TM 55-1925-286-13&P

This manual supersedes TM 55-1925-221-24&P, dated 16 August 1991

TECHNICAL MANUAL

OPERATOR, UNIT AND DIRECT SUPPORT
MAINTENANCE MANUAL INCLUDING
REPAIR PARTS AND SPECIAL TOOLS LIST
FOR
AIR COMPRESSOR

INLAND AND COASTAL LARGE TUG (LT)
NSN 1925-01-509-7013 (EIC XAG)

HEADQUARTERS, DEPARTMENT OF THE ARMY

30 NOVEMBER 2005

WARNING SUMMARY

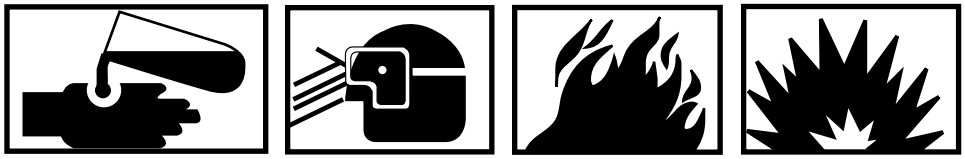
FIRST AID

Although the 128' Large Tug is normally assigned a medic, first aid is still an important skill for all crewmembers. The ability to promptly administer first aid to another crewmember could mean the difference between life and death for that crewmember. First aid procedures for soldiers are contained in FM 4-25.11.

WARNING SUMMARY CONTENT

This warning summary contains general safety warnings and hazardous materials warnings that must be understood and applied during operation and maintenance of this vessel and its equipment. Failure to observe these precautions could result in serious injury or death to personnel. Also included are explanations of safety and of hazardous materials used within the technical manual.

OILS/CLEANING SOLVENTS



Do not allow hydraulic fluid, engine oil, or cleaning solvents to come in contact with unprotected skin or eyes. Prolonged skin contact can cause illness or injury. Eye contact can cause serious injury. Always wear chemical protective gloves and goggles when handling hydraulic fluid, engine oil, and cleaning solvents. Failure to follow these precautions can result in illness or serious injury.

Cleaning solvent is flammable and its vapor is potentially explosive. Do not use cleaning solvent in the vicinity of spark, open flame, or excessive heat. Do not use cleaning solvent in unventilated spaces. Failure to follow these precautions can result in death or serious injury.

CRANES/LIFTING

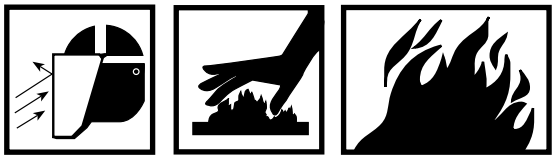
Heavy loads can crush. Do not allow any body parts to come under the load or between the load and a stationary object. Death or serious injury can result.

ELECTRICAL

Take great care when working around energized electrical equipment. Contact between unprotected body parts and electrical conductors can cause serious injury or death. Do not wear jewelry or other conductive items while servicing energized electrical equipment. Failure to comply with these precautions can cause serious injury or death.

Replace or repair components only after the affected circuit has been secured, locked out, and tagged out. Performing replacement with the circuit energized may result in injury.

HOT WORK, WELDING, AND GRINDING



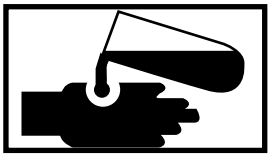
Removing components by means of grinding or cutting produces hot, flying particles. These particles can cause serious injury to personnel. These hot particles can also ignite fires in the work area and in adjacent spaces. During and after removal, the work area will be very hot. Protective goggles, gloves, and/or aprons must be worn at all times during cutting and grinding operations. A fire watch must be posted whenever grinding or cutting operations are taking place. Failure to comply with this warning can result in serious injury or death to personnel and serious damage to the vessel.

LOCKING HARDWARE

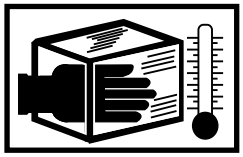
Never reuse locking hardware. Reuse of locking hardware such as lock washers, locking nuts, cotter pins, and lockwire can result in undetected loosening of fastening hardware causing catastrophic component failure resulting in death, injury, or damage to equipment. In accordance with TB 43-0218, ensure that all locking hardware is discarded upon removal and replaced with new.

EXPLANATION OF SAFETY WARNING ICONS

BIOLOGICAL - abstract symbol bug shows that a material may contain bacteria or viruses that present a danger to life or health.



CHEMICAL - drops of liquid on hand show that the material will cause burns or irritation to human skin or tissue.



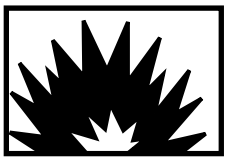
CRYOGENIC - hand in block of ice shows that the material is extremely cold and can injure human skin or tissue.

EAR PROTECTION - headphones over ears show that noise level will harm ears.

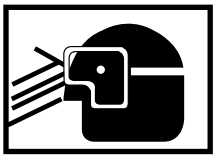
ELECTRICAL - electrical wire to arm with electricity symbol running through human body shows that shock hazard is present.

EXPLANATION OF SAFETY WARNING ICONS (continued)

ELECTRICAL - electrical wire to hand with electricity symbol running through hand shows that shock hazard is present.



EXPLOSION - rapidly expanding symbol shows that the material may explode if subjected to high temperatures, sources of ignition, or high pressure.

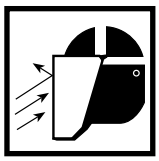


EYE PROTECTION - person with goggles shows that the material will injure the eyes.

FALLING PARTS - arrow bouncing off human shoulder and head shows that falling parts present a danger to life or limb.

FIRE - flame shows that a material may ignite and cause burns.

FLYING PARTICLES - arrows bouncing off face show that particles flying through the air will harm face.



FLYING PARTICLES - arrows bouncing off face with face shield show that particles flying through the air will harm face.

HEAVY OBJECT - human figure stooping over heavy object shows physical injury potential from improper lifting technique.

HEAVY PARTS - hand with heavy object on top shows that heavy parts can crush and harm.

EXPLANATION OF SAFETY WARNING ICONS (continued)

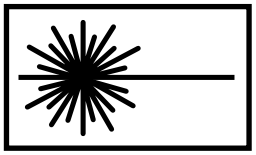
HEAVY PARTS - foot with heavy object on top shows that heavy parts can crush and harm.

HEAVY PARTS - heavy object on human figure shows that heavy parts present a danger to life or limb.

HEAVY PARTS - heavy object pinning human figure against wall shows that heavy, moving parts present a danger to life or limb.

HELMET PROTECTION - arrow bouncing off head with helmet shows that falling parts present a danger.

HOT AREA - hand over object radiating heat shows the part is hot and can burn.



LASER LIGHT - laser light hazard symbol indicates extreme danger for eyes from laser beams and reflections.

MOVING PARTS - human figure with an arm caught between gears shows that the moving parts of the equipment present a danger to life or limb.

MOVING PARTS - hand with fingers caught between gears shows that the moving parts of the equipment present a danger to life or limb.

MOVING PARTS - hand with fingers caught between rollers shows that the moving parts of the equipment present a danger to life or limb.

EXPLANATION OF SAFETY WARNING ICONS (continued)

POISON - skull and crossbones show that a material is poisonous or is a danger to life.

RADIATION - three circular wedges show that the material emits radioactive energy and can injure human tissue.

SHARP OBJECT - pointed object in hand shows that a sharp object presents a danger to limb.

SHARP OBJECT - pointed object in hand shows that a sharp object presents a danger to limb.

SHARP OBJECT - pointed object in foot shows that a sharp object presents a danger to limb.

SLICK FLOOR - wavy line on floor with legs prone shows that slick floor presents a danger for falling.

VAPOR - human figure in a cloud shows that material vapors present a danger to life or health.

LIST OF EFFECTIVE PAGES/WORK PACKAGES

NOTE: The portion of text affected by the changes is indicated by a vertical line in the outer margins of the page. Changes to illustrations are indicated by miniature pointing hands. Changes to wiring diagrams are indicated by shaded areas.

Date of original issue for this manual is:

Original 30 November 2005

TOTAL NUMBER OF PAGES FOR FRONT AND REAR MATTER IS 30 AND TOTAL NUMBER OF WORK PACKAGES IS 33, CONSISTING OF THE FOLLOWING:

* Zero in this column indicates an original page or work package

**HEADQUARTERS,
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 30 NOVEMBER 2005**

TECHNICAL MANUAL

OPERATOR, UNIT, AND DIRECT SUPPORT MANUAL, INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST FOR AIR COMPRESSOR

**INLAND AND COASTAL LARGE TUG (LT)
NSN 1925-01-509-7013 (EIC XAG)**

REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DA Form 2028 (Recommended Changes to Equipment Technical Publications) through the Internet on the Army Electronic Product Support (AEPS) Web site. The Internet address is https://aeps.ria.army.mil. The DA Form 2028 is located under the Public Applications section on the AEPS public home page. Fill out the form and click on SUBMIT. Using this form on the AEPS site will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax, or e-mail your letter or DA Form 2028 directly to: AMSTA-LC-LPIT / TECH PUBS, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The e-mail address is TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

TABLE OF CONTENTS

This manual supersedes TM 55-1925-221-24&P, dated 16 August 1991

TABLE OF CONTENTS (continued)

HOW TO USE THIS MANUAL

USING THIS MANUAL

When using this manual, read and understand the entire maintenance action before performing the task. Also, read and understand all warnings, cautions, and notes as well as general safety precautions that apply to the task to be performed. The warning summary will inform personnel of hazards associated with the equipment to be worked on. However, the summary is not all inclusive and personnel should be aware at all times of hazardous conditions that may arise.

ACCESSING INFORMATION

Information is accessed by referring to the table of contents, located in the front of this manual, or by looking in the alphabetical index, located in the back of this manual.

To locate information using the table of contents, first scan the chapter titles to determine the general area in which your information will be contained. After locating the proper chapter, look beneath the chapter title to find the desired informational or procedural work package title. To the right of the work package title is a work package sequence number. This work package sequence number will direct you to the proper work package. Work packages are arranged in numerical order in this manual.

To locate information using the alphabetical index, look down the subject column on the left side of the page until you find the desired subject. To the right of the subject is the work package sequence number and page number. Go to the indicated work package and indicated page number to find the desired information.

INITIAL SETUP

Initial setup requirements are located directly above many of the procedures in this manual. The information is given to ensure that all materials, expendables, tools and any other equipment necessary are readily available for use. The initial setup will be accomplished prior to starting the actual steps of each maintenance procedure. There are five basic headings listed under the initial setup:

Tools and Special Tools: This section lists all tools (standard or special) required to perform the task. Tools are identified with an item number and work package number from table 2 of the Maintenance Allocation Chart (MAC).

Materials/Parts: This section lists all of the materials and parts required to perform the task. If the material or part is needed each time to work package is used, then it is listed here. If the part is optional, replaced on a conditional basis, or is only needed for certain specific procedures within the work package, it is not listed.

Personnel Required: This section lists all personnel necessary to perform the task. When a specific MOS or other personnel qualification is required, this MOS or additional requirement is also indicated.

Equipment Condition: This section notes the conditions that must exist before starting the task. The equipment condition will also include any prerequisite maintenance tasks to be performed with reference to the work package number or to the TM number that contains the required maintenance task.

References: This section lists any other publications necessary to complete the task. When there are no references listed, all steps necessary to complete the task are contained within this manual. A listing of reference materials is contained in the Supporting Information chapter at the rear of this manual.

ILLUSTRATIONS

Various visual methods are used to locate and repair components. Locator illustrations in Controls and Indicator tables, Preventive Maintenance Checks and Services (PMCS) tables, exploded views, and cut-away diagrams make the information in the manual easier to understand and follow.

LOCATING MAJOR COMPONENTS

This work package gives a brief description of the major components, and provides illustrations showing the location of the components. Knowing the major components of the system is the first step to understanding system operation and maintenance.

THEORY OF OPERATION

This work package contains the theory of operation for the system. Theory of operation is provided to familiarize the user with system operating principles. Once the operating principles are understood, the user is better equipped to operate, troubleshoot, and maintain the system.

DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS

This work package describes all of the operator controls and indicators contained in the system. Use of the operator controls and indicators is also described. Turn to the figure that shows the desired control or indicator. Note the key number corresponding to the control or indicator. Refer to the table below the illustration and find the desired key number in the column on the far left hand side. The center column contains the name of the control or indicator and the right hand column briefly describes the control or indicator's function.

OPERATOR INSTRUCTIONS

Work packages are included in this manual to describe operation under usual conditions as well as operation under unusual conditions. Prior to performing any operating procedure, perform the initial setup by obtaining the expendables, tools, materials and other items listed prior to starting the task. Always perform the listed steps in the listed order.

TROUBLESHOOTING PROCEDURES

A troubleshooting index work package is contained in this manual to permit easy location of troubleshooting procedures. Full directions for using the troubleshooting index and the accompanying troubleshooting procedures are contained in the troubleshooting index work packages. The troubleshooting procedure work package(s) immediately follow the troubleshooting index.

MAINTENANCE PROCEDURES

To locate a maintenance procedure, consult the table of contents or the alphabetical index. Each level of maintenance (operator, unit, and direct support) has a chapter dedicated to maintenance procedures for the appropriate level of maintenance. Each maintenance work package contains complete maintenance procedures, starting with initial setup and continuing through follow-on-service as appropriate. Always ensure that all of the initial setup is complete before beginning a maintenance procedure and always ensure that all warnings, cautions, and notes are heeded.

MAINTENANCE ALLOCATION CHART

The MAC lists all of the authorized maintenance for the system and assigns that maintenance to the appropriate maintenance level (operator, unit, and direct support). Use of the MAC is explained fully in the Maintenance Allocation Chart Introduction work package.

REPAIR PARTS AND SPECIAL TOOLS LIST (RPSTL)

The RPSTL lists all of the repair parts authorized for the system. Illustrations are provided to assist in locating the desired repair parts. Full instructions for use of the RPSTL are contained in the Repair Parts and Special Tools List Introduction work package. Always follow the directions contained in this work package when using the RPSTL.

ALPHABETICAL INDEX

The Alphabetical Index, located in the back of this manual, contains an alphabetical list of all sections of this manual. For example, Location and Description of Major Components is found in section L. The work package sequence number is found on the right side of the title where the Location and Description of Major Components is located. Turn to the work package indicated to find the description and location of each component.

Chapter 1

General Information, Equipment Description, and Theory of Operation for Air Compressor

Inland and Coastal Large Tug (LT)

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE AIR COMPRESSOR FOR INLAND AND COASTAL LARGE TUG (LT) GENERAL INFORMATION

SCOPE

The information in this manual applies to all Inland and Coastal Large Tugs (LT) with the increased capacity air compressor configuration. This manual contains operator instructions and maintenance procedures for the air compressors, dryers, receivers, and regulators that supply and store all of the LT's compressed air. Although the control air system is supplied from the ship's service air system, operation and maintenance of the control air system is contained in TM 55-1925-273-10.

MAINTENANCE FORMS, RECORDS, AND REPORTS

Department of the Army (DA) forms and procedures used for equipment maintenance will be those prescribed by DA PAM 738-750, Functional Users Manual for The Army Maintenance Management System (TAMMS) or AR 700-138, Army Logistics Readiness and Sustainability.

REPORTING EQUIPMENT IMPROVEMENT RECOMMENDATIONS (EIR)

You can help improve this publication. If you find any mistakes or if you know of a way to improve the procedures, please let us know. Submit your DA Form 2028 (Recommended Changes to Equipment Technical Publications) through the Internet on the Army Electronic Product Support (AEPS) Web site. The Internet address is https://aeps.ria.army.mil. The DA Form 2028 is located under the Public Applications section on the AEPS public home page. Fill out the form and click on SUBMIT. Using this form on the AEPS site will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, fax, or e-mail your letter or DA Form 2028 directly to: AMSTA-LC-LMIT / TECH PUBS, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The e-mail address is TACOM-TECH-PUBS@ria.army.mil. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

CORROSION PREVENTION AND CONTROL (CPC)

Corrosion Prevention and Control (CPC) of Army materiel is a continuing concern. It is important that any corrosion problems with this item be reported so that the problem can be corrected and improvements can be made to prevent the problem in future items.

