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**USS ANCHORAGE LSD 36
PROPULSION OPERATING GUIDE**



**PUBLISHED BY DIRECTION OF COMMANDER
NAVAL SEA SYSTEMS COMMAND
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**LONG BEACH NAVAL SHIPYARD
LONG BEACH, CALIFORNIA**

NAVAL SEA SYSTEMS COMMAND

NAVY DEPARTMENT

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FOREWORD

THIS BOOKLET IS INTENDED TO SERVE ENGINEERING PERSONNEL AS A PERFORMANCE STANDARD IN DESCRIBING THE DESIGN FUNCTIONS OF THE MAIN AND AUX PROPULSION SYSTEMS AND MAY BE USED FOR MONITORING OPERATING CONDITIONS OF THOSE SYSTEMS. RATINGS AND DATA HAVE BEEN SELECTED FROM DESIGN HEAT BALANCE CALCULATIONS, PERFORMANCE CHARACTERISTICS OF INDIVIDUAL EQUIPMENT, AND MANUFACTURERS TECHNICAL MANUALS. SYSTEM DIAGRAMS AND MACHINERY ARRANGEMENT SKETCHES WERE DERIVED FROM INGALLS SHIPBUILDING DIV, LITTON SYSTEMS PLANS AND MODIFIED BY SHIPALT AND OTHER SYSTEM CHANGES. PROPULSION SYSTEM OPERATING, SAFETY AND MAINTENANCE NOTES WERE DERIVED FROM REFERENCED NAVY PUBLICATIONS. THE PUBLICATIONS REFERENCED, AND THIS BOOKLET SHOULD BE THOROUGHLY STUDIED SINCE PROPER OPERATION AND MAINTENANCE WILL ENSURE SAFE AND EFFICIENT OPERATION OF THE PROPULSION SYSTEMS. FOR ADDITIONAL DATA AND DETAILED OPERATIONAL PROCEDURES FOR SPECIFIC MACHINERY AND SYSTEMS, CONSULT THE POSTED OPERATING PLATES, SHIP INFORMATION BOOKS, THE VARIOUS MANUALS AND PLANS FURNISHED THE SHIP AND THE FOLLOWING TECHNICAL MANUALS:

NAVSHIP TECHNICAL MANUALS		CHAPTER		PROPULSION MACHINERY TECHNICAL MANUALS		NAVSEA NO.
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FUEL OIL STOWAGE AND EQUIPMENT.....	9550	541	MN. CONDENSATE PUMP.....	0947-131-6010		
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ENGINEERING CASUALTY CONTROL.....	9880-111	079-3	100 CFM 150 P.S.I. LOW PRESSURE AIR	0949-029-2010		
FIREFIGHTING - SHIP.....	9930	555	COMPRESSOR.....	0951-018-5010		
			MAIN BOILERS.....	0951-018-7010		
			AUTO. COMB. AND FDW CONTROLS FOR MAIN BOILERS..	0953-011-5010		
			FORCED DRAFT BLOWERS.....	0956-014-6010		
			DEAERATING FEED TANK.....	0358-038-4000		
			30,000 G.P.D. FLASH TYPE DISTILLING PLANT.....	0961-029-7010		
			SHIP'S SERVICE TURBINE GEN. SET.....			

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CONSULT THE SHIP INFORMATION BOOK, VOLUME 2, FOR ADDITIONAL
DETAILS OF THE ABOVE SYSTEMS AND THOSE SYSTEMS NOT LISTED.

OPERATING NOTES FOR NAVY FUELS

*1. FUELS FOR USE FOR SURFACE FOSSIL FUELED SHIPS SPECIFIED BY OPNAV INSTRUCTION 9550.4A ARE LISTED BELOW IN ORDER OF PREFERENCE:

A. DIESEL FUEL MARINE (DFM) MIL-F-16884G, NATO SYMBOL F-76.

B. ACCEPTABLE ALTERNATE FUELS (LISTED IN PRIORITY ORDER AND COMPATIBLE IN ANY PROPORTION).

- (1) JP-5, MIL-T-5624, (NATO SYMBOL F-44).
- (2) NATO SYMBOL F-75
(AS AVAILABLE FROM NATO COUNTRIES).
- (3) FEDERAL SPECIFICATION VV-F-800, DF-2, NATO SYMBOL F-54, PROVIDING THE FLASH POINT IS 140°F OR ABOVE.
- (4) AS TM-D-975 NO. 2-D, PROVIDING THE FLASH POINT IS 140°F OR ABOVE.

II. THE SPECIFICATION HEAT CONTENT IS 19,500 BTU/LB. FOR ALL DISTILLATES (ND, DIESEL, JP-5). THE SPECIFICATION DENSITY IS 7.0 LB/GAL. FOR DIESEL AND 6.8 FOR JP-5.

III. THE STRAIGHT MECHANICAL BURNER SYSTEM WHEN OPERATING WITH DISTILLATE FUEL REQUIRES THE SPRAYER PLATE SIZE SHOWN ON PAGE 22.

WHEN BURNING DISTILLATE FUELS, A HAZE (STACK CONDITION) SHOULD NOT BE USED. PROPER COMBUSTION IS BEST ATTAINED BY LOWERING AIR PRESSURE UNTIL A LIGHT HAZE APPEARS IN THE STACK AND THEN RAISING BLOWER SPEED SLIGHTLY UNTIL A CLEAR STACK APPEARS.

IV. FUEL OIL SERVICE TANKS

SHIFT FUEL OIL SERVICE TANKS WHEN TANK IN SERVICE REACHES 50% LEVEL TO ENSURE AN ADEQUATE GRAVITY HEAD FOR THE FUEL OIL SERVICE PUMP.

V. FUEL OIL TESTING - TAKE SAMPLES AND MEASURE B.S.&W. (USE LIMIT-.1% OF FUEL TANKS AS FOLLOWS:

ALL TANKS - AT LEAST ONCE EACH WEEK
STORAGE TANKS - 24 HOURS AFTER RECEIPT AND PRIOR TO TRANSFER
SERVICE TANKS - PRIOR TO PLACING ON SUCTION

VI. TUBE BLOWING PROCEDURE

- A. WHILE UNDERWAY, IN PORT, OR AT ANCHOR, THOROUGHLY BLOW TUBES IN ALL STEAMING BOILERS AT LEAST ONCE PER WEEK.
- B. ALWAYS THOROUGHLY BLOW TUBES AFTER LEAVING OR JUST PRIOR TO ENTERING PORT.
- C. WHEN PRACTICAL, THOROUGHLY BLOW TUBES JUST AFTER THE MAKING OF HEAVY SMOKE FROM ANY CAUSE (LIGHTING OFF, CASUALTY, ETC.).

*NOTE: ABOVE FUELS AUTHORIZED FOR NAVY USE AT TIME OF PUBLICATION OF THIS POG. FOR EMERGENCY SUBSTITUTE FUELS AND DETAILED OPERATING PROCEDURES SEE OPNAV INSTRUCTION 9550.4A NAVSEA TM CHAPTER 541 (PETROLEUM FUEL STORAGE, USE AND TESTING) AND NAVY DISTILLATE (ND) CONVERSION PROGRAM ACQUISITION MASTER PLAN VOLUMES I AND II AND PERTINENT ND ADVISORIES.

RATINGS FOR PROPULSION UNITS

MAIN TURBINE

MANUFACTURER: DELAVAL TURBINE, INC
 2 INSTALLED: CROSS COMPOUND IMPULSE TYPE
 HP AND LP WITH ASTERN ELEMENTS IN LP STAGE
 24,000 SHP PER SHIP AHEAD AT 235 PRPM
 12,000 SHP PER UNIT AHEAD AT 235 PRPM
 4,800 SHP PER SHIP ASTERN AT 130 PRPM
 2,400 SHP PER UNIT ASTERN AT 130 PRPM

DESIGN CONDITIONS: (FULL POWER)

THROTTLE STEAM PRESSURE - 585 PSIG
 THROTTLE STEAM TEMPERATURE - 850° F
 CONDENSER PRESSURE - 2.0 IN H_g ABSOLUTE

MAIN REDUCTION GEAR

MANUFACTURER: DE LAVAL TURBINE, INC
 2 INSTALLED: DOUBLE HELICAL, ARTICULATED, DOUBLE
 REDUCTION TYPE
 HP TURBINE REDUCTION - 7637/235
 LP TURBINE REDUCTION - 5298/235

MAIN CONDENSER

MANUFACTURER: INDUSTRIAL PROD. DIV. MARYLAND SHIPBLDG.
 & DRYDOCK CO.
 2 INSTALLED PER SHIP, SINGLE PASS ARRANGED ATHWARTSHIP
 SURFACE AREA - 6300 SQUARE FEET

DESIGN CONDITIONS - FULL POWER

STEAM CONDENSED (LB/HR)..... 77,280
 ABS. PRESSURE AT CONDENSER INLET (IN. HG.)..... 2.0
 INLET WATER TEMPERATURE (°F)..... 75
 OUTLET WATER TEMPERATURE (°F)..... 83.6
 CIRCULATING WATER QUANTITY (GPM)..... 17,000
 AUXILIARY EXHAUST STEAM (LB/HR)..... 6,000

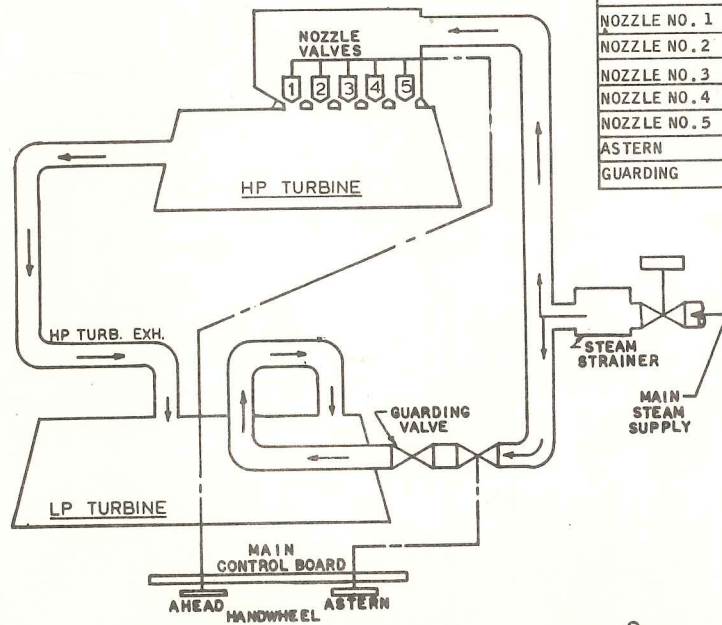
MAIN AIR EJECTOR-DESIGN CONDITIONS-FULL POWER
ONE TWO-STAGE AIR EJECTOR IN OPERATION

DESIGN STEAM OPERATING PRESSURE (PSIG)..... 135
 STEAM TEMPERATURE TO AIR EJECTOR (°F)..... 450
 STEAM CONSUMPTION -
 FIRST STAGE NOZZLE (LB/HR)..... 150
 SECOND STAGE NOZZLE (LB/HR)..... 1200
 FREE AIR REMOVAL CAPACITY PER ELEMENT (LB/HR)..... 22.5
 PRESSURE TO BE MAINTAINED (IN HG. ABS)..... 1.00
 TEMPERATURE AIR VAPOR MIXTURE (°F)..... 71.5
 COOLING WATER QUANTITY AT N.P. (GPM)..... 165
 COOLING WATER INLET TEMPERATURE (°F)..... 79.0
 COOLING WATER OUTLET TEMPERATURE (°F)..... 120.6
 COOLING WATER PRESSURE DROP (PSI @165 GPM)..... 1.6

PROPELLER

MANUFACTURER: BETHLEHEM STEEL CO.
 2 PER SHIP: 1 RH (STBD) AND 1 LH (PORT)
 5 BLADE, MANGANESE BRONZE
 DIAMETER - 12 FEET 6 INCHES
 PITCH - 11 FEET 10-5/8 INCHES AT 0.7R

TURBINE STEAM FLOW



PROPULSION TURBINE VALVE OPERATION

VALVE	TURBINE SERVED	20 KNOTS	FULL POWER	20% OVERLOAD	ASTERN
NOZZLE NO. 1	HP	●	○	●	●
NOZZLE NO. 2	HP	○	○	●	●
NOZZLE NO. 3	HP	○	○	○	●
NOZZLE NO. 4	HP	○	○	○	●
NOZZLE NO. 5	HP	●	○	●	●
ASTERN	LP	●	●	●	○
GUARDING	LP	○	○	○	○

○ - OPENED ● - CLOSED

ORDER OF OPENING

1ST	2ND	3RD	4TH	5TH
NOZZLE NO. 3	NOZZLE NO. 4	NOZZLE NO. 2	NOZZLE NO. 5	NOZZLE NO. 1

BOILER PERFORMANCE DATA

MANUFACTURER: COMBUSTION ENGINEERING INC.
 2 PER SHIP. "D" TYPE STEAM GENERATORS, FUEL OIL
 FIRED, TWO DRUM, SINGLE FURNACE, INTEGRAL SUPERHEATER,
 FORCED DRAFT TYPE, WITH ECONOMIZER, SOOT BLOWERS,
 AND WATER DRUM INSTALLED DESUPERHEATER

OPERATING PRESSURES AND TEMPERATURES

DESIGN PRESSURE 710 PSIG
 STEAM DRUM PRESSURE 660 PSIG (FULL POWER)
 SUPERHEATER OUTLET PRESSURE 660 PSIG (F.P.)
 SUPERHEATER OUTLET TEMPERATURE 850°F
 DESUPERHEATER STEAM OUTLET PRESSURE 570 PSIG (F.P.)
 600 CRUISING
 DESUPERHEATER STEAM OUTLET TEMPERATURE 588°F (F.P.)
 ECONOMIZER INLET TEMPERATURE 241°F
 ECONOMIZER OUTLET TEMPERATURE 355°F (F.P.)
 350°F (CRUISING)

<u>BOILER SAFETY VALVES</u>	<u>POPPING (PSIG)</u>	<u>RESEATING (PSIG)</u>
DRUM PILOT ACTUATOR.....	710	685
SUPERHEATER.....	725	700
DRUM VALVE NO. 1.....	725	700
DRUM VALVE NO. 2.....	735	710

BURNERS

MANUFACTURER: TODD SHIPYARDS CORPORATION
 THREE INSTALLED PER BOILER, RETURN FLOW, MECHANICAL
 PRESSURE ATOMIZING, MODEL D-17, WITH CONSTANT SUPPLY
 PRESSURE AND VARIABLE RETURN PRESSURE.

AUTOMATIC COMBUSTION CONTROL

MANUFACTURER: HAGAN CONTROLS CORPORATION
 ONE SYSTEM INSTALLED PER BOILER TO MAINTAIN PROPER
 COMBUSTION BY REMOTE MANUAL OR AUTOMATIC REGULATION
 OF FUEL OIL AND AIR REQUIREMENTS.

AUTOMATIC THREE ELEMENT FEEDWATER REGULATOR SYSTEM

MANUFACTURER: HAGAN CONTROLS CORPORATION
 ONE SYSTEM IS INSTALLED PER BOILER TO MAINTAIN SAFE
 WATER LEVEL IN STEAM DRUM BY SENSING FEEDWATER FLOW,
 STEAM FLOW AND STEAM DRUM WATER LEVEL.

NOTES ON MAIN TURBINE OPERATION

THE FOLLOWING DESCRIPTION RELATES TO ONE TURBINE SET; IT CAN BE ASSUMED THAT OPERATION OF BOTH MAIN TURBINE SETS IS IDENTICAL.

AHEAD OPERATION IS ACCOMPLISHED BY A SINGLE HANDWHEEL OPERATING THE AHEAD NOZZLE THROTTLE VALVES THROUGH A CAM LIFTING MECHANISM. DURING AHEAD OPERATION THE ASTERN VALVE SHOULD BE VERIFIED CLOSED.

ASTERN OPERATION IS ACCOMPLISHED BY A SINGLE HANDWHEEL OPERATING THE ASTERN THROTTLE VALVE. GUARDING VALVE IN STEAM LINE TO ASTERN TURBINE MUST ALSO BE CHECKED OPEN. DURING ASTERN OPERATION THE AHEAD NOZZLE THROTTLE VALVES SHOULD BE VERIFIED CLOSED.

BEFORE TURNING THE PROPULSION TURBINE, CHECK THE LUBE OIL TEMPERATURE. IF IT IS BELOW 90 DEGREES F, HEAT THE OIL TO THAT TEMPERATURE BY RECIRCULATING IT THROUGH THE LUBE OIL PURIFIER HEATER. DO NOT OPERATE THE TURBINES WITH A LUBE OIL TEMPERATURE BELOW 90 DEGREES F, EXCEPT IN AN EMERGENCY. DURING NORMAL OPERATION THE TEMPERATURE OF THE SUPPLY LUBE OIL SHOULD BE APPROXIMATELY 120°/130°F. THE MAXIMUM TEMPERATURE RISE OF LUBE OIL PASSING THROUGH ANY BEARING, UNDER ANY OPERATING CONDITION, SHALL NOT EXCEED 50°F NOR SHOULD THE FINAL TEMPERATURE OF THE LUBE OIL AT OUTLET OF ANY BEARING EXCEED 180°F.

