1. REPORT DATE  
APR 1985

2. REPORT TYPE  
N/A

3. DATES COVERED  
-

4. TITLE AND SUBTITLE  
Tool List Program Feasibility Study for Outside Machinery Operations

5a. CONTRACT NUMBER  
-

5b. GRANT NUMBER  
-

5c. PROGRAM ELEMENT NUMBER  
-

5d. PROJECT NUMBER  
-

5e. TASK NUMBER  
-

5f. WORK UNIT NUMBER  
-

6. AUTHOR(S)  
Naval Surface Warfare Center CD Code 2230 - Design Integration Tools  
Building 192 Room 128 9500 MacArthur Blvd Bethesda, MD 20817-5700

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)  
-

8. PERFORMING ORGANIZATION REPORT NUMBER  
-

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)  
-

10. SPONSOR/MONITOR’S ACRONYM(S)  
-

11. SPONSOR/MONITOR’S REPORT NUMBER(S)  
-

12. DISTRIBUTION/AVAILABILITY STATEMENT  
Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES  
-

14. ABSTRACT  
-

15. SUBJECT TERMS  
-

16. SECURITY CLASSIFICATION OF:  
-

a. REPORT  
unclassified

b. ABSTRACT  
unclassified

c. THIS PAGE  
unclassified

17. LIMITATION OF ABSTRACT  
SAR

18. NUMBER OF PAGES  
244

19a. NAME OF RESPONSIBLE PERSON  
-

Standard Form 298 (Rev. 8-98)  
Prescribed by ANSI Std Z39-18
THE NATIONAL SHIPBUILDING
RESEARCH PROGRAM

Task ES-8-21
Tool List Program Feasibility Study
For Outside Machinery Operations

CONDUCTED AT:

Industrial Engineering Department
Ingalls Shipbuilding Division
Litton
P.O. Box 149
Pascagoula, Mississippi 39567

January 1985 through April 1985

FOR:

Bath Iron Works Corporation
700 Washington St.
Bath, Maine 04530

The Society of Naval Architects and Marine Engineers
Ship Production Committee
SP-8 Panel on Industrial Engineering

The U.S. Department of Transportation
Maritime Administration
THE NATIONAL SHIPBUILDING RESEARCH PROGRAM

FINAL REPORT FOR TASK ES-8-21

Tool List Program Feasibility Study For outside Machinery Operations
This final report was written to reveal the results of a fourteen (14) week feasibility study on a tool identification list program for outside machinery operations.

The scope of this project includes the complete development and evaluation of a tool identification list pilot program.

This project was performed as part of the National Shipbuilding Research Program, under subcontract to Bath Iron Works Corporation. Funding was provided jointly by the Maritime Administration (MarAd) and the U. S. shipbuilding industry. Administration of this project was through the Society of Naval Architects and Marine Engineers (SNAME) Sp-8 panel on Industrial Engineering. Performance of the project was by the Industrial Engineering Department of Ingalls Shipbuilding.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PREFACE</td>
<td>ii</td>
</tr>
<tr>
<td>LIST OF ILLUSTRATIONS</td>
<td>iv</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>PROGRAM BENEFITS</td>
<td>2</td>
</tr>
<tr>
<td>Tool List Program Advantages</td>
<td></td>
</tr>
<tr>
<td>Tool List Program Disadvantages</td>
<td></td>
</tr>
<tr>
<td>Tool List Program Payback Analysis</td>
<td></td>
</tr>
<tr>
<td>PROGRAM DESCRIPTION</td>
<td></td>
</tr>
<tr>
<td>Tool List Program Network</td>
<td></td>
</tr>
<tr>
<td>TIDB Text System</td>
<td></td>
</tr>
<tr>
<td>PROJECT ACTIVITIES</td>
<td>12</td>
</tr>
<tr>
<td>TOOL LIST PILOT PROGRAM EVALUATION</td>
<td>14</td>
</tr>
<tr>
<td>TOOL LIST SUMMARY</td>
<td>17</td>
</tr>
<tr>
<td>Ventilation System Equipment</td>
<td></td>
</tr>
<tr>
<td>Main High Pressure Air System Equipment</td>
<td></td>
</tr>
<tr>
<td>Main Oil Lubrication System Equipment</td>
<td></td>
</tr>
<tr>
<td>Miscellaneous Equipment</td>
<td></td>
</tr>
<tr>
<td>FIGURE NO.</td>
<td>TITLE</td>
</tr>
<tr>
<td>-----------</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>1.</td>
<td>Tool List Program Administration Cost</td>
</tr>
<tr>
<td>2.</td>
<td>Tool List Program Payback Analysis .</td>
</tr>
<tr>
<td>3.</td>
<td>Tool List Program Network Diagram</td>
</tr>
<tr>
<td>4.</td>
<td>Sample Tool List</td>
</tr>
<tr>
<td>5.</td>
<td>Sample Account and Item to Tool List Code No. Matrix</td>
</tr>
<tr>
<td>6.</td>
<td>Printed Tool List on a Bill of Material Form</td>
</tr>
<tr>
<td>7.</td>
<td>TIDB Text System Options</td>
</tr>
<tr>
<td>8.</td>
<td>Tool List Program Annual Cost Savings</td>
</tr>
</tbody>
</table>
INTRODUCTION

In December of 1983 Ingalls Shipbuilding assumed an active part in the Maritime Administration’s National Shipbuilding Research Program. At that time the Industrial Engineering Department at Ingalls began to work on Task ES-8-21, the Data Development of Detail Standards for Outside Machinery Operations. The purpose of this project was twofold. It was primarily to provide the shipbuilding industry with a set of universal standards for Outside Machinery Operations. It was also to identify specific areas where methods improvements could be made to benefit both Ingalls and the U. S. Shipbuilding industry.

It was during the shipyard observations by methods analysts that the problem of excessive travel for tools by outside machinists became apparent. It was observed that some machinists were reporting to shipboard job sites without all of the required tools to perform the job. Numerous trips were made off the ship for additional tools. Further analysis revealed that the problem was costing Ingalls almost one million dollars annually in excessive labor costs. Communications with other shipyards through NSRP (The National Shipbuilding Research Program) Sp-8 Panel on Industrial Engineering revealed that the problem was industry wide.

Seeing that the problem was industry wide, Ingalls submitted a proposal to and received approval from the Sp-8 Panel to implement and evaluate a solution to this problem. The proposed solution was to provide machinists with tool lists that would enumerate all of the necessary equipment required to perform each job. The implementation of this solution was considered capable of reducing the numerous trips made off the ship for additional tools. The implementation of a pilot program utilizing and evaluating the effectiveness of this solution is the subject of this Tool List Program Feasibility Study.
It is estimated that Ingalls Shipbuilding expends approximately $900,000 annually in labor costs for excessive tool travel by outside machinists. The tool list program was designed as an instrument to aid in the reduction of excessive travel for tools by outside machinists. The tool list program alone will not totally eliminate excessive travel for tools. Tool lists will however do the following:

- Provide a comprehensive list of tools required to perform specific tasks.
- Provide the necessary information to reduce the amount of time an experienced machinist would have to spend planning a job.
- Provide the necessary information to reduce excessive travel time incurred by inexperienced machinists.

In-yard studies revealed that Ingalls could annually reduce its excessive travel for tools labor costs by $323,651 annually. This would involve using tool lists in CG 47 class cruisers and LHD assault ship new construction areas aboard ship for outside machinists.

The major disadvantage of the tool list program is that it relies heavily upon the persistence of the outside machinery supervisor. The supervisor must continue to encourage and monitor the use of tool lists or the program will lose its potential.

The tool list program is not a cure-all for the excessive travel for tools problem. Below are some examples of situations for which the tool list concept is rather limited.

- Tool lists won’t eliminate excessive travel for tools costs caused by employees trying to escape from work. Supervisors must monitor their employees work habits to do this. Tool lists can be used in cooperation with good supervision to eliminate excuses for leaving the ship to obtain tools.
- The tool list concept doesn’t work very well with unplanned work. By the very nature of such work it is impossible to anticipate the scope, when it will occur and what tools might be required.
The tool list concept doesn't work well with complex long term jobs. Tool lists that become multi-page in length tend to be easy to ignore in the long-run.

The tool list concept is not conducive to assist type work. Where work descriptions are vague and task requirements are subject to change from ship to ship, it is questionable whether a tool list would significantly reduce excessive travel time.

Even though there are areas where the tool list concept is limited in the shipbuilding environment, the advantages outweigh the disadvantages.

The tool list program does produce savings if properly utilized. However, there are administrative costs associated with the implementation and continued operation of this program. The administrative costs must be considered in a payback analysis to determine the economical feasibility of such a program.

The administrative costs are shown in figure 1. Also shown in figure 1 are the departments involved and the scope of their activities as it relates to the tool list program.

Figure 2 shows the payback analysis. The continuing annual operation cost is subtracted from the gross annual savings to yield a net annual savings. The implementation administrative cost is considered as an investment cost. The payback period is calculated by dividing the investment by the net annual savings.

Based on the information in figure 2, it is economically advantageous for Ingalls to implement the tool list program for the Outside Machinery Department.
<table>
<thead>
<tr>
<th>Administrative Implementation Cost</th>
<th>$85,920</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Services (Computer Usage)</td>
<td>1,035</td>
</tr>
<tr>
<td>Industrial Engineering (Coordination and Tool List Development)</td>
<td>76,125</td>
</tr>
<tr>
<td>Outside Machinery (Rollow Tool List Development)</td>
<td>8,760</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Annual Administrative Operating Cost</th>
<th>$10,059</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computer Services (Computer Usage)</td>
<td>1,421</td>
</tr>
<tr>
<td>Outside Machinery (Changes and Now Equipment)</td>
<td>876</td>
</tr>
<tr>
<td>Production Planning (Tool List added to BOM)</td>
<td>7,697</td>
</tr>
<tr>
<td>Reprographic Services (Addltional Paper Generated)</td>
<td>165</td>
</tr>
</tbody>
</table>
## Tool List Program Payback Analysis

<table>
<thead>
<tr>
<th>Description</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Annual Savings</td>
<td>$323,651</td>
</tr>
<tr>
<td>Less Annual Administrative Operating Cost</td>
<td>-10,059</td>
</tr>
<tr>
<td>Net Annual Savings</td>
<td>313,592</td>
</tr>
<tr>
<td>Investment (Administrative Implementation Cost)</td>
<td>$85,920</td>
</tr>
<tr>
<td>Payback Period</td>
<td>0.27 years</td>
</tr>
</tbody>
</table>
TOOL LIST PROGRAM DESCRIPTION

This Tool List Program was designed to provide the maximum amount of information to the craftsman with the intention of holding the administrative cost of the program to a minimum. The program described in this section was developed by the Ingalls Industrial Engineering Department with the cooperation of the Production Planning Department. The highlight of this program is that the tool list is printed on the bill of material. Use of this system provides a complete summary of both tools and materials required to complete a given job.