Corrosion specifically occurs with metals. It is an electrochemical process that causes the degradation of metals. It is commonly caused by exposure to moisture, acids, bases, or salts. An example is the rusting of iron. Corrosion damage in metals can be seen, depending on the metal, as tarnishing, pitting, fogging, surface residue, and/or cracking.

Plastics, composites, and rubbers can also degrade. Degradation is caused by thermal (heat), oxidation (oxygen), solvation (solvents), or photolytic (light, typically UV) processes. The most common exposures are excessive heat or light. Damage from these processes will appear as cracking, softening, swelling, and/or breaking.

If a corrosion problem is identified, it can be reported using SF 368 (Product Quality Deficiency Report). Use of key words such as “corrosion,” “rust,” “deterioration,” or “cracking” will ensure that the information is identified as a CPC problem.The form should be submitted to the address specified in DA PAM 738-750, Functional Users Manual for The Army Maintenance Management Systems (TAMMS).

OZONE DEPLETING SUBSTANCES

There are no Ozone Depleting Substances (ODS) contained in the compressed air system.

DESTRUCTION OF ARMY MATERIEL TO PREVENT ENEMY USE

For procedures to destroy this equipment to prevent its use by the enemy, refer to TM 750-244-6, Procedures for Destruction of Tank - Automotive Equipment to Prevent Enemy Use.

PREPARATION FOR STORAGE OR SHIPMENT

Detailed procedures for preparing the compressed air system for storage or shipment are contained in TB 740-97-4, Preservation of Vessels for Storage and TM 38-470, Storage and Maintenance of Army Prepositioned Stock Materiel. The compressed air system must be prepared for storage or shipment in accordance with that publication.

WARRANTY INFORMATION

Unit maintenance maintains records of the warranty status of equipment on the compressed air system. The warranty starts on the date found in block 23 of DA Form 2408-9 (Equipment Control Record). Report all defects to your supervisor, who will take appropriate action.

LIST OF ABBREVIATIONS/ACRONYMS

Abbreviation/Acronym	Name
°C	Degrees Centigrade
°F	Degrees Fahrenheit
A	Ampere(s)
AAL	Additional Authorization List
AEPS	Army Electronic Product Support
AMP	Ampere(s)
bar	Air Pressure
BII	Basic Issue Items
BOI	Basis of Issue
cm	Centimeter(s)
CAGEC	Commercial And Government Entity Code
COEI	Components of End Item
COTS	Commercial Off the Shelf
COV	Cut Off Valve
CPC	Corrosion Prevention and Control
DA	Department of the Army
DA PAM	Department of the Army Pamphlet
EDG	Emergency Diesel Generator
EDIL	Expendable and Durable Items List
EIR	Equipment Improvement Recommendations
ft	Foot(feet)
ft^2	Square foot(feet)
ft^3/min	Cubic feet per minute
FGC	Functional Group Code
FLTR	Filter
FM	Field Manual
FM	Flow Meter
FO	Fuel Oil
F.O.	Fuel Oil
GAL	Gallon
GS	General Service
Hg	Mercury
in	Inch(es)
in^3	Cubic Inch(es)

LIST OF ABBREVIATIONS/ACRONYMS (continued)

Abbreviation/Acronym	Name
J.B.	Junction Box
kg	Kilogram
L	Liter(s)
L/min	Liters per minute
lb	Pound(s)
lb-ft	Pounds Feet (torque)
LT	Large Tug
m	Meter(s)
m^2	Square meter(s)
mmHg	Milimeter(s) of Mercury
MAC	Maintenance Allocation Chart
Nm	Newton Meter
NHA	Next Higher Assembly
NPT	National Pipe Thread
NSN	National Stock Number
ODS	Ozone Depleting Substance(s)
ppm	Parts Per Million
PG	Pressure Gauge
PMCS	Preventive Maintenance Checks and Services
PMP	Pump
P/N	Part Number
PPM	Parts Per Million
PSI	Pounds per Square Inch
REV	Reverse
RPSTL	Repair Parts and Special Tools List
SEP	Separator
SMR	Source Maintenance and Recoverability
SSDG	Ship's Service Diesel Generator
SUCT	Suction
TAMMS	The Army Maintenance Management System
TK	Tank
TMDE	Test, Measurement, and Diagnostic Equipment
U/I	Unit of Issue
UOC	Useable On Code
UUT	Unit Under Test
UV	Ultraviolet
V	Valve
Vac	Volts, Alternating Current
Vdc	Volts, Direct Current
XFER	Transfer

QUALITY OF MATERIAL

Material used for replacement, repair, or modification must meet the requirements of this manual. If quality of material requirements are not stated in this manual, the material must meet the requirements of the drawings, standards, specifications, or approved engineering change proposals applicable to the subject equipment.

END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
EQUIPMENT DESCRIPTION AND DATA

EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

The compressed air system is comprised of two 2-stage, pressure lubricated, air cooled air compressors, two starting air receivers, one ship's service air receiver, two air dryers, six pressure regulators, three automatic drains, and miscellaneous gauges, valves, and piping. The technical characteristics of these components are detailed in the equipment data paragraph in this work package. Theory of operation is outlined in WP 0003 00.

LOCATION AND DESCRIPTION OF MAJOR COMPONENTS

1. Port Main Engine Starting Air Regulator (figure 1, item 1). The regulator reduces the pressure of the starting air entering the port main engine's starting motor.

2. SSDG 2 Starting Air Regulator (figure 1, item 2). The regulator reduces the pressure of the starting air entering the SSDG 2 starting motor.

3. Air Compressors (figure 1, item 3). The compressors supply all of the compressed air for use onboard the LT.

4. Ship's Service Air Receiver (figure 1, item 4). This receiver stores all of the air for the ship's service air system, ensuring that an ample reserve of compressed air is available for the vessel's use.

5. Starting Air Receivers (figure 1, item 5). These two receivers store all of the compressed air for the starting air system. Air from these receivers is supplied to the starting systems of the main engines, SSDG 2, the bow thruster engine, and the pump drive engine.

6. Ship's Service Air Regulator and Bypass Manifold (figure 1, item 6). The regulator controls the pressure of air entering the ship's service receiver from the starting air receivers. The bypass manifold permits bypassing of the regulator in the event of regulator failure.

7. Bow Thruster Engine Starting Air Regulator (figure 1, item 7). The regulator reduces the pressure of the starting air entering the bow thruster engine starting motor.

8. Pump Drive Engine Starting Air Regulator (figure 1, item 8). The regulator reduces the pressure of the starting air entering the pump drive engine starting motor.

9. Starboard Main Engine Starting Air Regulator (figure 1, item 9). The regulator reduces the pressure of the starting air entering the starboard main engine's starting motor.

DIFFERENCES BETWEEN MODELS

At the time of issue for this manual, only hull number LT-803 had received the higher capacity air compressor upgrade. Therefore, no differences between models currently exist. As other vessels are upgraded, this manual will be revised to reflect those installations. Differences between models will be identified at that time.

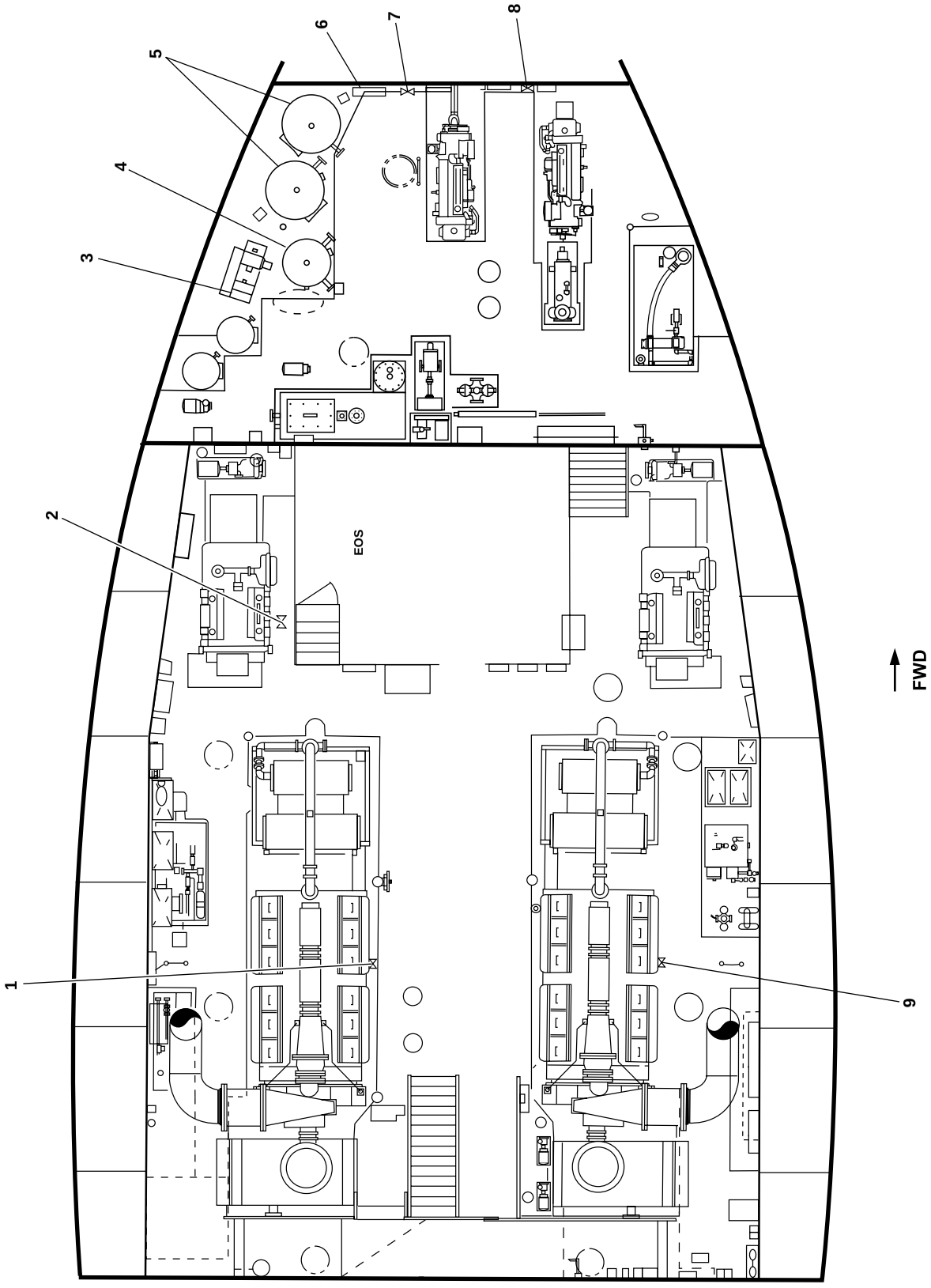


Figure 1. Major System Components

EQUIPMENT DATA

AIR COMPRESSORS

Two 2-stage air compressors supply all of the compressed air needs of the Inland and Coastal Large Tug (LT). The compressors are permanently mounted on the port side of Auxiliary Machinery Space 1 (AMS 1). Compressor 1 is the uppermost compressor, while compressor 2 is the lowest unit.

Each compressor is driven by its own electric motor via a V-belt. These motors are controlled by motor controllers mounted in the vicinity of the air compressors. Maintenance of the motor controllers is contained in TM 55-1925-273-24&P.

Technical characteristics of the compressors are contained in table 1.

Table 1. Air Compressor Technical Characteristics

Item	Data
Manufacturer	Quincy
Series	QR-25
Model	340
Type	2 Stage
Stroke	3.50 in (88.9 mm)
Bore, Low Pressure	5.25 in (133.35 mm)
Bore, High Side	3.00 in (76.2 mm)
Speed Range (r/min)	400-900
Maximum Pressure (continuous)	200 PSI (13.8 bar)
Maximum Pressure (intermittent)	500 PSI (34.5 bar)
Cooling	Air

RECEIVERS

Two receivers, located inboard and forward of the air compressors, store the air for the starting air system. These receivers also supply air to the ship's service air receiver, located just aft of the starting air receivers. Technical characteristics of the receivers are contained in table 2.

Table 2. Receiver Technical Characteristics

Item	Data
Starting Air Receivers	
Quantity	2
Capacity	400 gallons (1514 liters) each
Working Pressure	250 PSI (17.2 bar)
Relief Pressure	275 PSI (19.0 bar)
Design Temperature	150 °F (66 °C)
Ship's Service Air Receivers	
Quantity	1
Capacity	200 gallons (757 liters)
Working Pressure	125 PSI (8.6 bar)
Relief Pressure	137.5 PSI (9.5 bar)
Design Temperature	150 °F (66 °C)

DRYERS

Each air compressor is furnished with a dryer. The dryers are mounted in each compressor's discharge piping and remove moisture from the discharge air prior to delivering that air to the receivers. Characteristics of the dryers are contained in table 3.

Table 3. Dryer Technical Characteristics

Item	Data
Manufacturer	Hayward
Model	1.25TS6
Material	Stainless Steel

REGULATORS

Six compressed air regulators are installed in the compressed air system. One regulator controls the air pressure entering the ship's service air system. The other five regulators control the air pressure entering the starting motors of the bow thruster engine, the pump drive engine, SSDG 2, and the main engines. Technical characteristics of these regulators are contained in table 4.

Table 4. Regulator Technical Characteristics

Item	Data
Ship's Service Air System	
Manufacturer	Wilkerson Corporation
Model	R30
Size	1-1/4" NPT
Capacity	800 ft^3/min (22.7 m^3/min)
Output Setting	125 PSI (8.6 bar)
Bow Thruster Starting Air	
Manufacturer	Grove Valve and Regulator Company
Model	202H
Size	1" NPT
Output Setting	125 PSI (8.6 bar)
Pump Drive, and SSDG 2 Starting Air	
Manufacturer	Wilkens
Model	300
Size	1" NPT
Output Setting	125 PSI (8.6 bar)
Main Engine Starting Air	
Manufacturer	Wilkens
Model	300
Size	1-1/2" NPT
Output Setting	200 PSI (13.8 bar)

AUTOMATIC DRAINS

Each receiver is equipped with an automatic drain to prevent accumulation of condensate inside the receiver. Technical characteristics of the drains are contained in table 5.

Table 5. Automatic Drain Technical Characteristics

Item	Data
Manufacturer	Arrow Pneumatic
Model	5702S
Adjustable Cycle Time	1 to 60 minutes
Adjustable Drain Time	1 to 30 seconds
Maximum Working Pressure	200 PSI (13.8 bar)
Maximum Fluid Temperature	165 °F (74 °C)
Ambient Temperature	35 to 165 °F (2 to 74 °C)
Voltage	115 Vac, 1 phase, 60 Hz
Amps	0.25 A

END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
THEORY OF OPERATION

GENERAL

This work package describes the theory of operation for the Inland and Coastal Large Tug's (LT) compressed air system. The theory of operation for the system as a whole is discussed first. Following the system theory of operation, the theory of operation for the air compressor is discussed.

SYSTEM

Two electric powered, two-stage air compressors (figure 1, item 1) compress air for use throughout the vessel. See the Air Compressor paragraph below for theory of operation for the compressors.

After leaving the compressors (figure 1, item 1), the compressed air passes through air dryers (figure 1, item 2). These air dryers remove moisture from the air before the air reaches the starting air receivers (figure 1, item 3). Removal of moisture from the compressed air is necessary to prevent the accumulation of water in the receivers. This accumulated water can corrode the interior of the receivers, and can also travel downstream in the compressed air system damaging components further down the line. Each dryer is equipped with a bypass valve (figure 1, item 4) to permit air to bypass the dryer in the event of a dryer failure.