WITH LUBE OIL SYSTEM OPERATING, ENGAGE THE TURNING GEAR AND ADMIT SEALING STEAM TO WARM-UP TURBINE ROTORS. WHEN TURBINE ROTOR WARM-UP IS COMPLETED DISENGAGE THE TURNING GEAR AND ADMIT ASTERN AND AHEAD THROTTLE STEAM ALTERNATELY TO SPIN THE TURBINES. DO NOT PUT WAY ON THE SHIP WHILE SPINNING. BE ATTENTIVE TO ANY RUBBING SOUND OR UNDUPE NOISE AND IF ANY IS DETECTED, SECURE THROTTLE STEAM AND CORRECT THE CAUSE.

TURBINE ROTORS SHOULD NOT BE PERMITTED TO REMAIN STATIONARY FOR LONGER THAN 3 MINUTES WITH STEAM ENTERING THE TURBINE FROM ANY SOURCE. FOR PROLONGED STANDBY CONDITION, ROTATE TURBINE ROTORS BY MEANS OF THE TURNING GEAR.

ALL TRAPPED TURBINE DRAINS SHOULD REMAIN OPEN DURING TURBINE OPERATION. HOWEVER, ALL UNTRAPPED TURBINE DRAINS TERMINATING IN THE CONDENSER SHOULD BE CLOSED DURING NORMAL OPERATION. THEREFORE, ANY UNTRAPPED TURBINE DRAINS KEPT IN OPEN POSITION TO FACILITATE STANDBY OR EXTENDED MANEUVERING OPERATIONS SHOULD BE OBSERVED CLOSELY FOR EFFECT ON VACUUM AND CONDENSING EQUIPMENT, AND SHOULD BE CLOSED IMMEDIATELY WHEN THEIR SERVICE OPERATION IS COMPLETED.

UNDER NO CIRCUMSTANCE SHOULD THROTTLE STEAM BE ADMITTED TO THE TURBINES WHEN THE TURNING GEAR IS ENGAGED.

NOTES ON BOILER OPERATION

IN ORDER TO OBTAIN MAXIMUM EFFICIENCY FROM THE STEAM GENERATING EQUIPMENT AND SUPPORTING AUXILIARIES, IT IS MANDATORY THAT ALL OPERATING PERSONNEL BECOME FAMILIAR WITH THE FOLLOWING APPROVED OPERATING AND MAINTENANCE PROCEDURES:

THE NORMAL WATER LEVEL IS AT THE HORIZONTAL CENTERLINE OF THE STEAM DRUM. THE LEVEL SHOULD BE HELD AS CLOSE TO THIS POINT AS POSSIBLE. IT IS IMPORTANT NEVER TO ALLOW THE LEVEL TO GO ABOVE THE TOP OF THE UPPER GAGE GLASS. TO KEEP THE LEVEL FROM RISING TOO HIGH, SHUT OFF THE FEEDWATER; AND, IN CASES OF EMERGENCY, OPEN THE SURFACE BLOWDOWN VALVE.

IN CASE OF HIGH OR LOW WATER LEVELS, EXCEPT FOR MOMENTARY FLUCTUATIONS DURING RAPID MANEUVERING, WHENEVER THE WATER DISAPPEARS FROM SIGHT (EITHER HIGH OR LOW):

1. SECURE OIL SUPPLY TO ALL BURNERS.
2. OPEN SUPERHEATER OUTLET HEADER DRAIN VALVE TO VENT THE SUPERHEATER BY MAINTAINING STEAM FLOW.
3. CLOSE FEED-CHECK VALVES.
4. CLOSE BOILER STEAM STOP VALVES.
5. IF THERE IS ANY QUESTION AS TO WHETHER THE CONDITION IS HIGH WATER OR LOW WATER, BLOW THROUGH WATER GAGES TO DETERMINE DEFINITELY WHETHER GAGES ARE FULL OR EMPTY.
6. IN EVENT OF HIGH WATER, BLOW THE BOILER DOWN TO THE MIDDLE OF THE GAGE GLASS BY USING THE SURFACE BLOW VALVE. RELIGHT BURNERS AS USUAL.
7. IN THE EVENT OF LOW WATER, OPEN SAFETY VALVES CAUTIOUSLY BY HAND AND RELIEVE BOILER PRESSURE GRADUALLY.
8. CLOSE BURNER REGISTERS AND DIMINISH AIR SUPPLY TO THE BOILER BY STOPPING THE BLOWERS.
9. IN THE EVENT OF LOW WATER, IT IS ESSENTIAL THAT NO ATTEMPT BE MADE TO RESTORE NORMAL WATER LEVEL IN ANY MANNER THAT WOULD RESULT IN SUDDEN AND TOO RAPID COOLING OF OVERHEATED PRESSURE PARTS.

NOTES ON BOILER OPERATION (CONT'D)

LOW WATER IS THE MOST DANGEROUS CONDITION EXPERIENCED IN THE OPERATING OF STEAM GENERATORS, AND IS GENERALLY DUE TO INATTENTION ON THE PART OF THE OPERATORS. IF THE LOSS IS GRADUAL AND NOTICED BY THE OPERATORS:

1. INCREASE THE RATE OF FEED.
2. CHECK FEED LINE FOR LEAKS OR PARTIALLY CLOSED VALVES.
3. CHECK BLOW DRAIN AND VENT VALVES FOR LEAKS OR OPENED VALVES.
4. CHECK AUXILIARIES FOR WATER IN STEAM FROM AUXILIARY STEAM LINE WHICH INDICATES LEAKAGE FROM BOILER WATER DRUM INTO DESUPERHEATER.
5. START AUXILIARY FEED SYSTEM.

OPERATING WITH MARINE DIESEL FUEL OPERATE THE SOOT BLOWERS AT LEAST ONCE PER WEEK WHILE UNDERWAY, IN PORT, OR AT ANCHOR TO THOROUGHLY BLOW TUBES IN ALL STEAMING BOILERS. ALWAYS THOROUGHLY BLOW TUBES AFTER LEAVING OR JUST PRIOR TO ENTERING PORT. WHEN PRACTICAL, THOROUGHLY BLOW TUBES JUST AFTER THE MAKING OF HEAVY SMOKE FROM ANY CAUSE (LIGHTING-OFF, CASUALTY, ETC.). IT IS MANDATORY THAT THE BOILERS BE FIRED DURING ANY SOOT BLOWER OPERATION.

WHEN LIGHTING OFF, THE FUEL OIL SERVICE DISCHARGE HEADER PRESSURE SHOULD BE 400 PSIG AND THE COMBUSTION CONTROL SYSTEM SHOULD BE OPERATED ON "MANUAL". BRING BOILER PRESSURE UP TO PRESSURE WITH ONE BURNER IN USE AND COMBUSTION CONTROL SYSTEM ON "REMOTE MANUAL". DO NOT PERMIT SUPERHEATER OUTLET TEMPERATURE TO EXCEED 850°F. IT SHOULD BE NOTED THAT THE WATER LEVEL IN THE STEAM DRUM WILL RISE AS THE BOILER IS BROUGHT UP TO PRESSURE; IN THIS CASE, REDUCE RATE OF FEED OR OPERATE SURFACE BLOW VALVE TO LIMIT THE WATER LEVEL RISE TO 5 IN. (MAX.) ABOVE NORMAL WATER LEVEL.

THE BOILER OPERATING CONDITIONS DESCRIBED ON THE FOLLOWING PAGES ARE FOR ECONOMICAL STEADY STATE STEAMING CONDITIONS. FOR MANEUVERING, ALL BURNERS AND MAIN FORCED BLOWERS SERVING STEAMING BOILERS SHOULD BE IN OPERATION.

NOTES ON AUXILIARY MACHINERY OPERATION

THE OPERATION OF AUXILIARY MACHINERY SHALL BE IN ACCORDANCE WITH TECHNICAL MANUALS APPLICABLE TO THE SPECIFIC EQUIPMENT. ALL SAFETY PRECAUTIONS CONTAINED IN TECHNICAL MANUALS AND AS POSTED AT EQUIPMENT LOCATIONS SHALL BE STRICTLY ENFORCED IN ORDER TO OBIVIATE POSSIBILITY OF INJURY TO PERSONNEL AND DAMAGE TO EQUIPMENT.

WHEN WARMING UP THE TURBO-GENERATORS, BE ATTENTIVE FOR ANY RUBBING OR OTHER UNDUE NOISE. CHECK FOR PROPER OIL FLOW AND BEARING TEMPERATURES, PROPER GLAND SEALING STEAM FLOW AND FOR EASE OF OPERATION. TURBINE ROTORS SHOULD NOT BE PERMITTED TO REMAIN STATIONARY FOR LONGER THAN THREE MINUTES WITH STEAM ENTERING THE TURBINE FROM ANY SOURCE.

BEFORE STARTING ANY PUMP, VERIFY THAT THE SUCTION LINE AND PUMP CASING HAVE BEEN FLOODED WITH SYSTEM FLUID. PUMPS FITTED WITH PRIMERS SHALL BE PRIMED AS REQUIRED. SOME PUMPS ARE LUBRICATED BY THE SYSTEM FLUID. THEREFORE, IT IS MANDATORY THAT THE FAILURE OF ANY PUMP TO MAINTAIN PROPER DISCHARGE, BE INVESTIGATED AND CORRECTED.

WARNING: TO ELIMINATE POTENTIAL HAZARDS WITH COMPRESSED AIR SYSTEMS COMPLY WITH THE FOLLOWING PROCEDURES:

1. ALL AIR DRYERS AND FILTERS SHALL BE MAINTAINED CLEAN AND IN GOOD WORKING ORDER.
2. AIR FLASKS, MOISTURE SEPARATORS AND LOW SPOTS IN PIPING SYSTEM SHALL BE PURGED FREQUENTLY TO ELIMINATE WATER AND OIL.
3. COMPRESSOR AIR INTAKE FILTERS SHALL BE KEPT CLEAN AND CARE SHALL BE EXERCISED TO ENSURE THAT THE AIR INTAKE IS NOT OBSTRUCTED WITH CLOTHING, RAGS, DEBRIS, ETC.
4. FOLLOW INSTRUCTIONS OF CHAPTER 551 OF NAVAL SHIPS TECHNICAL MANUAL.

RATINGS OF AUXILIARY MACHINERY

NAVSEA S9LSD-BC-POG-010 POG-LSD 36

FRESH WATER PUMPS	NO. PER SHIP	DRIVE	GPM	DISCH PRESS PSIG	SUCTION LIFT	PUMP		MOTOR HP	REMARKS
						RPM	BHP		
POTABLE WATER	2	M	125	60	FLOODED	3550	7	10	
DIST. DISTILLATE	2	M	50	35	FLOODED	3500	1.75	3	

SEA WATER PUMPS	BILGE	NO. PER SHIP	DRIVE	GPM	DISCH PRESS PSIG	SUCTION LIFT	PUMP		MOTOR HP	REMARKS
							RPM	BHP		
		2	M	2500	11.48	3 FT	800	62.5	75	
MN COND CIRC	CIRC			7600	5.80			40.8		
SSTG COND CIRC		4	M	950	20.	FLOODED	1750	13	15	
DIST. FEED PUMP		2	M	430	35	FLOODED	1760	11.1	15	
DIST. BRINE OVBD		2	M	410	30	27" HG	1175	12.0	15	
AUX. MCHRV SW CIRC		2	M	300	50	FLOODED	3535	12	15	
FIRE PUMP		4	M	500	150	FLOODED	3500		100	
FIRE PUMP		2	T	1000	150	FLOODED	3500		---	4930 LB/HR ST.
		1	M	1000	150	FLOODED	3500		125	

RATINGS OF AUXILIARY MACHINERY

OIL PUMPS & PURIFIERS	NO. PER SHIP	DRIVE	GPM	DISCH PRESS PSIG	SUCTION LIFT	PUMP		MOTOR HP	REMARKS
						RPM	BHP		
MAIN F.O. SERVICE	4	T	21	400	5" HG	2020	8.3	---	
PORT USE F.O. SERV.	2	M	14/5	400	15/20" HG	3500/1750	10/3.6	10/5	
F.O. TRANSFER	2	M	250/500	150	15/20	850/1750	57.5		
BILGE AND F.O. TANK STRIPPING	2	RECIP	100	50	12" HG	6"x17"x12" -- SINGLE PISTON-22 FPM			340 LBS/HR STEAM FLOW
L. OIL PURIFIER	2	M	225 GPH	25	20" HG	1800		1.5	
L.O. SERV NORMAL (STANDBY) WARM-UP	2	T	225 20	50	10" HG	1255 155	11.5 .9	---	1036 - LB/HR ST 200 - LB/HR ST
L.O. SERV. (EMER)	2	M	225	50	5" HG	1200	10		
L.O. SERV. (MAIN)	2	RG	100	60/25	FLOODED	2179/726	11.5/.9		
JP-5 SERVICE	1	R	50	90	13" HG	1800	4.0	5.0	
JP-5 TRANSFER	1	R	50	50	13" HG	1800		5.0	

FEED, CONDENSATE & DRAIN PUMPS	NO. PER SHIP	DRIVE	GPM	DISCH PRESS PSIG	SUCTION	PUMP		MOTOR HP	REMARKS
						RPM	BHP		
MAIN FEED	4	T	240	789	50 FT. NPSH	6900	191	---	6384 LB/HR ST.
MAIN FEED BOOSTER	4	M	270	35	FLOODED	1785	8.5	10	
MAIN CONDENSATE	4	M	165	70	18" HG	1775	13.	20	
EMER. FEED & TRANSFER	2	RECIP	100	787	20" HG	----	----	--	9"x6"x16" SINGLE PISTON
SSTG COND CONDENSATE	4	M	40	75	4 FT	3550	4.8	5	
F.W. DRAIN TANK	2	M	30	50	0.5 FT	3500	3.75	5	
DIST SW HTR DRAIN	2	M	15	75	3 FT	3500	2.32	3	

RATINGS OF AUXILIARY MACHINERY

DEAERATING FEED TANK		TEMPERATURE °F		PRESSURE PSIG			AUX EXHAUST TO TANK
NO. PER SHIP	CAPACITY, LB/HR	INLET	OUTLET	COND INLET	ST. INLET	SHELL	
2	108,580	131	242	25	18		14,250

AUX AIR EJECTORS	NO. PER SHIP	TYPE	CAPACITY	REMARKS
SS TURBO-GEN COND	4	TWIN STAGE	9 LB/HR DRY AIR W/WATER VAP. AT 5" HG ABS. TEMP. AIR V. MIX. 121°F	138 LB/HR AT 135 PSIG AND 450-550°F
DISTILLING PLANT	2	TWO STAGE	39.5 LB/HR AIR W/WATER VAP. AT 2.99" HG BAS AND 105.8°F	475 LB/HR AT 135 PSIG AND 400°F

AIR CONDENSERS	NO. PER SHIP	TYPE	CAPACITY LB/HR	CIRC WATER GPM	COND VAC		TEMP °F	CIRC WATER °F		ST. TO COND LB/HR	AUX BXH TO COND LB/HR
					"H ₂ O	"HG		INLET	OUTLET		
SS TURBO-GEN COND	4	TWO PASS	-----	875	---	5.0 ABS.		75	101.84	11,600	2000
AUX GLAND (LEAK OFF) CONDENSER	2	TWO PASS	300 AIR 1050 ST.	200	3"	----		85	97.1	-----	-----

HEAT EXCHANGERS	NO. PER SHIP	LIQUID		SURFACE SQ FT	OIL FLOW GPM	OIL TEMP °F		CIRC. WATER GPM	ST FLOW LB/HR	INLET TEMP °F	
		HEATED	COOLED			INLET	OUTLET			SW	STEAM
L.O. COOLER	2			435	312	140	120	444			85
L.O. PUR. PRFGN PRE HTR WARM-UP	2			5.33	10 3.75	40	123 60			198 115	

RATINGS OF AUXILIARY MACHINERY

GLAND EXHAUSTER	NO. PER SHIP	DRIVE	CAPACITY, CFM	DISCH PRESS	SUCT. LIFT "H ₂ O	RPM	MOTOR HP
AUX. COND. GLAND	2	M	300	ATMOS		3500	3

BLOWERS	NO. PER SHIP	DRIVE	CAPACITY (MAX)	TOTAL HEAD	RPM	BHP	REMARKS
MAIN FORCED DRAFT	4	T	19,040SCFM	39.2" H ₂ O	5010	177.2	

AIR COMPRESSORS	NO. PER SHIP	DRIVE	CAPACITY		AIR PRESSURE, PSIG		AIR TEMP, °F		RPM	BHP	MOTOR HP
			CFCA/HR	CFFA/MIN	DISCHARGE	SUCTION	DISCHARGE	SUCTION			
SS AND CONTROL	4	M		100	150	ATMOS	100	122	830	27.06	30

