AC 115V AC 24V DC	Hauptschalter: Main switch:	
Schutzart: Degree of protection:	IP65			<input checked="" type="checkbox"/> Vorne Front <input type="checkbox"/> links left	
Farbe: Color:	RAL7035	Aderbeschriftung: Wire labeling:	-	<input type="checkbox"/> rechts right	
Türranschlag: Door stop:	Rechts Right	Kabeltyp: Cable type:	H07V-K		
Montage: Mounting:	Wandabstandshalter Wall spacer	Netzform: Network types:	TN		Kundenvorschriften: Customer specifications:
Gewicht: Weight:	15kg	Umgebungstemperatur: Environment temperature:	55°C	<input type="checkbox"/> Ja Yes <input checked="" type="checkbox"/> Nein No	
Anzahl Seiten: Number of pages:	13	Arbeitsstromkreis: Load circuit:	Schwarz Black		
Bearbeiter: Edited by:	gruenwald	Schutzleiter: PE conductor:	Grün/Gelb Green/Yellow	<b>Steuergerät: Control device:</b>	BK2300
Datum: Date:	16.05.2019	Steuerstromkreis: Control circuit:	Rot Red	<b>Getriebemotorleistung:</b>	0,09 - 0,18kW <b>Gear motor power:</b>
				Fremdspannung: External voltage:	Orange Orange

**Normen:  
Specifications:** Ausführung der Schaltanlage nach DIN VDE 0660 Teil 5 bzw. IEC 439.  
 Bestimmungen für fabrikfertige Schaltgerätekombinationen mit  
 Nennspannung bis 750V. Nennisolationsspannung 450/750V  
 und Nennspannung 450/750V.  
 Execution of the switchgear according to DIN VDE 0660 part 5 or IEC 439.  
 Regulations for factory-fabricated switchgear combinations with  
 rated voltage up to 750V. Rated insulation voltage 450/750V  
 and rated voltage 450/750V.

Die Verdrahtung erfolgt von oben nach unten bzw. von links nach rechts gemäß den Stromlaufplänen.

The main circuit is laid with 1.5mm<sup>2</sup> and the control circuit with 1mm<sup>2</sup>.

The wiring is carried out from top to bottom or from left to right according to the circuit diagrams.

Hersteller Manufacturer	Deckblatt Cover sheet	BK-Artikel-Nr.: BK-Article-No.:	4302300	=
<b>BOLLFILTER</b> <b>Protection Systems</b>	Filtertyp 6.18/6.19/6.44/aquaBoll 6.18.3	+ Blatt Page		1 of 13
Revision Modification	Boll & Kirch Filterbau GmbH	Zeichnungs-Nr.: Drawing-No.:	Z46600	

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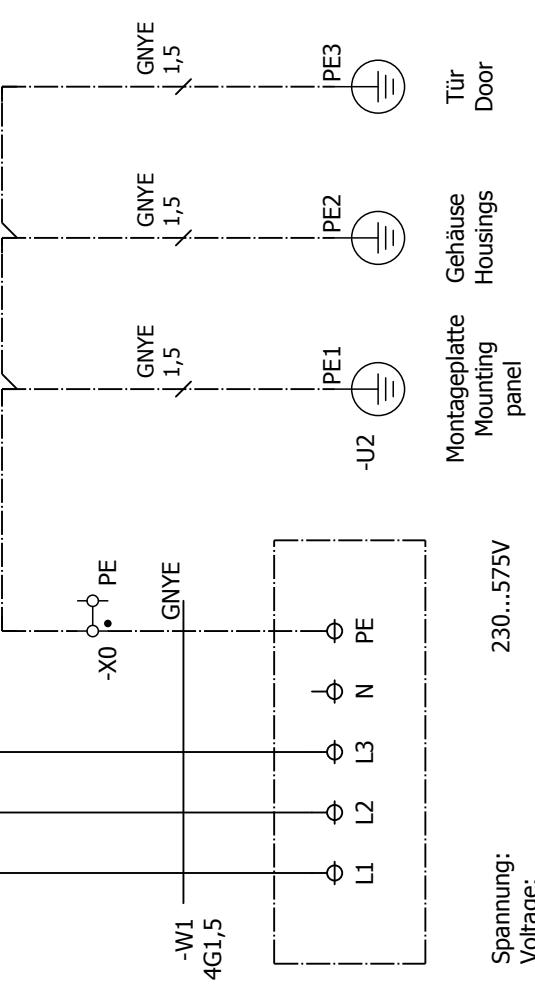
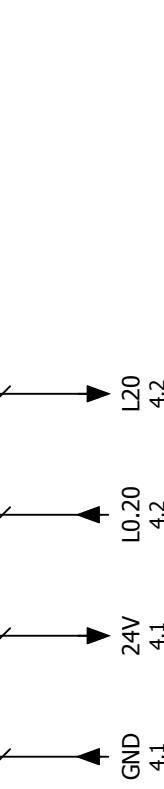
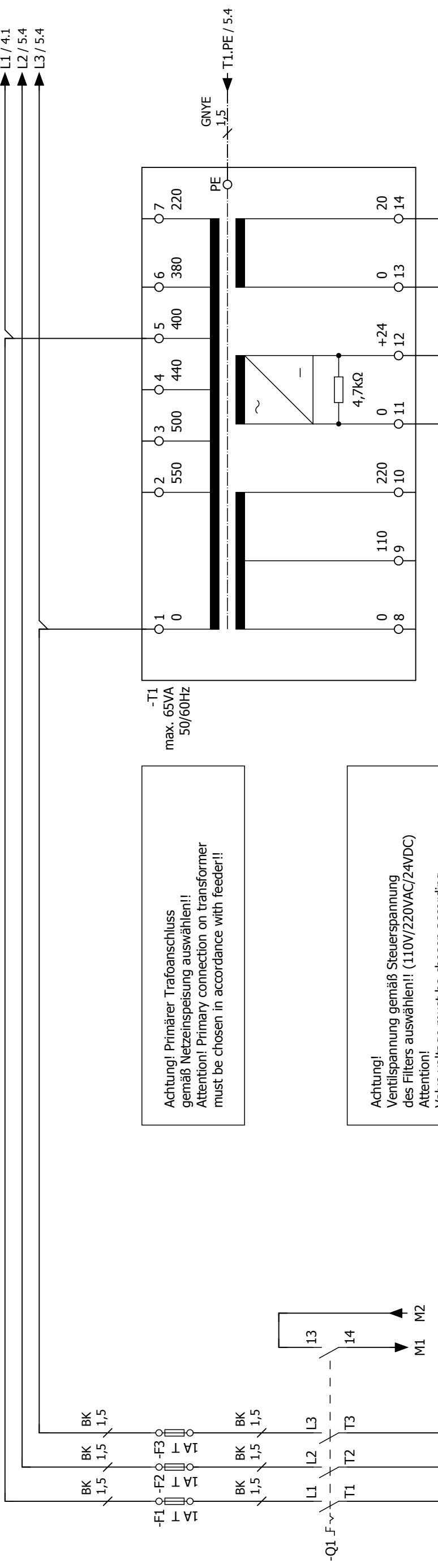
Anlage Plant	Einbauort Mounting location	Dokumentenart Document type	Seite Page	Seitenbezeichnung Page designation	Datum Date	Bearbeiter Edited by
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Schaltplan Wiring diagram	1	Deckblatt Cover sheet			11.07.2019	gruenwald
Schaltplan Wiring diagram	2	Inhaltsverzeichnis Table of contents			11.07.2019	gruenwald
Schaltplan Wiring diagram	3	Einspeisung und Stromversorgung Feed-in and power supply			05.07.2019	gruenwald
Schaltplan Wiring diagram	4	Platine Circuit board			10.07.2019	gruenwald
Schaltplan Wiring diagram	5	Getriebemotor Gear motor			03.07.2019	gruenwald
Schaltplan Wiring diagram	6	Bedienfeld Control panel			03.07.2019	gruenwald
Schaltplan Wiring diagram	7	Aufbauplan Assembling diagram			11.07.2019	gruenwald
Materialliste Part list	8	Materialliste Part list			11.07.2019	gruenwald
Materialliste Part list	9	Materialliste Part list			11.07.2019	gruenwald
Klemmenplan Terminal diagram	10	Klemmenplan Terminal diagram			11.07.2019	gruenwald
Klemmenplan Terminal diagram	11	Klemmenplan Terminal diagram			11.07.2019	gruenwald
Klemmenplan Terminal diagram	12	Klemmenplan Terminal diagram			11.07.2019	gruenwald
Klemmenplan Terminal diagram	13	Klemmenplan Terminal diagram			11.07.2019	gruenwald

		Datum Date	Hersteller Manufacturer	Inhaltsverzeichnis Table of contents
		Bearbeiter Edited by	<b>BOLLFILTER</b> <b>Protection Systems</b>	BK-Artikel-Nr.: BK-Article-No.: 4302300 =
		Auftrag Order		+ Blatt Page
Revision Modification	Bearbeiter Edited by	Datum Date	Vorgang Process	von of 13
				Filtertyp 6.18/6.19/6.44/aquaBoll 6.18.3 Filter type 6.18/6.19/6.44/aquaBoll 6.18.3 Zeichnungs-Nr.: Drawing-No.: Z46600

## NO.2 AFU

0      1      2      3      4      5      6      7      8      9



Spannung:  
Voltage:  
Frequenz:  
Frequency:  
max. Vorsicherung:  
max. Pre-protection:

230...575V  
50/60Hz  
Kundenseitig  
by customer

Einspeisung vom Netz  
Power supply input  
from mains

Alle nicht bezeichneten  
Leitungen = 1mm²  
All unnamed leads = 1mm²

BK-Artikel-Nr.:	4302300	=
BK-Article-No.:		+ Blatt
Zeichnungs-Nr.:	Z46600	Page
Drawing-No.:	13	of 13

Filtertyp 6.18/6.19/6.44/aquaBoll 6.18.3  
Filter type 6.18/6.19/6.44/aquaBoll  
6.18.3

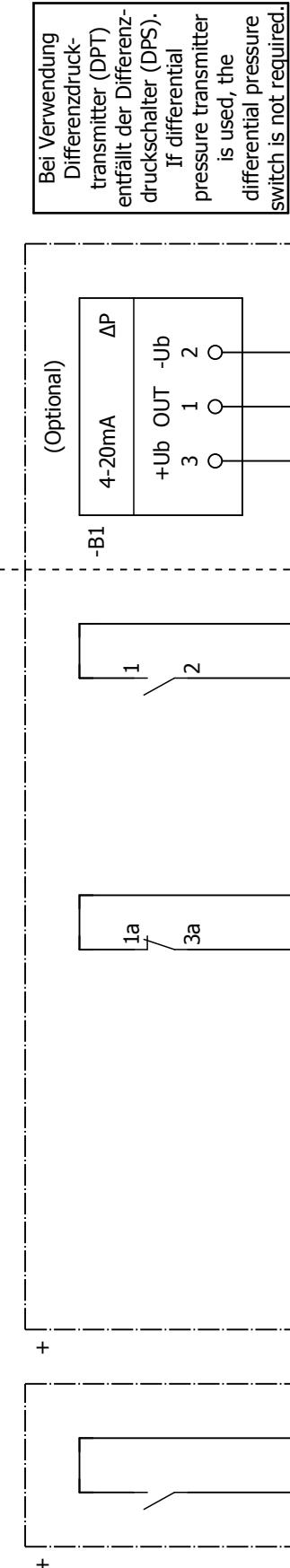
0	1	2	3	4	5	6	7	8	9
---	---	---	---	---	---	---	---	---	---

Sperrung Filter  
(Kundenseitig)  
Filter inactive  
(provided by the customer)  
Fern EIN/AUS  
Remote ON/OFF

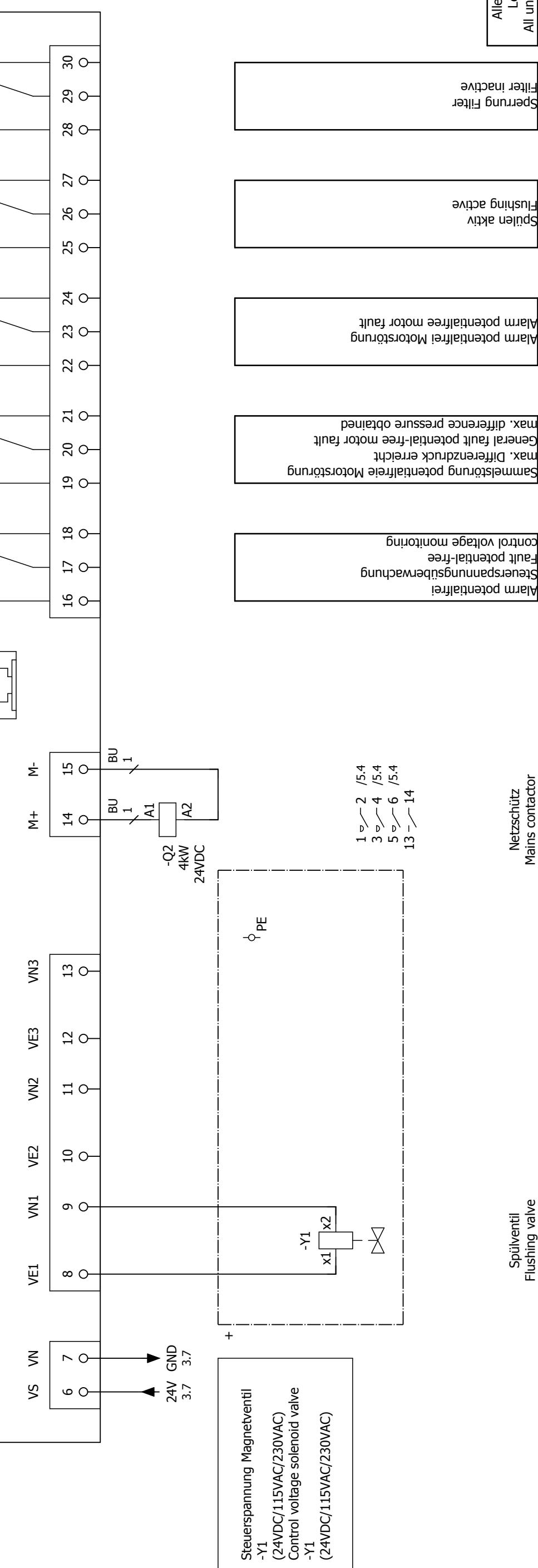
Differenzdruck  
zu Hoch DP 100%  
Differential  
pressure too  
High DP 100%

Differenzdrucktransmitter  
DP 75%  
Differential  
pressure DP 75%

Differenzdruck  
24VDC (optional)  
Differential pressure transmitter  
24VDC (optional)



### BOLL & KIRCH BK2300

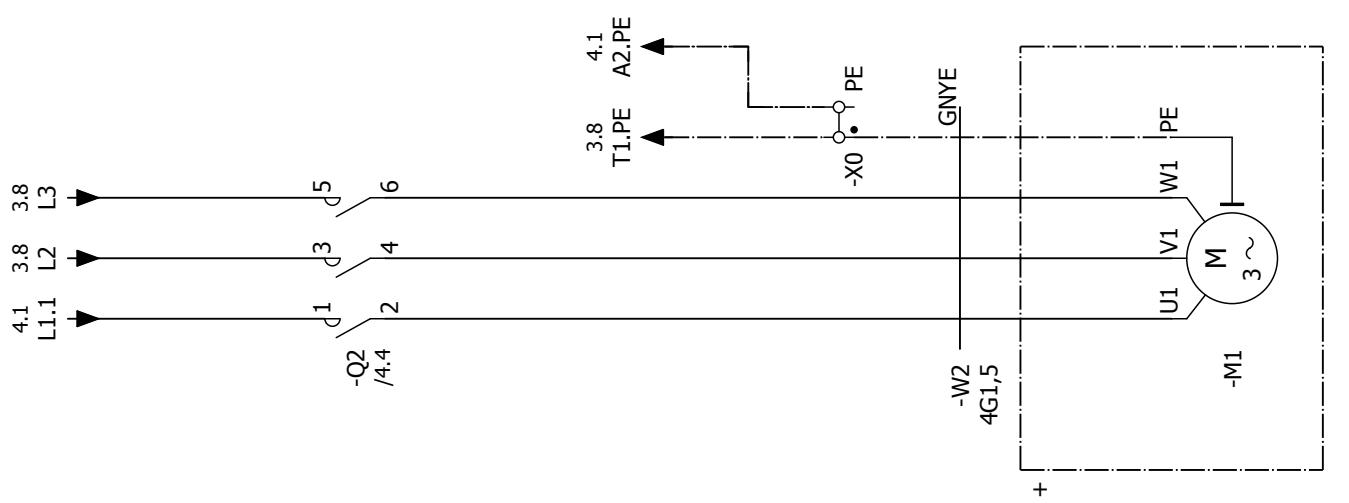


Revision Modification	Bearbeiter Edited by	Datum Date	Hersteller Manufacturer	Platine Circuit board
		Datum Date	Bearbeiter Edited by	Filtertyp 6.18/6.19/6.44/aquaBoll 6.18.3
		Auftrag Order	Auftrag Order	BOLLFILTER Protection Systems
		Vorgang Process	Vorgang Process	Boll & Kirch Filterbau GmbH

BK-Artikel-Nr.: BK-Article-No.:	4302300	=	
Zeichnungs-Nr.: Drawing-No.:	Z46600	+	Blatt Page von of

## NO.2 AFU



Getriebemotor  
Gear motor

BK-Artikel-Nr.:	4302300	=
BK-Article-No.:		+ Blatt
Zeichnungs-Nr.:	Z46600	Page von
Drawing-No.:		of 13

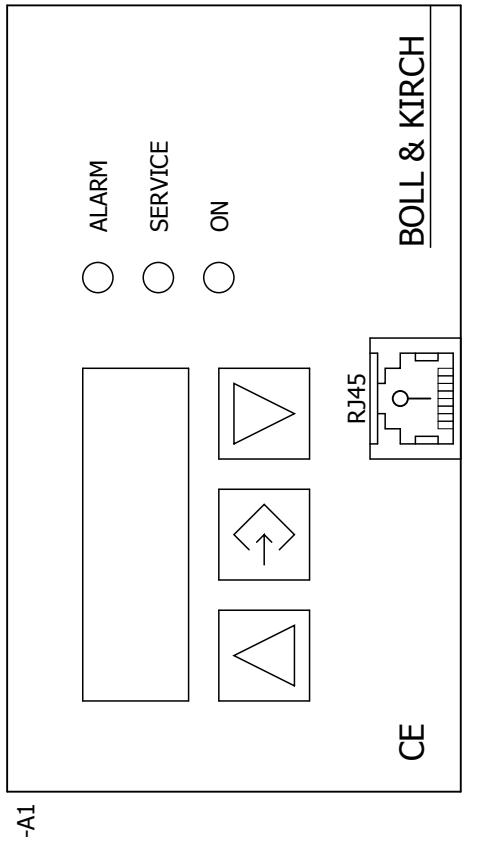
Filtertyp 6.18/6.19/6.44/aquaBall 6.18.3	Filter type 6.18/6.19/6.44/aquaBall 6.18.3
Boll & Kirch Filterbau GmbH	

Hersteller Manufacturer	Getriebemotor Gear motor
<b>BOLLFILTER</b> <b>Protection Systems</b>	

Datum Date	16.05.2019	Getriebemotor Gear motor
Bearbeiter Edited by	gruenwald	
Auftrag Order		
Vorgang Process		
Revision Modification	Bearbeiter Edited by	Datum Date

# NO.2 AFU

0      1      2      3      4      5      6      7      8      9



Revision Modification	Bearbeiter Edited by	Datum Date	Datum Date	Hersteller Manufacturer	Bedienfeld Control panel	BK-Artikel-Nr.: BK-Article-No.:	4302300	=
				<b>BOLLFILTER</b> <b>Protection Systems</b>	Filtertyp 6.18/6.19/6.44/aquaBoll 6.18.3	+ Blatt Page		6 von of 13
				Boll & Kirch Filterbau GmbH	Filter type 6.18/6.19/6.44/aquaBoll 6.18.3	Zeichnungs-Nr.: Drawing-No.:	Z46600	

## Materialliste Part list

				BK-Artikel-Nr.:	BK-Artikel-No.:	
Nr. No.	BMK DT	Anzahl Quant.	Bezeichnung Designation	Hersteller Manufacturer	Typ Type	Beschreibung Description
1	-A1	1	Display	BOLL & KIRCH 43007862300		2 zeiliges universelles Display 2 lined universal Display
2	-A1	1	Patchkabel Patch cable	Reco	4100368TP	Doppelt geschirmt, 0,5m, RJ 45, cat 6, gerade - gewinkelt Double shielded, 0,5m, RJ 45, cat 6, straight - angulated
3	-A2	1	E/A-Modul I/O-Modul	BOLL & KIRCH 43007862300		IN 20VAC, 6DI, 5 Relaisausgänge, 3 Ventilausgänge, Steuerung für BK2300
4	-A2-F1	1	Schmelzsicherung Safety fuse	ESKA	522.516	IN 20VAC, 6DI, 5 Relay outputs, 3 Valve outputs, Control for BK2300 0,8A, 5x20mm, Träger 0,8A, 5x20mm, Passive
5	-A2-F2	1	Schmelzsicherung Safety fuse	ESKA	522.520	4200162 2A, 5x20mm, Träger 2A, 5x20mm, Passive
6	-F1	1	Sicherungsklemme Fused terminal	Conta-Clip	4200586K 10/7 BG	4200163 10 mm <sup>2</sup> , NS35, Beige, Schraubanschluss 10 mm <sup>2</sup> , NS35, Fawn, Screw terminal
7	-F1	1	Schmelzsicherung Safety fuse	ESKA	632.717	4200146 1A, 6,3x32mm, Träger 1A, 6,3x32mm, Passive
8	-F2	1	Sicherungsklemme Fused terminal	Conta-Clip	SIK 10/7 BG	4200526 10 mm <sup>2</sup> , NS35, Beige, Schraubanschluss 10 mm <sup>2</sup> , NS35, Fawn, Screw terminal
9	-F2	1	Schmelzsicherung Safety fuse	ESKA	632.717	4200146 1A, 6,3x32mm, Träger 1A, 6,3x32mm, Passive
10	-F3	1	Sicherungsklemme Fused terminal	Conta-Clip	4200586K 10/7 BG	4200146 10 mm <sup>2</sup> , NS35, Beige, Schraubanschluss 10 mm <sup>2</sup> , NS35, Fawn, Screw terminal
11	-F3	1	Schmelzsicherung Safety fuse	ESKA	42001462.717	4200146 1A, 6,3x32mm, Träger 1A, 6,3x32mm, Passive
12	-Q1	1	Haupt-/Not-Aus-Schalter Main / Emergency stop switch	ABB	4200106F3	3 Polig, 16A, Bodenbefestigung 3 Core, 16A, Bottom mounting
13	-Q1	1	Hilfskontakt	ABB	4200108A1G10	1NO, seitlich, für OT16...OT125 Hauptschalter, bis 16A 1NO, side mounting, for OT16...OT125 Main switch, to 16A
14	-Q1	1	Auxiliary contact	ABB	4200109IYS2AJ	für Hauptschalter OT16...125F, Rot/Gelb, IP65, NEMA 1 for Main switch OT16...125F, Red/Yellow, IP65, NEMA 1
15	-Q1	1	Hauptschaltergriff Main switch handle	ABB	4200108S6X95	für Hauptschalter OT16...125F, 95mm lang for Main switch OT16...125F, 95mm long
16	-Q2	1	Hauptschalterwelle Main switch shaft	ABB	42001B66-30-10	4kW, 1 NO, 24VDC, Schraubanschluss 4kW, 1 NO, 24VDC, Screw connections
17	-T1	1	Leistungsschütz Power contactor	MDEXX	420057AM3496-0EJ00-0FA2	einphasig, 65VA, IN 220-550VAC, OUT 20VAC 220VAC 24VDC, 50/60Hz, IP00, Schraubanschluss single-phase, 65VA, IN 220-550VAC, OUT 20VAC 220VAC 24VDC, 50/60Hz, IP00, Screw terminal
18	-X0	2	Steuertransformator Control transformer	Phoenix Contact	410000B 2,5-QUATTRO-PE	4mm <sup>2</sup> , NS35, Grün/Gelb, Schraubanschluss 4mm <sup>2</sup> , NS35, Green/Yellow, Screw connections
19	-Z1	1	Schutzleiterklemme Protective conductor terminal	Rittal	43065#B 1555.500	300 x 300 x 120mm, Stahl, RAL7035, 1 Türig, Bearbeitet 300 x 300 x 120mm, Steel, RAL7035, 1 Door, Edited
20	-Z1	4	E-Box	Rittal	45075#B 1590.000	Stahlblech verzinkt, Wandabstand 8 mm Carbon steel zinc-plated, Projection 8 mm
						Materialliste Part list
						BK-Artikel-Nr.: 4302300 Bk-Article-No.: 4302300
						Filtertyp 6.18/6.19/6.44/aquaBoll 6.18.3 Filter type 6.18/6.19/6.44/aquaBoll 6.18.3
						Boll & Kirch Filterbau GmbH
						Revision Modification
						Blatt Page
						von of

# Materialliste

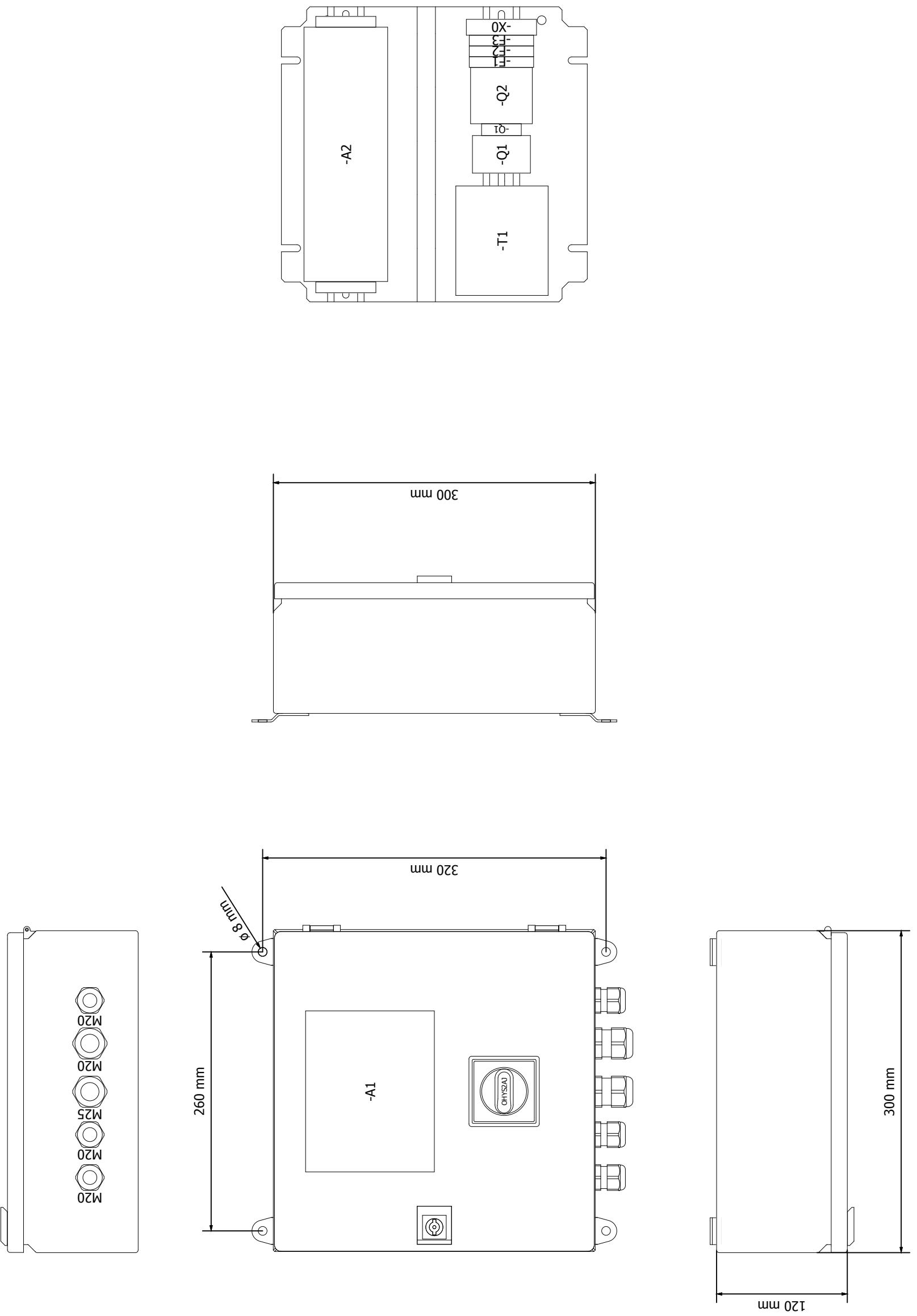
## Part list

Nr. No.	BMK DT	Anzahl Quant.	Bezeichnung Designation	Hersteller Manufacturer	Typ Type	Beschreibung Description	BK-Artikel-Nr.: BK-Article-No.:
21	-Z1	3	Kabelverschraubung Cable gland	WISKA	41000077SKV 20-25 EMV-Z	M20, Messing, vernickelt, EMV-fest, Kabeldurchmesser 9-17mm	
22	-Z1	3	Gegenmutter Locknut	WISKA	41003000IMU 20	M20, Brass, nickel-plated, EMC-proof, Cable diameter 9-17mm	
23	-Z1	2	Kabelverschraubung Cable gland	WISKA	41000077SKV 25-32 EMV-Z	M25, Messing, vernickelt, EMV-fest, Kabeldurchmesser 13-21mm	
24	-Z1	2	Gegenmutter Locknut	WISKA4100310	EMMU 25	M25, Messing, vernickelt M25, Brass, nickel-plated	
25	-Z1	3	Reduzierdichteinsatz Reduced seal insert	WISKA&250001	RDE 25	Kabeldurchmesser 7-12mm, für M25 Kabelverschraubung Cable diameter 7-12mm, for M25 Cable gland	
26	-Z1	2	Reduzierdichteinsatz Reduced seal insert	WISKA	RDE 32	Kabeldurchmesser 9-14mm, für M32 Kabelverschraubung Cable diameter 9-14mm, for M32 Cable gland	
27	-Z1	2	Endwinkel End angle	Contate&#0311	ZES 35/2 BG	Beige, für NS35 Tragschiene Fawn, for NS35 Mounting rail	

		Datum Date	16.05.2019	Hersteller Manufacturer	Materialiste Part list
		Bearbeiter Edited by	gruenwald	<b>BOLLFILTER</b> <b>Protection Systems</b>	BK-Artikel-Nr.: BK-Article-No.: 4302300 =
		Auftrag Order			+ Blatt Page 9
Revision Modification	Bearbeiter Edited by	Datum Date	Vorgang Process	Zeilchnungs-Nr.: Drawing-No.: 246600	von of 13
				Filter type 6.18/6.19/6.44/aquaBoll 6.18.3	

## NO.2 AFU CONTROL PANEL

-Z1 0 1 2 3 4 5 6 7 8 9

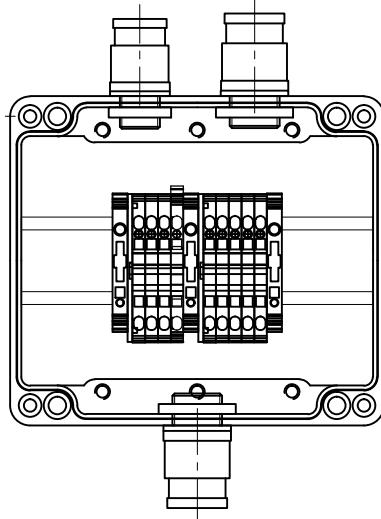


Revision Modification	Bearbeiter Edited by	Datum Date	Datum Date	Aufbauplan Assembling diagram	BK-Artikel-Nr.: BK-Article-No.:
				Filtertyp 6.18/6.19/6.44/aquaBoll 6.18.3	4302300 + Blatt Page von of 13
				Filter type 6.18/6.19/6.44/aquaBoll 6.18.3	Zzeichnungs-Nr.: Drawing-No.: Z46600 7 13

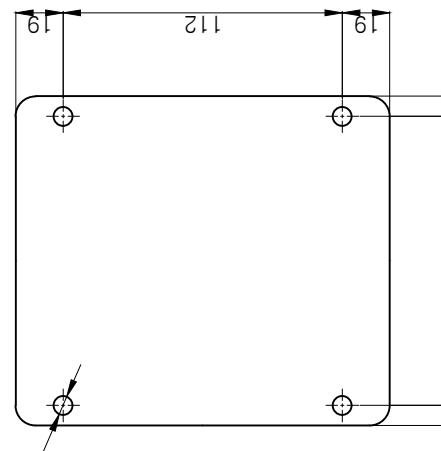
**BOLLFILTER**  
**Protection Systems**

# JUNCTION BOX ASSY

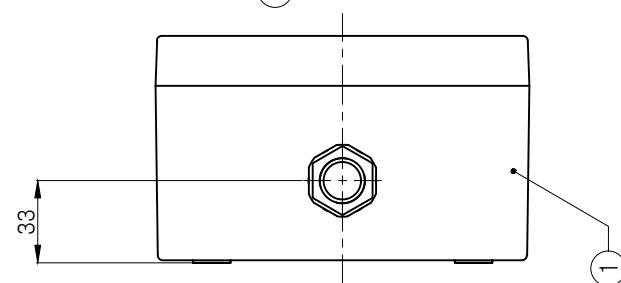
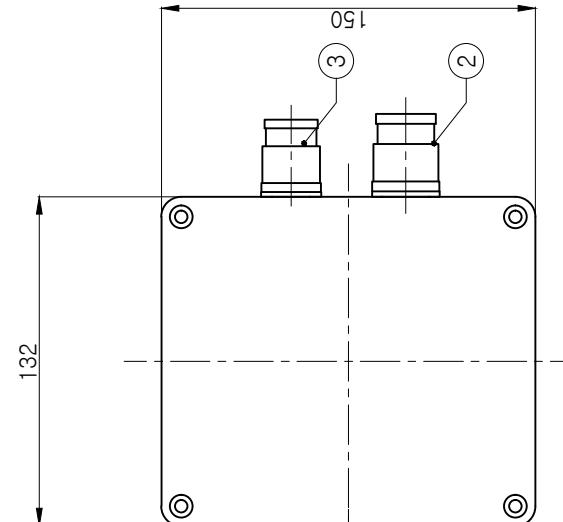
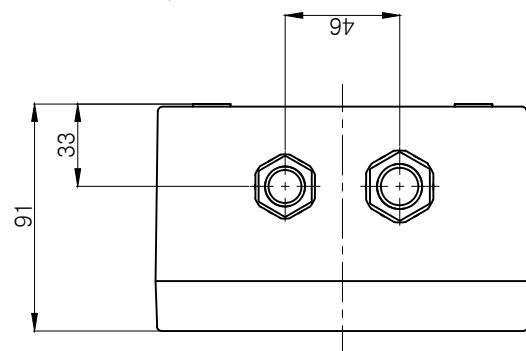
REV \_\_\_\_\_ DESCRIPTION \_\_\_\_\_ CHKD \_\_\_\_\_ APPD \_\_\_\_\_ DATE \_\_\_\_\_



INNER VIEW



BOTTOM VIEW



NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
3	CABLE GLAND	OSIU-16X(16.95-10.3)	BRASS	1	
2	CABLE GLAND	OSIU-20(M20,0.95-15.3)	BRASS	2	
1	ALUMINUM BOX	BC-AL-151309	AL	1	

**TECHCROSS**

DATE : 2022.09.08	PART NAME	JUNCTION BOX ASSY
APPD BY Y.M.KIM	DRAWING NO	-
CHKD BY -		
DSND BY H.C.LEE		
SHEET NO : 1 OF 1		REV. 0



## ECS-HYCHLOR GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING  
HULL NO. : S1940  
MODEL : ECS-HYCHLOR-1200

### DETAIL OF THE FMU

#### 1. Flow Meter Unit (NO.2 FMU)

DIVISION	SPECIFICATION
WEIGHT	7Kg
CONNECTION	JIS 10K-40A FLANGE TYPE
FLUID TEMPERATURE	0°C ~ 60°C
AMBIENT TEMP"	-10°C ~ +60°C
POWER INPUT	AC 220V
SIGNAL OUTPUT	4~20mA
IP GRADE	IP66
MATERIAL	FLANGE : SUS304 LINING : PTFE ELECTRODES : TITANIUM
CERTIFICATE	15-BK1336397-PDA (ABS) / INC32500-AE001 (KR)

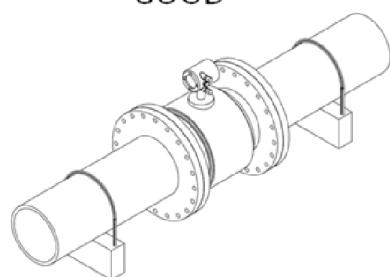
#### 2. INSTALLATION GUIDE

Notice : When installing FMU, FMU power should be turn off before starting any work(welding...etc)

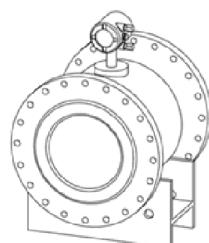
When installing a flow meter larger than 400A, housing bending and damage of internal electric coil may occur.

It is recommended to install support at the end of housing as in the picture below.

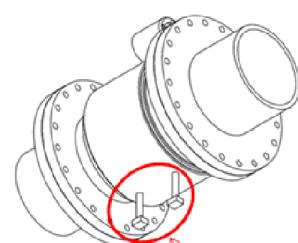
GOOD



GOOD



WRONG



SUPPORT BAR

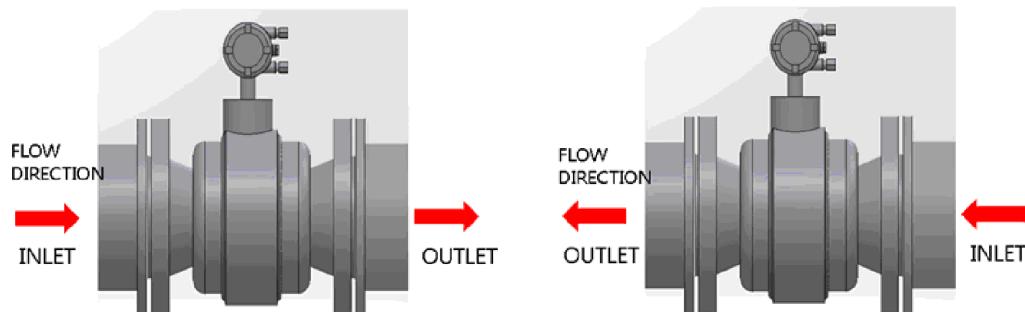


## ECS-HYCHLOR

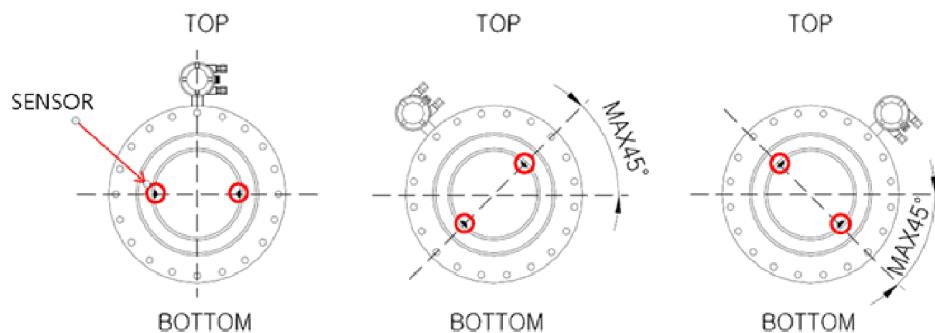
### GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING  
HULL NO. : S1940  
MODEL : ECS-HYCHLOR-1200

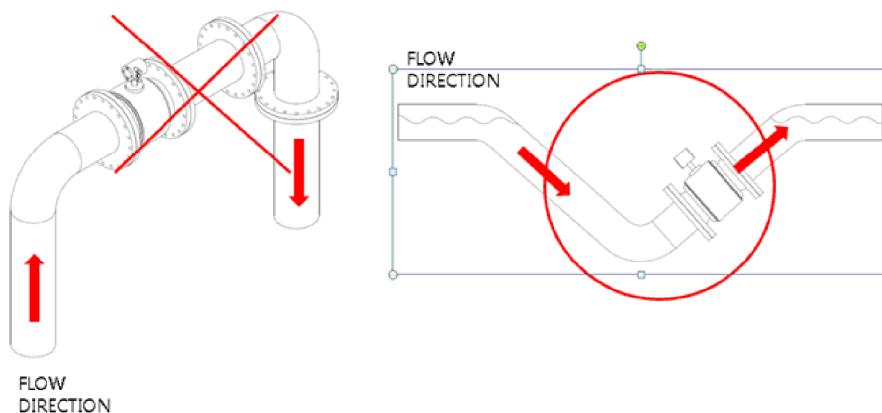
Flow meter can be used for both directions.



It is necessary to keep elec. rod's position horizontally, If it is hard to maintain it horizontally, it shpould not tilt more than 45 degrees from horizontal line.



When installing FMU on the highest point or downstream point, inaccurate value may be measured as full water condition is not fulfilled. In this case, install it as shown in the right picture so full water condition can be fulfilled.





## ECS-HYCHLOR

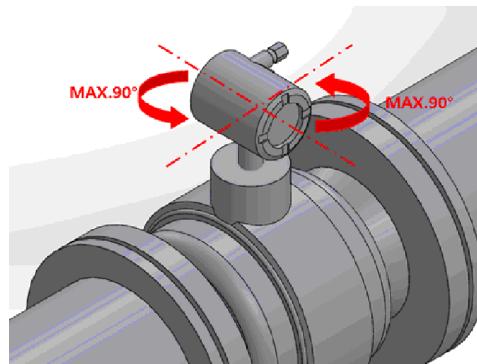
### GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

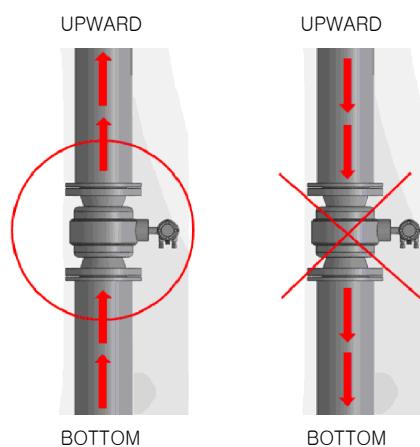
HULL NO. : S1940

MODEL : ECS-HYCHLOR-1200

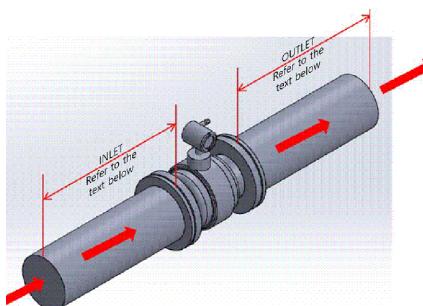
Display can be turned into 4 directions, 90 Degrees(Total of 360 Degrees)



When installing FMU vertically, the ballast water should flow from bottom to upward



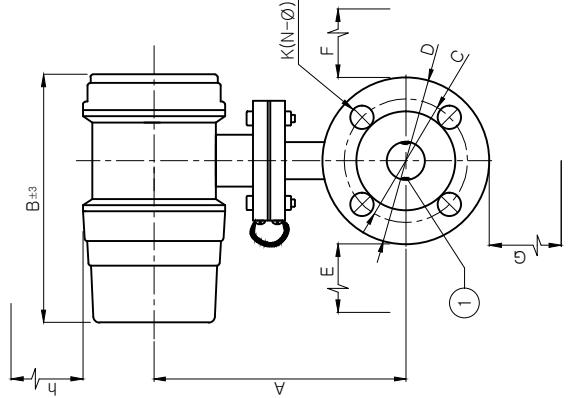
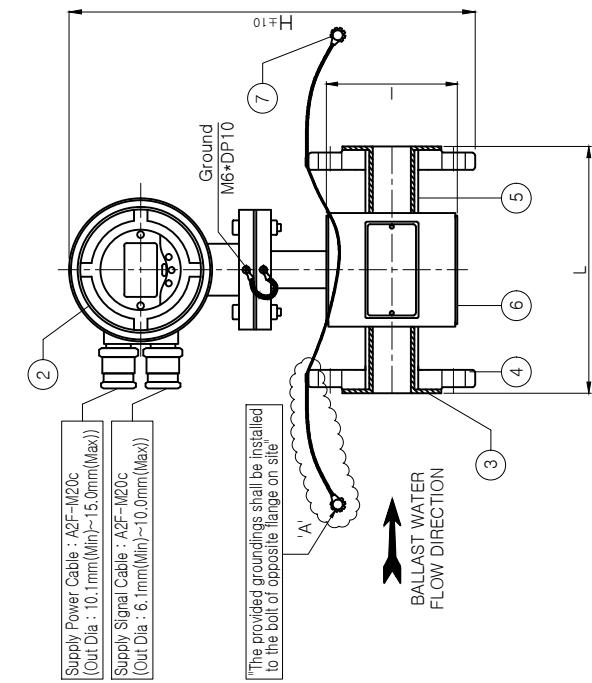
Check the pipe length of FMU inlet & outlet as shown in the picture below to ensure FMU's accuracy



(Inlet side : Min 2D, Outlet side : Min 1D D: pipe diameter)

The controller could be adjusted within 45 degree of angle ranges from center to right/left direction by unscrewing the bolt on site.

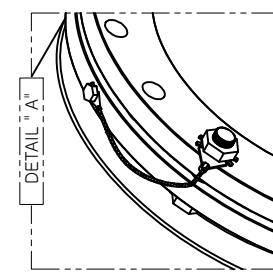
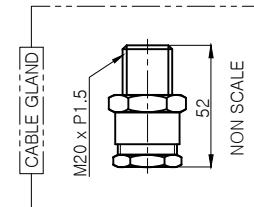
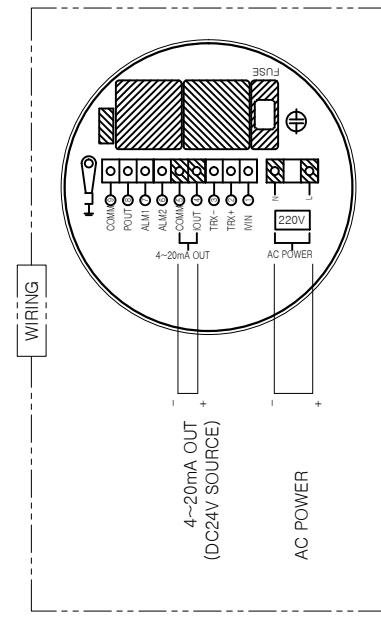
It is essential to install the Gasket between the flange When it is connected with the counter flange.