All air discharged from the air compressors (figure 1, item 1) arrives first at the starting air receivers (figure 1, item 3). Here, the air is stored at 250 PSI (17.2 bar) to ensure that an adequate supply of compressed air is on hand for use in starting the main engines, the bow thruster engine, the pump drive engine, and the engine for SSDG 2. SSDG 1 is equipped with an electric starter, and does not require compressed air.

Compressed air for ship's service use (air tools, ship's whistle, sea chest blowdowns, etc.) is stored in the ship's service air receiver (figure 1, item 5). This receiver is supplied from the starting air receivers (figure 1, item 3) through a regulator (figure 1, item 6). This regulator reduces the starting air pressure to 125 PSI (8.6 bar) before the air is permitted to enter the ship's service air receiver. A bypass valve (figure 1, item 7) permits manual filling of the ship's service air receiver in the event of a regulator failure.

All three receivers (figure 1, items 3 and 5) are equipped with relief valves (figure 1, item 8), local pressure gauges (figure 1, item 9), manual drain valves (figure 1, item 10), and automatic drain valves (figure 1, item 11). The relief valves prevent overpressurization of the receivers, which could result in catastrophic failure. The relief valve for the starting air system is set at 275 PSI (19.0 bar) and the relief for the ship's service system is set for 137.5 PSI (9.5 bar). The manual drains permit manual draining of water from the receivers. They also permit the system to be drained when receiver or compressed air system maintenance is required. The automatic drains open on a preset schedule, keeping the receivers drained under normal operating conditions.

Although the starting air is stored at 250 PSI (17.2 bar), this pressure is too high for the engines' starters to accommodate without damage. Therefore, each engine's starting air piping is fitted with a regulator. The regulator for the bow thruster engine (figure 1, item 12) and the pump drive engine (figure 1, item 13) each reduces the starting air pressure to 125 PSI (8.6 bar). The regulators (figure 1, item 14) for the main engines each reduce the engines' starting air pressure to 200 PSI (13.8 bar).

Additional regulators are provided for the forward (figure 1, item 15) aft (figure 1, item 16) and high level (figure 1, item 17) sea chest blowouts. These reducing valves reduce the ship's service air to 25 PSI (1.7 bar) to prevent damage to the sea chests.

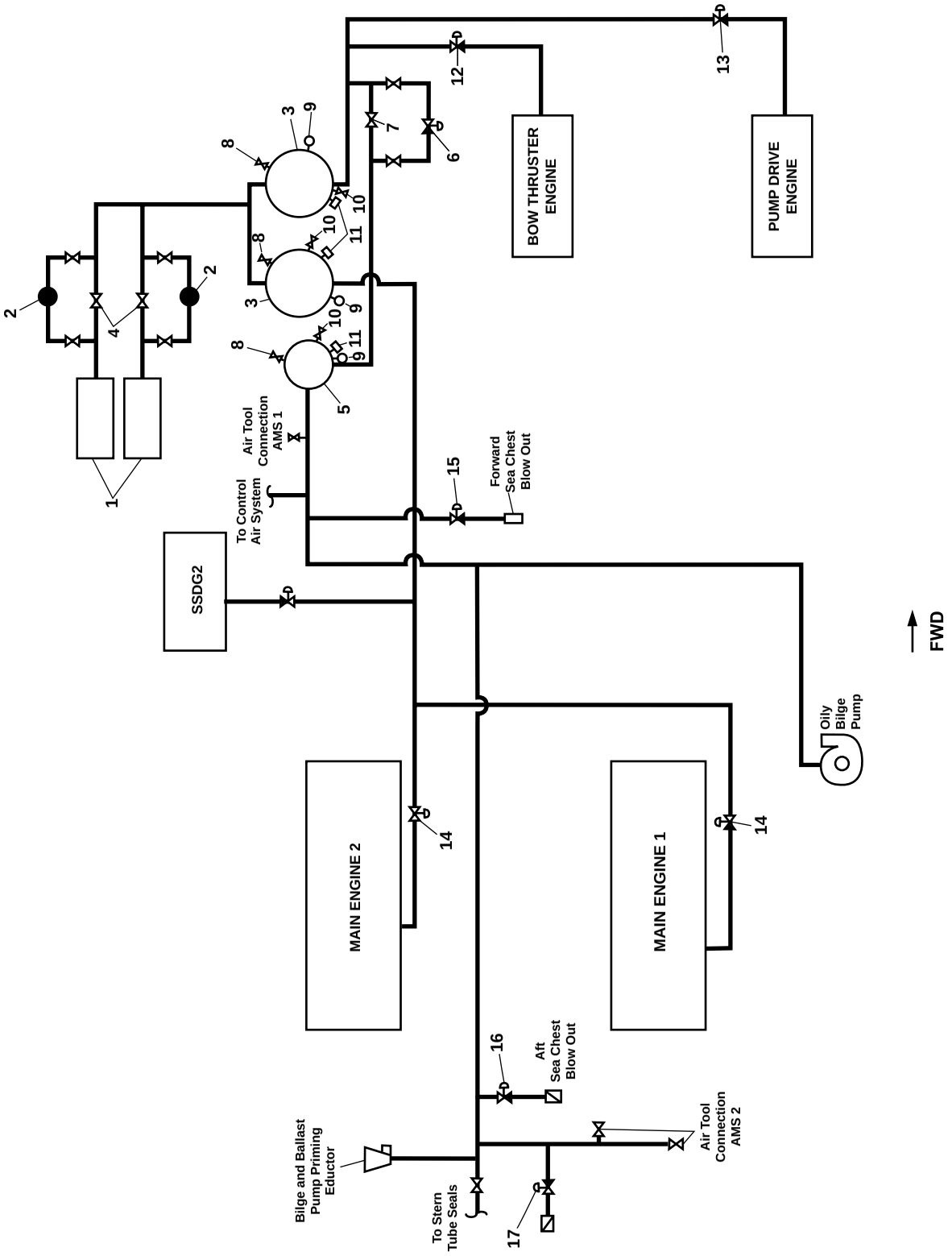


Figure 1. Compressed Air System Simplified Schematic

AIR COMPRESSOR

COMPRESSION

The compressor's crankshaft (figure 2, item 1) is turned by an electric motor, via a V-belt drive. As the crankshaft turns, the pistons move up and down. During the downstroke of the low-pressure piston (figure 2, item 2), air is drawn through an intake valve in the head of the compressor into the low-pressure cylinder (figure 2, item 3). During the upstroke of the piston, this air is compressed.

The air that was compressed by the low-pressure piston (figure 2, item 2) is then released through a discharge valve in the head of the compressor to a finned tube intercooler where the heat resulting from compression is allowed to dissipate. The cooler compressed air is then drawn into the high-pressure cylinder by the downstroke of the high-pressure piston (figure 2, item 4). On the upstroke of the high-pressure piston, the air is further compressed before being discharged through a discharge valve in the compressor head. At this point, the compressed air enters the vessel's compressed air piping system enroute to the starting air receivers.

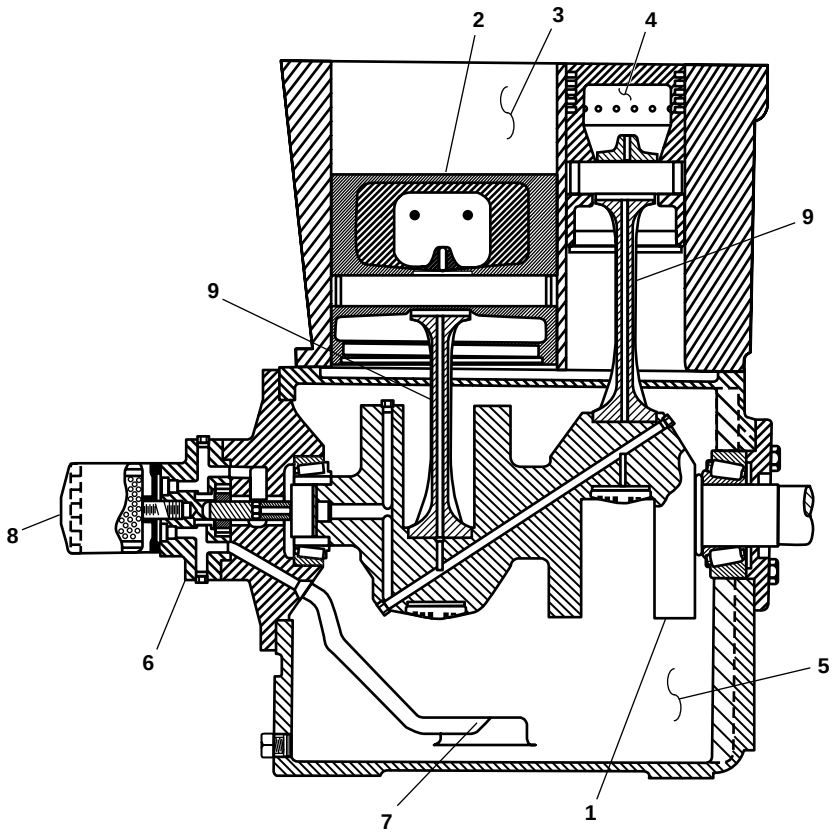


Figure 2. Air Compressor

LUBRICATION

The air compressor is pressure lubricated. The moving parts within the crankcase (figure 2, item 5) are supplied with lubrication by a positive displacement, gerotor type oil pump (figure 2, item 6). Oil is drawn up from the bottom of the crankcase to the oil pump through an oil sump strainer screen (figure 2, item 7). The oil is then forced under pressure through the oil filter (figure 2, item 8). After being filtered, the oil travels under pressure through drilled journals in the crankshaft (figure 2, item 1) and connecting rods (figure 2, item 9) to lubricate crankshaft bearings, wrist pin bearings, and the cylinder walls.

COOLING

The fan blades of the compressor pulley force ambient air across the fins of the cylinder heads and intercooler fins to cool the compressor.

END OF WORK PACKAGE

Chapter 2

Operator Instructions
for
Air Compressor

Inland and Coastal Large Tug (LT)

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS

COMPRESSED AIR OPERATOR CONTROLS AND INDICATORS

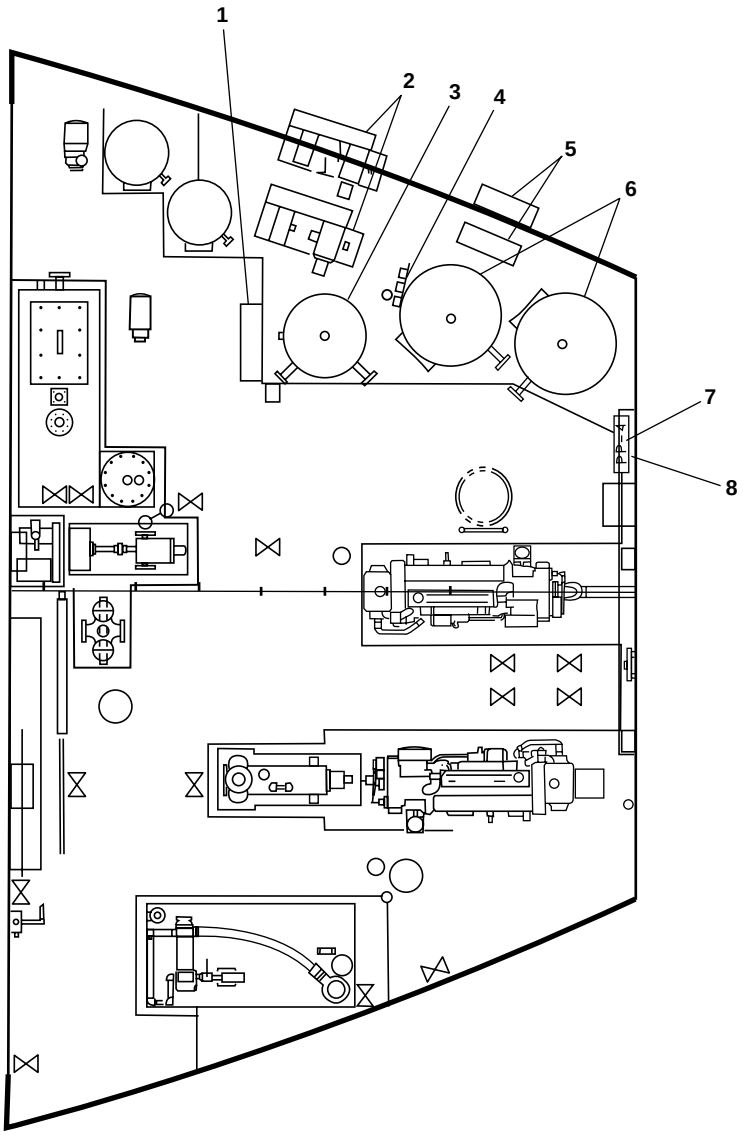


Figure 1. Compressed Air Operator Controls and Indicators, AMS 1, General Arrangement

Table 1. Compressed Air Operator Controls and Indicators, AMS 1, General Arrangement (refer to figure 1)

Key	Control/Indicator	Function
1	Air Compressor Motor Controllers	This panel contains the motor controllers for the air compressors. See figure 2 for details.
2	Air Compressors	The air compressors supply compressed air to the ship's service and starting air receivers. See figure 3 for details.
3	Ship's Service Air Receiver	The air receiver stores the compressed air for the ship's service use. See figure 4 for details.
4	Compressed Air Gauge Panel	This panel contains air pressure gauges for the starting air and the ship's service air receiver. See figure 5 for details.
5	Air Compressor Discharge Manifold	This manifold controls the direction of the discharged compressed air from the air compressors. See figure 3 for details.
6	Starting Air Receivers	The starting air receivers store compressed air for starting the vessel's main engines, auxiliary engines, and one SSDG. Refer to figure 4 for details.
7	440V Power Panel No. 4	This panel provides circuit breaker protection and 440 Vac for air compressors 1 and 2. See figure 6 for details.
8	Compressed Air Piping, Manifold Forward Bulkhead	This manifold contains valves and a regulator for the starting air and ship's service air. See figure 7 for details.

AIR COMPRESSOR MOTOR CONTROLLERS CONTROLS AND INDICATORS

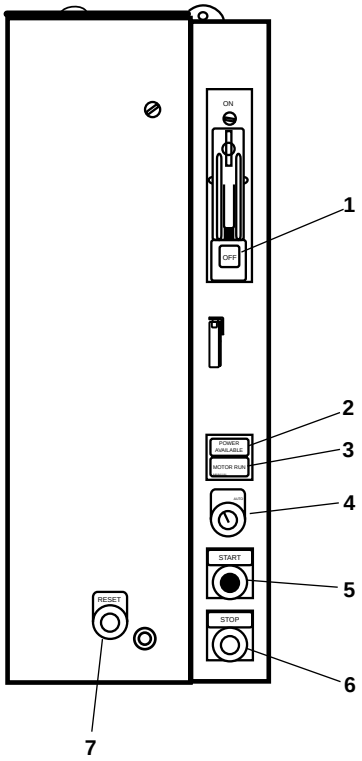


Figure 2. Air Compressor Motor Controllers

Table 2. Air Compressor Motor Controllers (refer to figure 2)

Key	Control/Indicator	Function
1	ON/OFF Breaker	This breaker serves as a disconnect switch for the air compressor motor controller.
2	POWER AVAILABLE Indicator	This indicator illuminates to indicate that power is available to the motor controller.
3	MOTOR RUN Indicator	This indicator illuminates to indicate that the motor is running.
4	MANUAL/AUTO Switch	This switch permits the selection of operating mode. When in the AUTO position, the compressor turns ON and OFF automatically depending upon the air pressure in the receivers. When in the MANUAL position, the air compressor runs continuously no matter how much air pressure is in the receivers.
5	START Pushbutton	This pushbutton is used to START the air compressor.
6	STOP Pushbutton	This pushbutton is used to STOP the air compressor.
7	RESET Pushbutton	This pushbutton is used to RESET the motor controller.

