MATERIAL SCHEDULE

SERVICE	PIPING		TAKEDOWN JOINTS			VALVES		FITTINGS	FLEX CONNECTIONS	REMARKS
	SIZE	MATERIAL	MATERIAL	GASKETS	BOLTING	BODY	TRIM			
BILGE AND SHELL CONNECTIONS MAWP: 55 PSIG TEMP: AMBIENT	2 ½" & ABOVE	CARBON STEEL ASTM A53 OR A106, GRADE B SEAMLESS ANSI B36.10 SCH 80	FLANGE, CARBON STEEL WELD NECK OR SLIP-ON, 150# ANSI B16.5, ASTM A105	INORGANIC FIBER WITH NITRILE BINDER ABS FIRE-SAFE TYPE APPROVED	BOLTS: STAINLESS STEEL ASTM A193 GRADE B8M ANSI B18.2.1 NUTS: STAINLESS STEEL ASTM A194 GRADE 8M ANSI B18.2.2	BUTTERFLY: CARBON STEEL ASTM A216 GR WCB 150#, WAFER TYPE SWING CHECK: CARBON STEEL ASTM A216 GR WCB 150#, FLANGED STOP CHECK: CARBON STEEL ASTM A216 GR WCB 150#, FLANGED GATE: CARBON STEEL ASTM A216 GR WCB 150#, FLANGED	BUTTERFLY: SS DISC AND STEM BUNA SEATS SWING CHECK: SS DISC ASTM A182 STOP CHECK: SS RENEWABLE DISC AND SEAT ASTM A276-316 GATE: SS STEM SS RENEWABLE DISC AND SEAT ASTM A182	CARBON STEEL ASTM A234, GR WPB ANSI B16.9 BUTT WELD LONG RADIUS SCH 80	–	NOTE 14
	2" & BELOW		CARBON STEEL UNION, 3000#, SOCKET WELD, GROUND JOINT ANSI B16.11 OR FLANGE, SOCKET WELD OR SLIP-ON, 150#, ANSI B16.5			GATE: CARBON STEEL ASTM A216 GR WCB 150#, FLANGED	GATE: SS STEM SS RENEWABLE DISC AND SEAT ASTM A182			
BALLAST MAWP: 15 PSIG TEMP: AMBIENT	ALL	CU-NI 90/10 ASTM B466 SEAMLESS CLASS 200	FLANGE: CU-NI 90/10 ANSI B16.5 SLIP-ON OR WELD NECK, 150#			BUTTERFLY: BRONZE ASTM B61 OR LINED DUCTILE IRON ASTM A395, WAFER TYPE CHECK: BRONZE, ASTM B61 OR B62, 150#, FLANGED	BUTTERFLY: BRONZE DISK CHECK: BRONZE DISK, RENEWABLE SEATS & SEALS	CU-NI 90/10, BUTT WELD		NOTE 21

SYMBOLS LIST

	PIPE
	REDUCER
	DECK/BULKHEAD PENETRATION
	MANIFOLD, STOP CHECK VALVES
	MATERIAL TRANSITION
	BUTTERFLY VALVE
	GATE VALVE
	BUTTERFLY VALVE, ACTUATED
	GATE VALVE WITH REACH ROD
	SWING CHECK VALVE
	ANGLE STOP CHECK VALVE
	BILGE ROSEBOX SUCTION
P	PRESSURE GAUGE
VP	VACUUM PRESSURE GAUGE
	FLANGE
DP	DIFFERENTIAL PRESSURE GAUGE
	DUPLEX STRAINER
	CENTRIFUGAL PUMP
	OVERBOARD DISCHARGE
	SEA CHEST
	BALLAST SUCTION

EQUIPMENT LIST

QTY.	SERVICE	TYPE	MODEL	CAPACITY	DRIVE	REMARKS
2	BILGE PUMP	CENTRIFUGAL SELF-PRIMING	–	149 GPM @ 40' TDH	208V/3ϕ/60HZ 5 HP TEFC MOTOR 3450 RPM	BRONZE BODY
2	BILGE PUMP STRAINER 3" NPS	DUPLEX BASKET TYPE	–	–	–	SS BASKET BRONZE BODY
2	BALLAST PUMP	CENTRIFUGAL	–	200 GPM 20' TDH	208V/3ϕ/60HZ 2 HP TEFC MOTOR 1165 RPM	SS BODY
2	BALLAST PUMP STRAINER 4" NPS	DUPLEX BASKET TYPE	–	–	–	SS BASKET BRONZE BODY