SIZE	FLOW RATE (m <sup>3</sup> /hr~Max)	A(mm)	I(mm)	B(mm)	H(mm)	D(Ø)	C(Ø)	K(N-Ø)	Weight (kg)	Extra Space(mm) E or F or G or h	
										W	Ø
40A	45	212	113	200	201	327	120	95	4-15	7	300
50A	70	223	133	200	201	343	130	105	4-15	8	300
65A	119	229.5	149	200	201	362	155	130	4-15	10	300
80A	180	228	163	200	201	373	180	145	4-19	11	300
100A	282	251	189	250	201	406	200	165	8-19	14	300
125A	441	269.5	224	250	201	442	235	200	8-19	18	300

<A sign for Extra Space>  
E: Front G: Below  
F: Back h: Upper  
L: +0 L: -3

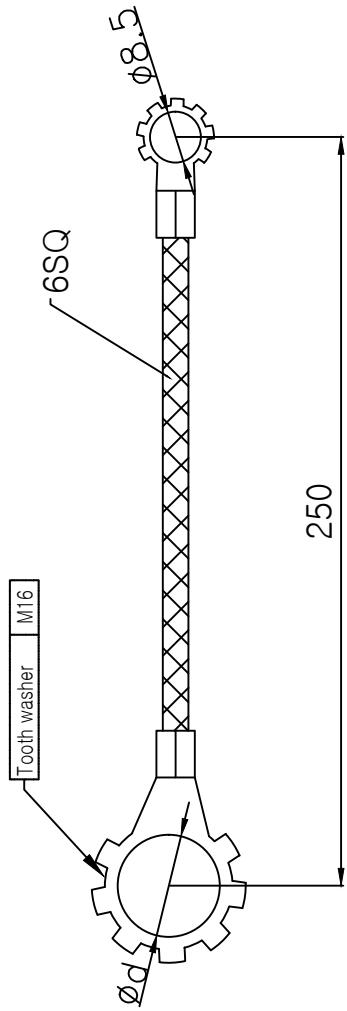
7	Tooth Washer	316SS	2	
6	COVER	SUS304	1	
5	PIPE	SUS304	1	
4	FLANGE		2	
3	LINING	PTFE	1	
2	CONTROLLER	Al Die Cast	1	
1	ELECTROD(inner)	TITANIUM	2	
NO	PART NAME	SPEC	MATERIAL	Q'TY REMARK
K	SHIPBUILDING	S1940	FMU	<b>TECHCROSS</b>
DATE : 2022. 09. 08	PART NAME	NO.2 FLOW METER UNIT		
APPD BY Y.M.KIM	DRAWING NO	FMU004-GC-A001Z-S1940		
CHKD BY -				SHEET NO : 1 OF 1
DSND BY H.C.LEE				REV. C



REV	DESCRIPTION	CHKD	APPD	DATE
	Pipe diameter	Earth Wire (Tooth washer)		
	User bolt	Thick (t)		d
	5K 40A	M12		12.6
	5K 50A			
	5K 65A			
	10K 40A			
	10K 50A			
	10K 65A			
	10K 80A			
	10K 100A	M16		17
	5K 80A			
	5K 100A			
	5K 125A			
	5K 150A			
	10K 125A			
	10K 150A			
	10K 200A	M20		21
	5K 200A			
	5K 250A			
	5K 300A			
	10K 250A			
	10K 300A			
	10K 350A	M22		23
	5K 350A			
	5K 400A			
	5K 450A			
	5K 500A			
	10K 400A			
	10K 450A			
	10K 500A	M24		25
	5K 550A			
	5K 600A			
	5K 650A			
	5K 700A			
	10K 550A			
	10K 600A			
	10K 650A			
	10K 700A			
	10K 800A	M30		31
	5K 750A			
	5K 800A			

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME			
K SHIPBUILDING	S1940	FMU			
DATE : 2022. 09. 08	PART NAME	FMU EARTH WIRE			
APPD BY Y.M.KIM	DRAWING NO				
CHKD BY -	-				
DSND BY H.C.LEE	-				
					REV. 0
					SHEET NO : 1 OF 1





## ECS-HYCHLOR GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

HULL NO. : S1940

MODEL : PMU-120

### DETAIL OF THE PMU

#### 1. MAIN COMPONENT

- PUMP+MOTOR
- PRESSURE TRANSMITTER
- CONDUCTIVITY SENSOR UNIT

#### 2. PUMP+MOTOR (PM01)

DIVISION	SPECIFICATION
TYPE	VERTICAL, MULTISTAGE CENTRIFUGAL PUMP
MATERIAL	HOUSING : SUS316
	IMPELLER : SUS316L
LIQUID	SEAWATER
LIQUID TEMP"	MAX. 32°C(SEA WATER)
ACTUAL CALCULATED RATE	12.39m <sup>3</sup> /hr
ACTUAL DEVELOPED HEAD	85.26m
RATED MOTOR POWER	5.5KW
RATED MOTOR CURRENT	9A
ENCLOSURE CLASS(MOTOR)	IP55
INSULATION CLASS(MOTOR)	F
POWER INPUT	AC 440V, 3PHASE
WEIGHT	91Kg
REQUIRED NPSH	2.35m

#### 3. PRESSURE TRANSMITTER

DIVISION	SPECIFICATION
PROCESS CONNECTION	G1/2
POWER INPUT	DC 24V, 2-WIRES
SIGNAL OUTPUT	4~20mA
MEASURING PRESSURE RANGE	0~16bar
OPERATING TEMP"	-40°C ~ 100°C
AMBIENT TEMP"	-40°C ~ 85°C
ENCLOSURE CLASS	IP65
CERTIFICATE	RINA class : ELE065117XG DNV-GL class : TAA000013A LR class : 17/20079 ABS class : 17-HG1662651-1-PDA



## ECS-HYCHLOR GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

HULL NO. : S1940

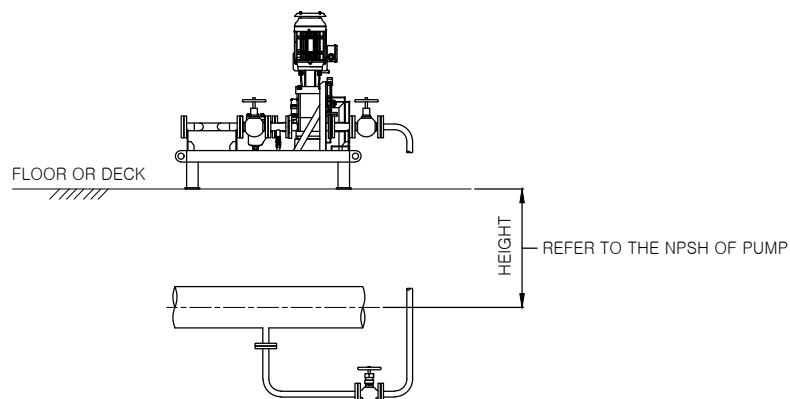
MODEL : PMU-120

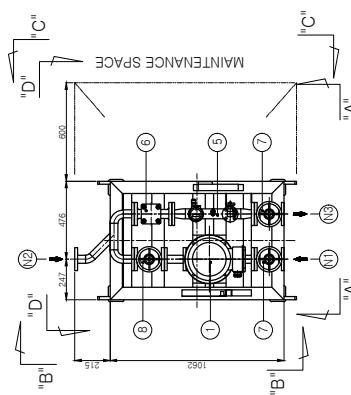
### 4. CONDUCTIVITY SENSOR UNIT

DIVISION	SPECIFICATION
MATERIAL	HOUSING : PBT, SENSOR : PEEK
POWER INPUT	DC 24V, 3-WIRES
SIGNAL OUTPUT	4~20mA(CONDUCTIVITY)
	4~20mA(TEMP")
MEASURING RANGE	0.2uS/cm ~ 1000mS/cm
MEASURING TEMP" RANGE	-10°C ~ 130°C
PROCESS TEMP" RANGE	-10°C ~ 110°C (MAX.130°C, UP TO 60 MINUTES)
ENCLOSURE CLASS	IP69K
CERTIFICATE	DNV-GL class : 42 131 - 15 HH DNV-GL class : TAA00000F0 BV class : 42181/A0 BV LR class : 16/20058 KR class : HTM34800-AE001

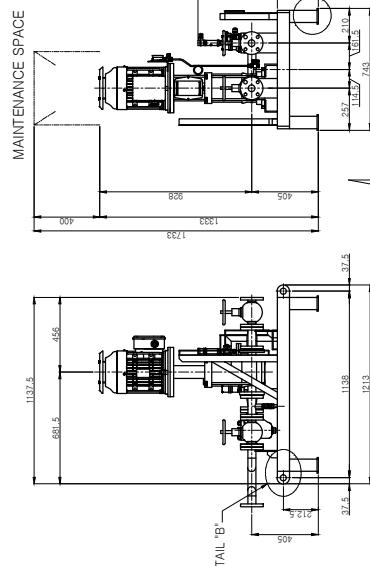
### 5. INSTALLATION GUIDE

When installing PMU, refer to the NPSH of PUMP





VIEW "A"

PIPE SPEC<sup>®</sup> (MAKER STANDARD)

PIPE SPEC <sup>®</sup> (MAKER STANDARD)		PAINTING	
N.D	MATERIAL	SURFACE TREATMENT	PAINTING
40A	STPG370ERW #40	HOP DIP GALV	ONLY OUT SIDE Hempell's HB primer K150 White (1X030) 100μm OVER
75x75x6T	SS400	BLASTING (SA 2.5)	Hempell's HB primer K150 White (1X030) 100μm OVER

FRAME SPEC<sup>®</sup> (MAKER STANDARD)

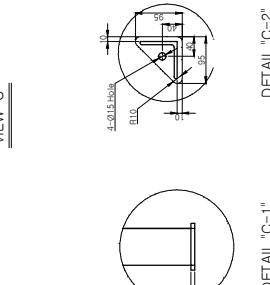
STANDARD	MATERIAL	SURFACE TREATMENT	PAINTING
40x40x5T	SS400		
75x75x6T	SS400		

VALVE LIST (MAKER STANDARD)

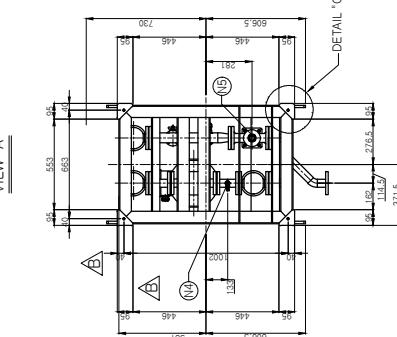
SYMBOL	STANDARD	POSITION	SPECIFICATION
-	JIS 10K 40A	B.W OUTLET	MANUAL GLOVE VALVE
-	JIS 10K 40A	B.W LINE	MANUAL GLOVE CHECK VALVE
-	Ø12, PT 1/2"	DRAIN PORT	MANUAL BALL VALVE
-	JIS 10K 40A	B.W INLET	MANUAL GLOVE VALVE

N5	BUCKET STRAINER DRAIN	M20x P1.5 PLUG	SS400	1 -
N4	DRAIN PORT	Ø12	BRASS	1 -
N3	B.W OUTLET	JIS 10K 40A	BRASS	SUP-ON
N2	MIXING INLET	JIS 10K 40A	SS400	SUP-ON
N1	B.W INLET	JIS 10K 40A	BRASS	SUP-ON

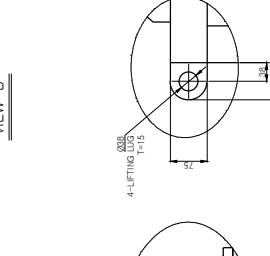
VIEW "C"



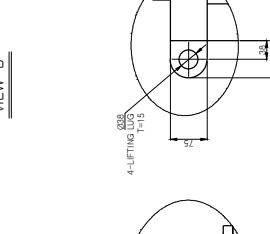
VIEW "E"



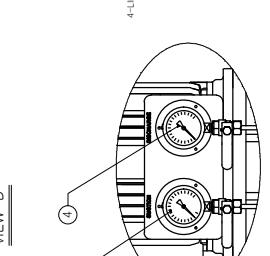
VIEW "D"



VIEW "E"



VIEW "A"



VIEW "E"

DETAIL "A"

DETAIL "B"

DETAIL "C-2"

DETAIL "C-1"

DETAIL "C-2"

DETAIL "C-1"

DETAIL "A"

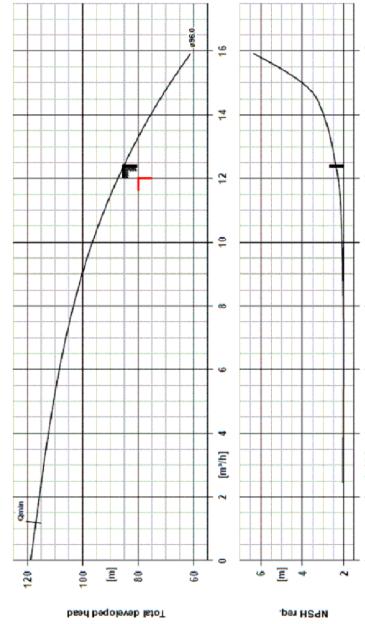
TECHCROSS

DATE : 2022. 09. 08	PART NAME	MODEL NAME	REMARK
APPD BY Y.M.KIM		PUMP MODULE UNIT	
CHKD BY -			
DSND BY H.C.LEE	PMU120-GA-A001Z-S1940	PMU-120	REV. C

SHEET NO : 1 OF 1

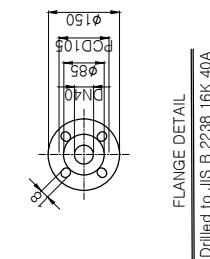
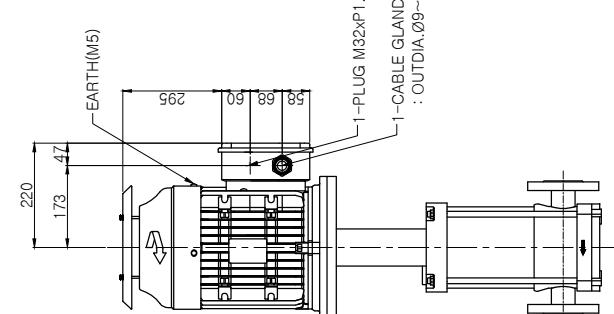
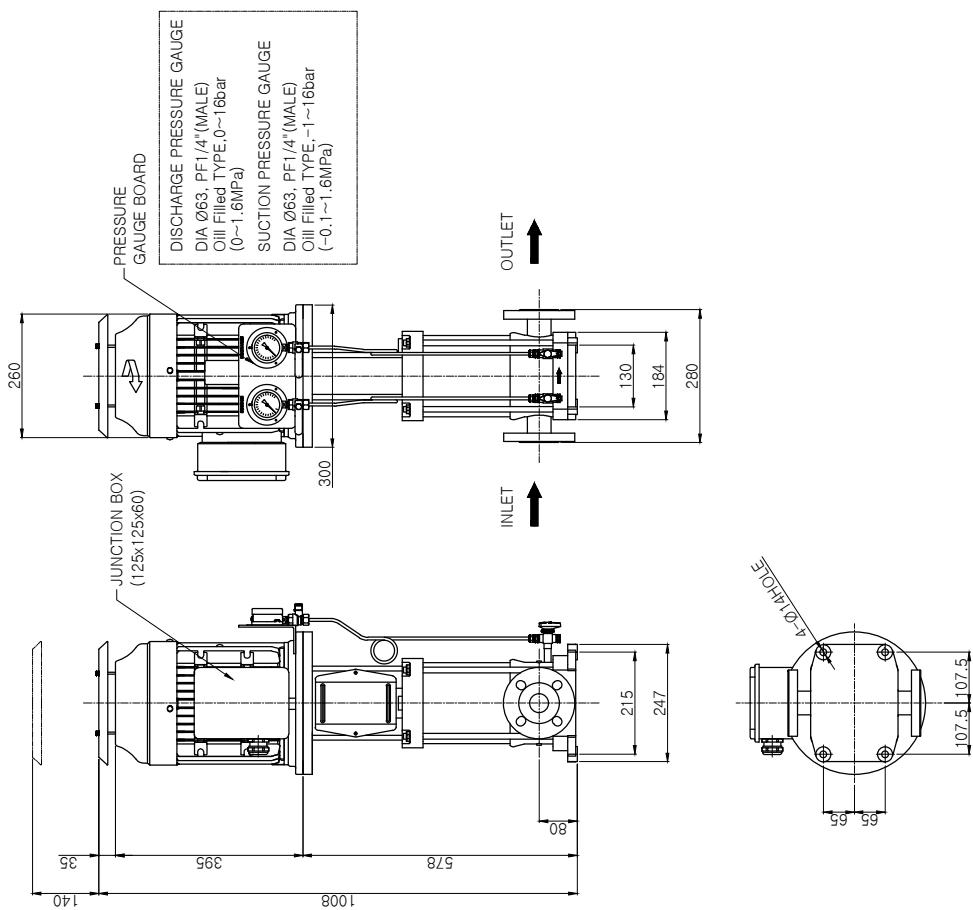
# BOOSTER PUMP (PM1)

REV \_\_\_\_\_ DESCRIPTION \_\_\_\_\_ CHKD \_\_\_\_\_ APPD \_\_\_\_\_ DATE \_\_\_\_\_



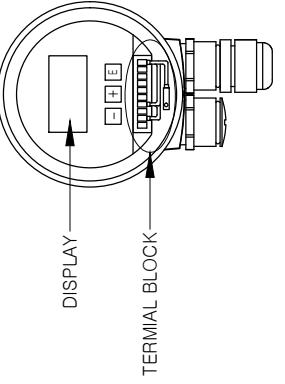
SPECIFICATION	
TYPE	VERTICAL, MULTISTAGE CENTRIFUGAL PUMP
MATERIAL	HOUSING : SUS316L IMPELLER : SUS316L
LIQUID	SEAWATER
LIQUID TEMP <sup>o</sup>	MAX. 32°C(SEA WATER)
ACTUAL CALCULATED RATE	12.36m <sup>3</sup> /hr
ACTUAL DEVELOPED HEAD	85.26m
RATED MOTOR POWER	5.5kW
RATED MOTOR CURRENT	9A
ENCLOSURE CLASS(MOTOR)	IP55
INSULATION CLASS(MOTOR)	F
POWER INPUT	AC 440V, 3PHASE
WEIGHT	91Kg

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME			<b>TECHCROSS</b>
K SHIPBUILDING	S1940	PMU-120			
DATE : 2022. 09. 08	PART NAME	BOOSTER PUMP (PM01)			
APPD BY Y.M.KIM	DRAWING NO	PMU120-GA-E001Z-S1940			SHEET NO. 1 OF 1
CHKD BY -	REV.	C			
DSND BY H.C.LEE					



REV	DESCRIPTION	CHKD	APPD	DATE

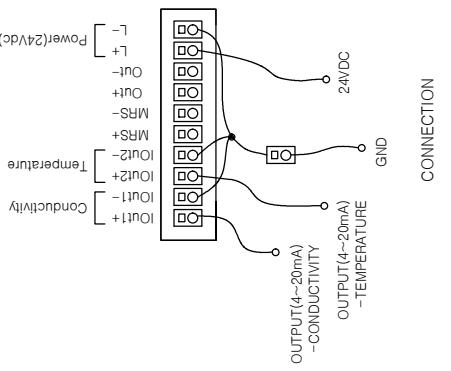


PLUG M20X1.5

CABLEGLAND M20X1.5 O.D : Ø7~Ø13

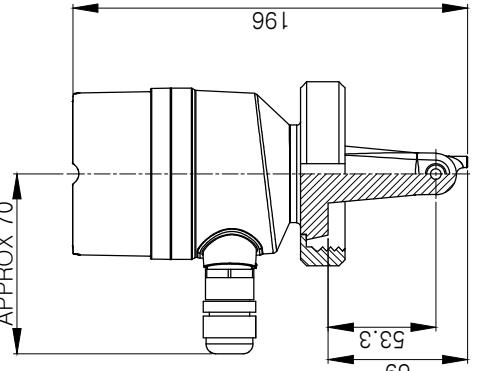
DISPLAY

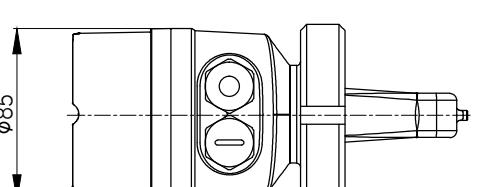
TERMINAL BLOCK



CONNECTION





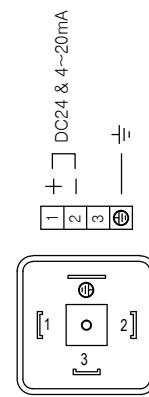
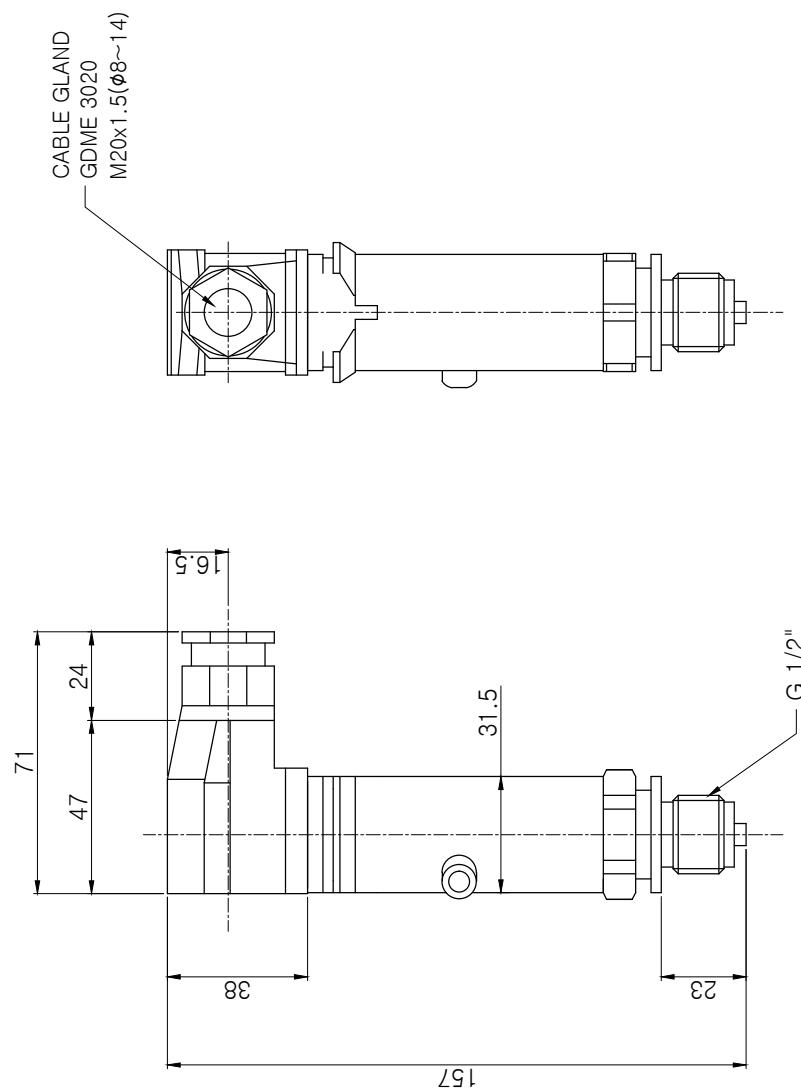
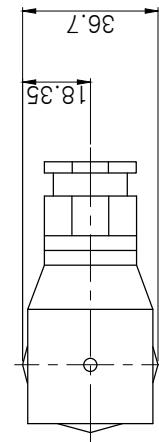
  

DIVISION	SPECIFICATION
MATERIAL	HOUSING : PBT, SENSOR : PEEK
POWER INPUT	DC 24V, 3-WIRES
SIGNAL OUTPUT	4~20mA(TEMP <sup>°</sup> )
MEASURING RANGE	0.2uS/cm ~ 1000mS/cm
MEASURING TEMP <sup>°</sup> RANGE	-10°C ~ 130°C
PROCESS TEMP <sup>°</sup> RANGE	-10°C ~ 110°C (MAX.130°C, UP TO 60 MINUTES)
ENCLOSURE CLASS	IP69K
CERTIFICATE	DNV-GL class : 42.131 - 15 HH DNV-GL class : TAA00000F0 BV class : 42181/A0/BV LR class : 16/20056 KR class : HTM34800-AE001

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
1	SHIP YARD	HULL NO.	MODEL NAME	CSU	TECHCROSS
DATE : 2022. 09. 08	PART NAME	DRAWING NO	CONDUCTIVITY SENSOR UNIT		
APPD BY Y.M.KIM	CHKD BY -	DSND BY H.C.LEE	ECS000-00-E028A-S1940		

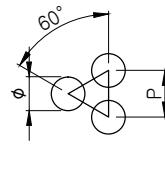
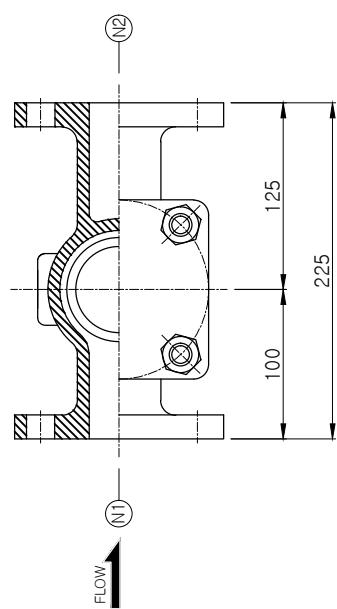
SHEET NO : 1 OF 1



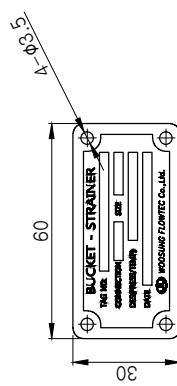
## CONNECTION

DIVISION	SPECIFICATION
PROCESS CONNECTION	G1/2
POWER INPUT	DC 24V, 2-WIRES
SIGNAL OUTPUT	4~20mA
MEASURING PRESSURE RANGE	0~16bar
OPERATING TEMP°	-40°C ~ 100°C
AMBIENT TEMP°	-40°C ~ 85°C
ENCLOSURE CLASS	IP65
CERTIFICATE	RINA class : EUE065117XG DNV GL class : TAA000013A LR class : 17/20079 ABS class : 17-HG1662651-1-PDA

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
K SHIPBUILDING	HULL NO.	MODEL NAME			<b>TECHCROSS</b>
	S1940	PMU			
DATE : 2022. 09. 08	PART NAME				
APPD BY Y.M.KIM		PRESSURE TRANSMITTER			
CHKD BY -	DRAWING NO				
DSND BY H.C.LEE	PMU000-00-E0012-S1940				
					SHEET NO : 1 OF 1
					REV. 1.0



DETAIL OF FILTER

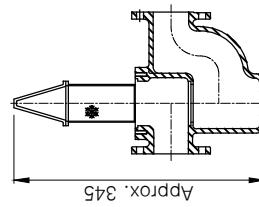


NAME PLATE

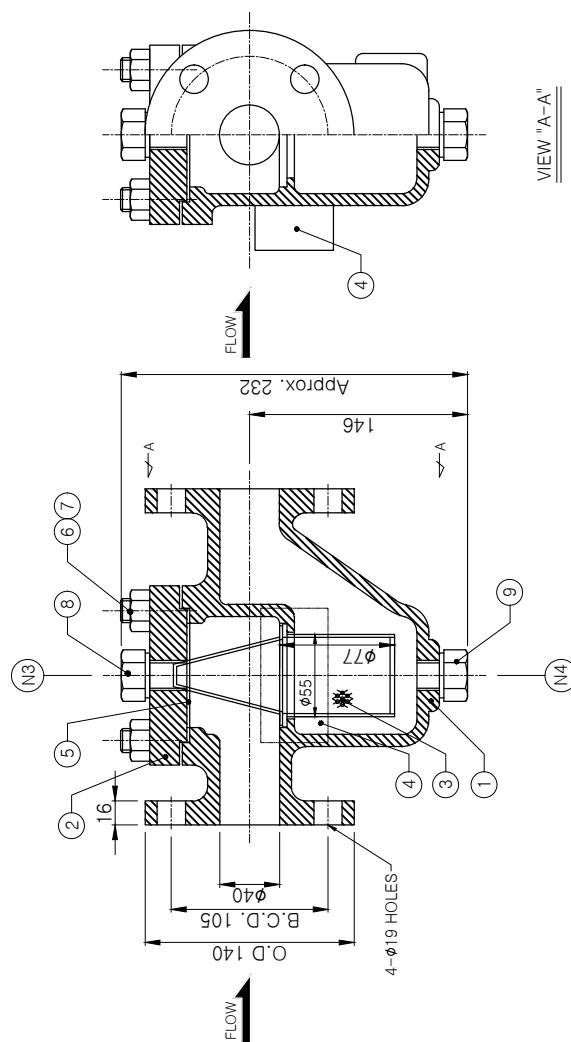
DESIGN DATA					
(Abt.)WEIGHT (Kg)	14KG	KIND OF FLUID	SEA WATER	COATING	INSIDE HOT DIPPED GALV'D OUTSIDE HOT DIPPED GALV'D

LIST OF NOZZLE						
MARK NO.	NO. REQ'D	SIZE (in/mm)	RATING	SCH.	TYPE & FLANGE	PROJECTION
N-1	1	40A	10K	40	FF	SEE DWG
N-2	1	40A	10K	40	FF	SEE DWG
N-3	1	M20x1.5P	-	-	-	SEE DWG
N-4	1	M20x1.5P	-	-	-	SEE DWG

- NOTE  
 1. FLANGE'S BOLT HOLES IS STRADDLE.  
 2. FLOW DIRECTION SYMBOL ATTACHED ON THE BODY ONE SIDE.  
 3. IN CASE OF INSTALLING THE PART WHICH OCCURS INTERFERENCE IN CONNECTION PIPE AT THE FRONT AND REAR OF ITEM, (RUBBER COAT, BUTTERFLY VALVE, M.G.P.S.,...) INFORMATION SHOULD BE CERTAINLY PROVIDED TO US.



SCREEN REMOVAL SPACE

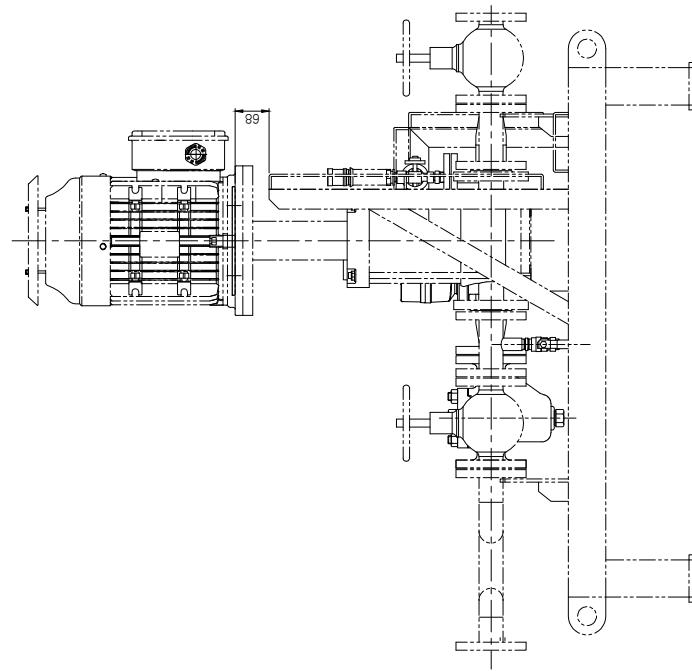


NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
1	BODY	-	SC480	1	
2	NAME PLATE	-	SUS304	1	
3	PERFORATED PLATE	Ø34.8P	SUS304	1	
4	COVER	-	SC480	1	
5	GASKET	-	JOHNSSTOS	1	
6	HEXAGON NUT	-	SS400	4	HOT DIPPED GALV'D
7	STUD BOLT	-	SS400	4	HOT DIPPED GALV'D
8	VENT PLUG	M20x1.5P	SS400	1	HOT DIPPED GALV'D
9	DRAIN PLUG	M20x1.5P	SS400	1	HOT DIPPED GALV'D

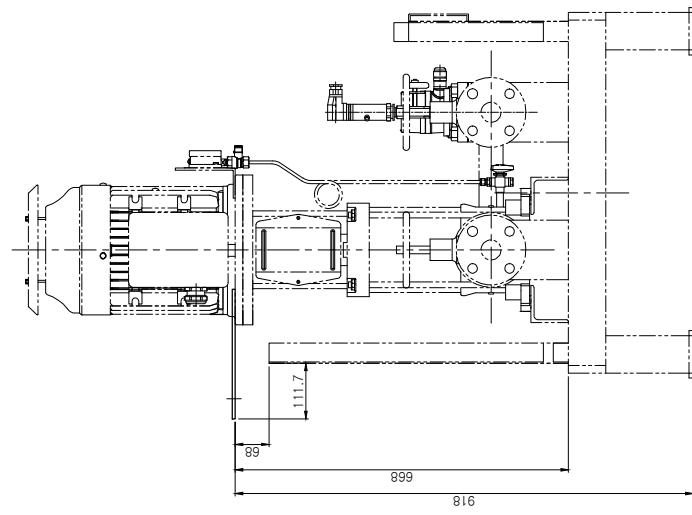
**TECHCROSS**

DATE : 2022. 09. 08  
 APPD BY Y.M.KIM  
 CHKD BY -  
 DSNB BY H.C.LEE

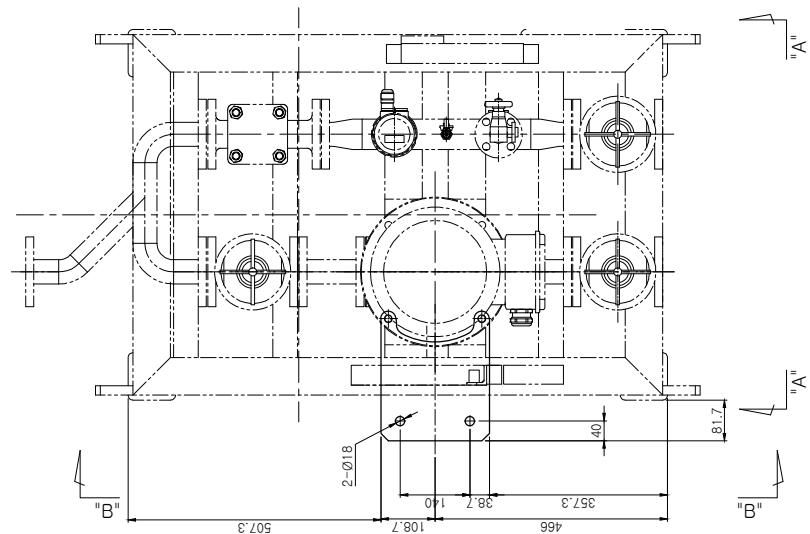
PART NAME BUCKET TYPE STRAINER  
 DRAWING NO BSR040-GA-A001Z-S1940  
 SHEET NO : 1 OF 1  
 REV. 1.0



VIEW "B"



VIEW "A"



PMU TOP PLAN

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.				
K SHIPBUILDING	S1940				
	MODEL NAME	PMU-120			
DATE : 2022. 09. 08	PART NAME	SWAY SUPPORT INSTALLATION - BOOSTER PUMP (PM01)			
APPD BY Y.M.KIM	DRAWING NO	PMU120-GA-A001Z-S1940			
CHKD BY -	REV.	0			
DSND BY H.C.LEE	REVISION				

SHEET NO : 1 OF 1





REV.	DESCRIPTION	CHKD	APPD	DATE
	-	-	-	-

217.4

187.4

260

40

140

9

2-Ø18

2-C15

2-Ø15

NOTE  
1. MATERIAL : SPCC  
2. SPEC : T=6.0  
3. PAINT COLOR : WHITE

NO	PART NAME	HULL NO.	SPEC	MATERIAL	Q.TY	REMARK
SHIP/YARD						
K SHIPBUILDING	SI940		PMU-120			
DATE : 2022. 09. 08.	PART NAME	SWAY SUPPORT FOR VSF 10-7				
APPD BY Y.M.KIM	DRAWING NO.					SHEET NO : 1 OF 1
CHKD BY -						REV. 0
DSND BY H.C.LEE						



## ECS-HYCHLOR GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING  
HULL NO. : S1940  
MODEL : HGU-100x2

### DETAIL OF THE HGU

#### 1. MAIN COMPONENT

- ELECTRODE MODULE
- Ex-PRESSURE SWITCH
- GAS DETECTION SENSOR

#### 2. ELECTRODE MODULE

DIVISION	SPECIFICATION
MATERIAL	FITTINGS,PIPES & VALVEES : PVC-C
	ELECTRODE : TITANIUM
	BUSBAR : COPPER, TITANIUM
LIQUID	SEAWATER
TARGET TRO	5.0PPM
CONDUCTIVITY	OVER 8 PSU @ 1°C
TREATMENT CAPACITY	RATE 2000m3/hr
POWER CONSUMPTION	MAX 5.2kw/100m3/hr
AMBIENT TEMP"	0°C ~ 55°C

#### 3. Ex-PRESSURE SWITCH(NO.1,NO.2 PS)

DIVISION	SPECIFICATION
MATERIAL	SUS316L
PROCESS CONNECTION	1/4" NPT
POWER INPUT	DC 24V
SIGNAL OUTPUT	SPDT
MEASURING PRESSURE RANGE	1~13.8bar
SETTING PRESSURE	10bar
AMBIENT TEMP"	-50°C ~ 71°C
IP GRADE	IP66
TYPE OF Ex CODE	Ex d IIC T6; Ex Td A21 IP66 T85°C
CERTIFICATE	IECEx UL 03.0001X



ECS-HYCHLOR  
GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

HULL NO. : S1940

MODEL : HGU-100x2

#### 4. PRESSURE INDICATOR

DIVISION	SPECIFICATION
MATERIAL	SUS316L
ACCURACY CLASS	CLASS 1.6
PROCESS CONNECTION	G1/2B
CASE FILLING FLUID	GLYCERINE
MEASURING PRESSURE RANGE	-1~15bar
AMBIENT TEMP <sup>°</sup>	-20°C ~60°C
IP GRADE	IP65



## ECS-HYCHLOR

### GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

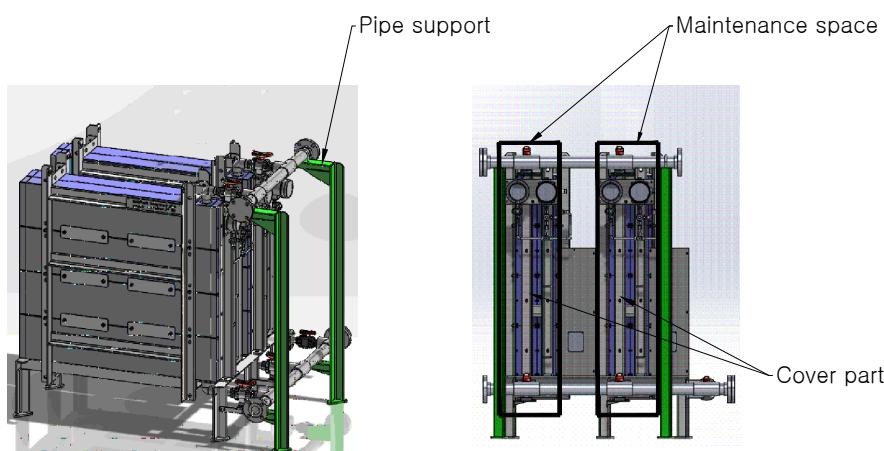
HULL NO. : S1940

MODEL : HGU-100x2

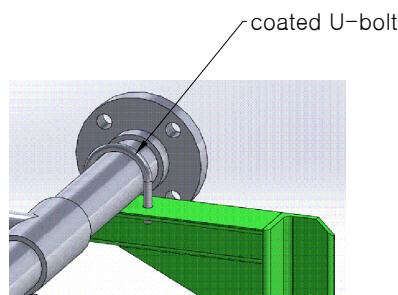
## DETAIL OF THE HGU

### 6-1. INSTALLATION GUIDE

When installing the pipe support, install the pipe support so that there is no interference with the cover for maintenance of the electrode module.



To protect the "cpvc pipe"coated U-bolt should be used





## ECS-HYCHLOR GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

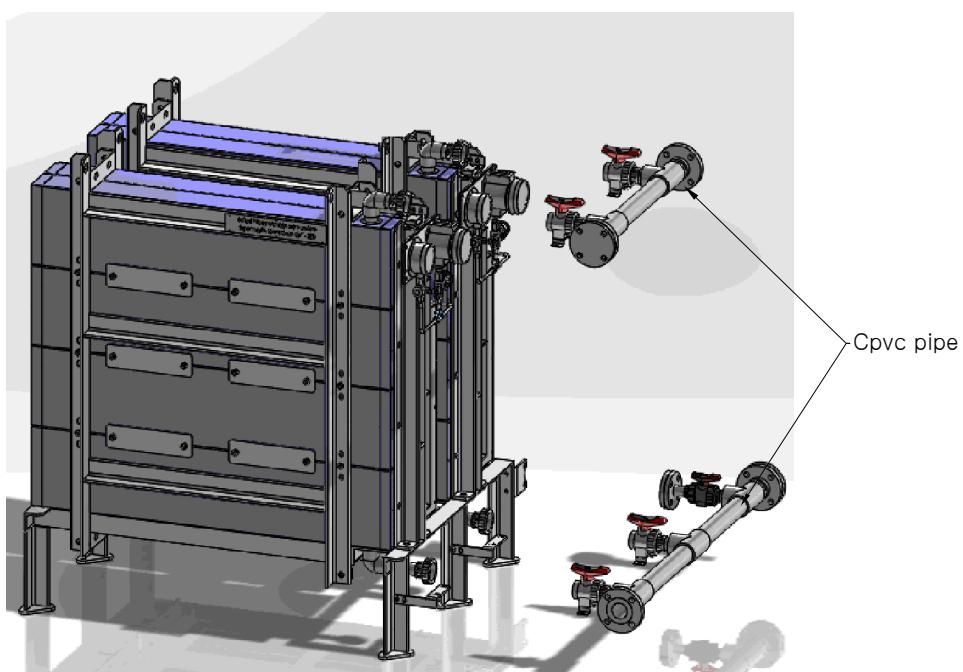
HULL NO. : S1940

MODEL : HGU-100x2

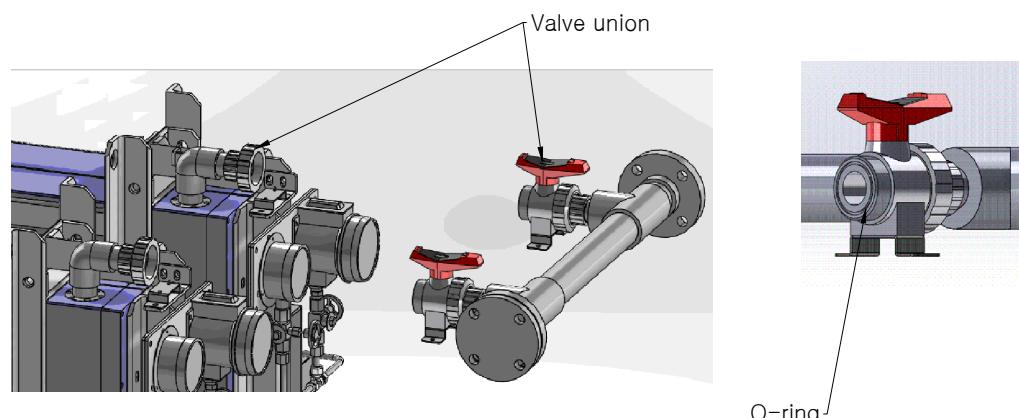
### DETAIL OF THE HGU

#### 6-2. INSTALLATION GUIDE

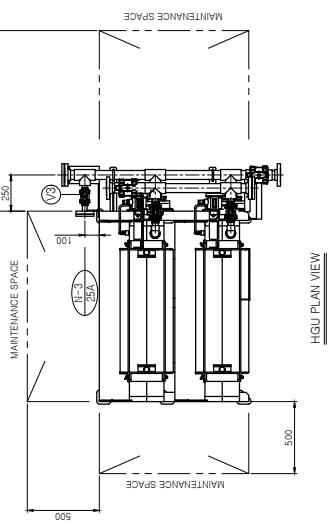
Fix the equipment and install the provided "Cpvc pipe"



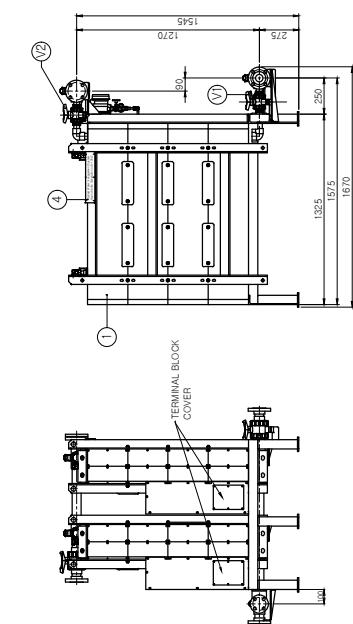
When assembling the valve union, check whether there is an O-ring and tighten it by hand.



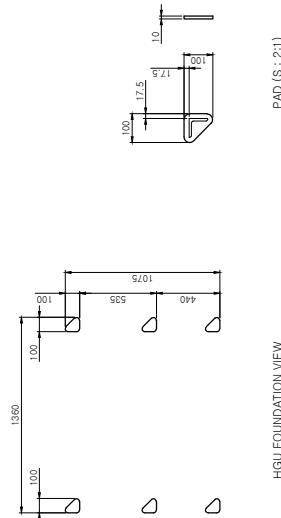
REV.	DESCRIPTION	CHKD	APPD	DATE
△				



HGU PLAN VIEW

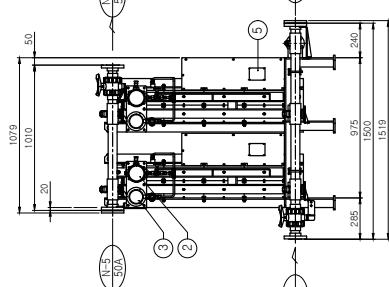


GU FRONT VIEW



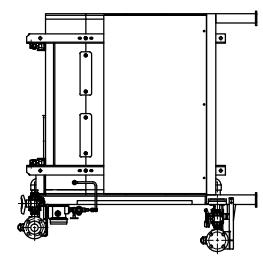
HGU FOUNDATION VIEW  
BOTTOM VIEW

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HGU RIGHT SIDE VIEW

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HGU REAR VIEW

PIPE SPEC <sup>a</sup> (MAKER STANDARD)			
N.D.	MATERIAL	SURFACE TREATMENT	PAINTING
25A	C/P/C	—	—
32A	C/P/C	—	—
50A	C/P/C	—	—

FRAME SPEC <sup>a</sup> (MAKER STANDARD)			
STANDARD	MATERIAL	SURFACE TREATMENT	PAINTING
65x65x8.0T	SS400	BLASTING (Sa 2.5) 100µm OVER	Hempel's HB primer K 150 White (1x30L)

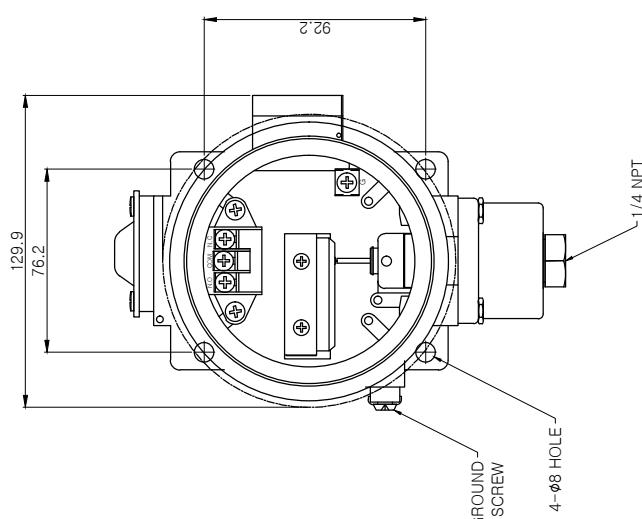
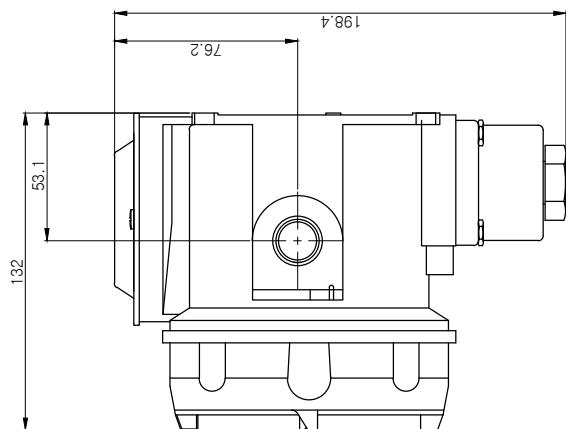
  

VALVE LIST (MAKER STANDARD)			
SYMBOL	STANDARD	POSITION	SPECIFICATION
V1	JIS 10K 32A	HGU INLET VALVE	BALL VALVE (LIMIT SWITCH TYPE)
V2	JIS 10K 32A	HGU OUTLET VALVE	BALL VALVE (LIMIT SWITCH TYPE)
V3	JIS 10K 25A	DRAIN VALVE	BALL VALVE
V4	JIS 10K 50A	MANIFOLD INLET VALVE	BALL VALVE (LOCKING DEVICE TYPE)
V5	JIS 10K 50A	MANIFOLD INLET VALVE	BALL VALVE (LOCKING DEVICE TYPE)

		PART NAME		SPEC		MATERIAL		QTY		REMARK	
6	GAS DETECTION SENSOR	=	-	-	-	1	CONSUMABLE PART				
5	MFR. NAME PLATE	-	-	AL	2						
4	NAME PLATE	-	-	AL	1						
3	PRESSURE INDICATOR	DIA Ø100, PFT 1/2(MALE)	SUS316L		2		Oiled type, 1~1bar				
2	EX-PRESSURE SWITCH	JIS Ø20A, 011~Ø1/2	SUS316	2							
1	ELECTRODE MODULE	-	CPVC	16							
NO	PART NAME	HULL NO.	MODEL NAME								
K SHIPBUILDING	S1940	HGU-100x2									
DATE : 2022. 09. 08											
APP'D BY Y.M.KIM											
CHK'D BY -											
DSND BY H.C.LEE											
		DRAWING NO		HGU200-GA-A001Z-S1940						SHEET NO : 1 OF 1	
										REV. 0	

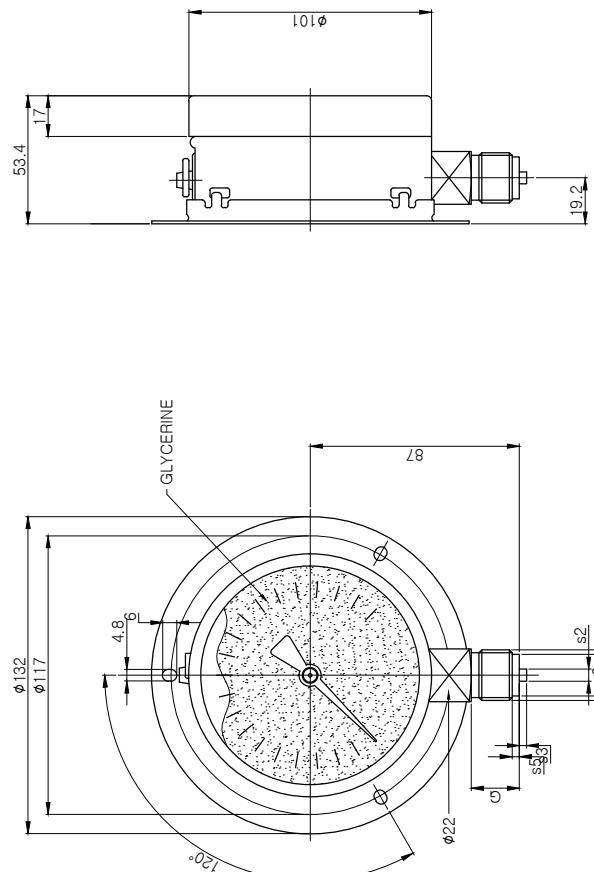
NOTE  
1. WEIG - DRY - WET

REV.	DESCRIPTION	CHKD	APPD	DATE
SPECIFICATION				<b>JTECHCROSS</b>



NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME			<b>JTECHCROSS</b>
K SHIPBUILDING	S1940	HGU			
DATE : 2022. 09. 08	PART NAME	NO.1/NO.2 EX-PRESSURE SWITCH			
APPD BY Y.M.KIM	DRAWING NO	ECS000-00-E0252-S1940			
CHKD BY -	DSND BY H.C.LEE				
					REV. 0
					SHEET NO : 1 OF 1

REV.	DESCRIPTION	CHKD	APPD	DATE
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SPECIFICATION	
MATERIAL	SUS316L
ACCURACY CLASS	CLASS 1.6
PROCESS CONNECTION	G1/2B
CASE FILLING FLUID	GLYCERINE
MEASURING PRESSURE RANGE	-1~15bar
AMBIENT TEMP.	-20°C ~ 60°C
ENCLOSURE CLASS	IP65

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME			<b>JECHCROSS</b>
K SHIPBUILDING	S1940	HGU			
DATE : 2022. 09. 08	PART NAME				
APPD BY Y.M.KIM	DRAWING NO	PRESSURE INDICATOR			
CHKD BY -	ECS000-00-P018Z-S1940				SHEET NO : 1 OF 1
DSND BY H.C.LEE				REV. 0	

G	s2	s3	s4	s5	s6	H±1
G 1/2B	φ6	20	3	3	φ17.5	87



## ECS-HYCHLOR GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

HULL NO. : S1940

MODEL : DMU-150

## DETAIL OF THE DMU

### 1. MAIN COMPONENT

- DEGAS TANK
- AIR VENT
- BLOWER
- FLOW SWITCH
- GAS SENSOR
- GAS DETECTION SENSOR
- LEVEL SWITCH
- SAFETY FAIL CLOSE VALVE

### 2. DEGAS TANK

DIVISION	SPECIFICATION
MATERIAL	SS400(WITH PE COATING/INNER)
CAPACITY	15m3/h
CONCENTRATION OF H <sub>2</sub> GAS	<1%

### 3. AIR VENT

DIVISION	SPECIFICATION
TYPE	BALL FLOATING
MATERIAL	CrNiMo-steel
OPERATING TEMP <sup>°</sup>	MAX. 130°C
OPERATING PRESSURE	0 ~ 16 bar
FLOW RATE	248 Nm <sup>3</sup> /h

### 4. BLOWER (BL01,02)

DIVISION	SPECIFICATION
TYPE	NON SPARK TYPE
MATERIAL	CASTING & BASE : SS400
	IMPELLER : A5083 + A6061 T1
AMBIENT TEMP <sup>°</sup>	0 ~ 50°C
CAPACITY	6.81m <sup>3</sup> /min
STATIC PRESSURE	100mmAq(OUTLET)
IP GRADE(MOTOR)	IP55
INSULATION CLASS(MOTOR)	F



## ECS-HYCHLOR GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

HULL NO. : S1940

MODEL : DMU-150

POWER INPUT	AC 440V
TYPE OF Ex CODE(MOTOR)	Ex d IIC T4
CERTIFICATE (MOTOR)	IECEx BAS 10.0042X

### 5. FLOW SWITCH

DIVISION	SPECIFICATION
MATERIAL	SUS316
OPERATING PRESSURE	MAX.30bar
PROCESS TEMP"	-20°C ~ 70°C
AMBIENT TEMP"	-20°C ~ 70°C
POWER INPUT	DC 24V
IP GRADE	IP67
TYPE OF Ex CODE	SWITCH : Ex ia IIC T5 Gb / II 2G Ex ia IIC T4 Gb SOCKET : Ex ia IIC T4 Gb / II 2G Ex ia IIC T5 Gb
CERTIFICATE	SENSOR : DMT 03 ATEX E091 IECEx BVS 06.0007 SOCKET : BVS 11 ATEX E 009 X / IECEx BVS 11.0002 X

