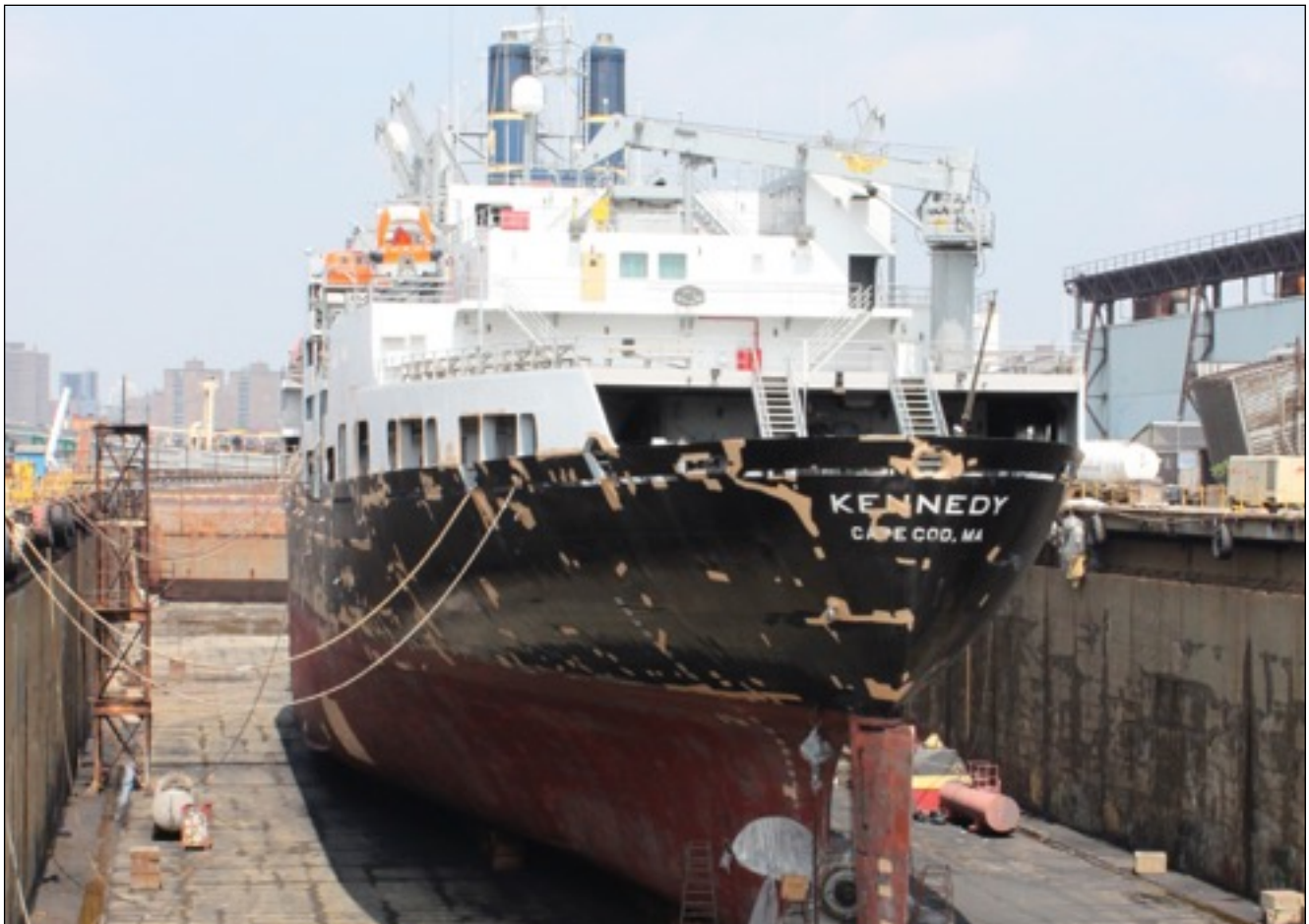

Auxiliary Machines I

Lab Book

Spring 2015



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Introduction

Auxiliary Machine Lab is an introduction to basic engineering skills. The six labs that will be covered will give the student an understanding of how to trace systems and create Piping and Instrumentation Diagrams (P&ID's). Lab meets every other week on a High or Low rotation.

Requirements for Lab:

Steel toed shoes, Eye protection, Hard hats, and Long sleeve boiler suits. Bring a Flashlight, Clipboard, Pen/Pencil, and Paper. If the student is not prepared for Lab, he/she will not be allowed to attend Lab and will receive an incomplete "I" for the Lab.