CALCULATIONS

BILGE SYSTEM (PER 46 CFR 56.50-50)

DATA:
L=178 FT
B=46 FT
D=10.5 FT
C=COMPARTMENT LENGTH (FT)

BILGE MAIN $d = 1 + \sqrt{\frac{L(B+D)}{2500}} = 3.01$ (USE 3" SCH 80 PIPE)

BRANCH SUCTION $d = 1 + \sqrt{\frac{C(B+D)}{1500}}$

COMPARTMENT	C	d	NOMINAL PIPE SIZE (MINIMUM)	ID
LAZARETTE A	11.8	2.000	2"	1.939
THRUSTER ROOM A	32.0	2.098	2"	1.939
VOID A	16.0	2.000	2"	1.939
ENGINE ROOM	48.0	2.345	2 1/2"	2.323
SWITCHBOARD ROOM	16.0	2.000	2"	1.939
VOID B	16.0	2.000	2"	1.939
THRUSTER ROOM B	32.0	2.098	2"	1.939
LAZARETTE B	11.8	2.000	2"	1.939

PUMP CAPACITY TO DEVELOP A SUCTION VELOCITY OF 400 FPM
$Q = 16.32xd^2$, WHERE d IS THE BILGE MAIN DIAMETER
Q = 148 GPM

GENERAL NOTES (CONT)

13. TOTAL DYNAMIC HEAD OF PUMPS FOR REQUIRED FLOW ARE APPROXIMATE ONLY. THE CONTRACTOR SHALL PROVIDE PUMPS MEETING THE REQUIRED FLOW WITH THE INSTALLED PIPING SYSTEMS. PUMP MOTORS SHALL BE SELECTED TO PREVENT MOTOR OVERLOAD OVER THE ENTIRE PUMP OPERATING RANGE.
14. VALVES CONSTRUCTED OF DUCTILE IRON, ASTM A395, MAY BE SUBSTITUTED WHERE APPROVED BY USCG & ABS REQUIREMENTS.
15. ALL BILGE LINES SHALL BE ROUTED NO LESS THAN ONE FIFTH OF THE VESSEL BEAM FROM THE SIDE SHELL AND ABOVE THE T/15 LINE IN ACCORDANCE WITH USCG AND ABS REGULATIONS.
16. WHERE PIPES PENETRATE TANK BOUNDARIES, BULKHEADS, OR DECKS HEAVY WEIGHT SPOOL PIECES SHALL BE USED. SEE DETAILS 2-5A AND 3-1C.
17. THE BILGE LINES SERVING THE LAZARETTES SHALL BE FITTED WITH AN ISOLATION VALVE OPERABLE FROM THE MAIN DECK. THE REMOTE OPERATOR SHALL BE A FLUSH MOUNTED DECK BOX WITH REACH ROD.
18. BALLAST CONTROL VALVES SHALL BE AIR OPERATED VALVES WITH CONTROLS LOCATED IN THE EOS. SEE REF 1 AND 5.
19. BALLAST PUMPS SHALL BE CONTROLLED LOCALLY AND FROM THE EOS.
20. MATERIAL TRANSITIONS FROM STEEL TO COPPER NICKEL PIPE SHALL BE ACCOMPLISHED VIA FLANGED JOINTS. THE JOINTS SHALL BE FITTED WITH GALVANIC ISOLATION KITS TO PREVENT DIRECT METAL TO METAL CONTACT.
21. WELDED CU-NI FITTINGS SHALL BE TIG WELDED. SIL-BRAZING IS NOT ACCEPTABLE.
22. CONTRACTOR SHALL INSTALL PUMPS SUCH THAT FLOODED SUCTIONS ARE MAINTAINED AT LIGHTSHIP DRAFT.