TOOL LIST PROGRAM NETWORK

The mechanics of this program directly involved three departments, Industrial Engineering, Production Planning and Outside Machinery (see figure 3). First, Industrial Engineering with the cooperation of Outside Machinery supervision develops the tool lists (see figure 4). The Industrial Engineering Department then stores the tool lists into the TIDB (Technical Information Data Base) Text System. Industrial Engineering also develops an Account and Item to Tool List Code Number Matrix to identify the location of each tool list in the TIDB System (see figure 5). The Planner then is familiarized with the Matrix and matches each major piece of equipment on a bill of material to a tool list code number. The tool list code numbers, bill of material number and hull number are typed into the TIDB System by the planner. Utilization of this system produces tool lists that are part of the computer generated bill of material (see figure 6). Now the machinists can gather all of the necessary tools and materials to complete a job by referring to one document.

TIDB TEXT SYSTEM

The TIDB Text (Technical Information Data Base) System is a program written by Ingalls Computer Services Department for the express purpose of adding notes to the bill of material to provide the craft supervisors and workers with information that would assist them in ship construction. During the tool list pilot program. forty-seven (47) tool lists were added to seven hundred seven (707) bill of materials.

Figure 7 shows the five (5) available options of the Text System. Option Number 1 allows tool list data to be input, changed or removed from the computer, thus, the actions create/modify/delete. The tool list data was input into the computer under a dummy bill of material (No. 0000-000-1) and a dummy hull (No. 4500). The second option, Detail Text View, allows one to view the data that has been created, modified or deleted in option number 1. Option Number 3, Merge paragraph from existing bill, allows the tool list stored on the dummy bill of material to be transferred to the large number of bill of materials that the tool list is applicable to. Option No. 4, Bill Paragraph List, displays the paragraph numbers (tool list code numbers) on any given bill of material. Option X allows one to end the session of interaction on the program.
FIGURE 3 - TOOL LIST PROGRAM NETWORK DIAGRAM

1. INPUT TOOL LISTS INTO TIDB (INDUSTRIAL ENGINEERING)
   - DEVELOP TOOL LISTS (OUTSIDE MACHINERY & INDUSTRIAL ENGINEERING)
   - DEVELOP CODE NO., ACCOUNT & DESCRIPTION MATRIX (INDUSTRIAL ENGINEERING)
2. INTRODUCE PLANNERS TO THE SYSTEM (PLANNING & INDUSTRIAL ENGINEERING)
   - PLANNERS USE TEXT TIDB & CODE MATRIX WITH ISSUING BILLS (PLANNING)
3. MACHINIST USES BILL OF MATERIAL WITH TOOL LIST TO INSTALL EQUIPMENT (OUTSIDE MACHINERY)
FIGURE 4 – SAMPLE TOOL LIST

<table>
<thead>
<tr>
<th>BOAT HANDLING WINCH INSTALLATION MACHINIST TOOLS REQUIRED</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. 6 IN. STEEL SCALE (RIGID)</td>
</tr>
<tr>
<td>2. DRILL BITS (17/32 IN. &amp; 25/32 IN.)</td>
</tr>
<tr>
<td>3. HAMMER</td>
</tr>
<tr>
<td>4. CENTER PUNCH</td>
</tr>
<tr>
<td>5. PORTABLE MAGNETIC BASE DRILL</td>
</tr>
<tr>
<td>6. SCRIBER</td>
</tr>
<tr>
<td>7. FILE (FOR FILING CHOCKS)</td>
</tr>
<tr>
<td>8. C-CLAMP</td>
</tr>
<tr>
<td>9. RATCHET (1/2 IN. DRIVE)</td>
</tr>
<tr>
<td>10. SOCKET (1-1/4 IN.)</td>
</tr>
<tr>
<td>11. FIXED END WRENCH (1-1/4 IN.)</td>
</tr>
<tr>
<td>12. REAMERS (VARIOUS SIZES 3/4 IN. TO 1 IN.)</td>
</tr>
<tr>
<td>13. FEELER GAGE</td>
</tr>
<tr>
<td>14. LEVEL</td>
</tr>
</tbody>
</table>
**FIGURE 5 - SAMPLE ACCOUNT AND ITEM TO TOOL LIST CODE NO. MATRIX**

<table>
<thead>
<tr>
<th>ACCOUNT NO.</th>
<th>ITEM DESCRIPTION</th>
<th>TOOL LIST CODE NO.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2501</td>
<td>BELLMOUTH</td>
<td>0100</td>
</tr>
<tr>
<td>2501</td>
<td>COOLING COIL</td>
<td>0101</td>
</tr>
<tr>
<td>2501</td>
<td>PRECIPITATOR</td>
<td>0102</td>
</tr>
<tr>
<td>2501</td>
<td>FAN COIL ASSEMBLY</td>
<td>0103</td>
</tr>
<tr>
<td>2501</td>
<td>FAN COIL UNIT</td>
<td>0104</td>
</tr>
<tr>
<td>2501</td>
<td>POWER PACK</td>
<td>0106</td>
</tr>
<tr>
<td>2501</td>
<td>TOXIC GAS DAMPER</td>
<td>0107</td>
</tr>
</tbody>
</table>
FIGURE 6 - PRINTED TOOL LIST ON A BILL OF MATERIAL FORM

BILL REV: ____  INGALLS SHIPBUILDING:____  MAIL CODE:____  CHANGE REASON:____
DEPT: P & B  REQ-DT: 11/19/94  DIST: N  KITTING REPORT:____  BILL PAGE NO: 1
SCHD: 1351  182204  ACT: 1351  101804  LATEST CHG: 608  LEAD DP: 24 ASST DP: 77
PLN: 1 RPT PAGE NO: 409  WORK STA NO: 510

Para: < < < --------------------------------- TEXT --------------------------------- > >

--------------------------------------------------------------------------------------
- O104
- OUTSIDE MACHINERY
- VENTILATION EQUIPMENT
- TOOL LISTING
- DESCRIPTION: FAN COIL UNIT
- SPECIFICATIONS: MODEL H1-HB & V7
- WEIGHT: 245-300 LBS.
- FOR BOLT SIZE 3/8 IN.

(A) TOOLS REQUIRED FOR INSTALLATION WHEN LINERS AREN'T
Necessary: Includes:
- BALL PEIN HAMMER DRILL 021/2/2 IN.
- CENTER PUNCH PORTABLE DRILL MOTOR
- SCREDDER RATCHET/1/2 IN. DRIVER
- 8" STEEL TAPE EXTENSION/2 IN. DRIVER
- 6" STEEL SCALE SOCKET/5/16 IN.
- POLYCRETE COMPOUND COMPRESSION WRENCH/1/8 IN.
- C-CLAMP PRE-MAFCTURED TEMPLATE
- CUTTING FLUID

(B) TOOLS REQUIRED FOR INSTALLATION WHEN LINERS ARE
Necessary: Includes:
- ALL ITEMS LISTED UNDER (A)
- FILE
- FEELER GAUGE
--------------------------------------------------------------------------------------

I. BILL REV: ____  INGALLS SHIPBUILDING:____  MAIL CODE:____  CHANGE REASON:____
DEPT: P & B  REQ-DT: 11/19/94  DIST: N  KITTING REPORT:____  BILL PAGE NO: 2
SCHD: 1351  182204  ACT: 1351  101804  LATEST CHG: 608  LEAD DP: 24 ASST DP: 77
PLN: 1 RPT PAGE NO: 409  WORK STA NO: 510

<table>
<thead>
<tr>
<th>LH6</th>
<th>HD DESC</th>
<th>SHG/FH</th>
<th>DLID CORP</th>
<th>DVR/BY</th>
<th>GQT</th>
<th>U/M</th>
<th>ECD</th>
<th>LOCATION TPS-DT</th>
<th>OTC-DT</th>
<th>OTC-DT</th>
<th>STATUS A</th>
</tr>
</thead>
<tbody>
<tr>
<td>F23-053149</td>
<td>B SCREW HEX HEAD CAP VL0185152</td>
<td>G002</td>
<td>A</td>
<td>500 24</td>
<td>8 EA</td>
<td>101049</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5/8-11 X 1-1/2 LG</td>
<td>8166</td>
<td>CS</td>
<td>ELECTRO ZINC PLD CHROMATED</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F36-246233</td>
<td>B HEX HEX SELF-LOCKING VL0185152</td>
<td>G002</td>
<td>400 24</td>
<td>8 EA</td>
<td>101049</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>5/8-11 MS1860-1 LC</td>
<td>891</td>
<td>3.393</td>
<td>4-6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4123-030-64473881 &amp; B FAN COIL UNIT VL0510152</td>
<td>G002</td>
<td>400 24</td>
<td>1 EA</td>
<td>101049</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>SIZE V-7 W/THR Y.8 RM</td>
<td>8803</td>
<td>3.393</td>
<td>4-6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

END OF BILL

FORM R-1457
**FIGURE 7 - TIDB TEXT SYSTEM OPTIONS**

---

**AVAILABLE OPTIONS:**
1. TEXT CREATE/MODIFY/DELETE
2. DETAIL TEXT VIEW
3. MERGE PARAGRAPH FROM EXISTING BILL
4. BILL PARAGRAPH LIST
X. EXIT

**AVAILABLE ACTIONS:**
C. CREATE  M. MODIFY  D. DELETE

**STATUS:** 033-*** PLEASE ENTER THE REQUIRED INFORMATION ***
PROJECT ACTIVITIES

The performance of this project was divided into five major activities. These activities were; Develop Plan of Attack, Set-Up Tool List Matrices, Develop Tool Lists, Add Tool Lists to Bill of Material, Evaluate Benefits of Tool List Usage.