### 6. GAS SENSOR(GAS DETECTION SENSOR)

DIVISION	SPECIFICATION
MEASURING TYPE	DIFFUSION TYPE
MEASURING GAS	H2
MEASURING RANGE	0 ~ 100% LEL
MEASURING METHOD	CATALYTIC CELL
ACCURACY	±3% / FULL SCALE
OPERATING TEMP"	-40°C to 80°C
POWER INPUT	DC 24V
OUTPUT SIGNAL	4~20mA
IP GRADE	IP66
PROTECTION	Ex II GD Ex d IIC Gb T4~T6 / Ex d IIC Gb T4~T6
CERTIFICATE	Sira 08ATEX1003 / IECEx SIR 08.0003
	MED, ABS, DNV, KR, SIL2



## ECS-HYCHLOR GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

HULL NO. : S1940

MODEL : DMU-150

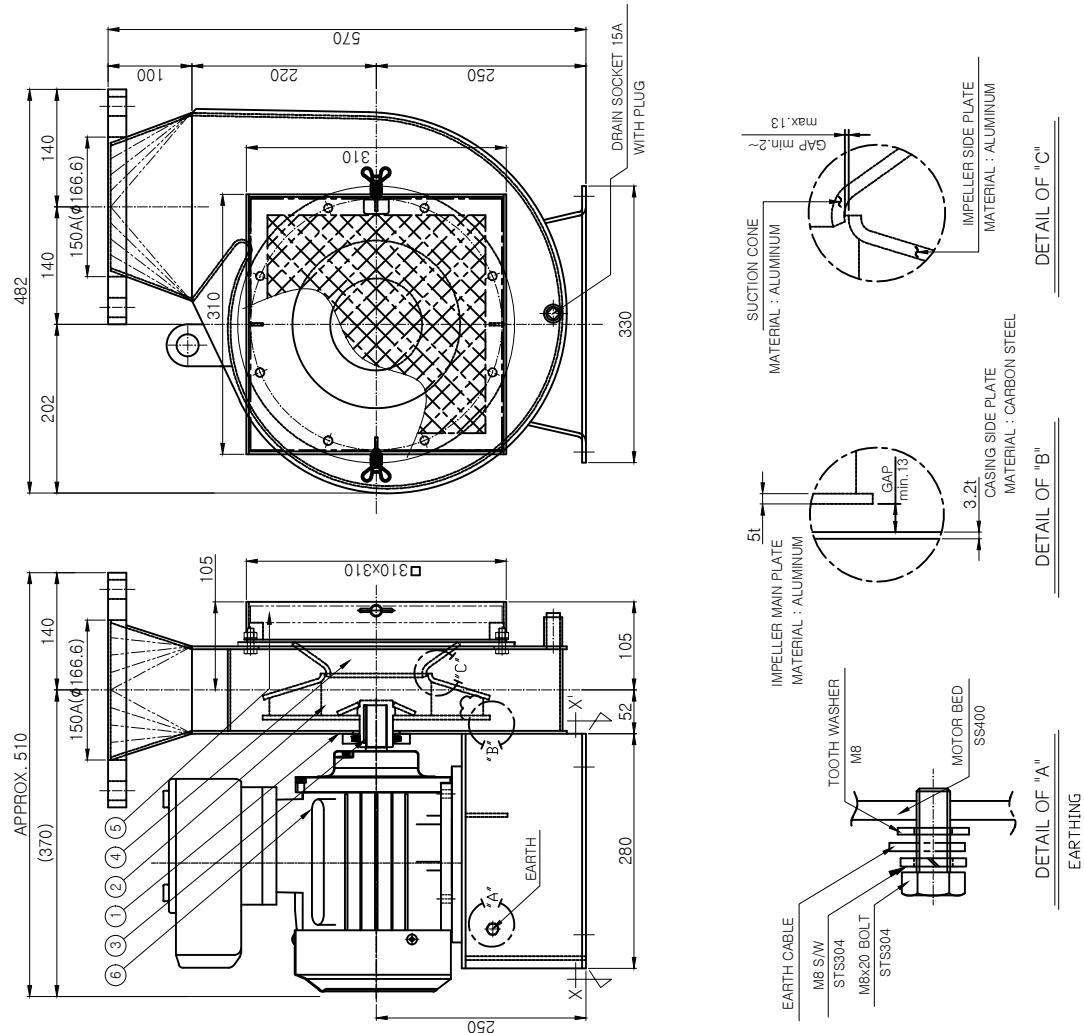
### 7. LEVEL LIMIT SWITCH

DIVISION	SPECIFICATION
MEASURING TYPE	THE SENSOR'S FORK VIBRATES AT ITS INTRINSIC FREQUENCY
POWER INPUT	DC 24V
OUTPUT SIGNAL	Dry Contact
PROCESS TEMP <sup>°</sup>	-50°C ~ 150°C
AMBIENT TEMP <sup>°</sup>	-50°C ~ 70°C
IP GRADE	IP66
TYPE OF Ex CODE	II 1/2G EEx d IIC T3~T6 / Ex d IIC Gb T3~T6 Ga/Gb
CERTIFICATE	KEMA 99ATEX1157 / IECEEx KEM 10.0047X ABS, GL, NKK, RINA, SIL

### 8. SAFETY FAIL CLOSE VALVE + ACTUATOR

DIVISION	SPECIFICATION
TYPE	HYDRAULIC SINGLE-ACTING BALANCED ROTARY ACTUATOR (QUARTER-TURN) FAIL-SAFE
AMBIENT TEMP <sup>°</sup>	-20°C ~ 80°C
MATERIAL	HOUSHING & PISTON : GGG 40
	OUTPUT SHAFT : SS 2142
	DISHED SPRINGS : 50 CrV4
	INDICATOR SHAFT : SUS316
ROTATION	90° ±1°
POWER INPUT	AC 220V
CERTIFICATE	A-14113 (ISSUED DNV CLASS), BV, GL

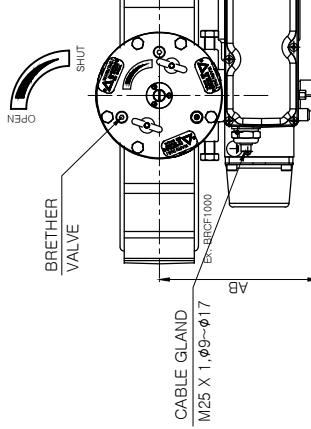
REV	DESCRIPTION	CHKD	APPD	DATE
	<img alt="Front view of the DMU unit with dimensions: 1116 (width), 900 (height), and 1016 (width). Labels include 341 (width), 250 (width), 2000 (width), 1986 (height), 34 (width), 342 (height			



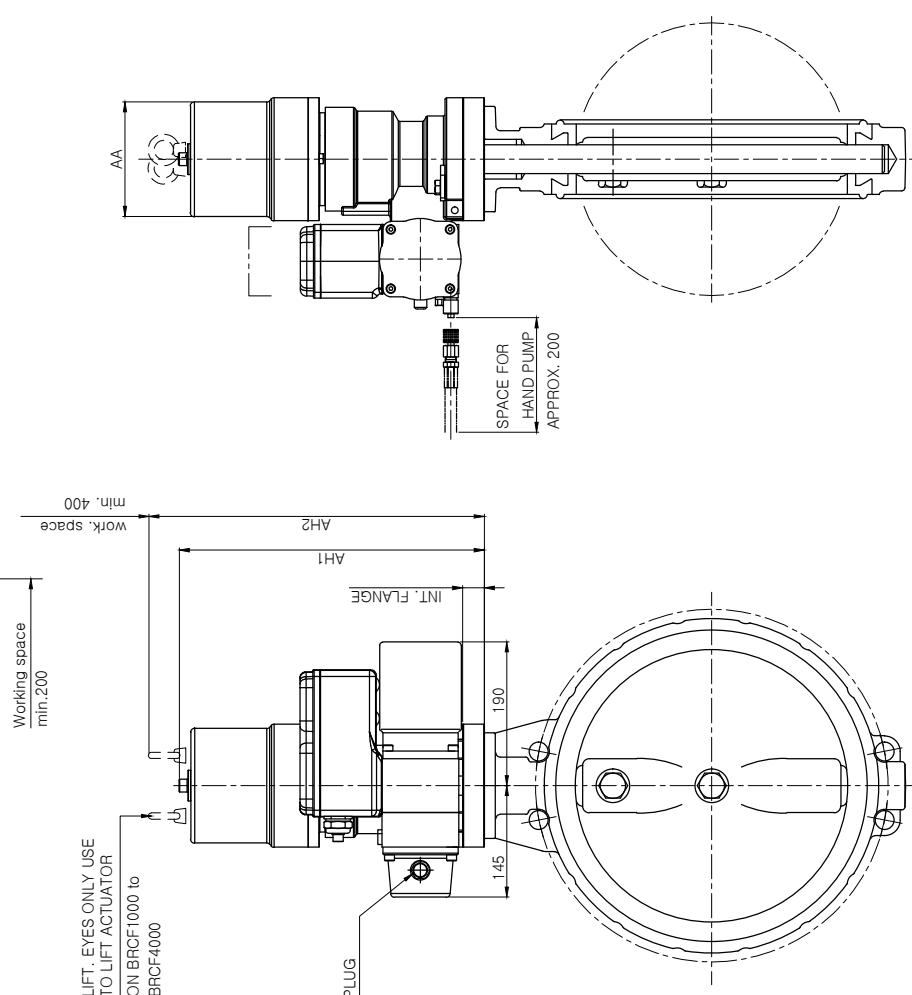
I. BLOWER+MOTOR		SPECIFICATION	
DIVISION	TYPE	NON SPARK TYPE	CASTING & BASE : SS400
MATERIAL	IMPELLER : A5083 + A6061 T1		
AMBIENT TEMP"	0 ~ 50°C		
CAPACITY	6.81m³/min		
STATIC PRESSURE	100mmAq(OUTLET)		
IP GRADE(MOTOR)	IP55		
INSULATION CLASS(MOTOR)	F		
POWER INPUT	AC 440V		
TYPE OF EX CODE(MOTOR)	Ex d IIC T4		
CERTIFICATE (MOTOR)	IECEx BAS 10.0002X		

TECHCROSS		SHEET NO : 1 OF 2	
NO	PART NAME	MATERIAL	Q'TY
6	MOTOR	0.75KwX2P-440V	1
5	SUCTION FILTER	300 x 300 x 20t	1
4	SUCTION CONE	-	1
3	BOSS	-	1
2	IMPELLER	A60.61T1	1
1	CASING	A50B3	1
	SHIP YARD	#1.5-S1	1
K	SHIPBUILDING	DMU-150	1
		DMU000-00-P0012	1
		REV.	1.0

REV	DESCRIPTION	CHKD	APPD	DATE																																
(a) FAN SPECIFICATION																																				
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr><td>FLOW RATE</td><td>6.81 <math>\text{m}^3/\text{min}</math></td><td>TYPE</td><td>INDUCTION MOTOR End II C T4</td></tr> <tr><td>STATIC PRESSURE</td><td>100(1-20)</td><td>OUTPUT</td><td>0.75 kW</td></tr> <tr><td>TEMPERATURE</td><td>45 °C</td><td>PHASE</td><td>2 P</td></tr> <tr><td>DENSITY</td><td>1.110 <math>\text{kg/m}^3</math></td><td>SPEED</td><td>3500 rpm</td></tr> <tr><td>SPEED</td><td>3500 rpm</td><td>FREQUENCY</td><td>60 Hz</td></tr> <tr><td>FAN INPUT</td><td>10W</td><td>POWER TRANS.</td><td>DIRECT MOTOR <input type="checkbox"/> COUPING <input type="checkbox"/> V-BELT</td></tr> <tr><td>EFFICIENCY</td><td>0.27 %</td><td>BEARING</td><td>TYPE <input type="checkbox"/> ROLLING <input type="checkbox"/> SLIDING</td></tr> <tr><td>LUB.</td><td>50</td><td>LUB.</td><td><input type="checkbox"/> GREASE <input type="checkbox"/> OIL</td></tr> </table>					FLOW RATE	6.81 $\text{m}^3/\text{min}$	TYPE	INDUCTION MOTOR End II C T4	STATIC PRESSURE	100(1-20)	OUTPUT	0.75 kW	TEMPERATURE	45 °C	PHASE	2 P	DENSITY	1.110 $\text{kg/m}^3$	SPEED	3500 rpm	SPEED	3500 rpm	FREQUENCY	60 Hz	FAN INPUT	10W	POWER TRANS.	DIRECT MOTOR <input type="checkbox"/> COUPING <input type="checkbox"/> V-BELT	EFFICIENCY	0.27 %	BEARING	TYPE <input type="checkbox"/> ROLLING <input type="checkbox"/> SLIDING	LUB.	50	LUB.	<input type="checkbox"/> GREASE <input type="checkbox"/> OIL
FLOW RATE	6.81 $\text{m}^3/\text{min}$	TYPE	INDUCTION MOTOR End II C T4																																	
STATIC PRESSURE	100(1-20)	OUTPUT	0.75 kW																																	
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FAN INPUT	10W	POWER TRANS.	DIRECT MOTOR <input type="checkbox"/> COUPING <input type="checkbox"/> V-BELT																																	
EFFICIENCY	0.27 %	BEARING	TYPE <input type="checkbox"/> ROLLING <input type="checkbox"/> SLIDING																																	
LUB.	50	LUB.	<input type="checkbox"/> GREASE <input type="checkbox"/> OIL																																	
(b) FAN CURVE	<p>The graph plots Power (kW) on the Y-axis (0 to 120) against Flow Rate (<math>\text{m}^3/\text{min}</math>) on the X-axis (0 to 210). The curve shows efficiency, total pressure, static pressure, and shaft power as they relate to flow rate.</p>																																			
(c) FOUNDATION PLAN	<p>SECTION X-X': Foundation plan showing dimensions: 280 (total width), 200 (inner width), 40 (inner height), 140 (outer height), 305 (outer width), 12.5 (inner width), 30 (inner height), and 52 (outer height). It also indicates 4-<math>\phi</math>12 HOLES.</p>																																			
(d) DETAIL OF FILTER	<p>Detail of filter wire mesh showing: SUS DEMISTER, WIRE: <math>\phi 0.254</math> mm, DENSITY: 22KG/m<sup>3</sup>, MATT'L: STS304, WIRE DA: <math>\phi 1.4</math> mm, MESH: 12mmX12mm(Pitch).</p>																																			
(e) DETAIL OF DISCHARGE FLANGE	<p>Detail of discharge flange showing: 8-<math>\phi</math>23 HOLES, 150A(<math>\phi</math>166.6), <math>\phi</math>240 P.C.D., <math>\phi</math>80, and 12.5 (inner height).</p>																																			
(f) DETAIL PROTEC. WIRE	<p>Detail of protection wire showing: 12 (inner height), 12 (outer height), and <math>\phi 1.4</math> mm.</p>																																			
<b>DETAIL OF DISCHARGE FLANGE</b> KS 10K 150A(22+) FF TYPE																																				
<b>DETAIL PROTEC. WIRE</b>																																				
<b>TECHCROSS</b>																																				
<b>REV. 1.0</b>																																				
<b>SHEET NO : 2 OF 2</b>																																				



LIFT EYES ONLY USE  
TO LIFT ACTUATOR  
ON BRCF1000 to  
BRCF4000



### VALVE NO. : AC02V

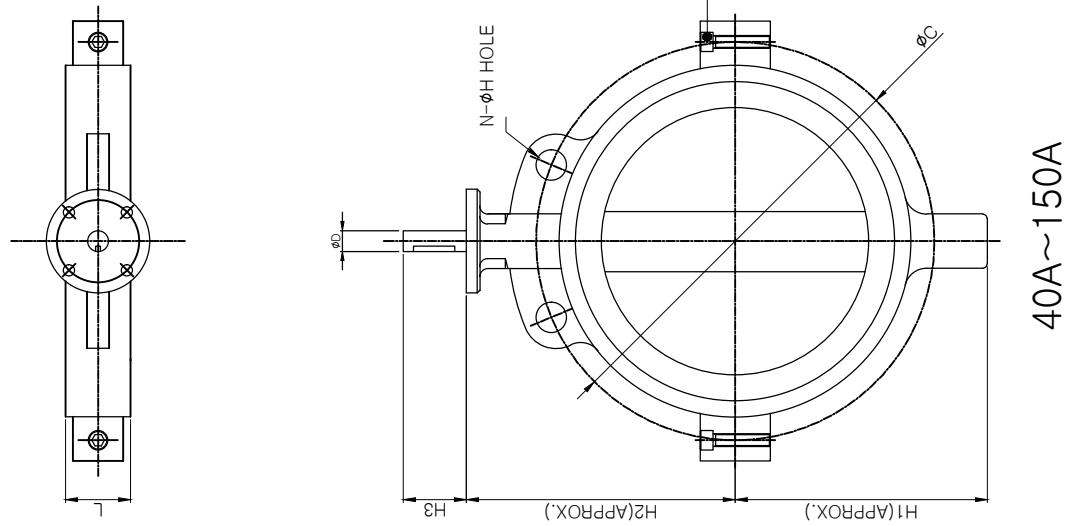
#### \* ACTUATOR DEMENSION TABLE

	AA	AB	AH1	AH2
BRCF 125	93	174.5	243	-
BRCF 250	108	181.5	274	-
BRCF 500	136	194.5	326	-
BRCF1000	164	206.5	-	450
BRCF2000	195	218.5	-	520
BRCF4000	253	246.5	-	650

DIVISION	SPECIFICATION
ACTUATOR TYPE	ELECTRO HYDRAULIC POWER UNIT SINGLE ACTING(FAIL CLOSED)
WORKING PRESSURE	135BAR
BURST TEST	675BAR
WEIGHT	13.6KG
OIL DISPLACEMENT	0.05 LITER
AMBIENT TEMP <sup>°</sup>	-20°C ~ 80°C
ROTATION	90° ±1°
CERTIFICATE	DNV(A-14113)

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.				<b>JTECHCROSS</b>
K SHIPBUILDING	S1940	DMU-150			
DATE : 2022. 09. 08	PART NAME	ACTUATOR (AC02V)			
APPD BY Y.M.KIM	DRAWING NO	DMU000-00-P007Z			
CHKD BY -	DSND BY H.C.LEE				
				REV.	1.0
					SHEET NO : 1 OF 1

Actuator shown in closed position(fail safe)



\* VALVE DIMENSION TABLE

NOMINAL DIAMETER	L	FLANGE 10K	H1	H2	H3	φD	KEY
DN50(2")	43	120	4-Φ19	70	130	35	14
DN65(2.5")	46	140	4-Φ19	75	140	35	14
DN80(3")	46	150	8-Φ19	85	145	35	14
DN100(4")	52	175	8-Φ19	100	165	35	16
DN125(5")	56	210	8-Φ23	116	195	35	19
DN150(6")	56	240	8-Φ23	132	210	35	19
DN200(8")	60	290	12-Φ23	175	235	50	22
						6X6	

APPLICABLE CODE

1. FLANGE RATING : JIS B 2220
2. FACE TO FACE DIMENSION : API 609 CATEGORY "A"
3. DESIGN BASE : API 609
4. HYDROSTATIC TEST : API 598

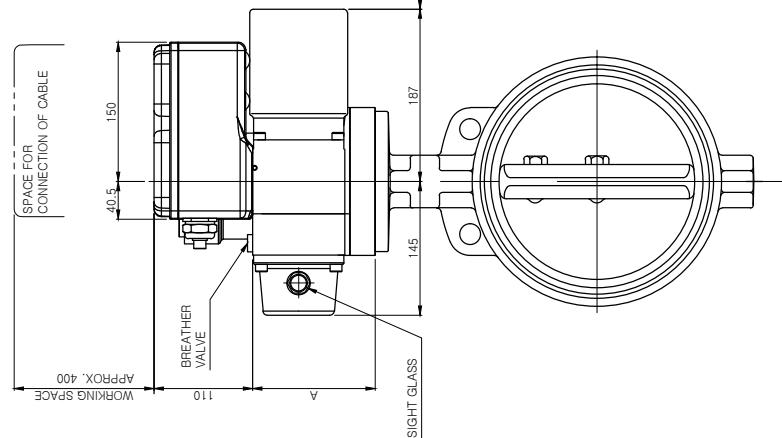
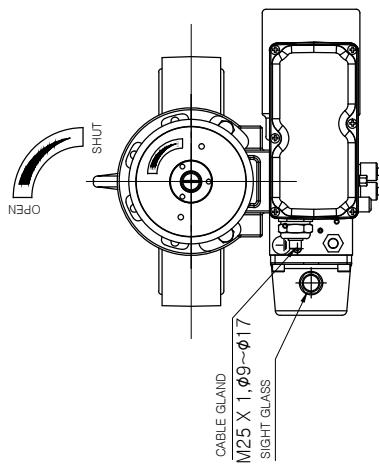
FLANGE 10K	DESIGN PRESSURE 10K
SHELL TEST	DESIGN PRESSURE X 1.5

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
1	BODY	-	FCD50	1	
2	STEM	-	SUS316	1	
3	SEAT	-	PIFEE	1	
4	DISC	-	ALB-TEFLON	1	
5	TAPE PIN	-	SUS316	2	
6	PACKING	-	NBR	1	
7	PACKING RING	-	P.P.	1	
8	PACKING GLAND	-	STAINLESS	1	
9	KEY	-	SA55C	1	
10	WRENCH BOLT	-	SCM440	2	

**TECHCROSS**

DATE : 2022. 09. 08  
APPD BY Y.M.KIM  
CHKD BY -  
DSND BY H.C.LEE

PART NAME BUTTERFLY VALVE (AC02V)  
DRAWING NO DMU000-00-P006Z  
SHEET NO : 1 OF 1  
REV. 1.0

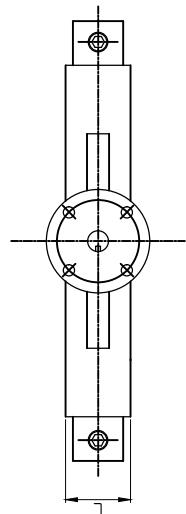


\* ACTUATOR DIMENSION TABLE

	A	B	C	D	E	F	G	H
BR250	121	174.5	231	156	59	21	181.5	150
BR500	124.5	199	234.5	169	66	24.5	194.5	163
BR1000	133	229	243	181	80	33	206.5	175
BR2000	144	271	254	193	96	44	218.5	187
BR4000	153	319	263	221	150	53	246.5	215

DIVISION	SPECIFICATION
ACTUATOR TYPE	ELECTRO-HYDRAULIC POWER UNIT DOUBLE ACTING
WORKING PRESSURE	135BAR
BURST TEST	675BAR
WEIGHT	8.3kg
OIL DISPLACEMENT	0.05 LITER
AMBIENT TEMP <sup>°</sup>	-20°C ~ 80°C
ROTATION	90° ±1°
CERTIFICATE	DNV(A-14113)

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME			<b>TECHCROSS</b>
K SHIPBUILDING	S1940	DMU-150			
DATE : 2022. 09. 08	PART NAME	ACTUATOR (AC03V & AC04V)			
APPD BY Y.M.KIM	DRAWING NO	DMU000-00-P0122			SHEET NO : 1 OF 1
CHKD BY -	REV.	1.0			
DSND BY H.C.LEE					



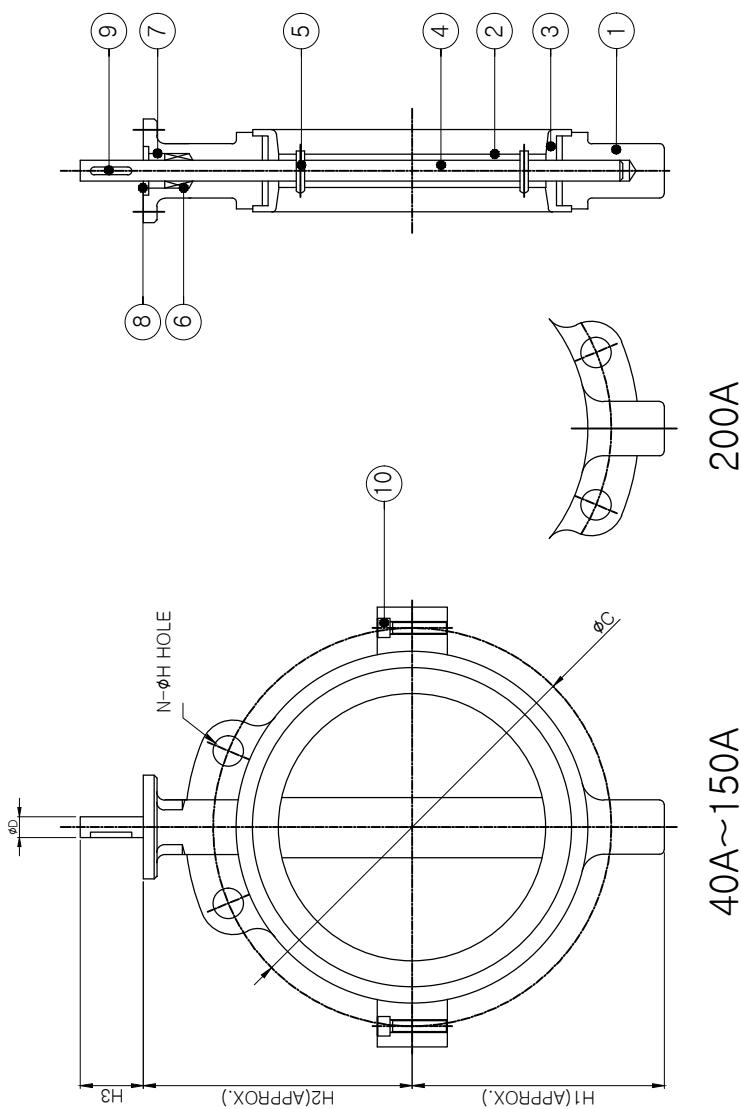
\* VALVE DIMENSION TABLE

NOMINAL DIAMETER	L	FLANGE 10K	H1	H2	H3	$\phi D$	KEY
DN50(2")	43	120	4-Φ19	70	130	35	14
DN65(2.5")	46	140	4-Φ19	75	140	35	14
DN80(3")	46	150	8-Φ19	85	145	35	14
DN100(4")	52	175	8-Φ19	100	165	35	16
DN125(5")	56	210	8-Φ23	116	195	35	19
DN150(6")	56	240	8-Φ23	132	210	35	19
DN200(8")	60	290	12-Φ23	175	235	50	22
						6X6	

APPLICABLE CODE

1. FLANGE RATING : JIS B 2220
2. FACE TO FACE DIMENSION : API 609 CATEGORY "A"
3. DESIGN BASE : API 609
4. HYDROSTATIC TEST : API 598

FLANGE 10K	DESIGN PRESSURE 10K
SHELL TEST	DESIGN PRESSURE X 1.5



NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
1	BODY	-	FCD50	1	
2	DISC	-	AU-CTEFILON	1	
3	SEAT	-	SUS316	1	
4	STEM	-	PIPE	1	
5	TAFFER PIN	-	SUS316	2	
6	PACKING	-	NBR	1	
7	PACKING RING	-	P.P.	1	
8	PACKING GLAND	-	STAINLESS	1	
9	KEY	-	SA55C	1	
10	WRENCH BOLT	-	SCM440	2	

TECHCROSS

DATE : 2022. 09. 08  
APPD BY Y.M.KIM  
CHKD BY -  
DSND BY H.C.LEE

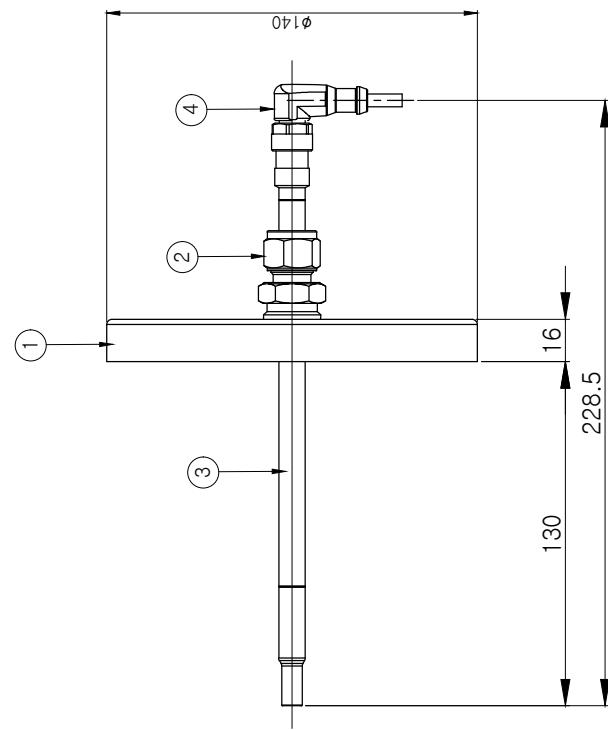
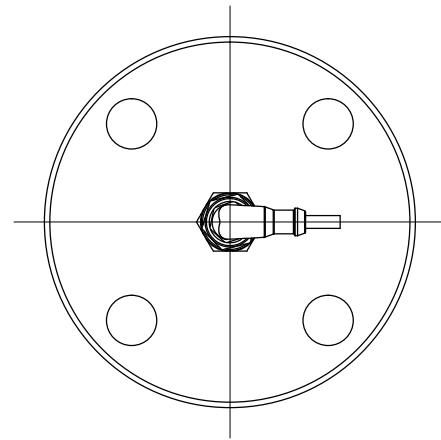
PART NAME BUTTERFLY VALVE (AC03V & AC04V)  
DRAWING NO DMU000-00-P011Z  
SHEET NO : 1 OF 1

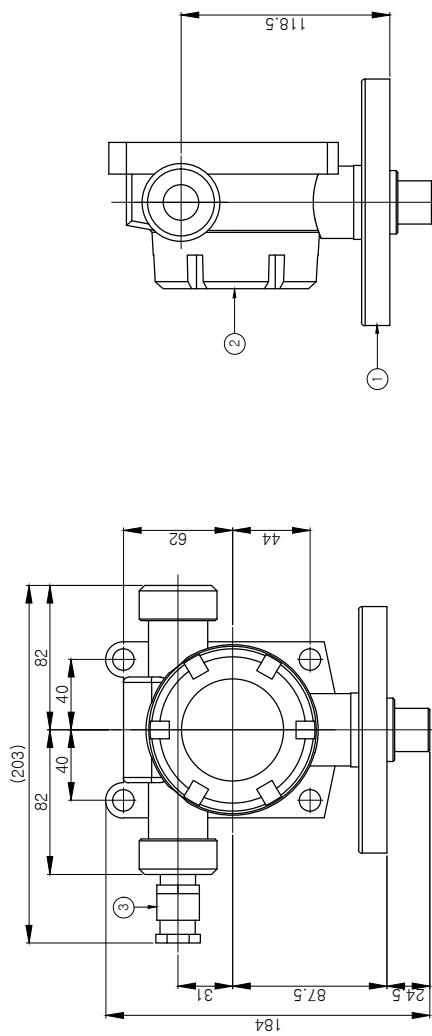
REV. 1.0

SPECIFICATION	
DIVISION	
WEIGHT	0.2kg
POWER SUPPLY	DC 24V
OUTPUT SIGNAL	4~20mA
RESPONSE TIME(SEC)	1~10
OPERATION PRESSURE	MAX: 30bar
CABLE CONNECTION	M12x1
AMBIENT TEMP°	-20°C ~ 70°C
PROCESS TEMP°	-20°C ~ 70°C
IP GRADE	IP67
TYPE OF EX CODE(SENSOR)	II 1G Ex ia IIC T4 Gb / Ex ia IIIC T4 Gb
CERTIFICATE(SENSOR)	DMT 03 ATEX E091 / IECEx BVS 06.0007
TYPE OF EX CODE(SOCKET)	II 2G Ex ia IIC T4 Gb / Ex ia IIIC T6 Gb
CERTIFICATE(SOCKET)	DMT 03 ATEX E091 / IECEx BVS 11.0002X

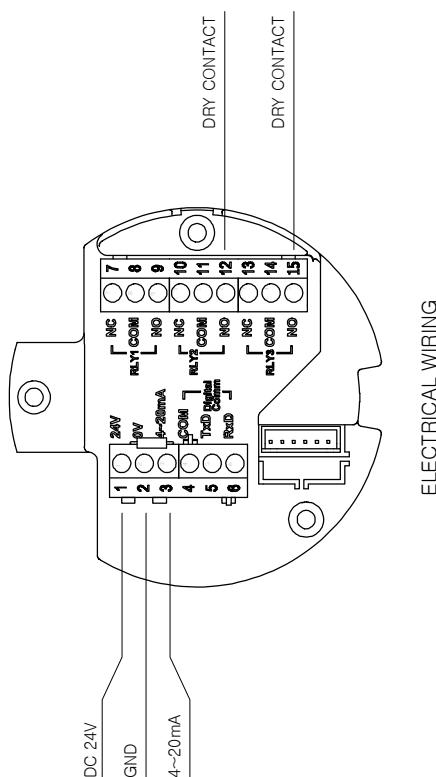


DATE : 2022. 09. 08	PART NAME	FLOW SWITCH ASSY (FS)	SHEET NO : 1 OF 1
APPD BY Y.M.KIM	DRAWING NO	DMU000-00-A001Z-S1940	REV. 1.0
CHKD BY -			
DSND BY H.C.LEE			

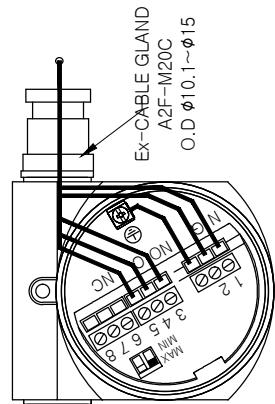




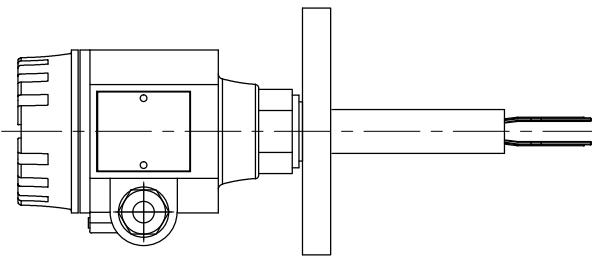
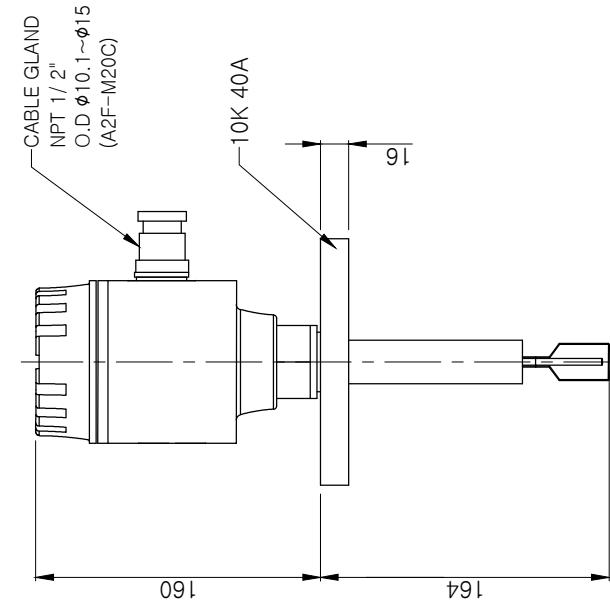
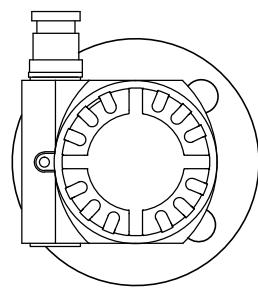
SPECIFICATION	
DIMENSION (W x D x H)	164mm x 99mm x 225mm
WEIGHT	2KG
POWER SUPPLY	DC 24V
OUTPUT SIGNAL	4~20mA & DRY CONTACT
CABLE CONNECTION	2x M20 (CABLE OUTSIDE 10.1-#15)
OPERATING TEMPERATURE	-40°C to +65°C
IP GRADE	IP66
TYPE OF EX. CODE	Ex II GD Ex d IIC Gb T6 / Ex d IIC Gb T6
CERTIFICATE	BASEFAOBATEX0222 / IECEx BAS 08.0072 / MED-D-1397(DIN)



NO	PART NAME	MODEL NAME	MATERIAL	Q'TY	REMARK
3	Ex-CABLE GLAND	AGF-M20C (OD Ø10.1-Ø15)	SUS 316	1	
2	GAS DETECTION SENSOR	EGS00-00-E032-S1940	-	1	HONEYWELL
1	GAS SENSOR FLANGE	JIS Ø 40A	SUS 316	1	
		SPEC			
K SHIPBUILDING	HULL NO.	DMU-150			<b>TECHCROSS</b>
DATE : 2022. 09. 08	PART NAME	DMU-150			
APPD BY Y.M.KIM	DRAWING NO	GAS SENSOR ASSY (GS)			
CHKD BY -					
DSND BY H.C.LEE					
		DMU000-00-A0022-S1940			SHEET NO : 1 OF 1
					REV. 1.0

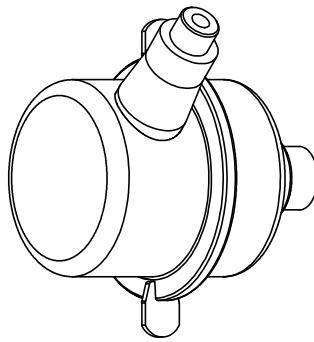


CABLE CONNECTION



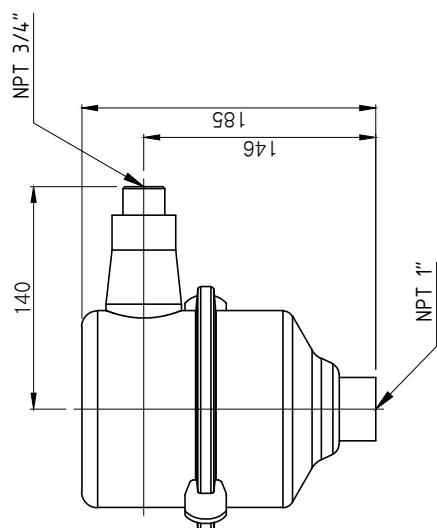
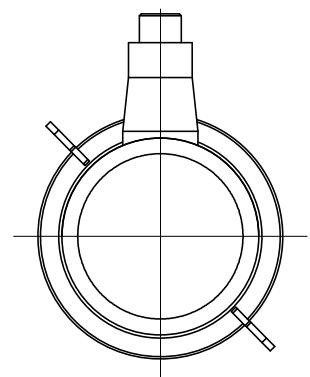
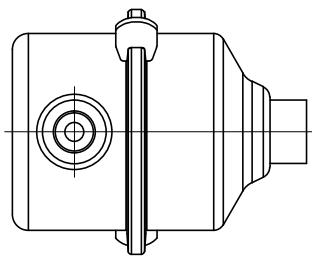
SPECIFICATION	
DIVISION	SPECIFICATION
WEIGHT	2KG
POWER SUPPLY	DC 24V
OUTPUT SIGNAL	Dry Contact
CABLE CONNECTION	2 x M20 (CABLE OUT Dia "φ10.1~φ15")
T amb°	-50°C to +70°C
OPERATING PRESSURE	MAX. 64bar (928psi)
IP GRADE	IP66
TYPE OF Ex CODE	EEEx d IIC T3~T6 / Ex d IIC Gb T3~T6
CERTIFICATE	KEMA 39ATEX157 / IECEx BKI 08.0009
CLASS CERTIFICATE	ABS PQA, NK, T.A., RINA T.A., GL T.A
SIL CERTIFICATE	No. 966/EU 146-00/01(TUV)

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME			
K SHIPBUILDING	S1940	DMU-150			<b>TECHCROSS</b>
DATE : 2022. 09. 08	PART NAME	LEVEL SWITCH ASSY (LS1)			
APPD BY Y.M.KIM	DRAWING NO	DMU000-00-A003Z-S1940			SHEET NO : 1 OF 1
CHKD BY -	DSND BY H.C.LEE				REV. 1.0



SPECIFICATION	
DIVISION	SPECIFICATION
WEIGHT	0.8 KG
OPERATING PRESSURE	0~16BAR
FLOW RATE	248 Km <sup>3</sup> /h
TEMPERATURE	130°C
MATERIAL	BODY : CrNiMo-steel BODY Seal : FPM Internals : CrNiMo-steel Float : CrNiMo-steel Valve : CSM Profile Clamp: CrNiMo-steel

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME			<b>TECHCROSS</b>
K SHIPBUILDING	S1940	DMU-150			
DATE : 2022. 09. 08	PART NAME	AIR VENT (AV)			
APPD BY Y.M.KIM	DRAWING NO				
CHKD BY -	DMU000-00-P0152-S1940				SHEET NO : 1 OF 1
DSND BY H.C.LEE					REV. 1.0



REV	DESCRIPTION	CHKD	APPD	DATE

Front View Dimensions:

- Total Height: 99
- Display Mounting Hole: 12
- Side Panel Width: 225
- Bottom Panel Depth: 164
- Mounting Hole Centers: 80 and 106

Side View Labels:

- CABLE GLAND
- O.D φ10.1-φ15 (A2F-M20C)
- DISPLAY
- TRANSMITTER
- SENSOR COVER

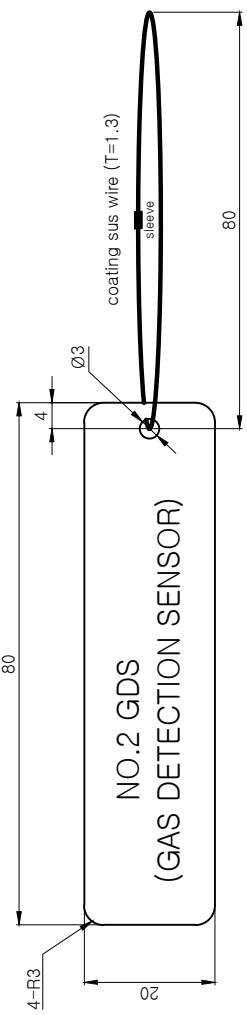
SPECIFICATION	
DIMENSION (W x D x H)	164mm x 96mm x 225mm
WEIGHT	2KG
POWER SUPPLY	DC 24V
OUTPUT SIGNAL	4~20mA & DRY CONTACT
CABLE CONNECTION	2x M20 (CABLE OUTSIDE 10.1-15)
OPERATING TEMPERATURE	-40°C to +65°C
IP GRADE	IP66
TYPE OF EX. CODE	Ex II G Ex d IIC Gb T6 / Ex d IIC Gb
CERTIFICATE	BASEFA04ATE0222 / IECEx BAS 08.0072 / ATEX D-1397(DIN)

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME	<b>TECHCROSS</b>		
K SHIPBUILDING	S1940	DMU-150			
DATE : 2022. 09. 08	PART NAME	NO.2 GAS DETECTION SENSOR			
APPD BY Y.M.KIM	DRAWING NO	ECS000-00-E0332-S1940			
CHKD BY -	DSND BY H.C.LEE	SHEET NO : 1 OF 1			
		REV. 1.0			

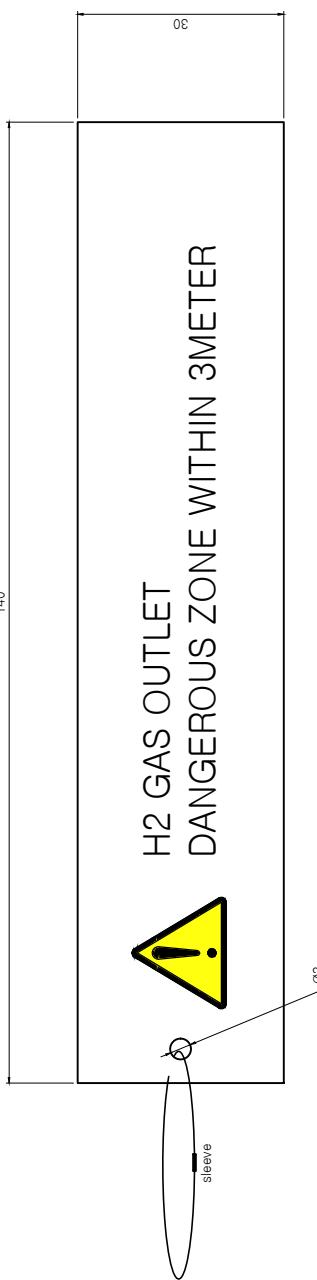
ELECTRICAL WIRING

REV.	DESCRIPTION	CHKD	APPD	DATE
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NOTE  
1. MATERIAL: SUS316L t1.0

NO	PART NAME	HULL NO.	SPEC	MODEL NAME	MATERIAL	Q.TY	REMARK	
							SHIP YARD	TECHCROSS
K SHIPBUILDING	S1940		GDS					
DATE : 2022. 09. 08	PART NAME	GAS DETECTION SENSOR NAME PLATE					SHEET NO : 1 OF 1	
APFD BY Y.M.KIM	DRAWING NO							
CHRD BY -								
DSND BY H.C.LEE							REV. 0	
							GDS000-GA-L001Z-S1940	

REV	DESCRIPTION	CHKD	APPD	DATE																																																								
 <p><b>H2 GAS OUTLET DANGEROUS ZONE WITHIN 3METER</b></p> <p>SUS wire (L=1000mm T=1.5)      <b>sleeve</b></p> <p>140      30      Ø3</p>																																																												
<p><b>NOTE</b> 1. MATERIAL: SUS316, t1.0</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>NO</th> <th>PART NAME</th> <th>HULL NO.</th> <th>SPEC</th> <th>MATERIAL</th> <th>Q'TY</th> <th>REMARK</th> </tr> </thead> <tbody> <tr> <td>K SHIPBUILDING</td> <td>S1940</td> <td></td> <td></td> <td></td> <td></td> <td><b>TECHCROSS</b></td> </tr> <tr> <td>DATE : 2022. 09. 08</td> <td>PART NAME</td> <td></td> <td>WARNING PLATE</td> <td></td> <td></td> <td></td> </tr> <tr> <td>APPD BY Y.M.KIM</td> <td>DRAWING NO</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>CHKD BY -</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>DSND BY H.C.LEE</td> <td>-</td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>REV. 0</td> </tr> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>SHEET NO : 1 OF 1</td> </tr> </tbody> </table>					NO	PART NAME	HULL NO.	SPEC	MATERIAL	Q'TY	REMARK	K SHIPBUILDING	S1940					<b>TECHCROSS</b>	DATE : 2022. 09. 08	PART NAME		WARNING PLATE				APPD BY Y.M.KIM	DRAWING NO						CHKD BY -							DSND BY H.C.LEE	-												REV. 0							SHEET NO : 1 OF 1
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						SHEET NO : 1 OF 1																																																						



ECS-HYCHLOR  
GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

HULL NO. : S1940

MODEL : ECS-HYCHLOR 1200

## DETAIL OF THE SWH

### 1. GENERAL SPECIFICATION

DIVISION	SPECIFICATION
WEIGHT	125kg (138kg)
SIZE	1404(W)x331(D)x450(H)
CONNECTION	
SETAM INLET	JIS 10K-50A Flange Type
STEAM OUTLET	JIS 10K-40A Flange Type
S.W INLET	JIS 10K-65A Flange Type
S.W OUTLET	JIS 10K-65A Flange Type

No.	DATE	DESCRIPTIONS	DRW/N	CHK'D	APP'D
△	2022.11.16	ISSUED FOR APPROVAL	C.W.CHOI	-	Y.K.KIM
△	2022.11.25	REVISED BY COMMENT	J.H.KIM	C.W.CHOI	Y.K.KIM
△	2023.02.10	REVISED BY COMMENT	C.W.CHOI	-	Y.K.KIM
△	2023.03.30	REVISED BY P.O.S	J.H.KIM	C.W.CHOI	Y.K.KIM
<u>REMOVAL SPACE</u> → JIS 10K SO/FF Min. 500 WEIGHT:35kg					
<u>REMOVAL SPACE</u> → JIS 10K SO/FF Min. 1200 WEIGHT:35kg					
<u>STEAM INLET</u> A → JIS 10K SO/FF AST 1404					
<u>S.W. INLET</u> C → JIS 10K SO/FF 65A					
<u>STEAM OUTLET</u> D → JIS 10K SO/FF 65A					
<u>S.W. OUTLET</u> B → JIS 10K SO/FF 40A					
<u>VIEW X-X'</u>					
<u>VIEW Y-Y'</u>					
<u>VIEW Z-Z'</u>					
<u>DETAIL OF LIFTING EYEBOLT</u>					
<u>M12 EYEBOLT</u>					
<u>FIXED SIDE</u>					
<u>SUDING SIDE</u>					
<u>NOTE</u>					
1. INSULATION METHOD : GLASS WOOL 25ft & GALV THIN PLATE 0.6ft TO BE FULLY FITTED.					
2. THE #10 COPPER PIPE IS CONNECTED TO THE AIR VENT & DRAIN VALVE AND SUPPLIED TO THE BOTTOM OF THE SUPPORT SADDLE.					
<u>OUTSIDE FINAL COATING</u>					
CHANNEL INSIDE COATING		TAR FREE EPOXY COATING			
<u>ACCESSORIES</u>					
NO.	PART NAME	QTY	REMARK		
V1~2	AIR VENT VALVE	2	PT 3/8" WITH 3/8" LEAD PIPE		
d1~2	DRAIN VALVE	2	PT 3/8" WITH 3/8" LEAD PIPE		
t1~4	THERMOMETER	2/2	0~200°C , 0~100°C		
g	PRESS. GAUGE	1	DIA. 60 WITH ROOT V/V		
f	SAFETY VALVE	1	SETG PRESS. : 8.0 bar.G		
n	PROTECTING ANODE	2	10K 65A (#50x80L)		
<u>CONNECTION FLANGE</u>					
NO.	PART NAME	FLANGE	PIPE		
A	SETAM INLET FLANGE	50A	A516-70	JIS 10K SO/FF	STPG370 SCH.80
B	STEAM OUTLET FLANGE	40A	A516-70	JIS 10K SO/FF	STPG370 SCH.80
C	S.W. INLET FLANGE	65A	A516-70	JIS 10K SO/FF	STPG370 SCH.80
D	S.W. OUTLET FLANGE	65A	A516-70	JIS 10K SO/FF	STPG370 SCH.80
<u>DESIGN TEST CONDITION</u>					
FLUID	SHELL SIDE	TUBE SIDE			
FLUID QUANTITY	288.0	S.W.			
INLET TEMPERATURE	169.84 °C	20.0 M <sup>3</sup> /Hr			
OUTLET TEMPERATURE	169.84 °C	0.0 °C			
DESIGN TEMPERATURE	175.0 °C	7.0 °C			
NO. OF PASS	1	50.0 °C			
PRESSURE DROP.	0.015 bar.G	0.041 bar.G			
OPERATING PRESSURE	7.0 bar.G	7.0 bar.G			
DESIGN PRESSURE	8.0 bar.G	8.0 bar.G			
HYDROSTATIC TEST PRESSURE	12.0 bar.G	12.0 bar.G			
SURFACE AREA	0.9 M <sup>2</sup>				
HEAT DUTY	140,426 Kcal/H				
CLEANLINESS FACTOR	85 %				
DRW/N					
PROJECT					
CHK'D					
APP'D					
Y.K.KIM					
THREE DRAPE PROJECTION					
SCALE					
CLASS					
DRWG NO.					
20M3-SWH-15-800-001					
<u>S.W. HEATER (20 m<sup>3</sup>/hr)</u>					
<u>ASSEMBLY DRAWING</u>					
<u>Mystar</u> ■ ■ ■					

COMMON TOOL LIST				HULL NO.			
S.W. HEATER (20 m <sup>3</sup> /hr)				S1940			
NO.	NAME	SKETCH	MATERIAL	SUPPLY PER SHIP		DRAWING NO. SPARE	REMARK
				WORK	SPARE		
1	NYLON BRUSH		NYLON & SS400	-	1 Set	THIS TOOL TO BE USED TOGETHER WITH OTHER H/EX. AND ASSEMBLED WITH ITEM 1-1,1-2,1-3,1-4	
1-1	NYLON BRUSH		NYLON & SS400	-	1		
1-2	HANDLE		SS400	-	1		
1-3	BAR		SS400	-	3		
1-4	JOINT		SS400	-	4		
2	SPARE & TOOL BOX		MILD STEEL	-	1		COLOR : 7.5 BG 7/2
3	SPARE GASKET BOX		-	-	1		
4	TUBE PLUG		WOOD	-	10	R4	JIS 10K 65A
5	CHEMICAL CLEANING		SS400 STPG370	-	2		
Manufactures Name & Address				I21-4BL, Mieum industrial complex , Gangseo-Gu, Busan, Korea Tel : +82 51 831 7474 , Fax : +82 51 831 7717			

Mytec Co., Ltd.