AIR COMPRESSORS AND DISCHARGE MANIFOLDS CONTROLS AND INDICATORS

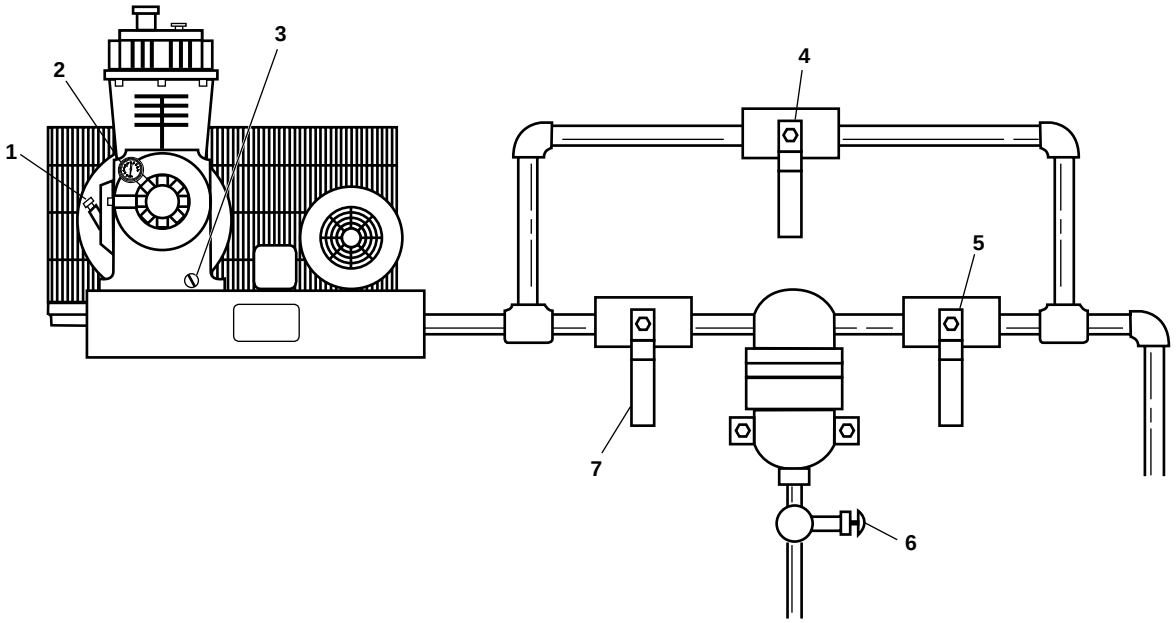


Figure 3. Air Compressors and Discharge Manifolds

Table 3. Air Compressors and Discharge Manifolds (refer to figure 3)

Key	Control/Indicator	Function
1	Dipstick	The dipstick permits the operator to check the lube oil level in the air compressor crankcase.
2	Oil Pressure Gauge	This gauge indicates the lube oil pressure for the air compressor.
3	Drain Fitting	This drain permits draining of the lube oil from the crankcase.
4	CA-89 and CA-90 COV-COMPR DISCH	OPEN this valve to bypass the air dryer.
5	CA-87 and CA-88 COV-COMPR DISCH	When CLOSED, these valves secure the discharge side of the air dryer.
6	CA-93 and CA-94 MOISTURE SEP DR	OPEN these valves to drain the air dryer. The drain sends all trapped moisture to the bilge when opened.
7	CA-1 and CA-2 COV-COMPR DISCH	CLOSE these valves to cut off the air dryer.

AIR RECEIVERS AND VALVES CONTROLS AND INDICATORS

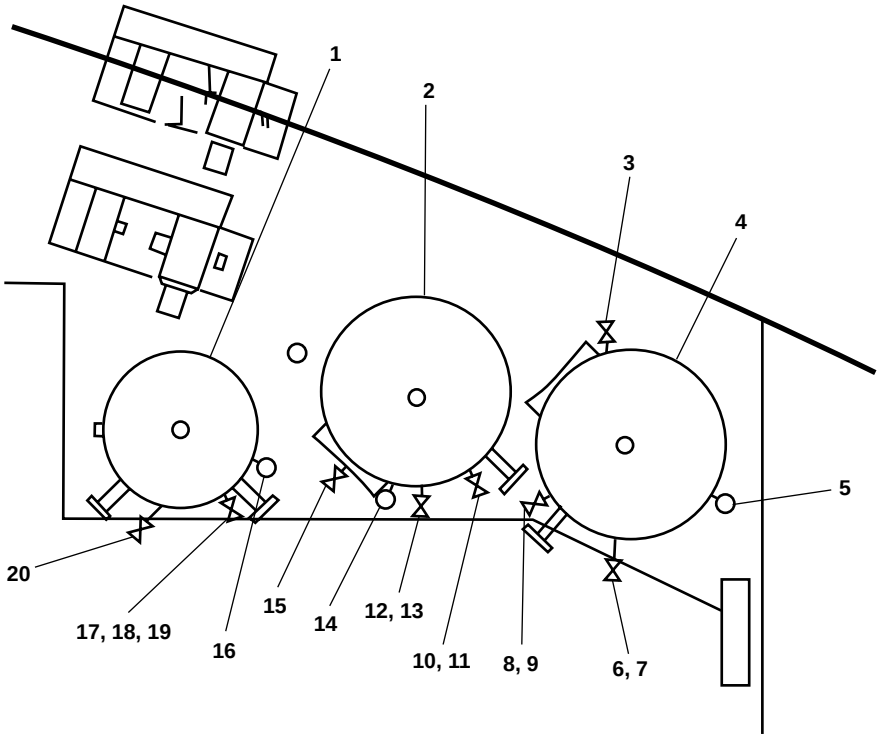


Figure 4. Air Receivers and Valves

Table 4. Air Receivers and Valves (refer to figure 4)

Key	Control/Indicator	Function
1	SHIPS SERVICE AIR RCVR	This receiver stores compressed air for the ship's service compressed air system (Working pressure 125 PSI (8.6bar)).
2	STARTING AIR RCVR NO. 2	This receiver stores compressed air for the starting air system (Working pressure 250 PSI (17.2 bar)).
3	CA-97 Cutoff Valve, Air Compressor Regulator	This valve secures the pressure to the air compressor regulator.
4	STARTING AIR RCVR NO. 1	This receiver stores compressed air for the starting air system (Working pressure 250 PSI (17.2 bar)).
5	Pressure Gauge, STARTING AIR RCVR NO. 1	This gauge indicates the air pressure present in the starting air receiver 1 (Working pressure 250 PSI (17.2 bar)).
6	CA-47 STG AIR TK DR	This valve is located below the deckplate. When OPEN, this valve valve drains condensation and air from starting air receiver 1.
7	CA-50 AUTO DR	This cutoff valve prevents the automatic drain valve from operating.

Table 4. Air Receivers and Valves (refer to figure 4) (continued)

Key	Control/Indicator	Function
8	CA-3 STG AIR TK OUT	This valve is located near the top of the receiver. When OPEN, it discharges air from the receiver to the starting air system.
9	CA-11 STG AIR TK INL	This valve is located just above the deckplate. When OPEN, this valve permits compressed air from the air compressors to enter this receiver.
10	CA-4 STG AIR TK OUT	This valve is located near the top of the receiver. When OPEN, this valve discharges air from the receiver to the starting air system.
11	CA-12 STG AIR TK INL	This valve is located just above the deckplate. When OPEN, this valve permits compressed air from the air compressors to enter this receiver.
12	CA-46 STG AIR TK DR	This valve is located below the deckplate. When OPEN this valve drains condensation and air from the starting air receiver 2.
13	CA-49 AUTO DR	This cutoff valve prevents the automatic drain valve from operating.
14	Pressure Gauge, STARTING AIR RCVR NO. 2	This gauge indicates the air pressure present in starting air receiver 2 (Working pressure 250 PSI (17.2 bar)).
15	CA-97 Cutoff Valve, Air Compressor Regulator	This valve secures the pressure to the air compressor regulator.
16	Pressure Gauge, SHIPS SERVICE AIR RCVR	This gauge indicates the air pressure present in the ship's service air receiver (Working pressure 125 PSI (8.6bar)).
17	CA-48 SVCE AIR TK DR	This valve is located below the deckplate. When OPEN, this valve drains condensation and air from the ship's service air receiver.
18	CA-51 AUTO DR	This valve secures the pressure to the automatic drain valve, preventing the automatic drain valve from operating.
19	CA-14 SVCE AIR TK OUT	This valve secures the pressure to the air compressor regulator.
20	Discharge Valve, Ship's Service Air	When OPEN, this valve permits compressed air from the ship's service air receiver to supply the vessel.

COMPRESSED AIR GAUGE PANEL CONTROLS AND INDICATORS

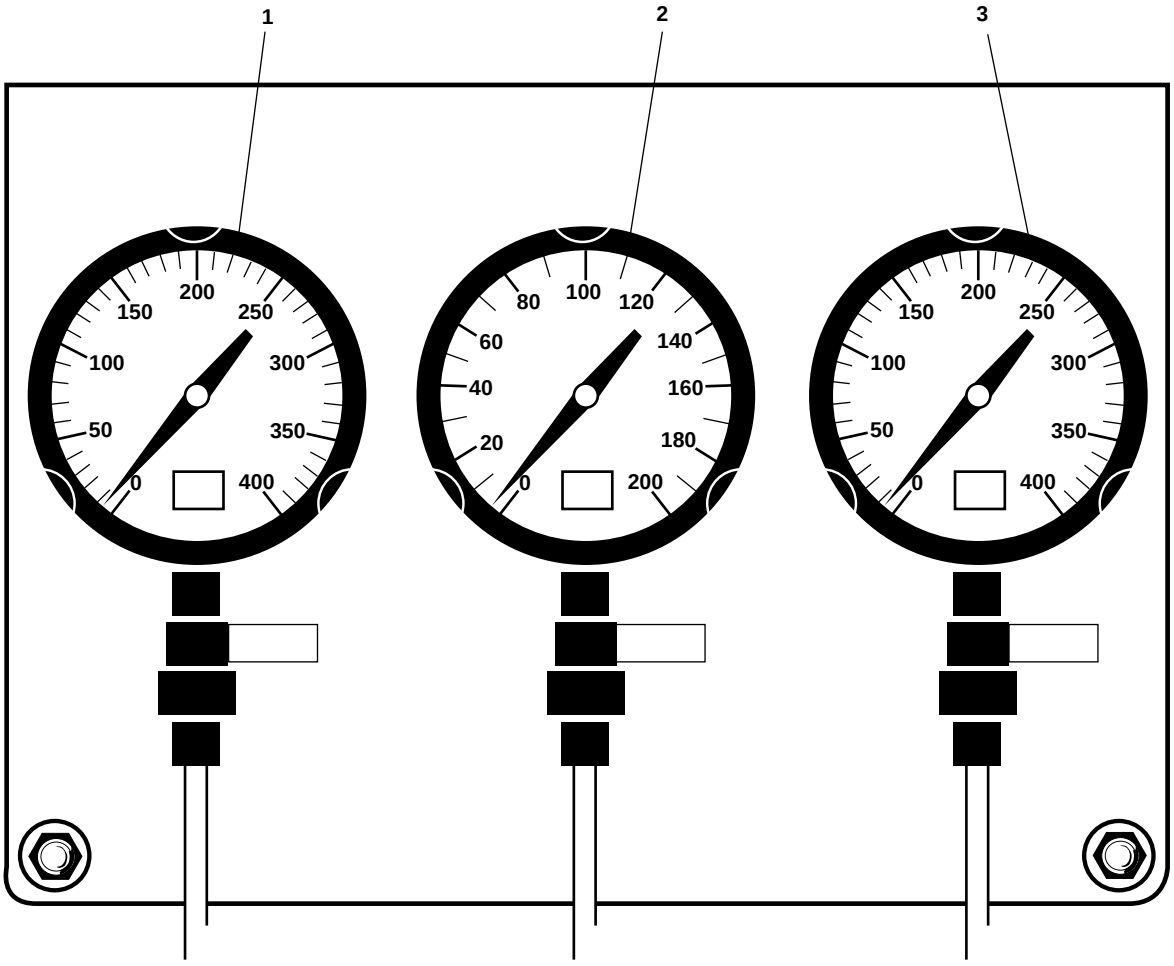


Figure 5. Compressed Air Gauge Panel

Table 5. Compressed Air Gauge Panel (refer to figure 5)

Key	Control/Indicator	Function
1	AIR CPRSR #2 DISCH PRESS Gauge	This gauge indicates the discharge pressure from air compressor 2.
2	SHIP SERVICE AIR PRESS Gauge	This gauge indicates the air pressure available for the ship's service compressed air system.
3	AIR CPRSR #1 DISCH PRESS Gauge	This gauge indicates the discharge pressure from air compressor 1.

440V POWER PANEL NO. 4 CONTROLS AND INDICATORS

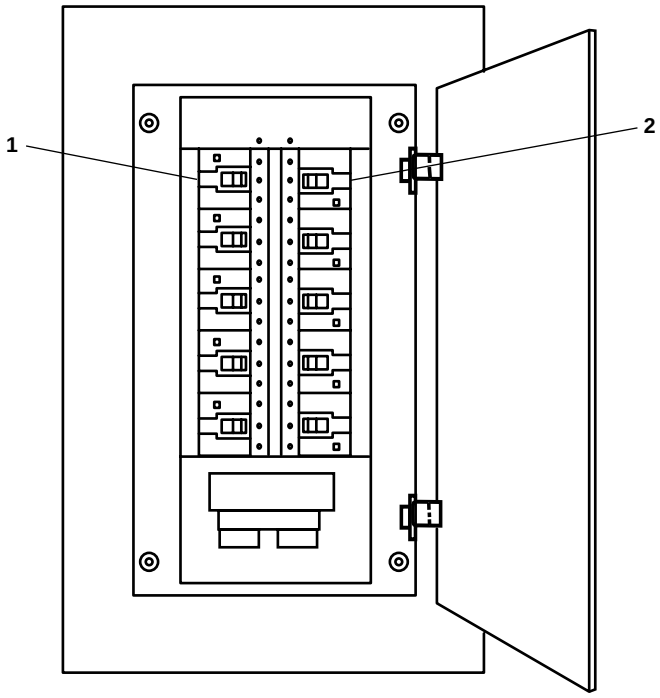


Figure 6. 440V Power Panel No. 4

Table 6. 440V Power Panel No. 4 (refer to figure 6)

Key	Control/Indicator	Function
1	AIR COMPRESSOR NO. 1 Circuit Breaker	This circuit breaker provides circuit protection for air compressor 1.
2	AIR COMPRESSOR NO. 2 Circuit Breaker	This circuit breaker provides circuit protection for air compressor 2.