DEVELOP PLAN OF ATTACK

The first activity performed was the development of a detailed plan of attack. This document listed all of the necessary detailed tasks to be completed. The tasks were time phased over the fourteen (14) week span of the project in a manner which would facilitate a steady, even-flow of work throughout the contract. Completion of these tasks were necessary for the successful completion of the entire project.

SET-UP TOOL LIST MATRICES

The next major step in completing this project was to choose various systems throughout the ship whose equipment would have a high probability of being installed during the time span of the project. This was done so that shipyard observations could be made to evaluate the tool list concept effectiveness. The systems chosen with this purpose in mind were ventilation, main high pressure air system, and the main lubrication oil system. After this step, each major equipment item in each system was identified by account and matched to a four digit tool list code (paragraph no.). The result is a document that can be used by the planner to relate the tool list code to the proper bill of material.

DEVELOP TOOL LISTS

Industrial Engineering's original proposed involvement in the development of tool lists was to be limited to directing craft supervisors as to which tool lists to develop and to follow-up on their progress. Insteads the Industrial Engineering coordinator reviewed the related drawings and developed the majority of the tool lists. The tool lists were then reviewed with the craft supervisors for approval. A total of forty-seven (47) tool lists were developed during this pilot program, using information from the Ticonderoga (CG 47) Class cruisers under construction at Ingalls Shipbuilding. The tool lists take into consideration the variations in size and manufacturing methods by having a separate section on each tool list to handle each peculiarity.
The average time required to develop the forty-seven (47) tool lists during this project was 3 hours. This included time to request and review the required drawings, time to determine the type and size tools required (example: for a ½ in. bolt, determine that the drill size is 17/32 in., socket size is 3/4 in. and the ratchet required would be 1/2 in. drive). It also includes time to review the developed tool list with the craft and input the tool list into the computer system. Care must be exercised in using this estimated time of 3 hours as time to develop a tool can vary greatly. Depending upon the type of tool list developed the time can range from one-half (1/2) to twelve (12) hours for a single tool list. There are two types of tool lists, a general tool list and a specific tool list. A general tool list for an item incorporates many variations. For example, on a CG 47 Class cruiser there are over one-hundred, (100) vaneaxial fans. Therefore, to develop a tool list for a vaneaxial fan over one-hundred drawings have to be requested and reviewed noting the tooling difference of the different sizes. Then, the different sizes have to be classed by similar tooling requirements (see page 28 ). Therefore, a general tool list requires a large amount of time to develop. A specific tool list for an item doesn't have to incorporate any variations because all of the units are identical as far as their tooling requirements are concerned. An example of this is a fan coil unit (see page 23). Even though this item may vary in weight from two hundred sixty-five (265) to eight hundred five (805) pounds the tooling requirements are identical. Therefore, to develop a tool list for a fan coil unit only one fan coil unit drawing is reviewed and the tooling requirements will apply to all variations in size.

### ADD TOOL LISTS TO BILL OF MATERIAL

After tool lists were developed, they were input into the TIDB Text "dummy" bill of material created by Industrial Engineering for storage purposes. Then, the Industrial Engineering coordinator reviewed the bill of materials and added the proper tool lists from the dummy bill of material (0000-000-j) to each active bill of material (for example: 2502-302-3). This was done with the TIDB Text System using the merge (No. 3) command (see TIDB Text System section).

### EVALUATE BENEFITS OF TOOL LIST USAGE

The final phase of this pilot program was an evaluation of the effectiveness of the tool list concept. In-yard studies were performed with machinists who had tool lists. Supervisors made the machinists aware of the proper use of the tool lists and Industrial Engineering observed the machinists activities. Cost savings data was generated from these observations.

Another part of the evaluate benefits phase, was the development of the administrative cost and determining if the program was economically feasible.
The purpose of this section of the report is to expound upon the benefits Ingalls Shipbuilding received from this pilot program. It also reveals the requirements for Ingalls to fully implement this program and to fully realize all of the potential savings.

Below are the original pilot program tasks.

1. Industrial Engineering and Outside Machinery Departments were to work together to develop as many of the five hundred (500) CG 47 class cruiser related tool lists as possible during the time frame available.

2. Industrial Engineering was to input the tool lists into the TIDB Text System.

3. Industrial Engineering was to develop tool list code number, account and description matrices.

4. Production Planning was to use the code number, account and description matrices to match each major piece of equipment on a bill of material to the appropriate tool list code number.

5. Industrial Engineering was to publish a final report revealing the effectiveness, administrative cost and economic feasibility of a tool list program.

Status of tasks at end of pilot program.

1. A total of forty-seven (47) tool lists were developed.

2. Industrial Engineering input forty-seven (47) tool lists into the TIDB Text System.

3. Industrial Engineering coordinator developed code number, account and description matrices for forty-seven (47) tool lists.

4. Industrial Engineering added the tool lists to seven hundred seven (707) bill of materials on CG 53 through CG 57, CG 59, and CG 62.

5. Industrial Engineering conducted in-yard studies and determined that tool lists were being used by outside machinists. In every case studied, where tool lists were provided, excessive job preparation was eliminated.
The total excessive job preparation problem at Ingalls represents $898,527 annually in labor costs. The effect of tool lists on the total excessive job preparation problem was determined by the following actions:

- Re-evaluating the initial studies and identifying those instances where only direct supervision control could have eliminated excessive job preparation.
- Identifying those jobs which the tool list concept would be ineffective (example: unplanned work).
- Performing in-yard studies to determine how often the tool list is used by the machinist.

The re-evaluation of the initial studies revealed that $252,517 annually could be controlled directly by supervisors. The identification of those jobs where the tool list concept is ineffective represented $322,359 annually. Performance of in-yard studies revealed that in every case where tool lists were provided, excessive job preparation was eliminated. Taking these factors into account, the effect of a fully implemented tool list program at Ingalls would annually save $323,651.

The forty-seven (47) tool lists developed during this pilot program represents fourteen and seven-tenths percent (14.7%) of the work effort where tool lists can be used. When this percentage is applied to the annual savings of a fully implemented program it yields a savings of $47,577 annually. This savings was incurred as a direct result of this pilot program (see figure 8). To obtain additional savings from this tool list program, additional tool lists would have to be developed and added to bill of materials. The time frame required to complete the implementation phase of such a project would be one year.
FIGURE 8- TOOL LIST PROGRAM ANNUAL COST SAVINGS

ANNUAL. EXCESSIVE JOB PREPARATION COST $898,527

LESS SUPERVISION RELATED COST -252,517
  ◦ REPORTING TO JOB SITE WITHOUT ANY TOOLS
  ◦ RETURNING TOOLS UNNECESSARILY BEFORE SHIFT ENDS