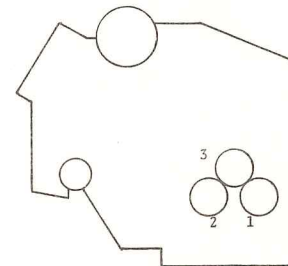
GENERATORS	NO. PER SHIP	DRIVE	KW	VOLTS	PHASE	CYCLES	PF	AMPS	KVA	RPM	REMARKS
SSTURBO-GEN	4	T	1000	450	3	60	0.8	1602	1247	1200	ST AT 585 PSIG. 850°F, 9989 TURBINE RPM.
EMER. DIESEL	2	DIESEL	300	450	3	60	0.8	481	375	1800	

DISTILLING PLANT	TYPE	CAPACITY GPD	TOTAL STEAM CONSUMPTION	REMARKS
2 PER SHIP	L.P. 2 STAGE FLASH	30,000	5,325 LB/HR (HEATER) 475 LB/HR (EJECTOR)	426 GPM FEED

REFRIGERATION PLANT	NO. OF PLANTS PER SHIP	NO. OF COMPRESSORS PER SHIP	CAPACITY PER COMPRESSOR, TONS	MOTOR H.P.
AIR CONDITIONING	4	4	65	75
SHIPS STORES	1	2	22.8	30

BOILER OPERATION

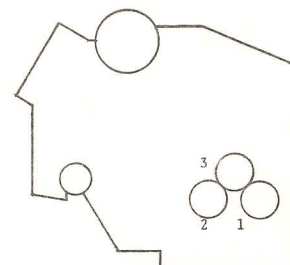
	0 SHP
<u>AT ANCHOR</u>	<u>0 RPM</u>
MAIN STEAM CONDITIONS	
DRUM PRESSURE.....	660 PSIG
SUPERHEATER OUTLET PRESSURE.....	660 PSIG
SUPERHEATER OUTLET TEMPERATURE.....	855° F
AUXILIARY STEAM CONDITIONS	
DESUPERHEATER OUTLET PRESSURE.....	660 PSIG
DESUPERHEATER OUTLET TEMPERATURE.....	515° F
NUMBER OF BOILERS IN USE.....	1
NUMBER OF BURNERS IN USE PER BOILER.....	1
BURNER TIP SIZE.....	5-41-53-53-80
FUEL OIL PER BURNER.....	1851 LB/HR
FUEL OIL TOTAL (SHIP).....	1851 LB/HR
FUEL OIL SERVICE DISCHARGE PRESSURE.....	400 PSIG
FUEL OIL PRESSURE (BURNER HEADER).....	170 PSIG
NUMBER OF BLOWERS IN USE PER BOILER.....	1
FORCED DRAFT BLOWER SPEED (ESTIMATED).....	2150 RPM
AIR PRESSURE AT FORCED DRAFT BLOWER DISCHARGE.....	7.2 IN. H ₂ O
AIR PRESSURE AT BOILER FRONT CASING.....	5.2 IN. H ₂ O
CO ₂ IN STACK GAS.....	13.5%
TURBO GENERATOR LOAD (ESTIMATED).....	1243 KW
AUXILIARY EXHAUST MAIN PRESSURE.....	15 PSIG
FEEDWATER TEMPERATURE (ECONOMIZER OUTLET).....	333° F
FEEDWATER TEMPERATURE (DFT OUTLET).....	245° F



BOILER OPERATION

STANDBY -- ONE BOILER

	0 SHP
	0 RPM
<u>MAIN STEAM CONDITIONS</u>	
DRUM PRESSURE.....	660 PSIG
SUPERHEATER OUTLET PRESSURE.....	660 PSIG
SUPERHEATER OUTLET TEMPERATURE.....	855°F
<u>AUXILIARY STEAM CONDITIONS</u>	
DESUPERHEATER OUTLET PRESSURE.....	660 PSIG
DESUPERHEATER OUTLET TEMPERATURE.....	515°F
NUMBER OF BOILERS IN USE.....	1
NUMBER OF BURNERS IN USE PER BOILER.....	1
BURNER TIP SIZE.....	5-41-53-53-80
FUEL OIL PER BURNER.....	2152 LB/HR
FUEL OIL TOTAL (SHIP).....	2152 LB/HR
FUEL OIL SERVICE DISCHARGE PRESSURE.....	400 PSIG
FUEL OIL PRESSURE (BURNER HEADER).....	225 PSIG
NUMBER OF BLOWERS IN USE PER BOILER.....	1
FORCED DRAFT BLOWER SPEED (ESTIMATED).....	2150 RPM
AIR PRESSURE AT FORCED DRAFT BLOWER DISCHARGE.....	8.8 IN. H ₂ O
AIR PRESSURE AT BOILER FRONT CASING.....	6.5 IN. H ₂ O
CO ₂ IN STACK GAS.....	13.9%
TURBO-GENERATOR LOAD (ESTIMATED).....	1355 KW
AUXILIARY EXHAUST MAIN PRESSURE.....	15 PSIG
FEEDWATER TEMPERATURE (ECONOMIZER OUTLET).....	333°F
FEEDWATER TEMPERATURE (DFT OUTLET).....	245°F

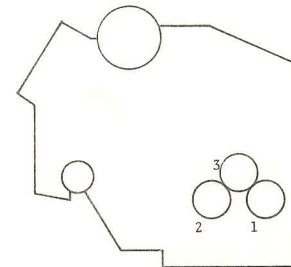


BOILER OPERATION

STANDBY -- TWO BOILERS

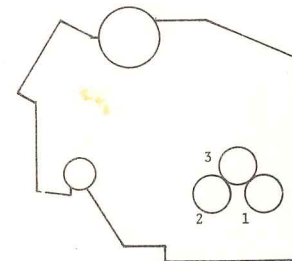
0 SHP
0 RPM

MAIN STEAM CONDITIONS	
DRUM PRESSURE.....	660 PSIG
SUPERHEATER OUTLET PRESSURE.....	660 PSIG
SUPERHEATER OUTLET TEMPERATURE.....	855°F
AUXILIARY STEAM CONDITIONS	
DESUPERHEATER OUTLET PRESSURE.....	660 PSIG
DESUPERHEATER OUTLET TEMPERATURE.....	515°F
NUMBER OF BOILERS IN USE.....	2
NUMBER OF BURNERS IN USE PER BOILER.....	2
BURNER TIP SIZE.....	5-41-53-53-80
FUEL OIL PER BURNER.....	1271 LB/HR
FUEL OIL TOTAL (SHIP).....	5084 LB/HR
FUEL OIL SERVICE DISCHARGE PRESSURE.....	400 PSIG
FUEL OIL PRESSURE (BURNER HEADER).....	110 PSIG
NUMBER OF BLOWERS IN USE PER BOILER.....	1
FORCED DRAFT BLOWER SPEED (ESTIMATED).....	1440 RPM
AIR PRESSURE AT FORCED DRAFT BLOWER DISCHARGE.....	4.4 IN. H ₂ O
AIR PRESSURE AT BOILER FRONT CASING.....	2.2 IN. H ₂ O
CO ₂ IN STACK GAS.....	13%
TURBO-GENERATOR LOAD (ESTIMATED).....	1355 KW
AUXILIARY EXHAUST MAIN PRESSURE.....	15 PSIG
FEEDWATER TEMPERATURE (ECONOMIZER OUTLET).....	333°F
FEEDWATER TEMPERATURE (DFT OUTLET).....	245°F



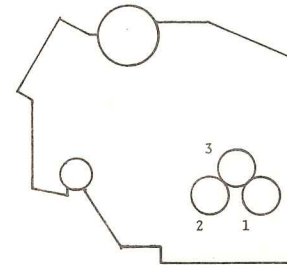
BOILER OPERATION

	18300 RPM
	<u>216 RPM</u>
<u>20 KNOTS ENDURANCE</u>	
MAIN STEAM CONDITIONS	
DRUM PRESSURE.....	660 PSIG
SUPERHEATER OUTLET PRESSURE.....	660 PSIG
SUPERHEATER OUTLET TEMPERATURE.....	855°F
AUXILIARY STEAM CONDITIONS	
DESUPERHEATER OUTLET PRESSURE.....	600 PSIG
DESUPERHEATER OUTLET TEMPERATURE.....	580°F
NUMBER OF BOILERS IN USE.....	2
NUMBER OF BURNERS IN USE PER BOILER.....	3
BURNER TIP SIZE.....	5-41-53-53-80
FUEL OIL PER BURNER.....	2084 LB/HR
FUEL OIL TOTAL (SHIP).....	12390 LB/HR
FUEL OIL SERVICE DISCHARGE PRESSURE.....	400 PSIG
FUEL OIL PRESSURE (BURNER HEADER).....	210 PSIG
NUMBER OF BLOWERS IN USE PER BOILER.....	2
FORCED DRAFT BLOWER SPEED (ESTIMATED).....	3110 RPM
AIR PRESSURE AT FORCED DRAFT BLOWER DISCHARGE.....	14.2 IN. H ₂ O
AIR PRESSURE AT BOILER FRONT CASING.....	11.5 IN. H ₂ O
CO ₂ IN STACK GAS.....	13.9%
TURBO-GENERATOR LOAD (ESTIMATED).....	1384.3 KW
AUXILIARY EXHAUST MAIN PRESSURE.....	15 PSIG
FEEDWATER TEMPERATURE (ECONOMIZER OUTLET).....	350°F
FEEDWATER TEMPERATURE (DFT OUTLET).....	245°F



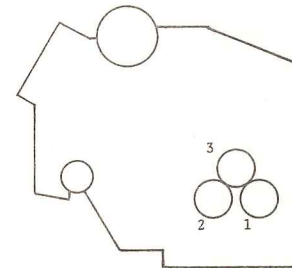
BOILER OPERATION

<u>FULL POWER</u>	<u>24000 SHP</u> <u>235 RPM</u>
<u>MAIN STEAM CONDITIONS</u>	
DRUM PRESSURE.....	660 PSIG
SUPERHEATER OUTLET PRESSURE.....	600 PSIG
SUPERHEATER OUTLET TEMPERATURE.....	850°F
<u>AUXILIARY STEAM CONDITIONS</u>	
DESUPERHEATER OUTLET PRESSURE.....	570 PSIG
DESUPERHEATER OUTLET TEMPERATURE.....	588°F
NUMBER OF BOILERS IN USE.....	2
NUMBER OF BURNERS IN USE PER BOILER.....	3
BURNER TIP SIZE.....	5-41-53-53-80
FUEL OIL PER BURNER.....	2644 LB/HR
FUEL OIL TOTAL (SHIP).....	15864 LB/HR
FUEL OIL SERVICE DISCHARGE PRESSURE.....	400 PSIG
FUEL OIL PRESSURE (BURNER HEADER).....	320 PSIG
NUMBER OF BLOWERS IN USE PER BOILER.....	2
FORCED DRAFT BLOWER SPEED (ESTIMATED).....	4300 RPM
AIR PRESSURE AT FORCED DRAFT BLOWER DISCHARGE.....	25 IN. H ₂ O
AIR PRESSURE AT BOILER FRONT CASING.....	14.5 IN. H ₂ O
CO ₂ IN STACK GAS.....	13.9%
TURBO-GENERATOR LOAD (ESTIMATED).....	1384.3 KW
AUXILIARY EXHAUST MAIN PRESSURE.....	15 PSIG
FEEDWATER TEMPERATURE (ECONOMIZER OUTLET).....	335°F
FEEDWATER TEMPERATURE (DFT OUTLET).....	245°F



BOILER OPERATION

	<u>4800 SHP</u>
	<u>130 RPM</u>
<u>ASTERN</u>	
MAIN STEAM CONDITIONS	
DRUM PRESSURE.....	660 PSIG
SUPERHEATER OUTLET PRESSURE.....	625 PSIG
SUPERHEATER OUTLET TEMPERATURE.....	850°F
AUXILIARY STEAM CONDITIONS	
DESUPERHEATER OUTLET PRESSURE.....	600 PSIG
DESUPERHEATER OUTLET TEMPERATURE.....	583°F
NUMBER OF BOILERS IN USE.....	2
NUMBER OF BURNERS IN USE PER BOILER.....	3
BURNER TIP SIZE.....	5-41-53-53-80
FUEL OIL PER BURNER.....	1911 LB/HR
FUEL OIL TOTAL (SHIP).....	11467 LB/HR
FUEL OIL SERVICE DISCHARGE PRESSURE.....	400 PSIG
FUEL OIL PRESSURE (BURNER HEADER).....	180 PSIG
NUMBER OF BLOWERS IN USE PER BOILER.....	2
FORCED DRAFT BLOWER SPEED (ESTIMATED).....	2800 RPM
AIR PRESSURE AT FORCED DRAFT BLOWER DISCHARGE.....	13.6 IN. H ₂ O
AIR PRESSURE AT BOILER FRONT CASING.....	9.7 IN. H ₂ O
CO ₂ IN STACK GAS.....	14.5%
TURBO-GENERATOR LOAD (ESTIMATED).....	11384.3 KW
AUXILIARY EXHAUST MAIN PRESSURE.....	15 PSIG
FEEDWATER TEMPERATURE (ECONOMIZER OUTLET).....	350°F
FEEDWATER TEMPERATURE (DFT OUTLET).....	245°F



PROPULSION TURBINE OPERATING CONDITIONS PER SHAFT

SPEED OF SHIP		20 KNOTS	FULL POWER	ASTERN	20% OVERLOAD
SHAFT HORSEPOWER	SHP	9150	12000	2400	11800
SHAFT REVOLUTION	RPM	216	235	130	187.5
THROTTLE STEAM PRESSURE	PSIG	615	585	615	575
THROTTLE STEAM TEMPERATURE	OF	860	850	860	840
THROTTLE STEAM FLOW LB/HR		53370	77280	53760	77499
STEAM RATE LB/SHAFT HP/HR		6.27	6.44	22.4	6.57
HP TURBINE	RPM	7019	7637	--	6009
HP TURBINE SHAFT HORSEPOWER	SHP	4950	6000	--	5380
LP TURBINE	RPM	4870	5298	--	4220
LP TURBINE SHAFT HORSEPOWER	SHP	4200	6000	--	2520
LP TURBINE MOISTURE %		9.0	8.6	--	8.5
AHEAD NOZZLE AREA ACTION SQ. IN.		2.54	3.39	--	1.905
HP TURBINE INLET PRESSURE	PSIG	615	585	615	575
HP TURBINE INLET TEMPERATURE	OF	860	850	860	840
HP TURBINE EXHAUST PRESSURE	PSIA	34.6	45.4	--	17
HP TURBINE EXHAUST TEMPERATURE	OF	333	369	--	245
LP TURBINE INLET PRESSURE	PSIA	33.6	44.4	--	16
LP TURBINE INLET TEMPERATURE	OF	333	369	--	243
LP TURBINE EXHAUST PRESSURE	PSIA	.835	.98	--	.72
LP TURBINE EXHAUST TEMPERATURE	OF	96	101	--	90.8
ASTERN TURBINE INLET PRESSURE	PSIG	--	--	395	--
ASTERN TURBINE INLET TEMPERATURE	OF	--	--	845	--
ASTERN TURBINE EXHAUST PRESSURE	PSIA	--	--	1.47	--
ASTERN TURBINE EXHAUST TEMPERATURE	OF	--	--	556	--
MAIN CONDENSER EXHAUST PRESSURE IN. HG ABS		1.7	2.0	3.0	1.4

PROPULSION AUXILIARY MACHINERY IN USE

<u>NO. PER SHIP</u>	<u>PLANT CONDITION SHIPS & SPEED KNOTS</u>	<u>IDENTIFICATIONS</u>	<u>PORT AT ANCHOR</u>	<u>20 KNOTS</u>	<u>SPLIT PLANT</u>			<u>X CONN 20% OVL D</u>
					<u>FULL POWER</u>	<u>ASTERN</u>	<u>QTY IN USE PER SHIP</u>	
2		BOILERS.....	1	2	2	2	2	SEE NOTE 1
4T		MAIN FEED PUMP	1	2	4	2	2	2
4M		MAIN FEED BOOSTER PUMP.....	1	2	4	2	2	2
2R		EMERGENCY FEED PUMP	0	0	0	0	0	0
2		DEAERATING FEED HEATER	1	2	2	2	2	1
4T		MAIN FORCED DRAFT BLOWER.....	1	4	4	4	4	2
4T		MAIN FUEL OIL SERVICE PUMP	0	2	2	2	2	1
2M		PORT USE FUEL OIL SERVICE PUMP	1	0	0	0	0	0
2		FEED WATER COOLER	1	2	2	2	2	1

M - MOTOR DRIVEN

R - RECIPROCATING

T - TURBINE DRIVEN

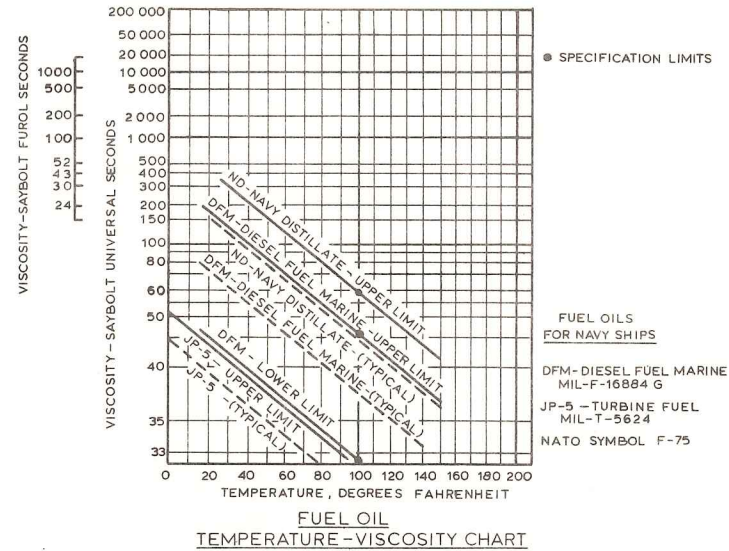
NOTE 1 - DURING 20% OVERLOAD, BOILER IN NO. 1 MACHINERY SPACE SHALL BE PLACED IN OPERATION.