The Marine and Facility Engineering departments have given permission to use the Facilities located on MMA's campus to use for "Learning Labs". At NO time will students be allowed to operate any equipment in or around the Facility. This includes valve lineup as well. **Do not touch ANY valves, breakers, or switches.**

Labs are mandatory. This is a STCW lab. If you miss a lab, this will result in a failing grade for the semester until the lab has been made up at the instructor's convenience or the Fall of 2015.

Lab 1A - Hand Tools

Learning Objectives:

- ❖ OICEW - C1.6: Use of hand tools
- ❖ AB-D - D1.6: Knowledge of the application, maintenance and use of hand tools
- ❖ Discuss the importance of the “lock out-tag out” safety procedure
- ❖ Determine the proper hardware to be used by size and its use

Hand Tool Lab:

Modern Hand Tools:

1. Determine what tools are located in the Tool Boxes
2. On the Handout provided, identify the tools by name, use, and location in the tool box

Job Plan:

1. Determine what tools will be needed
2. Determine what Hardware is needed to complete the Job Plan

Work Sheet for Tool Box:

Tool Box Drawer	List The Tools You Find
1	
2	
3	
4	
5	
6	
7	

Job Plan Worksheet:

On each pump find the tools needed to remove the suction and discharge pipes from the flange. Place the correct tools for the job on the top of the tool box. Determine the correct bolt, nut, and gasket size.

Notes:

Lab 1B - Wilkinson Steam Plant

Learning Objectives:

- ❖ Knowledge of the phases of the steam cycle
- ❖ Ability to identify equipment of all systems
- ❖ Identification of pipe fittings
- ❖ Ability to interpret and draw a P&ID

Lab Directions

Identify and trace all systems listed below.

Fuel System:

1. Identify valves and pipe fittings

Steam System:

1. Identify valves and pipe fittings

Condensate / Feedwater System:

1. Identify pumps
2. Identify valves and pipe fittings

Circulating Water System:

1. Identify pumps and location of pumps
2. Identify valves and pipe fittings

City Water:

1. Identify valves and pipe fittings

Assignment:

To complete this Lab the student will have to at the beginning of the next Lab, completely trace out the above mentioned systems and turn in the finished P&ID. Drawings will be graded on accuracy and neatness. Hand drawn or CAD will be accepted. All hand drawn P&ID's must have straight edges. On a spreadsheet create an inventory of all pipe fittings for the condensate/feedwater system. Write a brief description of the Wilkinson Steam Cycle compared to the TS Kennedy Steam Cycle.

Notes:

Table 1. Saturation, Temperatures

Temp, °f	Abs press, psi	Specific vol		Enthalpy (heat)		
		Sat liquid	Sat vapor	Sat liquid	Evap	Sat vapor
32	0.08859	0.01602	3304.7	0.01	1075.5	1075.5
40	0.12170	0.01602	2444	8.05	1071.3	1079.3
50	0.17811	0.01603	1703.2	18.07	1065.6	1083.7
60	0.2563	0.01604	1206.7	28.06	1059.9	1088.0
70	0.36931	0.01606	867.9	38.04	1054.3	1092.3
80	0.5069	0.01608	633.1	43.02	1048.6	1096.6
90	0.6982	0.01610	468.0	57.99	1042.9	1100.9
100	0.9492	0.01613	350.4	67.97	1037.2	1105.2
110	1.2748	0.01617	265.4	77.94	1031.6	1109.5
120	1.6924	0.01620	203.27	87.92	1025.8	1113.7
130	2.2225	0.01625	157.34	97.90	1020.0	1117.9
140	2.8886	0.01629	123.01	107.9	1014.1	1122.0
150	3.718	0.01634	97.07	117.9	1008.2	1126.1
160	4.741	0.01639	77.29	127.9	1002.3	1130.2
170	5.992	0.01645	62.06	137.9	996.3	1134.2
180	7.510	0.01651	50.23	147.9	990.2	1138.1
190	9.339	0.01657	40.96	157.9	984.1	1142.0
200	11.526	0.01663	33.64	168.0	977.9	1145.9
212	14.696	0.01672	26.80	180.0	970.4	1150.4
220	17.186	0.01677	23.15	188.1	965.2	1153.4
240	24.969	0.01692	16.323	208.3	952.2	1160.5
280	49.203	0.01726	8.645	249.1	924.7	1173.8
300	67.013	0.01745	6.466	269.6	910.1	1179.7
340	118.01	0.01787	3.788	311.1	879.0	1190.1
380	195.77	0.01856	2.335	353.5	844.6	1198.1
400	247.31	0.01864	1.8633	375.0	826.0	1201.0