LESS UNCONTROLLABLE COST -322,359
  ◦ UNPLANNED WORK
  ◦ ASSIST WORK
  ◦ COMPLEX, LONG DURATION TASKS

TOTAL SAVINGS OF A FULLY IMPLEMENTED TOOL LIST PROGRAM AT INGALLS 323,651

TOTAL SAVINGS INCURRED- AS A DIRECT RESULT OF THIS PILOT PROGRAM’ 47,577
## TOOL LIST SUMMARY

<table>
<thead>
<tr>
<th>VENTILATION SYSTEM EQUIPMENT</th>
<th>TOOL LIST CODE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>BELLMOUTH FAN INTAKE</td>
<td>0100</td>
<td>19</td>
</tr>
<tr>
<td>COOLING COIL</td>
<td>0101</td>
<td>20</td>
</tr>
<tr>
<td>ELECTROSTATIC PRECIPITATOR</td>
<td>0102</td>
<td>21</td>
</tr>
<tr>
<td>FAN COIL ASSEMBLY</td>
<td>0103</td>
<td>22</td>
</tr>
<tr>
<td>FAN COIL UNIT</td>
<td>0104</td>
<td>23</td>
</tr>
<tr>
<td>GRAVITY COIL</td>
<td>0105</td>
<td>24</td>
</tr>
<tr>
<td>POWER PACK</td>
<td>0106</td>
<td>25</td>
</tr>
<tr>
<td>TOXIC GAS DAMPER</td>
<td>0107</td>
<td>26</td>
</tr>
<tr>
<td>TUBEAXIAL FAN</td>
<td>0108</td>
<td>27</td>
</tr>
<tr>
<td>VANEAXIAL FAN</td>
<td>0109</td>
<td>28</td>
</tr>
<tr>
<td>VENTILATION HEATER</td>
<td>0110</td>
<td>29</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MAIN HIGH PRESSURE AIR SYSTEM EQUIPMENT</th>
<th>TOOL LIST CODE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>AIR FLASK - 0.5 CU. FT.</td>
<td>0120</td>
<td>30</td>
</tr>
<tr>
<td>AIR FLASK - 1.5 CU- FT.</td>
<td>0121</td>
<td>31</td>
</tr>
<tr>
<td>AIR FLASK - 6.0 CU. FT.</td>
<td>0122</td>
<td>32</td>
</tr>
<tr>
<td>AIR FLASK - 8.0 CU. FT.</td>
<td>0123</td>
<td>33</td>
</tr>
<tr>
<td>BLIND FLANGE - 8 IN. Ips</td>
<td>0124</td>
<td>35</td>
</tr>
<tr>
<td>HOSE REEL</td>
<td>0125</td>
<td>36</td>
</tr>
<tr>
<td>RELAY TANK</td>
<td>0126</td>
<td>37</td>
</tr>
<tr>
<td>AIR DRYER</td>
<td>0127</td>
<td>38</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MAIN OIL LUBRICATION SYSTEM EQUIPMENT</th>
<th>TOOL LIST CODE</th>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELECTRIC-WATER HEATER</td>
<td>0130</td>
<td>39</td>
</tr>
<tr>
<td>LUBE OIL COOLER</td>
<td>0131</td>
<td>40</td>
</tr>
<tr>
<td>LUBE OIL FILTER</td>
<td>0132</td>
<td>41</td>
</tr>
<tr>
<td>LUBE OIL PURIFIER</td>
<td>0133</td>
<td>42</td>
</tr>
<tr>
<td>LUBE OIL PURIFIER HEATER</td>
<td>0134</td>
<td>43</td>
</tr>
<tr>
<td>LUBE OIL PURIFIER STRAINER</td>
<td>0135</td>
<td>44</td>
</tr>
<tr>
<td>LUBE OIL SERVICE PUMP</td>
<td>0136</td>
<td>45</td>
</tr>
<tr>
<td>LUBE OIL STORAGE AND COND. ASSEMBLY</td>
<td>0137</td>
<td>46</td>
</tr>
<tr>
<td>MISCELLANEOUS EQUIPMENT</td>
<td>TOOL LIST CODE</td>
<td>PAGE</td>
</tr>
<tr>
<td>-------------------------------------------------------------</td>
<td>----------------</td>
<td>------</td>
</tr>
<tr>
<td>AIR CONDITIONING PLANT</td>
<td>9200</td>
<td>47</td>
</tr>
<tr>
<td>ELECTRICAL ENCLOSURE</td>
<td>9201</td>
<td>48</td>
</tr>
<tr>
<td>SHIP’S SERVICE EMERGENCY GENERATOR</td>
<td>9202</td>
<td>49</td>
</tr>
<tr>
<td>FIVE INCH GUN MOUNT MACHINING</td>
<td>9203</td>
<td>50</td>
</tr>
<tr>
<td>STERN TUBE AND STRUT BORING</td>
<td>9204</td>
<td>51</td>
</tr>
<tr>
<td>MAIN ENGINE PAD MACHINING</td>
<td>9205</td>
<td>52</td>
</tr>
<tr>
<td>WASTE HEAT BOILER</td>
<td>9206</td>
<td>53</td>
</tr>
<tr>
<td>CHILL WATER PUMP</td>
<td>9207</td>
<td>54</td>
</tr>
<tr>
<td>BOAT HANDLING WINCH</td>
<td>9208</td>
<td>55</td>
</tr>
<tr>
<td>SEWAGE PUMP</td>
<td>9209</td>
<td>56</td>
</tr>
<tr>
<td>BRIDGE CRANE AND RAILS</td>
<td>9210</td>
<td>57</td>
</tr>
<tr>
<td>CONVECTION OVEN</td>
<td>9211</td>
<td>58</td>
</tr>
<tr>
<td>HOIST AND MONORAIL</td>
<td>9212</td>
<td>59</td>
</tr>
<tr>
<td>BORING RUDDER CASTINGS</td>
<td>9213</td>
<td>60</td>
</tr>
<tr>
<td>CAPSTAN</td>
<td>9214</td>
<td>61</td>
</tr>
<tr>
<td>OPERATING GEAR INSTALLATION</td>
<td>9215</td>
<td>62</td>
</tr>
<tr>
<td>HYDRAULIC OIL POWER MODULE</td>
<td>9216</td>
<td>63</td>
</tr>
<tr>
<td>FEED PUMP</td>
<td>9217</td>
<td>64</td>
</tr>
<tr>
<td>AEGIS WATER COOLER</td>
<td>9218</td>
<td>65</td>
</tr>
<tr>
<td>ISOLATOR FOR 400 HERTZ CONVERTER</td>
<td>9219</td>
<td>66</td>
</tr>
</tbody>
</table>
OUTSIDE MACHINERY

VENTILATION EQUIPMENT

TOOL LISTING

DESCRIPTION: BELLMOUTH FAN INTAKE

SPECIFICATIONS: FH3 BOLT SIZE 1/2 IN.

(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

RATCHET (1/2 IN. DRIVE)
EXTENSION (1/2 IN. DRIVE)
SOCKET (3/4 IN.)
COMBINATION WRENCH 3/4 IN.
MOLYCOE OR CSA COMPOUND
UTILITY KNIFE
**DESCRIPTION:** COOLING COILS-50 SERIES, CLASS DW

**SPECIFICATIONS:**
- TYPE: 51-56 DW 57-50 DW
- WEIGHT (LBS): 145-636 1000-1310
- FDN BOLT SIZE: 3/4 IN. 5/8 & 1 IN.
- LIST ID: (A) (B) & (C)

**(A) TOOLS REQUIRED FOR INSTALLATION OF 51-56 DW COOLING**
- COILS INCLUDE:
  - BALL PEIN HAMMER
  - CENTER PUNCH
  - SCRIBER
  - 8' STEEL TAPE
  - 6' STEEL SCALE
  - TEMPLATE MATERIAL
  - UTILITY KNIFE
  - CUTTING FLUID

**(B) TOOLS REQUIRED FOR INSTALLATION OF 57-50 DW COOLING**
- COILS WITHOUT LINERS INCLUDE:
  - ALL ITEMS LISTED UNDER (A). NOTE: WRENCH, SOCKET,
  - EXTENSION, RATCHET, AND DRILL BIT SIZES ARE DIFFERENT.
  - DRILL BITS (17/64, 21/32, & 1-1/16 IN.)
  - SOCKETS (15/16 & 1-1/2 IN.)
  - RATCHET (1/2 & 1 IN. DRIVE)
  - EXTENSION (1/2 & 1 IN. DRIVE)

**(C) TOOLS REQUIRED FOR INSTALLATION OF 57-58 DW COOLING**
- COILS WITH LINERS INCLUDE:
  - ALL ITEMS LISTED UNDER (B)
  - FILE
  - FEELER GAGE
0102

******************************************************************************
** OUTSIDE MACHINERY
** VENTILATION EQUIPMENT
** TOOL LISTING
**
** DESCRIPTION: ELECTROSTATIC PRECIPITATOR
**
** SPECIFICATIONS:
** SIZE 16
** WEIGHT 610 LBS.
** FDN BOLT SIZE 3/4 IN.
**
**
** (A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:
**
** BALL PEIN HAMMER DRILL BITS(25/32 IN.)
** CENTER PUNCH PORTABLE DRILL MOTOR
** SCRIBER RATCHET(1/2 IN. DRIVE)
** 8' STEEL TAPE EXTENSION(1/2 IN. DRIVE)
** 6" STEEL SCALE SOCKET(1-1/8 IN.)
** FILE COMBINATION WRENCH(1-1/16 &1-1/8 IN.)
** FEELER GAGE MOLYCOTE OR CSA COMPOUND
** CUTTING FLUID
**
**
******************************************************************************
0103

OUTSIDE MACHINERY
VENTILATION EQUIPMENT
TOOL LISTING

DESCRIPTION: FAN COIL ASSEMBLY

SPECIFICATIONS:
SIZE: 21-25 TONS
HEIGHT: 1301-1823 LBS.
FDN BOLT SIZE: 1 IN.

(A) TOOLS REQUIRED FOR INSTALLATION WHEN LINERS AREN'T NECESSARY INCLUDE:

BALL PEIN HAMMER
CENTER PUNCH
SCRIBER
6" STEEL TAPE
6" STEEL SCALE
HOLYCOTE COMPOUND
CUTTING FLUID

(B) TOOLS REQUIRED FOR INSTALLATION WHEN LINERS ARE NECESSARY INCLUDE:

ALL ITEMS LISTED UNDER(A)
FILE
FEELER GAGE
0104

* DESCRIPTION:  FAN COIL UNIT

* SPECIFICATIONS: 
  MODEL  H1-H8 & V7
  WEIGHT  265-285 LBS.
  FDN BOLT SIZE  5/8 IN.

* (A) TOOLS REQUIRED FOR INSTALLATION WHEN LINERS AREN'T NECESSARY INCLUDE:

  BALL PEIN HAMMER  DRILL BITS(21/32 IN.)
  CENTER PUNCH  PORTABLE DRILL MOTOR
  SCRIBER  RATCHET(1/2 IN. DRIVE)
  8' STEEL TAPE  EXTENSION(1/2 IN. DRIVE)
  6' STEEL SCALE  SOCKET(15/16 IN.)
  HOLY-COT COMPOUND  COMBINATION WRENCH(15/16 IN.)
  C-CLAMP  PRE-MANUFACTURED TEMPLATE
  CUTTING FLUID

* (B) TOOLS REQUIRED FOR INSTALLATION WHEN LINERS ARE NECESSARY INCLUDE:

  ALL ITEMS LISTED UNDER (A)
  FILE
  FEELER GAGE
0105

******************************************************************************
* OUTSIDE MACHINERY
* VENTILATION EQUIPMENT
* TOOL LISTING
* DESCRIPTION: GRAVITY COILS
* SPECIFICATIONS:
  SIZE 1, 3, & 5G
  WEIGHT 125-197 LBS
  FDN BOLT SIZE 1/2 IN.

(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

  BALL PEIN HAMMER
  CENTER PUNCH
  SCRIBER
  8' STEEL TAPE
  6' STEEL SCALE
  NOLYCOVE COMPOUND
  CUTTING FLUID

******************************************************************************
0106

*****************************************************************************
* OUTSIDE MACHINERY *
* VENTILATION EQUIPMENT *
* TOOL LISTING *
* DESCRIPTION: POWER PACK *
* SPECIFICATIONS: TYPE MODEL 432100 *
* WEIGHT 117 LBS *
* FDN BOLT SIZE 3/8 IN *
* (A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:
* BALL PEIN HAMMER DRILL BITS(13/32 IN.) *
* CENTER PUNCH PORTABLE DRILL MOTOR *
* SCRIBER RATCHET(1/2 IN. DRIVE) *
* 8' STEEL TAPE EXTENSION(1/2 IN. DRIVE) *
* 6' STEEL SCALE SOCKET(9/16 IN.) *
* MARKER COMBINATION WRENCH(9/16 IN.) *
* MOLYCOLE COMPOUND CUTTING FLUID *
*****************************************************************************
**OUTSIDE MACHINERY**

**VENTILATION EQUIPMENT**

**TOOL LISTING**

**DESCRIPTION:** TOXIC GAS DAMPER

**SPECIFICATIONS:**
- **MODEL:** MODIFIED 2341 MARINE DAMPER
- **WEIGHT:** 104-113 LBS.
- **FON BOLT SIZE:** 3/8, 5/8, & 1/2 IN.