COMPRESSED AIR PIPING MANIFOLD, FORWARD BULKHEAD CONTROLS AND INDICATORS

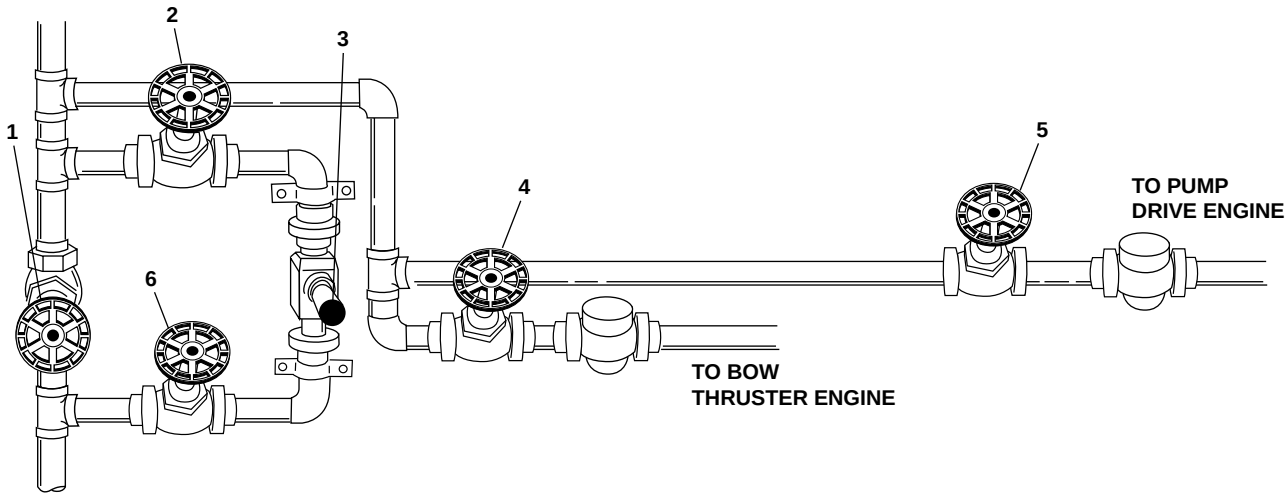


Figure 7. Compressed Air Piping Manifold, Forward Bulkhead

Table 7. Compressed Air Piping Manifold, Forward Bulkhead (refer to figure 7)

Key	Control/Indicator	Function
1	CA-41 BYP RDC STA	This valve permits compressed air to bypass the ship's service air regulator.
2	CA-39 SVCE AIR TK INL	This valve isolates the ship's service air regulator.
3	Regulator	This regulator regulates the pressure of the compressed air entering the ship's service air receiver.
4	CA-5 STG AIR TO BOW THRUSTER ENG	This valve, when OPEN, provides starting air pressure to the bow thruster engine.
5	CA-6 STG AIR TO PMP DR ENG	This valve, when OPEN, provides starting air pressure to the pump drive engine.
6	CA-40 SVCE AIR TK INL	This valve isolates the ship's service air regulator.

END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER USUAL CONDITIONS

INITIAL SETUP:

Personnel Required:
One Watercraft Engineer, 88L

SECURITY MEASURES FOR ELECTRONIC DATA

No electronic data is used or stored in the compressed air system.

OPERATING PROCEDURES

SYSTEM STARTUP

1. OPEN valves CA-4 STG AIR TK OUT (figure 1, item 1) and CA-3 STG AIR TK OUT (figure 1, item 2) at the starting air receivers (figure 1, item 3).

2. CLOSE CA-89 and CA-90 COV-COMPR DISCH valves (figure 2, item 1) and CA-93 and CA-94 MOISTURE SEP DR valves (figure 2, item 2).

3. OPEN CA-1 and CA-2 COV-COMPR DISCH valves (figure 2, item 3) and CA-87 and CA-88 COV- COMPR DISCH valves (figure 2, item 4).

4. OPEN valves CA-11 STG AIR TK INL (figure 1, item 4) and CA-12 STG AIR TK INL (figure 1, item 5).

5. OPEN valves CA-50 AUTO DR (figure 1, item 6) and CA-49 AUTO DR (figure 1, item 7).

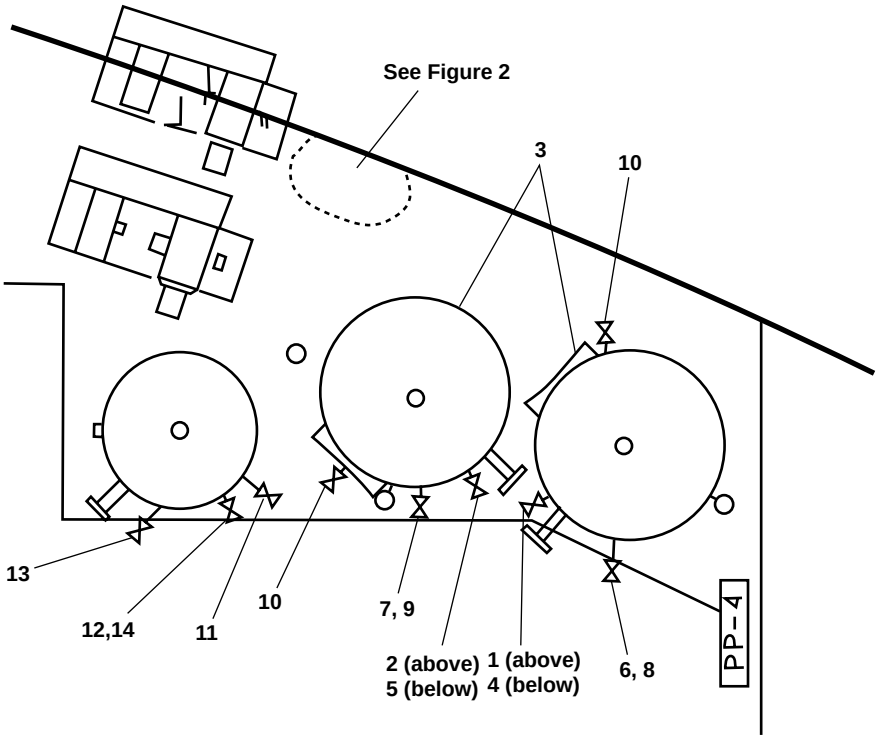


Figure 1. Compressed Air System Component Locations

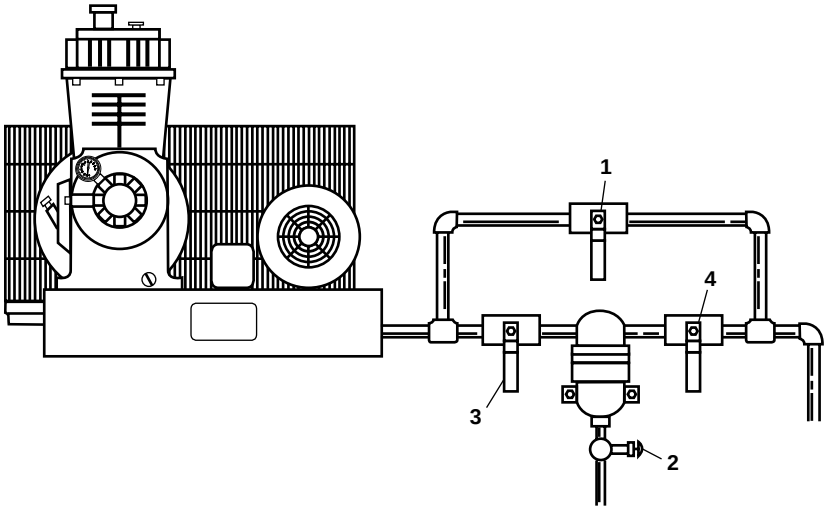


Figure 2. Dryer Valve Locations

6. Check that CA-46 and CA-47 STG AIR TK DR valves (figure 1, items 8 and 9) are CLOSED.

7. Check that CA-98 and CA-99 valves (figure 1, item 10) are OPEN.

8. At the main switchboard in the EOS, set the AMS 1 power panel 4 circuit breaker (figure 3, item 1) to the ON position.

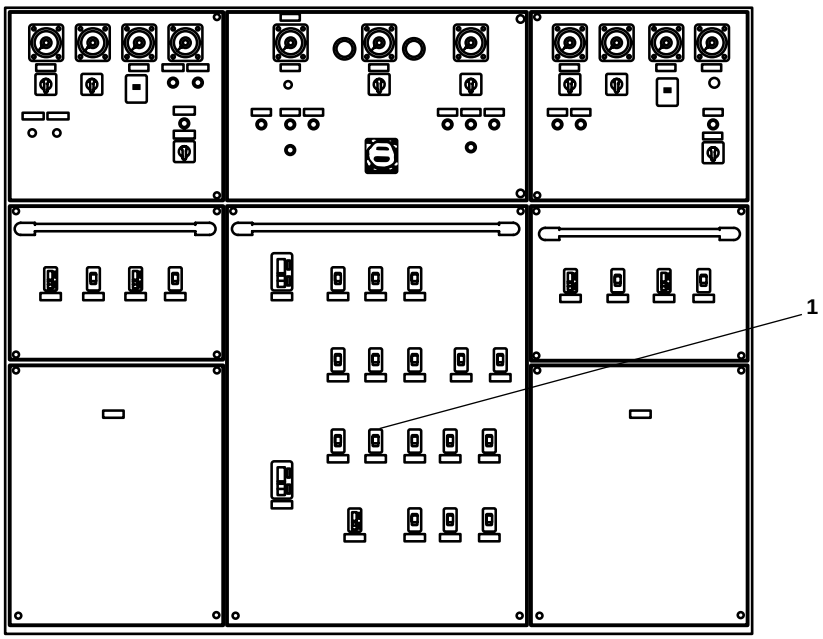


Figure 3. EOS Main Switchboard

9. At 440V power panel No. 4 (figure 4), set the following circuit breakers to the ON position:

   a. AIR COMPRESSOR NO. 1 circuit breaker (figure 4, item 1).

   b. AIR COMPRESSOR NO. 2 circuit breaker (figure 4, item 2).

NOTE

Activation of the air compressor motor controller will cause the power available light to energize, and the compressor will start automatically unless pressure is above 210 PSI (14.5 bar).

10. Set the motor controller MANUAL-AUTO switches (figure 5, item 1) for both compressors to the AUTO position.

11. Set both motor controllers' ON-OFF switches (figure 5, item 2) to the ON position.

12. Ensure that the POWER AVAILABLE light (figure 5, item 3) is illuminated on both motor controllers.

13. Ensure that the MOTOR RUN light (figure 5, item4) is illuminated on both motor controllers.

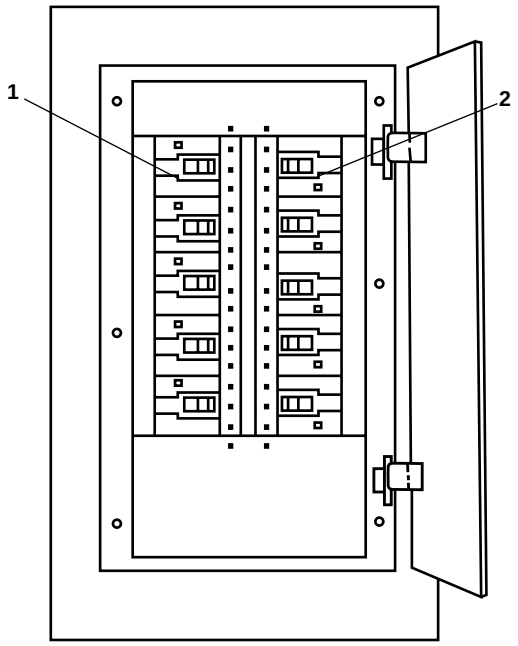


Figure 4. 440V Power Panel No. 4

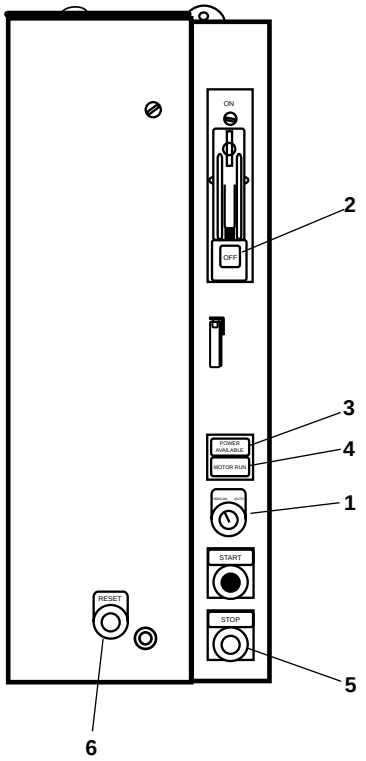


Figure 5. Air Compressor Motor Controller

ACTIVATE SHIP'S SERVICE AIR SYSTEM

1. OPEN valves CA-39 SVCE AIR TK INL (figure 6, item 1) and CA-40 SVCE AIR TK INL (figure 6, item 2).

2. Check that valve CA-41 BYP RDC STA (figure 6, item 3) is CLOSED.

3. OPEN valves CA-13 SVCE AIR TK INL (figure 1, item 11), CA-51 AUTO DR (figure 1, item 12), and CA-14 SVCE AIR TK OUT (figure 1, item 13).

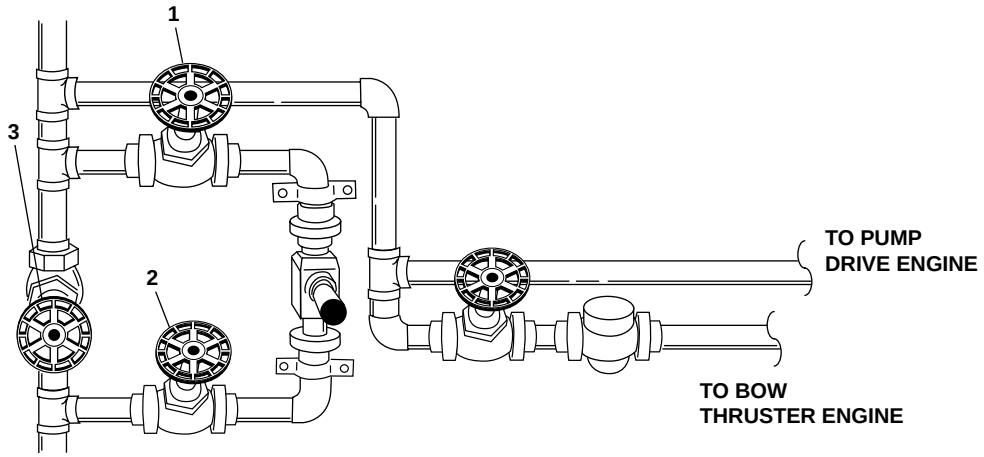


Figure 6. Ship's Service Air System Valve Locations (Forward Bulkhead)

4. Check that valve CA-48 SVCE AIR TK DR (figure 1, item 14) is CLOSED.

5. Activate the control air system by completing the following actions:

   a. Align air dryer piping and valves by completing the following actions:

      (1) OPEN the air dryer inlet valve (figure 7, item 1).

      (2) OPEN the air dryer outlet valve (figure 7, item 2).

      (3) Open the transducer valve (figure 7, item 3).

      (4) OPEN the filter valve (figure 7, item 4).

      (5) CLOSE the bypass valve (figure 7, item 5).

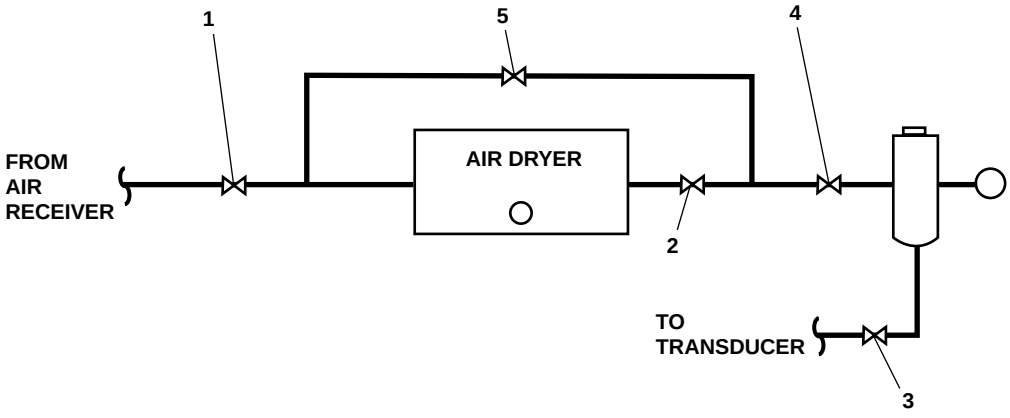


Figure 7. Control Air Dryer Valve Locations

b. Start the control air dryer by completing the following actions:

(1) Set J.B. FOR AUTO DRAIN ON AIR RECEIVER. (INC. REFER DRYER), circuit breaker (figure 8, item 1) on 120V distribution panel No.4 to ON.