Table 2. Saturation, Pressures

Abs press, psi	Temp, °f	Specific vol		Enthalpy (heat)		
		Sat liquid	Sat vapor	Sat liquid	Evap	Sat vapor
0.50	79.58	0.01608	641.4	47.6	1048.8	1096.4
1.0	101.74	0.01614	333.6	69.7	1036.3	1106.0
5.0	162.24	0.01640	73.52	130.1	1001.0	1131.1
10	193.21	0.01659	38.42	161.2	982.1	1143.3
14.7	212.00	0.01672	26.80	180.0	970.4	1150.4
15	213.03	0.01672	26.29	181.1	969.7	1150.8
20	227.96	0.01683	20.089	196.2	960.1	1156.3
25	240.07	0.01692	16.303	208.5	952.1	1160.6
30	250.33	0.01701	13.746	218.8	945.3	1164.1
40	267.25	0.01715	10.498	236.0	933.7	1169.7
50	281.01	0.01727	8.515	250.1	924.0	1174.1
60	292.71	0.01738	7.175	262.1	915.5	1177.6
70	302.92	0.01748	6.206	272.6	907.9	1180.6
80	312.03	0.01757	5.472	282.0	901.1	1183.1
90	320.27	0.01766	4.896	290.6	894.7	1185.3
100	327.81	0.01774	4.432	298.4	888.8	1187.2
110	334.77	0.01782	4.049	305.7	883.2	1188.9
120	341.25	0.01789	3.728	312.4	877.9	1190.4
130	347.32	0.01796	3.455	318.8	872.9	1191.7
140	353.02	0.01802	3.220	324.8	868.2	1193.0
150	358.42	0.01809	3.015	330.5	863.6	1194.1
200	381.79	0.01839	2.288	355.4	843.0	1198.4
250	400.95	0.01865	1.8438	376.0	825.1	1201.1
300	417.33	0.01890	1.5433	393.8	809.0	1202.8
350	431.72	0.01913	1.3260	409.7	794.2	1203.9
400	444.59	0.0193	1.1613	424.0	780.5	1204.5

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Lab 2A - Stationary Shore Boiler

Learning Objectives:

- ❖ Demonstrate a basic knowledge of thermodynamics
- ❖ Ability to read steam tables
- ❖ Knowledge of what a hot water boiler is and an unfired pressure vessel is

Lab Directions:

Identify and trace all systems listed below. Record temperature and pressure readings. Compare them to the values found on the steam table.

P&ID's:

Fuel System

Hot Water System

Steam/Condensate System

City Water

Nitrogen

Include all pumps, strainers, and valves that are in these systems. For the steam/condensate system, make sure you trace it to the ship and back. No need to include fittings for the shore boiler.

Assignment:

Complete a P&ID to be turned in at the beginning of the next lab meeting. The same rules apply from the last P&ID.

Notes:

Lab 2B - Main and Auxiliary Circulating Water System

Learning Objectives:

The objective is for the students to trace out the Main and Auxiliary Circulating System and to become familiar with all the main parts, equipment, their function, and where they are located in the system.

Lab Directions:

Trace the main circulating system from the high and low suction to the main condenser, lube oil coolers, and overboard.

Trace the auxiliary circulating system from the high and low suction to the auxiliary condenser, auxiliary lube oil cooler, wind box, and overboard.

Assignment:

Complete a P&ID to be turned in at the beginning of the next lab meeting. The same rules apply from the last P&ID.

Notes:

Lab 3A - Shoreside Sanitary Treatment Facility

Learning Objectives:

- ❖ Knowledge of the phases in the treatment plant
- ❖ Understanding of regulations that apply to the treatment of the plant
- ❖ Ability to define terminology

Lab Directions:

Trace the lines from the lift stations to the pump station. Once into the building, identify the stages of treatment.

Sanitary Treatment Systems:

1. Influent (Untreated)
2. Effluent (Treated)
3. Sludge
4. Chemical Addition System

Assignment:

Complete a P&ID to be turned in at the beginning of the next lab meeting. The same rules apply from the last P&ID.