REVISION HISTORY

REV	ZONE	DESCRIPTION	DWN	DATE	APVD

GENERAL NOTES

1. VESSEL TO BE CONSTRUCTED IN ACCORDANCE WITH 46 CFR SUBCHAPTER H REGULATIONS.
2. THIS DRAWING IS DIAGRAMMATIC AND DOES NOT REPRESENT A COMPLETE DETAILED DESIGN. EQUIPMENT LAYOUT IN A GIVEN AREA IS APPROXIMATE. THE CONTRACTOR SHALL DEVELOP A DETAILED DESIGN THAT PROVIDES A FULLY FUNCTIONAL ARRANGEMENT SUITABLE FOR INSTALLATION, TAKING INTO ACCOUNT ALL NECESSARY SYSTEM INTERFACES AND INTERFERENCES. DIMENSIONS SHALL BE VERIFIED FROM THE SHIP AND MANUFACTURERS' CERTIFIED DRAWINGS AS APPROPRIATE.
3. PIPING SHALL BE RUN AS DIRECTLY AS PRACTICABLE WITH A MINIMUM NUMBER OF BENDS AND FITTINGS. PIPE SPOOLS SHALL BE SIZED AND ARRANGED TO PROVIDE FOR REMOVAL, INSPECTION, SERVICING, AND REPLACEMENT OF PIPING, VALVES, FITTINGS, AND EQUIPMENT WITHOUT CUTTING STRUCTURE OR PIPING.
4. AVOID POCKETS IN THE PIPE LINES. BOSSES AND VALVES OR SCREWED PLUGS SHALL BE FITTED TO ENABLE COMPLETE DRAINING OF PIPES WHERE POCKETS DO OCCUR.
5. THE PIPING SYSTEM SHALL BE CLEANED AND TESTED IN ACCORDANCE WITH USCG REQUIREMENTS. SEE REF 1.
6. PIPING SHALL BE ADEQUATELY SUPPORTED BY HANGERS IN ACCORDANCE WITH ASTM F708. HANGERS SHALL BE ATTACHED TO THE PIPE WITH BOLTED CLAMPS AND WELDED TO BASIC SHIP STRUCTURE. HANGERS SHALL NOT BE WELDED DIRECTLY TO PIPES. ALL COPPER-NICKEL PIPING SHALL BE SUPPORTED USING INSULATED HANGERS.
7. VALVES LOCATED BELOW THE FLOOR PLATES SHALL BE PROVIDED WITH REACH RODS. ALL VALVES SHALL BE PROVIDED WITH VISUAL POSITION INDICATION.
8. BILGE ROSEBOXES SHALL BE HOT DIP GALVANIZED AFTER FABRICATION. ROSEBOXES SHALL HAVE AN OPEN AREA OF AT LEAST THREE TIMES THE AREA OF SUCTION PIPE.
9. OVERBOARD PENETRATIONS SHALL BE LOCATED AS FAR ABOVE BASELINE AS POSSIBLE WHILE STILL BEING UNDER THE GUARDS.
10. BILGE SUCTIONS SHALL BE LOCATED AT THE COMPARTMENT LOW POINT.
11. BILGE PUMPS SHALL BE CONTROLLED LOCALLY AND FROM THE EOS.
12. EMERGENCY BILGE SUCTION IS LOCATED ON THE FIRE MAIN SYSTEM. SEE REF 4.

REFERENCES

1. 18026-200-832-1 TECHNICAL SPECIFICATION
2. 18026-200-256-1 COOLING SYSTEM DIAGRAM
3. 18026-200-506-1 FILLS, VENTS, AND SOUNDS
4. 18026-200-521-1 FIRE MAIN SYSTEM SCHEMATIC
5. 18026-200-551-1 COMPRESSED AIR PIPING SCHEMATIC