(2) In the forward port corner of the engine room, above SSDG 2:

(a) Set the control air dryer switch (figure 9, item 1) to ON.

(b) Monitor the control air dryer gauge (figure 9, item 2) to ensure normal operation. 125 PSI (8.6 bar).

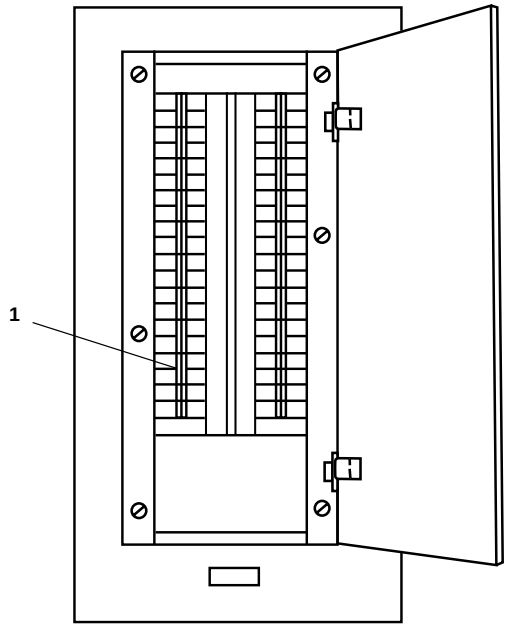


Figure 8. 120V Distribution Panel No. 4

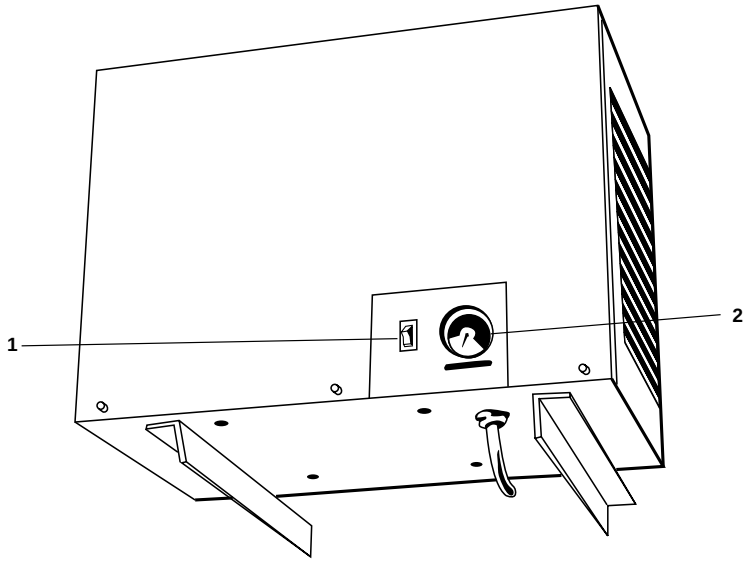


Figure 9. Control Air Dryer

SYSTEM SHUTDOWN

1. Check that CA-48 SVCE AIR TK DR valve (figure 1, item 14) is CLOSED.

2. CLOSE valves CA-13 SVCE AIR TK INL (figure 1, item 11), CA-51 AUTO DR (figure 1, item 12), and CA-14 SVCE AIR TK OUT (figure 1, item 13).

3. CLOSE valves CA-40 SVCE AIR TK INL (figure 6, item 1) and CA-39 SVCE AIR TK INL (figure 6, item 2).

4. Set the motor controller MANUAL-AUTO switches (figure 5, item 1) for both compressors to the MANUAL position.

5. On each motor controller, PUSH the STOP pushbutton (figure 5, item 5) and observe that the MOTOR RUN indicator light (figure 5, item 4) goes out and that the affected air compressor stops running.

6. Set both motor controller ON-OFF switches (figure 5, item 2) to the OFF position and observe that the POWER AVAILABLE indicator light (figure 5, item 3) goes out.

7. At 440V power panel no. 4, set the following circuit breakers to the OFF position:

   a. AIR COMPRESSOR NO. 1 circuit breaker (figure 4, item 1).

   b. AIR COMPRESSOR NO. 2 circuit breaker (figure 4, item 2).

8. Check that CA-47 STG AIR TK DR (figure 1, item 8) and CA-46 STG AIR TK DR valves (figure 1, item 9) are CLOSED.

9. CLOSE valves CA-50 AUTO DR (figure 1, item 6) and CA-49 AUTO DR (figure 1, item 7).

10. CLOSE valves CA-11 STG AIR TK INL (figure 1, item 4) and CA-12 STG AIR TK INL (figure 1, item 5).

11. CLOSE CA-1 and CA-2 COV-COMPR DISCH valves (figure 2, item 3) and CA-87 and CA-88 COV-COMPR DISCH valves (figure 2, item 4).

12. Check that CA-89 and CA-90 COV-COMPR DISCH valves (figure 2, item 1) and CA-93 andCA-94 MOISTURE SEP DR valves (figure 2, item 2) are CLOSED.

13. CLOSE valves CA-4 STG AIR TK OUT (figure 1, item 1) and CA-3 STG AIR TK OUT (figure 1, item 2) at the starting air receivers (figure 1, item 3).

END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
OPERATION UNDER UNUSUAL CONDITIONS

INITIAL SETUP:

Materials/Parts:
Tag, Danger (Item 6, Table 1, WP 0033 00)

References:
FM 55-502
WP 0005 00

Personnel Required:
Two Watercraft Engineers, 88L

SECURITY MEASURES FOR ELECTRONIC DATA

No electronic data is used or stored in the compressed air system.

UNUSUAL ENVIRONMENT/WEATHER

The air compressors may only be operated when the ambient temperature in AMS 1 is between 32 and 104 °F (0 and 40 °C). If the temperature is above this range, ventilate the space until the temperature falls into the operating range. If the temperature is below this range, operate the space heater until the temperature rises into this range.

EMERGENCY PROCEDURES

OPERATION WITH ONE COMPRESSOR

If one air compressor has failed, or if the compressor needs to be taken out of service for maintenance, the LT can operate with only one compressor. Recovery times will be much longer, but normal operation will be possible in all other respects.

SYSTEM SECURED

NOTE

If single-compressor operation is desired, and both compressors are secured, follow the procedure below.

1. Perform the system startup as detailed in WP 0005 00 with the following exceptions:

   a. On the out-of-service compressor, CLOSE valve CA-1 or CA-2 COV COMPR DISCH (figure 1, item 1) and valve CA-87 or CA-88 COV-COMPR DISCH (figure 1, item 2). Lock out and tag out the valves (FM 55-502).

   b. CLOSE the unloader cutoff valve CA-98 or CA-99 (figure 2, item 1 or 2) for the out-of-service compressor. Lock out and tag out the valves (FM 55-502).

   c. At the 440V power panel No. 4, turn OFF the circuit breaker (figure 3, item 1 or 2) for the out-of-service compressor. Lock out and tag out the valves (FM 55-502).

2. The compressed air system may now be operated with the remaining compressor.

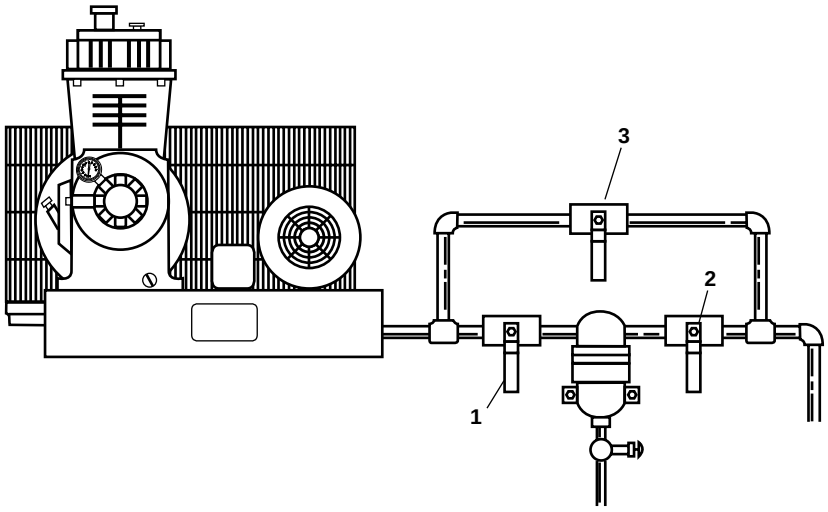


Figure 1. Dryer and Valves

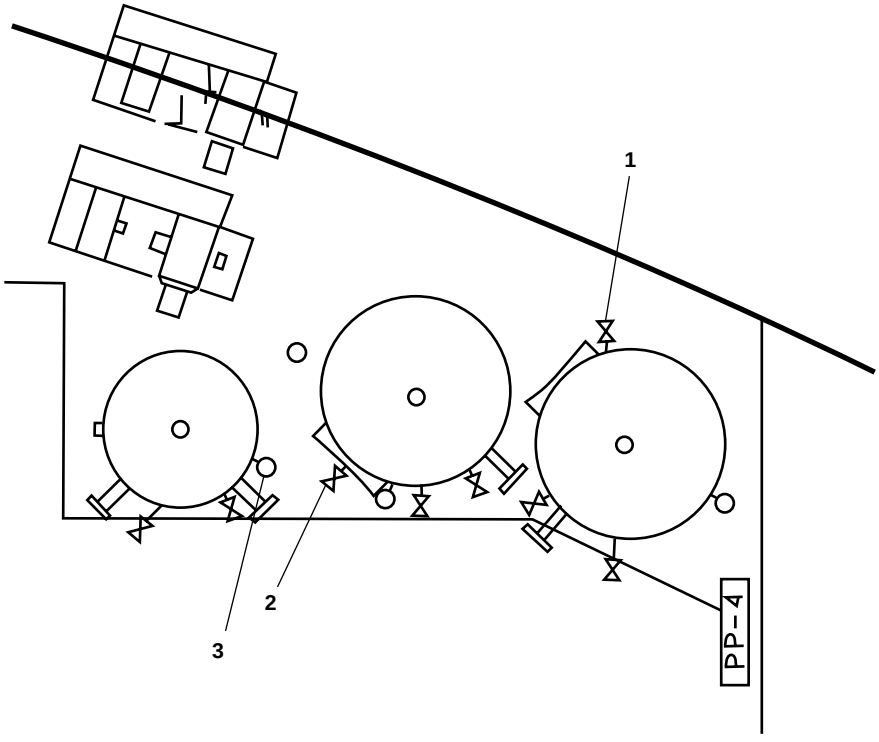


Figure 2. Compressed Air System Valve Locations

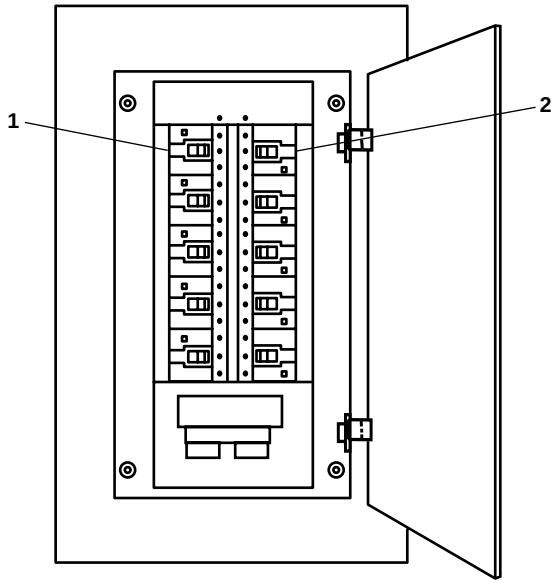


Figure 3. 440V Power Panel No. 4

SYSTEM ALREADY RUNNING

NOTE

If a compressor fails while the compressed air system is operating, follow the procedure below.

1. Set the AUTO/MANUAL switch (figure 4, item 1) on the failed compressor's motor controller to MANUAL.

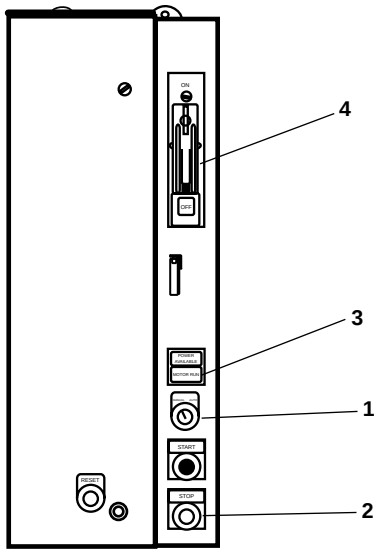


Figure 4. Air Compressor Motor Controller

2. Press the STOP pushbutton (figure 4, item 2) and observe that the MOTOR RUN indicator light (figure 4, item 3) goes out.

3. Turn OFF the main disconnect switch (figure 4, item 4).

4. CLOSE valve CA-1 or CA-2 COV-COMPR DISCH (figure 1, item 1) and valve CA-87 or CA-88 COV-COMPR DISCH (figure 1, item 2) for the failed compressor.

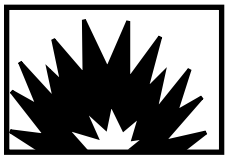
5. CLOSE the unloader cutoff valve CA-98 or CA-99 (figure 2, item 1 or 2) for the failed compressor.

6. Lock out and tag out (FM 55-502) the valves and switches affected in steps 3-5.

OPERATION WITH FAILED SHIP'S SERVICE PRESSURE REDUCING VALVE

1. CLOSE valves CA-40 SVCE AIR TK INL (figure 5, item 1) and CA-39 SVCE AIR TK INL (figure 5, item 2). Lock out and tag out (FM 55-502).

WARNING



Do not overpressurize the ship's service air receiver. Overpressurization can cause catastrophic, explosive failure, with the potential for death or serious injury to personnel.

2. Have one crewmember slowly OPEN valve CA-41 BYP RDC STA (figure 5, item 3) while another monitors the ship's service air pressure gauge (figure 2, item 3).

3. When the ship's service air pressure approaches 125 PSI (8.6 bar), begin to CLOSE valve CA-41 BYP RDC STA (figure 5, item 3). The valve must be fully closed before the ship's service air pressure reaches 125 PSI (8.6 bar).

4. Continue to monitor the ship's service air pressure and repeat steps 2 and 3 above as required to maintain adequate pressure for vessel operation.

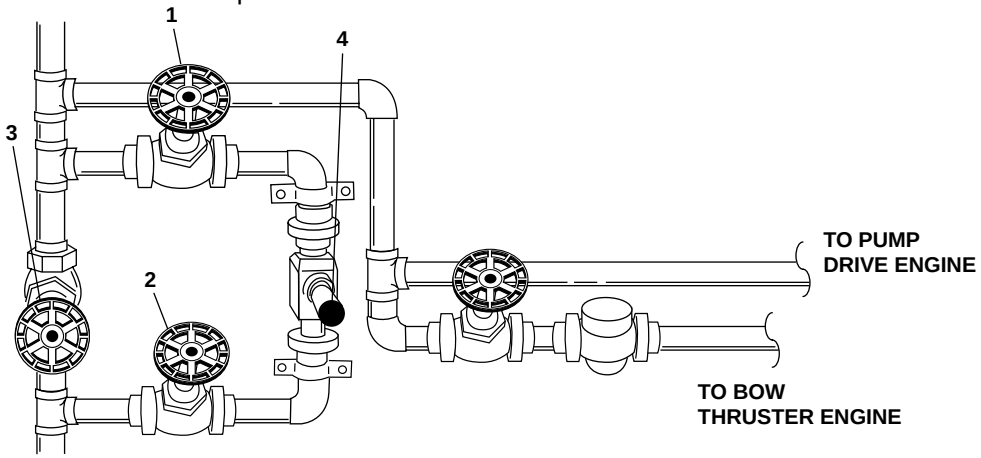


Figure 5. Ship's Service Air Pressure Reducing Valve Bypass Valve

BYPASSING / NOT USING AIR DRYERS

⚠ CAUTION

Moisture occurs naturally in air lines as a result of compression. Moisture vapor in ambient air is concentrated when pressurized and condenses when cooled in downstream air piping. Failure to use air dryer may cause damage to downstream piping and equipment.