## Manufactures

## Name & Address



**Co., Ltd.**

I21-4BL, Mieum industrial complex , Gangseo-Gu, Busan, Korea

Tel : +82 51 831 7474 , Fax : +82 51 831 7717

Mytec Co., Ltd.



## ECS-HYCHLOR GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING  
HULL NO. : S1940  
MODEL : ANU-05T

### DETAIL OF THE ANU-5T

#### 1. Auto Neutralization Unit (ANU-5T)

DIVISION	SPECIFICATION
WEIGHT (DRY/WET)	220Kg / 420Kg
SIZE	800(W) X 733(D) X 1655(H)
CONTROL SYSTEM	AUTOMATIC CONTROL BY HMI-PC
POWER SUPPLY	AC 220V, 60Hz
MAIN COMPONENT	TANK, PLC, METERING PUMP, AGITATOR, LEVEL SENSOR, SOLENOID VALVE, DISPLAY PANEL
WATER INLET	FRESH WATER, 0.5~3 bar
NEUTRALIZER	SODIUM THIOSULFATE
MAX. INPUT NEUTRALIZER	APPROX. 50 Kg / Each 1 Tank
METERING PUMP MAX. CAPACITY	800ml/min (Each 1 pump)
METERING PUMP MAX. PRESSURE	7bar
INSTALL TYPE	FLOOR MOUNTING AND SELF STANDING
TANK CAPACITY	APPROX. 100 LITER (BOTH : 200 LITER)
Mixture Ratio	2(Fresh water) : 1(Counteractive)
ENCLOSURE CLASS	IP44

#### 2. INSTALL PIPE

DIVISION	SIZE	ea/set	LENGTH	SCOPE	NOTE
SUS TUBE	Ø12	4ea		Yard	
	Ø12	3ea		Maker	



## ECS-HYCHLOR GENERAL SPECIFICATION

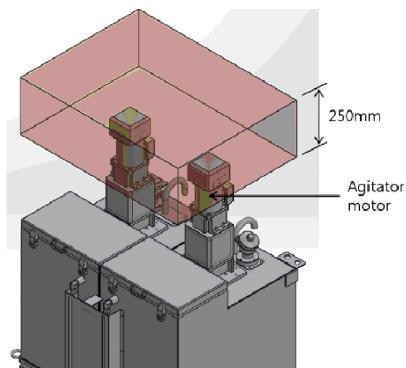
SHIP YARD : K SHIPBUILDING

HULL NO. : S1940

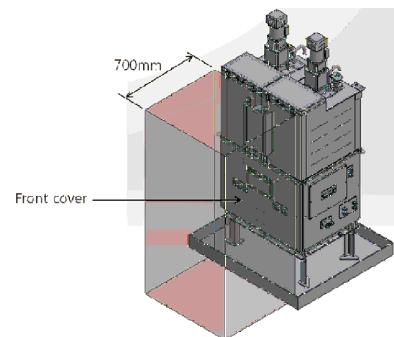
MODEL : ANU-05T

### 3. INSTALLATION GUIDE

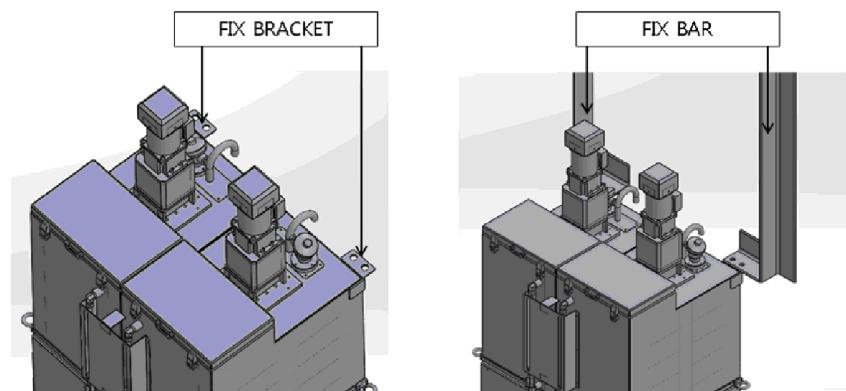
Secure space to open ANU top cover and to maintain agitator (Min. 250mm from the top of agitator)



Secure space to open ANU front cover (Min.1000mm from the front cover)



To protect equipment from vibration, support should be installed using fix bracket connecting hole on the ANU





## ECS-HYCHLOR

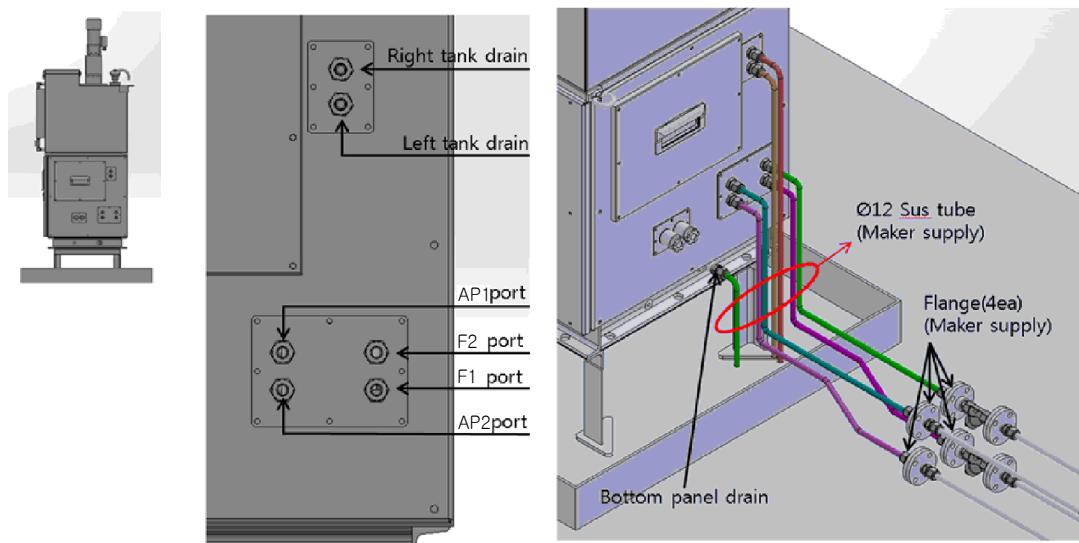
### GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

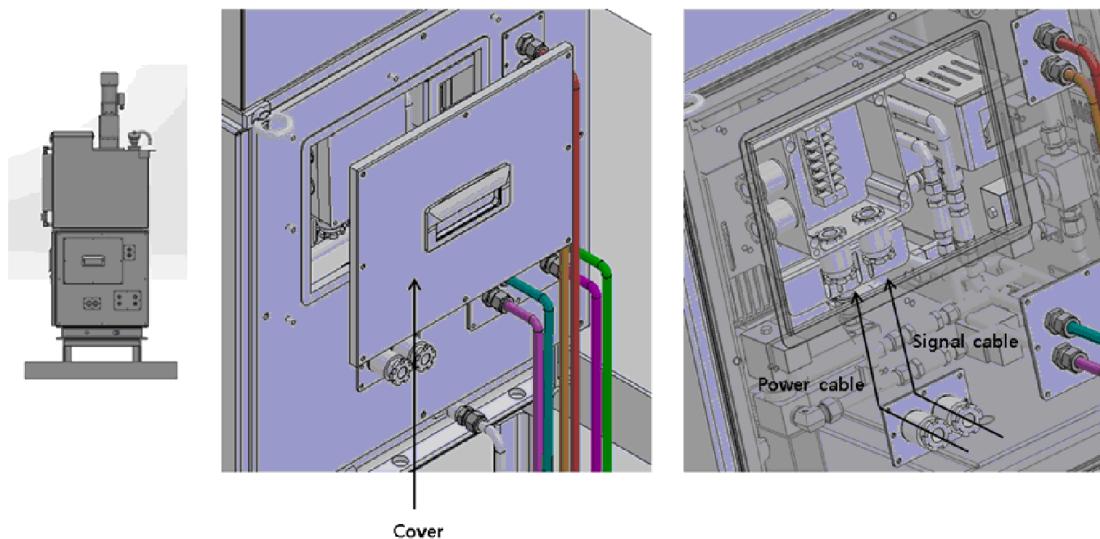
HULL NO. : S1940

MODEL : ANU-05T

For pipe connection, please refer to the drawing below.



For power & signal cable connection, please refer to the drawing below.





## ECS-HYCHLOR

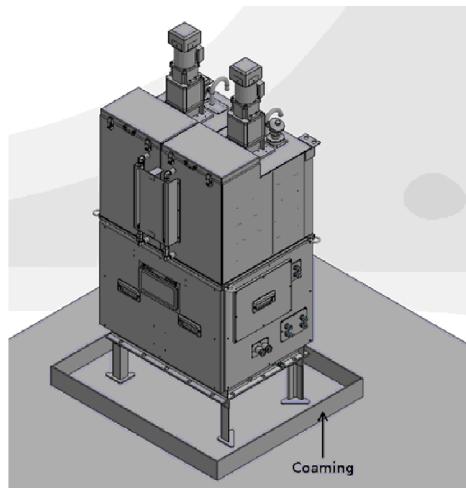
### GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

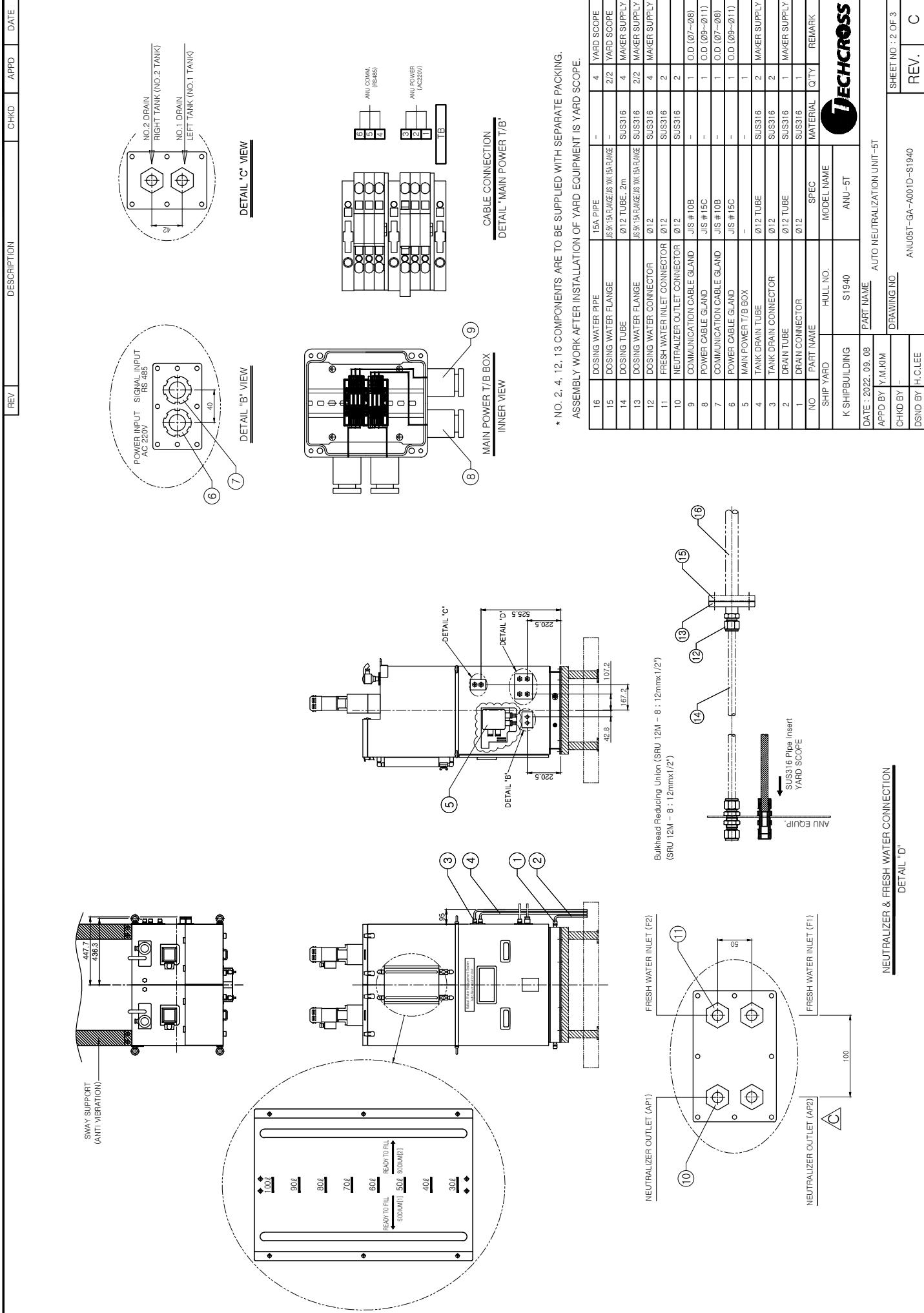
HULL NO. : S1940

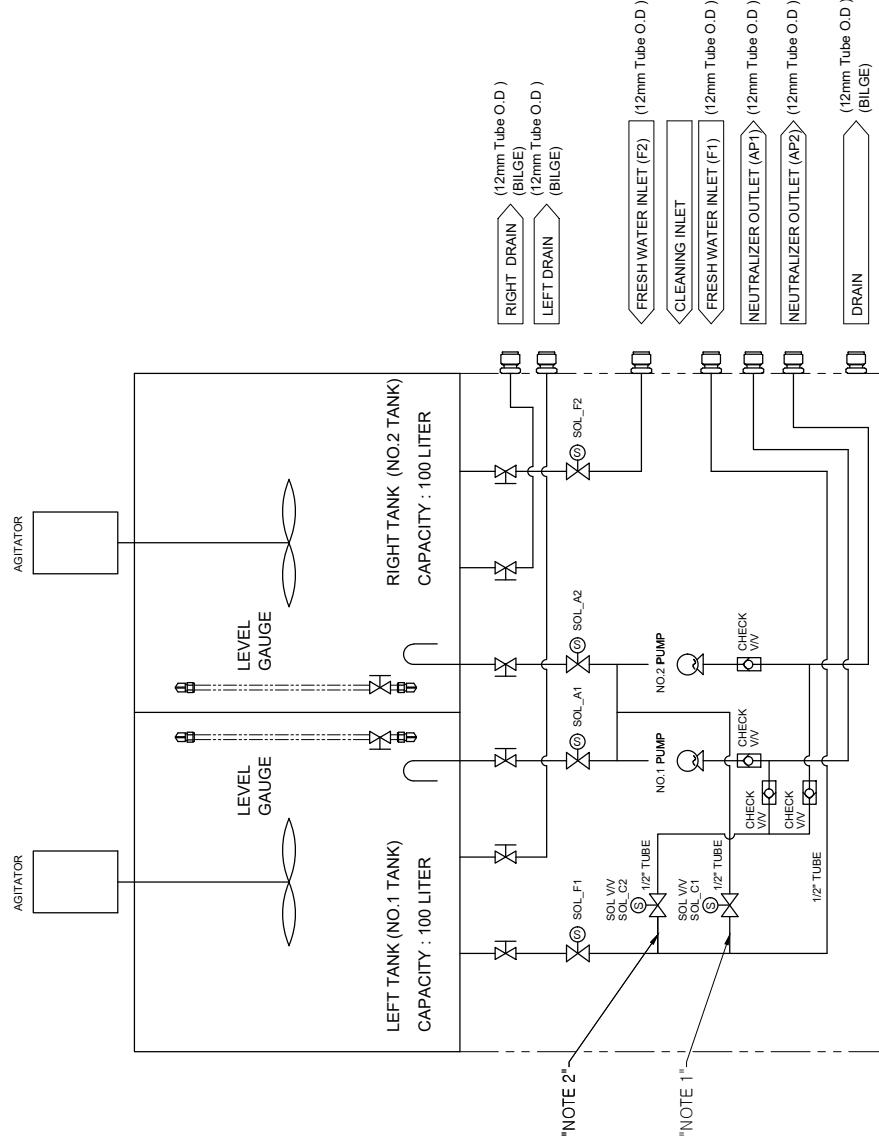
MODEL : ANU-05T

It is recommended to install coaming on the base seat to prevent pipe leakage









NOTE

1. INTERNAL PIPE OF ANU IS TO BE CLEANED WHEN SOL VV\_F1 &amp; SOL VV\_C2

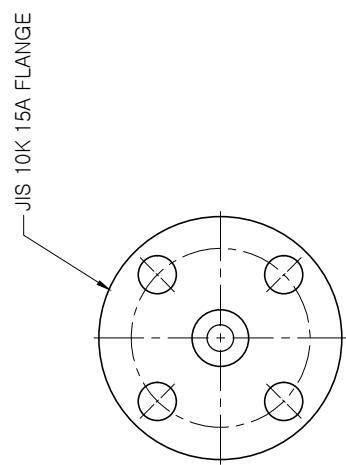
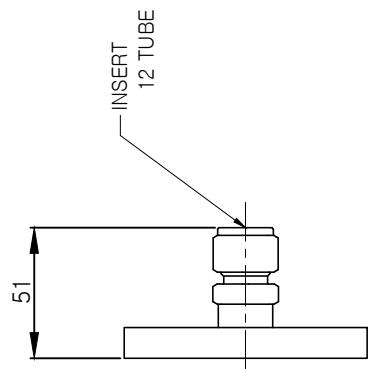
ARE CLOSED AND SOL VV\_C1 IS OPEN FOR 5 SEC.

2. SOL VV\_C2 IS SET TO OPEN FOR 5 SEC WHEN THE EQUIPMENT IS DELIVERED.  
CLEANING TIME CAN BE ADJUSTABLE ACCORDING TO THE LENGTH OF YARD PIPE.

## SYMBOL

SYMBOL	PART NAME	SPEC	MATERIAL	QTY	REMARK
☒	MANUAL VALVE	SHIP YARD	HULL NO.	MODEL NAME	<b>TECHCROSS</b>
☒	SOLENOID VALVE	K SHIPBUILDING	S1940	ANU-5T	
☒	CONTROLLED VOLUME PUMP	DATE : 2022. 09. 08	PART NAME	ANU P&ID	
☒	CHECK VALVE	APD BY Y.M.KIM	DRAWING NO	ANU05T-GA-A001D-S1940	SHEET NO : 3 OF 3
☒	CHKD BY -	CHKD BY H.C.LEE	DSND BY	REV. C	

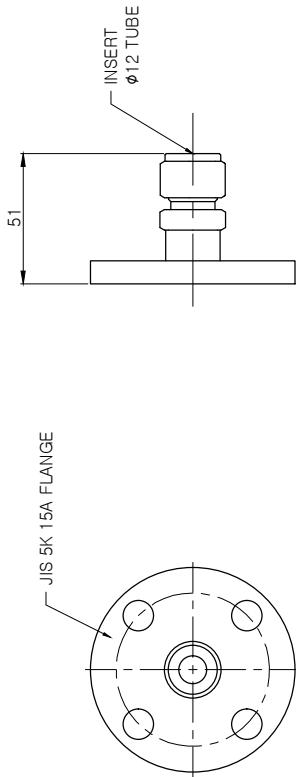
REV	DESCRIPTION	CHKD	APPD	DATE
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NOTE  
1. MATERIAL : SUS316

NO	PART NAME	HULL NO.	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD						<b>TECHCROSS</b>
K SHIPBUILDING	S1940		ANU-5T			
DATE : 2022. 09. 08	PART NAME		FLANGE ASSY			
APPD BY Y.M.KIM	DRAWING NO					
CHKD BY -	FLG000-00-A003Z-S1940					SHEET NO : 1 OF 1
DSND BY H.C.LEE					REV.	0

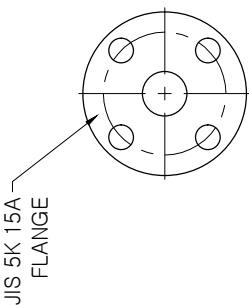
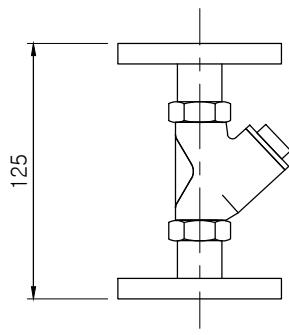
REV	DESCRIPTION	CHKD	APPD	DATE
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NOTE  
1. MATERIAL : SUS316

NO	PART NAME	HULL NO.	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	K SHIPBUILDING	S1940	MODEL NAME	ANU-5T		<b>TECHCROSS</b>
APPD BY	Y.M.KIM		PART NAME	FLANGE ASSY		
CHKD BY	-		DRAWING NO	FLG000-00-A003Z-S1940		SHEET NO : 1 OF 1
DSND BY	H.C.LEE				REV.	0

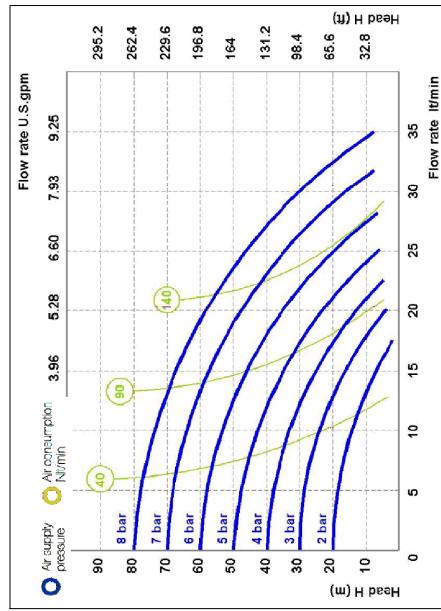
REV	DESCRIPTION	CHKD	APPD	DATE
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NOTE

1. MATERIAL : SUS316  
2. Y-STRAINER SPEC : 15A, MESH 0.8mm

NO	PART NAME	HULL NO.	MODEL NAME	SPEC	MATERIAL	Q'TY	REMARK
K SHIPBUILDING	S1940		ANU-5T				<b>TECHCROSS</b>
DATE : 2022. 09. 08	PART NAME						
APPD BY Y.M.KIM	DRAWING NO						
CHKD BY -							
DSND BY H.C.LEE							
	FLG000-00-A018Z-S1940						
							REV. 0
							SHEET NO : 1 OF 1



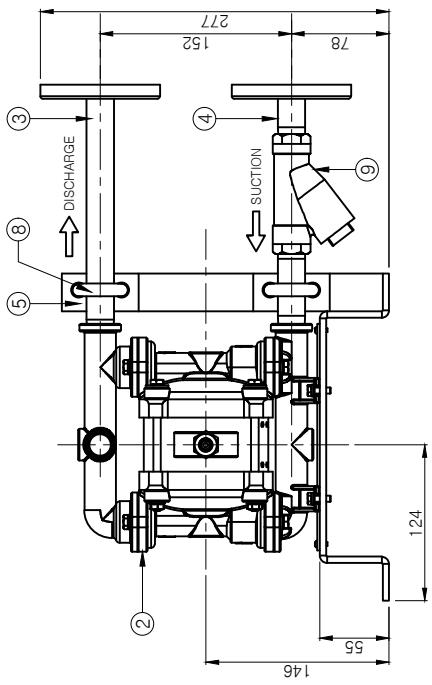
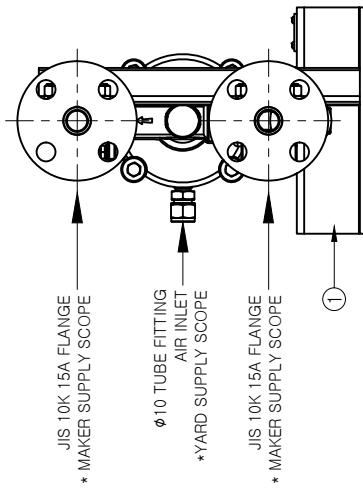
## NOTE

## 1. GENERAL SPECIFICATION

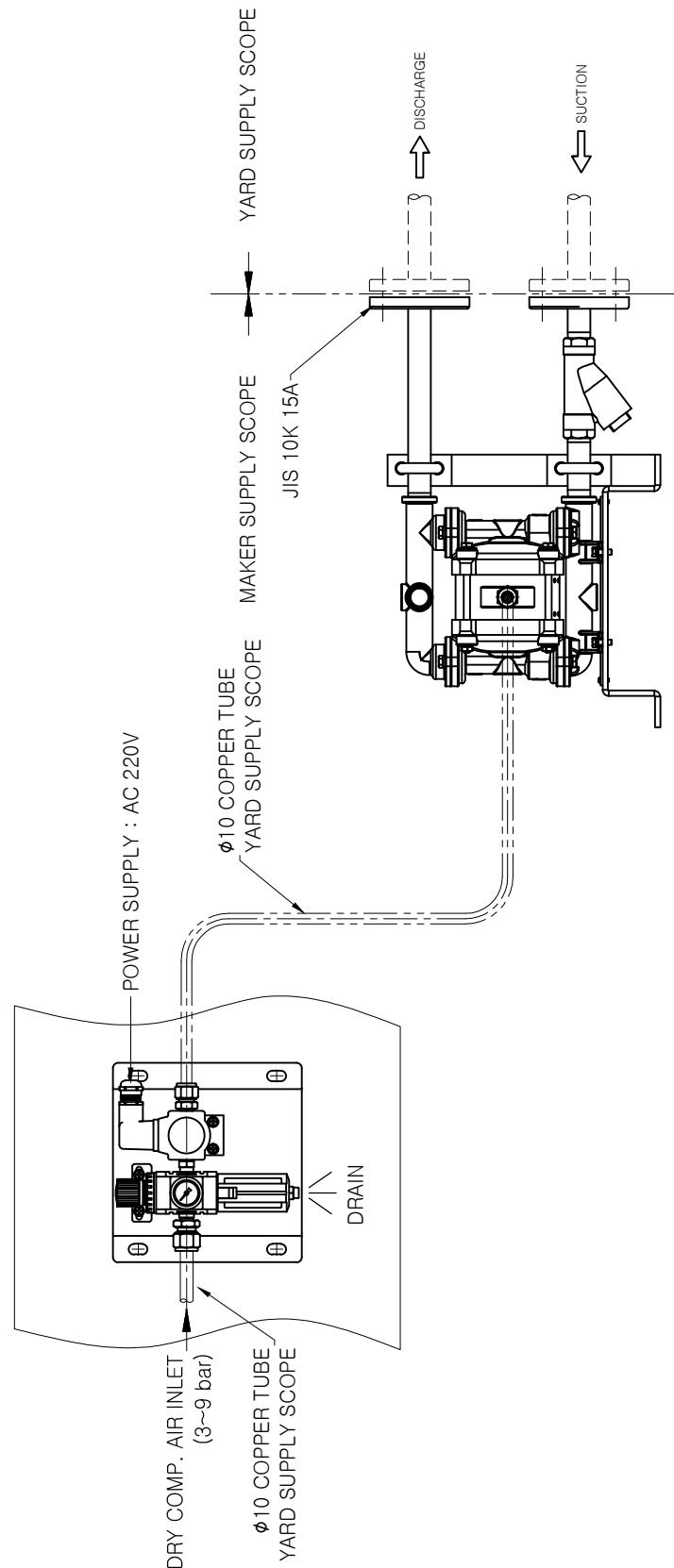
DIVISION	SPECIFICATION
MAXIMUM FLUID WORKING PRESSURE	8BAR / 0.8MPa / 116 psi
MAXIMUM FREE FLOW DELIVERY	35 lpm : 2.1m <sup>3</sup> /h
MAXIMUM SUCTION LIFT (DRY / WET)	5m / 9.8m
DIAPHRAGM OPERATING TEMP <sup>o</sup>	95°C
TYPICAL SOUND LEVEL AT 4.8BAR AIR @ 60CPM	65 dBA
MAXIMUM AIR CONSUMPTION	6.36scfm(0.18 m <sup>3</sup> /min)
AIR PRESSURE OPERATING RANGE	2~8 BAR / 0.2~0.8 MPa
WEIGHT	2.4kg ONLY PUMP / UNIT TOTAL 8kg

## 2. PAINT : POWDER COAT'G (60μm OVER)

## 3. COLOR : SHIPBUILDER STANDARD



### **NO.3 FILTER REGULATOR BOARD**



FLOW LINE VIEW

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME			
K SHIPBUILDING	S1940	APU			
DATE : 2022. 09. 08	PART NAME	AIR PUMP DIAGRAM			
APPD BY Y.M.KIM	DRAWING NO	APU000-GB-A003Z-S1940			
CHKD BY -	DSND BY H.C.LEE				
					SHEET NO : 1 OF 1
					REV. 0



ECS-HYCHLOR  
GENERAL SPECIFICATION

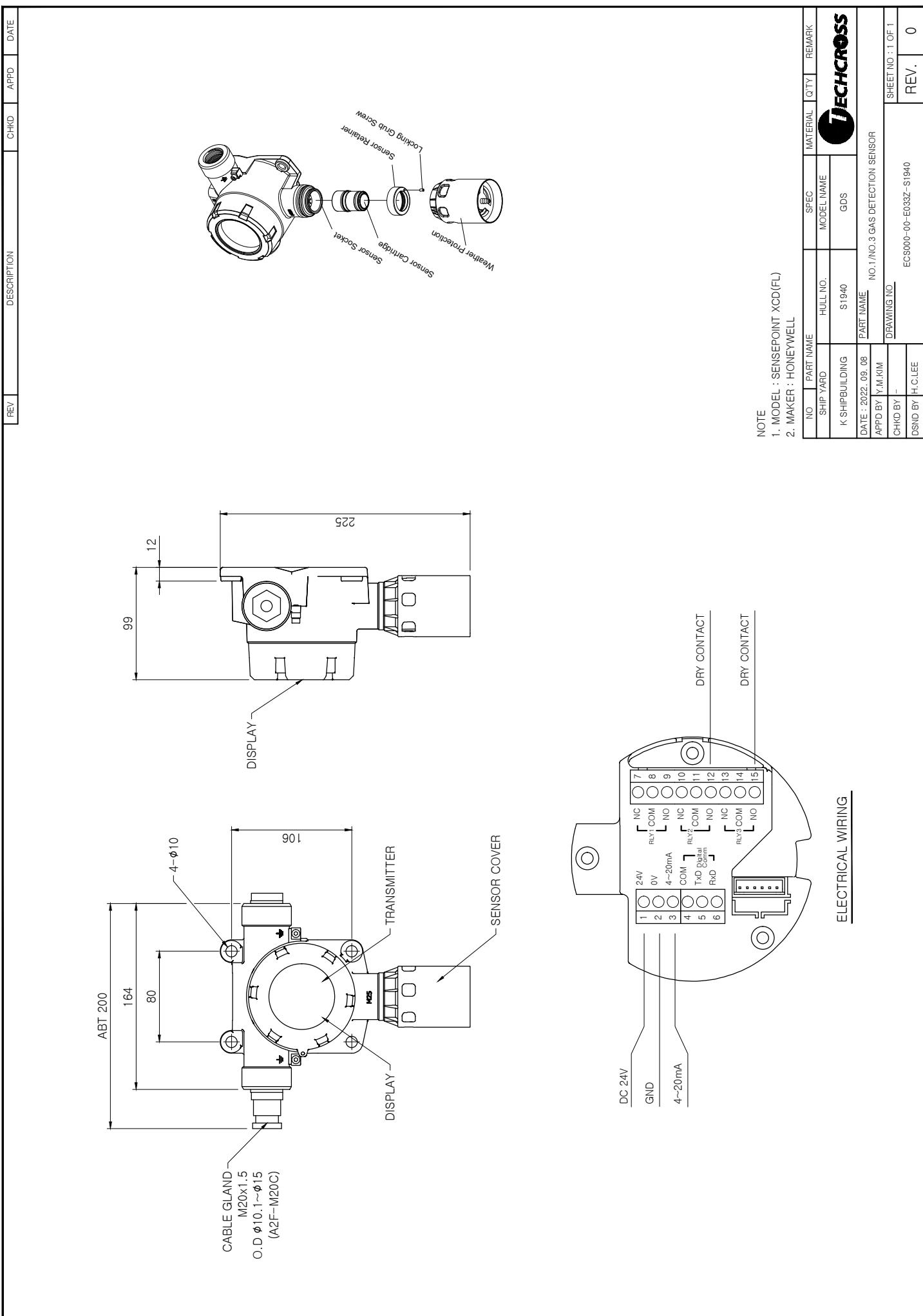
SHIP YARD : K SHIPBUILDING  
HULL NO. : S1940  
MODEL : ECS-HYCHLOR-1200

## DETAIL OF THE GDS

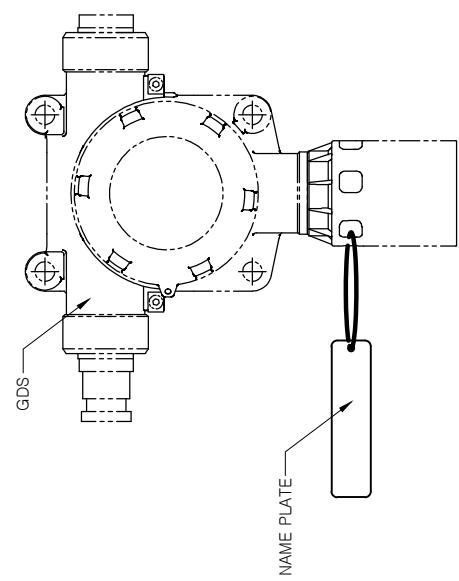
### Gas Detection Sensor (NO.1/NO.3 GDS)

#### 1. GENERAL SPECIFICATION

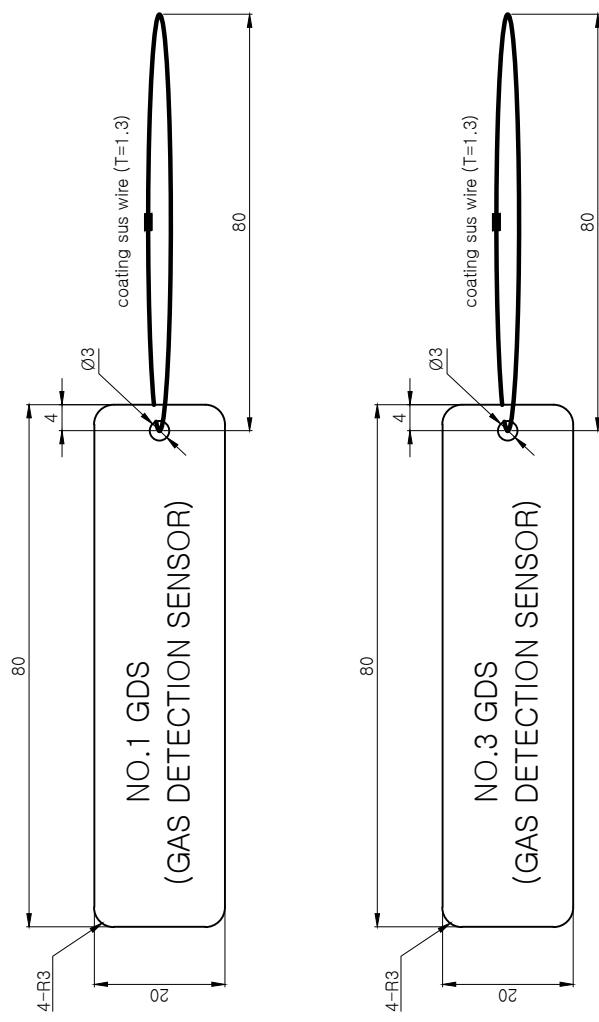
DIVISION	SPECIFICATION
DIMENSION (W x D x H)	164mm x 99mm x 225mm
WEIGHT	2kg
POWER SUPPLY	DC 24V
OUTPUT SIGNAL	4~20mA & DRY CONTACT
CABLE CONNECTION	2 x M20 (CABLE OUTDIA" Ø 10.1~Ø15)
OPERATING TEMPERATURE	-40°C to +65°C
OPERATING HUMIDITY	CONTINUOUS 20~90%RH (non condensing), INTERMITTENT 10~99%RH (non condensing)
OPERATING PRESSURE	90~110kPa
STORAGE CONDITIONS	-25°C to +65°C
IP GRADE	IP66
PROTECTION	Ex II GD Ex d IIC Gb T6 / Ex d IIC Gb T6
CERTIFICATE	Baseefa08ATEX0222 / IECEEx BAS 08.0072 / MED-D-1397(DNV)



REV.	DESCRIPTION	CHKD	APPD	DATE
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NOTE  
1. MATERIAL: SUS316L t1.0



NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME			
K SHIPBUILDING	S1940	GDS			
DATE : 2022. 09. 08	PART NAME	GAS DETECTION SENSOR NAME PLATE			
APPD BY Y.M.KIM	DRAWING NO	GDS000-GA-L001Z-S1940			
CHKD BY -	DESIGN BY H.C.LEE				

**TECHCROSS**

SHEET NO : 1 OF 1

REV. 0



## Electro-Cleen™ System

SHIP YARD : K SHIPBUILDING
HULL NO. : S1940
ECS -HYCHLOR 1200

### Details of the RDU

- Remote Display Unit (RDU)

#### 1. GENERAL SPECIFICATION

DIVISION	SPECIFICATION
WEIGHT	2.5kg (Only CONTROL PC)
DIMENSION (W x D x H)	358mm X 63mm X 283mm
OPERATING SYSTEM	LINUX
POWER SUPPLY	AC 220V, 60Hz
INSTALL TYPE	FLUSH MOUNTING
IP GRADE	IP44 (Only CONTROL PC Front)

REV	DESCRIPTION	CHKD	APPD	DATE

PANEL CUTTING

1. INSTALLATION CONDITION & REQUIRED ATTENTION  
1.1 IT IS RECOMMENDED TO INSTALL IN CCR/CARGO CONTROL ROOM  
OR SHIP'S OFFICE.

1.2 USB PORT FOR PROGRAM UPGRADE IS INSIDE T/B BOX.

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
6	OPC NAME PLATE	-	-	1	
5	MFN NAME PLATE	-	-	1	
4	POWER SWITCH NAME PLATE	-	-	1	
3	POWER ON/OFF KEY SWITCH	KSL25W/2-20	-	1	
2	BUZZER	KH-406SA	-	1	
1	HMI-PC	TPO-15	-	1	TECHCROSS

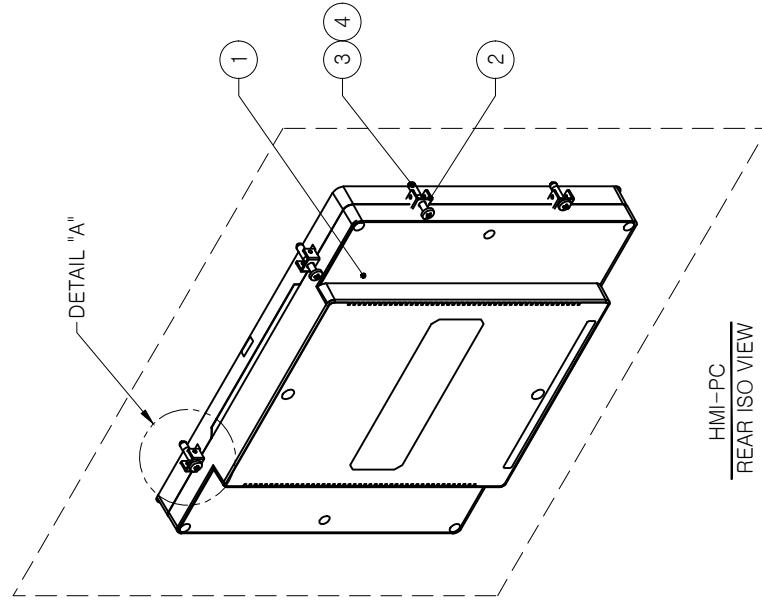
K SHIPBUILDING      HULL NO.      MODEL NAME  
S1940                  RDU

DATE : 2022. 09. 08      PART NAME      REMOTE DISPLAY UNIT (CONSOLE TYPE)  
APPD BY Y.M.KIM      DRAWING NO      CPC001-GB-A001Z-S1940  
CHKD BY -              DSNID BY H.C.LEE

**TECHCROSS**

DETAIL 'B'

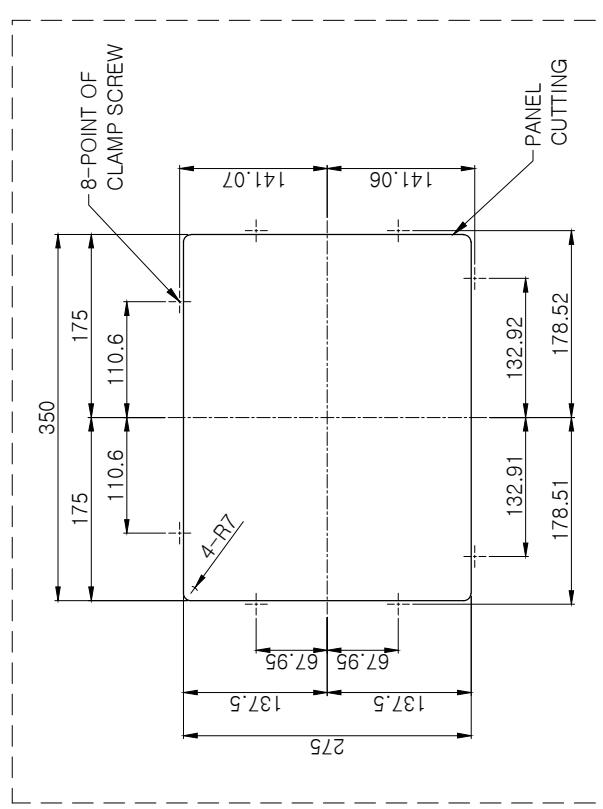
REV	DESCRIPTION	CHKD	APPD	DATE



**REAR ISO VIEW**

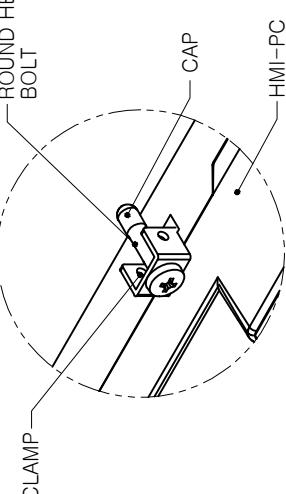
**DETAIL "A"**

**POINT OF CLAMP SCREW**



**PANEL CUTTING**

**ROUND HEAD BOLT**



**DETAIL VIEW "A"**

**POINT OF CLAMP SCREW**

1. INSTALL THE TPC-15  
 1.1 FIND OUT THE EIGHT CLAMP, EIGHT ROUND HEAD BOLT AND  
 EIGHT RUBBER CAPS IN THE ACCESSORY PACK.  
 1.2 HOOK THOSE CLAMP TO THOSE HOLE AROUND THE FOUR SIDES OF  
 THE BEZEL (TPC-15).  
 1.3 INSERT THE BOLT TO EVERY CLAMP AND FASTEN THEM WITH RUBBER CAPS.  
 1.4 THESE BOLT WILL THEN PUSH ON THE MOUNTING PANEL (WALL) AND FIX  
 THE UNIT.  
 \* THE TORQUE OF BOLT IS SUGGESTED TO BE 3.5 kg.f.cm (less than 4. kg.f.cm).