PROPULSION AUXILIARY MACHINERY IN USE

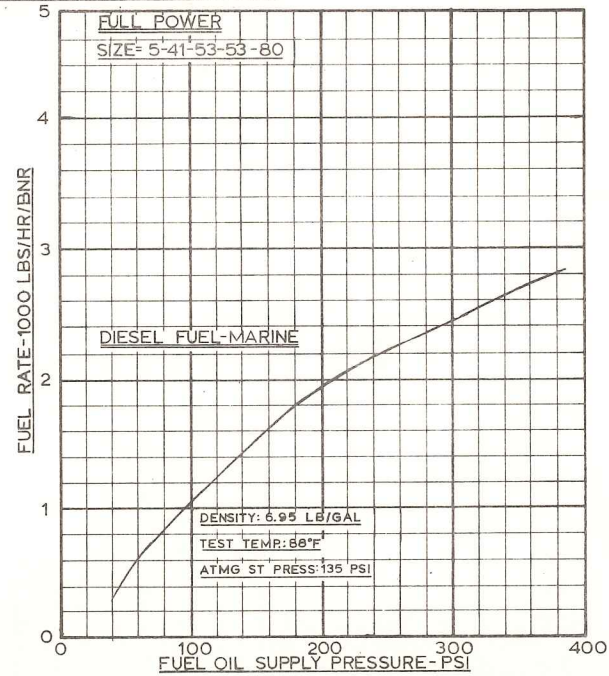
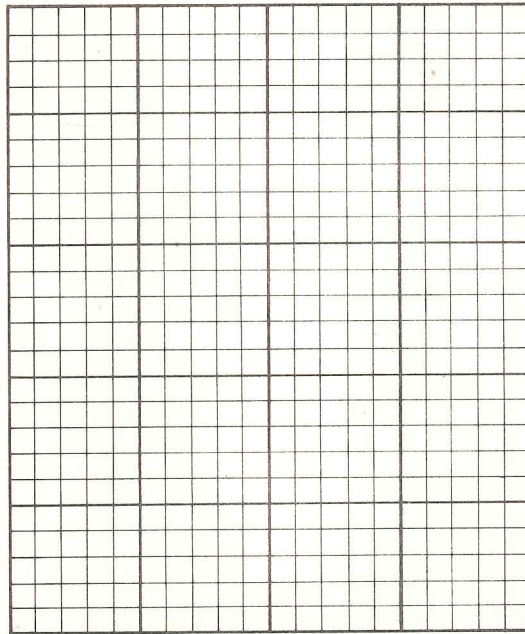
NO. PER SHIP	PLANT CONDITION SHIPS SPEED KNOTS	PORT AT ANCHOR	20 KNOTS	SPLIT PLANT		X CONN 20% OVLN
				FULL POWER	ASTERN	
	IDENTIFICATIONS			QTY IN USE PER SHIP		
2	MAIN PROPULSION TURBINE SETS	0	2	2	2	2
4M	MAIN CONDENSATE PUMP	0	2	4	2	2
2	MAIN AIR EJECTOR	0	2	2	2	2
2M	MAIN CIRCULATING PUMP	0	0	0	2	0
2M	MAIN LO SERVICE PUMP (EMERGENCY)			EMERGENCY STANDBY		
2T	MAIN LO SERVICE PUMP (STANDBY)	0	2- IDLING	2- IDLING	2	2- IDLING
2	ATTACHED LO SERVICE PUMP	0	2	2	0	2
2	LUBE OIL COOLER	0	2	2	2	2
4	TURBO-GENERATORS	2	2	2	2	2
4M	TURBO-GENERATOR CONDENSATE PUMP	2	2	2	2	2
4M	TURBO-GENERATOR CIRCULATING PUMP	2	2	2	2	2
4	TURBO-GENERATOR AIR EJECTOR	2	2	2	2	2
2	AUXILIARY GLAND LEAKOFF CONDENSER	1	2	2	2	2

BOILER OPERATING DATA
(USING DISTILLATE FUEL)

ALMOST ALL NAVAL BOILERS HAVING UNCONTROLLED SUPERHEATERS CAN ANTICIPATE SOME INCREASE IN SUPERHEATER OUTLET STEAM TEMPERATURE AFTER CONVERTING TO DISTILLATE FUEL. THE MAXIMUM LIMIT IS 850°F UNDER STEADY STATE CONDITIONS. BRIEF EXCURSIONS ABOVE THIS TEMPERATURE ARE TO BE EXPECTED DURING BOILER LOAD CHANGES.



SPRAYER PLATE CAPACITY CURVE-NAVJET STEAM ATOMIZER



SAFETY PRECAUTIONS

1. PIPING JOINTS MUST BE MAINTAINED TIGHT AND VALVES KEPT IN GOOD WORKING ORDER AT ALL TIMES.
2. NEVER ATTEMPT TO TIGHTEN A PRESSURIZED PIPING JOINT OR LEAKING COMPONENT BY SHARP OR HEAVY BLOWS OR APPLICATION OF HEAT. SUCH ACTION CAN RESULT IN SUDDEN FAILURE OF PRESSURIZED PIPING, OR AN EXPLOSION OF THE SYSTEM.
3. NEVER DEACTIVATE OR BYPASS A SAFETY DEVICE.
4. ALL WATER FROM STEAM PIPING SHOULD BE DRAINED BEFORE OPENING LINE VALVES TO PREVENT WATER HAMMER AND POSSIBLE DAMAGE TO PIPING AND EQUIPMENT. THE VALVE BYPASS ON LARGE STEAM VALVES MUST BE OPENED BEFORE OPENING THE MAIN LINE VALVE TO WARM UP THE LINE AND EQUALIZE THE PRESSURES. IF BYPASSES ARE NOT INSTALLED THE VALVES SHOULD BE OPENED SLOWLY.
5. ALL STEAM GLOBE, GATE AND ANGLE VALVES AND MANY VALVES USED IN OTHER SYSTEMS ARE EQUIPPED WITH BACK SEATS. A BACK SEAT IN GOOD CONDITION WILL REMOVE PRESSURE FROM THE PACKING GLAND WHEN THE VALVE IS FULLY OPEN. TO PROLONG THE LIFE OF PACKING, AND MINIMIZE CHANCE OF LEAKAGE OR BLOWING PACKING FROM VALVE GLANDS, ALL VALVES ARE TO BE FULLY OPEN OR FULLY CLOSED EXCEPT WHEN ACTUALLY BEING USED FOR THROTTLING PURPOSES. NORMAL HANDWHEEL TORQUE IS TO BE USED FOR SEATING AND BACKSEATING THE VALVE. NO WRENCH OR OTHER TOOL SHOULD BE NEEDED TO OPEN OR CLOSE A PROPERLY MAINTAINED VALVE.
6. IN CASE OF FIRE IN THE BILGES, CLOSE THE FUEL OIL CUTOUT VALVE AND STOP THE FUEL OIL PUMP. EXTINGUISH THE FIRE WITH PKP AND/OR AFFF.
7. IN CASE OF FIRE IN THE BOILER CASING, STOP THE FUEL SUPPLY TO THE BURNERS, STOP THE FUEL OIL PUMP, AND IMMEDIATELY ADMIT SMOTHERING STEAM TO THE CASING.
8. IN CASE OF MACHINERY BREAKDOWN, LOCATE THE CAUSE OF THE TROUBLE AND NOTIFY THE OFFICER OF THE WATCH.
9. OPERATING PERSONNEL SHOULD THOROUGHLY FAMILIARIZE THEMSELVES WITH THE SYSTEMS ABOARD SHIP BY ACTUALLY TRACING OUT INDIVIDUAL LINES AND EQUIPMENT.
10. CLEAN ALL STRAINERS PERIODICALLY AS REQUIRED IN ACCORDANCE WITH PREVENTIVE MAINTENANCE SYSTEM.
11. ALL SOUNDING TUBE CAPS SHOULD BE TIGHTLY SECURED WHEN NOT IN ACTUAL USE.
12. FREQUENT INSPECTIONS SHALL BE MADE TO ENSURE THAT FLASH SCREENS IN VENTS FROM FUEL TANKS ARE INTACT AND CLEAN ESPECIALLY AFTER PAINT SPRAYING IN VICINITY OF THE VENT TERMINALS IN ACCORDANCE WITH PREVENTIVE MAINTENANCE SYSTEM.
13. AUTOMATIC AIR RELIEF VALVES OR PRESSURE-VACUUM RELIEF VALVES FITTED TO THE TANKS OR IN THE TANK VENT SYSTEM SHALL BE TRIED FREQUENTLY FOR FREE OPERATION AND ONCE DURING EACH QUARTER SHALL BE THOROUGHLY INSPECTED AND CLEANED.
14. USE CO₂ OR PKP, IF CO₂ IS NOT READILY AVAILABLE, TO EXTINGUISH AN ELECTRICAL FIRE. DO NOT USE WATER.
15. FOR MOTOR OPERATED EQUIPMENT
 - A. BEFORE STARTING WORK ON UNIT OPEN AND TAG APPLICABLE MANUAL OR AUTOMATIC SWITCH OR CONTROLLER TO DEENERGIZE SYSTEM.
 - B. BEFORE STARTING ELECTRICAL REPAIR LOCK APPLICABLE CIRCUIT BREAKER IN "OFF" POSITION AND ATTACH WARNING TAG.
 - C. REFER TO CHAPTER 300 NAVSEA TECHNICAL MANUAL FOR ADDITIONAL SAFETY PRECAUTIONS.
16. FOR STEAM DRIVEN PUMPS
 - A. DO NOT TIE DOWN, OR OTHERWISE RENDER INOPERATIVE, THE OVERSPEED TRIP, SPEEDLIMITING OR SPEED-REGULATING GOVERNORS.
 - B. CHECK THE SETTING OF OVERSPEED TRIP, SPEEDLIMITING AND SPEED-REGULATING GOVERNORS AT LEAST QUARTERLY.
 - C. BEFORE STARTING REPAIR OPERATIONS ON THE UNIT, WIRE CLOSE AND TAG THE STEAM SUPPLY VALVE, OIL SUCTION AND DISCHARGE VALVES.
 - D. REFER TO CHAPTER 503 NAVSEA TECHNICAL MANUAL FOR ADDITIONAL SAFETY PRECAUTIONS.

SAFETY PRECAUTIONS WHEN OPERATING WITH DISTILLATE FUEL

1. KEEP FIRE FIGHTING EQUIPMENT IN GOOD WORKING CONDITION AND READILY ACCESSIBLE. SMOKE IN THE POSTED SAFE AREAS ONLY. WIPE UP SPILLED OIL AT ONCE.
2. CAREFUL HANDLING OF TORCH AND TORCH POT IS MANDATORY TO PREVENT THE POSSIBILITY OF OIL SPILLAGE AND FIRE.
3. WHEN LIGHTING OFF A BURNER, TWO MEN ARE REQUIRED; ONE MAN TO OPERATE AIR REGISTER AND INSERT TORCH; AND ANOTHER TO OPERATE FUEL OIL HEADER TOOT VALVES. DO NOT ATTEMPT TO RELIGHT FIRES OFF HOT BRICKWORK.
4. SHOULD LEAKAGE FROM THE FUEL OIL SYSTEM INTO THE FIRE ROOM OCCUR AT ANY TIME, IMMEDIATELY SECURE THE FUEL OIL SUPPLY BY MEANS OF THE QUICK CLOSING VALVES AND STOP THE FUEL OIL PUMP.
5. DISTILLATE FUEL WILL PRODUCE GASEOUS VAPORS AT TEMPERATURES APPROXIMATELY + 135°F. THESE VAPORS, WHEN MIXED IN THE PROPER PROPORTIONS WITH AIR, ARE EASILY IGNITED AND, IN SOME CASES CAN BE EXPLOSIVE. THUS, IT IS IMPORTANT TO PREVENT UNBURNED OIL FROM ACCUMULATING AND VAPORIZING. FREQUENT INSPECTIONS FOR LEAKS, SPILLAGE AND COLLECTED POOLS IS REQUIRED TO PREVENT FIRES.
6. OIL VAPORS ARE HEAVIER THAN AIR AND WILL TEND TO ACCUMULATE IN LOWER LEVELS SUCH AS BILGES. IGNITION OF THIS TYPE OF EXPLOSIVE MIXTURE MAY BE EASILY CAUSED BY OPEN FLAMES, SMOKING TOBACCO, ELECTRIC OR METALLIC SPARKS, HOT LAMP FILAMENTS OR HOT METAL SURFACES. OIL VAPOR EXPLOSIONS ARE USUALLY FOLLOWED BY FIRE WHEN OIL AND/OR COMBUSTIBLE MATERIALS ARE PRESENT.
7. IN TAKING ACTION TO EXTINGUISH AN OIL FIRE, PKP WITH A BLANKET OF AFFE, OR STEAM SMOTHERING (INSIDE BOILER CASING), ARE MOST EFFECTIVE. IT MAY BE NECESSARY TO EVACUATE PERSONNEL AND SECURE ALL OPENINGS TO THE SPACE.
8. INSPECT ALL STORAGE TANKS IN ACCORDANCE WITH PREVENTIVE MAINTENANCE SYSTEM.
9. PORTABLE COMBUSTIBLE GAS INDICATING INSTRUMENTS FOR DETECTING THE PRESENCE OF HYDROCARBON VAPORS AND OTHER COMBUSTIBLE GASES ARE AVAILABLE AND ARE IN THE SHIP'S ALLOWANCE LIST. THESE INSTRUMENTS SHOULD BE USED FOR DETECTING VAPORS IN SPACES INTO WHICH FUEL MIGHT LEAK OR IN WHICH THE PRESENCE OF HYDROCARBON VAPORS OR OTHER COMBUSTIBLE GASES ARE SUSPECTED.

SAFETY PRECAUTIONS ASSOCIATED WITH COMPRESSED AIR SYSTEMS

1. NEVER USE ANY FLAMMABLE SOLVENTS, OR VOLATILE OILS, TO CLEAN COMPRESSOR INTAKE AIR FILTERS, VALVES, CYLINDERS OR AIR PASSAGES. THESE LIQUIDS VAPORIZE EASILY AND WILL FORM EXPLOSIVE AIR/OIL MIXTURES WHEN COMPRESSED.
2. NEVER ATTEMPT TO TIGHTEN A PRESSURIZED PIPING JOINT OR LEAKING COMPONENT BY SHARP OR HEAVY BLOWS OR APPLICATION OF HEAT. SUCH ACTION CAN RESULT IN SUDDEN FAILURE OF PRESSURED PIPING OR AN EXPLOSION OF THE SYSTEM.
3. SECURE AN AIR COMPRESSOR IMMEDIATELY IF NOT SPOTS ARE DETERMINED BY TOUCH, OR IF THE DISCHARGE TEMPERATURE FROM ANY STAGE RISES UNDULY, OR EXCEEDS 400°F. INVESTIGATE AND DETERMINE THE CAUSE SINCE EXCESSIVE TEMPERATURES CAN RESULT IN AUTO-IGNITION.
4. DO NOT ATTEMPT TO RESTART AN AIR-COMPRESSOR AFTER SHUT-DOWN BY AN AUTOMATIC SAFETY DEVICE UNTIL THE CAUSE OF THE SHUT-DOWN HAS BEEN DETERMINED AND CORRECTED. FAILURE TO COMPLY WITH THIS INSTRUCTION MAY CAUSE SERIOUS DAMAGE TO THE EQUIPMENT AND/OR INJURY TO OPERATING PERSONNEL.
5. HIGH PRESSURE AIR VALVES SHOULD BE SLOWLY CRACKED OPEN UNTIL FLOW IS NOTED, AND SHOULD REMAIN IN THIS POSITION UNTIL THE PRESSURES ON BOTH SIDES HAVE GRADUALLY EQUALIZED. THE RATE OF AIR PRESSURE RISE SHOULD NOT EXCEED 200 PSI PER SECOND.
6. BEFORE WORKING ON A HIGH PRESSURE COMPRESSED AIR SYSTEM:
 - A. SECURE AIR COMPRESSOR. OPEN AND TAG CIRCUIT BREAKER.
 - B. BLOW-DOWN SYSTEM COMPLETELY.
 - C. CLOSE ALL SYSTEM VALVES AND TAG SHUT ISOLATION VALVES.
 - D. OBSERVE GAGES FOR INDICATIONS OF REMAINING AIR PRESSURES.
7. IF ANY OF THE AIR COMPRESSORS ARE TO REMAIN IDLE FOR SEVERAL WEEKS, IT IS RECOMMENDED THAT THE IDLE UNITS BE OPERATED FOR ABOUT A HALF HOUR EACH WEEK. THIS OPERATION WILL KEEP THE COMPRESSOR WELL LUBRICATED TO PREVENT CORROSION AND WILL ENSURE THAT THE CONTROL EQUIPMENT IS IN GOOD OPERATING CONDITION.
8. IF THE EQUIPMENT IS TO REMAIN IDLE FOR LONGER PERIODS WITHOUT BEING OPERATED, THE IDLE EQUIPMENT MAINTENANCE PROCEDURES LISTED IN THE MANUFACTURERS TECHNICAL MANUAL SHOULD BE FOLLOWED.