Notes:

Lab 3B - Shipboard MSD

Learning Objectives:

- ❖ Preparation for the STCW assessment
- ❖ To gain familiarity with the MSD
- ❖ Knowledge of the CFR regulations
- ❖ Understanding of how the lift station ties into the shore plant

Lab Directions:

Trace the black water and gray water lines going to the MSD, lift station, overboard, and holding tanks.

Shipboard Sanitary System:

Black Water

Gray Water

Influent

Effluent

Assignment:

Complete a P&ID to be turned in at the beginning of the next lab meeting. The same rules apply from the last P&ID.

Notes:

Lab 4A - Fire Protection System

Learning Objectives:

- ❖ Demonstrate knowledge of the fire protection system
- ❖ Comprehend the difference between a wet and dry system
- ❖ A better understanding of P&ID's
- ❖ Compare the TS Kennedy's sprinkler system to the shoreside system

Lab Directions:

The student will trace the TS Kennedy fire system and sprinkler system. Once done with the TS Kennedy, then head over to the ABS Information Commons and trace the shoreside system. Lastly, trace the dorm sprinkler system over by 6th company.

TS Kennedy Fire System:

1. Fire pump #1
2. Fire pump #2
3. Fire pump #3
4. Main header

TS Kennedy Sprinkler System:

1. Two Hold sprinkler system
2. Salt Water sprinkler pump

Shore Side Sprinkler System:

1. ABS Information Commons
2. Dorm sprinkler system

Assignment:

Complete a P&ID to be turned in at the beginning of the next lab meeting. The same rules apply from the last P&ID.

Notes:

Lab 4B - Micro Turbines

Learning Objectives:

- ❖ Determine how the Micro Turbines provide hot water heating
- ❖ Demonstrate an understanding of how the Micro Turbines interact with the boilers
- ❖ Ability to explain how the city water ties into the system

Lab Directions:

The student will trace out the Micro Turbines systems in 6th company. These systems consist of the following P&ID's:

P&ID's:

HW Supply
HW Return
Domestic Hot Water
City Water
Fuel

Assignment:

Complete a P&ID to be turned in at the beginning of the next lab meeting. The same rules apply from the last P&ID.

Notes:

Lab 5 - Geothermal System

Learning System:

- ❖ Basic knowledge of a heat pump system
- ❖ Elementary understanding of how building ventilation works
- ❖ Ability to trace lines individually
- ❖ Knowledge of basic HVAC equipment

Lab Directions:

The student will trace the geothermal system located in the ABS Information Commons. Only use ONE of the air handling units and ONE heat pump.

Geothermal Systems:

1. HW Supply
2. HW Return
3. CW Supply
4. CW Return
5. Glycol
6. Well Supply
7. Well Return

Assignment:

Complete a P&ID to be turned in at the beginning of the next lab meeting. The same rules apply from the last P&ID.

Notes:

Lab 6 - Fuel Oil Manifold

Learning Objectives:

- ❖ AB - E - A6.1: Knowledge of oil transfer operations
- ❖ AB - E - A6.1: Preparations for fueling and transfer operations
- ❖ AB - E - A6.1: Procedures for connecting and disconnecting fueling and transfer hoses
- ❖ AB - E - A6.1: Procedures relating to incidents that may arise during fueling or transferring operation
- ❖ AB - E - A6.1: Procedures for securing from fueling and transfer operations
- ❖ ABE - 1 - 6A: Assist with fuel oil transfer

Lab Directions:

1. Trace out the piping system and familiarize yourself with the equipment
2. Discuss the objectives and job hazards
3. Unbolt and remove the blank 6" flange from the manifold
4. Install grounding conductor between both manifold assemblies
5. Rig the cargo hose with the lifting gear and bolt up the flange connection using a new gasket and spud wrenches for alignment purposes
6. Tighten up the flange connection evenly
7. Once both sides of the cargo hose has been bolted up, prepare to pressure test the connections
8. Connect one end of the 1-1/2" fire hose to the dock siamese connection and the other end to the equipped fitting on one of the manifold assemblies
9. Verify that all valves on the manifold are in the correct position
10. Open the manifold vent line and close the drain valve
11. Open the fresh water supply from the dock system and slowly open the fresh water manifold supply valve to fill up the manifold header
12. Once the vent line is discharging water close the valve
13. Then proceed with the transferring of "fuel"
14. Check for leaks and if need repair
15. Once done shut off the water supply then drain the system
16. Make sure everything is back in the job box

Notes:

