

Illustration 4.14.1a Control Flow for ESD and Tank Protection System (DFDE Mode)

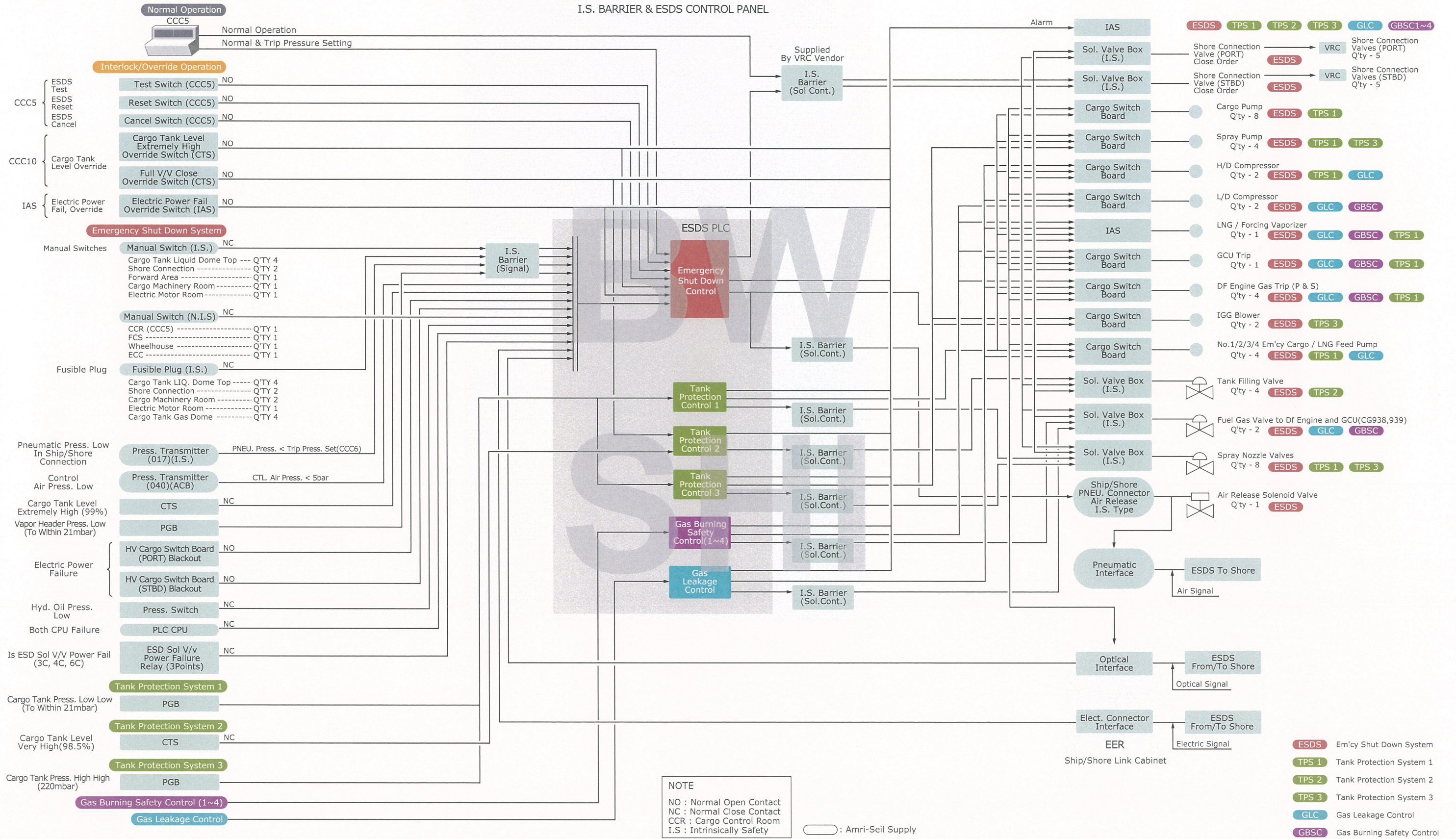


Illustration 4.14.1b Control Flow for ESD and Tank Protection System (FSRU Mode)