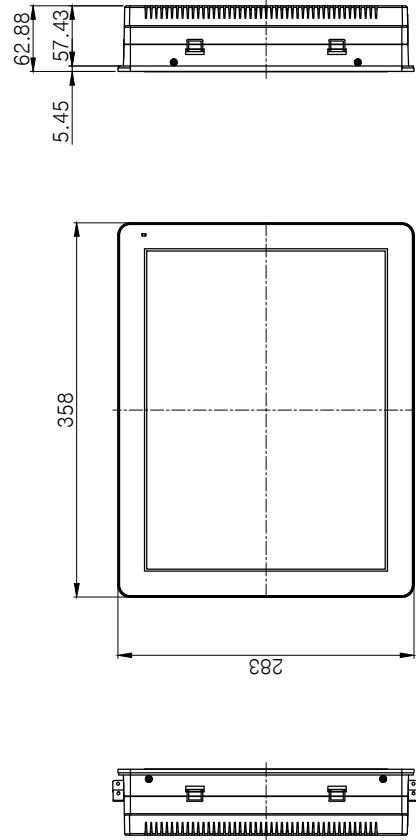
NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
4	CAP	-	RUBBER	8	TECHCROSS
3	ROUND HEAD BOLT	M6xL30	SUS304	8	TECHCROSS
2	CLAMP	-	-	8	TECHCROSS
1	HMI-PC	TPC-15	-	-	-

K SHIPBUILDING      HULL NO.      MODEL NAME  
PART NAME      HULL NO.      MODEL NAME  
SHIP YARD      K SHIPBUILDING      S1940      RDU

DATE : 2022.09.08      PART NAME      REMOTE DISPLAY UNIT (CONSOLE TYPE)  
APPD BY Y.M.KIM      DRAWING NO      CPC001-GB-A001Z-S1940  
CHKD BY -      SHEET NO : 2 OF 4  
DSND BY H.C.LEE      REV.      B

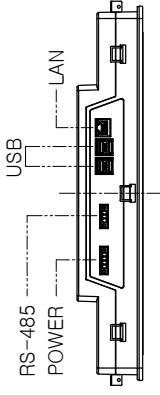
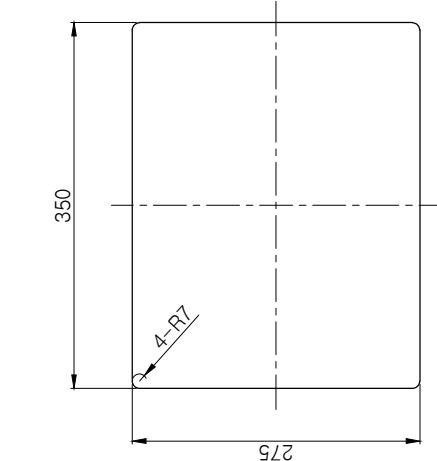
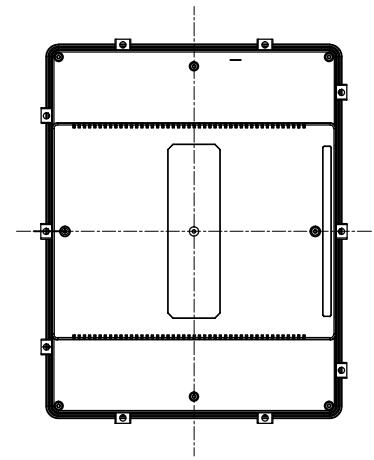
**TECHCROSS**

REV	DESCRIPTION	CHKD	APPD	DATE
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LEFT SIDE VIEW

RIGHT SIDE VIEW

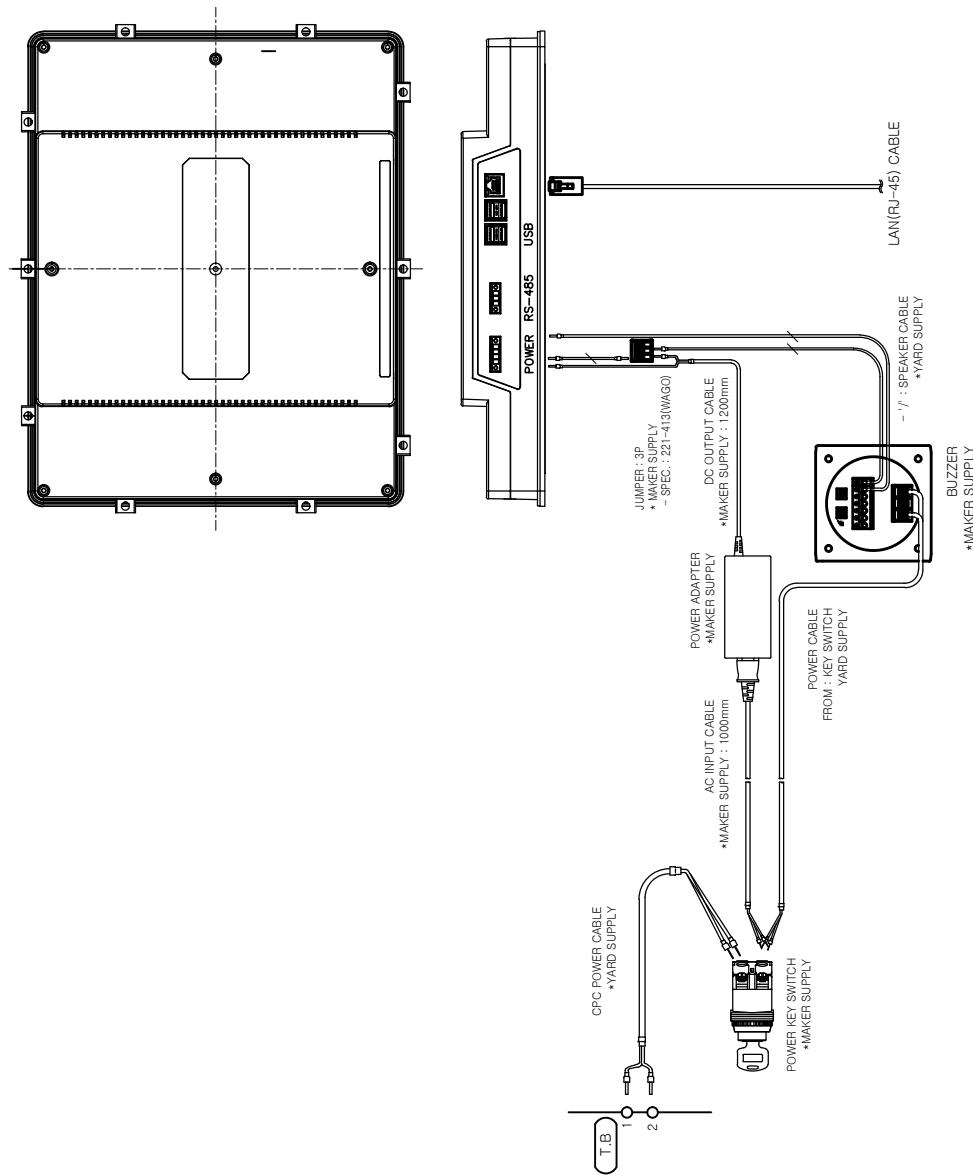


NOTE  
1. MODEL : TPC-15  
2. MAKER : TECHCROSS

NO	PART NAME	HULL NO.	MODEL NAME	SPEC	MATERIAL	Q'TY	REMARK
K SHIPBUILDING	S1940	RDU					<b>TECHCROSS</b>
APPD BY Y.M.KIM							
CHKD BY -							
DSND BY H.C.LEE							
	DRAWING NO	HMI PC					
	CPC001-GA-E001Z-S1940						
							SHET NO : 2 OF 4
							REV. B

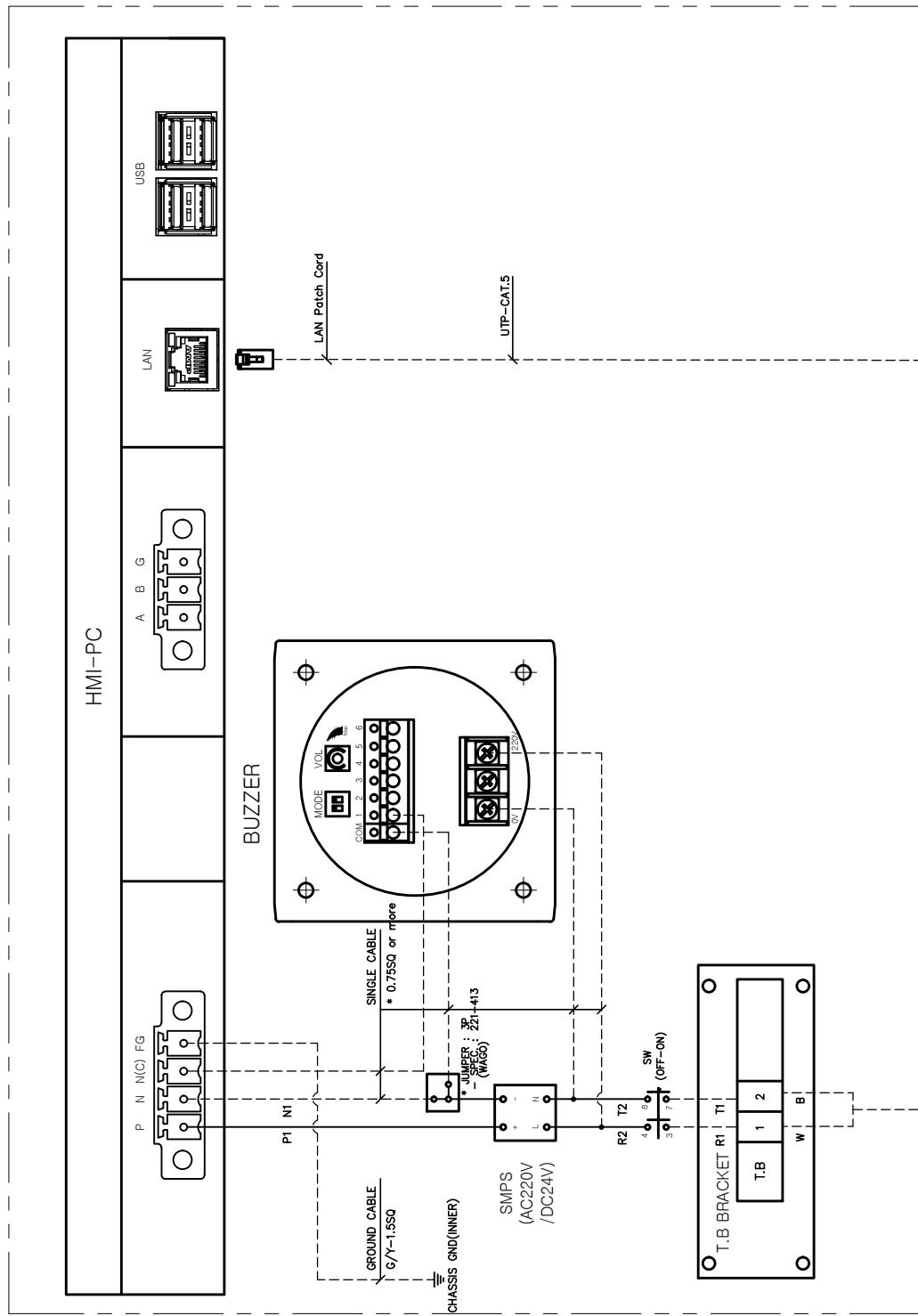
REV.	DESCRIPTION	CHKD	APPD	DATE
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HMI-PC (MONITOR 15")



NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME			
K SHIPBUILDING	S1940	RDU			
DATE : 2022. 09. 08	PART NAME	RDU WIRING OUTLINE			
APPD BY Y.M.KIM	DRAWING NO	CPC001-GB-C001Z-S1940			
CHKD BY -	REV.	B			
DSND BY H.C.LEE					

REV.	DESCRIPTION	CHKD	APPD	DATE
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SYMBOL	TYPE	MAKER	Q'TY
HMI-PC	TFC-15	TECHCROSS	1
ADAPTER	AC220/DC24V 3.1A	TECHCROSS	1
SW	KS25NW2-20	KONO	1
BUZZER	KH-4065	KONO	1
T/B	WAGO 10P	WAGO	1
CONNECTOR	JUMPER 3P	WAGO	1

\* TABLE 1

LINE	DESCRIPTION
SUPPLY	NAME
EQUIPMENT	MAKER
CABLE	MAKER
CABLE	YARD

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.				
K SHIPBUILDING	S1940				
DATE : 2022. 09. 08	PART NAME	RDU			
APPD BY Y.M.KIM	DRAWING NO	RDU CIRCUIT DIAGRAM			
CHKD BY -	DRAWING NO	CPC001-GB-C002Z-S1940			SHEET NO : 1 OF 1
DSND BY H.C.LEE	REV.	B			

STP CABLE  
(LAN)GPO POWER  
(DP-TC-2.5)



## ECS-HYCHLOR GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING  
HULL NO. : S1940  
MODEL : ECS-HYCHLOR-1200

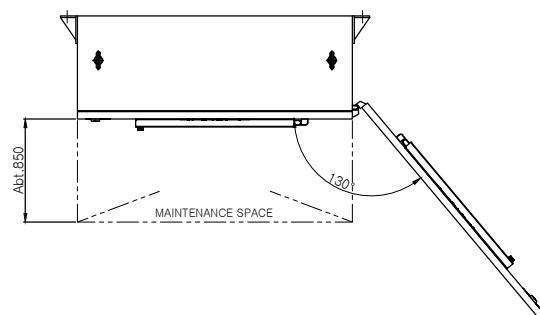
### DETAIL OF THE LCU

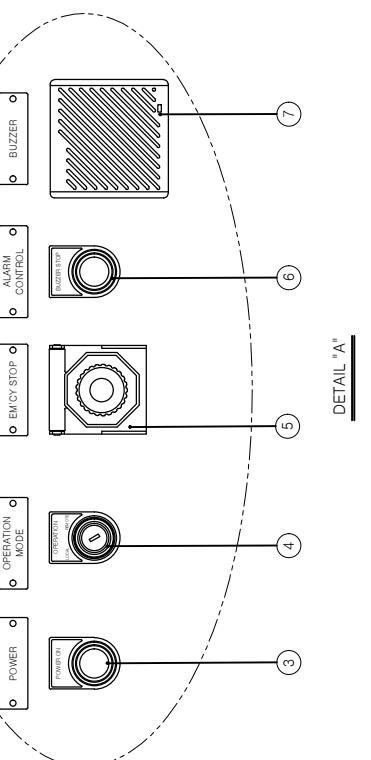
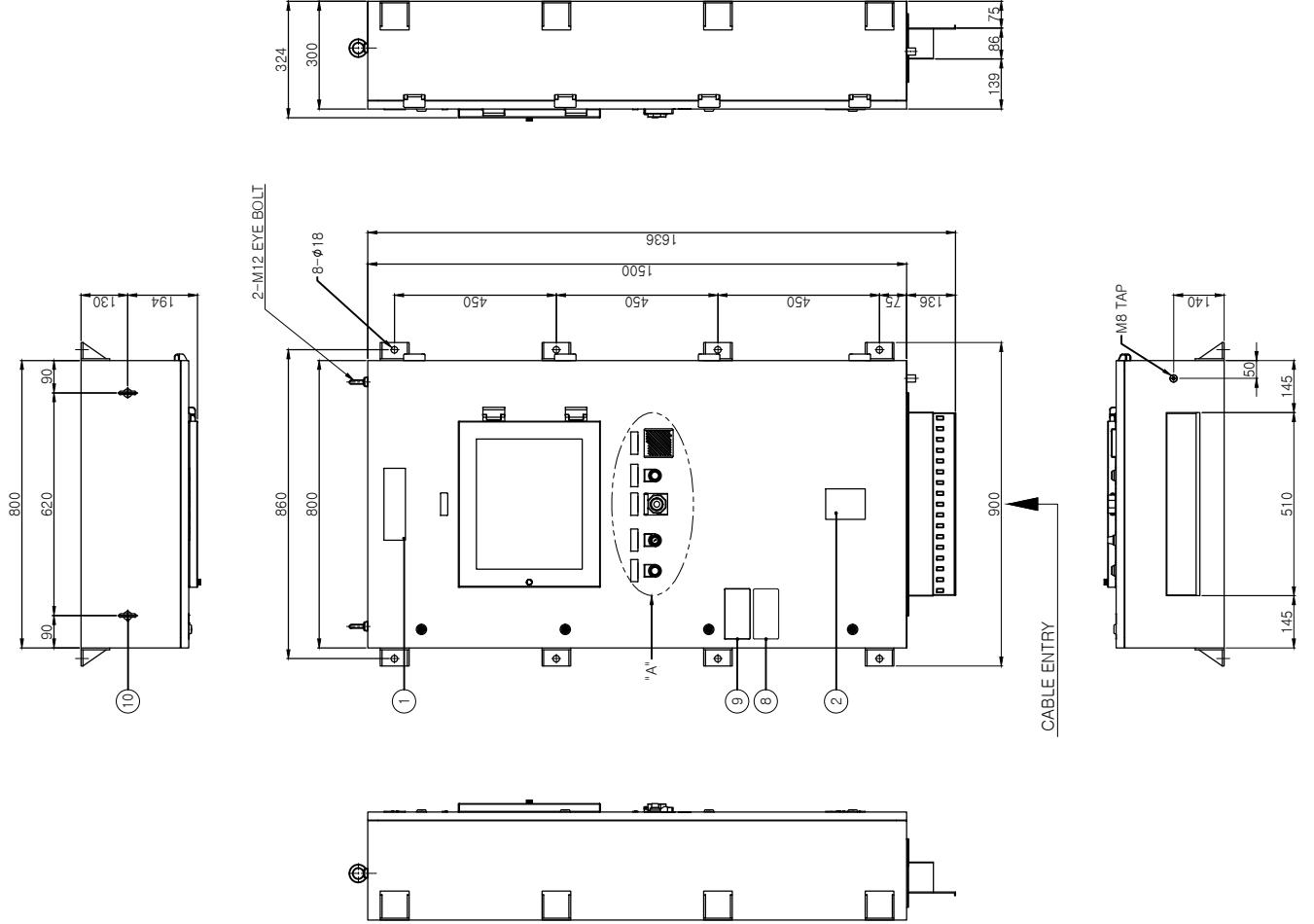
#### 1. LOCAL CONTROL UNIT(LCU)

DIVISION	SPECIFICATION
WEIGHT	200 Kg
SIZE	900(W)x324(D)x1500(H)
INSTALL TYPE	WALL MOUNT
MATERIAL	HOUSING : SS400
AMBIENT TEMP <sup>II</sup>	0°C~45°C
IP GRADE	IP44
POWER INPUT	AC220V
CABLE ENTERANCE	BOTTOM / CABLE COAMING

#### 2. INSTALLATION GUIDE

SECURE SPACE TO OPEN LCU DOOR(Min. 850mm)



REV	DESCRIPTION	CHKD	APPD	DATE																																																																																					
10	DETAIL "A"	-	-	-																																																																																					
 <p><b>NOTE</b></p> <p>1. PAINT : POWDER COATING (60<math>\mu\text{m}</math> OVER)      2. COLOR : SHIPBUILDER STANDARD</p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr><td>10</td><td>EYE BOLT</td><td>M12</td><td>SS400</td><td>2</td></tr> <tr><td>9</td><td>DANGER LABEL</td><td>140x70</td><td>FE</td><td>1</td></tr> <tr><td>8</td><td>WARNING LABEL</td><td>140x70</td><td>PE</td><td>1</td></tr> <tr><td>7</td><td>BUZZER</td><td>KF-405E(D224)</td><td>-</td><td>-</td></tr> <tr><td>6</td><td>BUZZER STOP SWITCH</td><td>KF-220(14x-220)-1(B)</td><td>-</td><td>1</td></tr> <tr><td>5</td><td>EMERGENCY SWITCH</td><td>KF-230(5Vx-230(E)-1(R))</td><td>-</td><td>1</td></tr> <tr><td>4</td><td>OPERATION SELECTION SWITCH</td><td>KF-220(2KH-220(2K-1))</td><td>-</td><td>1</td></tr> <tr><td>3</td><td>POWER ON SWITCH</td><td>KF-230(4x-24Vx-230(2-1)(W))</td><td>-</td><td>1</td></tr> <tr><td>2</td><td>MFR NAME PLATE</td><td>110x85x2.0T</td><td>SUS</td><td>1</td></tr> <tr><td>1</td><td>PART NAME PLATE</td><td>230x35x2.0T</td><td>SUS</td><td>1</td></tr> <tr><td>NO</td><td>PART NAME</td><td>HULL NO.</td><td>MODEL NAME</td><td>REMARK</td></tr> <tr><td>SHIP YARD</td><td>K SHIPBUILDING</td><td>S1940</td><td>LCU</td><td></td></tr> <tr><td colspan="2">PART NAME</td><td colspan="3">LOCAL CONTROL UNIT</td></tr> <tr><td colspan="2">DRAWING NO</td><td colspan="3">SHEET NO : 1 OF 1</td></tr> <tr><td colspan="2">APPD BY V.M.KIM</td><td colspan="3">LCU000-GA-A001Z-S1940</td></tr> <tr><td colspan="2">CHKD BY -</td><td colspan="3">REV. 0</td></tr> <tr><td colspan="2">DSND BY H.C.LEE</td><td colspan="3">TECHCROSS</td></tr> </table>					10	EYE BOLT	M12	SS400	2	9	DANGER LABEL	140x70	FE	1	8	WARNING LABEL	140x70	PE	1	7	BUZZER	KF-405E(D224)	-	-	6	BUZZER STOP SWITCH	KF-220(14x-220)-1(B)	-	1	5	EMERGENCY SWITCH	KF-230(5Vx-230(E)-1(R))	-	1	4	OPERATION SELECTION SWITCH	KF-220(2KH-220(2K-1))	-	1	3	POWER ON SWITCH	KF-230(4x-24Vx-230(2-1)(W))	-	1	2	MFR NAME PLATE	110x85x2.0T	SUS	1	1	PART NAME PLATE	230x35x2.0T	SUS	1	NO	PART NAME	HULL NO.	MODEL NAME	REMARK	SHIP YARD	K SHIPBUILDING	S1940	LCU		PART NAME		LOCAL CONTROL UNIT			DRAWING NO		SHEET NO : 1 OF 1			APPD BY V.M.KIM		LCU000-GA-A001Z-S1940			CHKD BY -		REV. 0			DSND BY H.C.LEE		TECHCROSS		
10	EYE BOLT	M12	SS400	2																																																																																					
9	DANGER LABEL	140x70	FE	1																																																																																					
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7	BUZZER	KF-405E(D224)	-	-																																																																																					
6	BUZZER STOP SWITCH	KF-220(14x-220)-1(B)	-	1																																																																																					
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CHKD BY -		REV. 0																																																																																							
DSND BY H.C.LEE		TECHCROSS																																																																																							
 <p><b>NOTE</b></p> <p>DATE : 2022. 09. 08      APPD BY V.M.KIM      CHKD BY -      DSND BY H.C.LEE</p>																																																																																									

<RIGHT SIDE INNER VIEW>

<FRONT INNER VIEW>



## ECS-HYCHLOR GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

HULL NO. : S1940

MODEL : ECS-HYCHLOR-1200

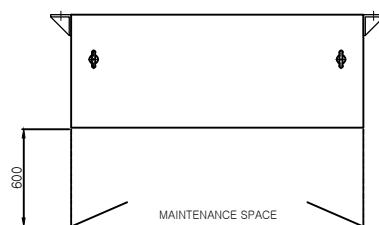
### DETAIL OF THE HTM

#### 1. HYPOCHLORITE TERMINAL MODULE(HTM)

DIVISION	SPECIFICATION
WEIGHT	250 Kg
SIZE	970(W)x300(D)x1650(H)
INSTALL TYPE	WALL MOUNT
MATERIAL	HOUSING : SS400
AMBIENT TEMP <sup>II</sup>	0°C~45°C
IP GRADE	IP44
POWER INPUT	AC440V
CABLE ENTERANCE	BOTTOM / CABLE COAMING

#### 2. INSTALLATION GUIDE

SECURE SPACE TO OPEN HTM DOOR(Min. 600mm)



**NOTE**

1. PAINT : POWDER COAT G (60μm OVER)
2. COLOR : SHIPBUILDER STANDARD

Part No.	Description	Material	Q.T.Y	REMARK	
8	EYE BOLT	M12	2	M12	
7	DANGER LABEL	SS400	2	-	
6	WARNING LABEL	140x70	-	-	
5	ROTARY HANDLE	140x70	-	-	
4	POWER ON LAMP	EH250	-	LSIS	
3	AMMETER	KH-2030L-2(KH-2030L-2W)	-	KONO	
2	MFR NAME PLATE	SB-AA	-	DEESYS	
1	NAME PLATE	110x85, T=2.0	SUS	1	-
NO	PART NAME	230x35, T=2.0	SUS	1	-
SHIP YARD	HULL NO.	SPEC	MATERIAL	Q.T.Y	REMARK
K SHIPBUILDING	S1940	HTM	-	-	-

**TECHCROSS**

REV	DESCRIPTION	CHKD	APPD	DATE

**HEADER**

DATE : 2022. 09. 08	PART NAME : HYPOCHLORITE TERMINAL MODULE	APPD BY : Y.M.KIM	CHKD BY : -	DRAWING NO : HTM060-GA-A001Z-S1940	DSND BY : H.C.LEE	RE.V. : 0	SHEET NO : 1 OF 2
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## ECS-HYCHLOR GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING  
HULL NO. : S1940  
MODEL : ECS-HYCHLOR-1200

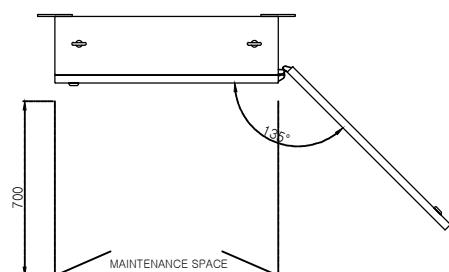
### DETAIL OF THE PDM-A

#### 1. POWER DISTRIBUTOR MODULE(PDM)

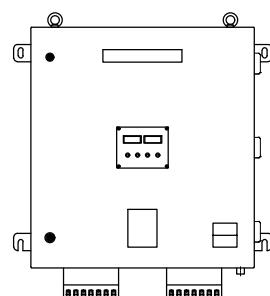
DIVISION	SPECIFICATION
WEIGHT	50Kg
SIZE	750(W)x200(D)x805(H)
INSTALL TYPE	WALL MOUNT
MATERIAL	HOUSING : SS400
AMBIENT TEMP <sup>II</sup>	0°C~45°C
IP GRADE	IP44
POWER INPUT	AC440V 3PHASE, AC220V, DC24V
CABLE ENTERANCE	BOTTOM / CABLE COAMING

#### 2. INSTALLATION GUIDE

SECURE SPACE TO OPEN PDM DOOR(Min. 700mm)

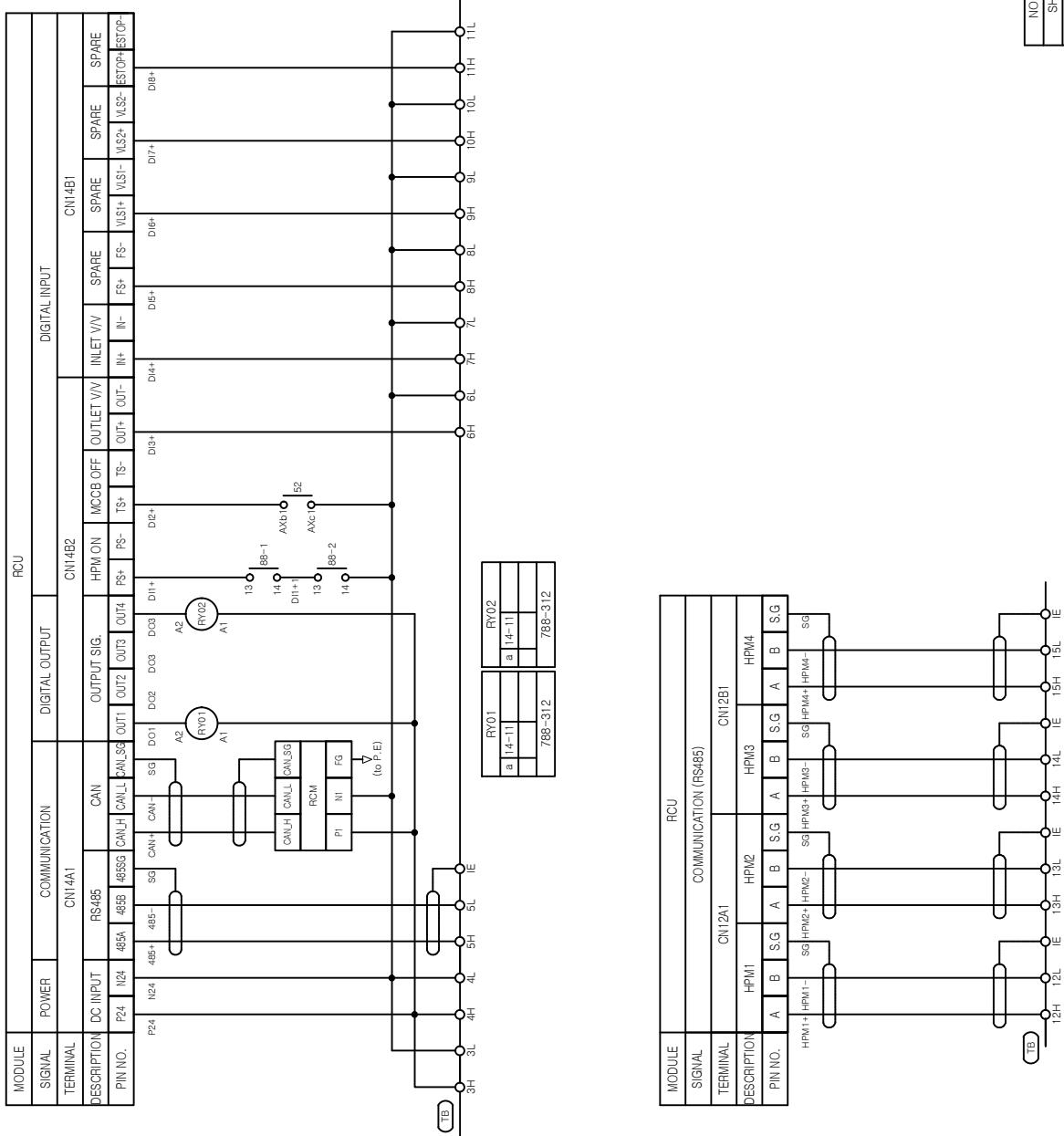


FOR CABLEING, PLEASE REFER TO THE DRAWING BELOW.









<p>-1~8: ON(N/O SIG.), OFF(N/C SIG.)</p>			
<p>NOTE</p>			
<p>1) RCU DIP-SWITCH SETTING</p>			
-PROGRAM / RESET-			
S3		ON(1) OFF(0)	
2			
* 1-2: ON(NORMAL) OFF(NORMAL)			
* 2-3: ON(PROGRAMMING), OFF(NORMAL)			
-PRU-			
S8			
1		2	3
ON(1)			
* 1100(PROGRAMMING), 0011(NORMAL)			
-485 ID-			
S1			
1		2	3
ON(1)			
* 00001(st), 10002(nd), 0, 0003(rd), 1100(4th)			
* APPLIED TO RCU-14 MODEL			
-CAN ID-			
S2			
1		2	3
ON(1)			
* 00001(st), 10002(nd), 0, 10003(rd), 1100(4th)			
* APPLIED TO RCU-14 MODEL			
-CAPACITY ID-			
S4			
1		2	3
ON(1)			
* 00001(st), 10002(nd), 0, 10003(rd), 1100(4th)			
* APPLIED TO Q100(3ba), 1100(4ea), 1110(8ba)			
-N/O, N/C SELECT-			
S5			
8		7	6
VLS2		L51	FS
4		3	2
TS		RS	ESTOP

NO	PART NAME	HULL NO.	SPEC	MATERIAL	QTY	REMARK
SHIP YARD	K SHIPBUILDING	S 1940	PDM-A			
DATE : 2022-09-08		PART NAME	SCHEMATIC DIAGRAM			
APP'D BY	Y.M.KIM	DRAWING NO.	PDM000-Ga-C001Z-S1940			SHEET NO : 2 OF 2
CHK'D BY	=					REV. 0
DSN'D BY	H.C.LEE					



## ECS-HYCHLOR GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

HULL NO. : S1940

MODEL : ECS-HYCHLOR-1200

### DETAIL OF THE HPU-200

#### 1. HYPOCHLORITE POWER UNIT(HPU)

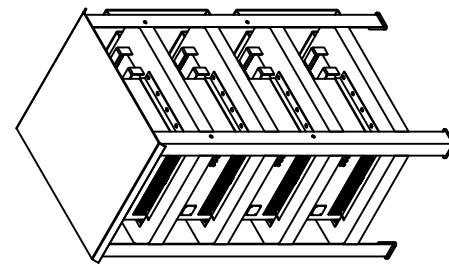
##### 1. FRAME

DIVISION	SPECIFICATION
WEIGHT	320 kg
SIZE	720(W)x870(D)x1600(H)
INSTALL TYPE	FLOOR MOUNTING AND SELF STANDING
MATERIAL	SS400

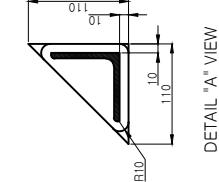
#### 2. HYPOCHLORITE POWER MODULE(HPM)

DIVISION	SPECIFICATION
POWER INPUT	AC 440V 3PHASE
OUTPUT SIGNAL	RS-485
OPERATION TEMP"	0 ~ 45°C
OUTPUT VOLTAGE	130V
OUTPUT CURRENT	MAX" 200A
COOLING TYPE	FORCED AIR COOLING
MATERIAL	HOUSING : AL
WEIGHT	40Kg / 1EA
IP GRADE	IP44
CALORIC VALUE	4,025Kcal x 4EA(HPM) = 16,100Kcal

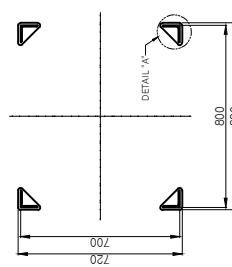
REV	DESCRIPTION
	CHKD APPD DATE



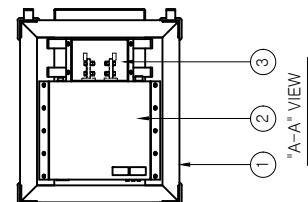
"ISO" VIEW



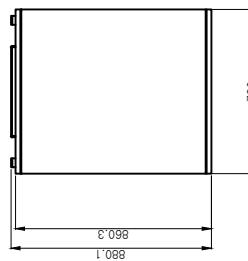
DETAIL "A" VIEW



"B-B" VIEW



"A-A" VIEW



"TOP" VIEW

CABLE INSTALL GUIDE

FRAME SPEC' (MAKER STANDARD)			
STANDARD	MATERIAL	SURFACE TREATMENT	PAINTING
75x75x6T	SS400	BLASTING (SA 2.5)	Hammel's HB primer K150 White(XX30)

From: PDM (HPM SIGNAL)

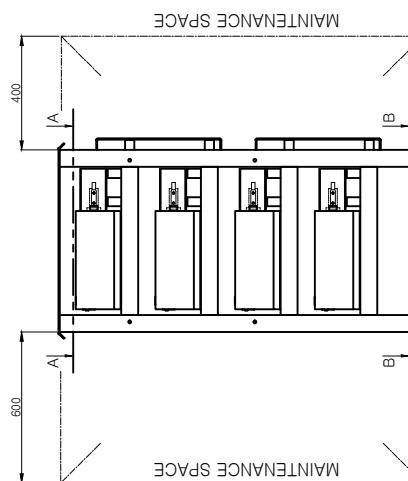
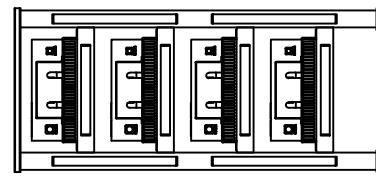
To: HGU (HGU POWER)

From: PDM (HPM SIGNAL)

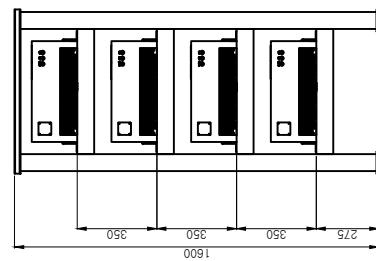
CABLE INSTALL GUIDE

NO	PART NAME	SHIP NAME	MODEL NAME	REMARK
3	HPM BUSBAR COVER		T=2.5	
2	HYPHOCHLORITE POWER MODULE		130V, MAX* 200A	SS400 4
1	HPU FRAME		75x75, T=6.0	AL 4
			SPEC	MATERIAL Q'TY
K SHIPBUILDING	S1940		HPU-200	
APPD BY Y.M.KIM		PART NAME		
CHKD BY -		DRAWING NO	HPU200-GA-A001Z-S1940	HYPHOCHLORITE POWER UNIT
DSND BY H.C.LEE				SHEET NO : 1 OF 1

"REAR" VIEW

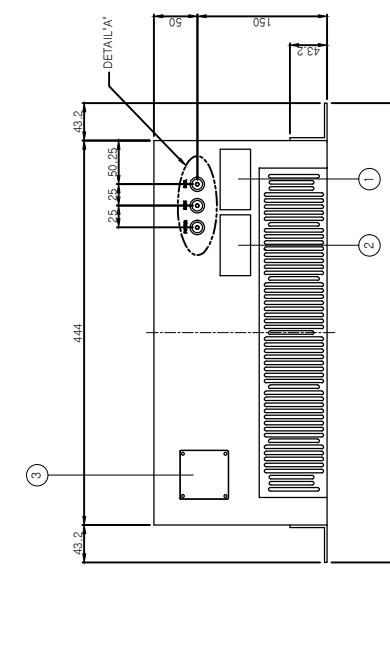
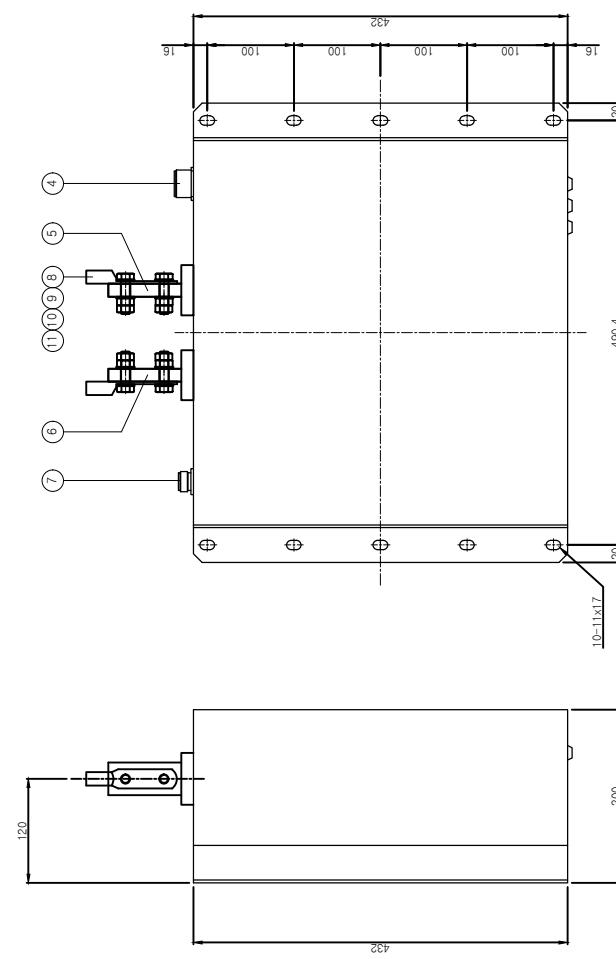
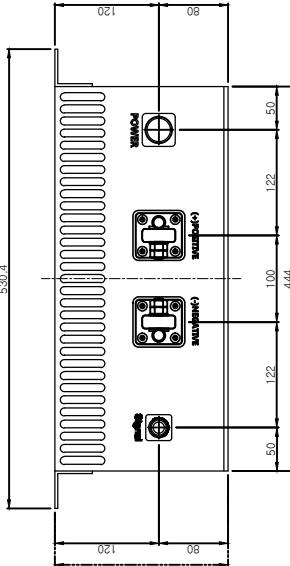


"RIGHT" VIEW



"FRONT" VIEW

REV	DESCRIPTION	CHKD	APPD	DATE
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SPECIFICATION	
POWER INPUT	AC 440V 3PHASE
OUTPUT SIGNAL	RS-485
OPERATION TEMP <sup>o</sup> C	0 ~ 45 <sup>o</sup> C
OUTPUT VOLTAGE	130V
OUTPUT CURRENT	MAX <sup>o</sup> 200A
COOLING TYPE	AIR COOLING
MATERIAL	AL
WEIGHT	40KG / 1EA
IP GRADE	IP44
CALORIC VALUE	4,025kcal

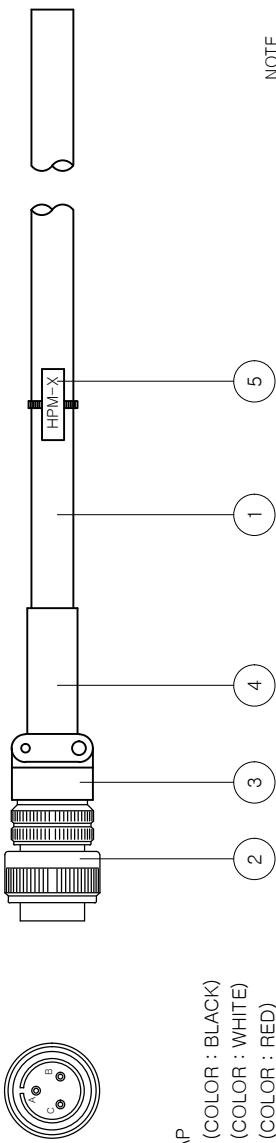
NO	PART NAME	SHIP OWNER	SHIP NAME	MODEL NAME	REMARK
11	HEXAGON NUT		M10	SUS	
10	PLAIN WASHER		M10x1.40	SUS	8
9	HEXAGON HEAD BOLT		M10x1.40	SUS	4
8	TUBULAR CABLE LUG		JGCT 0207-S1940X10	COPPER	2
7	SIGNAL CONNECTOR		MS1102A-14S-1	ALDC	1
6	NEGATIVE BUSBAR	38x15		COPPER	1 (-)
5	POSITIVE BUSBAR	38x15		COPPER	1 (+)
4	POWER CONNECTOR		MS1102A-20-19	ALDC	1 AC 440V
3	MFR NAME PLATE		56x56, T=2	SUS	1
2	WARNING LABEL		70x35	PE	1
1	DANGER LABEL		70x35	PE	1
NO	PART NAME		SPEC	MATERIAL	Q'TY
					REMARK



DATE : 2022. 09. 08	PART NAME	HYPOMICRO POWER MODULE
APPD BY Y.M.KIM	DRAWING NO	HPM000-GA-A001Z-S1940
CHKD BY -		
DSND BY H.C.LEE		REV. 0

SHEET NO : 1 OF 1

REV	DESCRIPTION	CHKD	APPD	DATE
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PINMAP

A : R (COLOR : BLACK)  
B : S (COLOR : WHITE)  
C : T (COLOR : RED)

NOTE  
1. LABEL MARKING TEXT  
1.1 HPM - 1  
1.2 HPM - 2  
1.3 HPM - 3  
1.4 HPM - 4

NO	PART NAME	CABLE LENGTH	QTY	REMARK
4	NO.4 HPM POWER CABLE	20m	1	-
3	NO.3 HPM POWER CABLE	20m	1	-
2	NO.2 HPM POWER CABLE	20m	1	-
1	NO.1 HPM POWER CABLE	20m	1	-
NO	PART NAME	CABLE LENGTH	QTY	

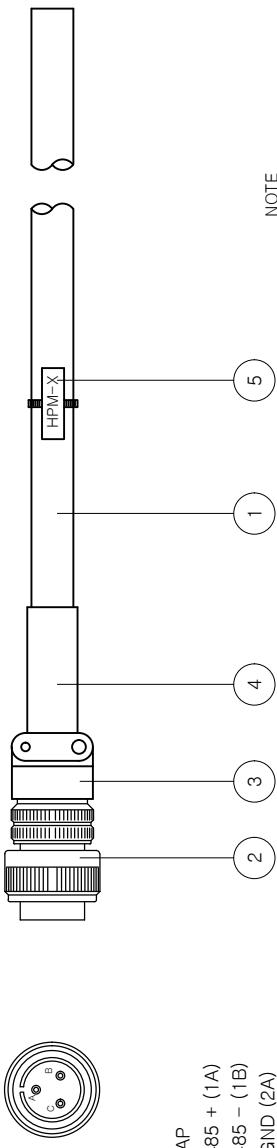
SHIP OWNER	SHIP NAME	MODEL NAME	REMARK
K SHIPBUILDING	S1940	HPU-200	<b>TECHCROSS</b>

APPD BY	Y.M.KIM	PART NAME	POWER CABLE ASSY	DRAWING NO	HPU200-GA-H001Z-S1940	REV.	0
CHKD BY	-						
DSND BY	H.C.LEE						

Sheet No : 1 of 1

REV	DESCRIPTION	CHKD	APPD	DATE
-----	-------------	------	------	------



1. NO.4 HPM COMMUNICATION CABLE  
2. NO.3 HPM COMMUNICATION CABLE  
3. NO.2 HPM COMMUNICATION CABLE  
4. NO.1 HPM COMMUNICATION CABLE

NO	PART NAME	CABLE LENGTH	QTY	REMARK
4	NO.4 HPM COMMUNICATION CABLE	20m	1	-
3	NO.3 HPM COMMUNICATION CABLE	20m	1	-
2	NO.2 HPM COMMUNICATION CABLE	20m	1	-
1	NO.1 HPM COMMUNICATION CABLE	20m	1	-
NO	PART NAME	CABLE LENGTH	QTY	REMARK

NO	PART NAME	SHIP OWNER	SHIP NAME	MODEL NAME	REMARK
5	WARNING CABLE TIE	K SHIPBUILDING	S1940	HPU-200	<b>TECHCROSS</b>

APPD BY	Y.M.KIM	PART NAME	COMMUNICATION CABLE ASSY	DATE : 2022. 09. 08
CHKD BY	=	DRAWING NO	HPU200-GA-H0022-S1940	APPD BY Y.M.KIM
DSND BY	H.C.LEE			CHKD BY =
				DSND BY H.C.LEE

REV. 0  
SHEET NO : 1 OF 1



## ECS-HYCHLOR GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING  
HULL NO. : S1940  
MODEL : ECS-HYCHLOR-1200

### 1. VALVE (AC01V)

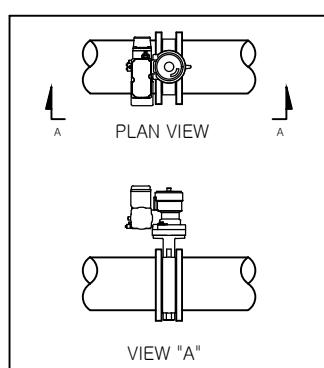
DIVISION	SPECIFICATION
TYPE	BUTTERFLY
MATERIAL	BODY : FCB450 DISK : ALBC+TEFLON SEAT : PTFE
FLANGE	JIS 10K 50A(LUG TYPE)

### 2. ACTUATOR

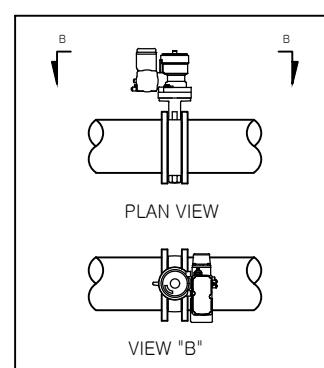
DIVISION	SPECIFICATION
TYPE	ELECTRO HYDRAULIC POWER UNIT(SINGLE ACTING/ON-OFF)
AMBIENT TEMP"	-20°C ~ 80°C
MATERIAL	HOUSHING & PISTON : GGG 40
	OUTPUT SHAFT : SS 2142
	DISHED SPRINGS : 50 CrV4
	INDICATOR SHAFT : SUS316
OPERATING PRESSURE	135BAR
OIL DISPLACEMENT	0.05 LITER
ROTATION	90° ±1°
POWER INPUT	AC 220V
CERTIFICATE	A-14113 (ISSUED DNV CLASS), BV, GL

### 3. INSTALLATION GUIDE

GOOD



WRONG



P.NO.	DESCRIPTIONS	MATERIAL	Q'TY	REMARK
1	BODY	FCD450	1	or EQUAL
2	DISC	ALBC-T-TEFLON	1	or EQUAL
3	SEAT	PTFE	1	
4	STEM	SUS304	2	or EQUAL
5	PACKING	NBR	-	
6	PACKING RING	ACETAL	1	
7	PLUG	STEEL	1	+ Plated
8	BOLT	STEEL	2	

## NOTE

- 1.BASIC DESIGN : EN93/BS5155  
 2.FACE TO FACE : ISO5752 SERIES.20  
 / EN558 SERIES.20  
 3.FLANGE DRILLING : JIS B2220-5K/10K

## 4. HYDRO TEST

BODY	FLANGE RATING * 1.5
SEAT	FLANGE RATING * 1.1

## 5. BODY MARKING

Front	Back
	FCD 10K Heat No.

6. Flange or pipe inside diameter must be min. 3mm larger than  $\phi C$  dimension.

VALVE NO. : AC01V

NO.	DATE	DESCRIPTION	DRA.	DES.	CHK.	APR.



YOOHAN VALVE

BUTTERFLY VALVE LUG TYPE JIS 10K  
 BARE-SQUARE 50A

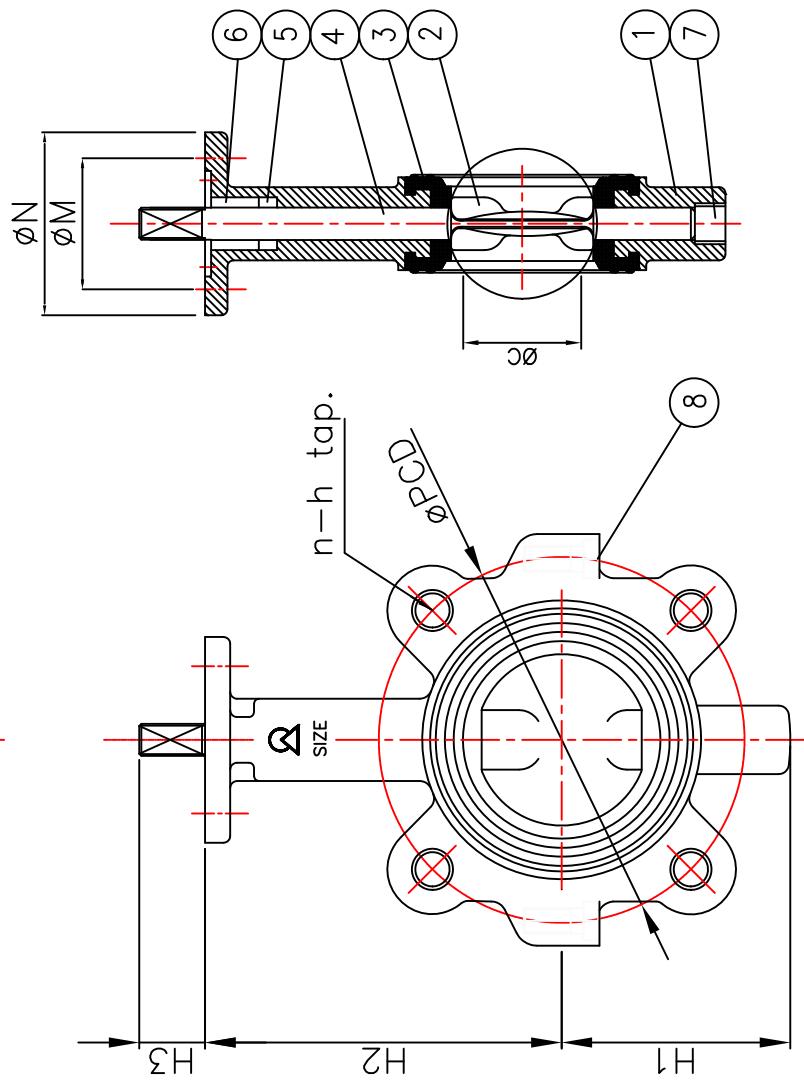
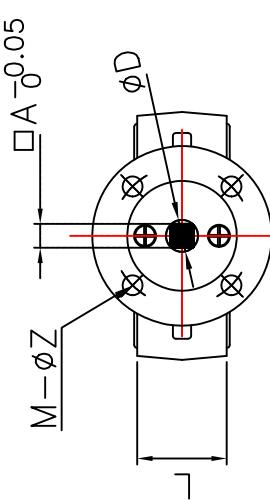
SCALE N / S REV.  
 APR. DATE NO.

CHK. DATE 2010.10.08

DES. DWG No. ATP-2005-021

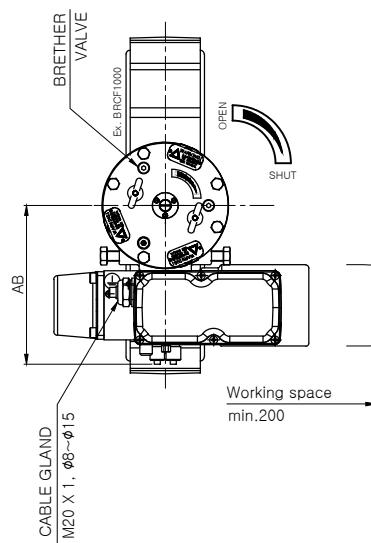
△ 0

DIMENSIONS											Unit : mm							
SIZE	$\phi d$	FLANGE JIS 10K	REFERENCE				$\phi C$	$\square A$	$\phi D$	TYPE	$\phi M$	$\phi N$	$M-\phi Z$	(Kg)				
			L	H1	H2	H3												
50A(2")	51.5	120	4	M16	43	75	130	36	30	9	31.8	11	14	F07	70	90	4- $\phi$ 10	1.9



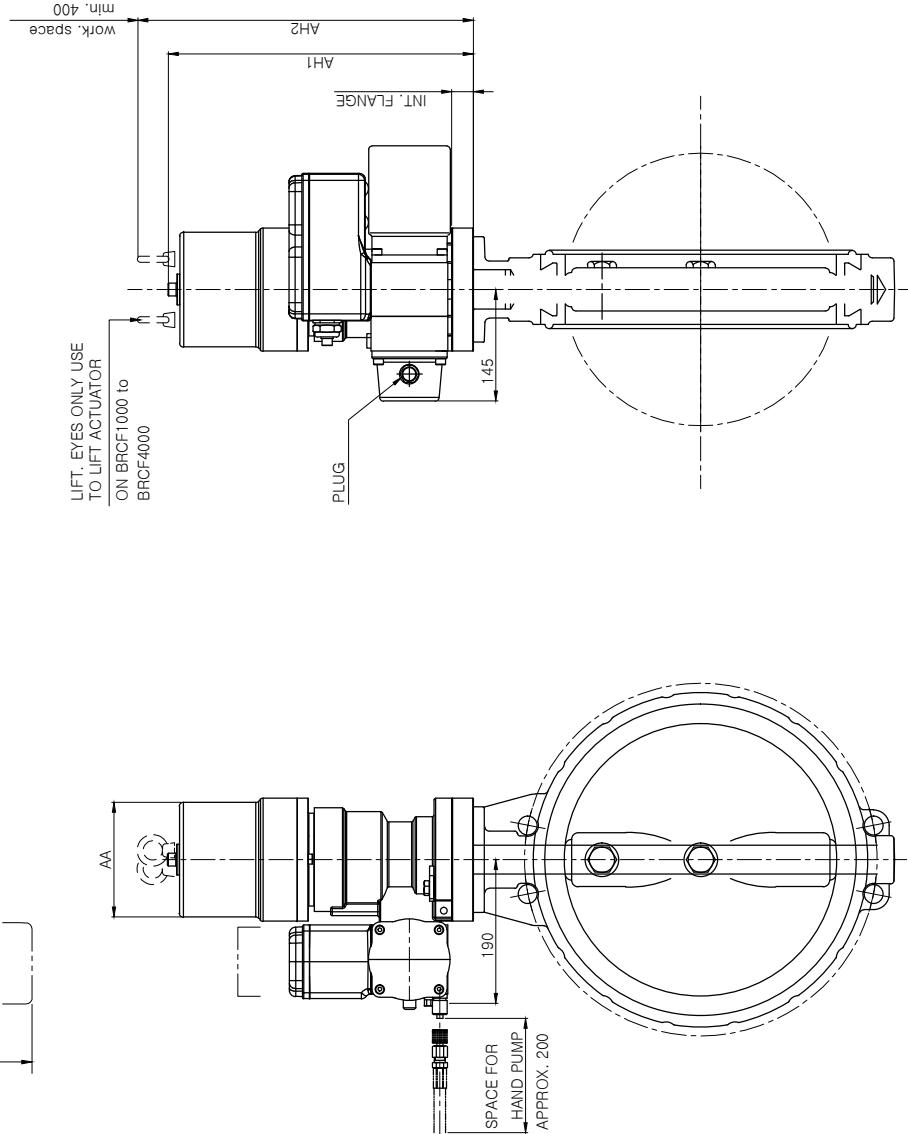
# SAFETY FAIL CLOSED VALVE (AC01V)

REV	DESCRIPTION	CHKD	APPD	DATE
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\* ACTUATOR DEMENSION TABLE

	AA	AB	AH1	AH2
BRCF 125	93	174.5	243	-
BRCF 250	108	181.5	274	-
BRCF 500	136	194.5	326	-
BRCF1000	164	206.5	-	450
BRCF2000	195	218.5	-	520
BRCF4000	253	246.5	-	650



SPECIFICATION	
TYPE	ELECTRO HYDRAULIC POWERUNIT(SINGLE ACTING)
AMBIENT TEMP <sup>o</sup>	-20°C ~ 80°C
MATERIAL	HOUSING & PISTON : GGG 40 OUTPUT SHAFT : SS 2142 DISHED SPRINGS : 50 CrV4 INDICATOR SHAFT : SUS316
OPERATING PRESSURE	135BAR
OIL DISPLACEMENT	0.05 LITER
ROTATION	90° ±1°
POWER INPUT	AC 220V
CERTIFICATE	A-14113 (ISSUED DIV CLASS) BV, GL

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
K SHIPBUILDING	SHIP OWNER	SHIP NAME	MODEL NAME		<b>JTECHCROSS</b>
		S1940	AC01V		
APPD BY Y.M.KIM	PART NAME	SAFETY FAIL CLOSED VALVE ACTUATOR			
CHKD BY -	DRAWING NO				
DSND BY H.C.LEE	REV.	B			

Actuator shown in closed position(fail safe)

DATE : 2022. 09. 08 PART NAME : SAFETY FAIL CLOSED VALVE  
APPD BY : Y.M.KIM DRAWING NO :  
CHKD BY : -  
DSND BY : H.C.LEE

REV. : B  
SHEET NO : 1 OF 1



## ECS-HYCHLOR GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING  
HULL NO. : S1940  
MODEL : ECS-HYCHLOR-1200

### 1. VALVE (FCV01)

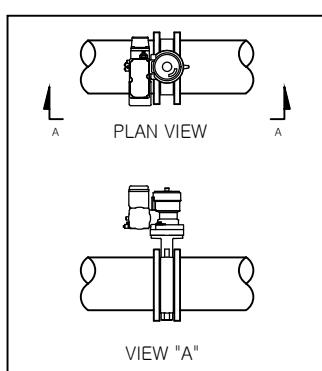
DIVISION	SPECIFICATION
TYPE	BUTTERFLY
MATERIAL	BODY : FCB450 DISK : ALBC+TEFLON SEAT : PTFE
FLANGE	JIS 10K 50A(LUG TYPE)

### 2. ACTUATOR

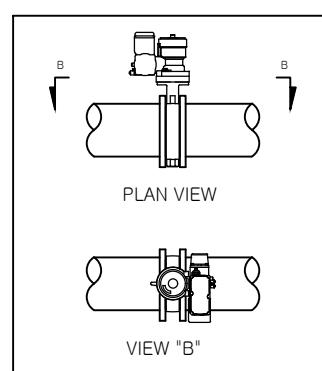
DIVISION	SPECIFICATION
TYPE	ELECTRO HYDRAULIC POWER UNIT(DOUBLE ACTING)
AMBIENT TEMP"	-20°C ~ 80°C
MATERIAL	HOUSHING & PISTON : GGG 40 OUTPUT SHAFT : SS 2142 DISHED SPRINGS : 50 CrV4 INDICATOR SHAFT : SUS316
OPERATING PRESSURE	135BAR
OIL DISPLACEMENT	0.05 LITER
ROTATION	90° ±1°
POWER INPUT	AC 220V
CERTIFICATE	A-14113 (ISSUED DNV CLASS), BV, GL

### 3. INSTALLATION GUIDE

GOOD



WRONG



P.NO.	DESCRIPTIONS	MATERIAL	Q'TY	REMARK
1	BODY	FCD450	1	or EQUAL
2	DISC	ALBC-T-TEFLON	1	or EQUAL
3	SEAT	PTFE	1	
4	STEM	SUS304	2	or EQUAL
5	PACKING	NBR	-	
6	PACKING RING	ACETAL	1	
7	PLUG	STEEL	1	+ Plated
8	BOLT	STEEL	2	

## NOTE

- 1.BASIC DESIGN : EN593/BS5155  
 2.FACE TO FACE : ISO5752 SERIES.20  
 / EN558 SERIES.20  
 3.FLANGE DRILLING : JIS B2220-5K/10K

## 4. HYDRO TEST

BODY	FLANGE RATING * 1.5
SEAT	FLANGE RATING * 1.1

## 5. BODY MARKING

Front	Back
	FCD 10K Heat No.