**(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:**

- BALL PEIN HAMMER
- DRILL BITS (21/32, 13/32, & 17/32 IN.)
- CENTER PUNCH
- PORTABLE DRILL MOTOR
- SCRIBER
- RATCHET (1/2 IN. DRIVE)
- 8' STEEL TAPE
- EXTENSION (1/2 IN. DRIVE)
- 6' STEEL SCALE
- SOCKET (9/16, 15/16, & 3/4 IN.)
- MARKER
- COMBINATION WRENCH (9/16, 15/16, 3/4 IN.)
- CUTTING FLUID
- MOLYCOSE OR CSA COMPOUND
**OUTSIDE MACHINERY**

**VENTILATION EQUIPMENT**

**TOOL LISTING**

**DESCRIPTION:** Tubeaxial Fan

**SPECIFICATIONS:** Flange bolt size 3/8 in.

(A) **TOOLS REQUIRED FOR INSTALLATION INCLUDE:**

- Ball Pein Hammer
- Drill Bits (7/16 in.)
- Center Punch
- Portable Drill Motor
- Scriber
- Ratchet (1/2 in. drive)
- 0" Steel Tape
- Extension (1/2 in. drive)
- 6" Steel Scale
- Socket (9/16 in.)
- Molycote Compound
- Combination Wrench (9/16 in.)
- Cutting Fluid
OUTSIDE MACHINERY
VENTILATION EQUIPMENT
TOOL LISTING

**DESCRIPTION:** VANE AXIAL FAN

**SPECIFICATIONS:**

**SIZE**
A1/4A - A2A
A2-1/2A - A7A
A8A - A16A

**WEIGHT (LBS)**
65 - 180
220 - 530
600 - 1100

**FDN BOLT SIZE (IN)**
5/16, 3/8, 1/2, 5/8
1/2, 5/8
9/16, 1/2, 5/8
3/4

**LIST ID**
(A)
(B)
(C)

(A) TOOLS REQUIRED FOR INSTALLATION OF A SIZE A1/4A THRU A2A FAN INCLUDES:
- PAINT BRUSH
- FEELER GAGE
- FILE
- RATCHET (1/2 IN. DRIVE)
- MOLYCOATE COMPOUND EXTENSION (1/2 IN. DRIVE)
- COMB. WRENCH SOCKET (1/2, 9/16, 3/4, 13/16, 15/16 IN.)
- (1/2, 9/16, 3/4, 13/16, 15/16 IN.) RESILIENT MOUNT PRESERVATIVE (SPRAY)
- 13/16, 15/16 IN.) LAC
- HAMMER STENCIL (1/4 OR 1/8 IN.)

(B) TOOLS REQUIRED FOR INSTALLATION OF SIZE A2-1/2A THRU A7A FANS INCLUDES:
- ALL ITEMS LISTED UNDER (A). SOCKETS AND COMBINATION
- WRENCH SIZES ARE DIFFERENT.
- SOCKETS (3/4, 15/16 IN.)
- COMBINATION WRENCH (3/4, 15/16 IN.)

(C) TOOLS REQUIRED FOR INSTALLATION OF SIZE A8A THRU A16A FANS INCLUDES:
- ALL ITEMS LISTED UNDER (A). SOCKET AND COMBINATION
- WRENCH SIZES ARE DIFFERENT.
- SOCKETS (3/4, 15/16, 1-1/8 IN.)
- COMBINATION WRENCH (3/4, 15/16, 1-1/8, 1-1/8 IN.)
0110

******************************************************************************
* OUTSIDE MACHINERY
* VENTILATION EQUIPMENT
* TOOL LISTING
*
* DESCRIPTION: VENTILATION HEATER
*
* SPECIFICATIONS:
*   SIZE: 33 - 36 H
*   WEIGHT: 133 - 171 LBS
*   FDN BOLT SIZE: 1/2 IN
*
* (A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:
*
* BALL PEIN HAMMER
* CENTER PUNCH
* SCRIBER
* 8' STEEL TAPE
* 6" STEEL SCALE
* MARKER
* UTILITY KNIFE
* TEMPLATE MATERIAL
* DRILL BITS(17/32 IN.)
* PORTABLE DRILL MOTOR
* RATCHET(1/2 IN. DRIVE)
* EXTENSION(1/2 IN. DRIVE)
* SOCKET(3/4 IN.)
* COMBINATION WRENCH(3/4 IN.)
* MOLYCOTE OR CSA COMPOUND
* CUTTING FLUID
*
******************************************************************************
OUTSIDE MACHINERY

MAIN HIGH PRESSURE AIR SYSTEM EQUIPMENT

TOOL LISTING

DESCRIPTION: AIR FLASK - 0.5 CU. FT.

SPECIFICATIONS:
- CAPACITY: 0.5 CU. FT.
- WEIGHT: 140 -175 LBS.
- FDN BOLT SIZE: 1/2 IN.

(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

- BALL PEIN HAMMER
- CENTER PUNCH
- SCRIBER
- 8' STEEL TAPE
- 6' STEEL SCALE
- FILE
- FEELER GAGE
- MARKER
- CUTTING FLUID
**OUTSIDE MACHINERY**

**MAIN HIGH PRESSURE AIR SYSTEM EQUIPMENT**

**TOOL LISTING**

**DESCRIPTION:**
AIR FLASK - 1.5 CU. FT.

**SPECIFICATIONS:**
CAPACITY 1.5 CU. FT.
WEIGHT 335 LBS.
FDN BOLT SIZE 5/8 IN.

**(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:**

- BALL PEIN HAMMER
- CENTER FUNCH
- SCRIBER
- 6' STEEL TAPE
- 6" STEEL SCALE
- FILE
- FEELER GAGE
- MARKER
- CUTTING FLUID

- DRILL BITS(21/32 IN.)
- PORTABLE DRILL MOTOR
- RATCHET(1/2 IN. DRIVE)
- EXTENSION(1/2 IN. DRIVE)
- SOCKET(15/16 IN.)
- COMBINATION WRENCH(15/16 IN.)
- C-CLAMP
- HOLYCOTE OR CSA COMPOUND
**INGALLS SHIPBUILDING DIVISION**

**DATE:** 04/11/05  **BILL:** 0000-000-0  **HULL:** 4500  **DESC:** NO DESCRIPTION FOUND ON CDB
**DEPT:** ENGINEERING  **DISTR:** M  **LATEST CHG:** KITTING REPORT TEXT FLY-SHEET  **BILL PAGE NO:** 14
**SCHD ISS:**  **ACT ISS:**  **LEAD DP:**  **ASSIST DP:**

**REPORT NO:** X82890-RI  **PAGE NO:** 22  **WORK STA NO:**

*******************************************************************************
**OUTSIDE MACHINERY**
**MAIN HIGH PRESSURE AIR SYSTEM EQUIPMENT**
**TOOL LISTING**

**DESCRIPTION:** AIR FLASK - 6.0 CU. FT.

**SPECIFICATIONS:**
- DRAWING NO. APPLICATION (VLD SERIES)
  - VLD185366  VLD185117  VLD185649
- CAPACITY (CU. FT.) 6.0 6.0 6.0
- WEIGHT (LBS.) 680 720 615
- FDN DOLT SIZE (IN.) 1-1/8 3/4 5/8
- LIST ID (A) (B) (C)

**A** TOOLS REQUIRED FOR INSTALLATION OF A 6.0 CU. FT. AIR FLASK ON DRAWING VLD185366 INCLUDES:
- BALL PEIN HAMMER
- CENTER PUNCH PORTABLE DRILL MOTOR
- SCRIBER RATCHET (1/2 IN. DRIVE)
- 8' STEEL TAPE EXTENSION (1/2 IN. DRIVE)
- 6' STEEL SCALE SOCKET (1-11/16 IN.)
- FILE COMBINATION WRENCH (1-11/16 IN.)
- FEELER GAGE C-CLAMP
- MARKER MOLYCOLE OR CSA COMPOUND
- CUTTING FLUID

**B** TOOLS REQUIRED FOR INSTALLATION OF A 6.0 CU. FT. AIR FLASK ON DRAWING VLD185117 INCLUDES:
- ALL ITEMS LISTED IN (A). SOCKET, DRILL BIT, AND COMBINATION WRENCH SIZES DIFFER.
- SOCKET (1-1/8 IN.)
- DRILL BITS (17/64, 25/32 IN.)
- COMBINATION WRENCH (1-1/8 & 11/16 IN.)

**C** TOOLS REQUIRED FOR INSTALLATION OF A 6.0 CU. FT. AIR FLASK ON DRAWING VLD185649 INCLUDES:
- ALL ITEMS LISTED IN (A). SOCKET, DRILL BIT, AND COMBINATION WRENCH SIZES DIFFER.
- SOCKET (15/16 IN.)
- COMBINATION WRENCH (15/16 IN.)
- DRILL BITS (17/64 & 21/32 IN.)