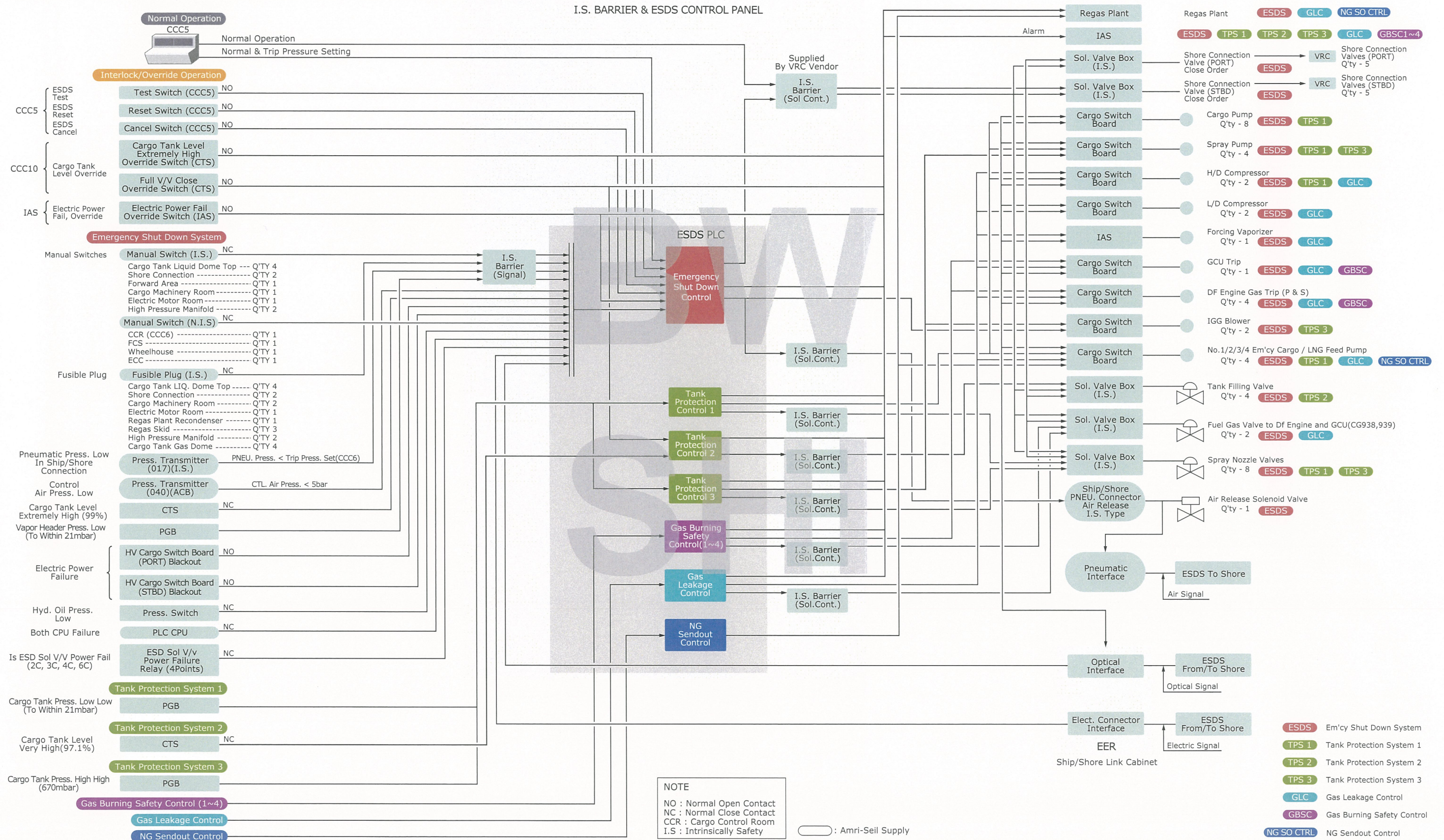


Illustration 4.14.1c ESDS Screen Shot

Home Page

EMERGENCY SHUTDOWN SYSTEM

Cause Of ESD Trip

☐ ESD Total Alarm
☐ Hydr Oil Press Low
☐ 1 Cargo Tank level Extream High
☐ 2 Cargo Tank level Extream High
☐ 3 Cargo Tank level Extream High
☐ 4 Cargo Tank level Extream High
☐ Vapor HDR Press LL
☐ CTL Air Pressure Low < 5bar
☒ IS ESD Sol VV Power Fail (3C)
☒ IS ESD Sol VV Power Fail (4C)
☒ IS ESD Sol VV Power Fail (8C)
☐ IS ESD Sol VV Power Fail(8C)
☒ ELECTRIC POWER FAIL (CSBD 1/2)

Manual Push Button Station(No Delay)

☐ ESD Manual Activated

Thermo Fusible Plugs

☐ ESD Fusible Plug Activated

Shore Activated ESD

☐ SHORE TO SHIP LNG ESD
☐ SHORE TO SHIP CNG ESD
☐ ESD Pneumatic Press Low Alarm

CTL Air Pressure(PT040) 0.00

ELECTRIC POWER FAIL OVERRIDE

☐

DFDE P&S Gas Trip Reset

☐

Tank Protection TPS1

☐ 1 Cargo Tank Press Low Low(TPS1)
☐ 2 Cargo Tank Press Low Low(TPS1)
☐ 3 Cargo Tank Press Low Low(TPS1)
☐ 4 Cargo Tank Press Low Low(TPS1)

Tank Protection TPS2

☐ 1 Cargo Tank Level Very High(TPS2)
☐ 2 Cargo Tank Level Very High(TPS2)
☐ 3 Cargo Tank Level Very High(TPS2)
☐ 4 Cargo Tank Level Very High(TPS2)

Tank Protection TPS3

☐ 1 Cargo Tank Press High High(TPS3)
☐ 2 Cargo Tank Press High High(TPS3)
☐ 3 Cargo Tank Press High High(TPS3)
☐ 4 Cargo Tank Press High High(TPS3)

Important Alarms (Not ESD)

☐ PC CPU Fail Alarm (Both CPU Fail->ESD)
☐ 3C Sol VV Box Hyd Press
☐ 4C Sol VV Box Hyd Press
☐ 6C Sol VV Box Hyd Press
☒ 8C Sol VV Box Hyd Press

ESD Override

☐ ESD Total Alarm Override
☐ Electrical Power Fail ESD Override
☐ Shore To SHIP ESD Override
☐ Pneumatic Press Low ESD Override
☐ 1C TK Level EH ESD Override
☒ 2C TK Level EH ESD Override
☐ 3C TK Level EH ESD Override
☐ 4C TK Level EH ESD Override
☐ 1C TK level VH(FILL VV Close) Override
☐ 2C TK level VH(FILL VV Close) Override
☐ 3C TK level VH(FILL VV Close) Override
☐ 4C TK level VH(FILL VV Close) Override

Gas Burning Saftey Control

☐ Gas Burning Safety Controller 1 Activated P DFDE
☐ Gas Burning Safety Controller 2 Activated S DFDE
☐ Gas Burning Safety Controller 3 Activated P&S DFDE
☐ Gas Burning Safety Controller 4 Activated GCU

Gas Leakage Control

☐ Gas Leakage Controller Activated IN EMR Or CMR
☐ Port DFDE RM Or GVU RM Gas Leakage
☐ Stbd DFDE RM Or GVU RM GAS Leakage
☐ GCU AREA GAS Leakage