NORTH CAROLINA FERRY SYSTEM
8500 SHIPYARD RD MANNS HARBOR, NC 27953

MICHAEL E. JOHNSON STATE OF WASHINGTON 49387 REGISTERED PROFESSIONAL ENGINEER
Michael E. Johnson
7/31/2018

Elliott Bay Design Group
North Carolina, PLLC

CLIENT: NORTH CAROLINA D.O.T.
RALEIGH, NORTH CAROLINA
PROJECT: DOUBLE-ENDED AZIMUTH DRIVE FERRY

TITLE: BILGE AND BALLAST PIPING SCHEMATIC

SIZE	DWG NO.	REV
D	18026-200-529-1	–

SCALE	FILE NAME	SHEET	OF
NTS	18026-200-529-1-	1	3

DWN	MOD	CKD	APVD	APVD DATE
NJB			MEJ	7/31/18

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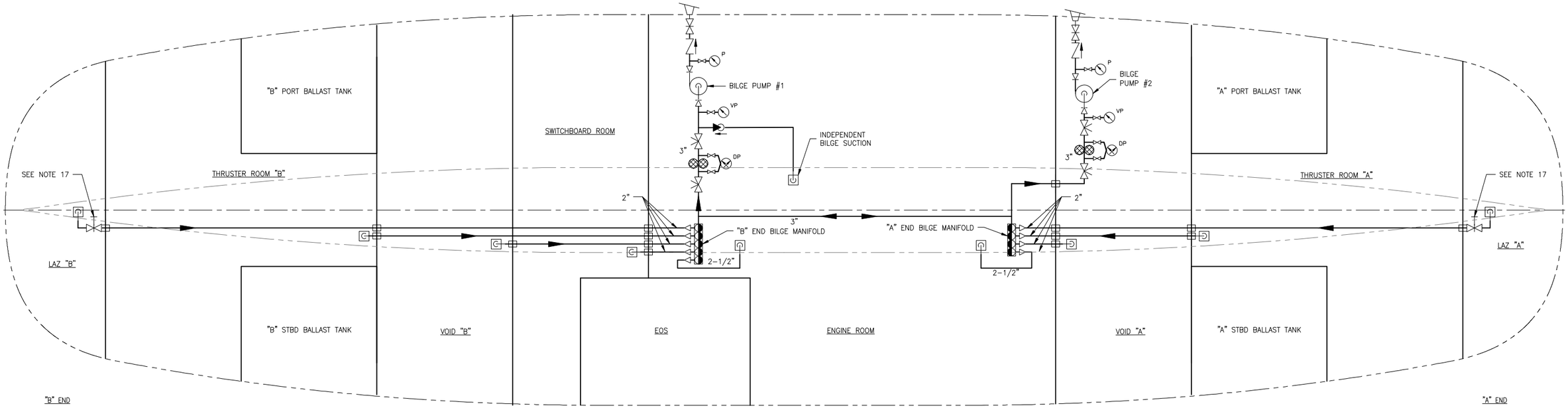
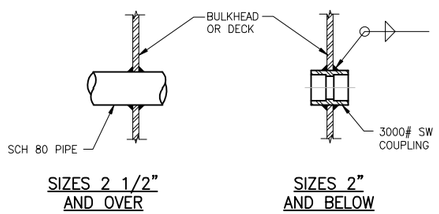
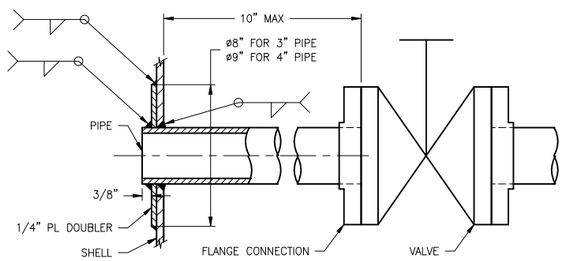


PLAN 2-3B
BILGE SYSTEM DIAGRAM



SIZES 2 1/2" AND OVER | SIZES 2" AND BELOW

DETAIL 2-5A
TYP DECK/BHD PENETRATION



DETAIL 2-3A
OVERBOARD DISCHARGE

Michael E. Johnson
7/31/2018

SIZE	DWG NO.	REV
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SCALE NTS	FILE NAME 18026-200-529-1-	SHEET 2 OF 3

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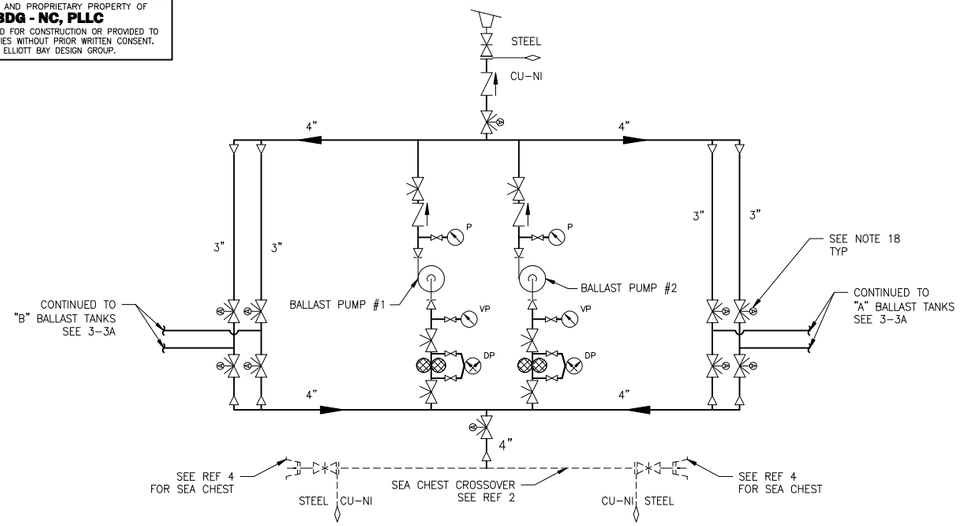
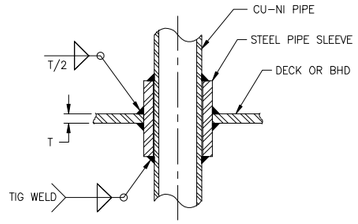
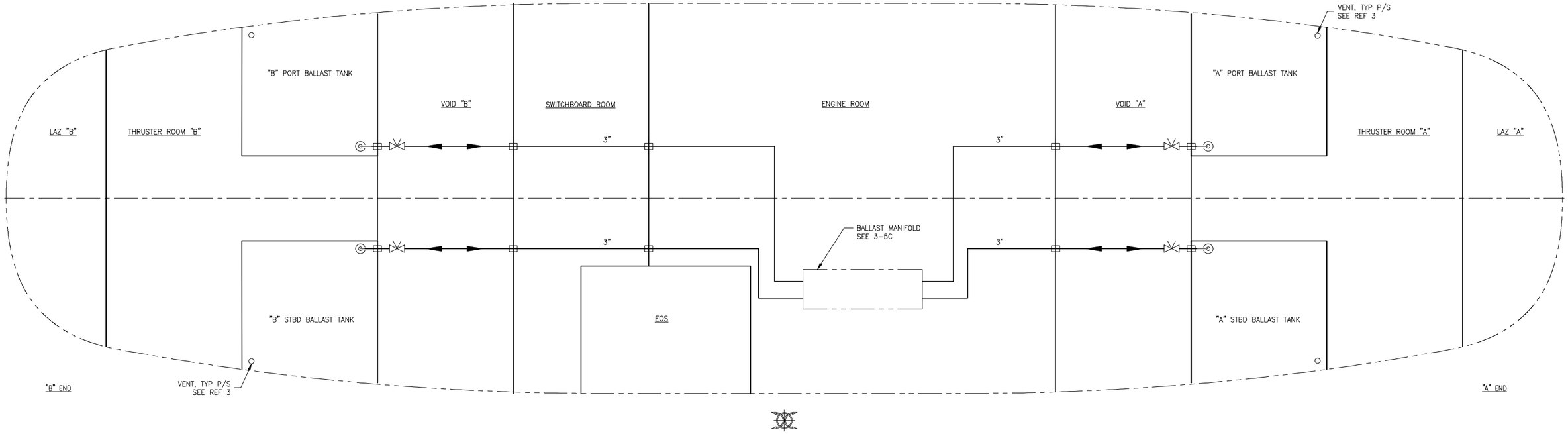


PLAN 3-5C
BALLAST MANIFOLD



DETAIL 3-1C
TYP DECK/BHD PENETRATION
CU-NI PIPING



PLAN 3-3A
BALLAST SYSTEM DIAGRAM

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SIZE	DWG NO.	REV
D	18026-200-529-1	–
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