*******************************************************************************

```
0123

OUTSIDE MACHINERY

MAIN HIGH PRESSURE AIR SYSTEM EQUIPMENT

TOOL LISTING

DESCRIPTION: AIR FLASK - 8.0 CU. FT.

SPECIFICATIONS:

<table>
<thead>
<tr>
<th>DRAWING NO.</th>
<th>APPLICABILITY (VLD SERIES)</th>
</tr>
</thead>
<tbody>
<tr>
<td>105368</td>
<td></td>
</tr>
<tr>
<td>105118</td>
<td></td>
</tr>
<tr>
<td>105366</td>
<td></td>
</tr>
<tr>
<td>105016</td>
<td></td>
</tr>
<tr>
<td>105363</td>
<td></td>
</tr>
</tbody>
</table>

CAPACITY (CU. FT.) 8.0

HEIGHT (LBS.) 800 800

FDN BOLT SIZE (IN.) 5/8 3/4 1-1/8 1

LIST ID

(A) BALL PEIN HAMMER DRILL BITS (21/32 & 15/16 IN.)

CENTER PUNCH PORTABLE DRILL MOTOR

SCRIBER RATCHET (1/2 & 1 IN. DRIVE)

6" STEEL TAPE EXTENSION (1/2 & 1 IN. DRIVE)

6" STEEL SCALE SOCKET (15/16 & 1-5/16 IN.)

FILE COMB. WRENCHES (15/16 & 1-5/16 IN.)

FEELER GAGE C-CLAMP

MARKER MOLYCORD OR CSA COMPOUND

UTILITY KNIFE PAINT BRUSH

200' AIR LINE AIR IMPACT WRENCH

CUTTING FLUID

(B) TOOLS REQUIRED FOR INSTALLATION OF A 8.0 CU. FT. AIR FLASK DRAWING VLD105368 INCLUDES:

ALL ITEMS LISTED IN (A) EXCEPT PAINT BRUSH AND UTILITY KNIFE. SOCKET, COMB. WRENCH, & DRILL BIT SIZES DIFFER.

SOCKET (1-1/8 IN.)

COMBINATION WRENCH (1-1/8 & 1-1/16 IN.)

(C) TOOLS REQUIRED FOR INSTALLATION OF A 8.0 CU. FT. AIR FLASK ON DRAWING VLD105366 INCLUDES:

ALL ITEMS INCLUDED IN (A) EXCEPT PAINT BRUSH AND UTILITY KNIFE. SOCKET, COMBINATION WRENCH, DRILL BIT SIZES DIFFER.

SOCKET (1-11/16 IN.)

DRILL BITS (17/64, 21/32, 25/32, 1-3/16 IN.)

COMBINATION WRENCH (1-11/16 IN.)
* (D) TOOLS REQUIRED FOR INSTALLATION OF 8.0 CU. FT. AIR FLASK ON DRAWING VLD185016 INCLUDES:

* ALL ITEMS INCLUDED IN (A) EXCEPT PAINT BRUSH & UTILITY KNIFE. SOCKET, COMBINATION WRENCH, & DRILL BIT SIZES DIFFER.

* SOCKET(1-1/2 IN.)
* COMBINATION WRENCH(1-1/2 IN.)
* DRILL BIT(1-1/16, 1-1/32, 1-7/64 IN.)

******************************************************************************************
OUTSIDE MACHINERY
MAIN HIGH PRESSURE AIR SYSTEM EQUIPMENT

TOOL LISTING

DESCRIPTION: 8 IN. IPS BLIND FLANGE

SPECIFICATIONS: BOLT SIZE 3/4 IN.

(A) TOOLS REQUIRED FOR INSTALLATION INCLUDES:

GASKET PUNCH
UTILITY KNIFE
MOLYCOTE COMPOUND

COMBINATION WRENCH(1-1/16 IN.)
SOCKET(1-1/8 IN.)
RATCHET(1/2 IN. DRIVE)
EXTENSION(1/2 IN. DRIVE)
OUTSIDE MACHINERY
MAIN HIGH PRESSURE AIR SYSTEM EQUIPMENT

TOOL LISTING

DESCRIPTION: HOSE REEL

SPECIFICATIONS:
- TYPE: HANNAY MODEL 718-2526
- WEIGHT: 110 LBS.
- FDN BOLT SIZE: 1/2 IN.

(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

- BALL PEIN HAMMER
- CENTER PUNCH
- SCRIBER
- 8' STEEL TAPE
- 6" STEEL SCALE
- C-CLAMP
- CUTTING FLUID
- DRILL BIT (17/32 IN.)
- PORTABLE DRILL MOTOR
- RATCHET (1/2 IN. DRIVE)
- EXTENSIONAL (1/2 IN. DRIVE)
- SOCKET (3/4 IN.)
- COMBINATION WRENCH (3/4 IN.)
- MOLYCOTE OR C5A COMPOUND
0126

OUTSIDE MACHINERY

MAIN HIGH PRESSURE AIR SYSTEM EQUIPMENT

TOOL LISTING

DESCRIPTION: RELAY TANK

SPECIFICATIONS:
- CAPACITY: 2 CU. FT.
- WEIGHT: 170-387 LBS.
- FDN BOLT SIZE: 1/2 IN.

(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

- BALL PEIN HAMMER
- CENTER PUNCH
- SCRIBER
- 8' STEEL TAPE
- 6' STEEL SCALE
- PAINT BRUSH
- 6-CLAMP
- MARKER
- CUTTING FLUID
- DRILL BITS (17/32 IN.)
- PORTABLE DRILL MOTOR
- RATCHET (1/2 IN. DRIVE)
- EXTENSION (1/2 IN. DRIVE)
- SOCKET (3/4 IN.)
- COMBINATION WRENCH (3/4 IN.)
- MOLYCOATE OR CSA COMPOUND
- UTILITY KNIFE
OUTSIDE MACHINERY

MAIN HIGH PRESSURE AIR SYSTEM EQUIPMENT

TOOL LISTING

DESCRIPTION: AIR DRYER

SPECIFICATIONS:
- WEIGHT: 650 LBS.
- FDN BOLT SIZE: 3/4 IN.

(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

- BALL PEIN HAMMER
- CENTER PUNCH
- SCRIBER
- 8' STEEL TAPE
- 6' STEEL SCALE
- FILE
- FEELER GAGE
- CUTTING FLUID

- DRILL BIT (1/16, 1/32 & 1/64 IN.)
- PORTABLE DRILL MOTOR
- RATCHER (1/2 IN. DRIVE)
- EXTENSION (1/2 IN. DRIVE)
- SOCKET (1-1/8 IN.)
- COMB. WRENCH (1-1/8 & 1-1/16 IN.)
- MOLYCOTE OR C5A COMPOUND

- MOLY DUST
- MOLY CLOTH
- MOLY PASTE
- MOLY COTTON TIP
- MOLY WIRE
0130

OUTSIDE MACHINERY
MAIN OIL LUBRICATION SYSTEM EQUIPMENT
TOOL LISTING

DESCRIPTION: ELECTRIC WATER HEATER

SPECIFICATIONS:
- CAPACITY: 5 GALLON
- WEIGHT: 130 LBS.
- FNH BOLT SIZE: 5/8 IN.

A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:
- BALL PEIN HAMMER
- DRILL BITS (21/32 IN.)
- CENTER PUNCH
- PORTABLE DRILL MOTOR
- SCRIBER
- RATCHET (1/2 IN. DRIVE)
- 8" STEEL TAPE
- EXTENSION (1/2 IN. DRIVE)
- 6" STEEL SCALE
- SOCKET (15/16 IN.)
- BUCKEYE GRINDER
- COMBINATION WRENCH (15/16 IN.)
- 200' AIR LINE
- MOLYCOSE OR CSA COMPOUND
- AIR WHIP
- CUTTING FLUID
**OUTSIDE MACHINERY**

**MAIN OIL LUBRICATION SYSTEM EQUIPMENT**

**TOOL LISTING**

**DESCRIPTION:**

**LUBE OIL COOLER**

**SPECIFICATIONS:**

- DRAWING NO. (VLD) 182014 165737
- WEIGHT (LBS) 718 3400
- FDN BOLT SIZE (IN.) 7/8 1-3/8 & 1-1/2
- LIST ID (A) (B)

(A) TOOLS REQUIRED FOR INSTALLATION OF A LUBE OIL COOLER ON DRAWING NO. VLD182014 INCLUDES:

- BALL PEIN HAMMER
- CENTER PUNCH
- SCRIBER
- 8" STEEL TAPE
- 6" STEEL SCALE
- FILE
- FEELER GAGE
- 200' AIR LINE
- CUTTING FLUID

(B) TOOLS REQUIRED FOR INSTALLATION OF A LUBE OIL COOLER ON DRAWING NO. VLD165737 INCLUDES:

- ALL ITEMS LISTED UNDER (A). SOCKET, COMBINATION WRENCH, AND DRILL SIZES DIFFER.
- SOCKETS (2-1/16 & 2-1/4 IN.)
- COMBINATION WRENCH (2-1/16 & 2-1/4 IN.)
- DRILL BIT (1-7/16, 1-9/16 IN.)
OUTSIDE MACHINERY
MAIN OIL LUBRICATION SYSTEM EQUIPMENT
TOOL LISTING

DESCRIPTION: LUBE OIL FILTER

SPECIFICATIONS: WEIGHT 1800 LBS.(WET)
DN BOLT SIZE 7/8 IN.

(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

* R DRILL BITS(15/16 IN.)
* PORTABLE DRILL MOTOR
* RATCHET(1 IN. DRIVE)
* EXTENSION(1 IN. DRIVE)
* SOCKET(1-5/16 IN.)
* COMBINATION WRENCH(1-5/16 IN.)
* UTILITY KNIFE
* MOLYCOTE OR CSA COMPOUND
OUTSIDE MACHINERY

MAIN OIL LUBRICATION SYSTEM EQUIPMENT

TOOL LISTING

DESCRIPTION: LUBE OIL PURIFIER

SPECIFICATIONS:
- WEIGHT: 947 LBS.
- FDN BOLT SIZE: 3/4 & 5/8 IN.

(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

- BALL PEIN HAMMER
- CENTER PUNCH
- SCRIBER
- 6" STEEL TAPE
- 6" STEEL SCALE
- FILE
- FEELER GAGE
- 200' AIR LINE
- PAINT BRUSH
- CUTTING FLUID
- AIR WHIP
- DRILL BITS (1/32, 1/32 IN.)
- PORTABLE DRILL MOTOR
- RATCHET (1/2 IN. DRIVE)
- EXTENSION (1/2 IN. DRIVE)
- SOCKET (1-1/8, 15/16 IN.)
- COMBINATION WRENCH (1-1/16, 15/16 IN.)