Misc Alarms

☐ Master Gas VV(CG938(DFDE))
☐ Master Gas VV (CG938(GCU))
☒ Port DFDE Fuel Gas Valve (CG946) Trip
☒ Stbd DFDE Fuel Gas Valve (CG947) Trip
☐ LNG / Forcing Vaporizer Stop
☐ NO 2 & NO 3 EIR Supply Fans Stop(P&S)
☐ Port GVU RM Or NO 3 EIR Fans Stop
☐ Stbd GVU RM Or NO 2 EIR Fans Stop
☐ GCU GVU RM EXT Fans Stop
☐ BOG Temp HH/LL For CG939(GCU)
☐ BOG Temp HH/LL For CG938(DFDE)
☐ LD Comp. Stop & Master Gas VV Close(W/H)
☐ LD Comp. Stop & Master Gas VV Close(CCC)
☐ LD Comp. Stop & Master Gas VV Close(ECC)
☐ LD Comp. Stop & Master Gas VV Close(FCS)
☐ Normal Source Power Fail
☐ UPS Source Power Fail
☒ UPS abnormal alarm

SHIP SHORE LINK SYSTEM

☐ Ship Shore Link System Abnormal
☐ Ship Shore Link System Inhibit Ind

REGAS SYSTEM

☒ Fusible Plug Activated For Regas Plant
☒ Regas Plant EMCY Stop
☒ NG Sendout ESD VV Closed

Illustration 4.14.1d Cause and Effect Chart (DFDE Mode_1/2)

Note

1. Categories in Action part mean the following

– ESD: ESD related action

– TPS1/2/3: Tank Protection Action Type 1/2/3

– GBSC : Gas Burning Safety Control

– GLC : Gas Leakage Control

2. Symbol(signal status) and abbreviation

○ : On at activated condition, ● : Off at activated condition

NE : Normal Energized, NDE : Normal De-energized

3. ESD Cause Time Delay: Time delay to be adjustable

– Manual Switch: Time delay 0sec.

– Fusible Plug: Time delay 5sec.

– S/S Link: Time delay 5sec.

– Tank Level: Time delay 5sec.

– Press. Low/High: Time delay 5sec. (except for Hydraulic Oil Press. Low => 10sec.)

– Power Fail: Time delay 5sec.