6. Flange or pipe inside diameter must be min. 3mm larger than  $\phi C$  dimension.

VALVE NO. : FCV01

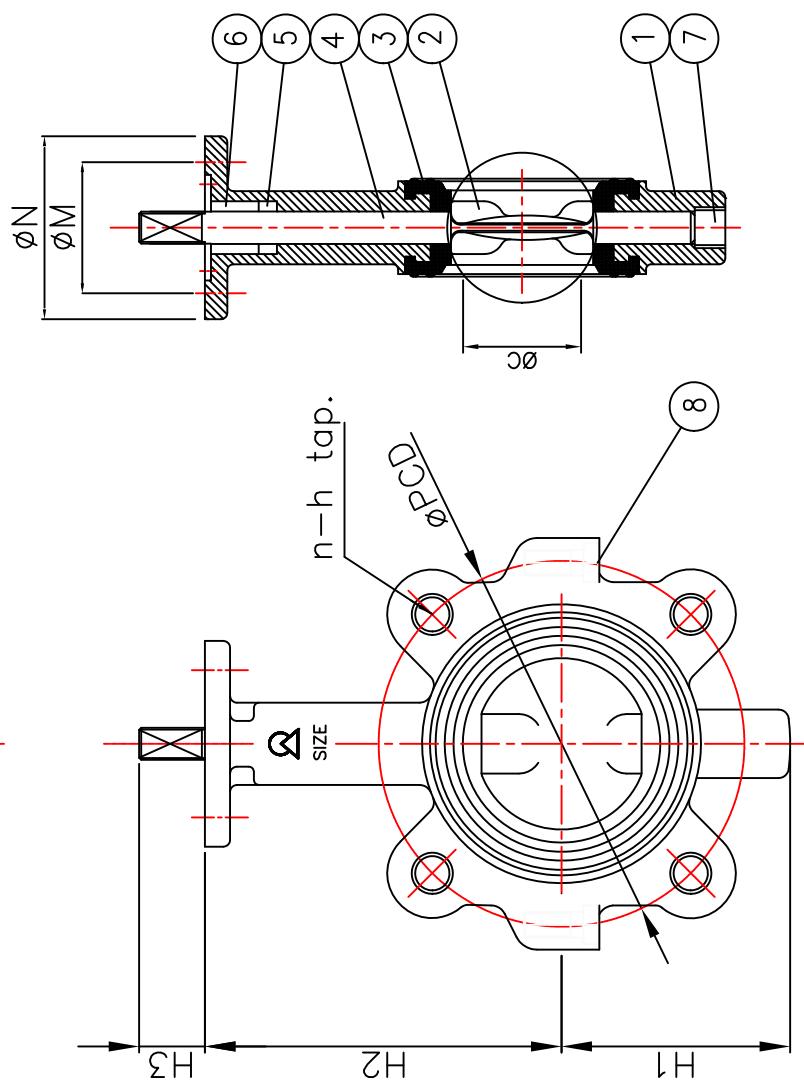
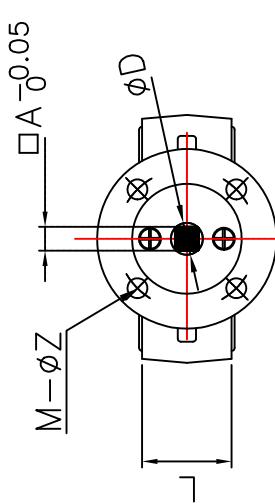
NO.	DATE	DESCRIPTION	DRA.	DES.	CHK.	APR.



YOOHAN VALVE

TITLE	BUTTERFLY VALVE LUG TYPE JIS 10K		
	BARE-SQUARE 50A		REV. NO.
APR.	SCALE	N / S	
CHK.	DATE	2010.10.08	
DES.	DWG No.	ATP-2005-021	△0

DIMENSIONS										Unit : mm	
SIZE	$\phi d$	FLANGE JIS 10K	REFERENCE						TOP FLANGE (ISO5211)	WEIGHT	
			L	H1	H2	H3	B	T			
									$\phi M$	$\phi N$	
50A(2")	51.5	120	4	M16	43	75	130	36	30	9	31.8
									14	F07	70
									14		90
									4-φ10		1.9



## COATING SPEC FOR BUTTERFLY VALVE

## CERTIFICATE OF ANALYSIS

TO :

ITEM NAME : KOMATON

PRODUCT CODE : AU5072MSE092

LOT NO. : HC60525011

PRODUCT NAME : UT5001-A-BLUE(KP)

ITEM	STANDARD	RESULT	REMARK
SPECIFIC GRAVITY	0.96 ~ 1	0.996	
NON VOLATILE	48 ~ 52 %	50.21	
STATE IN CONTAINER	GOOD	GOOD	
APPEARANCE	GOOD	GOOD	
FINENESS OF GRIND	MAX.30 $\mu\text{m}$	30	
VISCOSITY	60 ~ 70 KU	68	
COLOR	GOOD	GOOD	전LOT 비교
COLOR	MAX.2 ( $\Delta E$ )	1	*
WORKING PROPERTY	GOOD	GOOD	
HIDING POWER	GOOD	GOOD	
-End of Document-			

ISSUED DATE : 2016-08-22

- PAGE 1/1 -

TEST RESULT : PASS

THIS LETTER IS APPROVED BY Q.M MANAGER IN ACCORDANCE WITH COMPUTER DATA CONTROL SYSTEM OF K.C.C  
 THIS IS RESULT GOT BY THE AUTHORIZED METHODS OF KS,ASTM AND KCC

Q.M MANAGER / Ulsan Plant

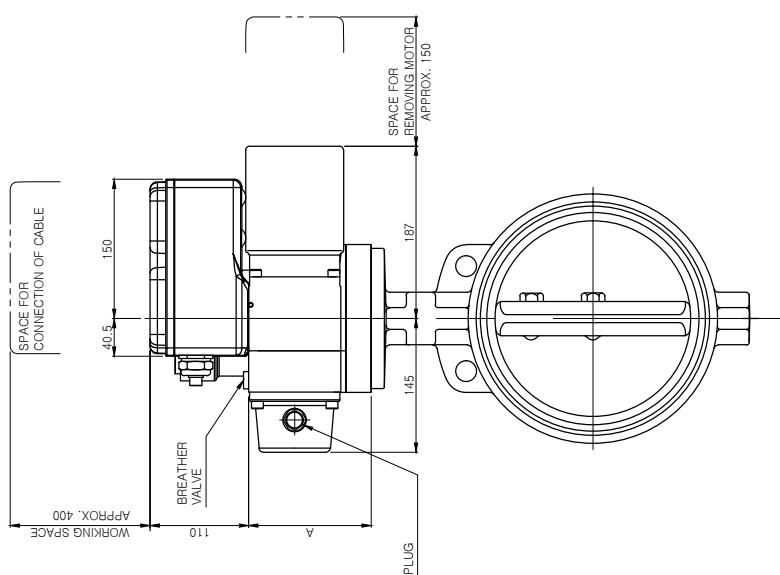
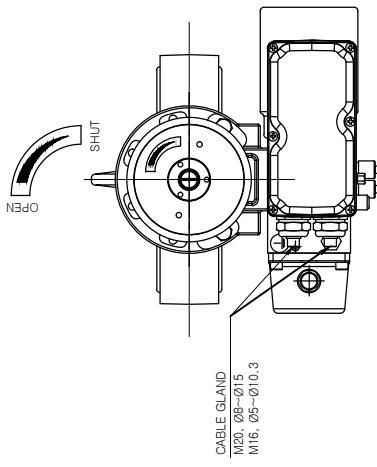


# FLOW CONTROL VALVE ( VALVE NO. : FCV01 )

REV	DESCRIPTION	CHKD	APPD	DATE
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\* ACTUATOR DIMENSION TABLE

	A	B	C	D	E	F	G	H
BRC250	121	174.5	231	156	59	21	181.5	150
BRC500	124.5	199	234.5	169	66	24.5	194.5	163
BRC1000	133	229	243	181	80	33	206.5	175
BRC2000	144	271	254	193	96	44	218.5	187
BRC4000	153	319	263	221	150	53	246.5	215



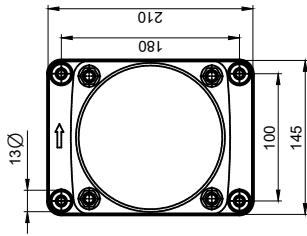
DIVISION	SPECIFICATION
TYPE	ELECTRO HYDRAULIC POWER UNIT(DOUBLE ACTING)
AMBIENT TEMP"	-20°C ~ 80°C
MATERIAL	HOUSING & PISTON : GGG 40 OUTPUT SHAFT : SS 2142 DISHED SPRINGS : 60 CrV4 INDICATOR SHAFT : SUS316
OPERATING PRESSURE	135BAR
OIL DISPLACEMENT	0.05 LITER
ROTATION	90° ± 1°
POWER INPUT	AC 220V
CERTIFICATE	A-14113 (ISSUED DIN CLASS), BV, GL

1. VALVE NO. : FCV01

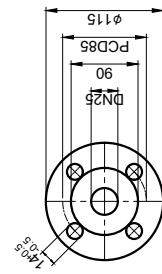
NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
K SHIPBUILDING	SHIP NAME	MODEL NAME			<b>JTECHCROSS</b>
DATE : 2022. 09. 08	PART NAME	FCV01			
APPD BY Y.M.KIM	DRAWING NO	FLOW CONTROL VALVE			
CHKD BY -	CVA00-GA-P0022				SHEET NO : 1 OF 1
DSND BY H.C.LEE	REV.	C			

1. WORD NUMBER/  
1. WERK-NUMMER/

## BASE PLATE DETAIL



## FLANGE DETAIL



Note	Model : Movitec VSF 4/8B
SIZES	1. Model : KSB TEFIC 100L LMV18/1P5F 2.2kW / 3.73A 440V 3525RPM

DN1	Drilled to JIS B 2235 16K 25A	3. Ambient temp. : -20~80 (Not freezing)
DN2	Drilled to JIS B 2235 16K 25A	4. Pump Material 1) Casing : 1.4408 / ASTM Gr.CF8M 2) Impeller : 1.4404 / ASTM SS316L

FLANGES  
FLANGES

3) Shaft : 14460 / ASIM SS329

5. Coating

1) Motor, Motor stool : Ultramarine Blue RAL 5002

2) Baseframe : Graphite Black RAL 9011

1c

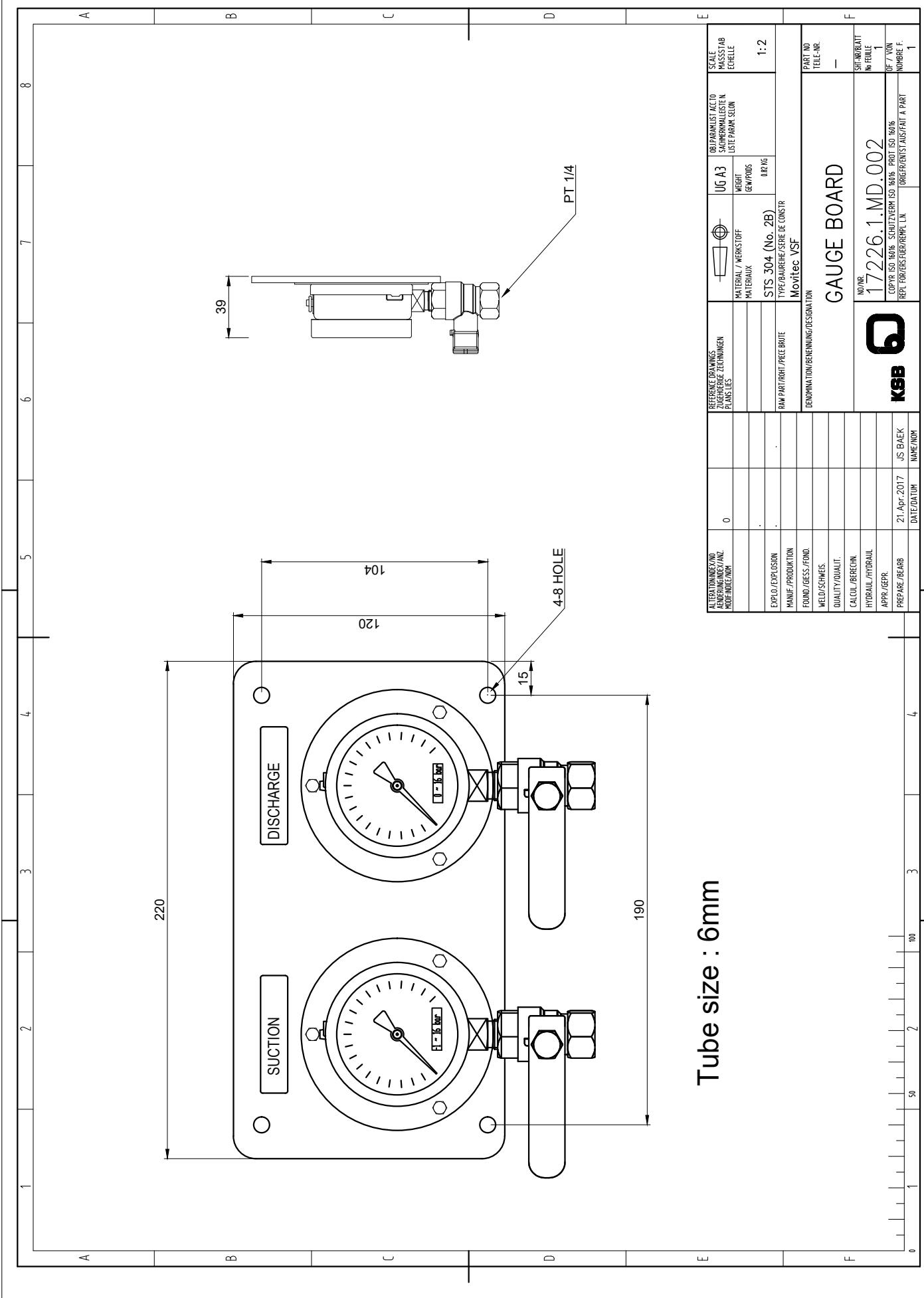
MOTOR	20
GUAGE & BOARD	3
TOTAL	39
WEIGHTS	KG

CONNECTION	SIZE	DESIGNATION	CLOSED WITH SCREW PLUG	CUSTOMER KSB	CONNECTED BY ✓
5D	G 3/8	VENTING	✓	-	-
6B.1	G 1/4	DRAIN	-	✓	-
6B.2	G 1/4	DRAIN	-	✓	-

THE EXECUTION OF THE ORDER IS MARKED BY ✓

CONNECTIONS

**GAUGE BOARD FOR  
MIXING SEA WATER PUMP**



## MIXING SEA WATER PUMP

### Operating data

Requested flow rate	3.00 m <sup>3</sup> /h	Actual flow rate	3.11 m <sup>3</sup> /h
Requested developed head	90.00 m	Actual developed head	96.74 m
Pumped medium	Water, sea and brackish water Sea water	Efficiency	55.5 %
Pumped medium details	Not containing chemical and mechanical substances which affect the materials	Power absorbed	1.52 kW
Max. ambient air temperature	20.0 °C	Pump speed of rotation	3532 rpm
Min. ambient air temperature	20.0 °C	NPSH required	1.98 m
Fluid temperature	15.0 °C	Permissible operating pressure	25.00 bar.g
Fluid density	1029 kg/m <sup>3</sup>	Discharge press.	9.76 bar.g
Fluid viscosity	1.21 mm <sup>2</sup> /s	Shutoff head	107.70 m
Suction pressure max.	0.00 bar.g	Min. allow. flow for continuous stable operation	0.60 m <sup>3</sup> /h
Mass flow rate	0.89 kg/s	Min. allow. mass flow for continuous stable operation	0.17 kg/s
Max. power on curve	2.11 kW	Design	Single system 1 x 100 % Tolerances to ISO 9906 Class 3B; below 10 kW acc. to paragraph 4.4.2
Max. allow. mass flow	2.25 kg/s		

### Design

Pump standard	KSB high pressure in-line international execution	Shaft seal manufacturer	DP
Design	Close-coupled	Shaft seal type	RMG-AC
Orientation	Vertical	Material code	U3U3VGG
Suction nominal dia.	DN 25	Shaft seal code	16
Suction nominal pressure	16K	Sealing plan	I Single-acting mechanical seal(internal circulation)
Suction position	90° (right)	Pumped liquid without solids in continuous operation	
Connection standard discharge	JIS	Seal chamber design	Standard seal chamber
Discharge nominal dia.	DN 25	Contact guard	With
Discharge nominal pressure	16K	Impeller diameter	86.0 mm
Discharge position	270° (left 90°)	Direction of rotation from drive	Clockwise
Round flange (F)		Color	Graphite black (RAL 9011)
Shaft seal	Single acting mechanical seal		

## MIXING SEA WATER PUMP

### Driver, accessories

Driver type	Electric motor	Insulation class	F to IEC 34-1
Drive standard mech.	IEC	Motor enclosure	IP55
Drive standard elec.	IEC	Cos phi at 4/4 load	0.89
Model (make)	KSB	Motor efficiency at 4/4 load	86.1 %
Drive supplied by	Standard motor supplied by KSB - mounted by KSB	Temperature sensor	Without
Motor const. type	V18	Terminal box position	90° (right) Viewed from the drive
Motor size	90L	Motor winding	460 V
Efficiency class	Efficiency class IE3 acc. to IEC60034-30-1	Number of poles	2
Motor speed	3529 rpm	Fixed bearing reinforced	axial
Frequency	60 Hz	Connection mode	Star
Rated voltage	440 V	Motor cooling method	Surface cooling
Rated power P2	2.20 kW	Motor material	Aluminium
Performance limit P2max	2.50 kW	Frequency inverter operation allowed	FI allowed
Available reserve	64.75 %	Motor noise pressure level	66 dBA
Rated current	3.73 A		
Starting current ratio	6		

### Materials VS

Notes	Motor stool (341)	Grey cast iron EN-GJL-250
For continuous operation only; in case of stoppage greater than 24 h, flushing with tap water is necessary to prevent local corrosion.	O-Ring (412)	Fluor caoutchouc FPM
Pump shroud (10-6)	Seal cover (471)	Stainless steel 1.4408
Pump casing (101)	Bearing sleeve (529)	Tungsten Carbide
Stage casing (108)	Flange (723)	Ductile cast iron
Cover (160)	Baseplate (890)	EN-GJS-400-15
Diffuser (171)	Screwed plug (903)	Grey cast iron EN-GJL-250
Shaft (210)	Tie bolt (905)	CrNiMo steel 1.4404
Impeller (230)	Nut (920)	Chrome steel 1.4057+QT800
		CrNiMo steel 1.4404

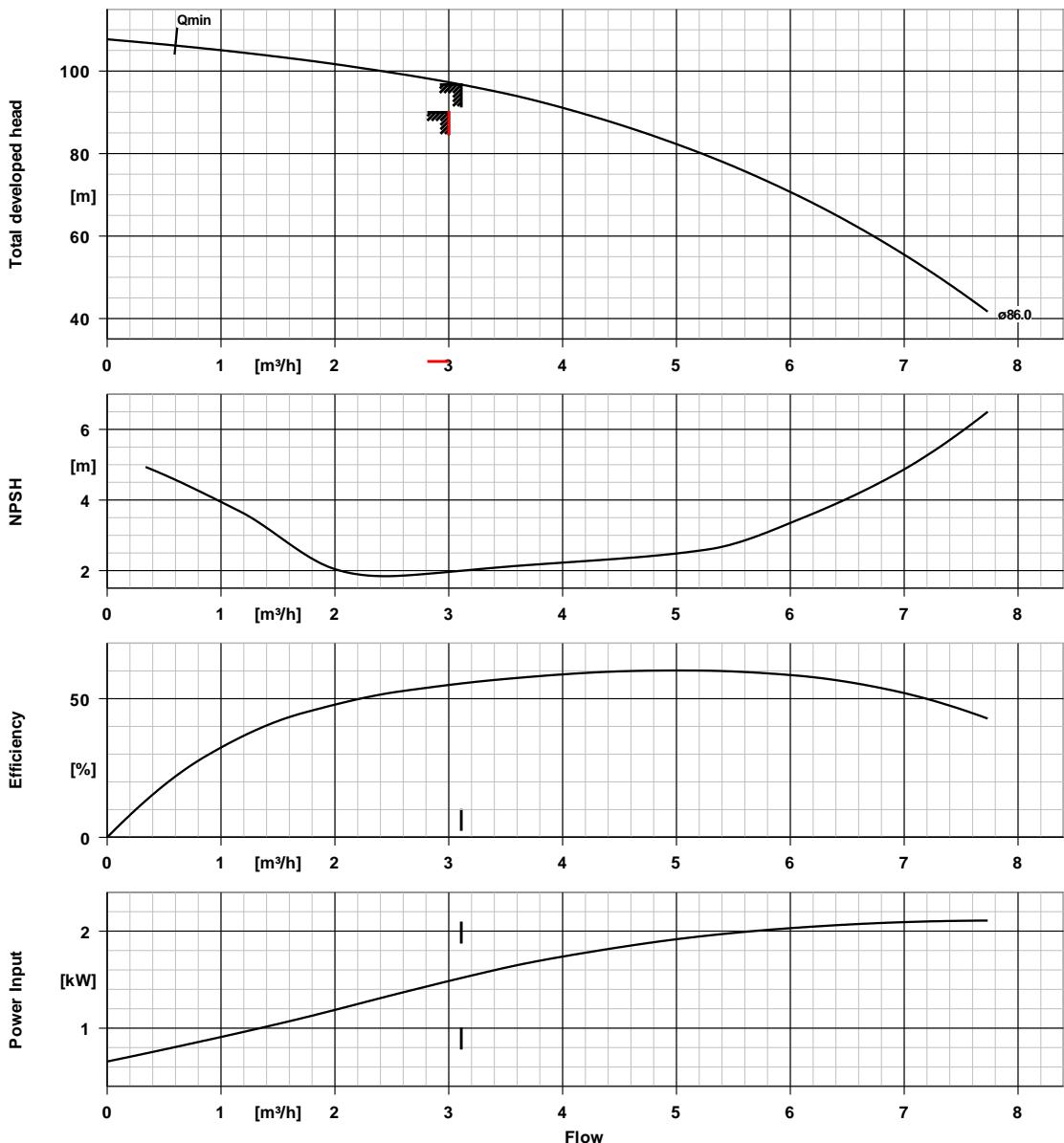
### Packaging

Packaging category	A1 Throw-away pallet	Packaging for transport	Truck
Packaging for storage	Indoor	IPPC Standard ISPM 15	Yes

### Nameplates

Nameplates language	International
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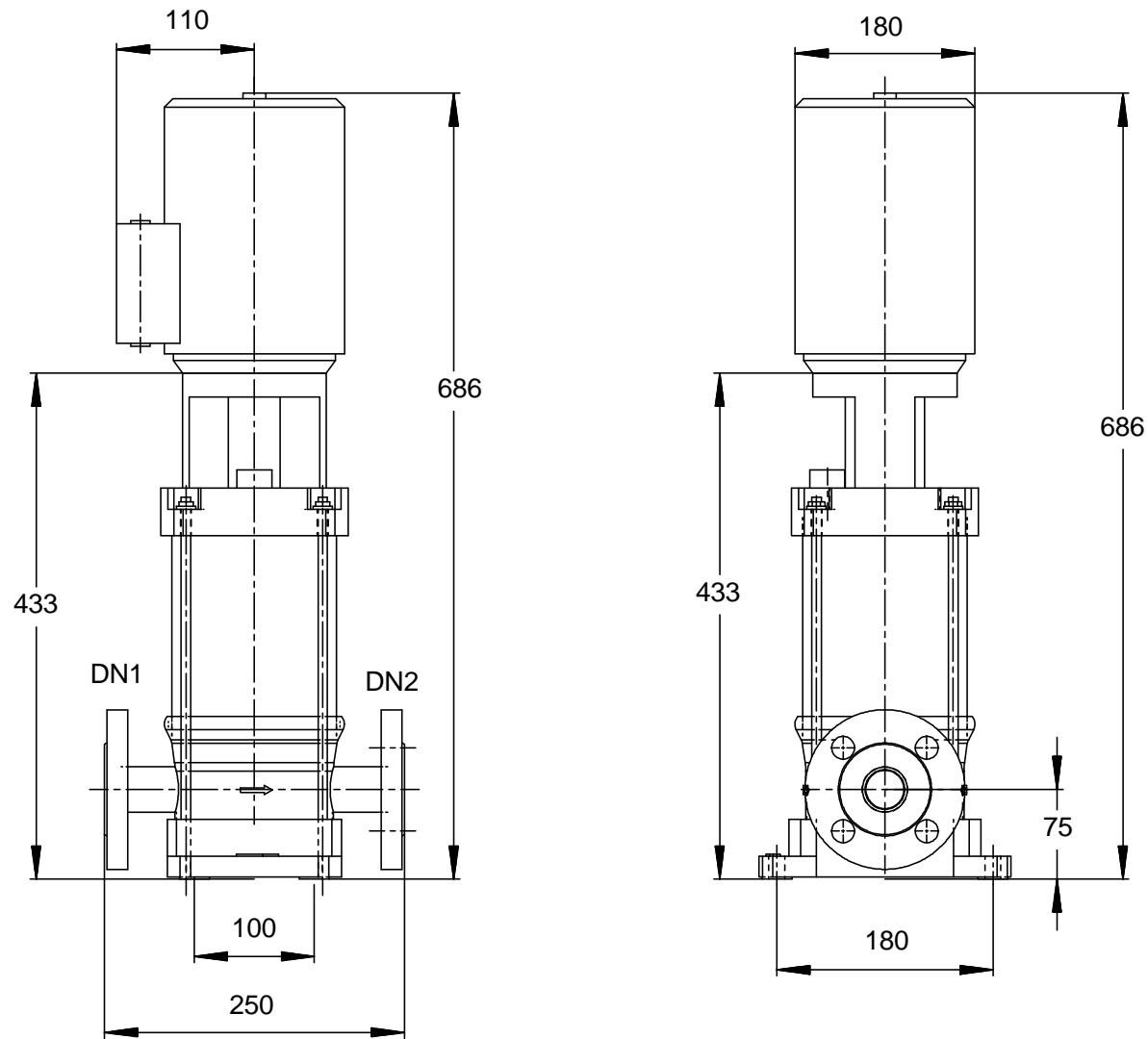
## MIXING SEA WATER PUMP



### Curve data

Speed of rotation	3532 rpm	Efficiency	55.5 %
Fluid density	1029 $\text{kg/m}^3$	Power absorbed	1.52 kW
Viscosity	1.21 $\text{mm}^2/\text{s}$	NPSHR	1.98 m
Flow rate	3.11 $\text{m}^3/\text{h}$	Curve number	K95000401/2
Requested flow rate	3.00 $\text{m}^3/\text{h}$	Effective impeller diameter	86.0 mm
Total developed head	96.74 m	Acceptance standard	Tolerances to ISO 9906 Class 3B; below 10 kW acc. to paragraph 4.4.2
Requested developed head	90.00 m		

## MIXING SEA WATER PUMP



*Drawing is not to scale*

*Dimensions in mm*

## MIXING SEA WATER PUMP

**Motor**

Motor manufacturer	KSB (DMW)
Motor size	90L
Motor power	2.20 kW
Number of poles	2
Speed of rotation	3529 rpm
Position of terminal box	90° (right) Viewed from the drive
Thrust bearing housing	No

**Connections**

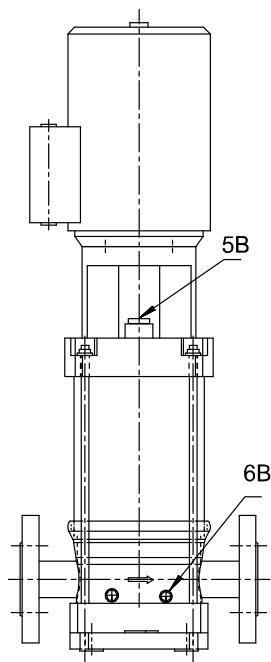
Suction nominal size DN1	DN 25 / JIS
Discharge nominal size DN2	DN 25 / JIS
Nominal pressure suct.	16K
Rated pressure disch.	16K
Round flange (F)	

**Weight net**

Pump	16 kg
Motor	20 kg
Total	36 kg

**Connect pipes without stress or strain!**

**For auxiliary connections see  
separate drawing.**



### Connections

5B venting

6B Pumped liquid drain

G 3/8

G 1/4

Closed with venting plug

Drilled and plugged.

SPARE PARTS LIST

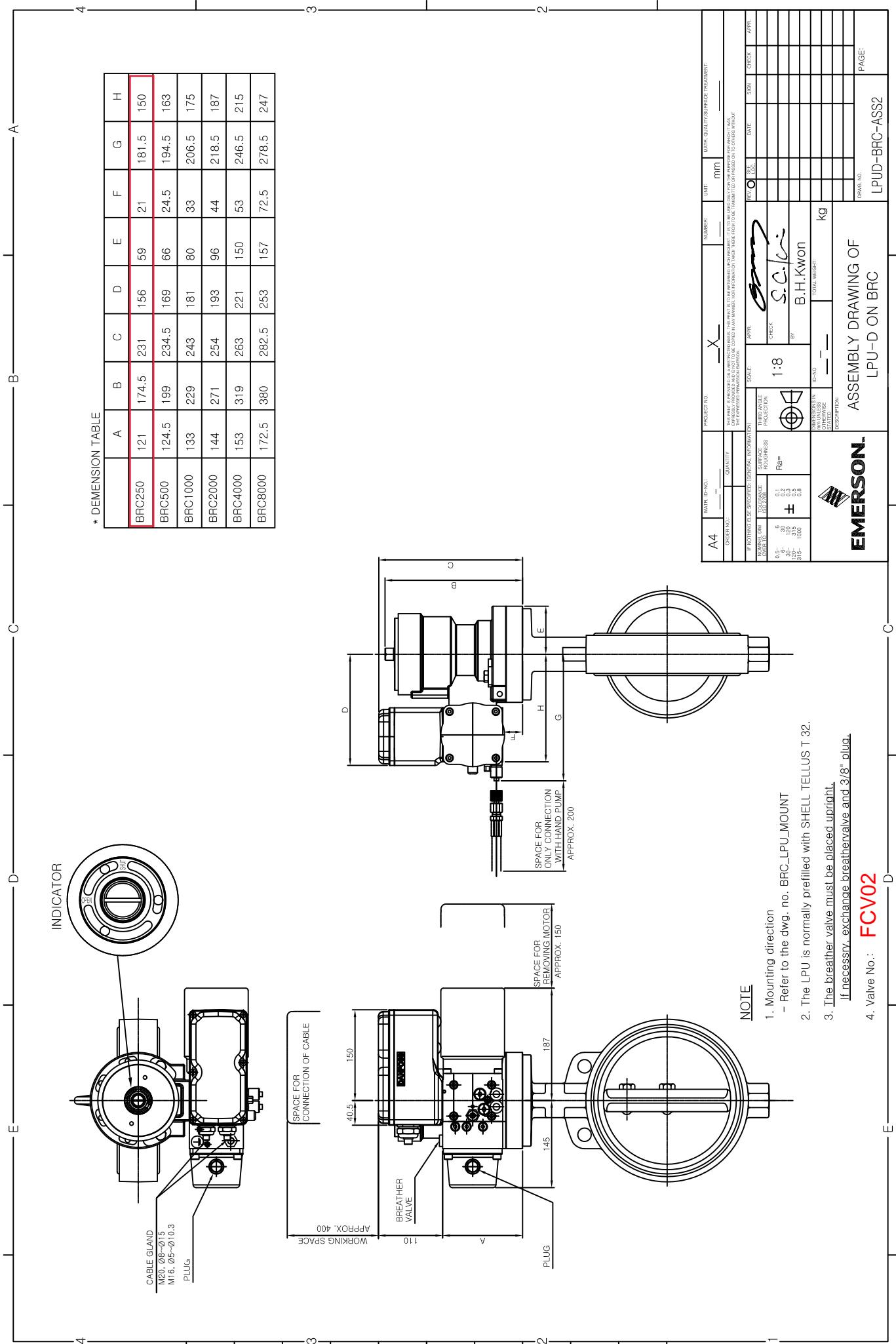
Customer: Techcross

Shipyard:

Hull no.:

Item	Service	Pump	Qty/ship	Spare parts	Drawing
1	Easy access	MOVITEC VSF 6	1	Mechanical seal kit (Part no. 433.01)	A technical line drawing of a mechanical seal assembly. It shows a vertical housing with a flange at the top. A shaft extends from the bottom, with a keyway and a shoulder. A circular seal ring is positioned between the housing and the shaft. The part number 969 is indicated near the top flange. Below the housing, the part number 412.06 is shown next to a small oval. At the bottom, the part number 433 is shown next to a detailed view of the seal ring.

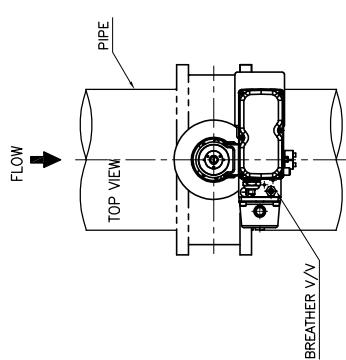
# FLOW CONTROL VALVE (FCV02)



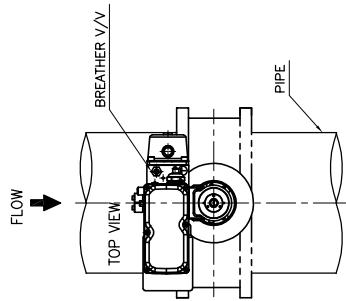
## FLOW CONTROL VALVE (FCV02)

HORIZONTAL PIPE

ACTUATOR TURN AS 180°

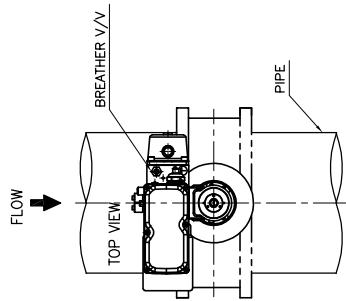


### TYPE A (STANDARD)

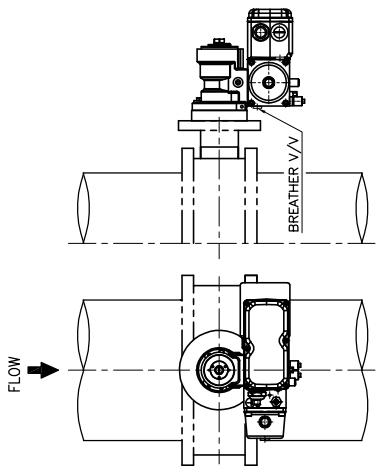


TYPE C

ACTUATOR TURN AS 180°

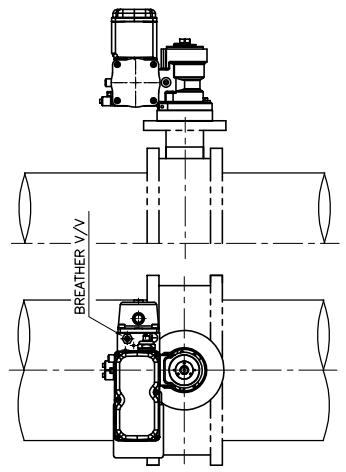


TYPE C



TYPE E

Note) "F" Position is not available for FFx



TYPE G

1. THE BREATHER VALVE MUST BE PLACED UPRIGHT. IF NECESSARY, EXCHANGE BREATHER VALVE AND 3/8" PLUG.
2. DAMCOS RECOMMEND SUPPORT OF THE LPU ACTUATOR WHEN ON SMALLER VALVES (<=100) FOR PROTECTION OF THE VALE NECK
3. THE LPU IS NORMALLY PRE-FILLED WITH SHELL TELLUS S2 V32 (T 32)

P.NO.	DESCRIPTIONS	MATERIAL	Q'TY	REMARK
1	BODY	FCD450	1	or EQUAL
2	DISC	ALBC-T-TEFLON	1	or EQUAL
3	SEAT	PTFE	1	
4	STEM	SUS304	2	or EQUAL
5	PACKING	NBR	-	
6	PACKING RING	ACETAL	1	
7	PLUG	STEEL	1	+ Plated
8	BOLT	STEEL	2	

## NOTE

- 1.BASIC DESIGN : EN593/BS5155  
 2.FACE TO FACE : ISO5752 SERIES.20  
 / EN558 SERIES.20  
 3.FLANGE DRILLING : JIS B2220-5K/10K

## 4. HYDRO TEST

BODY	FLANGE RATING * 1.5
SEAT	FLANGE RATING * 1.1

## 5. BODY MARKING

Front	Back
	FCD 10K Heat No.

6. Flange or pipe inside diameter must be min. 3mm larger than  $\phi C$  dimension.

VALVE NO. : FCV02

NO.	DATE	DESCRIPTION	DRA.	DES.	CHK.	APR.

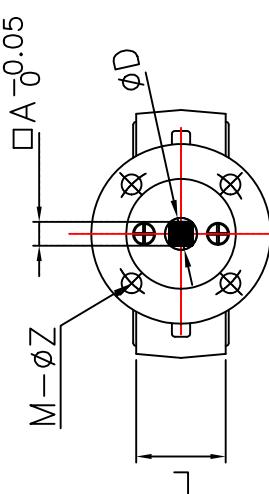
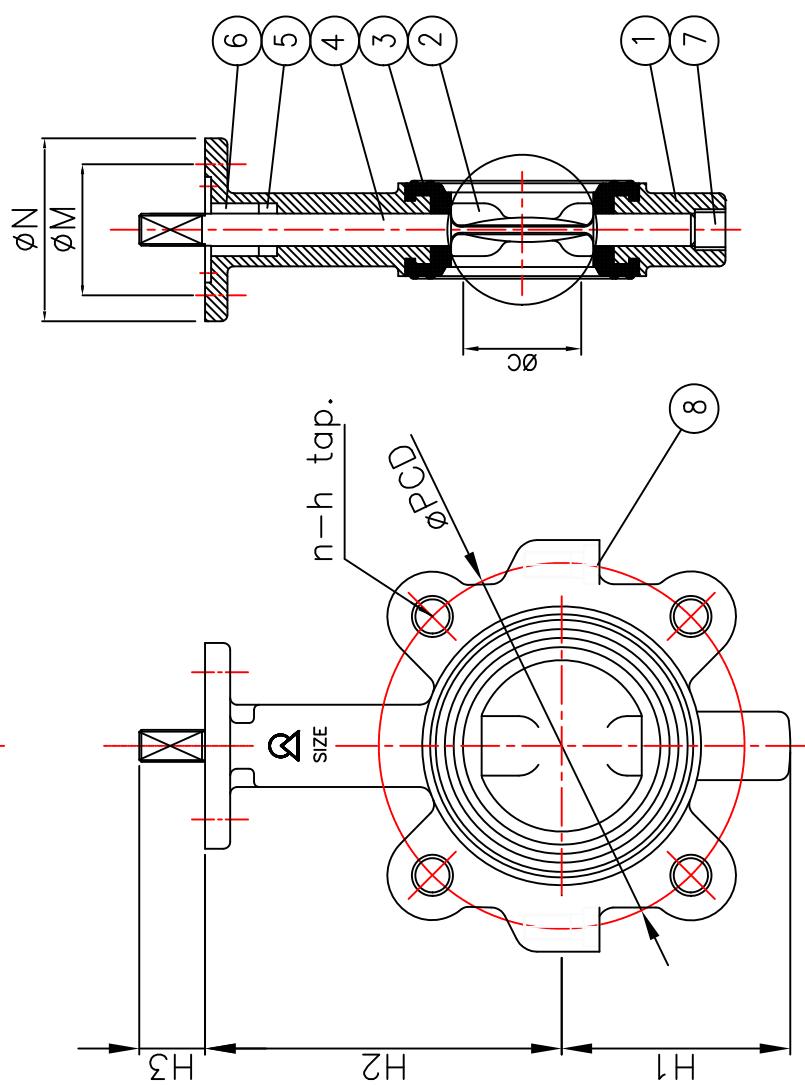


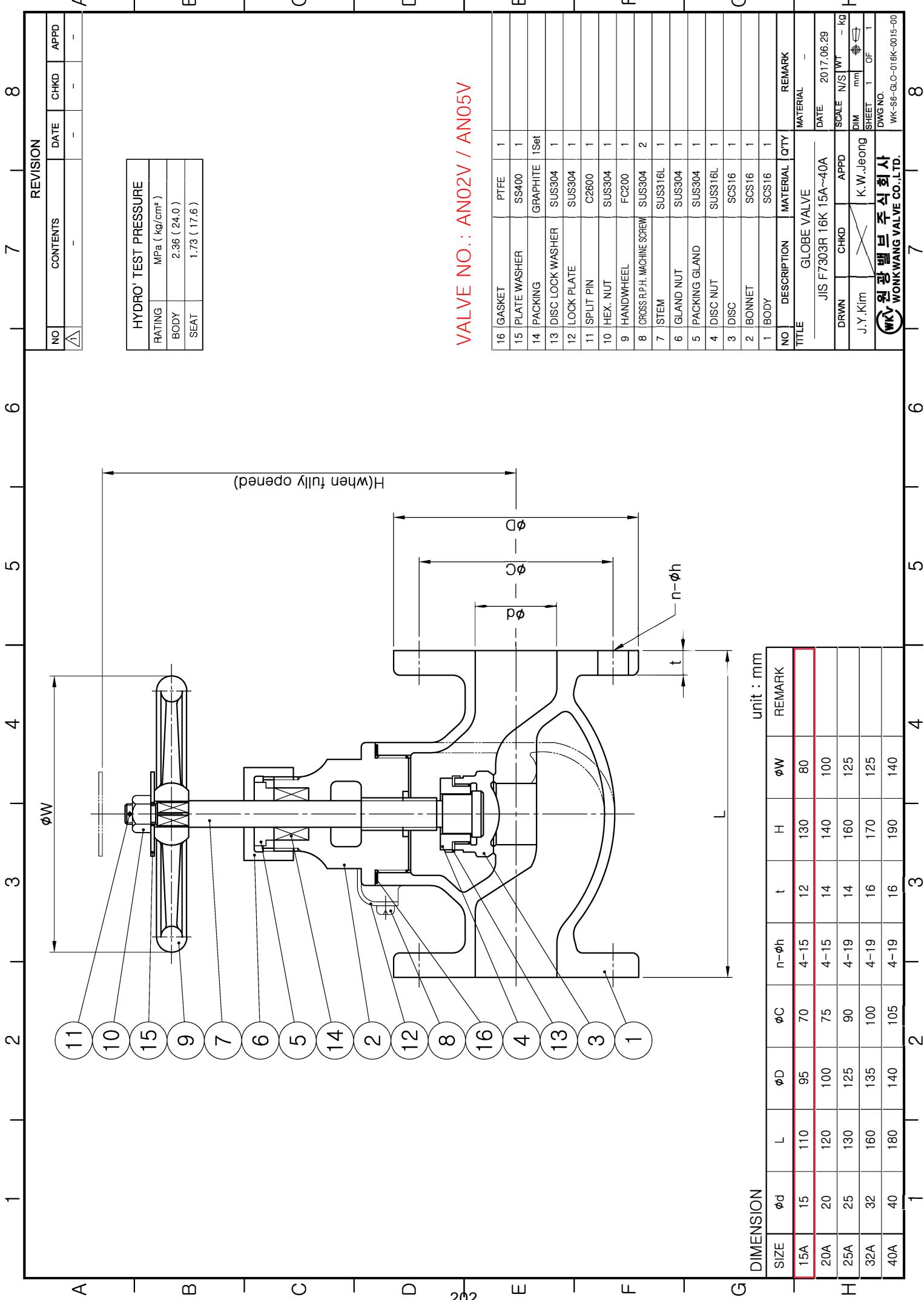
YOOHAN VALVE

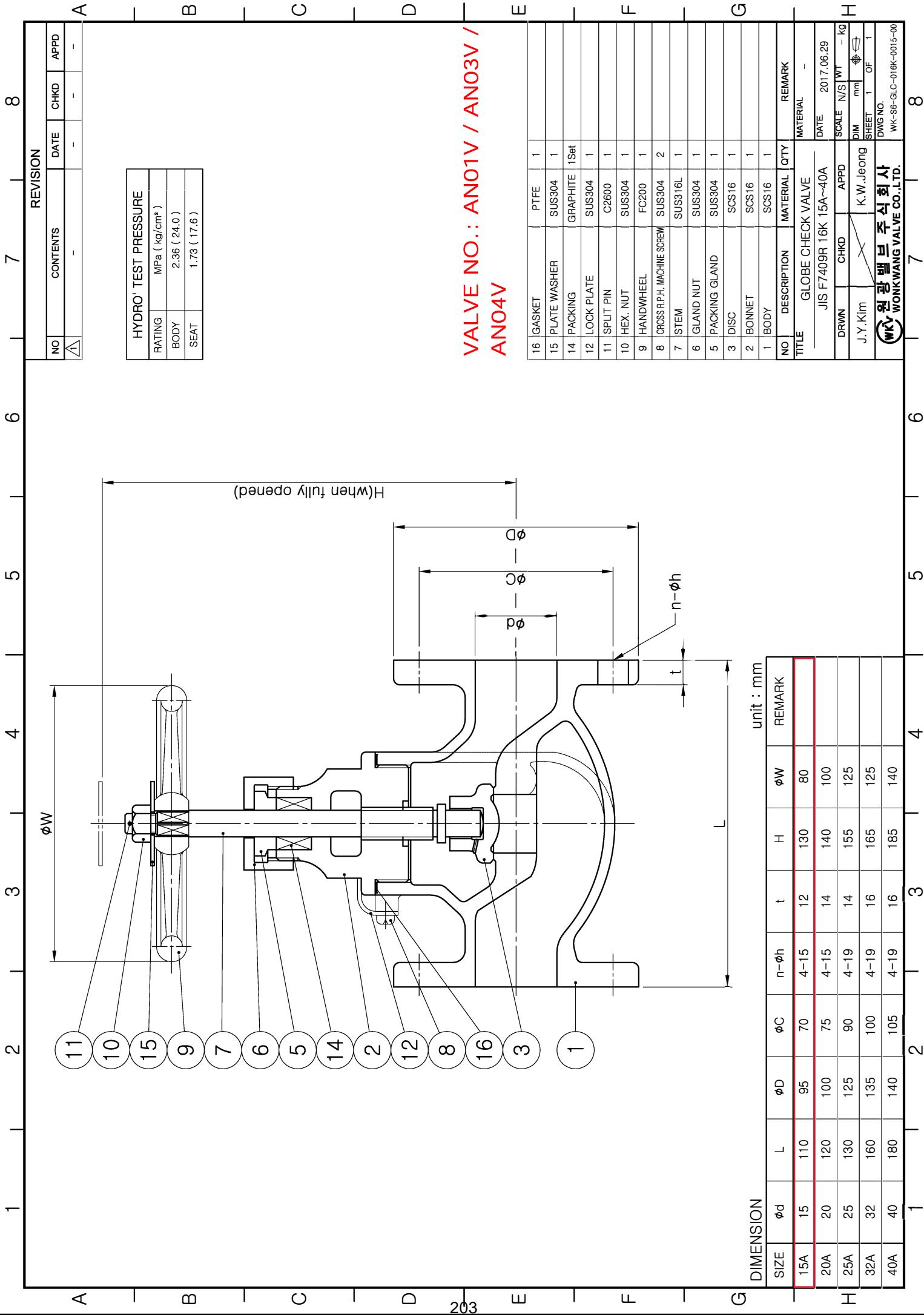
BUTTERFLY VALVE LUG TYPE JIS 10K  
 BARE-SQUARE 50A

TITLE	BUTTERFLY VALVE LUG TYPE JIS 10K		
APR.	CHK.	DES.	DWG No. ATP-2005-021

DIMENSIONS											Unit : mm							
SIZE	$\phi d$	FLANGE JIS 10K	REFERENCE				STEM		TOP FLANGE (ISO5211)		WEIGHT (Kg)							
			$\phi PCD$	n	$\phi h$	L	H1	H2	H3	B	T	$\phi C$	$\square A$	$\phi D$	TYPE	$\phi M$	$\phi N$	$M-\phi Z$
50A(2")	51.5	120	4	M16	43	75	130	36	30	9	31.8	11	14	F07	70	90	4- $\phi 10$	1.9



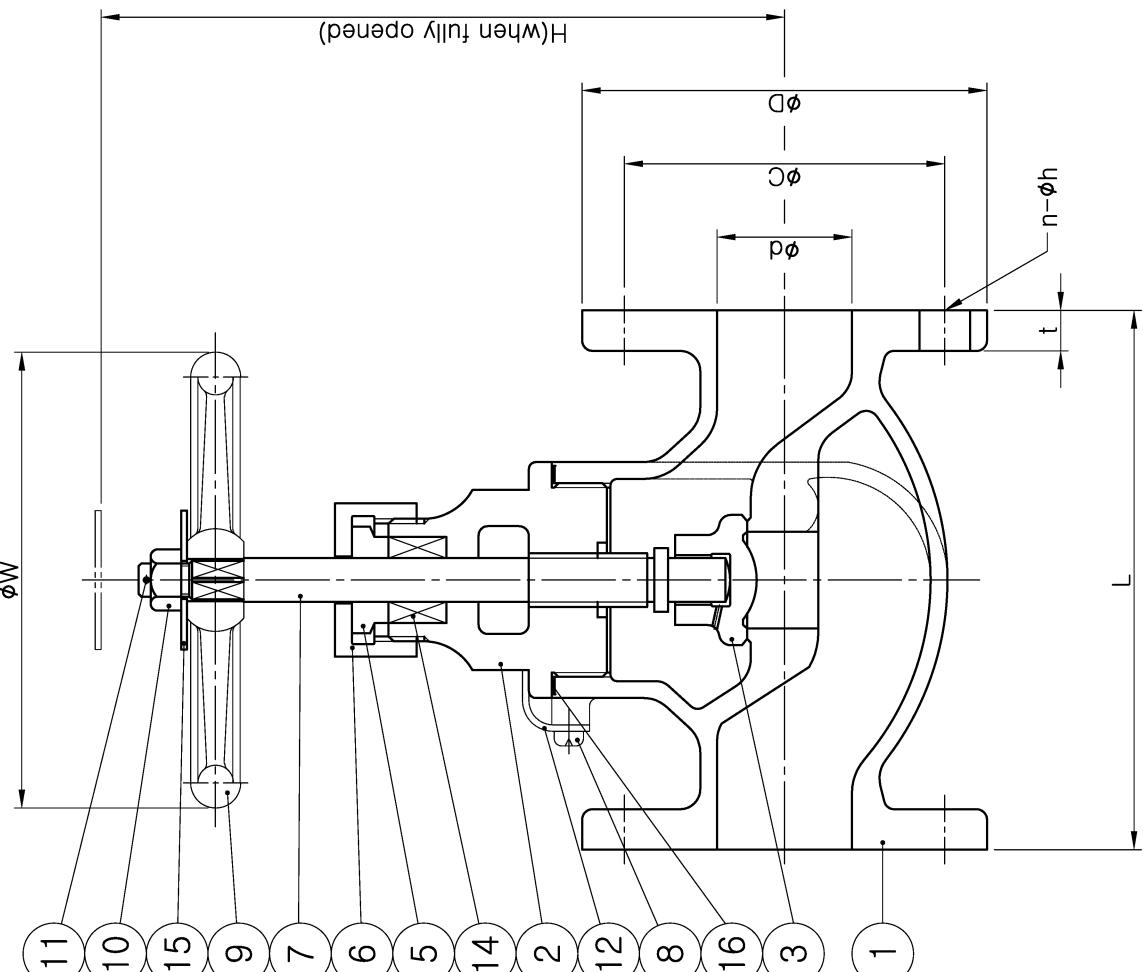




REVISION				
NO	CONTENTS	DATE	CHKD	APPD
△	-	-	-	-

HYDRO' TEST PRESSURE	
RATING	MPa ( kg/cm <sup>2</sup> )
BODY	2.36 ( 24.0 )
SEAT	1.73 ( 17.6 )

VALVE NO.: SS01V, SS02V, SS03V



unit : mm

DIMENSION

SCS16 1						REMARK
NO	DESCRIPTION	MATERIAL	Q'TY	MATERIAL	DATE	
TITLE GLOBE CHECK VALVE						-
	JIS F7409R 16K 15A~40A				2017.06.29	
DRWN	CHKD	APPD	SCALE N/S WT	mm	kg	
J.Y.Kim	X	K.W.Jeong	SHEET 1	OF 1	DWG NO.	
 원광밸브 주식회사	WOKWANG VALVE CO.,LTD.		WK-S6-GLC-01BK-0015-00			



ECS-HYCHLOR  
GENERAL SPECIFICATION

SHIP YARD : K SHIPBUILDING

HULL NO. : S1940

MODEL : ECS-HYCHLOR-1200

## DETAIL OF THE EWU

### 1. Electrode module Washing Unit (EWU)

#### 1.1 TANK

DIVISION	SPECIFICATION
DIMENSION	Ø600 X 1400(H)
CAPACITY (WATER TANK)	300 L
MATERIAL	LLDPE
WEIGHT	31.5kg

#### 1.2 TANK SUPPORT

DIVISION	SPECIFICATION
DIMENSION (W x D x H)	670mm X620mm X500mm
MATERIAL	SS400
WEIGHT	52.5kg

## **EWU OPERATION PROCEDURE**

HGU / EWU (300L)

# EWU OPERATION PROCEDURE

## HGU / EWU (300L)

### (1) Filling of fresh water in EWU tank

Diagram (1) shows a hose assembly connected from a 'YARD PIPE CONNECTOR (MAKER SUPPLY)' to an 'EWU TANK'. The tank has a valve labeled 'V/V Close'.