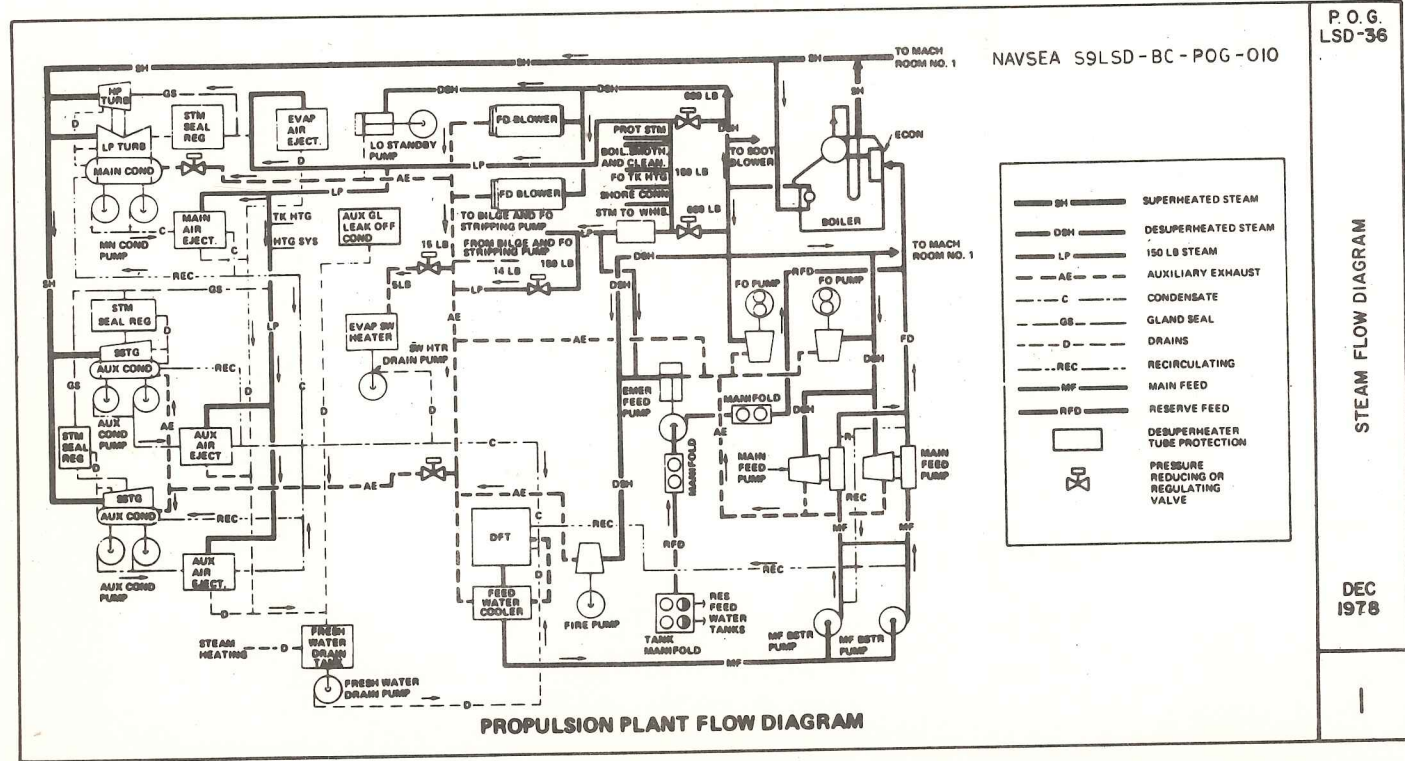
P.O.G.
LSD-36

NAVSEA S9LSD-BC-POG-010

STEAM FLOW DIAGRAM

DEC
1978

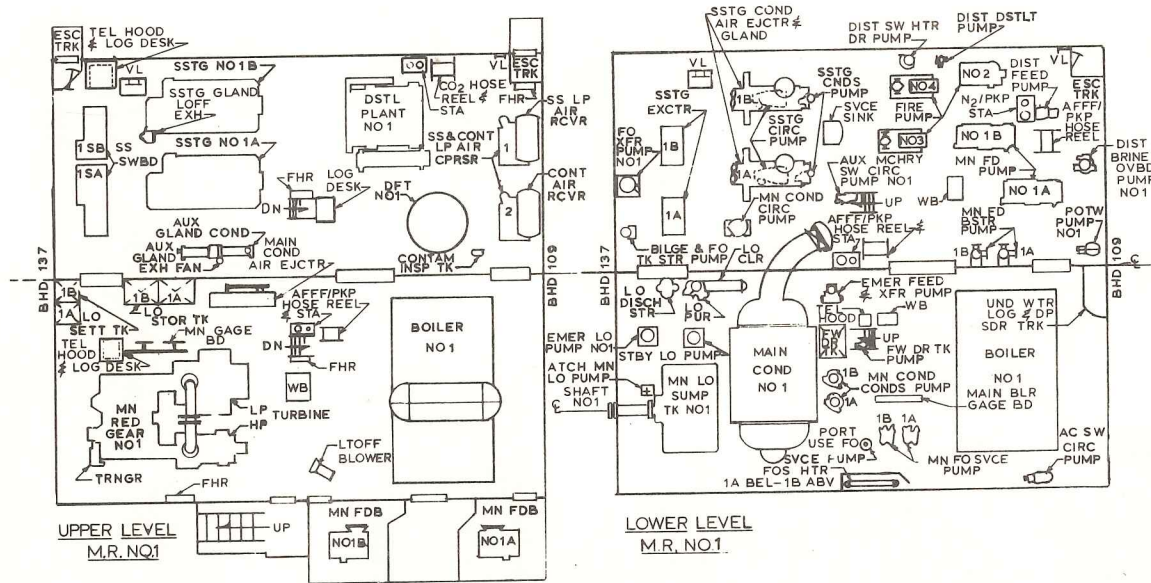
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PROPULSION PLANT FLOW DIAGRAM

NAVSEA S9LSD-BC-POG-010

POG
LSD36



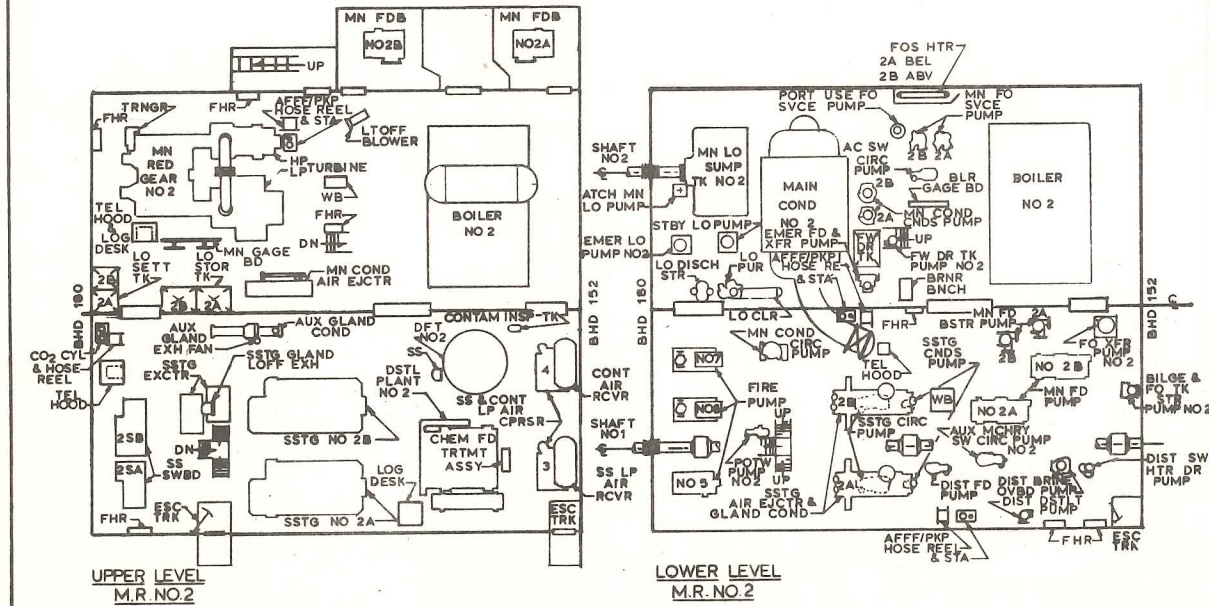
MACHINERY ARRANGEMENT
MACHINERY ROOM NO 1

DEC
1978

2

NAVSEA S9LSD-BC-POG-010

POG
LSD36



MACHINERY ARRANGEMENT
MACHINERY ROOM NO 2

DEC
1978

3

NAVSEA S9LSD-BC-POG-010

68

65

60

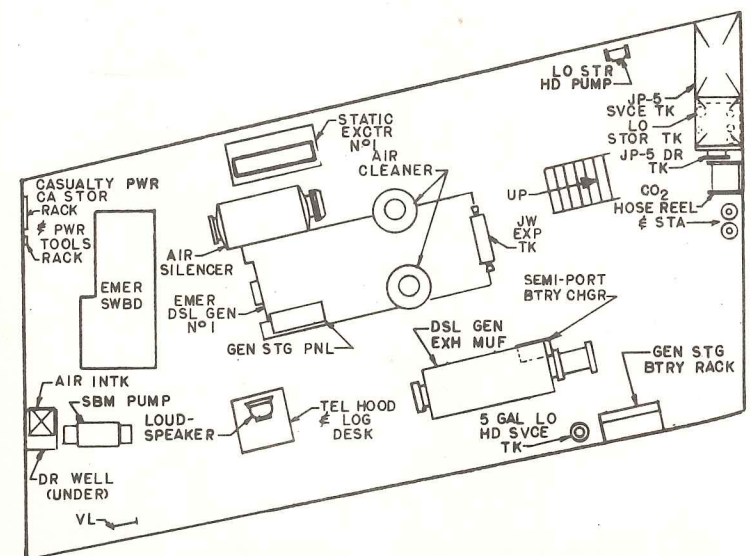
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52

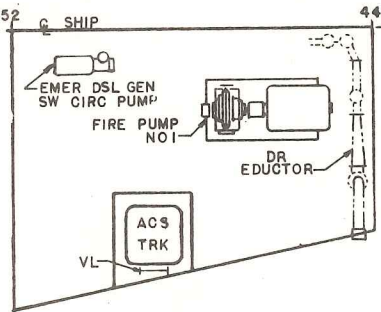
52

SHIP

44



EMER DIESEL GEN ROOM NO 1
(3RD DECK)



FIRE PUMP ROOM
(7'-0" LVL)
6-44-1-E

POG
LSD36

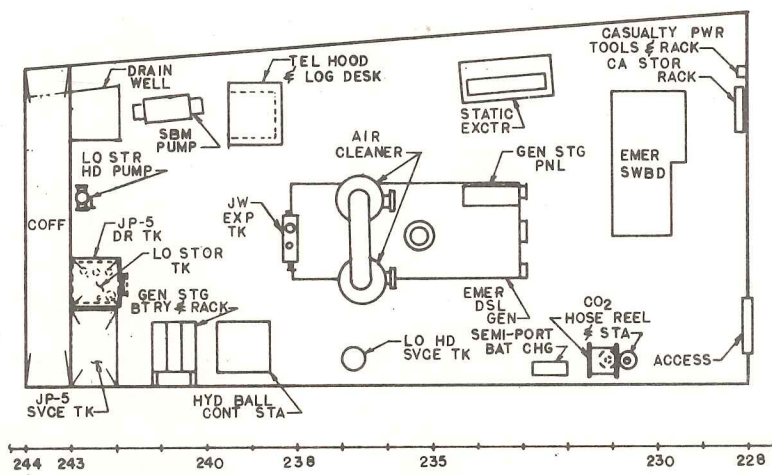
MACHINERY ARRANGEMENT
EMERGENCY DIESEL GENERATOR ROOM NO 1
& FIRE PUMP ROOM

DEC
1978

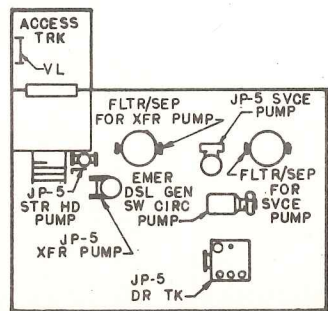
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NAVSEA S9LSD-BC-POG-010

POG
LSD 36



JP-5 PUMP ROOM (HOLD)



EMER DIESEL GEN ROOM NO 2 (2ND DECK)

MACHINERY ARRANGEMENT
EMERGENCY DIESEL GENERATOR ROOM NO 2
& JP-5 PUMP ROOM

DEC
1978

5

BHD 212

FR 204

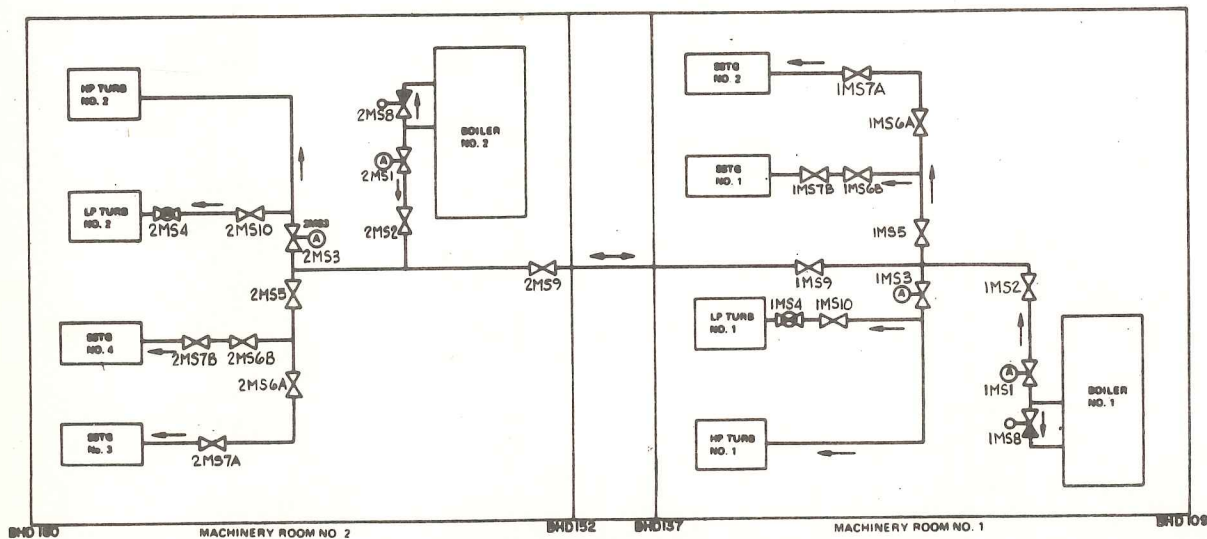
⊗ GLOBE STOP CHECK
LOCKED OPEN

⊗ MANUAL & PNEUMATIC
REMOTE OPERATION

⊗ MANUAL REMOTE
OPERATION

NAVSE S9LSD - BC - POG - 010

P.O.G.
LSD-36












MAIN STEAM SYSTEM

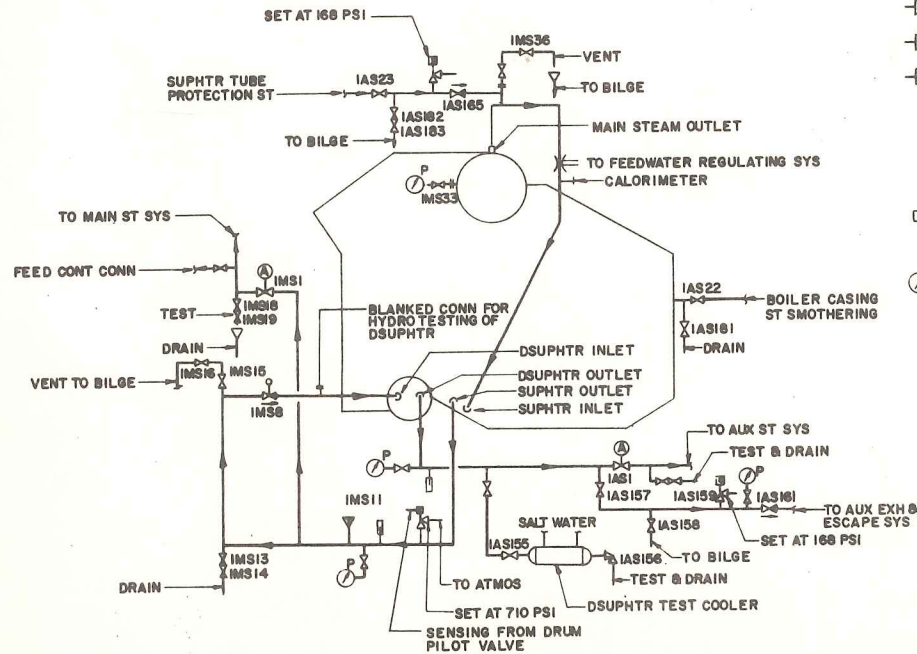
DEC
1976

6

PIPING DIAGRAM - MAIN STEAM

SYMBOLS

-  GLOBE VALVE
-  GLOBE STOP CHECK VALVE
-  PNEUMATIC OPERATED VALVE
-  SENTINAL VALVE
-  ANGLE GLOBE VALVE
-  DISTANT READING THERMOMETER
-  THERMOMETER
-  FUNNEL
-  PRESSURE GAGE