Preliminary check list for test

1. Cable wiring condition of ESDS local panel.

2. Operating condition of VRC, IAS and all Equipments related ESDS.

3. Supplied power for ESDS

Category	Cause	TB No.(I/O Add.)	Result	Set Value	Status	Activated Group	Effect (TB No. [Relay No.])
LNG DFDE Mode	LNG MODE (CCC5 MODE SWITCH)	1-59,60(I:01/29)			OFF	ESD, TP51	#1 Cargo Tank Cargo Pump #1,2 Stop (7-33,34,73,74(2016))
ESD	Test	ESD Test			ON	ESD, TP51	#2 Cargo Tank Cargo Pump #1,2 Stop (7-31,32,71,72(2015))
	ESD reset	ESD Reset			ON	ESD, TP51	#3 Cargo Tank Cargo Pump #1,2 Stop (7-27,28,67,68(2013))
		No.3C Accumulator			ON	ESD, TP51	#4 Cargo Tank Cargo Pump #1,2 Stop (7-25,26,65,66(2012))
		No.4C Accumulator			ON	ESD, TP51, TP53	#1 Cargo Tank Spray Pump Stop (7-37,38(2018))
Manual switch	Inhibit*1	ESD Inhibit			ON	ESD, TP51, TP53	#2 Cargo Tank Spray Pump Stop (7-47,48(2023))
		#1 Liquid Dome			OFF	ESD, TP51, TP53	#3 Cargo Tank Spray Pump Stop (7-39,40(2019))
		#2 Liquid Dome			OFF	ESD, TP51, TP53	#4 Cargo Tank Spray Pump Stop (7-49,50(2024))
		#3 Liquid Dome			OFF	ESD, TP51, TP53	No. 1,2 H/D Comp. Stop (7-29,30,69,70(2014))
Fusible plug		#4 Liquid Dome			OFF	ESD, TP51, TP53	No. 1,2 L/D Comp. Stop (7-35,36,75,76(2017))
		FWD END OF TRUNK DECK	IS-1-18 (I:02/13)		OFF	ESD, TP51, GBSC3,4, GLC	IGA Blower Stop (07-45,46,51,52(2022,2025))
		Shore Conn PORT			OFF	ESD, TP51	No. 1 LNG Feed/Emcy's Pump Stop (10-47,48(5021))
		Shore Conn STBD			OFF	ESD, TP51	No.2 LNG Feed/Emcy's Pump Stop (10-51,52(5023))
S/S link		Cargo Machinery Room			OFF	ESD, TP51	No.3 LNG Feed/Emcy's Pump Stop (10-49,50(5022))
		Elec Motor Room			OFF	ESD, TP51	No.4 LNG Feed/Emcy's Pump Stop (10-53,54(5024))
		CCC (Cargo Control console)	2-1,2(I:02/00)		OFF	ESD, TP51, GBSC3,4, GLC	ESD Sig. FOR LNG (10-43,44(5019))
		ECC (Engine Control console)	1-53,54(I:01/26)		OFF	ESD, TP51	ESD Sig. FOR CNG (10-41,42(5018))
Override		Wheel House	2-21,22(I:02/10)		OFF	ESD, TP51	Fuel Gas Master Valve Close by 6C ACC. (9-5(64002)) *8
		F.C.S	2-23,24(I:02/11)		OFF	ESD, TP51	Shore Conn. Valve Close by 4C ACC.(9-1,2(4000))
		High Pressure manifold PORT	IS-39-42 (I:01/24)		OFF	ESD, TP51	Shore Conn. Valve Close by 3C ACC.(9-3,4(4001))
		High Pressure manifold SWBD			OFF	ESD, TP51	Pneumatic Air Release Valve 5A(05-57,58(3004))
Power fail		#1 Liquid Dome			OFF	ESD, TP51, GBSC3, GLC	Pneumatic Air Release Valve 5A(05-57,58(3004))
		#2 Liquid Dome			OFF	ESD, TP51, GBSC4, GLC	LCU trip(7-21,22(2010)) Trip signal pulse 3sec
		#3 Liquid Dome			OFF	ESD, TP51, GBSC1,3, GLC	DF engine gas trip(P)(10-27,28,31,32(5015,5014))
		#4 Liquid Dome			OFF	ESD, TP51, GBSC2,3, GLC	DF engine gas trip(S)(10-19,20,23,24(5009,5011))
Override		#1 Gas Dome			OFF	ESD, TP51, GBSC3, GLC	CG938 fuel gas valve to DF engine (P&S) close(10-3,4(5001))
		#2 Gas Dome			OFF	ESD, TP51, GBSC4, GLC	CG939 fuel gas valve to GCU close(10-7,8(5003))
		#3 Gas Dome			OFF	ESD, TP51, GBSC1,3, GLC	CG946 fuel gas valve to DF engine (P) close(6-61,62(1030))
		#4 Gas Dome			OFF	ESD, TP51, GBSC2,3, GLC	CG947 fuel gas valve to DF engine (S) close(6-63,64(1031))
Override		Shore Conn PORT			OFF	ESD, TP51, TP53	#1 Cargo Tank Spray Nozzle Valve 1,2 Close (9-13,14,17,18(4006,4008))
		Shore Conn STBD			OFF	ESD, TP51, TP53	#2 Cargo Tank Spray Nozzle Valve 1,2 Close (9-25,26,29,30(4012,4014))
		Cargo Machinery Room 1			OFF	ESD, TP51, TP53	#3 Cargo Tank Spray Nozzle Valve 1,2 Close (9-37,38,41,42(4018,4020))
		Cargo Machinery Room 2			OFF	ESD, TP51, TP53	#4 Cargo Tank Spray Nozzle Valve 1,2 Close (9-53,54,57,58(4026,4028))
Override		Electric Motor Room			OFF	ESD, TP52	#1 Cargo Tank Fill Valve Close (9-9,10(4004))
		Regas Plant Recondenser			OFF	ESD, TP52	#2 Cargo Tank Fill Valve Close (9-21,22(4010))
		Regas Train 1 OR 2 OR 3 (Anyone)			OFF	ESD, TP52	#3 Cargo Tank Fill Valve Close (9-33,34(4016))
		NG sendout HP manifold Port OR Stbd (Anyone)			OFF	ESD, TP52	#4 Cargo Tank Fill Valve Close (9-49,50(4024))
Override		ESD SIG. FOR LNG	1-35,36(I:01/17)		OFF	N/A	REGAS Plant EMCY Stop (10-35,36(5015))
		ESD SIG. FOR CNG	1-33,34(I:01/16)		OFF	N/A	REGAS SKID 1 LNG Booster P/P A Stop (10-67,68(5025))
		#1 Cargo Tank (EH 99%)	2-31,32(I:02/15)		OFF	N/A	REGAS SKID 1 LNG Booster P/P B Stop (10-79,80(5028))
		#2 Cargo Tank (EH 99%)	2-33,34(I:02/16)		OFF	N/A	REGAS SKID 2 LNG Booster P/P A Stop (10-69,70(5026))
Override		#3 Cargo Tank (EH 99%)	2-35,36(I:02/17)		OFF	N/A	REGAS SKID 2 LNG Booster P/P B Stop (10-81,82(5029))
		#4 Cargo Tank (EH 99%)	2-37,38(I:02/18)		OFF	N/A	REGAS SKID 3 LNG Booster P/P A Stop (10-71,72(5027))
		#1 Cargo Tank (EH 99%) ESDS Override	2-47,48(I:02/23)		OFF	N/A	REGAS SKID 3 LNG Booster P/P B Stop (10-83,84(5030))
		#2 Cargo Tank (EH 99%) ESDS Override	2-49,50(I:02/24)		OFF	N/A	CG660 NG SENDOUT ESD Valve Close (9-61,62(4030))
Override		#3 Cargo Tank (EH 99%) ESDS Override	2-51,52(I:02/25)		OFF	N/A	ESD Total Alarm (7-53,54 [2026])
		#4 Cargo Tank (EH 99%) ESDS Override	2-53,54(I:02/26)		OFF	N/A	Electric Power Fail Override (6-41,42(1020))
		Hydraulic Oil Pressure Low(voting 2oo3)	3-21,22(I:03/10)		OFF	N/A	ESD Manual Activated (7-7,8(2003))
		Hydraulic Oil Pressure Low(voting 2oo3)	1-43,44(I:01/21)		OFF	N/A	ESD Fuel Plug Activated (7-9,10(2004))
Override		Hydraulic Oil Pressure Low(voting 2oo3)	1-45,46(I:01/22)		OFF	N/A	ESD SIG. FOR LNG (07-11,12(2005))
		Vapor Header Pressure Low Low(voting 2oo3)	IS-69,70(AI:12/04)		OFF	N/A	ESD SIG. FOR CNG (07-13,14(2006))
		Vapor Header Pressure Low Low(voting 2oo3)	IS-71,72(AI:12/05)		OFF	N/A	#1-#4 Tank Level Ext. High Alarm (99%) (6-19-26(1009-1012)) *3
		Vapor Header Pressure Low Low(voting 2oo3)	IS-73,74(AI:12/06)		OFF	N/A	#1-#4 Tank Level Ext. High Override (99%) (6-65-72(CR108-CR111))
Override		Control Air Pressure Low(voting 2oo3)	11-5,6(AI:11/02)		OFF	N/A	ESD HYDR. OIL PRESS. LOW (7-19,20(2009))
		Control Air Pressure Low(voting 2oo3)	11-1-1,2(AI:11/03)		OFF	N/A	Vapour header Press. Low low(7-55,56(2027)) voting 2 oo 3
		Control Air Pressure Low(voting 2oo3)	11-1-3,4(AI:11/04)		OFF	N/A	ESD Control Air Press. Low (6-35,36(1017))
		Pneumatic Pressure Low	IS-59,60(AI:11/01)		OFF	N/A	ESD Pneumatic Interface (7-15,16(2007))
Override		No.1 6.6 KV CARGO SWBD	3-61,62(I:03/30)		ON	N/A	CG660 NG SENDOUT ESD Valve Closed (6-63,64(1031))
		No.2 6.6 KV CARGO SWBD	3-63,64(I:03/31)		ON	N/A	#1-#4 cargo tank press. LL (7-57-64(2028-2031))
		IS ESD Sol V/V Power Fail(3C)	5-45,46(I:05/22)		OFF	N/A	#1-#4 cargo tank press. HH (6-27-34(1013-1016))
		IS ESD Sol V/V Power Fail(4C)	5-47,48(I:05/23)		OFF	N/A	#1-#4 Cargo Tank Level Very High Alarm (98.5%) (6-11-18(1005-1008))
Override		IS ESD Sol V/V Power Fail(6C)	5-49,50(I:05/24)		OFF	N/A	#1-#4 Cargo Tank Level Very High Override (98.5%) (6-73-80(CR112-CR115))
		IS ESD Sol V/V Power Fail(8C)			OFF	N/A	ESD P.C.CPU ALARM (7-5,6(2002)) *5
		Electric Power Fail Override	3-35,36(I:03/17)		ON	N/A	ESD Normal Source Power Failure (6-81,82)
					ON	N/A	ESD UPS Source Power Failure (6-83,84)
Override					ON	N/A	GBSC1 activated(10-9,10(5004))
					ON	N/A	GBSC2 activated(10-11,12(5005))
					ON	N/A	GBSC3 activated(10-13,14(5006))
					ON	N/A	GBSC4 activated(10-15,16(5007))
Override					ON	N/A	GLC activated(10-17,18(5008))
					ON	N/A	3C Earth sol. v/v power fail(08-53,54(3026))
					ON	N/A	4C Earth sol. v/v power fail(08-55,56(3027))
					ON	N/A	6C Earth sol. v/v power fail(08-59,60(3029))
Override					ON	N/A	8C Earth sol. v/v power fail(08-61,62(3030))
					ON	N/A	ESD Fuel Plug Active (for regas plan(06-51,52(1025))
					ON	N/A	
					ON	N/A	