- BUCKEYE GRINDER
- MOLYCYTE OR CSA COMPOUND
- TAPS (5/8 IN.-11UNC-2B)
- STENCIL (1/4 IN. OR 1/8 IN.)
- RESILIENT MOUNT PRESERVATIVE (SPRAY-LAC PAINT)
OUTSIDE MACHINERY

MAIN OIL LUBRICATION SYSTEM EQUIPMENT

TOOL LISTING

DESCRIPTION: LUBE OIL PURIFIER HEATER

SPECIFICATIONS:
- WEIGHT: 132 LBS.
- FDN BOLT SIZE: 5/8 IN.

A TOOLS REQUIRED FOR INSTALLATION INCLUDE:

- BALL PEIN HAMMER
- CENTER PUNCH
- SCRIBER
- 6' STEEL TAPE
- 6' STEEL SCALE
- FILE
- FEELER GAGE
- CUTTING FLUID
- DRILL BITS (21/32 IN.)
- PORTABLE DRILL MOTOR
- RATCHET (1/2 IN. DRIVE)
- EXTENSION (1/2 IN. DRIVE)
- SOCKET (15/16 IN.)
- COMBINATION WRENCH (15/16 IN.)
- NOLYCOTE OR CSA COMPOUND
OUTSIDE MACHINERY
MAIN OIL LUBRICATION SYSTEM EQUIPMENT
TOOL LISTING

Description: LUBE OIL PURIFIER STRAINER

SPECIFICATIONS:
- WEIGHT: 125 LBS.
- FDN BOLT SIZE: 1/2 & 7/8 IN.

(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

- BALL PEIN HAMMER
- CENTER PUNCH
- SCRIBER
- 8' STEEL TAPE
- 6' STEEL SCALE
- MOLYCOTE COMPOUND
- CUTING FLUID
- DRILL BITS (17/32, 15/16 IN.)
- PORTABLE DRILL MOTOR
- RATCHET (1/2 & 2 IN. DRIVE)
- EXTENSIONAL (1/2 & 1 IN. DRIVE)
- SOCKET (1-5/16, 3/4 IN.)
- COMBINATION WRENCH (1-5/16, 3/4 IN.)
**DESCRIPTION:** LUBE OIL SERVICE PUMP

**SPECIFICATIONS:**
- WEIGHT: 2000 LBS.
- FDN BOLT SIZE: 5/8, 3/4, 7/8, 1, 1-1/4 & 1-1/2 IN.

*(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

- BALL PEIN HAMMER
- PAINT BRUSH
- CENTER PUNCH
- SCRIBER
- STEEL TAPE
- STEEL SCALE
- UTILITY KNIFE
- FILE
- FEELER GAGE
- WIRE SAW
- HOLE SAW
- DIAMETER
- CUTTING FLUID
- BUCKEYE GRINDER
- AIR WHIP

* * *
OUTSIDE MACHINERY

MAIN OIL LUBRICATION SYSTEM EQUIPMENT

TOOL LISTING

DESCRIPTION:
LUBE OIL STORAGE AND
CONDITIONING ASSEMBLY

SPECIFICATIONS:
WEIGHT
1650 LBS.

FH BOLT SIZE
3/4 IN.

(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

BALL PEIN HAMMER
CENTER PUNCH
SCRIBER
8' STEEL TAPE
6' STEEL SCALE
FILE
FEELER GAGE
200' AIR LINE
PAINT BRUSH
MARKER
C-CLAMP
TEMPLATE MATERIAL
HOLE SAM
CUTTING FLUID
BUCKEYE GRINDER
AIR WHIP

AIR IMPACT WRENCH
MOLYCOTE OR CSA COMPOUND
MOLYBDENUM DISULFIDE GREASE
UTILITY KNIFE
TAPS
PRE-MADE TEMPLATES
GASKET PUNCH
TAPPING FLUID
STENCIL (1/4 IN. OR 1/8 IN.)
RESILIENT MOUNT PRESERVATIVE (SPRAY-LAC
PAINT)
**outside machinery**

**air conditioning system equipment**

**tool listing**

**description:** A/C PLANT

**specifications:**
- capacity: 200 TON
- weight: 22,000 LBS

A) tools required for installation include:

- ball pein hammer
- drill bits (7/8, 1/4, & 9/16 IN.)
- wedges
- portable drill motor
- cutting fluid
- ratchet (1 in. drive)
- 8 lb sledge hammer
- extension (1 in. drive)
- open end wrench (2-1/4 IN.)
- combination wrench (1-5/16 IN.)
- spot face (1-1/8 IN. diameter)
OUTSIDE MACHINERY

ELECTRICAL POWER DISTRIBUTION SYSTEM EQUIPMENT

TOOL LISTING

DESCRIPTION: ELECTRICAL ENCLOSURE

SPECIFICATIONS: FOR CG-47 CLASS CRUISER

(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

- BALL PEIN HAMMER
- CENTER PUNCH
- PORTABLE DRILL MOTOR
- STEEL WEDGE
- RATCHET(1/2 IN. DRIVE)
- PRY BAR
- EXTENSION(1/2 IN. DRIVE)
- CUTTING FLUID
- TAPS(3/4 & 5/8 IN)
- PHILLIPS SCREW DRIVER
- TRANSFER PUNCH(3/4 IN.)
- SOCKET(3/4, 15/16 & 1-1/8 IN.)
- DRILL BITS(1/4, 25/32, 17/32, & 21/32 IN.)
- COMBINATION WRENCH(15/16, 3/4, & 1-1/8 IN.)
OUTSIDE MACHINERY

AUXILIARY GENERATOR SYSTEM EQUIPMENT

TOOL LISTING

DESCRIPTION: SHIP'S SERVICE EMERGENCY GENERATOR

SPECIFICATIONS: FOR CG-47 CLASS CRUISER

TOOLS REQUIRED FOR INSTALLATION INCLUDE:

- SLEDGE HAMMER
- INDUSTRIAL COATING PAINT
- 6" STEEL SCALE
- MOLYCOE OR CSA COMPOUND
- DOG LEG PAINT BRUSH
- 200' AIR LINE
- REG. PAINT BRUSH
- AIR IMPACT WRENCH (1 IN. DRIVE)
- SOCKET (1-1/2, 1-1/4, 1-5/16, & 1-7/16 IN.)
- 1 IN. DIA. ROUND BAR (3 PCS., EACH 3 FT. LONG)
- 7/8 IN. DIA. TAPERED ALIGN. PINS (QTY 6, EACH 6 IN. LONG)
- COMBINATION WRENCH (1-1/2, 1-1/4, 1-5/16, & 1-7/16 IN.)
OUTSIDE MACHINERY
TOOL LISTING

DESCRIPTION: FIVE INCH GUN MOUNT MACHINING

SPECIFICATIONS: FOR CG-47 CLASS CRUISER

(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

- BALL PEIN HAMMER
- CENTER PUNCH
- SOCKET (1 IN.)
- 8' STEEL TAPE
- 6' STEEL SCALE
- FILE
- FEELER GAGE
- RATCHET (1/2 IN DRIVE)
- EXTENSIONAL (1/2 IN DRIVE)
- ALLEN WRENCH (1/4 IN.)
- COMBINATION WRENCH (1 IN.)
- CARBIDE CUTTING TOOL
- PORTABLE MILLING MACHINE
- CUTTING FLUID
**outside machinery**

**tool listing**

**description:** stern tube and strut boring

**specifications:** for cg-47 class cruiser

---

(A) tools required for installation include:

- ball pein hammer
- allen wrench set (1/16 to 3/8 in.)
- id micrometer
- chip puller rake
- file
- ratchet (1/2 in. drive)
- flat screw driver
- extension (1/2 in. drive)
- 6" steel scale
- socket (7/16 to 1-1/4 in.)
- file
- fixed end wrench set (3/8 to 1-1/4 in.)
- feeler gage
- carbide cutting tools
- cutting fluid
- portable surface grinder
- 200' air line
- air whip
- portable boring bar

---

* * *
**OUTSIDE MACHINERY**

**TOOL LISTING**

**DESCRIPTION:** MAIN ENGINE PADS MACHINING

**SPECIFICATIONS:** FOR CG-47 CLASS CRUISER

**(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:**

- BALL PEIN HAMMER
- CENTER PUNCH
- HYDRAULIC JACK
- 8' STEEL TAPE
- 6' STEEL SCALE
- FILE
- TAPER LEVEL
- CUTTING FLUID
- CHALKLINE
- CARBIDE SINGLE POINT CUTTING TOOLS
- RATCHET (1/2 IN. DRIVE)
- EXTENSION (1/2 IN. DRIVE)
- SOCKET (3/4 IN. DRIVE)
- ALLEN WRENCH (1/4 IN.)
- 10' STRAIGHT EDGE
- PORTABLE MILLING MACHINE
C-LM

* OUTSIDE MACHINERY
* TOOL LISTING
* DESCRIPTION: WASTE HEAT BOILER
* SPECIFICATIONS: FOR CG-47 CLASS CRUISER

* TOOLS REQUIRED FOR INSTALLATION INCLUDE:
* BALL PEIN HAMMER DRILL BITS(17/64, 25/32, 1-5/16 IN.)
* CENTER PUNCH PORTABLE DRILL MOTOR
* SCRIBER 2 FIXED END WRENCHES(1-7/8 IN.)
* 0' STEEL TAPE SPOT FACING TOOL
* 6' STEEL SCALE HYDRAULIC JACK
* FILE MOLYCOOT OR CSA COMPOUND
* FEELER GAGE

*
OUTSIDE MACHINERY

TOOL LISTING

DESCRIPTION: CHILL WATER PUMP

SPECIFICATIONS: FOR CG-47 CLASS CRUISER

(A) TOOLS REQUIRED

FOR INSTALLATION INCLUDE:

8’ STEEL TAPE
FEELER GAGE
FILE

6” STEEL SCALE
MOLYCORTE COMPOUND

STENCIL (1/4 OR 1/8 IN.)
EXTENSIONAL (1/2 IN. DRIVE)
RATCHET (1/2 IN. DRIVE)
SOCKET (13/16 & 1-1/8 IN.)
COMBINATION WRENCH (13/16 & 1-1/8 IN.)
RESILIENT MOUNT PRESERVATIVE (SPRAY-LAC PAINT)
DESCRIPTION: BOAT HANDLING WINCH

SPECIFICATIONS: FOR C6-47 CLASS CRUISER