TYPICAL ARRANGEMENT OF
STEAM PIPING AT BOILER

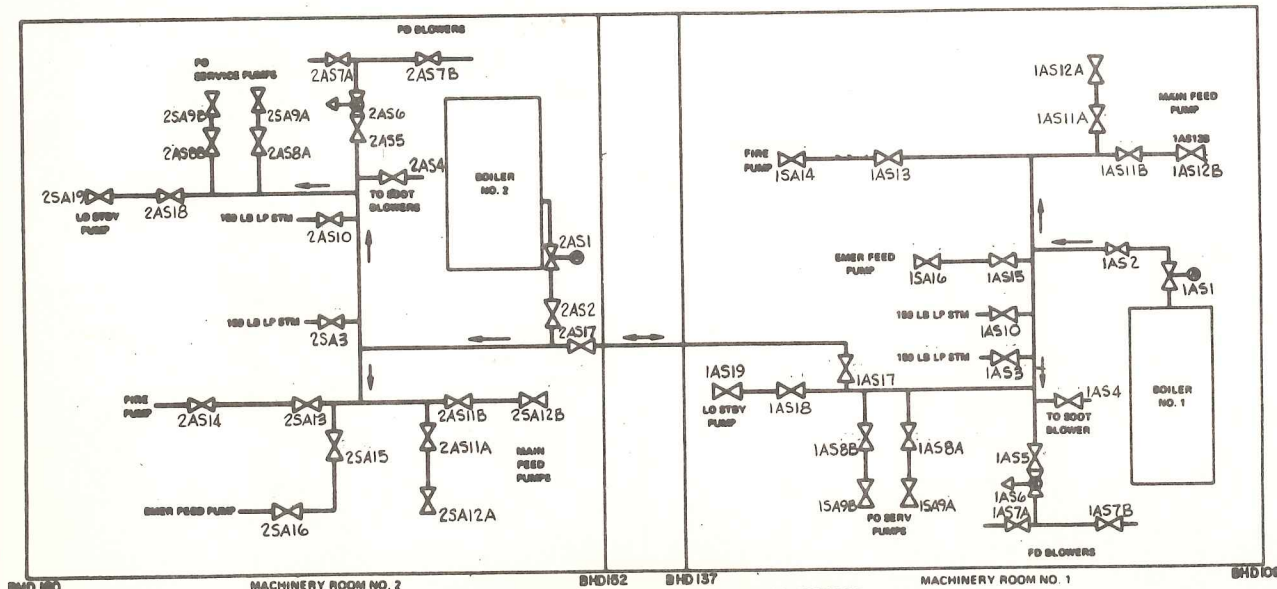
DEC
1978

NAVSEA S9LSD - BC - POG - 010

P.O.G.
LSD-38

CLOSE NEEDLE
REMOTE OPERATION

MANUAL & PNEUMATIC
REMOTE OPERATION

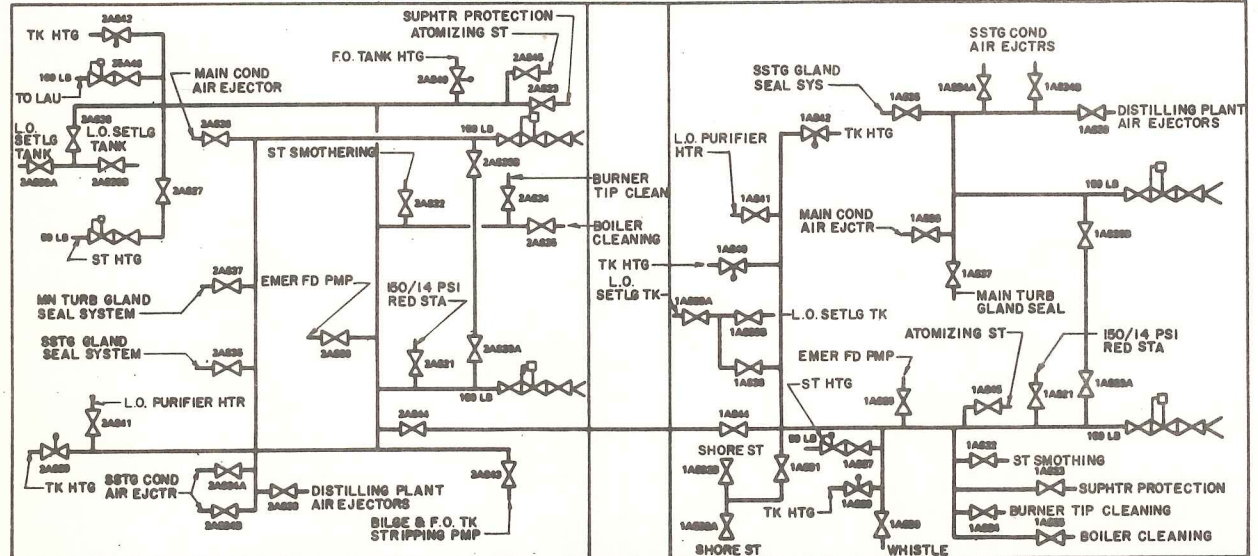


HP AUXILIARY STEAM SYSTEM

DEC
1978

8

PIPING DIAGRAM - HP AUXILIARY STEAM



LP AUXILIARY STEAM SYSTEM

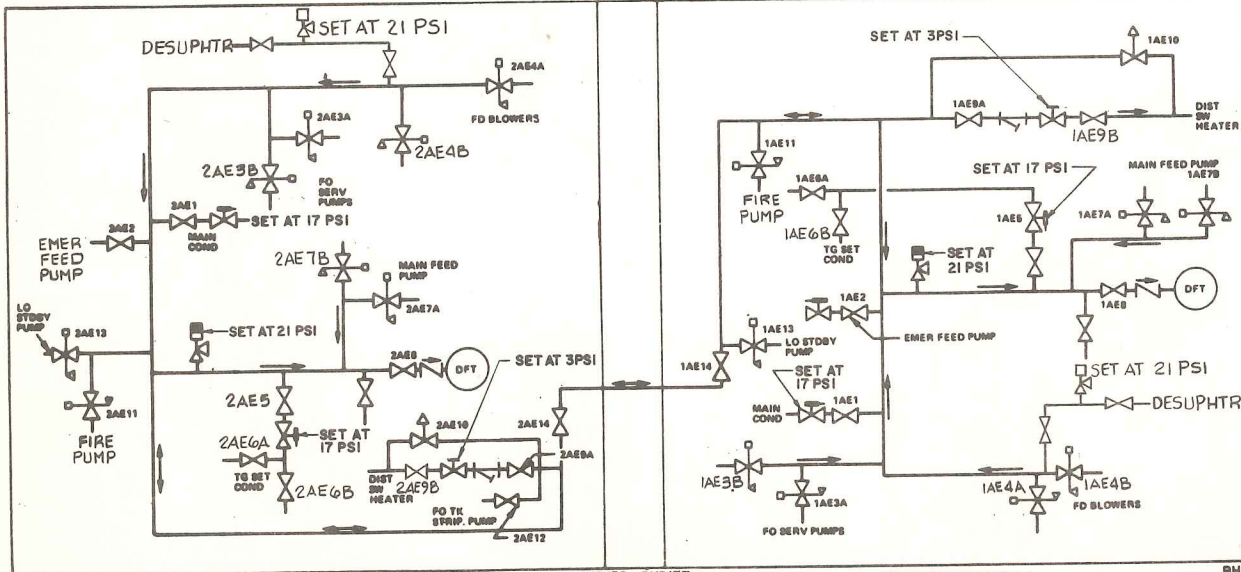
DEC
1978

PIPING DIAGRAM - LP AUXILIARY STEAM



NAVSEA S9LSD-BC-POG-010

P.O.G.
LSD-36



AUXILIARY EXHAUST AND ESCAPE SYSTEM

DEC
1978

BHD 150

MACHINERY ROOM NO. 2

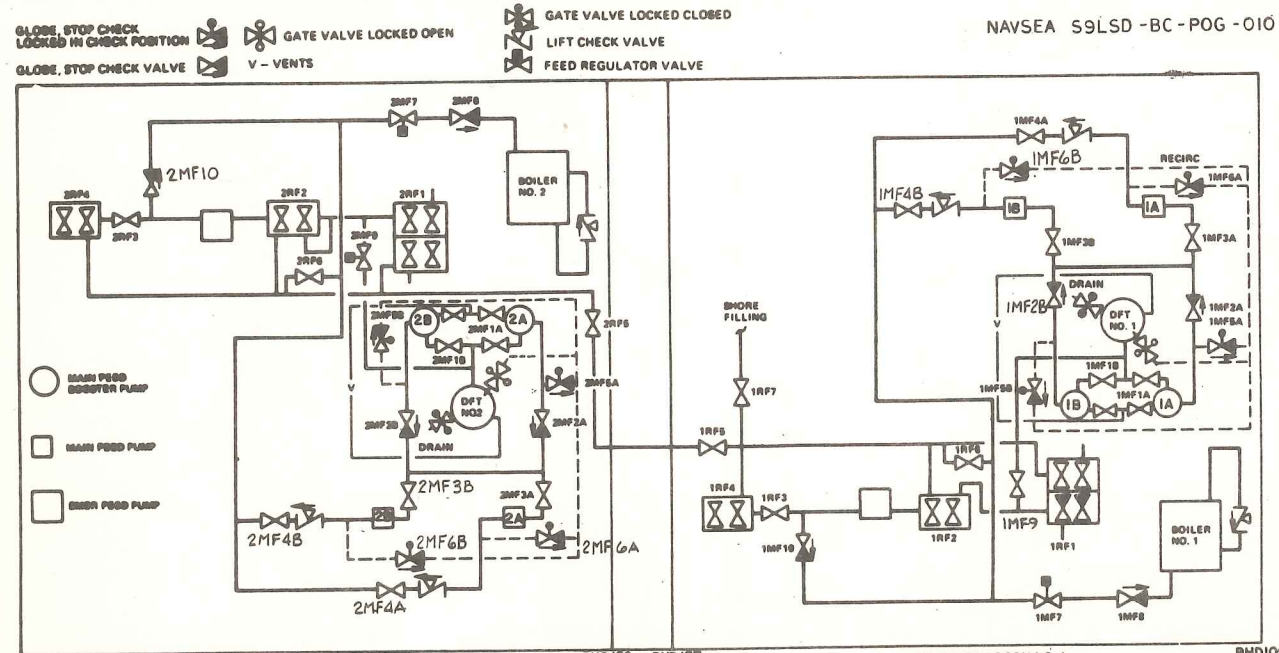
BHD 152 BHD 137

MACHINERY ROOM NO. 1

BHD 109

PIPING DIAGRAM - AUXILIARY EXHAUST

10

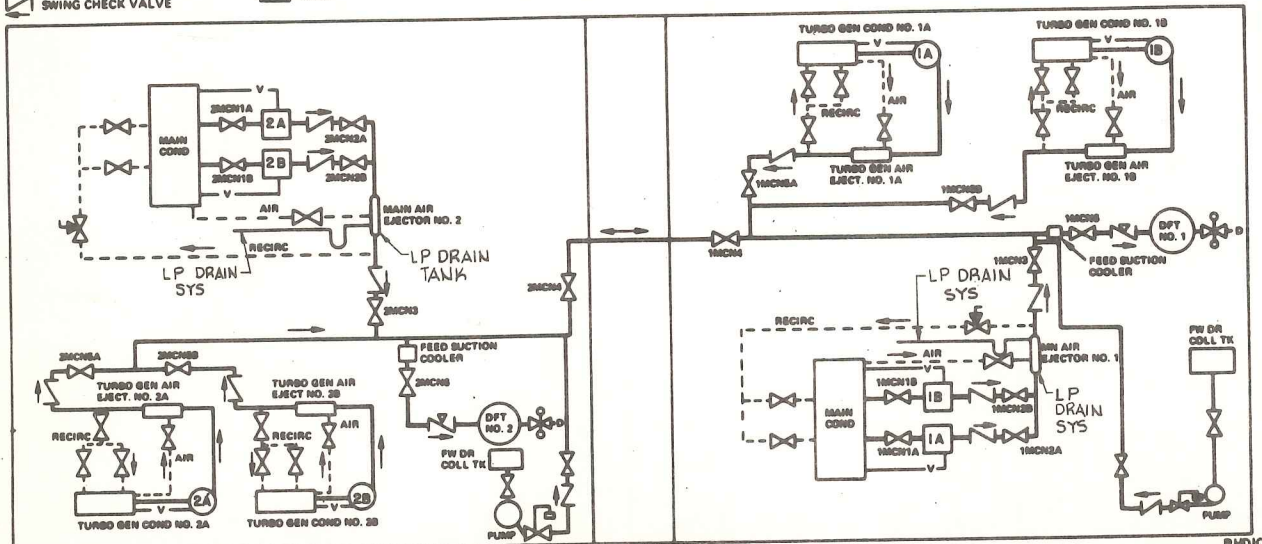


PIPING DIAGRAM - MAIN AND RESERVE FEED

MAIN AND RESERVE FEED SYSTEM

DEC
1978

11



CONDENSATE AND AIR SYSTEM

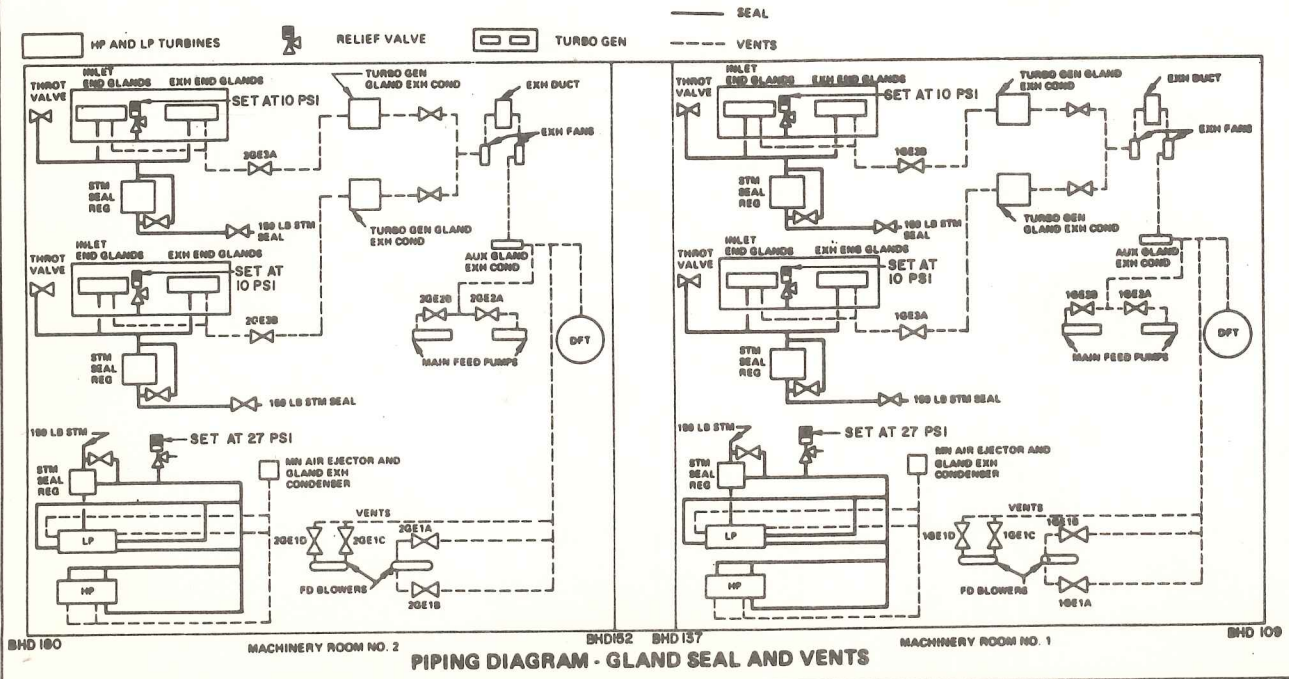
DEC 1978

12

PIPING DIAGRAM - CONDENSATE

NAVSEA S9LSD - BC - POG - 010

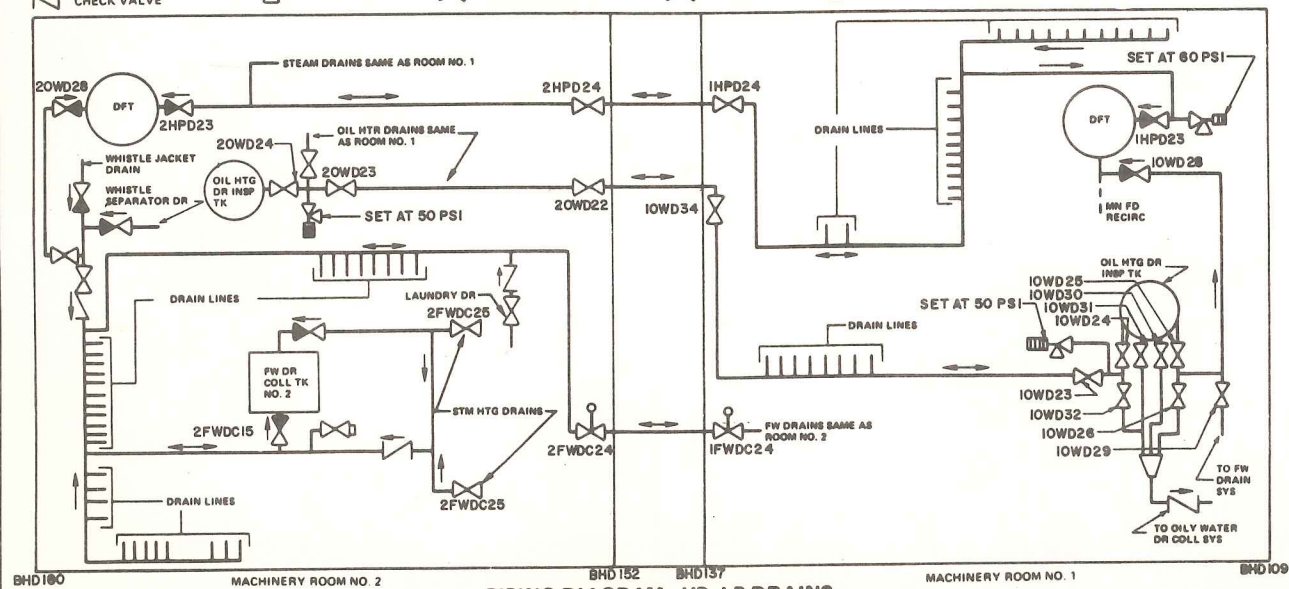
P.O.G.
LSD-36



GLAND SEAL AND VENT SYSTEM

DEC
1978

13

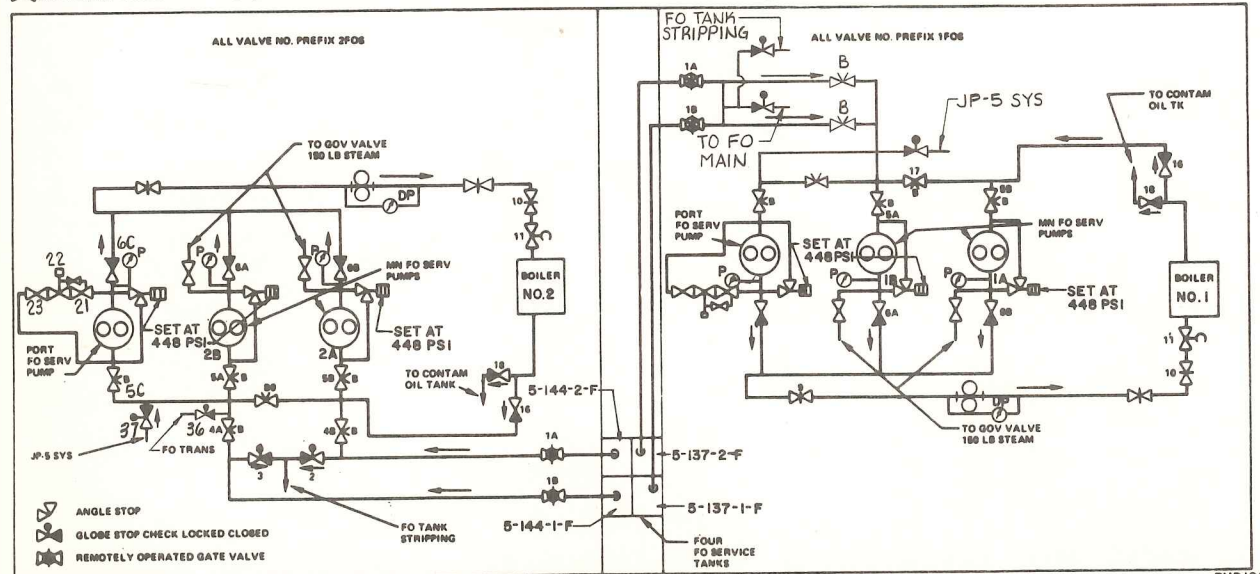


PIPING DIAGRAM - HP, LP DRAINS

HP - LP DRAINS

DEC
1978

14



BND180

MACHINERY ROOM NO. 2

PIPING DIAGRAM - FUEL OIL SERVICE

MACHINERY ROOM NO. 1

BND109

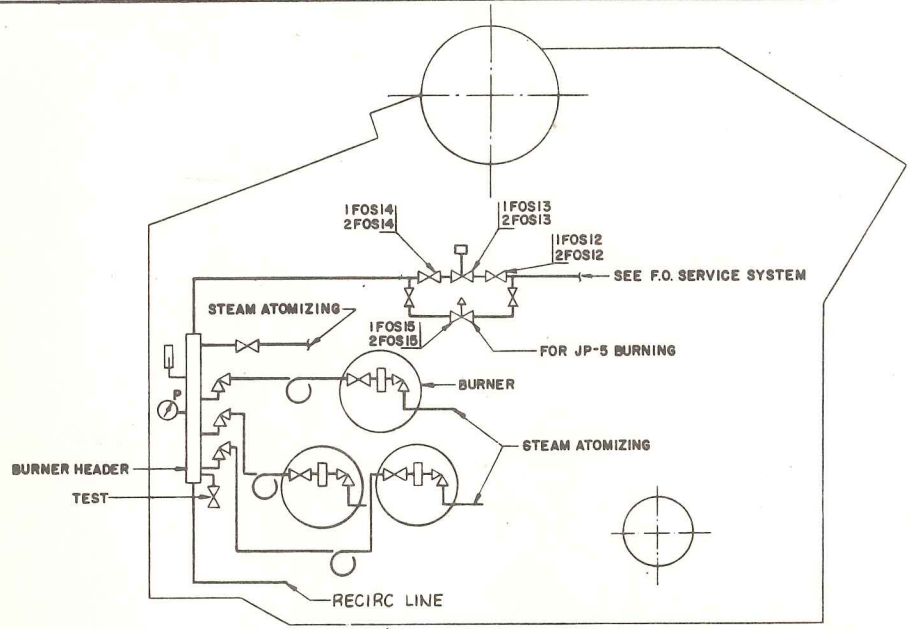
FUEL OIL SERVICE SYSTEM

DEC
1978

15

NAVSEA S9LSD-BC-POG-010

P.O.G.
LSD-36

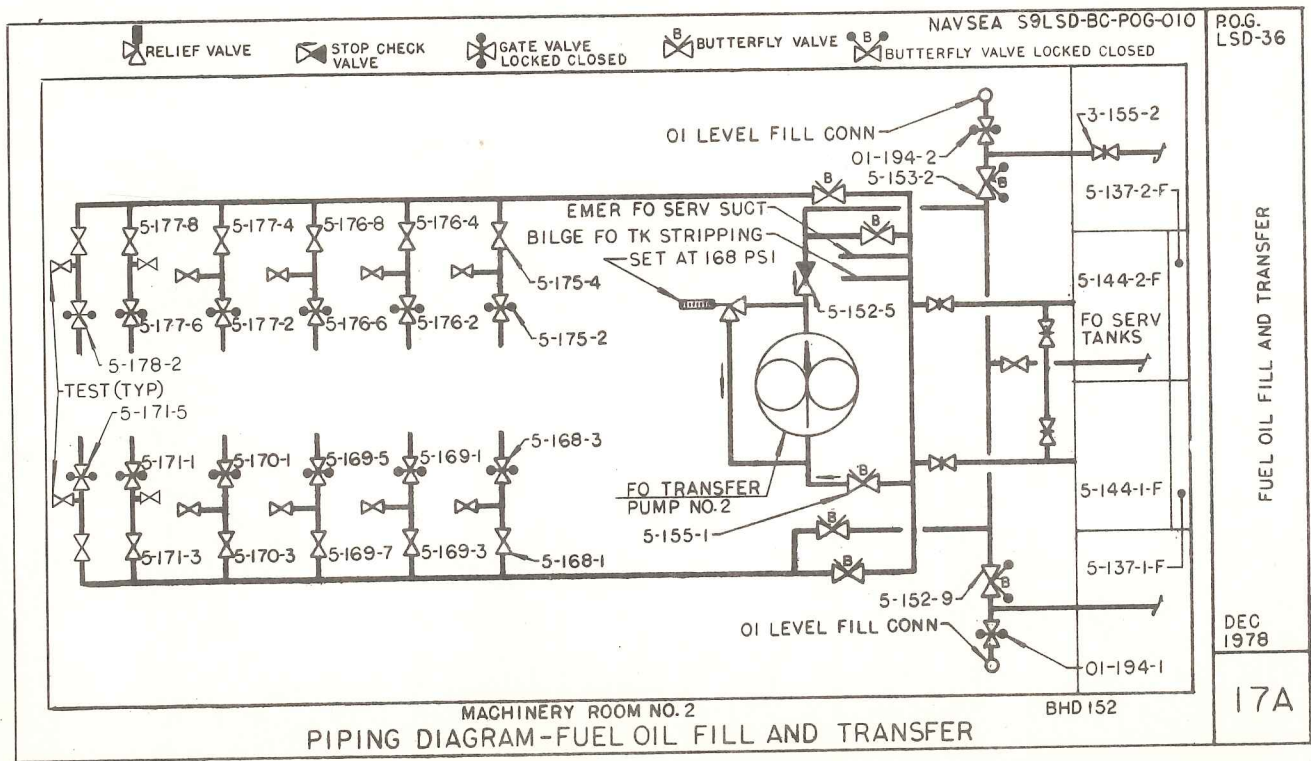


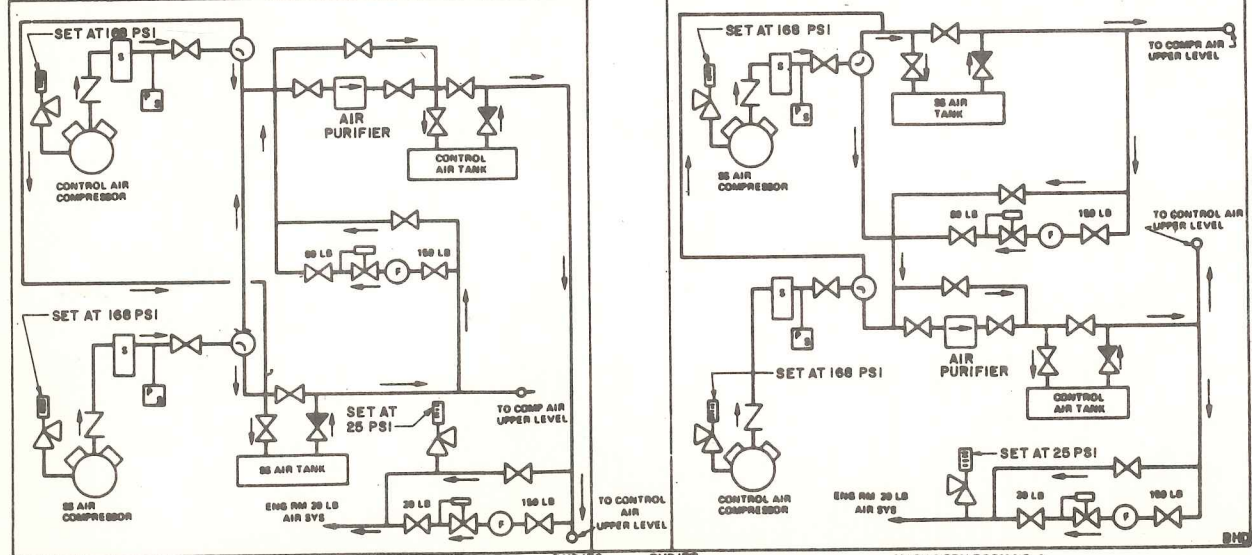
SYMBOLS

- COMB CONT VALVE (PNEU ACTUATED)
- GLOBE VALVE
- ANGLE GLOBE VALVE
- THERMOMETER
- PRESSURE GAGE
- MICROMETER VALVE

TYPICAL ARRANGEMENT OF
FUEL OIL PIPING AT BOILER

DEC
1978





BHD 160

MACHINERY ROOM NO. 2

BHD 162

BHD 137

MACHINERY ROOM NO. 1

BHD 161

PIPING DIAGRAM - SS AND CONTROL COMPRESSED AIR

S.S. AND CONTROL COMPRESSED AIR SYSTEMS

DEC 1978

BUTTERFLY VALVE
 GATE VALVE LOCKED OPEN
 STOP CHECK VALVE LOCKED OPEN

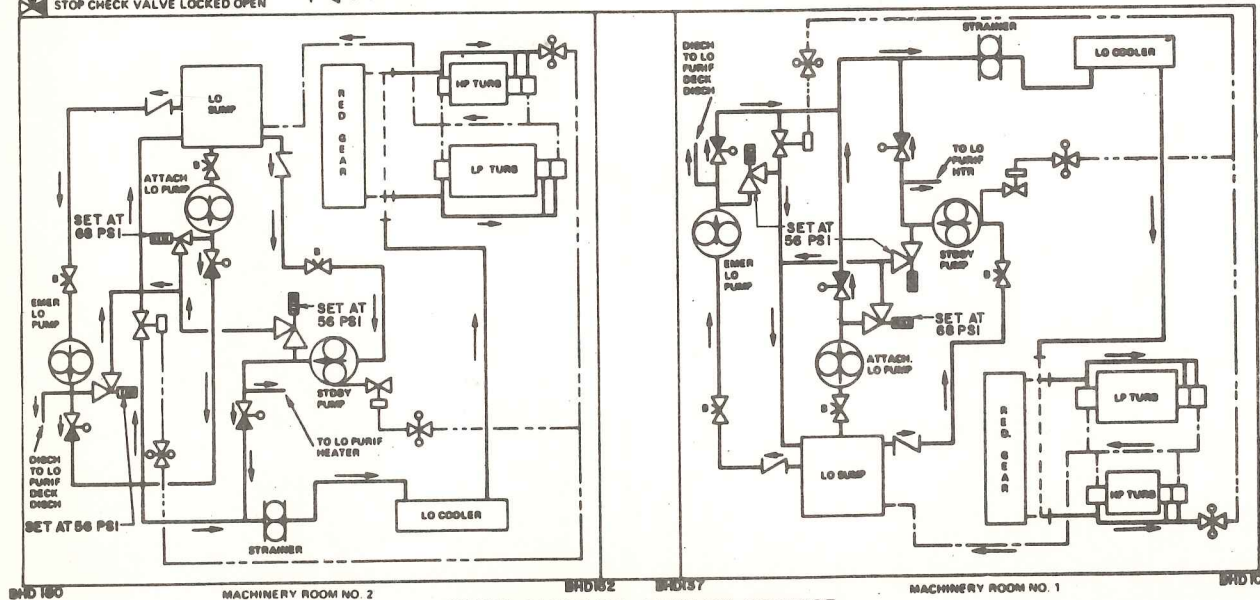
RELIEF VALVE
 CHECK VALVE

UNLOADING OR
 PUMP GOVERNOR
 VALVE

--- ENGINE PIPING
 - - - PRESSURE LINE
 - · - · DRAIN LINE

NAVSEA S9LSD-BC-POG-010

P.O.G.
LSD-36



BRD160

MACHINERY ROOM NO. 2

BRD162

BRD167

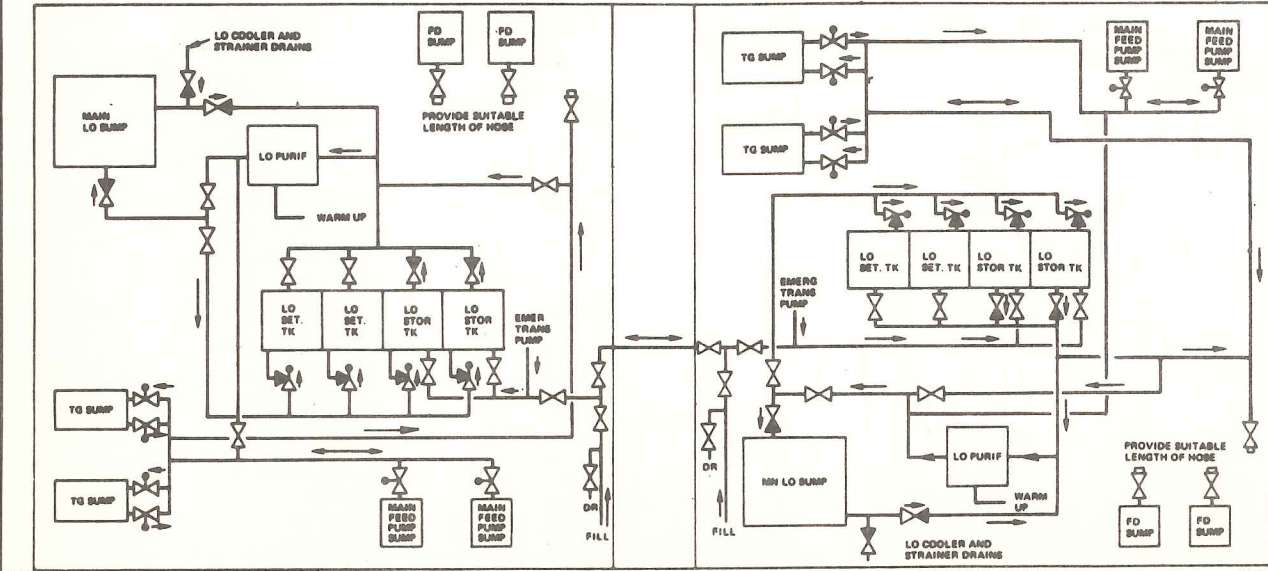
MACHINERY ROOM NO. 1

BRD166

PIPING DIAGRAM - LUBE OIL SERVICE

LUBE OIL SERVICE SYSTEM

DEC
1976

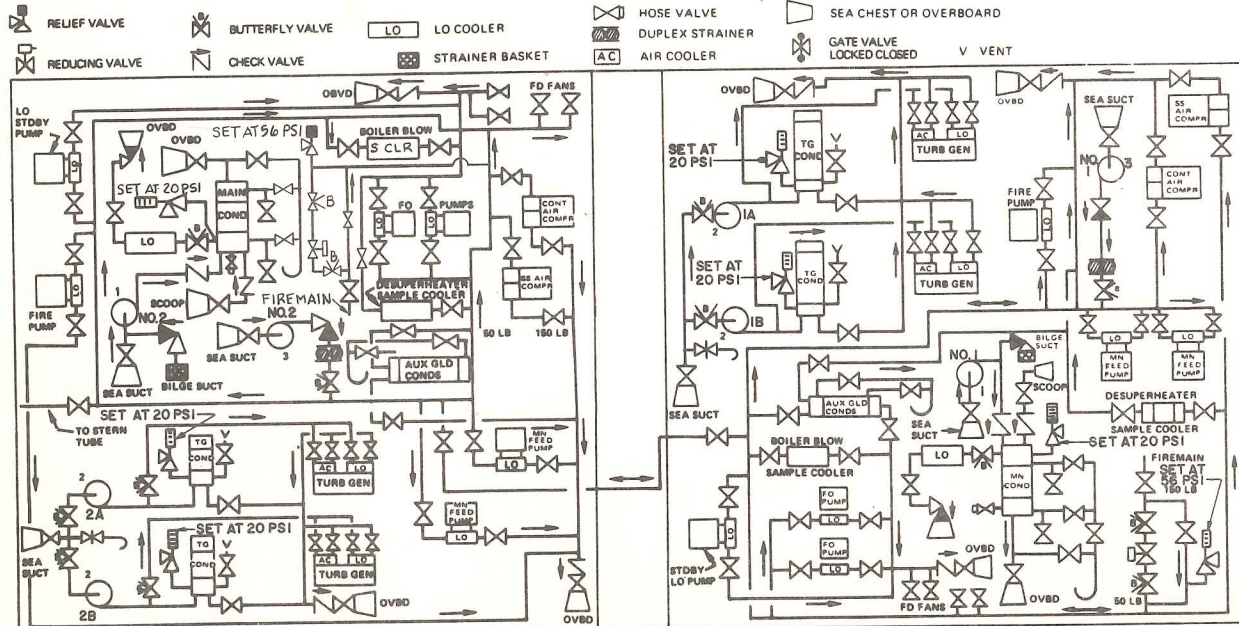