Illustration 4.14.1e Cause and Effect Chart (DFDE Mode 2/2)

[illegible]

* Revision

Rev.0 Prepared for Approval (July 25, 2013)

*1 When ESD Inhibit is selected, ESDS is not operated.

*2 When Override is activated, ESD or TPS2 is not operated.

*3 Each tank level alarm(Ext. High or Very High) is generated according to each tank condition.

*4 When Both CPUs are failed, ESD is activated and all output signals are turned off.

*5 When one of the redundant CPU is failed, an alarm for the CPU failure is generated and passed to IAS.

* P_{TS}: Trip Pressure Set Point which can be set by "PNEU. SETTING SWITCH (TRIP)" in CCR.

Illustration 4.14.1f Cause and Effect Chart (FSRU Mode_1/2)

Note

1. Categories in Action part mean the following

ESD: ESD related action

TPS1/2/3: Tank Protection Action Type 1/2/3

GBSC : Gas Burning Safety Control

GLC : Gas Leakage Control

2. Symbol(signal status) and abbreviation

○ : On at activated condition, ● : Off at activated condition

NE : Normal Energized, NDE : Normal De-energized

3. ESD Cause Time Delay: Time delay to be adjustable

Manual Switch: Time delay 0sec.

Fusible Plug: Time delay 5sec.

S/S Link: Time delay 5sec.

Tank Level: Time delay 5sec.

Press. Low/High: Time delay 5sec. (except for Hydraulic Oil Press. Low => 10sec.)

Power Fail: Time delay 5sec.

Preliminary check list for test

1. Cable wiring condition of ESDS local panel.

2. Operating condition of VRC, IAS and all Equipments related ESDS.

3. Supplied power for ESDS

Category	Cause	TB No. (I/O Add.)	Result	Set Value	Status	Activated Group	Effect (TB No. Relay No.)
FSRU Mode	FSRU MODE (CCCS MODE SWITCH)				ON	NE	ESD, TPS1
Test	ESD Test	1-59,60(I:01/29)			ON	NE	ESD, TPS1
	ESD Reset	2-15,16(I:02/07)			ON	NE	ESD, TPS1
	No.3C Accumulator	5-55,56(I:05/27)		90 barg	ON	NE	ESD, TPS1
ESD reset	No.4C Accumulator	5-57,58(I:05/28)		90 barg	ON	NE	ESD, TPS1
	No.6C Accumulator	5-59,60(I:05/29)		90 barg	ON	NE	ESD, TPS1, TPS3
	No.8C Accumulator	5-53,54(I:05/26)		90 barg	ON	NE	ESD, TPS1, TPS3
Inhibit+1	ESD Inhibit	2-19,20(I:02/09)			ON	NE	ESD, TPS1, TPS3
	#1 Liquid Dome				OFF	NE	ESD, TPS1, GLC
	#2 Liquid Dome				OFF	NE	ESD, TPS1, GLC
Manual switch	#3 Liquid Dome				OFF	NE	ESD, TPS1, GLC
	#4 Liquid Dome				OFF	NE	ESD, TPS1, GLC
	FWD, END OF TRUNK DECK				OFF	NE	ESD, TPS1, GLC
Manual switch	Shore Conn PORT				OFF	NE	ESD, TPS1, GLC
	Shore Conn STBD				OFF	NE	ESD, TPS1, GLC
	Cargo Machinery Room				OFF	NE	ESD, TPS1, GLC
Manual switch	Elec Motor Room				OFF	NE	ESD, TPS1, GLC
	CCC (Cargo control console)				OFF	NE	ESD, TPS1, GLC
	ECC (Engine control console)				OFF	NE	ESD, TPS1, GLC
Manual switch	Wheel House				OFF	NE	ESD, TPS1, GLC
	F.C.S				OFF	NE	ESD, TPS1, GLC
	High Pressure manifold PORT				OFF	NE	ESD, TPS1, GLC
Manual switch	High Pressure manifold STBD				OFF	NE	ESD, TPS1, GLC
	#1 Liquid Dome				OFF	NE	ESD, TPS1, GLC
	#2 Liquid Dome				OFF	NE	ESD, TPS1, GLC
Manual switch	#3 Liquid Dome				OFF	NE	ESD, TPS1, GLC
	#4 Liquid Dome				OFF	NE	ESD, TPS1, GLC
	#1 Gas Dome				OFF	NE	ESD, TPS1, GLC
Manual switch	#2 Gas Dome				OFF	NE	ESD, TPS1, GLC
	#3 Gas Dome				OFF	NE	ESD, TPS1, GLC
	#4 Gas Dome				OFF	NE	ESD, TPS1, GLC
Manual switch	Shore Conn PORT				OFF	NE	ESD, TPS1, GLC
	Shore Conn STBD				OFF	NE	ESD, TPS1, GLC
	Cargo Machinery Room 1				OFF	NE	ESD, TPS1, GLC
Manual switch	Cargo Machinery Room 2				OFF	NE	ESD, TPS1, GLC
	Electric Motor Room				OFF	NE	ESD, TPS1, GLC
	Regas Plant Recondenser				OFF	NE	ESD, TPS1, GLC
Manual switch	Regas Skid 1 OR 2 OR 3 (Anyone)				OFF	NE	ESD, TPS1, GLC
	NG sendout HP manifold Port OR Stbd (Anyone)				OFF	NE	ESD, TPS1, GLC
	ESD SIG. FOR LNG				OFF	NE	ESD, TPS1, GLC
Manual switch	ESD SIG. FOR CNG				OFF	NE	ESD, TPS1, GLC
	#1 Cargo Tank (EH 99%)				OFF	NE	ESD, TPS1, GLC
	#2 Cargo Tank (EH 99%)				OFF	NE	ESD, TPS1, GLC
Manual switch	#3 Cargo Tank (EH 99%)				OFF	NE	ESD, TPS1, GLC
	#4 Cargo Tank (EH 99%)				OFF	NE	ESD, TPS1, GLC
	#1 Cargo Tank (EH 99%) ESDS Override				OFF	NE	ESD, TPS1, GLC
Manual switch	#2 Cargo Tank (EH 99%) ESDS Override				OFF	NE	ESD, TPS1, GLC
	#3 Cargo Tank (EH 99%) ESDS Override				OFF	NE	ESD, TPS1, GLC
	#4 Cargo Tank (EH 99%) ESDS Override				OFF	NE	ESD, TPS1, GLC
Manual switch	Hydraulic Oil Pressure Low (voting 2oo3)				OFF	NE	ESD, TPS1, GLC
	Hydraulic Oil Pressure Low (voting 2oo3)				OFF	NE	ESD, TPS1, GLC
	Hydraulic Oil Pressure Low (voting 2oo3)				OFF	NE	ESD, TPS1, GLC
Manual switch	Vapor Header Pressure Low Low (voting 2oo3)				OFF	NE	ESD, TPS1, GLC
	Vapor Header Pressure Low Low (voting 2oo3)				OFF	NE	ESD, TPS1, GLC
	Vapor Header Pressure Low Low (voting 2oo3)				OFF	NE	ESD, TPS1, GLC
Manual switch	Control Air Pressure Low (voting 2oo3)				OFF	NE	ESD, TPS1, GLC
	Control Air Pressure Low (voting 2oo3)				OFF	NE	ESD, TPS1, GLC
	Control Air Pressure Low (voting 2oo3)				OFF	NE	ESD, TPS1, GLC
Manual switch	Pneumatic Pressure Low				OFF	NE	ESD, TPS1, GLC
	No.1 6.6 KV CARGO SWBD				OFF	NE	ESD, TPS1, GLC
	No.2 6.6 KV CARGO SWBD				OFF	NE	ESD, TPS1, GLC
Manual switch	IS ESD Sol V/V Power Fail(3C)				OFF	NE	ESD, TPS1, GLC
	IS ESD Sol V/V Power Fail(4C)				OFF	NE	ESD, TPS1, GLC
	IS ESD Sol V/V Power Fail(6C)				OFF	NE	ESD, TPS1, GLC
Manual switch	IS ESD Sol V/V Power Fail(8C)				OFF	NE	ESD, TPS1, GLC
	Electric Power Fail Override				ON	NE	ESD, TPS1, GLC

Illustration 4.14.1g Cause and Effect Chart (FSRU Mode 2/2)