(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

- BALL PEIN HAMMER
- CENTER PUNCH
- SCRIBER
- 8' STEEL TAPE
- 6" STEEL SCALE
- FILE
- FEELER GAGE
- 200' AIR LINE
- MOLYKOTE OR CSA COMPOUND
- AIR REAMER
- CUTTING FLUID
- C-CLAMP
- LEVEL

OUTSIDE MACHINERY

TOOL LISTING
OUTSIDE MACHINERY

TOOL LISTING

DESCRIPTION: SEWAGE PUMP

SPECIFICATIONS: FOR CG CLASS CRUISER

A TOOLS REQUIRED FOR INSTALLATION INCLUDE:

- BALL PEIN HAMMER
- CENTER PUNCH
- SCRIBER
- 6' STEEL TAPE
- 6" STEEL SCALE
- FILE
- FEELER GAGE
- MOLYCOTE COMPOUND
- CUTTING FLUID
- DRILL BITS (1/4, 7/32, 21/32 & 25/32 IN.)
- PORTABLE DRILL MOTOR
- RATCHET (1/2 IN. DRIVE)
- EXTENSION (1/2 IN. DRIVE)
- SOCKET (13/16 & 1-1/8 IN.)
- COMBINATION WRENCH (13/16 & 1-1/8 IN.)
- STENCIL (1/4 OR 1/8 IN.)
- RESILIENT MOUNT PRESERVATIVE (SPRAY-LAC.
- PAINT)
**OUTSIDE MACHINERY**

**TOOL LISTING**

**DESCRIPTION:** BRIDGE CRANE AND RAILS

**SPECIFICATIONS:** FOR CG-47 CLASS CRUISER

*(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

- BALL PEIN HAMMER
- DRILL BITS(1/8, 3/16, 1/4, 1/2, 3/8 & 5/32 IN)
- CENTER PUNCH
- PORTABLE DRILL MOTOR
- SCRIBER
- RATCHET(1/2 IN. DRIVE)
- 8' STEEL TAPE
- EXTENSION(1/2 IN. DRIVE)
- 6' STEEL SCALE
- SOCKET(7/16, 3/4 & 15/16 IN.)
- CHALKLINE
- ALLEN WRENCH(3/8, 5/16 IN.)
- NOLYCOTE COMPOUND
- COMBINATION WRENCH(7/16, 3/4 & 15/16)
- CUTTING FLUID
OUTSIDE MACHINERY

TOOL LISTING

DESCRIPTION: CONVECTION OVEN

SPECIFICATIONS: GALLEY EQUIPT. FOR CG-47 CLASS CRUISER

(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

- BALL PEIN HAMMER
- CENTER PUNCH
- SCRIBER
- 8' STEEL TAPE
- 6' STEEL SCALE
- SOLYCITE COMPOUND
- CUTTING FLUID
- DRILL BITS (1/8 & 9/16 IN.)
- PORTABLE DRILL MOTOR
- RATCHET (1/2 IN. DRIVE)
- EXTENSION (1/2 IN. DRIVE)
- SOCKET (3/4 IN.)
- COMBINATION WRENCH (3/4 IN.)
- TAPS (FOR 1/2-13 UNC 2A)
OUTSIDE MACHINERY

TOOL LISTING

DESCRIPTION: HOIST AND MONORAIL

SPECIFICATIONS: HELICOPTER HANGAR REPAIR FOR
CG-47 CLASS CRUISER

(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

BALL PEIN HAMMER DRILL BITS (1/6 & 17/32 IN.)
CENTER PUNCH PORTABLE DRILL MOTOR
SCRIBER RATCHET (1/2 IN. DRIVE)
8" STEEL TAPE EXTENSION (1/2 IN. DRIVE)
6" STEEL SCALE SOCKET (3/4 IN.)
CHALKLINE COMBINATION WRENCH (3/4 IN.)
CUTTING FLUID ALLEN WRENCH (5/16 IN.)
MOLYCOTE OR C5A COMPOUND
**DESCRIPTION:** BORING RUDDER CASTINGS

**SPECIFICATIONS:** FOR CG-47 CLASS CRUISER

**A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:**

- **BALL PEIN HAMMER** 1-1/2" REX-95 TOOL STEEL
- **CENTER PUNCH** PORTABLE BORING BAR
- **8 LB MACE** RATCHET(1/2 IN. DRIVE)
- **12" STEEL TAPE** EXTENSION(1/2 IN. DRIVE)
- **6" STEEL SCALE** SOCKET(9/16 TO 15/16 IN.)
- **16" CRESN WRENCH** 10" CRESN WRENCH
- **PLUMB BOB** ID MICROMETER 4"-60"
- **CUTTING FLUID** VERNIER CALIPERS
- **ALLEN WRENCH SET(UP TO 3/8")**
OUTSIDE MACHINERY

TOOL LISTING

DESCRIPTION: CAPSTAN

SPECIFICATIONS: FOR CG-47 CLASS CRUISER

(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

- BALL PEIN HAMMER
- CENTER PUNCH
- Scribe
- 6" STEEL TAPE
- 6" STEEL SCALE
- LAYOUT FLUID
- ID VERNIER CALIPER
- 6" DIA. FACING BAR
- MOLYCBOTE COMPOUND
- 7/6" SHELL REAMER
- CUTTING FLUID
- DRILL BIT (13/16", 1/4", & 13/16" T.S.)
- CENTER PUNCH (NO. 3 TAPER)
- SOCKET (1-1/8, 1-1/4 & 1-5/16 IN.)
- CRESNT WRENCHES (10 & 16 IN.)
- PORTABLE DRILL MOTOR
- ALLEN WRENCHES (1/4 & 3/16 IN.)
- OD MICROMETER (0 - 1 IN.)
- OD MICROMETER (0 - 2 IN.)
- 1-1/4" SHELL REAMER NO. 3 TAPER
- 1-1/4" EXPANSION REAMER
OUTSIDE MACHINERY TOOL LISTING

Description: OPERATING GEAR INSTALLATION AMR-1

SPECIFICATIONS: FOR CG-47 CLASS CRUISER

(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

- BALL peIN HAMMER
- CENTER PUNCH
- SCRIBER
- 12' STEEL TAPE
- 6" STEEL SCALE
- VISE GRIPS
- PIN PUNCH
- 200' AIR LINE
- BUCKEYE GRINDER
- CUTTING FLUID
- AIR WHIP
- PLAIN SCREW DRIVER
- GEAR BOX OPENER ADAPTER (1/2"-4")
OUTSIDE MACHINERY

MAIN PROPELLERS AUXILIARY EQUIPMENT

TOOL LISTING

DESCRIPTION: HYDRAULIC OIL POWER MODULE

SPECIFICATIONS: FOR CG-47 CLASS CRUISER

(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

BALL PEIN HAMMER DRILL BITS (1/4, 3/4, 1-5/16 IN.)
CENTER PUNCH PORTABLE DRILL MOTOR
SCRIBER 2 - BOXED END WRENCHES (1-7/8 IN.)
8' STEEL TAPE 2 - BOXED END WRENCHES (2 IN.)
6" STEEL SCALE HOLYCOTE OR CSA COMPOUND
CUTTING FLUID
DESCRIPTION: FEED PUMP

SPECIFICATIONS:

(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

- BALL PEIN HAMMER
- CENTER PUNCH
- SCRIBER
- 8' STEEL TAPE
- STEEL SCALE
- BUCKEYE GRINDER
- AIR WHIP
- 200' AIR LINE
- CUTTING FLUID
- DRILL BITS (1/4 & 21/32 IN.)
- PORTABLE DRILL MOTOR
- RATCHET (1/2 & 1 IN. DRIVE)
- EXTENSIONAL (1/2 IN. DRIVE)
- SOCKET (1-1/16, 1-1/8 & 1-5/16 IN.)
- COMBINATION WRENCH (1-1/16, 1-1/8 & 1-5/16 IN.)
- MOLYKOTE OR C5A COMPOUND

OUTSIDE MACHINERY

MAIN AND AUXILIARY FEED CONDENSATE SYSTEM EQUIPMENT

TOOL LISTING

- BALL PEIN HAMMER
- CENTER PUNCH
- SCRIBER
- 8' STEEL TAPE
- STEEL SCALE
- BUCKEYE GRINDER
- AIR WHIP
- 200' AIR LINE
- CUTTING FLUID
- DRILL BITS (1/4 & 21/32 IN.)
- PORTABLE DRILL MOTOR
- RATCHET (1/2 & 1 IN. DRIVE)
- EXTENSIONAL (1/2 IN. DRIVE)
- SOCKET (1-1/16, 1-1/8 & 1-5/16 IN.)
- COMBINATION WRENCH (1-1/16, 1-1/8 & 1-5/16 IN.)
- MOLYKOTE OR C5A COMPOUND

*H#W**WMMWHW* WNWWMHE: iWWWWE i#HH#* "MH#H*WMH**#H#*%H#*W#**WWM#H#N
4210

**OUTSIDE MACHINERY**

**FRESH WATER AND SPECIAL COOLING SYSTEMS EQUIPMENT**

**TOOL LISTING**

**DESCRIPTION:** AEGIS WATER COOLER

**SPECIFICATIONS:** FOR CG-47 CLASS CRUISER

**TOOLS REQUIRED FOR INSTALLATION INCLUDE:**

- BALL PEIN HAMMER
- CENTER PUNCH
- SCRIBER
- 8' STEEL TAPE
- 6' STEEL SCALE
- CUTTING FLUID
- HOLYCOTE COMPOUND

DRILL BITS (1/4 & 1-5/16 IN.)
PORTABLE DRILL MOTOR
12" CRESSENT WRENCH
"TOQUE WRENCH"
"3/4" DRIVE FOR TORQUE WRENCH"
COMBINATION WRENCH (1-5/16, 1-13/16 & 1-7/8 IN.)
OUTSIDE MACHINERY

ELECTRICAL POWER DISTRIBUTION SYSTEM EQUIPMENT

TOOL LISTING

DESCRIPTION: ISOLATORS FOR 400 HZ. CONVERTER EQUIPT.

SPECIFICATIONS: FOR CG-47 CLASS CRUISER

(A) TOOLS REQUIRED FOR INSTALLATION INCLUDE:

- BALL PEIN HAMMER
- CENTER PUNCH
- SCRIBER
- 8" STEEL TAPE
- 6" STEEL SCALE
- DIVIDERS
- LAYOUT FLUID
- DRILL BITS(1/4 & 15/16 IN.)
- PORTABLE DRILL MOTOR
- RATCHET(1/2 IN. DRIVE)
- EXTENSION(1/2 IN. DRIVE)
- SOCKET(15/16 IN.)
- COMBINATION WRENCH(15/16 IN.)
- CUTTING FLUID
- MOLYCOTE OR CSA COMPOUND