BHD180 MACHINERY ROOM NO. 2 BHD152 BHD137 MACHINERY ROOM NO. 1 BHD109

PIPING DIAGRAM - LUBE OIL FILL, TRANSFER AND PURIFYING

LUBE OIL FILL, TRANSFER AND PURIFYING SYSTEM

DEC 1978



BHD180

MACHINERY ROOM NO 2

BHD182

BHD137

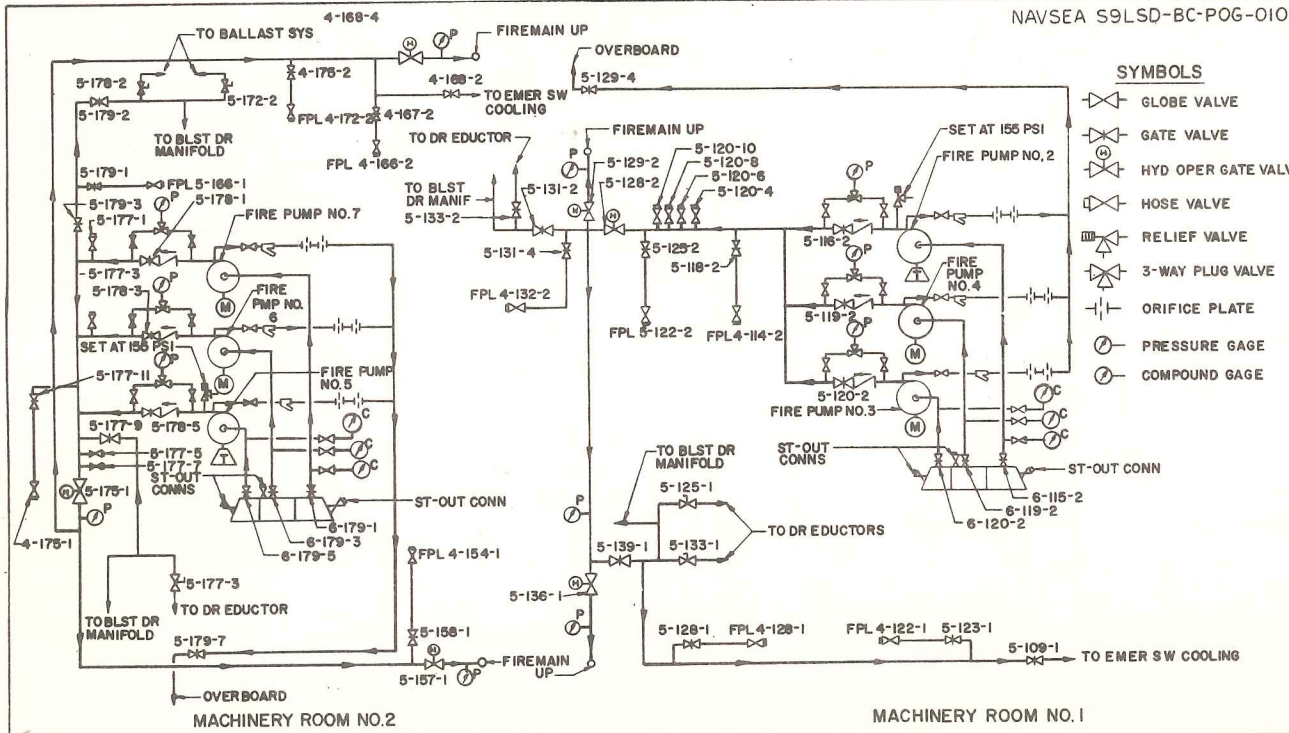
MACHINERY ROOM NO 1

- 1. MAIN CIRC PUMP BHD108
- 2. TG CIRC PUMP
- 3. AUX MACHY CIRC PUMP

PIPING DIAGRAM - SEA WATER CIRCULATING

MAIN AND AUXILIARY CIRCULATING WATER SYSTEM

DEC 1978

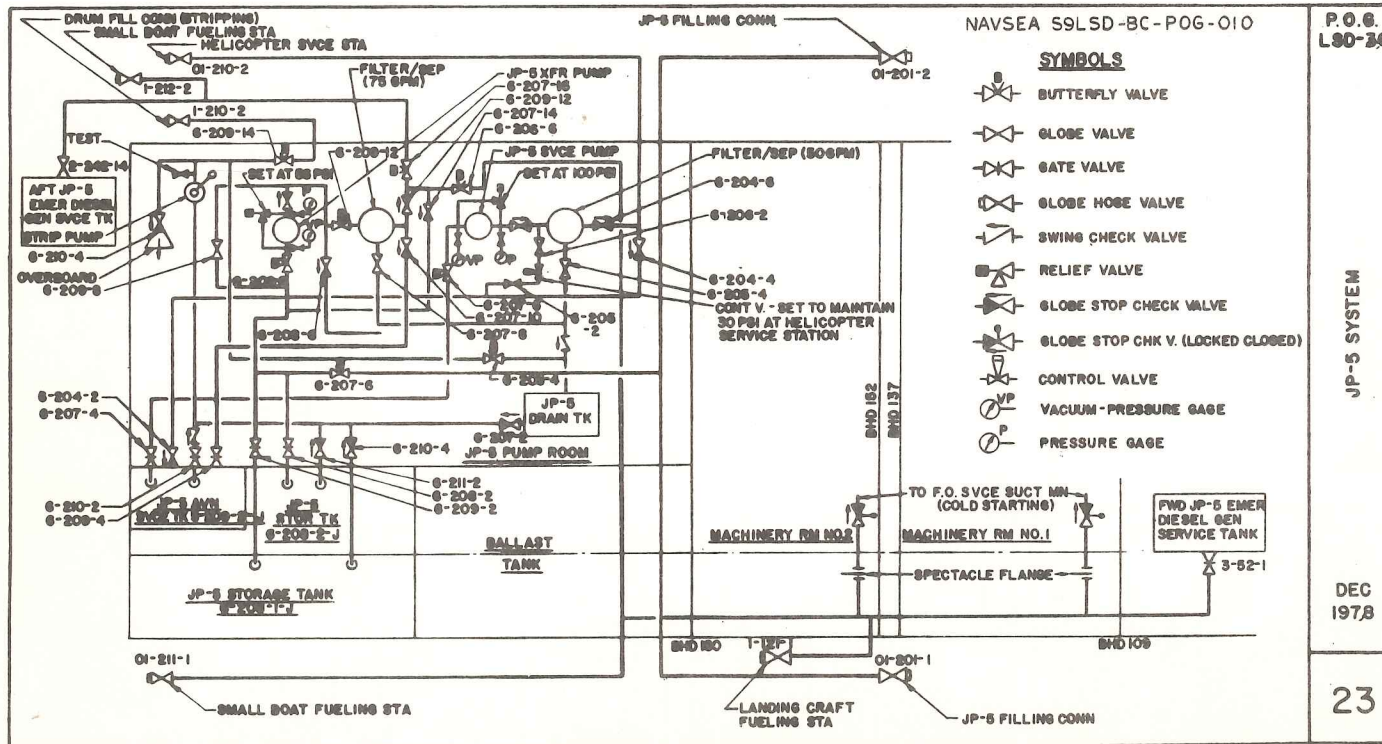


- SYMBOLS**
- GLOBE VALVE
 - GATE VALVE
 - HYD OPER GATE VALVE
 - HOSE VALVE
 - RELIEF VALVE
 - 3-WAY PLUG VALVE
 - ORIFICE PLATE
 - PRESSURE GAGE
 - COMPOUND GAGE

FIREMAIN - MACHINERY SPACES

DEC
1978

22








P.O.C.
L90-26

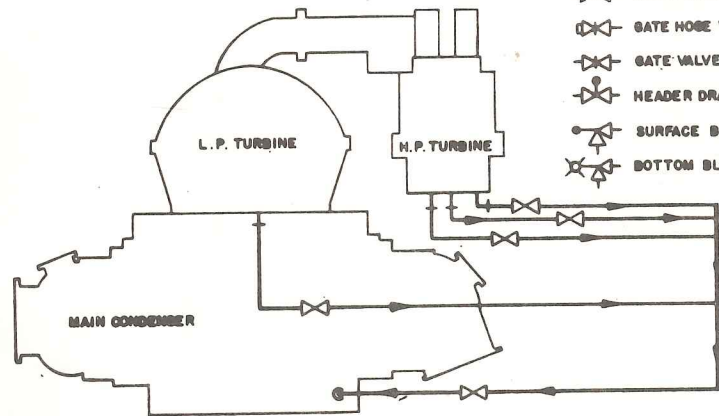
JP-5 SYSTEM

DEC
1978

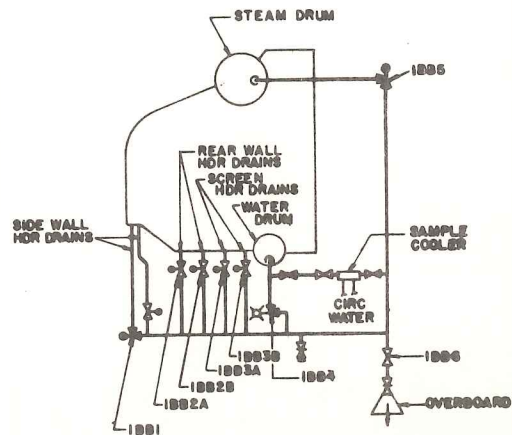
23

SYMBOLS

-  GLOBE VALVE
-  GATE HOSE VALVE
-  GATE VALVE
-  HEADER DRAIN BLOW VALVE
-  SURFACE BLOW VALVE
-  BOTTOM BLOW VALVE



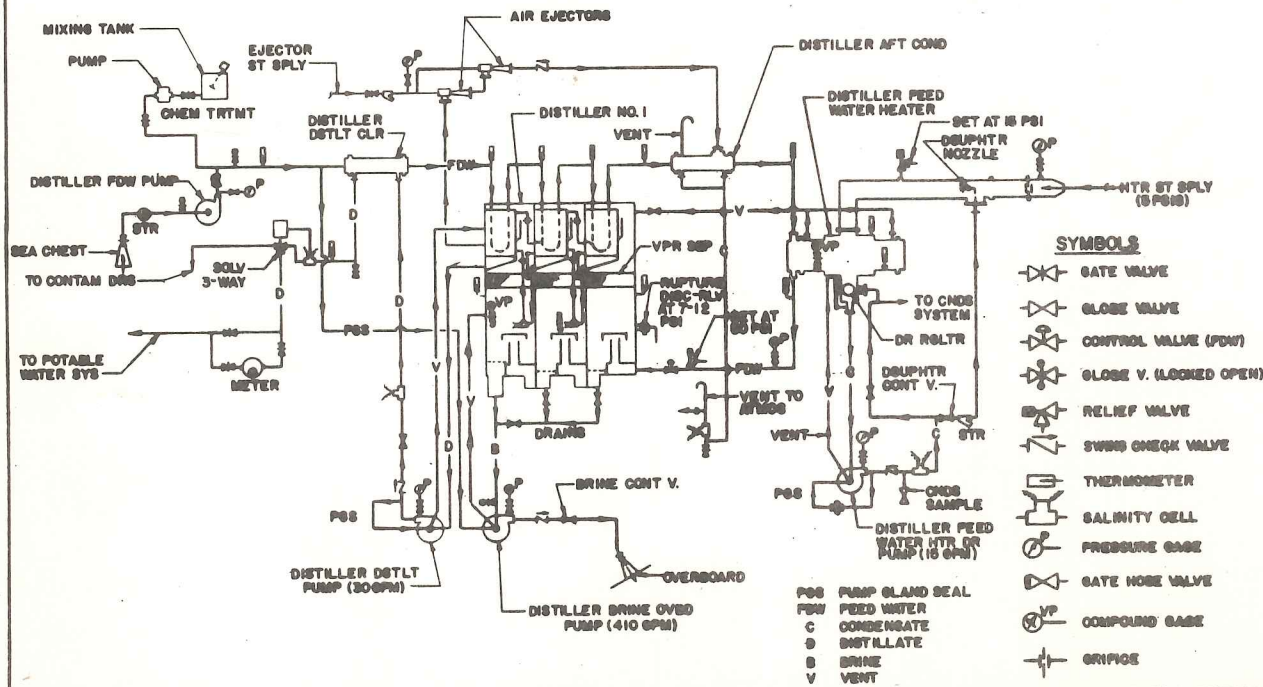
MAIN TURBINE DRAINS



BOILER BLOWDOWN SYSTEM

MAIN TURBINE DRAIN AND BOILER BLOW PIPING

DEC
1978



DISTILLING PLANT PIPING SYSTEM

DEC
1978

25