				Effect (TB No. [Relay No.])		Activated Group			
				#1 Cargo Tank Cargo Pump #1,2 Stop (7-33,34,73,74[2016])		ESD, TPS1			
				#2 Cargo Tank Cargo Pump #1,2 Stop (7-31,32,71,72[2015])		ESD, TPS1			
				#3 Cargo Tank Cargo Pump #1,2 Stop (7-27,28,67,68[2013])		ESD, TPS1			
				#4 Cargo Tank Cargo Pump #1,2 Stop (7-25,26,65,66[2012])		ESD, TPS1			
				#1 Cargo Tank Spray Pump Stop (7-37,38[2018])		ESD, TPS1, TPS3			
				#2 Cargo Tank Spray Pump Stop (7-47,48[2023])		ESD, TPS1, TPS3			
				#3 Cargo Tank Spray Pump Stop (7-39,40[2019])		ESD, TPS1, TPS3			
				#4 Cargo Tank Spray Pump Stop (7-49,50[2024])		ESD, TPS1, TPS3			
				No. 1,2 H/D Comp. Stop (7-29,30,69,70[2014])		ESD, TPS1, GLC			
				No. 1,2 L/D Comp. Stop (7-35,36,75,76[2017])		ESD, TPS1, GBSC3,4, GLC			
				GG Blower Stop (07-45,46,51,52[2022,2025])		ESD, TPS3			
				No.1 LNG Feed/Emcy's Pump Stop (10-47,48[5021])		ESD, TPS1, NG SO CONTROL			
				No.2 LNG Feed/Emcy's Pump Stop (10-51,52[5023])		ESD, TPS1, NG SO CONTROL			
				No.3 LNG Feed/Emcy's Pump Stop (10-49,50[5022])		ESD, TPS1, NG SO CONTROL			
				No.4 LNG Feed/Emcy's Pump Stop (10-53,54[5024])		ESD, TPS1, NG SO CONTROL			
				ESD Sig. FOR LNG (10-43,44[5019])		ESD			
				ESD Sig. FOR CNG (10-41,42[5018])		ESD			
				Fuel Gas Master Valve Close by 6C ACC. (9-5,6[4002]) *8		ESD			
				Shore Conn. Valve Close by 4C ACC. (9-1,2[4000])		ESD			
				Shore Conn. Valve Close by 3C ACC. (9-3,4[4001])		ESD			
				Pneumatic Air Release Valve SAG(S-57,58[3004])		ESD			
				LNG / Forcing vaporizer stop(6-57,58[3028])		ESD, TPS1, GBSC3, GLC			
				GCU trip(7-21,22[2010]). Trip signal pulse 3sec.		ESD, TPS1, GBSC4, GLC			
				DF engine gas trip(P)(10-27,28,31,32[5012,5014])		ESD, TPS1, GBSC1, 3, GLC			
				DF engine gas trip(S)(10-19,20,23,24[5009,5011])		ESD, TPS1, GBSC2, 3, GLC			
				CG938 fuel gas valve to DF engine (P&S) closed(10-3,4[5001])		ESD, GBSC3, GLC			
				CG939 fuel gas valve to GCU close(10-7,8[5003])		ESD, GBSC4, GLC			
				CG946 fuel gas valve to DF engine (P) closed(6-61,62[1030])		ESD, TPS1, GBSC1, 3, GLC			
				CG947 fuel gas valve to DF engine (S) closed(6-63,64[1031])		ESD, TPS1, GBSC2, 3, GLC			
				#1 Cargo Tank Spray Nozzle Valve 1,2 Close (9-13,14,17,18[4006,4008])		ESD, TPS1, TPS3			
				#2 Cargo Tank Spray Nozzle Valve 1,2 Close (9-25,26,29,30[4012,4014])		ESD, TPS1, TPS3			
				#3 Cargo Tank Spray Nozzle Valve 1,2 Close (9-37,38,41,42[4018,4020])		ESD, TPS1, TPS3			
				#4 Cargo Tank Spray Nozzle Valve 1,2 Close (9-53,54,57,58[4026,4028])		ESD, TPS1, TPS3			
				#1 Cargo Tank Fill Valve Close (9-9,10[4004])		ESD, TPS2			
				#2 Cargo Tank Fill Valve Close (9-21,22[4010])		ESD, TPS2			
				#3 Cargo Tank Fill Valve Close (9-33,34[4016])		ESD, TPS2			
				#4 Cargo Tank Fill Valve Close (9-49,50[4024])		ESD, TPS2			
				REGAS Plant EM CY Stop (10-35,36[5015])		ESD, NG SENDOUT CONTROL			
				REGAS SKID 1 LNG Booster P/P A Stop (10-55,56[5025])		ESD, NG SENDOUT CONTROL			
				REGAS SKID 1 LNG Booster P/P B Stop (10-61,62[5028])		ESD, NG SENDOUT CONTROL			
				REGAS SKID 2 LNG Booster P/P A Stop (10-57,58[5026])		ESD, NG SENDOUT CONTROL			
				REGAS SKID 2 LNG Booster P/P B Stop (10-63,64[5029])		ESD, NG SENDOUT CONTROL			
				REGAS SKID 3 LNG Booster P/P A Stop (10-59,60[5027])		ESD, NG SENDOUT CONTROL			
				REGAS SKID 3 LNG Booster P/P B Stop (10-65,66[5030])		ESD, NG SENDOUT CONTROL			
				CG660 NG SENDOUT Valve Close by 8C ACC. (9-43,44[4021])		ESD, NG SENDOUT CONTROL			
				ESD Total Alarm (7-53,54[2026])					
				Electric Power Fail Override (6-41,42[1020])					
				ESD Manual Activated (7-7,8[2003])					
				ESD Fusible Plug Activated (7-9,10[2004])					
				ESD SIG. FOR LNG (07-11,12[2005])					
				ESD SIG. FOR CNG (07-13,14[2006])					
				#1-#4 Tank Level Ext. High Alarm (99%) (6-19-26[1009-1012]) *3					
				#1-#4 Tank Level Ext. High Override (99%) (6-65-72[CR108-CR111])					
				ESD HYDR. OIL PRESS. LOW (7-19,20[2009])					
				Vapour header press. Low low(7-55,56[2027]) valving 2 oo 3					
				ESD Control Air Press. Low (6-35,36[1017])					
				ESD Pneumatic Interface (7-15,16[2007])					
				CG660 NG SENDOUT ESD Valve Closed (10-37,40[5017])					
				#1-#4 cargo tank press. LL (7-57-64[2028-2031])					
				#1-#4 cargo tank press. HH (6-27-34[1013-1016])					
				#1-#4 Cargo Tank Level Very High Alarm (97.1%) (6-11-18[1005-1008])					
				#1-#4 Cargo Tank Level Very High Override (97.1%) (6-73-80[CR112-CR115])					
				ESD P.C.CPU ALARM (7-5,6[2002]) *5					
				ESD Normal Source Power Failure (6-81,82)					
				ESD UPS Source Power Failure (6-83,84)					
				GBSC1 activated(10-9,10[5004])					
				GBSC2 activated(10-11,12[5005])					
				GBSC3 activated(10-13,14[5006])					
				GBSC4 activated(10-15,16[5007])					
				GLC activated(10-17,18[5008])					
				3C Each sol. v/v power fail(08-53,54[3026])					
				4C Each sol. v/v power fail(08-55,56[3027])					
				6C Each sol. v/v power fail(08-59,60[3029])					
				8C Each sol. v/v power fail(08-61,62[3030])					
				ESD Fusible Plug Activated for regas plant(06-51,52[1025])					
						ALARM OUTPUT SIGNAL			

Note

1. Categories in Action part mean the following

ESD: ESD related action

TPS1/2/3: Tank Protection Action Type 1/2/3

GBSC : Gas Burning Safety Control

GLC : Gas Leakage Control

2. Symbol(signal status) and abbreviation

O : On at activated condition, ● : Off at activated condition

NE : Normal Energized, NDE : Normal De-energized

3. ESD Cause Time Delay; Time delay to be adjustable

Manual Switch: Time delay 0sec.

Fusible Plug: Time delay 5sec.

S/S Link: Time delay 5sec.

Tank Level: Time delay 5sec.

Press. Low/High: Time delay 5sec. (except for Hydraulic Oil Press. Low => 10sec.)

Power Fail: Time delay 5sec.

Preliminary check list for test

Cable wiring condition of ESDS local panel.

Operating condition of VRC, IAS and all Equipments related ESDS.

Supplied power for ESDS

Category	Cause	TB No. (I/O Add.)	Result	Set Value	Status	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE	NE
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Illustration 4.14.2a ESDS Pneumatic System

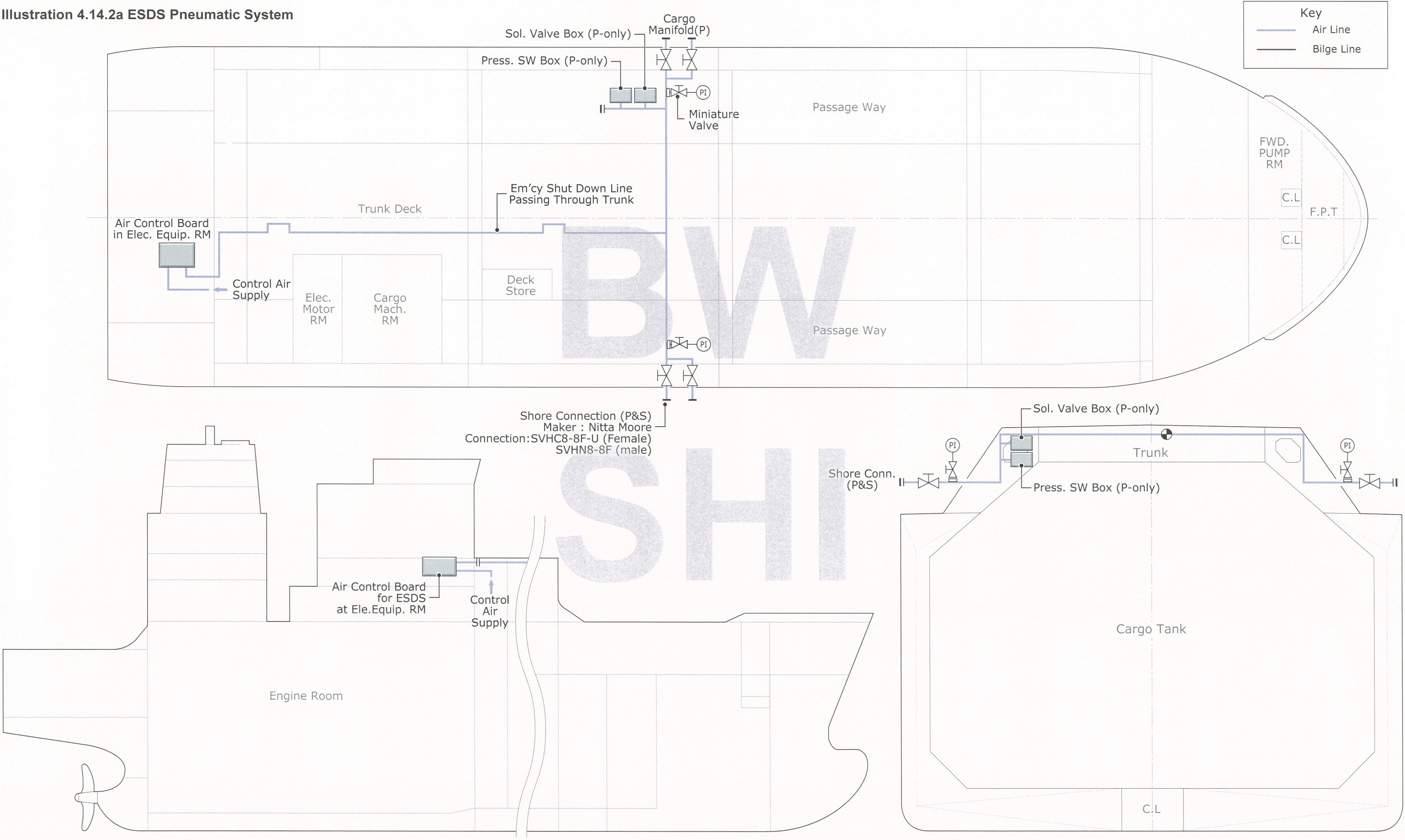


Illustration 4.14.3a Ship-Shore Link