### (2) Mixing of Citric acid

Diagram (2) shows a system for mixing citric acid. It consists of three hose assemblies. The first assembly connects an 'EWU TANK' to a 'PUMP'. The second assembly connects the 'PUMP' to a third assembly. The middle section of the second assembly has a valve labeled 'V/V Open'.

### (3) Filling of cleaning agent in HGU

Diagram (3) shows a complex hose assembly connecting an 'EWU TANK' to an 'HGU' unit. The assembly includes various valves and components labeled: 'EM CLEANING JIS 10K 50A', 'HGU INLET VALVE : CLOSE', 'HGU OUTLET VALVE : CLOSE', and 'PUMP'. Instructions include 'HOLDING TIME 60 MINUTES', 'V/V CLOSE CLOSE THE V/V AFTER FILLING HGU WITH CLEANING AGENT', and 'TURN OFF THE PUMP AFTER FILLING HGU WITH CLEANING AGENT'. A note at the top right says '\*CHECK "EM CLEANING FLANGE" ON THE HGU DRAWING.'

### (4) Circulating cleaning agent for cleaning

Diagram (4) shows a similar system to Diagram (3) for circulating cleaning agent. It consists of a hose assembly connecting an 'EWU TANK' to an 'HGU' unit. The assembly includes valves and components labeled: 'EM CLEANING JIS 10K 50A', 'HGU INLET VALVE : CLOSE', 'HGU OUTLET VALVE : CLOSE', and 'PUMP'. Instructions include 'HOLDING TIME 60 MINUTES', 'V/V CLOSE CLOSE THE V/V AFTER FILLING HGU WITH CLEANING AGENT', and 'TURN OFF THE PUMP AFTER FILLING HGU WITH CLEANING AGENT'. A note at the top right says '\*CHECK "EM CLEANING FLANGE" ON THE HGU DRAWING.'

### (5) Discharging cleaning agent

Diagram (5) shows a hose assembly connecting an 'EWU TANK' to a 'YARD PIPE CONNECTOR (MAKER SUPPLY)'. The tank has a valve labeled 'V/V Close'.

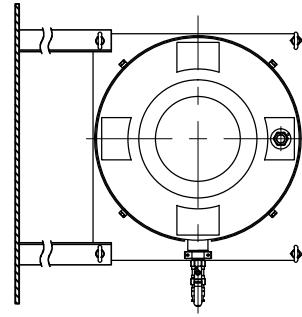
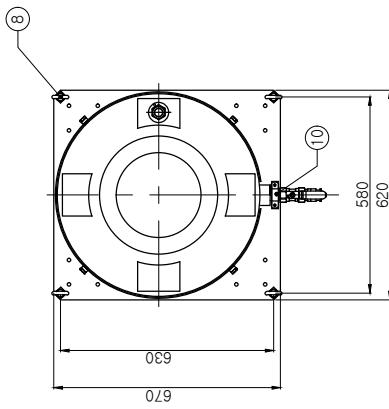
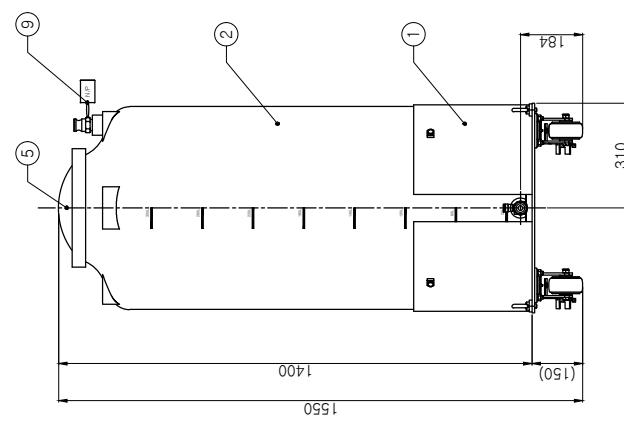
### (6) Rising with fresh water

Diagram (6) shows a hose assembly connecting an 'EWU TANK' to a 'YARD PIPE CONNECTOR (MAKER SUPPLY)'. The tank has a valve labeled 'V/V Close'. The assembly includes a valve labeled 'HGU INLET VALVE : CLOSE' and a note 'RISING OUT TIME 15 MINUTES'.

\* PLEASE CHECK THE EM CLEANING FLANGE AND DETAILS IN HGU DRAWING.

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
SHIP YARD	HULL NO.	MODEL NAME			
K SHIPBUILDING	S1940	EWU			
DRAWING NO	EWU000-GB-G001A-S1940	PART NAME			
APPD BY	Y.M.KIM	DATE : 2022. 09. 08			
CHKD BY	-	APPD BY			
DSND BY	H.C.LEE	CHKD BY			
		DSND BY			
					SHEET NO : 1 OF 1
					TECHCROSS

REV	DESCRIPTION	CHKD	APPD	DATE
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SWAY-SUPPORT GUIDANCEFRONT VIEWSIDE RIGHT VIEW

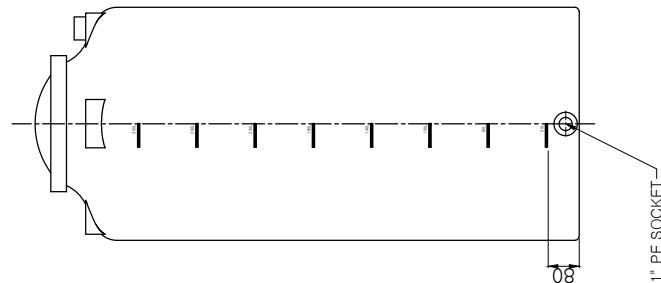
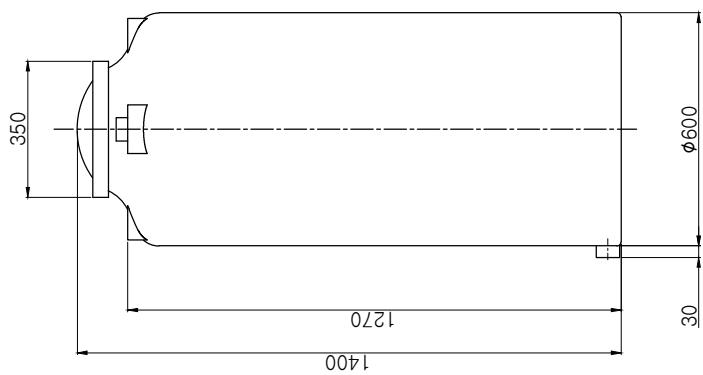
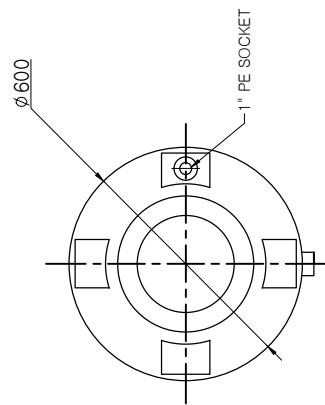
NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
10	PIPE BAND	25A	SPCC	1	-
9	NAME PLATE	-	-	1	-
8	EYE BOLT	M12	SS400	4	-
7	SWIVEL WITH BRACIE CASTER	LOAD CAPACITY(PS) : 320kg	STEEL/URETHANE	2	-
6	RIGID CASTER	LOAD CAPACITY(PS) : 320kg	STEEL/URETHANE	2	-
5	TANK TOP CAP	-	LLDPE	1	-
4	TANK OUTLET CONNECTOR	25A CAMLOCK	SUS304	1	-
3	TANK INLET CONNECTOR	25A CAMLOCK	SUS304	1	-
2	WATER TANK (300L PE TANK)	300L	LLDPE	1	-
1	EWU FRAME ASSY	-	SS400	1	-
NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK

SHIP YARD      HULL NO.      MODEL NAME  
K SHIPBUILDING      S1940      EWU

**JTECHCROSS**

DATE : 2022. 09. 08      PART NAME      ELECTRODE MODULE(EM) WASHING UNIT  
APPD BY Y.M.KIM      DRAWING NO      EWU000-GA-A001A-S1940  
CHKD BY -      DSNID BY H.C.LEE      SHEET NO : 1 OF 1  
REV.      0

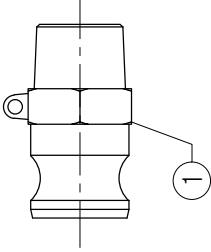
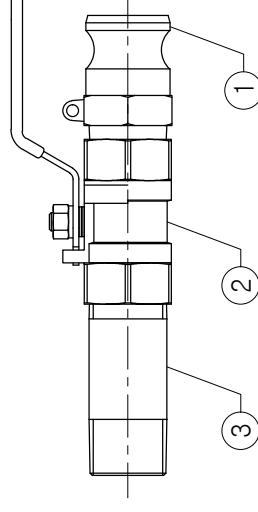
REV	DESCRIPTION	CHKD	APPD	DATE
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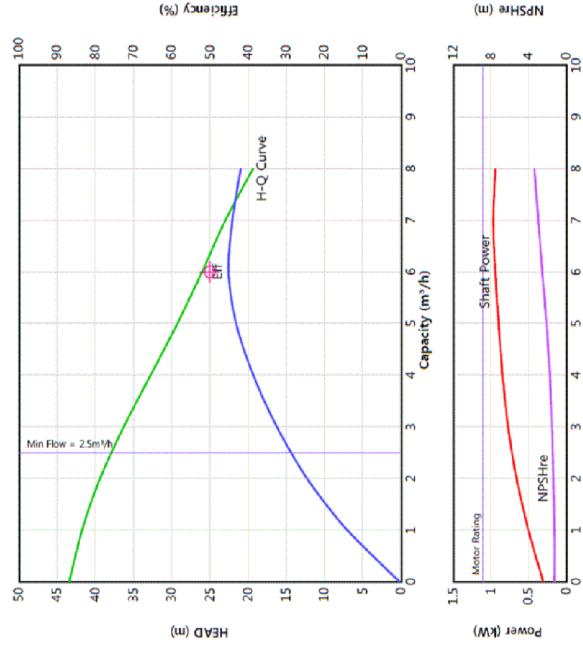
NOTE  
 1. MATERIAL : LLDPE  
 2. MODEL : 300L  
 3. THICKNESS : T=5.0

NO	PART NAME	HULL NO.	MODEL NAME	SPEC	MATERIAL	Q'TY	REMARK
K SHIPBUILDING	S1940	EWU					TECHCROSS

DATE : 2022. 09. 08	PART NAME	WATER TANK (300L PE TANK)	SHEET NO : 1 OF 1
APPD BY Y.M.KIM	DRAWING NO	EWU000-00-P001Z-S1940	REV. 0
CHKD BY -			
DSND BY H.C.LEE			

REV	DESCRIPTION	CHKD	APPD	DATE																																										
TANK INLET CONNECTOR																																														
																																														
TANK OUTLET CONNECTOR																																														
																																														
<b>TECHCROSS</b> 																																														
DATE : 2022. 09. 08 PART NAME : TANK INLET / OUTLET CONNECTOR APPD BY Y.M.KIM DRAWING NO. : EWU00-GC-A004Z-S1940 CHKD BY - DSND BY H.C.LEE SHEET NO : 1 OF 1 REV. 0																																														
<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>NO</th> <th>PART NAME</th> <th>SPEC</th> <th>MATERIAL</th> <th>Q'TY</th> <th>REMARK</th> </tr> </thead> <tbody> <tr> <td>3</td> <td>PIPE</td> <td>25A</td> <td>SUS304</td> <td>1</td> <td></td> </tr> <tr> <td>2</td> <td>BALL VALVE</td> <td>25A</td> <td>SUS304</td> <td>1</td> <td></td> </tr> <tr> <td>1</td> <td>CAMLOCK</td> <td>25A, MALE SCREW</td> <td>SUS304</td> <td>2</td> <td></td> </tr> <tr> <td>NO</td> <td>PART NAME</td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>SHIP YARD</td> <td>HULL NO.</td> <td>MODEL NAME</td> <td></td> <td></td> <td></td> </tr> <tr> <td>K SHIPBUILDING</td> <td>S1940</td> <td>EWU</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>					NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK	3	PIPE	25A	SUS304	1		2	BALL VALVE	25A	SUS304	1		1	CAMLOCK	25A, MALE SCREW	SUS304	2		NO	PART NAME					SHIP YARD	HULL NO.	MODEL NAME				K SHIPBUILDING	S1940	EWU			
NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK																																									
3	PIPE	25A	SUS304	1																																										
2	BALL VALVE	25A	SUS304	1																																										
1	CAMLOCK	25A, MALE SCREW	SUS304	2																																										
NO	PART NAME																																													
SHIP YARD	HULL NO.	MODEL NAME																																												
K SHIPBUILDING	S1940	EWU																																												

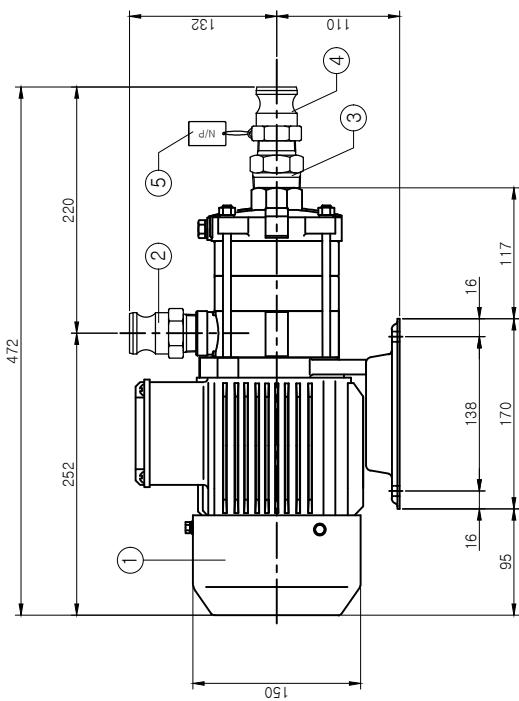
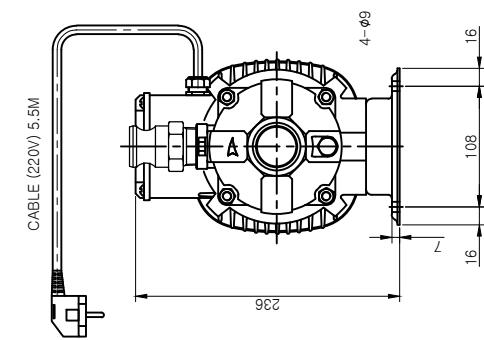
REV.	DESCRIPTION	CHKD	APPD	DATE
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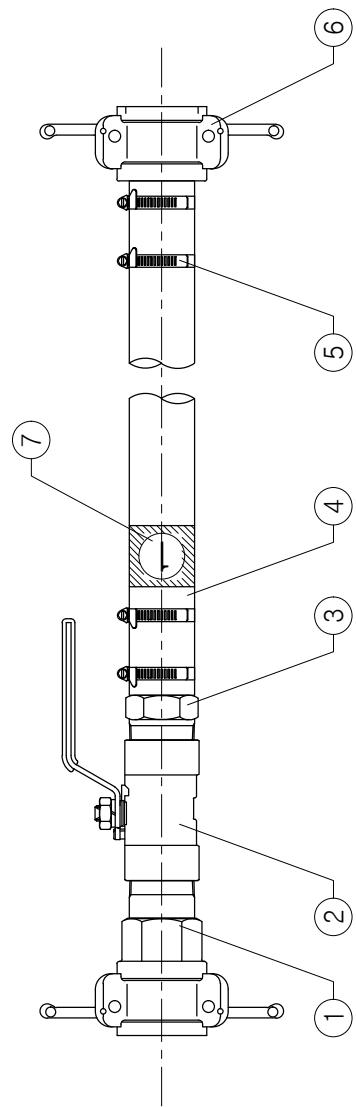
- NOTE  
 1. CONNECTION PART SHOULD BE TAPER BY TEFELON TAPE  
 3. PUMP MODEL : DOOCH, DHF4-3M  
 4. POWER : AC220V  
 5. POWER CONSUMPTION : 1.1kW  
 6. WEIGHT : 17KG

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
5	NAME PLATE	=		1	
4	CAMLOCK	25A, (+) FEMALE SCREW	SUS304	1	
3	HEXAGON NIPPLE	32A-25A	SUS304	1	
2	CAMLOCK	25A, (+) MALE SCREW	SUS304	1	
1	CIRCULATING PUMP	DHF4-3M	SUS304	1	

K SHIPBUILDING      HULL NO.      MODEL NAME  
 DATE : 2022. 09. 08      PART NAME      EWU  
 APPD BY Y.M.KIM      CIRCULATING PUMP ASSY  
 CHKD BY -      DRAWING NO      ECS000-00-E0172-S1940  
 DSNB BY H.C.LEE      SHEET NO : 1 OF 1  
 TECHCROSS      REV. 1.0



REV.	DESCRIPTION	CHKD	APPD	DATE
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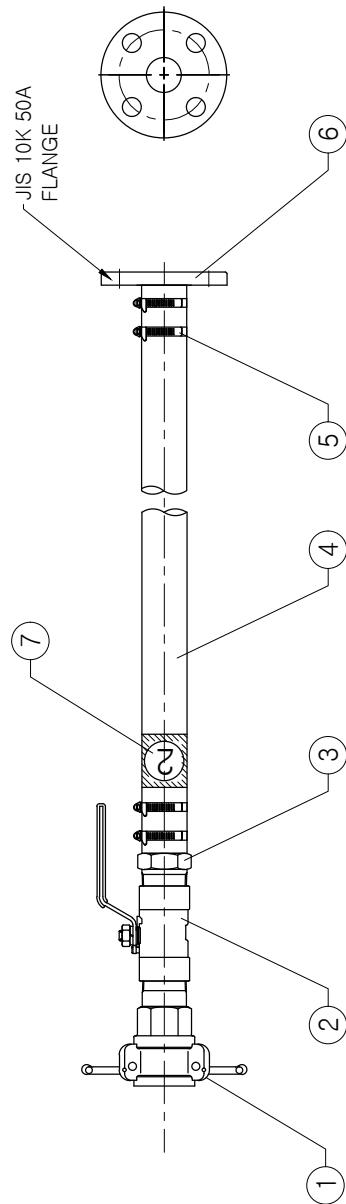
NOTE  
 1. CONNECTION PART SHOULD BE TAPE BY TEFLON TAPE  
 2. ATTACH HOSE NAME PLATE  
 3. LENGTH : 5m

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
7	HOSE NAME PLATE	-	-	1	
6	CAMLOCK	(-) SCREW, 25A	SUS304	1	
5	HOSE BAND	25A	SUS304	4	
4	HIGH PRESSURE HOSE	-	-	1	COLOR : BLUE
3	HOSE ADAPTER	25A	SUS304	1	
2	BALL VALVE	25A	SUS304	1	
1	CAMLOCK	TYPE-B, 25A	SUS304	1	

SHIP YARD	HULL NO.	MODEL NAME	TECHCROSS
K SHIPBUILDING	S1940	EWU	

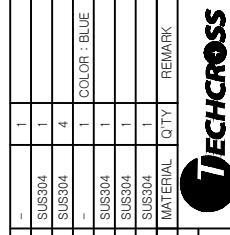
APPD BY	PART NAME	DRAWING NO	REV.
Y.M.KIM	HOSE ASSY-1	EWU000-00-A001Z-S1940	1.0
CHKD BY	-		SHEET NO : 1 OF 1
DSND BY	H.C.LEE		

REV.	DESCRIPTION	CHKD	APPD	DATE
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NOTE  
1. CONNECTION PART SHOULD BE TAPE BY TEFLON TAPE  
2. ATTACH HOSE NAME PLATE  
3. LENGTH : 5m

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
7	HOSE NAME PLATE	JIS 10K 50A	-	1	
6	FLANGE	25A	SUS304	1	
5	HOSE BAND	-	SUS304	4	
4	HIGH PRESSURE HOSE	-	-	1	COLOR : BLUE
3	HOSE ADAPTER	25A	SUS304	1	
2	BALL VALVE	25A	SUS304	1	
1	CAMLOCK	TYPE-B-25A	SUS304	1	
NO	SHIP YARD	HULL NO.	MODEL NAME		
	K SHIPBUILDING	S1940	EWU		
	APPD BY	PART NAME			
	Y.M.KIM	HOSE ASSY-2			
	CHKD BY	DRAWING NO			
	-	EWU000-00-A006Z-S1940			
	DSND BY				
	H.C.LEE				



DATE : 2022.09.08	PART NAME	HOSE ASSY-2
APPD BY		
Y.M.KIM		
CHKD BY		
-		
DSND BY		
H.C.LEE		

SHEET NO : 1 OF 1

REV. C

REV.	DESCRIPTION	CHKD	APPD	DATE
	JIS 10K 50A FLANGE			

**NOTE**  
1. CONNECTION PART SHOULD BE TAPE BY TEFLON TAPE  
2. ATTACH HOSE NAME PLATE  
3. LENGTH : 5m

NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
7	HOSE NAME PLATE	-	-	1	
6	FLANGE	JIS 10K 50A	SUS304	1	
5	HOSE BAND	25A	SUS304	4	
4	HIGH PRESSURE HOSE	-	-	1	COLOR : BLUE
3	HOSE ADAPTER	25A	SUS304	1	
2	BALL VALVE	25A	SUS304	1	
1	CAMLOCK	TYPE-B-25A	SUS304	1	

SHIP YARD	HULL NO.	MODEL NAME
K SHIPBUILDING	S1940	EWU

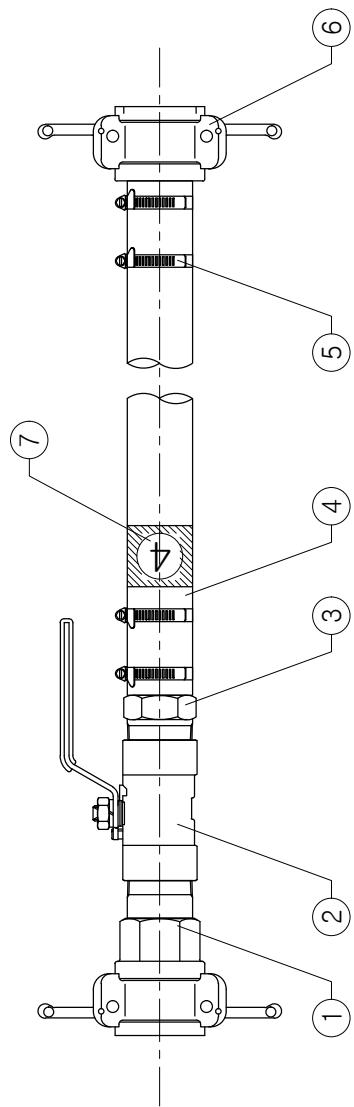
**TECHCROSS**

APPD BY	Y.M.KIM	PART NAME	HOSE ASSY-3
CHKD BY	-	DRAWING NO	EWU000-00-A007Z-S1940
DSND BY	H.C.LEE	REV.	C

SHEET NO : 1 OF 1

5-C-02-00

REV.	DESCRIPTION	CHKD	APPD	DATE
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NOTE  
 1. CONNECTION PART SHOULD BE TAPE BY TEFLON TAPE  
 2. ATTACH HOSE NAME PLATE  
 3. LENGTH : 5m

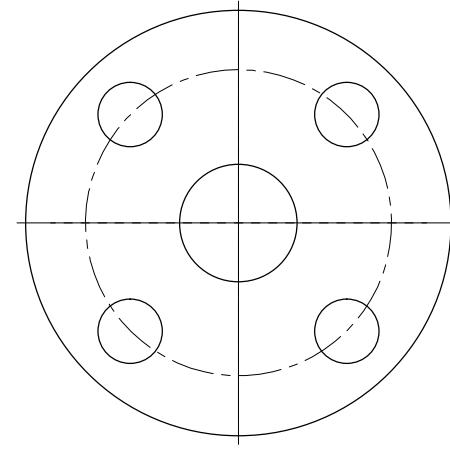
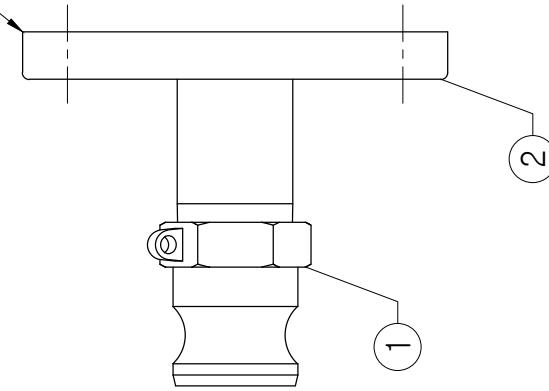
NO	PART NAME	SPEC	MATERIAL	Q'TY	REMARK
7	HOSE NAME PLATE	-	-	1	
6	CAMLOCK	25A (-) SCREW	SUS304	1	
5	HOSE BAND	25A	SUS304	4	
4	HIGH PRESSURE HOSE	-	-	1	COLOR : BLUE
3	HOSE ADAPTER	25A	SUS304	1	
2	BALL VALVE	25A	SUS304	1	
1	CAMLOCK	TYPE-B-25A	SUS304	1	



SHIP YARD	HULL NO.	MODEL NAME
K SHIPBUILDING	S1940	EWU
PART NAME	HOSE ASSY-4	
APPD BY	Y.M.KIM	
CHKD BY	-	
DSND BY	H.C.LEE	
DATE : 2022.09.08	DRAWING NO	EWU000-00-A004Z-S1940
		SHEET NO : 1 OF 1
		REV. 1.0

REV.	DESCRIPTION	CHKD	APPD	DATE
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- JIS 10K 32A  
ELANGE

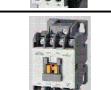
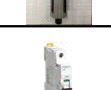


NOTE 1 CONNECTION PART SHOULD BE TAPE BY TEE ON TAPE

TECHNICAL DRAWING				DRAWING NO : 1 OF 1	
1. CONNECTION PARTS FOR USE IN THE SYSTEM				REV. 100	
ITEM NO.	PART NAME	DESCRIPTION	QTY	REMARK	
2	FLANGE ASSY	JIS 10K 32A	SUS304	1	
1	CAMLOCK	25A FEMALE SCREW	SUS304	1	
	NO.	SPEC	MATERIAL		
SHIP YARD	HULL NO.	MODEL NAME			
K SHIPBUILDING	S1940	EWU			
DATE : 2022.09.08		PART NAME	YARD PIPE CONNECTOR		
APPD BY Y.M.KM		DRAWING NO	EWU000-00-A08Z-S1940		
CHKD BY -					
DSND BY H.C.LEE					

# STANDARD SPARE PART LIST

## 1. SPARE PART LIST

NO	ITEM	PICTURE	SPEC'	UNIT	Q'TY	REMARK
1	SPARE PART CASE		400 x 800 x 300	EA	1	
2	REALY 1		DRM270024LD (DC24V)	EA	4	ANU / Ex-TSU
3	REALY 2		788-312 (DC24V)	EA	4	LCU / PDM
4	LED LAMP 1		KH-2203L-2W (WHITE)	EA	2	HTM
5	MAGNET CONTACTOR		MC-12b	EA	2	HTM
6	AUX. RELAY		MR-4	EA	1	HTM
7	FUSE 1		SB-C1 (1A)	EA	4	HTM
8	MAGNETIC CONTACTOR		MC-100A	EA	1	PDM
9	SOLENOID VALVE		EV212B (BB230CS)	EA	1	ANU
10	EX-SOLENOID VALVE		321K4506 -495905B8	EA	1	Ex-TSU
11	DIAPHRAGM		P30.7a AIR DIAPHRAGM P30.7b FLUID DIAPHRAGM	SET	2	Ex-APU
12	FILTER & REGULATOR		PP2-G02BDG	EA	1	Ex-APU
13	MCB 1		IC60N-1P (4A)	EA	1	LCU
14	MCB 2		IC60N-2P (6A)	EA	1	LCU
15	MCB 3		IC60N-2P (10A)	EA	1	LCU
16	O-RING 1		AN-274 (VITON)	EA	2	HGU

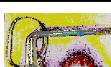
# STANDARD SPARE PART LIST

## 1. SPARE PART LIST

NO	ITEM	PICTURE	SPEC'	UNIT	Q'TY	REMARK
17	O-RING 2		AN-236 (VITON)	EA	4	HGU
18	O-RING 3		V-150 (VITON)	EA	4	HGU
19	O-RING 4		AN-247 (VITON)	EA	4	HGU
20	O-RING 5		AN-126 (VITON)	EA	1	HGU
21	O-RING 6		AN-130 (VITON)	EA	1	HGU
22	O-RING 7		AN-012 (VITON)	EA	26	HGU
23	O-RING 8		V-50 (VITON)	EA	2	HGU
24	WATERPROOF BOLT		M8 x 15 (TITANIUM)	EA	26	HGU
25	HEXAGON HEAD SOCKET CAP BOLT		M6 x 20 (TITANIUM)	EA	50	HGU
26	DISPOSABLE RESPIRATOR		3M 8822	EA	2	
27	LATEX GLOVES		LATEX-12"	SET	2	
28	PROTECTIVE EYEWEAR		MSO G-73A	EA	2	

## STANDARD SPARE PART LIST

### 2. TOOL PART LIST

NO	ITEM	PICTURE	SPEC'	UNIT	Q'TY	REMARK
1	PORTABLE TRO SENSOR		PTS	SET	1	PORTABLE TRO SENSOR
2	T-HANDLE TORX WRENCH		T20 (3.86mm)	EA	1	ANU
3	BOOSTER PUMP REPAIR PART		MECHANICAL SEAL, O-RING, TOOL	SET	1	PMU
4	SPECIAL SPANNER		Ø30	EA	1	FOR FCV (BRC250)

### 3. CONSUMABLE PART LIST

NO	ITEM	PICTURE	SPEC'	UNIT	Q'TY	REMARK
1	Ex-CLX REAGENT		1.4kg	SET	2	Ex-TSU
2	SODIUM THIOSULFATE		12.5kg	EA	24	ANU

# TYPE APPROVAL CERTIFICATE

Certificate No:  
**TAP000020V**  
Revision No:  
**1**

## This is to certify:

That the Ballast Water Management System

with type designation(s)

**ECS-HYCHLOR™ BWMS (model range ECS-HYCHLOR™-300 to ECS-HYCHLOR™-8000)**

Issued to

**TECHCROSS**

**Chungcheongnam-do, Republic of Korea**

is found to comply with

**IMO Resolution MEPC.300(72) - Code for Approval of Ballast Water Management Systems (BWMS Code)**

**Resolution MEPC.169(57)**

**DNV GL class programme DNVGL-CP-0209 – Type approval – Ballast water management systems**

**DNV GL rules for classification – Ships**

## Application :

**This is to certify that the Ballast Water Management System listed above has been examined and tested in accordance with the requirements of the specifications contained in the BWMS Code (MEPC.300(72)) and DNV GL Rules stated above. This Certificate is valid only for the Ballast Water Management System referred to above.**

**System Design Limitations / Limiting Operating Conditions imposed are described in this document.**

**For the compliance with the BWMS Code, the Certificate is issued on behalf of the Norwegian Maritime Authority.**

**Product(s) approved by this certificate is/are accepted for installation on all vessels classed by DNV GL, unless otherwise instructed by relevant Maritime Administrations.**

Issued at **Høvik** on **2020-05-11**

for **DNV GL**

This Certificate is valid until **2025-02-09**.

DNV GL local station: **Busan Station**

Approval Engineer: **Michael Lehmann**

**Dag Sæle-Nilsen**  
**Head of Section**

This Certificate is subject to terms and conditions overleaf. Any significant change in design or construction may render this Certificate invalid. The validity date relates to the Type Approval Certificate and not to the approval of equipment/systems installed.

LEGAL DISCLAIMER: Unless otherwise stated in the applicable contract with the holder of this document, or following from mandatory law, the liability of DNV GL AS, its parent companies and subsidiaries as well as their officers, directors and employees ("DNV GL") arising from or in connection with the services rendered for the purpose of the issuance of this document or reliance thereon, whether in contract or in tort (including negligence), shall be limited to direct losses and under any circumstance be limited to 300,000 USD.

## **Name of ballast water management system (BWMS)**

ECS-HYCHLOR™ BWMS

## **Ballast water management system manufactured by**

Techcross Inc.

## **Place of production**

Techcross Inc., 433 Noksansaneopbuk-ro, Gangseo-gu, Busan 46758, Republic of Korea

## **Type and model designations**

ECS-HYCHLOR™-300, ECS-HYCHLOR™-500, ECS-HYCHLOR™-600, ECS-HYCHLOR™-1000, ECS-HYCHLOR™-1200, ECS-HYCHLOR™-1500, ECS-HYCHLOR™-1800, ECS-HYCHLOR™-2000, ECS-HYCHLOR™-2400, ECS-HYCHLOR™-2600, ECS-HYCHLOR™-3000, ECS-HYCHLOR™-3600, ECS-HYCHLOR™-4000, ECS-HYCHLOR™-5000, ECS-HYCHLOR™-5200, ECS-HYCHLOR™-6000, ECS-HYCHLOR™-7200 and ECS-HYCHLOR™-8000

## **Equipment / Assembly drawings**

The ECS-HYCHLOR™ BWMS shall be installed in accordance with the documents listed below.

Description	Title	Drawing no.	Rev.
Operation, maintenance and safety manual	ECS-HYCHLOR™ System OMSM (Operation, Maintenance Safety Manual)	-	3.3
Piping and instrumentation diagram (P&ID)	<i>Non-Ex:</i> P&ID for HYCHLOR <i>Ex:</i> P&ID for BWTS	<i>Non-Ex:</i> EHS-XXX-G2-W001 <sup>(1)</sup> <i>Ex:</i> EHS-XXX-E2-W001 <sup>(1)</sup>	1.0 1.1
General arrangement (GA) drawings	ECS-HYCHLOR™ BWMS Component Drawings	-	1.4
Bill of materials (BoM)	ECS-HYCHLOR™ BWMS BOM lists	-	1.3
Electrical wiring diagram	Wiring Diagram	<i>Non-Ex:</i> EHSXXX-G2-W002 <sup>(1)</sup> <i>Ex:</i> EHSXXX-E2-W002 <sup>(1)</sup>	1.0 1.0

(1) XXX indicates the ECS-HYCHLOR™ BWMS model ranging from ECS-HYCHLOR™-300 (XXX = 030) to ECS-HYCHLOR™-8000 (XXX = 800)

## **Other equipment manufactured by**

The ECS-HYCHLOR™ BWMS applies one of the following self-cleaning filters

- Filters with 50 µm mesh manufactured by Techcross
- BS filters with 50 µm mesh manufactured by Filtersafe.

The Hypochlorite Generation Unit (HGU) manufactured by Techcross is available in an old design and a new more compact design, and this type approval applies to both the old and new design.

## **Treatment Rated Capacity**

300 – 8,000 m<sup>3</sup>/h

## **Product description**

### **Treatment sequence**

- Ballast water uptake: Filtration and injection of active substance generated by electrolysis

- Ballast water discharge: Neutralisation

## **System design limitations / Water quality parameters**

### **Temperature & Salinity**

The temperature of the ballast water shall be  $>2.5^{\circ}\text{C}$ .

Salinity of the ballast water is not a limiting condition for the ECS-HYCHLOR™ BWMS.

## **System design limitations / Operational parameters**

### **Feed water to Hypochlorite Generation Unit (HGU)**

The salinity of the feed water to the Hypochlorite Generation Unit (HGU) shall be  $\geq 8$  PSU. A Salt Tank Unit (STU) with an injection pump may be installed and used to increase the salinity of the feed water to the HGU. Alternatively, sea water that is filtered with the Auto Filtration Unit (AFU) and stored in a dedicated tank may be used as feed water to the HGU.

### **Holding time**

The BWMS has demonstrated performance to the discharge standard with a minimum holding time between intake and discharge of 3 hours during land-based testing with the Filtersafe filter. Holding time is thus not a practical limitation for the ECS-HYCHLOR™ BWMS when installed with BS filters manufactured by Filtersafe, but the treated ballast water shall be kept in ballast tanks for at least 3 hours before being neutralized and discharged.

The BWMS has demonstrated performance to the discharge standard with a minimum holding time between intake and discharge of 48 hours in land-based testing with the Techcross filter. A minimum holding time of 48 hours across all salinities is thus required for the ECS-HYCHLOR™ BWMS when installed with filters manufactured by Techcross.

### **Dosing**

The target TRO of the BWMS is 5 mg/L during ballast water uptake. The TRO level during ballast water uptake shall not exceed 9.5 mg/L. TRO concentration at discharge shall be  $\leq 0.1$  mg/L.

### **Treatment Rated Capacity**

The Treatment Rated Capacities (TRC) of designated ECS-HYCHLOR™ BWMS models are listed below. The list also specifies the major components of the ECS-HYCHLOR™ BWMS that shall be installed for a specific ECS-HYCHLOR™ BWMS model. An ECS-HYCHLOR™ BWMS model may be used with a larger Auto Filtration Unit (AFU) than specified below.

The BWMS has no flow control function, and the flow shall be regulated by the ballast pump. The system gives alarm if the flow rate exceeds 110% of TRC and activates a system shutdown if the flow rate exceeds 115% of TRC.

<b>BWMS model</b>	<b>TRC</b> [m <sup>3</sup> /h]	<b>Auto Filtration Unit (AFU)</b>		<b>Hypochlorite Generation Unit (HGU) with Electrode Modules (EM)</b>	
		<b>Techcross</b>	<b>Filtersafe</b>	<b>Old design</b>	<b>New design</b>
ECS-HYCHLOR™-300	300	AFU-015 x 2	BS061-H/V x 2	HGU(EM)-050	HGU(EM)-050
ECS-HYCHLOR™-500	500	AFU-030 x 2	BS101-H/V-T x 2	HGU(EM)-050	HGU(EM)-050
ECS-HYCHLOR™-600	600	AFU-030 x 2	BS101-H/V-T x 2	HGU(EM)-100	HGU(EM)-100
ECS-HYCHLOR™-1000	1000	AFU-050 x 2	BS151-H/V-ST x 2	HGU(EM)-100	HGU(EM)-100
ECS-HYCHLOR™-1200	1200	AFU-080 x 2	BS300-H/V-T x 2	HGU(EM)-150	HGU(EM)-100 x 2
ECS-HYCHLOR™-1500	1500	AFU-080 x 2	BS300-H/V-T x 2	HGU(EM)-150	HGU(EM)-100 x 2
ECS-HYCHLOR™-1800	1800	AFU-100 x 2	BS300-H/V-ST x 2	HGU(EM)-200	HGU(EM)-100 x 2
ECS-HYCHLOR™-2000	2000	AFU-100 x 2	BS300-H/V-ST x 2	HGU(EM)-200	HGU(EM)-100 x 2
ECS-HYCHLOR™-2400	2400	AFU-130 x 2	BS400-H/V-ST x 2	HGU(EM)-150 x 2	HGU(EM)-100 x 3
ECS-HYCHLOR™-2600	2600	AFU-130 x 2	BS400-H/V-ST x 2	HGU(EM)-150 x 2	HGU(EM)-100 x 3
ECS-HYCHLOR™-3000	3000	AFU-150 x 2	BS603-H/V-T x 2	HGU(EM)-150 x 2	HGU(EM)-100 x 3
ECS-HYCHLOR™-3600	3600	AFU-200 x 2	BS804-H/V-T x 2	HGU(EM)-200 x 2	HGU(EM)-100 x 4
ECS-HYCHLOR™-4000	4000	AFU-200 x 2	BS804-H/V-T x 2	(HGU(EM)-200 x 2	HGU(EM)-100 x 4
ECS-HYCHLOR™-5000	5000	AFU-300 x 2	BS1004-H/V-ST x 2	HGU(EM)-200 x 3	HGU(EM)-100 x 6
ECS-HYCHLOR™-5200	5200	AFU-300 x 2	BS1004-H/V-ST x 2	HGU(EM)-200 x 3	HGU(EM)-100 x 6
ECS-HYCHLOR™-6000	6000	AFU-300 x 2	BS1004-H/V-ST x 2	HGU(EM)-200 x 3	HGU(EM)-100 x 6
ECS-HYCHLOR™-7200	7200	AFU-400 x 2	BS1406-H/V-T x 2	HGU(EM)-200 x 4	HGU(EM)-100 x 8
ECS-HYCHLOR™-8000	8000	AFU-400 x 2	BS1406-H/V-T x 2	HGU(EM)-200 x 4	HGU(EM)-100 x 8

### Pressure

The minimum and maximum system operating pressure and the differential pressure triggering backflushing are listed below. The maximum operating pressure for the HGU is 10 bar.

<b>Auto Filtration Unit (AFU)</b>	<b>System operating pressure</b>	<b>Filter differential pressure triggering backflushing</b>
Techcross filters	1.5 <sup>(1)</sup> – 5 bar	0.5 bar
Filtersafe filters	1.6 <sup>(1)</sup> – 6.9 bar	0.4 bar

(1) Minimum pressure when using a backflush pump. Without backflush pump, the minimum pressure is 2.0 bar.

## **Control and monitoring equipment**

### **Software version**

The ECS-HYCHLOR™ BWMS is type approved with the system control software version 01.09.06. Any changes to the software are to be recorded as long as the system is in use onboard. The records of all changes are to be forwarded to DNV GL for evaluation. Major changes in the software, which can alter the performance of the system, require approval. Testing of the application functions of the revised software may be required.

### **Safety measures**

The ECS-HYCHLOR™ BWMS is type approved with the following instruments for monitoring the safe operation of the BWMS and for activating, as necessary, an automatic shutdown of the BWMS:

- Flow meters (No.3 FMU and No.4 FMU) monitoring the flow through the HGU
- Pressure switch (PS) on each HGU (arranged with safety function independent of BWMS control)
- Flow switch (FS) in H<sub>2</sub> vent duct (arranged with safety function independent of BWMS control)
- H<sub>2</sub> gas sensor (GS) in H<sub>2</sub> vent duct
- H<sub>2</sub> gas detection sensor (No.1 GDS) installed above the HGU
- H<sub>2</sub> gas detection sensor (No.2 GDS) installed in the room (arranged with safety function independent of BWMS control)
- H<sub>2</sub> gas detection sensor (No.3 GDS) installed above the degas tank of the DMU

### **Electrical and electronic components**

The ECS-HYCHLOR™ BWMS is type approved with the electrical and electronic components (including the above listed instruments for monitoring safe operation of the BWMS) indicated on the P&ID and specified on the BoM. Except for the components listed below, alternate models to the ones specified on the BoM may be used provided that information regarding the selected components is part of the documentation related to the specific installation, by providing either a reference to a valid type approval certificate or technical documentation demonstrating that the selected component was subject to environmental testing as per IACS UR E10.

For alternate models for the blowers (BL01 & BL02) and the flow switch (FS) of the Degas Module Unit (DMU), documentation shall also be provided that the blowers are of non-sparking type and that the blower motors and flow switchy are Ex-proof.

For the following electrical and electronic components, only the models listed below shall be used:

<b>Tag No.</b>	<b>Component name</b>	<b>Manufacturer</b>	<b>Model(s)</b>
LCU	Local Control Unit	Techcross PLC: ABB HMI: BINCONET	LCU PLC: PM564/DI562/D0573 HMI: ARA-MPPC(15")
RDU	Remote Display Unit	Techcross HMI: ADVANTECH	RDU HMI: FPM-2150G (15")
HPU	Hypochlorite Power Unit	Techcross	HPU-050, HPU-100, HPU-150 and HPU-200
HPM	Hypochlorite Power Module	Techcross	HPM
TSU	TRO Sensor Unit	Techcross TRO sensor: HF Scientific	TSU TRO sensor: CLX-X, CLX-Ex2

## **Hazardous area / Ex-proof**

The Auto Filtration Unit (AFU), Flow Meter Unit (FMU), Static Mixer Unit (SMU), TRO Sensor Unit (TSU) and Drain Tank Unit (DTU) of the ECS-HYCHLOR™ BWMS have been evaluated and found to be in compliance with DNV GL rules for classification of ships Pt.4 Ch.8 Sec.11 and may be installed in hazardous areas. All other units of the ECS-HYCHLOR™ must be located in non-hazardous areas.

Installation in a hazardous area are to be approved in each case according to the Rules and Ex-certification / Special Condition for Safe Use, listed in a valid Ex-certificate issued by a notified/recognized Certification Body. Ex-certification is not covered by this certificate.

## **Documents approval**

The following documentation is to be submitted for approval for each BWMS installation:

- Piping and Instrumentation Diagram (P&ID) of the ballast system including the treatment system installation
- Power supply arrangement (including power supply to dilution blowers)
- Commissioning procedure
- Interface description towards ship's existing systems including alarms for failure
- List of Ex-equipment according to DNV GL rules for classification of ships Pt.4 Ch.8 Sec.11 for components in possible contact with H<sub>2</sub> gas (H<sub>2</sub> gas sensor, flow switch)
- List of Ex-equipment according to DNV GL rules for classification of ships Pt.4 Ch.8 Sec.11 if the system is to be installed in hazardous area zone

## **Type approval documentation**

### **Test plan and reports:**

- Final approval of ECS-HYCHLOR™ BWMS by the Marine Environment Protection Committee (MEPC 69/21)
- DHI Denmark: Biological efficacy performance evaluation at land-based test facility – Techcross – Filtration and chemical treatment (Final test report of 2017-02-01)
- DHI Denmark: Biological efficacy performance evaluation of ECS-HYCHLOR Ballast Water Management System in shipboard test - Shipboard test report (Final test report of 2019-12-20)

- DHI Denmark: Biological efficacy performance evaluation of ECS-Hychlor-300 Ballast Water Management System in land-based test - Land-based test report (Final test report of 2019-09-10)
- SGS Korea: Environmental test reports SGS-E16-0076, SGS-E16-0078, SGS-E16-0080, SGS-E17-0035, SGS-E17-0037, SGS-E17-0039, SGS-E17-0054, SGS-E17-0087, SGS-E17-0103, SGS-E19-0108, SGS-E19-0109, SGS-E19-0110, SGS-E19-0111, SGS-E19-0126, SGS-R17-1674, SGS-R17-1675, SGS-R17-1676, SGS-R17-1681, SGS-R17-1687, SGS-R17-1688, SGS-R17-1689, SGS-R17-1694, SGS-R18-0069, SGS-R18-0070, SGS-R18-0071, SGS-R18-0108, SGS-R18-0109, SGS-R18-0110, SGS-R18-0111, SGS-R18-0112, SGS-R18-0132, SGS-R18-0134, SGS-R18-0135, SGS-R18-0136, SGS-R18-0137, SGS-R18-0138, SGS-R19-1632, SGS-R19-1909, SGS-R19-2277, SGS-R19-2278, SGS-R19-2279, SGS-R19-2280, SGS-R19-2286, SGS-R19-2287, SGS-R19-2288, SGS-R19-2300, SGS-R19-2339, SGS-R19-2342, SGS-R19-2447 and SGS-R19-2450
- Applica: Environmental test report no. 20987, 2017-02-21, Rev. 1

#### **System documentation:**

- Techcross Inc: ECS-HYCHLOR™ System OMSM (Operation, Maintenance & Safety Manual), 2020-05-06, Rev. 3.3
- Techcross Inc: ECS-HYCHLOR™ BWMS P&ID and Wiring diagram drawings, 2019-12-19, Rev. 1.1
- Techcross Inc: ECS-HYCHLOR™ BWMS Component Drawings, 2020-01-08, Rev. 1.4
- Techcross Inc: ECS-HYCHLOR™ BWMS BOM lists, 2020-03-02, Rev. 1.3
- Techcross Inc: ECS-HYCHLOR™ Ballast Water Management System - Scale up down calculation data, 2020-01-09, Rev. 1.9
- Techcross Inc: ECS-HYCHLOR™ Ballast Water Management System – Filter specification, 2020-01-06, Rev. 1.5
- Techcross Inc: ECS-HYCHLOR™ Ballast Water Management System - Specification of ANU injection pump, tank, Rev. 1.0
- Techcross Inc: ECS-HYCHLOR™ Ballast Water Management System - Specification of STU injection pump, tank, Rev. 1.0
- Techcross Inc: ECS-HYCHLOR™ Ballast Water Management System - Design of DMU Blower, Degas tank, 2019-05-10, Rev. 1.1
- Techcross Inc: ECS-HYCHLOR™ Ballast Water Management System - Electrolyzer (HGU) Comparative data, 2018-08-08, Rev. 1.1
- Techcross Inc: ECS-HYCHLOR™ Ballast Water Management System - Electrolyzer (HGU) Comparative data, 2020-01-09, Rev. 1.3
- Techcross Inc: ECS-HYCHLOR™ Ballast Water Management System – Filter specification Comparative data, 2018-08-20, Rev. 1.0

#### **Tests carried out**

- Land-based testing with ECS-HYCHLOR™-300 with a TRC of 300 m<sup>3</sup>/h with a HGU-050 of old design and one AFU-030 filter manufactured by Techcross in accordance with Resolution MEPC.300(72)
- Shipboard testing with ECS-HYCHLOR™-2000 with a TRC of 2000 m<sup>3</sup>/h with a HGU-200 of old design and two AFU-1000 filters manufactured by Techcross in parallel in accordance with Resolution MEPC.300(72)
- Additional land-based testing with ECS-HYCHLOR™-300 with a TRC of 300 m<sup>3</sup>/h with a HGU-050 of new design and one BS101-V-T filter manufactured by Filtersafe in accordance with Resolution MEPC.300(72)

- Function tests of the control and monitoring system witnessed by DNV GL
- Environmental testing in accordance with DNV GL class guidelines for environmental test specification for electrical, electronic and programmable equipment and systems (DNVGL-CG-0339) and IACS UR E10

## **Marking of product**

For traceability of this type approval, each treatment system is to be marked with:

- Manufacturer's name or trademark
- Type designation
- Serial number

## **Periodical assessment**

For retention of the Type Approval, DNV GL Surveyor shall perform periodical assessments to verify that the conditions of the TA are not altered since the certificate was issued.

The scope of periodical assessment includes:

- Review of the TA documentation and verification that the documentation is still used as basis for the production.
- Review of possible changes in design, material and performance of the product.
- Verification of the company's production and quality systems ensuring continued consistent production of the type approved products to the required quality.
- Verification that the product marking for identification and traceability to the TA Certificate is not altered

## **Copy of type approval certificate**

A copy of this type approval certificate should always be carried onboard a vessel fitted with this ballast water management system. An annex containing the summary reports of the test results of land-based and shipboard tests should be available for inspection onboard the vessel.

## ANNEX: SUMMARY OF TESTING

### Land-based testing

**Table 1 Test water conditions and operational parameters in land-based testing of the ECS-HYCHLOR™-300 with a TRC of 300 m³/h with a HGU-050 of old design and one AFU-030 filter manufactured by Techcross at the DHI Maritime Technology Evaluation Facility in Hundested, Denmark, during the period from March to August 2016.**

Test cycle <sup>(1)</sup>	Water temperature [°C]	Salinity [PSU]	DOC [mg/L]	POC [mg/L]	TSS [mg/L]	Holding time	TRO (average) [mg/L]	Flow rate <sup>(2)</sup> [m³/h]	Current (average) [A]
F-1 (2016)	8.8	0.35	7.3	7.9	66	5 days	5.3	297	99
F-2 (2016) <sup>(3)</sup>	11	0.37	6.7	7.4	72	5 days	5.3	305	98
F-3 (2016) <sup>(3)</sup>	11	0.36	6.7	7.4	72	5 days	5.4	281	97
F-4 (2016) <sup>(3)</sup>	16	0.36	7.5	7.0	64	48 hours	5.2	299	101
F-5 (2016) <sup>(3)</sup>	16	0.36	7.5	7.0	64	48 hours	5.3	299	98
B-1 (2016)	2.9	20	7.6	7.6	61	5 days	5.0	293	140
B-2 (2016) <sup>(3)</sup>	3.6	17	6.9	7.0	59	5 days	5.1	297	122
B-3 (2016) <sup>(3)</sup>	3.8	17	6.9	7.0	59	5 days	5.2	297	110
B-4 (2016) <sup>(3)</sup>	7	16	7.5	8.1	62	48 hours	5.2	302	100
B-5 (2016) <sup>(3)</sup>	7.1	16	7.5	8.1	62	48 hours	5.3	293	98
M-1 (2016)	14	28	7.3	6.6	42	5 days	5.3	303	98
M-2 (2016) <sup>(3)</sup>	19	29	7.8	7.5	43	48 hours	5.3	302	100
M-3 (2016) <sup>(3)</sup>	19	29	7.8	7.5	43	48 hours	5.3	302	99
M-4 (2016) <sup>(3)</sup>	18	29	6.3	7.3	42	5 days	5.3	299	99
M-5 (2016) <sup>(3)</sup>	18	29	6.3	7.3	42	5 days	5.3	298	96
M-6 (2016)	18	29	7.6	7.3	48	5 days	5.3	300	103
M-8 (2016)	18	28	7.3	7.2	60	48 hours	5.3	296	99

(1) Two additional test cycles with a 5 days holding time each in fresh water (F-6 and F-7) and marine water (M-7 and M-9) were carried out at the request by Techcross for the purpose of marketing. These tests cycles were not included in the test plan and were outside the scope of type approval testing as per the BWMS Code. The results of these test cycles are thus not shown in this table.

(2) Flow rate after filter.

(3) Two test cycles were performed on the same day using the same control water tank.

**Table 2 Average numbers of live organisms in inlet and treated discharge water during land-based testing of the ECS-HYCHLOR™-300 with a HGU-050 of old design and one AFU-030 filter manufactured by Techcross. Live organisms  $\geq 10$  and  $< 50 \mu\text{m}$  were quantified by microscopy counting after staining with CMFDA/FDA. All counts of pathogenic bacteria (*E. coli*, *Enterococci* and *Vibrio cholerae*) in treated water were below the ballast water discharge standard.**

Test cycle	Organisms $\geq 50 \mu\text{m}$ [organism/m <sup>3</sup> ]		Organisms $\geq 10 - < 50 \mu\text{m}$ (FDA/CMFDA) [organisms/mL]	
	Influent water	Treated discharge	Influent water	Treated discharge
F-1 (2016)	322,764	4.0	15,406	8.8
F-2 (2016) <sup>(1)</sup>	325,153	2.3	6,094	0
F-3 (2016) <sup>(1)</sup>	325,153	0	6,094	0.11
F-4 (2016) <sup>(1)</sup>	298,958	1.0	2,539	0.89
F-5 (2016) <sup>(1)</sup>	298,958	2.3	2,539	1.1
B-1 (2016)	118,229	0.33	4,617	0
B-2 (2016) <sup>(1)</sup>	254,092	0.33	2,589	0
B-3 (2016) <sup>(1)</sup>	254,092	0	2,589	0.56
B-4 (2016) <sup>(1)</sup>	361,791	0.33	2,825	0
B-5 (2016) <sup>(1)</sup>	361,791	0.67	2,825	0
M-1 (2016)	231,101	0.33	1,154	0.11
M-2 (2016) <sup>(1)</sup>	1,633,614	25 <sup>(2)</sup>	4,585	0.78
M-3 (2016) <sup>(1)</sup>	1,633,614	2.7	4,585	0.44
M-4 (2016) <sup>(1)</sup>	693,792	1.7	4,496	0.33
M-5 (2016) <sup>(1)</sup>	693,792	0.33	4,496	0
M-6 (2016) <sup>(1)</sup>	237,564	0.67	1068	5.0
M-8 (2016)	237,160	0.33	1160	1.3

(1) Two test cycles were performed on the same day using the same control water tank.

(2) The BWTS did not meet the discharge standard for organisms  $\geq 50 \mu\text{m}$  in test cycle M-2. During ballasting operation in test cycle M-2, there was continuous backflushing and the differential pressure (dP) increased to 0.45 bar at the end of operation. Moreover, a metallic sound could be heard. Nonetheless, test cycle M-2 was deemed valid, and further test cycles with marine water were carried out to complete five consecutive, valid and successful test cycles in marine water (M-3 to M-6 and M-8).

**Table 3 Test water conditions and operational parameters in additional land-based testing of the ECS-HYCHLOR™-300 with a TRC of 300 m<sup>3</sup>/h with a HGU-050 of new design and one BS101-V-T filter manufactured by Filtersafe at the DHI Maritime Technology Evaluation Facility in Hundested, Denmark, during the period from October to December 2018.**

Test cycle	Water temperature [°C]	Salinity [PSU]	DOC [mg/L]	POC [mg/L]	TSS [mg/L]	Holding time	TRO (average) [mg/L]	Flow rate <sup>(1)</sup> (average) [m <sup>3</sup> /h]	Current (average) [A]
F-1 (2018)	4.7	0.38	7.0	6.5	61	3.5 hours	3.9	294	186
F-2 (2018)	5.7	0.37	6.9	6.1	54	1 day	3.2	299	189
F-3 (2018)	3.7	0.39	7.1	5.9	58	3 hours	2.9	304	188
B-1 (2018)	7.9	18	6.8	7.4	81	4 hours	4.2	291	187
B-2 (2018)	10	19	5.9	8.6	78	4.5 hours	1.2 <sup>(2)</sup>	279	57
B-3 (2018)	7.9	19	6.5	7.4	54	1 day	4.9	297	168
B-4 (2018)	4.9	19	8.5	7.9	55	3 hours	4.2	292	178
M-1 (2018)	9.3	28	6.6	6.2	45	3 hours	5.4	293	162
M-2 (2018)	9.5	29	6.8	6.0	53	3 hours	5.3	302	157
M-3 (2018)	4.9	29	6.8	5.7	47	1 day	4.3	293	179

(1) Flow rate after filter.

(2) Test cycle B-2 (2018) is considered invalid due to the BWTS performance being outside the performance claim. The BWTS did not reach the target TRO.

**Table 4 Average numbers of live organisms in inlet and treated discharge water during additional land-based testing of the ECS-HYCHLOR™-300 with a HGU-050 of new design and one BS101-V-T filter manufactured by Filtersafe. Live organisms ≥10 and <50 µm were quantified by microscopy counting after staining with CMFDA/FDA. All counts of pathogenic bacteria (*E. coli*, *Enterococci* and *Vibrio cholerae*) in treated water were below the ballast water discharge standard.**

Test cycle	Organisms ≥50 µm [organism/m <sup>3</sup> ]		Organisms ≥10-<50 µm (FDA/CMFDA) [organisms/mL]	
	Influent water	Treated discharge	Influent water	Treated discharge
F-1 (2018)	119,945	0.73	1,029	1.3
F-2 (2018)	163,056	0	1,278	1.3
F-3 (2018)	157,628	0.78	1,493	3.8
B-1 (2018)	173,267	0.67	2,536	5.5
B-2 (2018)	98,875 <sup>(1)</sup>	399 <sup>(2)</sup>	2,460	198 <sup>(2)</sup>
B-3 (2018)	196,264	4.3	4,267	0.67
B-4 (2018)	103,225	0	2,702	1.3
M-1 (2018)	93,906 <sup>(1)</sup>	3	2,864	2.2
M-2 (2018)	99,922 <sup>(1)</sup>	1.3	2,787	1
M-3 (2018)	155,717	0.33	3,233	0.5

(1) Despite the best efforts of the test facility, the total densities of live organisms ≥50 µm in test cycles B-2, M-1 and M-2 in 2018 were lower than the BWMS Code requirement of minimum 100,000 organisms/m<sup>3</sup>. However, with densities of 98,875, 93,906 and 99,922 organisms/m<sup>3</sup>, challenge conditions were within 10% of the specified value. Hence, DNV GL considered these test cycles valid.

(2) Test cycle B-2 is considered invalid due to the BWTS performance being outside the performance claim. The BWTS did not reach the target TRO. Due to the low TRO, the treated discharge did not meet the discharge standard for both organisms ≥50 µm and ≥10-<50 µm.

## Shipboard testing

**Table 5 Test water conditions and operational parameters in shipboard testing of the ECS-HYCHLOR™-2000 with a TRC of 2000 m<sup>3</sup>/h with a HGU-200 of old design and two AFU-1000 filters manufactured by Techcross in parallel on board the bulk carrier Fortune Sunny (IMO No. 9317523) during the period from March 2017 to March 2019.**

Test cycle <sup>(1)</sup>	Water temperature [°C]	Salinity [PSU]	Holding time [hours]	Flow rate <sup>(2)</sup> (average, sum of port and starboard) [m <sup>3</sup> /h]	TRO (average) [mg/L]		Current (average) [A]
					Port	Starboard	
1	26	45	25	1793	5.5	5.1	502
2	26	37	163	1854	4.1	4.2	618
4	20	35	14	1896	4.8	4.9	689
7	11	34	15	1906	4.1	4.1	713
8	16	31	28	1960	1.4 <sup>(3)</sup>	1.1 <sup>(3)</sup>	699
9	17	29	21	1767	3.5	3.5	705
11	22	34	12	1732	3.4	2.5	720

(1) Test cycles 3, 5, 6 and 10 were cancelled either due to insufficient number of organisms ≥10-<50 µm in the inlet water or technical problems with the filter.

(2) Flow rate after filter.

(3) Investigations revealed that there was an inaccurate logging of the TRO in this test cycle. The average current in this test cycle was higher or comparable to the average current in the test cycles in which the target TRO was achieved

**Table 6 Average numbers of live organisms in inlet and treated discharge water during shipboard testing of the ECS-HYCHLOR™-2000. Live organisms ≥10 and <50 µm were quantified by microscopy counting after staining with CMFDA/FDA. All counts of pathogenic bacteria (*E. coli*, *Enterococci* and *Vibrio cholerae*) in treated water were below the ballast water discharge standard.**

Test cycle	Organisms ≥50 µm [organism/m <sup>3</sup> ]		Organisms ≥10-<50 µm (FDA/CMFDA) [organisms/mL]	
	Influent water	Treated discharge	Influent water	Treated discharge
1	14,505	0.28	224	0.83
2	12,045	0	101	0.17
4	2,643	0.24	110	0.83
7	17,618	15 <sup>(1)</sup>	495	7
8	29,515	0	107	1.5
9	50,642	701 <sup>(2)</sup>	619	20 <sup>(2)</sup>
11	46,896	0	138	1.3

(1) Contamination of the discharged ballast water occurred due to a manual valve from the sea chest being not properly closed. This test cycle was thus deemed invalid.

(2) Contamination of the discharged ballast water occurred due to ballast operations without use of the BWTS in between ballasting and deballasting of the test cycle. This test cycle was thus deemed invalid.



# BALLAST WATER MANAGEMENT SYSTEM

## Electro-Cleen™ System

### CONCEPT DRAWING

SHIP YARD : K SHIPBUILDING CO., LTD

SHIP OWNER : -

SHIP TYPE : -

HULL NO. : S1940

CLASS : -

TOTAL TRC : 1,600 m<sup>3</sup>/h X 1SET  
(Treatment Rated Capacity)

ECS MODEL : Ex-ECS-HYCHLOR 1200

REV. : 5

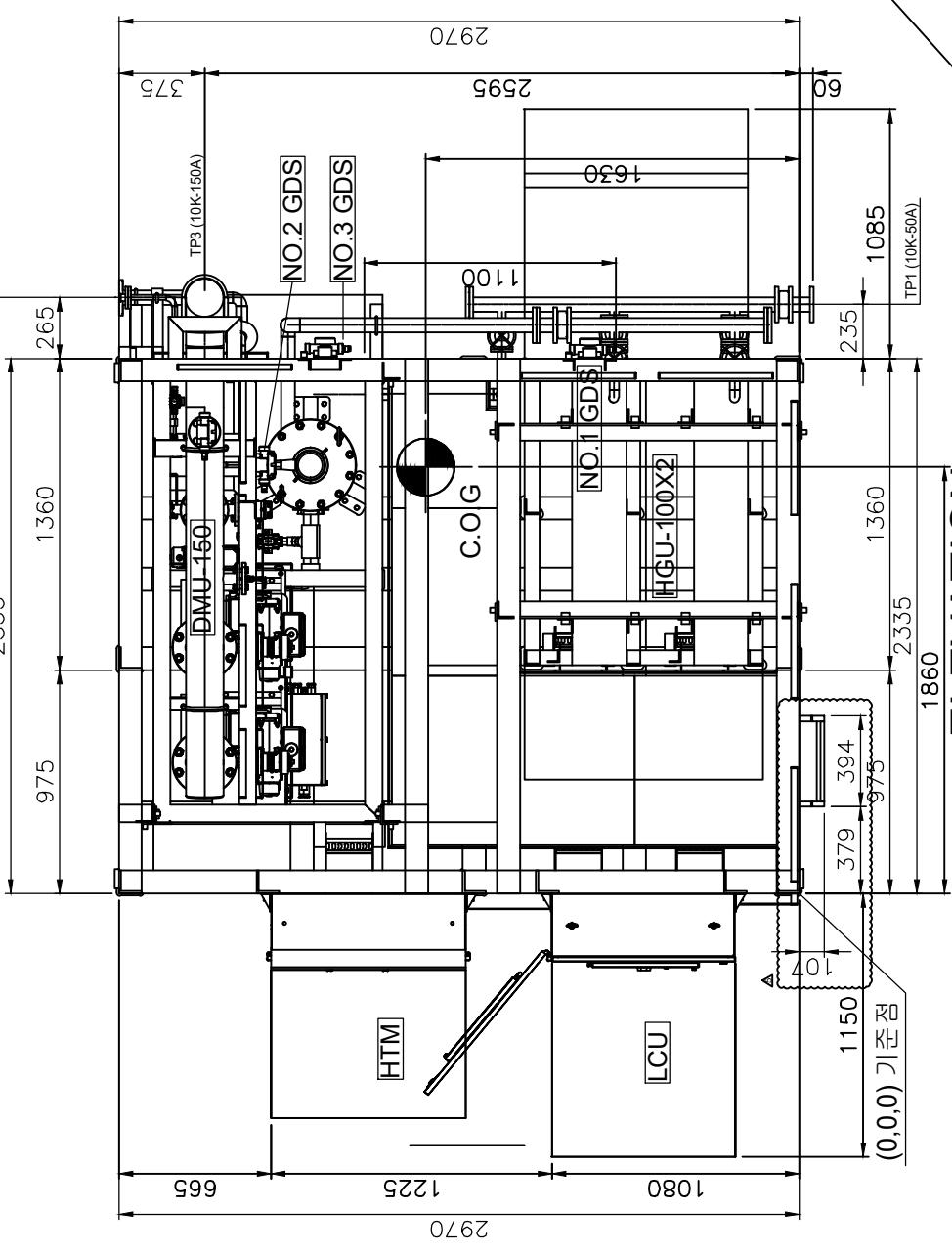
DATE	DRAWN	REVIEWED	CHECKED	APPROVED
2023.07.24	K.B.KIM	J.Y.KANG	I.S.KIM	T.W.HWANG

## PLAN HISTORY

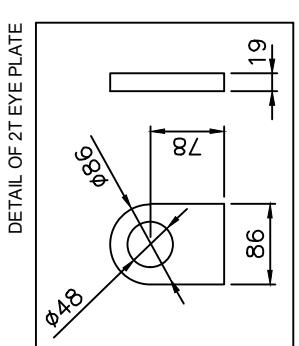
REV.	DATE	REVISION DESCRIPTION	PAGE
0	22.11.02	ISSUED THE CONCEPT DRAWING OF TECHCROSS.	-
1	23.05.04	C.O.G. 표기 추가	
2	23.05.10	LIFTING LUG 및 PAD 추가	
3	23.06.19	DMU AIR INLET SIZE 변경(10K-15A -> Ø10)	
4	23.07.13	HGU CABLE INLET 표기 추가	
5	23.07.24	최종 MODELING 반영	

SHIP YARD	HULL NO.	MODEL NAME
K SHIPBUILDING	S1940	Ex-ECS-HYCHLOR 1200
APPD BY	J.Y.KANG	TITLE
CHKD BY	J.Y.KANG	Ex-ECS-HYCHLOR 1200
DSND BY	K.B.KIM	Sheet No. 1 of 3
NAME	SYMBOL	PIPE SPEC
HGU INLET	TP1	STPG 370 #80 ERW 10K-50A (PE COATING)
GRAVITY DRAIN	TP2	STPG 370 #40 ERW 10K-40A (PE COATING)
DMU OUTLET(GAS)	TP3	STPG 370 #40 ERW 10K-150A BUTT WELDING
DRY CONT. AIR	TP4	φ10 COPPER TUBE
DMU OUTLET (HPOCHLORITE)	TP5	STPG 370 #40 ERW 10K-50A (PE COATING)

## PLAN



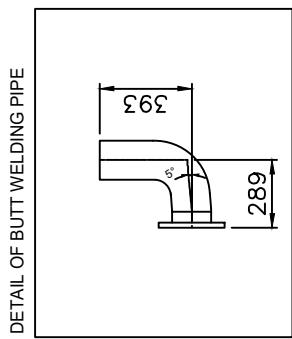
"A"



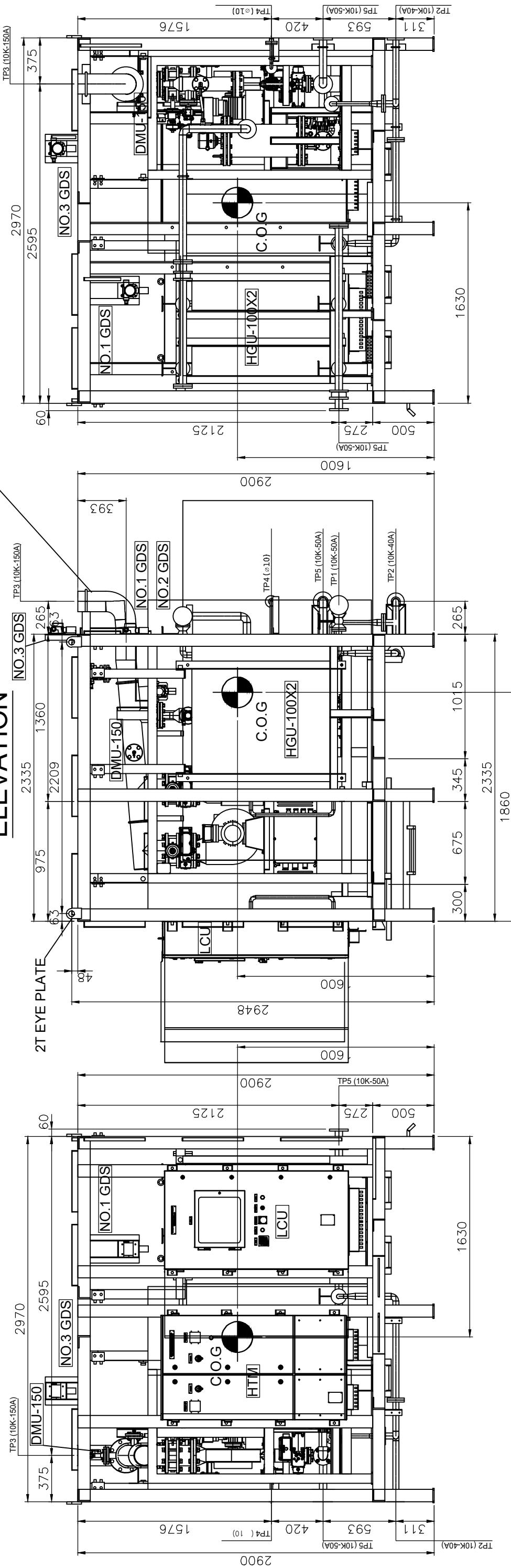
DETAIL OF 2T EYE PLATE

## "A - A VIEW"

## SECTION

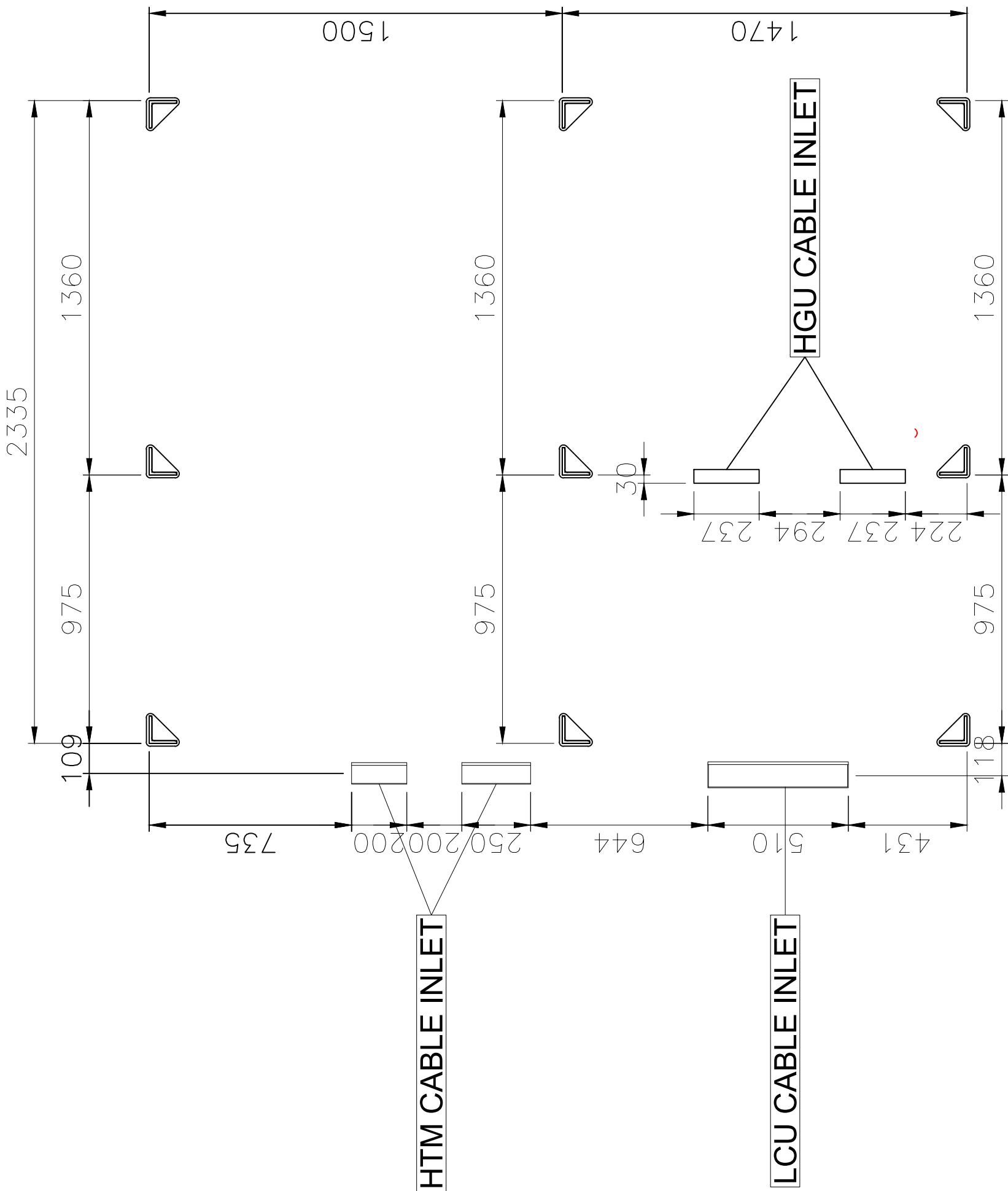


## ELEVATION

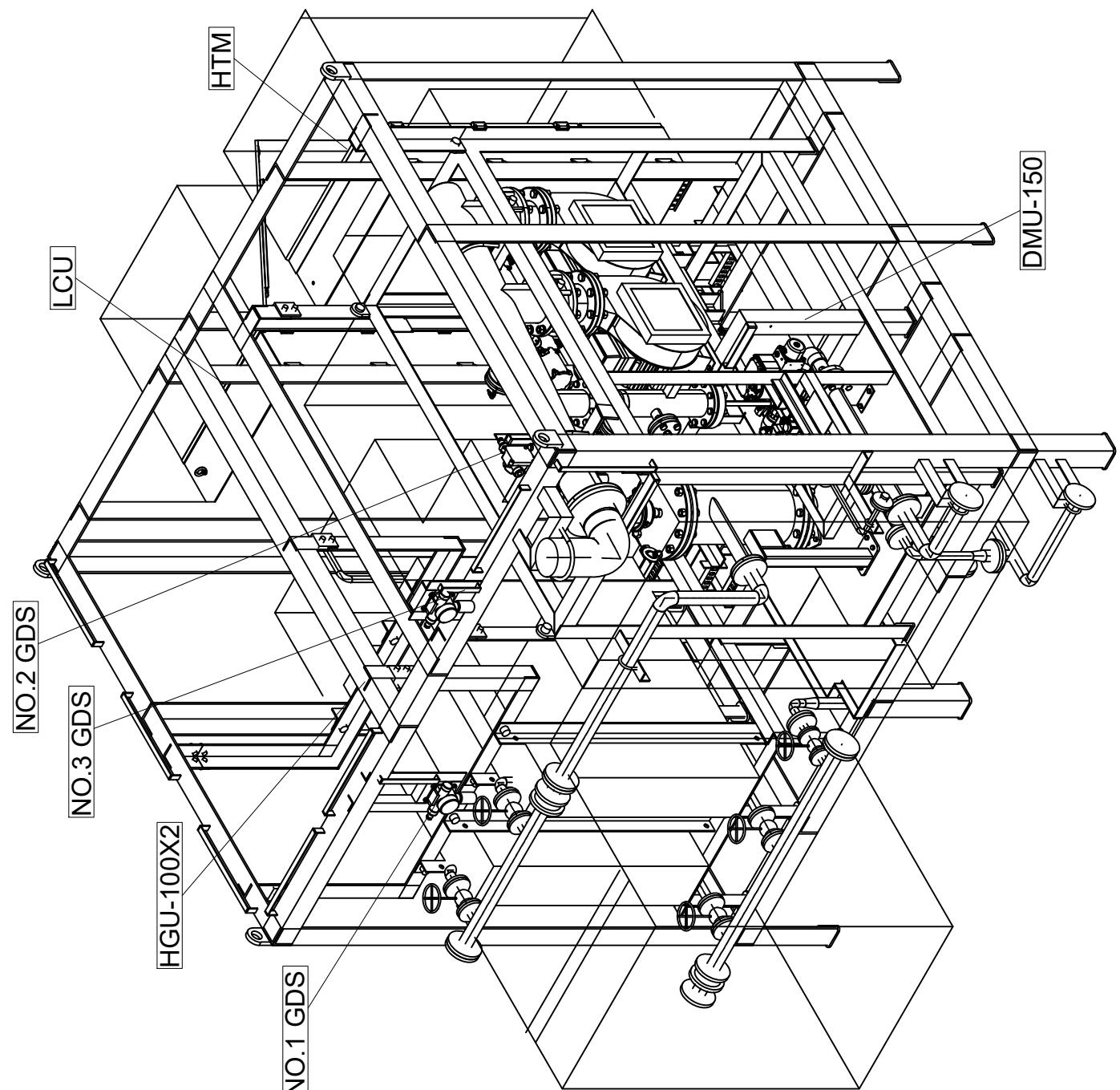


SHIP YARD	HULL NO.	MODEL NAME
K SHIPBUILDING	S1940	Ex-ECS-HYCHLOR 1200
APPD BY	J.Y.KANG	TITLE
CHKD BY	J.Y.KANG	SIZE
DSND BY	K.B.KIM	WEIGHT
	A3	3,600 KG
		mm
		SCALE
		REV.
		▲

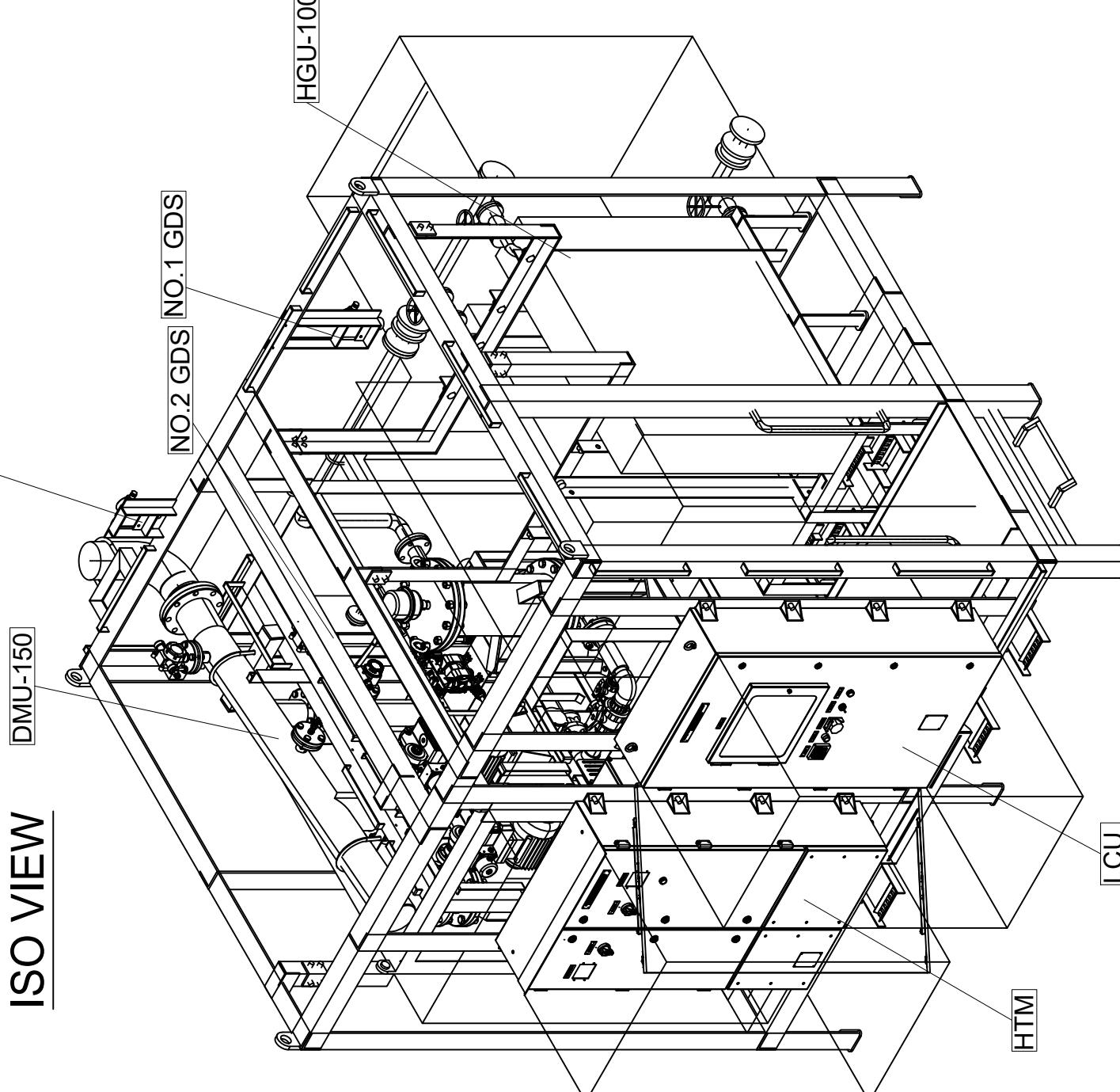
**SKID LEG POSITION**  
**(100X100X10t ANGLE)**



SHIP YARD	HULL NO.	MODEL NAME
K SHIPBUILDING	S1940	Ex-ECS-HYCHLOR 1200
APPD BY	J.Y.KANG	TITLE
CHKD BY	J.Y.KANG	SIZE
DSND BY	K.B.KIM	WEIGHT
		UNIT
		mm
		SCALE
		REV.
		A



## ISO VIEW



# SKID STANDARD PRACTICE

SHIP YARD	K Shipbuilding
HULL NO.	S1940
OWNER	

## 1. PIPING

ITEM	PRESSURE	PIPE SPEC				BOLT/NUT				U-BOLT
		NOM. DIA.	MATERIAL	COATING	GASKET	GRADE	THICKNESS	MATERIAL	TYPE	
BALLAST LINE	10K	-	STPG370 ERW, #80	POLY	T1	NON-ASB	RF	1.6T	10.9	N/A
DMU VENT LINE	10K	-	STPG370 ERW, #40	-	T1	NON-ASB	RF	1.6T	10.9	N/A
DRAIN LINE	10K	-	STPG370 ERW, #40	POLY	T1	NON-ASB	RF	1.6T	10.9	N/A
AIR SERVICE	10K	-	STPG370 ERW, #80	-	T1	NON-ASB	RF	1.6T	10.9	N/A

\* TOOTH WASHER : NOT APPLICABLE

## 2. 철의장

ITEM	TYPE	SPEC	MATERIAL
PLATE	CHECKED PLATE	COUNT SCREW M8 X 15L	SS30C
	OPEN GRATING		

## 3. 전장

CABLE TRAY	2	3	4	5	6	7	8	10	COATING	REMARK
WIDTH (W)	200	300	400	500	600	700	800	1000		F.B TYPE : RUNNER BAR 6T X 38 FB
CHANNEL TYPE			3.0T STL PLATE			3.0T STL PLATE			ELEC. GALV G (60um)	
F.B TYPE			2.3T STL PLATE			3.2T STL PLATE			ELEC. GALV G (60um)	
PIPE TYPE			25A, SCH.10						ELEC. GALV G (60um)	PIPE TYPE : PIPE 25A
SUPPORT (BOLTING)			EARTH CABLE Ø8(16SQ Y/G) SHANK FLANGE NUT, EARTH WIRE 적용							
SUPPORT (WELDING)			EARTH CABLE, SHANK FLANGE NUT, TOOTH WASHER 미적용							

## 4. SEATING

EQUIPMENT	MATERIAL	COATING	GRADE	BOLT	NUT	WASHER
GDS	SS400	ELEC. GALV	4.8	HEX.	ONE	NO
HTM	SS400	ELEC. GALV	4.8	HEX.	ONE	NO
LCU	SS400	ELEC. GALV	4.8	HEX.	ONE	NO

## 5. EARTH

EQUIPMENT	CABLE(mm2)	SIZE	REMARK	PAINTING AREA	CODE	COAT	BRAND NAME	DFT	REMARK
HTM	16	M8	-	PIPE	T1	1ST	JOTACOTE UNIVERSAL N10	160	AL. RT
LCU	4	M6	-			2ND	JOTACOTE UNIVERSAL N10	160	ALUMINIUM
				FRAME	E3	1ST	JOTACOTE F60	70	WHITE
						2ND	PENGUARD FSG II	70	GREEN(257)
				CHK. PLATE	E3	1ST	JOTACOTE F60	70	WHITE
						2ND	PENGUARD FSG II	70	GREEN(257)

## 6. PAINT SPEC.

PAINTING AREA	CODE	COAT	BRAND NAME	DFT	REMARK
PIPE	T1	1ST	JOTACOTE UNIVERSAL N10	160	AL. RT
		2ND	JOTACOTE UNIVERSAL N10	160	ALUMINIUM
FRAME	E3	1ST	JOTACOTE F60	70	WHITE
		2ND	PENGUARD FSG II	70	GREEN(257)
CHK. PLATE	E3	1ST	JOTACOTE F60	70	WHITE
		2ND	PENGUARD FSG II	70	GREEN(257)



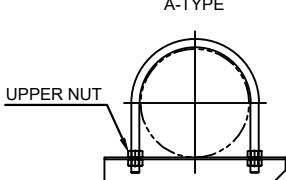
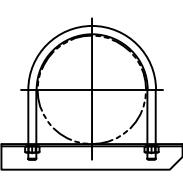
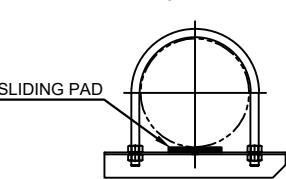
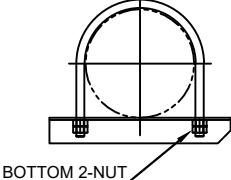
## U-BOLT

SHIP YARD : -

HULL NO. : -

OWNER : -

### TYPE & SKETCH

U-BOLT □ NUT	A-TYPE 	BOLT : 2-NUT (UPPER □ BOTTOM)
	B-TYPE 	BOLT : 1-NUT (BOTTOM)
	C-TYPE 	BOLT : 2-NUT (UPPER □ BOTTOM) SLIDING PAD
	D-TYPE 	BOLT : 2-NUT (BOTTOM)



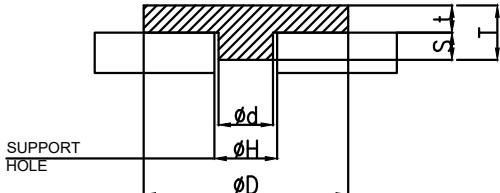
## PAD

SHIP YARD : -

HULL NO. : -

OWNER : -

### 1. SLIDING PAD

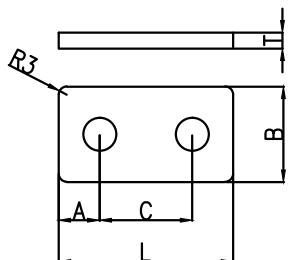


NOTE.

1. MATERIAL : PTFE
2. UNIT : mm

NO.	PIPE N.D	D	d	S	t	T	H
SP-1	125A - 150A	60	15	10	10	20	18
SP-2	200A - 400A	75	20	10	10	20	23
SP-3	450A - 550A	100	30	10	10	20	34
SP-4	600A □ ABOVE	130	40	12	10	20	44

### 2. SUS PAD



NOTE.

1. MATERIAL : SUS304
2. UNIT : mm

N.D	TYPE	A	C	L	B	T	H	BOLT
15	SL-15	15	34	64	35	1	ø12	M10
20	SL-20	15	40	70	35	1	ø12	M10
25	SL-25	15	46	76	35	1	ø12	M10
32	SL-32	15	56	86	35	1	ø12	M10
40	SL-40	15	62	92	35	1	ø12	M10
50	SL-50	15	74	104	35	1	ø12	M10
65	SL-65	15	92	122	45	1	ø15	M12
80	SL-80	23	104	150	45	1	ø15	M12
100	SL-100	23	134	180	50	1	ø19	M16



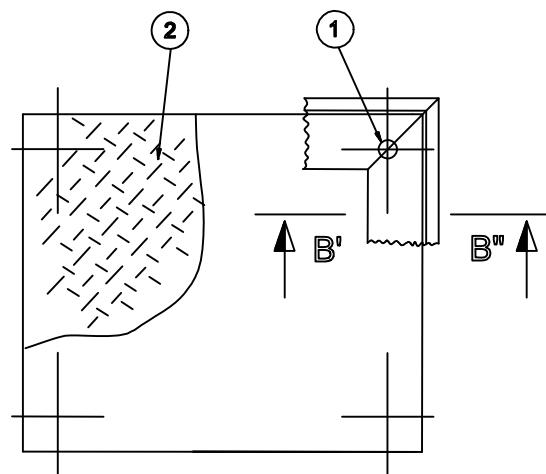
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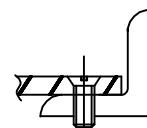
HULL NO. : -

OWNER : -

### CHECKED PLATE & BOLTING



**SECTION B' - B"**



2	CHECKERED PLATE	4.5 t	SS400			
1	COUNTER SUNKER SCREW	M8 X 15L	S20C			
NO.	DESCRIPTION	DIMENSION	MAT'L	Q'TY	HDS NO.	REMARK



# CHECKED PLATE

SHIP YARD : -

HULL NO. : -

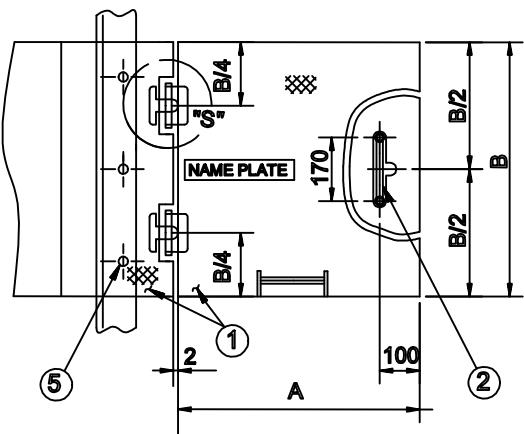
OWNER : -

## HINGE TYPE CHECKED PLATE

### PORTABLE TYPE GRATING COVER

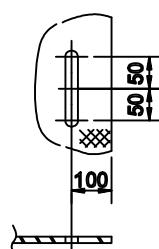
#### SA-TYPE

(WITH HANDLE FOR ACES)  
SIZE : A X B ≥ 450X450

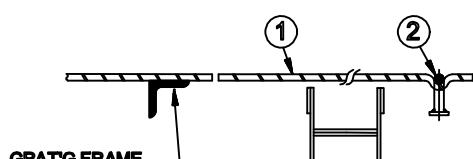


#### SB-TYPE

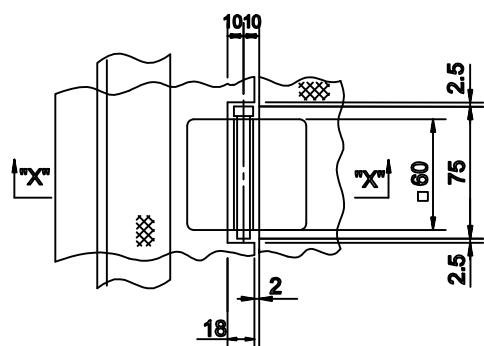
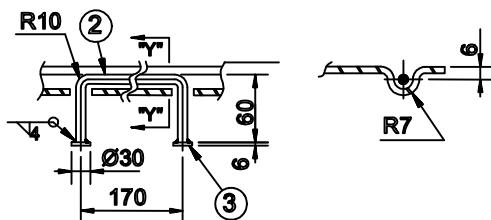
(WITHOUT HANDLE FOR  
V/V OR OTHER EQUIPMENT)  
SIZE : A X B < 450X450



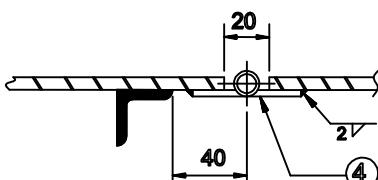
#### DETAIL OF HANDLE



#### "Y-Y" SEC



#### "X-X" SECTION



#### NOTES

1. NAME PLATE TO BE ATTACHED ON GRATING COVER AFTER GRINDING

NO.	DESCRIPTION	DIMENSION	MAT'L	Q'TY	HDS NO.	REMARK
5	COUNTER SUNKER SCREW	M8 X 15L	S20C			
4	HINGE	60X60X2.3T	SS400(GALV)	2		
3	PAD	6T	SS400	2		
2	HANDLE	Ø 9B.R	SS400	1		
1	CHECKERED PLATE	4.5T	SS400	2		



## EARTHING

SHIP YARD : -

HULL NO. : -

OWNER : -

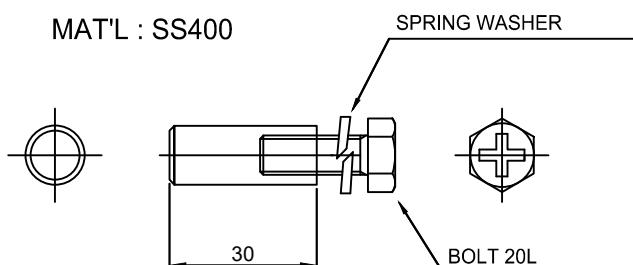
## EARTHING

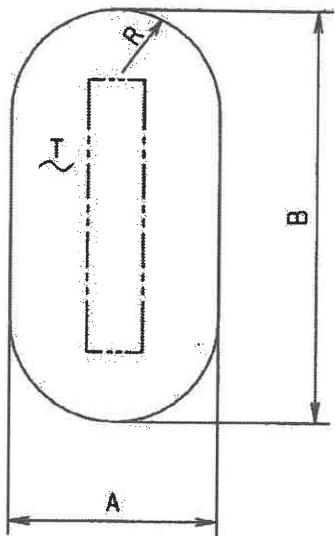
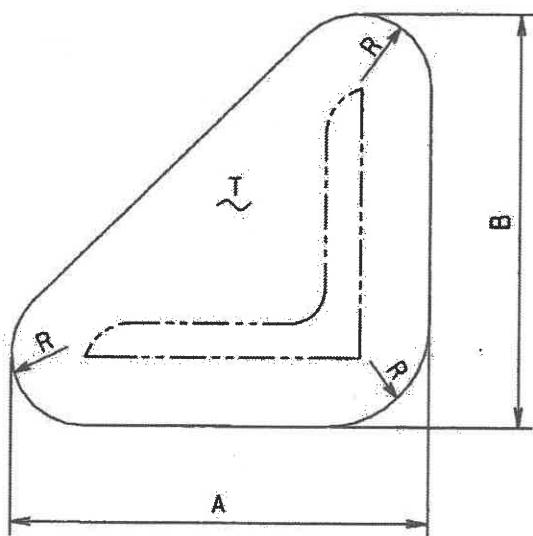
EQUIPMENT	CABLE	SIZE	REMARK
PDE	16 25 35 70	M8 M8 M10 M10	
ANU TSU	4	M6	
FTU	4	M6	
S.W.PUMP	4	M6	
ECU	16 25 35 70	M8 M8 M10 M10	
EPJ	16 25 35	M8 M8 M10	
ESJ		M6	
FMU	4	M6	
BELOW A.C 30V & D.C 50V	N/A	N/A	GDS,FTS,CSU,VLS, TS,PS

## INSTALLATION OF EARTH BOLT

### 1. EARTH BOLT

MAT'L : SS400



SQ-TYPESP-TYPE

UNIT : MM

	MARK NO.	A X B	T	R	PURPOSE	WEIGHT(Kg)	REMARK
APRD	SP - 1	30 X 60	8	15	38 X 6 FLAT BAR	0.06	
	SP - 9	180 X 180	10	15	150 X 150 EQUAL ANGLE	1.54	
	SP - 8	160 X 160	10	15	130 X 130 EQUAL ANGLE	1.24	
	SP - 7	130 X 130	10	15	100 X 100 EQUAL ANGLE	0.85	
	SP - 6	120 X 120	10	15	90 X 90 EQUAL ANGLE	0.73	
CHKD	SP - 5	100 X 100	10	10	75 X 75 EQUAL ANGLE	0.48	
	SP - 4	90 X 90	8	10	65 X 65 EQUAL ANGLE	0.32	
DRWN	SP - 3	70 X 70	8	10	50 X 50 EQUAL ANGLE	0.20	
	SP - 2	60 X 60	8	10	40 X 40 EQUAL ANGLE	0.15	
	SP - 1	50 X 50	8	10	25 X 25 30 X 30 EQUAL ANGLE	0.11	
RGTD	I	PAD	-		SS400		
	NO	DESCRIPTION	DIMENSION	MATERIAL	Q'TY	HDS NO	REMARK