1. CLOSE valve CA-1 or CA-2 COV-COMPR DISCH (figure 1, item 1) for the affected dryer.
2. CLOSE valve CA-87 or CA-88 COV-COMPR DISCH (figure 1, item 2) for the affected dryer.
3. OPEN valve CA-89 or CA-90 COV-COMPR DISCH (figure 1, item 3) for the affected dryer.
4. The dryer is now bypassed.

END OF WORK PACKAGE

Chapter 3

Troubleshooting Procedures
for
Air Compressor

Inland and Coastal Large Tug (LT)

OPERATOR AND UNIT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
TROUBLESHOOTING INDEX

USE OF THE INDEX

Troubleshooting begins by identifying the equipment and the malfunction. Table 1 contains the operator troubleshooting procedures, and table 2 contains the unit troubleshooting procedures. The equipment list is contained in the left column of the tables, and the malfunctions are listed in the center column of the tables. Once the correct equipment and malfunction are located, look immediately to the right for the work package and procedure that correspond to the malfunction. After locating the appropriate work package and procedure, turn to that procedure, and follow the instructions in the paragraph that follows.

USE OF TROUBLESHOOTING PROCEDURES

Functional flow logic tree troubleshooting procedures are used for all troubleshooting procedures in this manual. In this troubleshooting style, a pill shaped symbol (figure 1) is used to depict the beginning or end point of a procedure. Decision points are depicted by diamond shaped symbols (figure 2). Action points, as well as warnings, cautions, and notes are contained in rectangular symbols (figure 3). Procedures that are too large for one page are joined together by the circular shaped connector symbols (figure 4). The connector symbol will denote which page and step to go to (or come from) on another page. Finally, when flowchart lines cross, the technician must ensure that the correct path is followed. Crossing lines (figure 5) indicate that the points connect. Lines that cross with a jump symbol in the center (figure 6) indicate that the points do not connect. The technician must correctly follow the arrows to complete the troubleshooting procedure.

Look for the pill shaped beginning symbol in the upper left corner of the procedure. This symbol should contain the identified malfunction or symptom. Starting from this point, follow the arrowed lines through the procedure. Remember that the diamond shaped symbols denote a decision step. At each of these points you will be required to make a decision and to follow the appropriate line for that decision. Continue to follow the arrowed lines through the procedure until the malfunction or symptom is corrected.

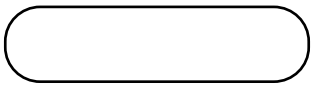


Figure 1. Pill Shaped Symbol

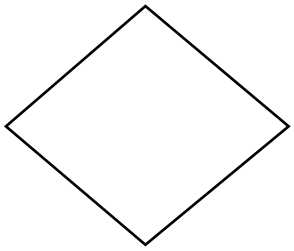


Figure 2. Diamond Shaped Symbol

Figure 3. Rectangle Shaped Symbol

Figure 4. Circular Shaped Symbol

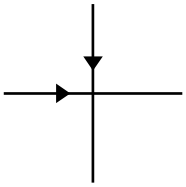


Figure 5. Crossed Lines Are Connected

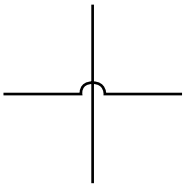


Figure 6. Crossed Lines Are Not Connected

Table 1. Operator Troubleshooting Procedures

Equipment	Symptom	Work Package, Procedure
Air Compressor	Compressor will not start	WP 0008 00, Procedure 1
	Ship's service air pressure is below 125 PSI (8.6 bar)	WP 0008 00, Procedure 3
	Ship's service air pressure is above 125 PSI (8.6 bar)	WP 0008 00, Procedure 4
	Starting air receivers will not pressurize to 250 PSI (17.2 bar)	WP 0008 00, Procedure 2

Table 2. Unit Troubleshooting Procedures

Equipment	Symptom	Work Package, Procedure
Air Compressor	Automatic drain does not drain	WP 0009 00, Procedure 14
	Automatic drain drains continuously	WP 0009 00, Procedure 15
	Compressor “knocks” during operation	WP 0009 00, Procedure 11
	Compressor loads and unloads excessively	WP 0009 00, Procedure 6
	Compressor lubricant appears milky	WP 0009 00, Procedure 12
	Compressor oil pressure low	WP 0009 00, Procedure 13
	Compressor overheats	WP 0009 00, Procedure 10
	Compressor vibrates excessively	WP 0009 00, Procedure 9
	Compressor will not run	WP 0009 00, Procedure 1
	Motor stalls or circuit breaker trips repeatedly	WP 0009 00, Procedure 7
	Ship’s service air pressure is above 125 PSI (8.6 bar)	WP 0009 00, Procedure 5
	Ship’s service air pressure is below 125 PSI (8.6 bar)	WP 0009 00, Procedure 4
	Starting air receivers pressurize above 250 PSI (17.2 bar)	WP 0009 00, Procedure 3
	Starting air receivers will not pressurize to 250 PSI (17.2 bar)	WP 0009 00, Procedure 2
	V-belt wears quickly or jumps off the sheave	WP 0009 00, Procedure 8

END OF WORK PACKAGE

OPERATOR MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
OPERATOR TROUBLESHOOTING PROCEDURES

INITIAL SETUP:

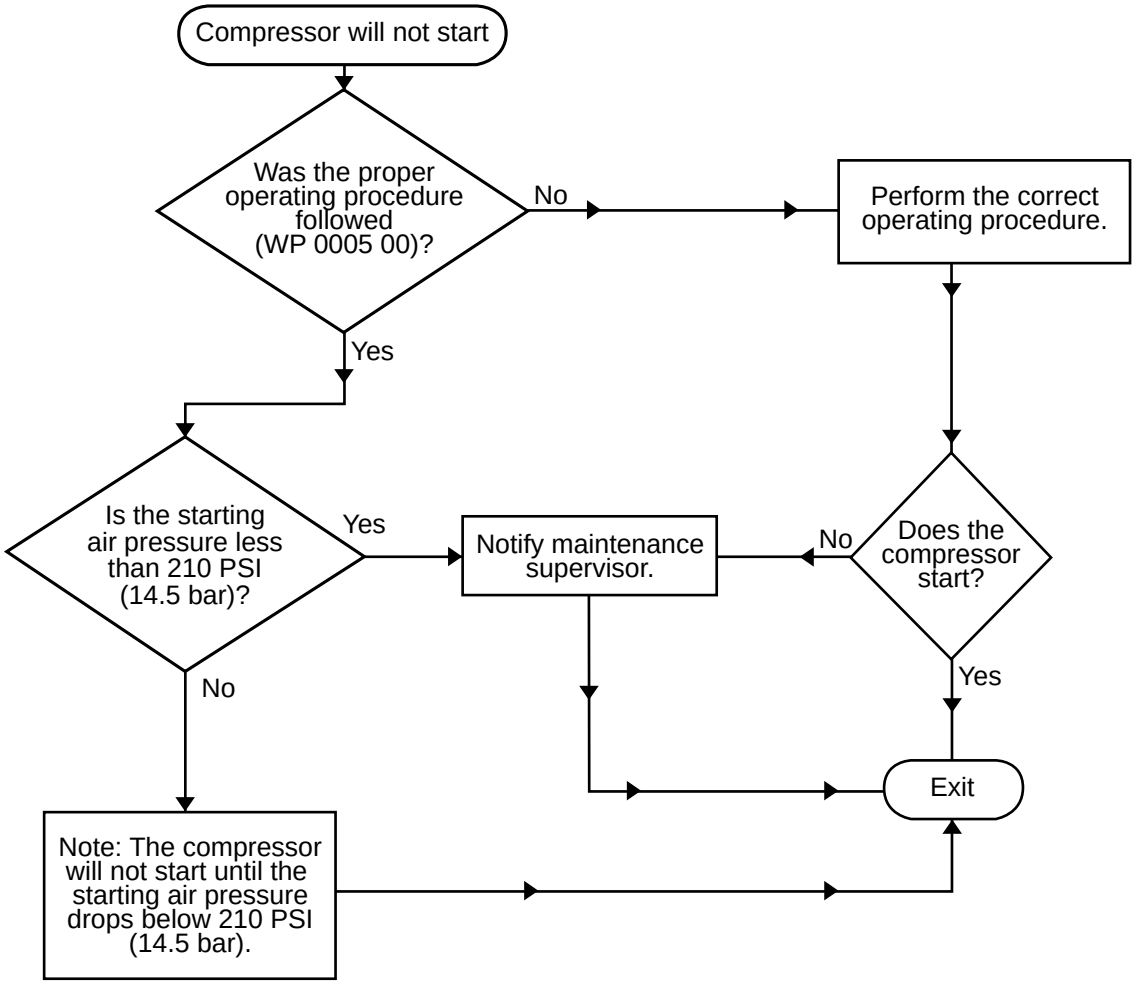
Personnel Required:
One Watercraft Engineer, 88L

References:
WP 0005 00
WP 0014 00

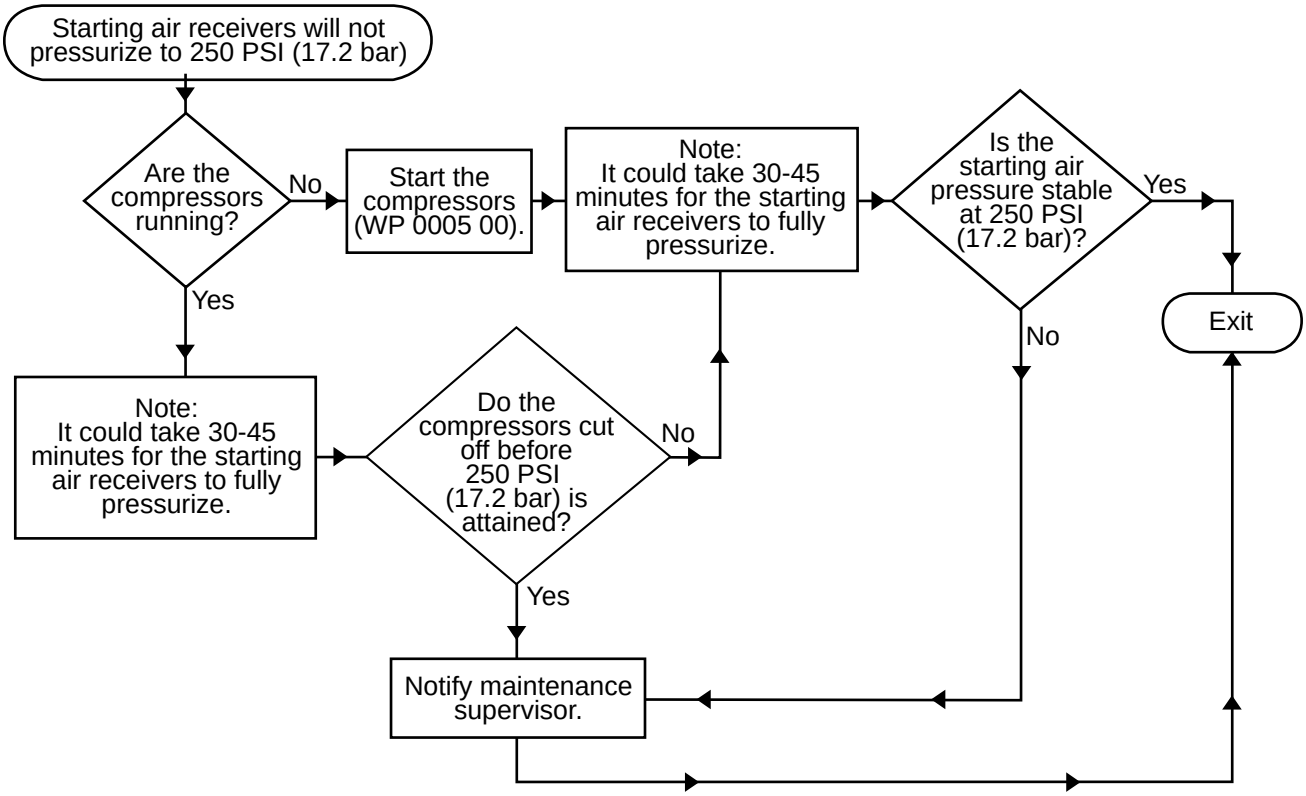
INTRODUCTION

The following troubleshooting procedures are included in this manual:

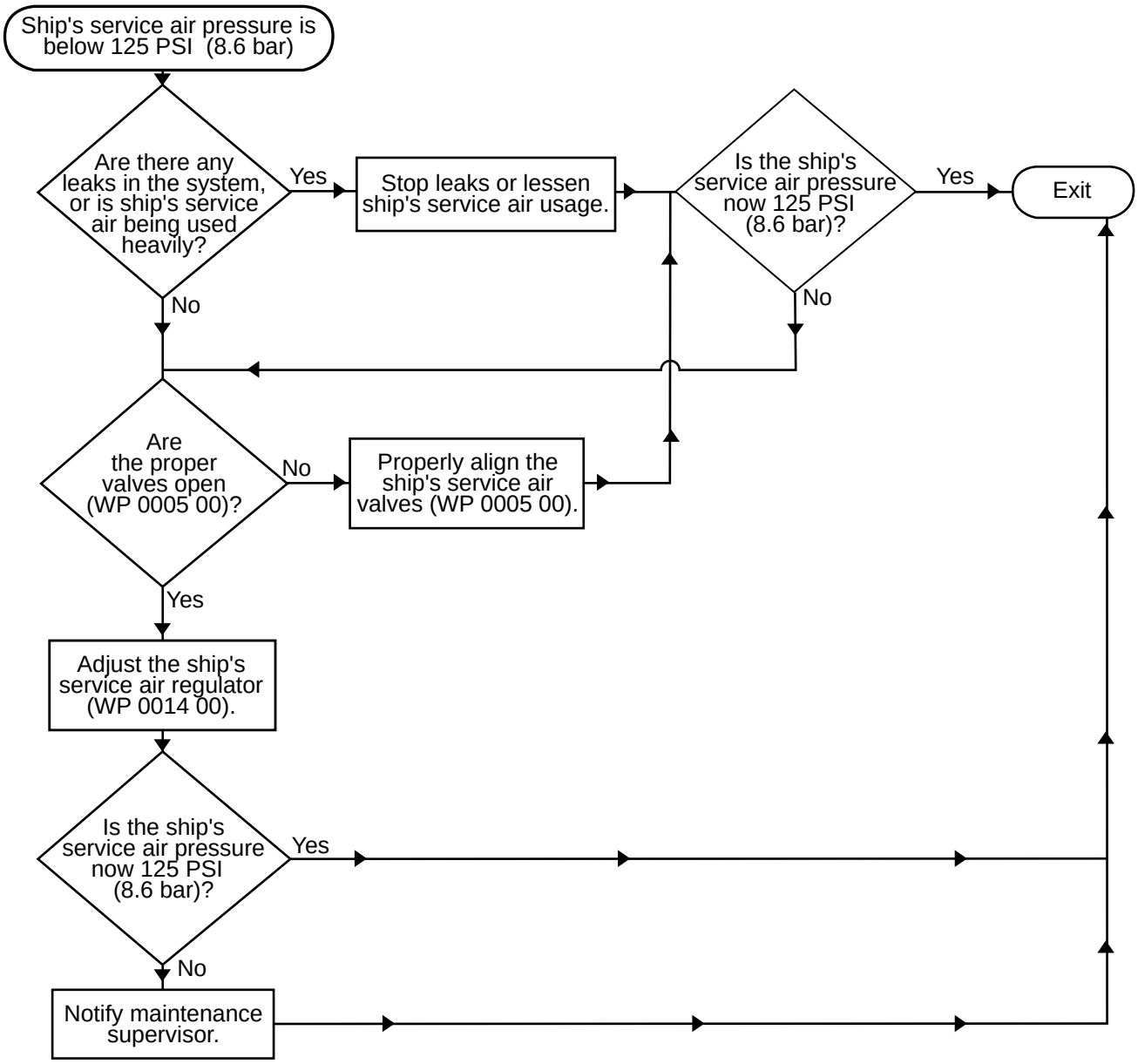
TROUBLESHOOTING PROCEDURES



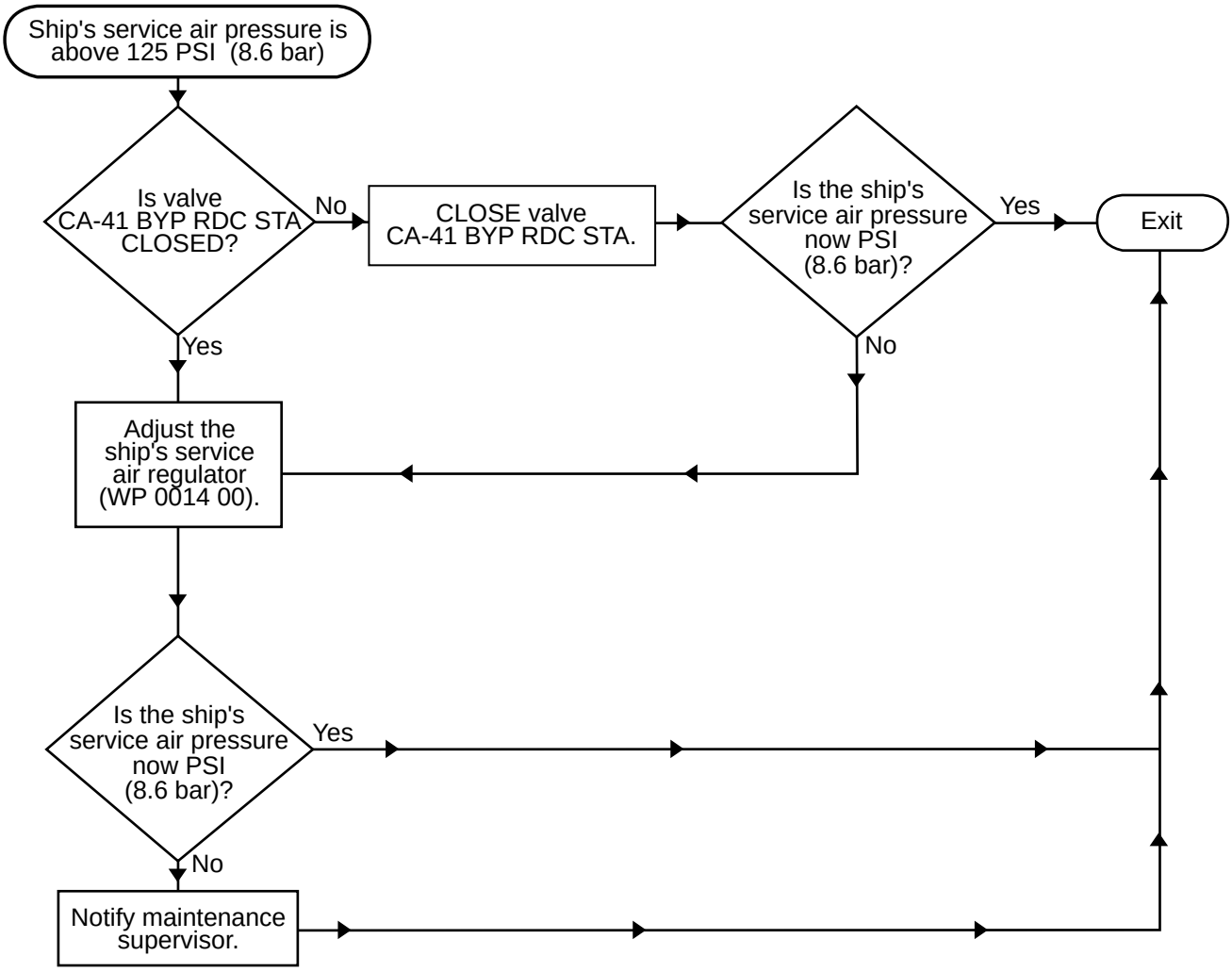
Procedure 1. Compressor Will Not Start



Procedure 2. Starting Air Receivers Will Not Pressurize To 250 PSI (17.2 bar)



Procedure 3. Ship's Service Air Pressure Is Below 125 PSI (8.6 bar)



Procedure 4. Ship's Service Air Pressure Is Above 125 PSI (8.6 bar)

END OF WORK PACKAGE

UNIT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
UNIT TROUBLESHOOTING PROCEDURES

INITIAL SETUP:

Tools and Equipment:

Tool Kit, General Mechanic's (Item 11, Table 3, WP 0032 00)
Multimeter (Item 6, Table 3, WP 0032 00)
Tool Kit, Electrician's (Item 10, Table 3, WP 0032 00)

Personnel Required:

Two Watercraft Engineers, 88L

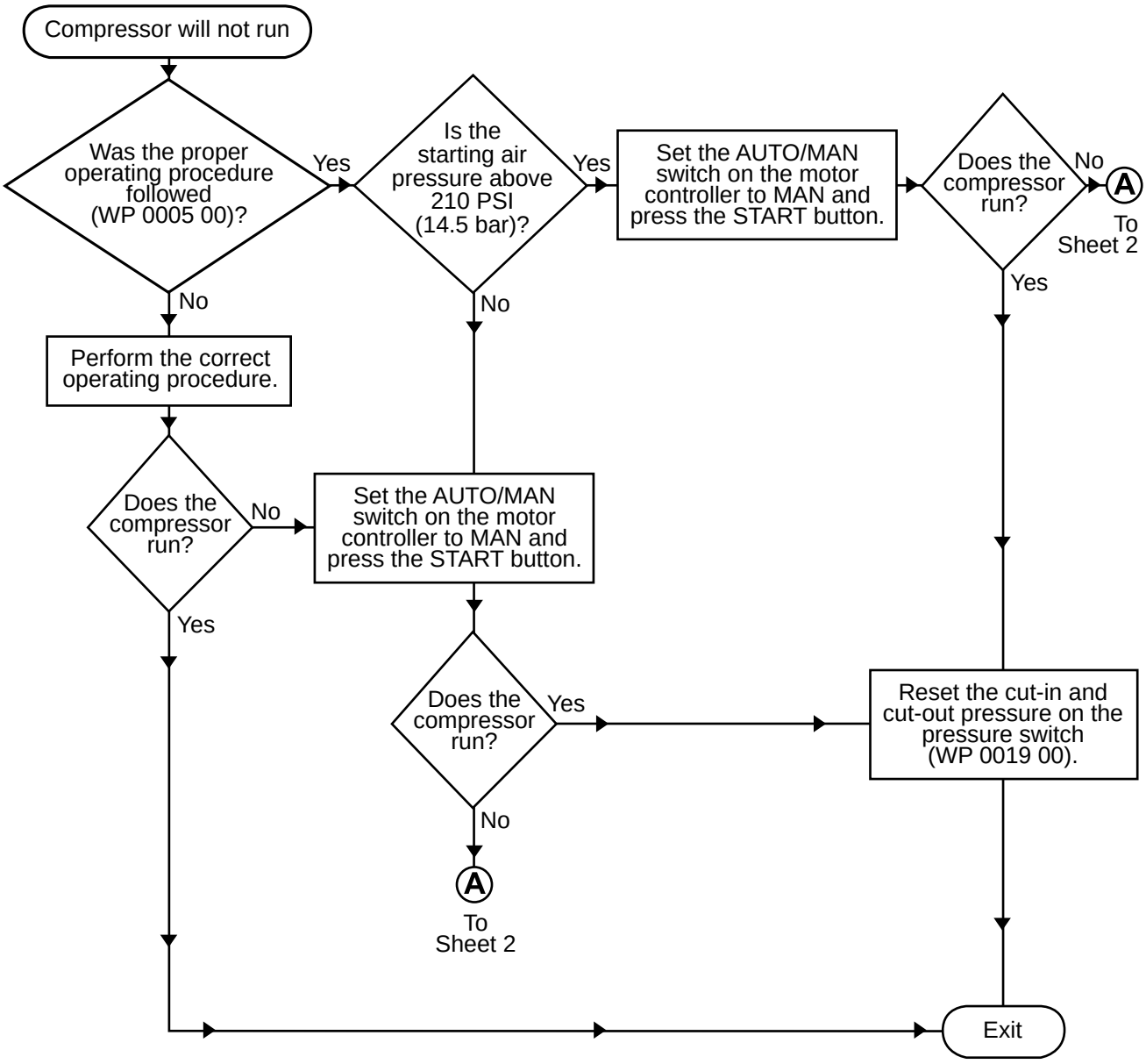
References:

FM 55-509
TM 55-1925-273-24&P
WP 0005 00
WP 0014 00
WP 0015 00
WP 0016 00
WP 0017 00
WP 0018 00
WP 0019 00
WP 0021 00
WP 0032 00

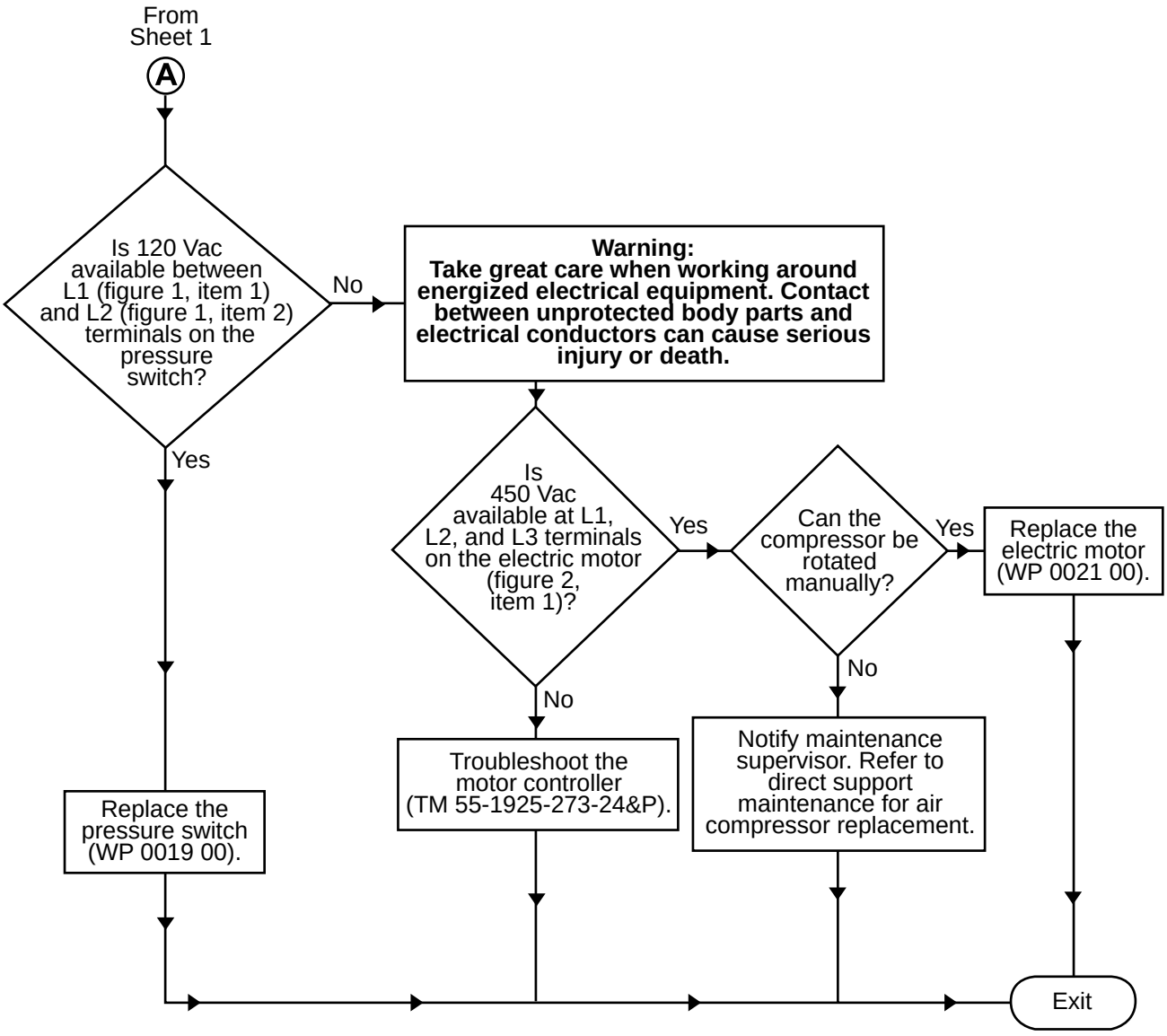
INTRODUCTION

The following troubleshooting procedures are included in this manual:

TROUBLESHOOTING PROCEDURES



Procedure 1. Compressor Will Not Run (Sheet 1 of 2)



Procedure 1. Compressor Will Not Run (Sheet 2 of 2)

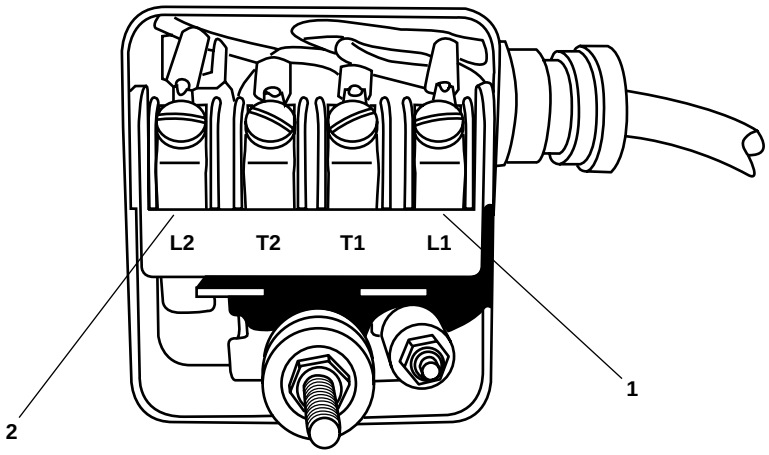


Figure 1. Pressure Switch

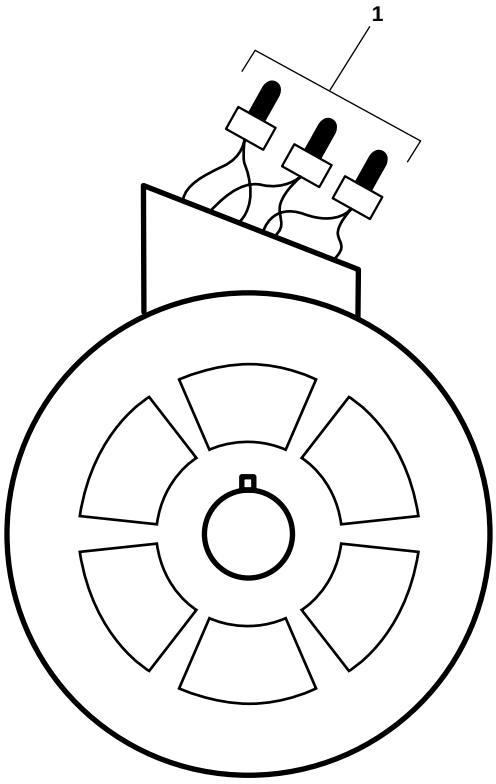
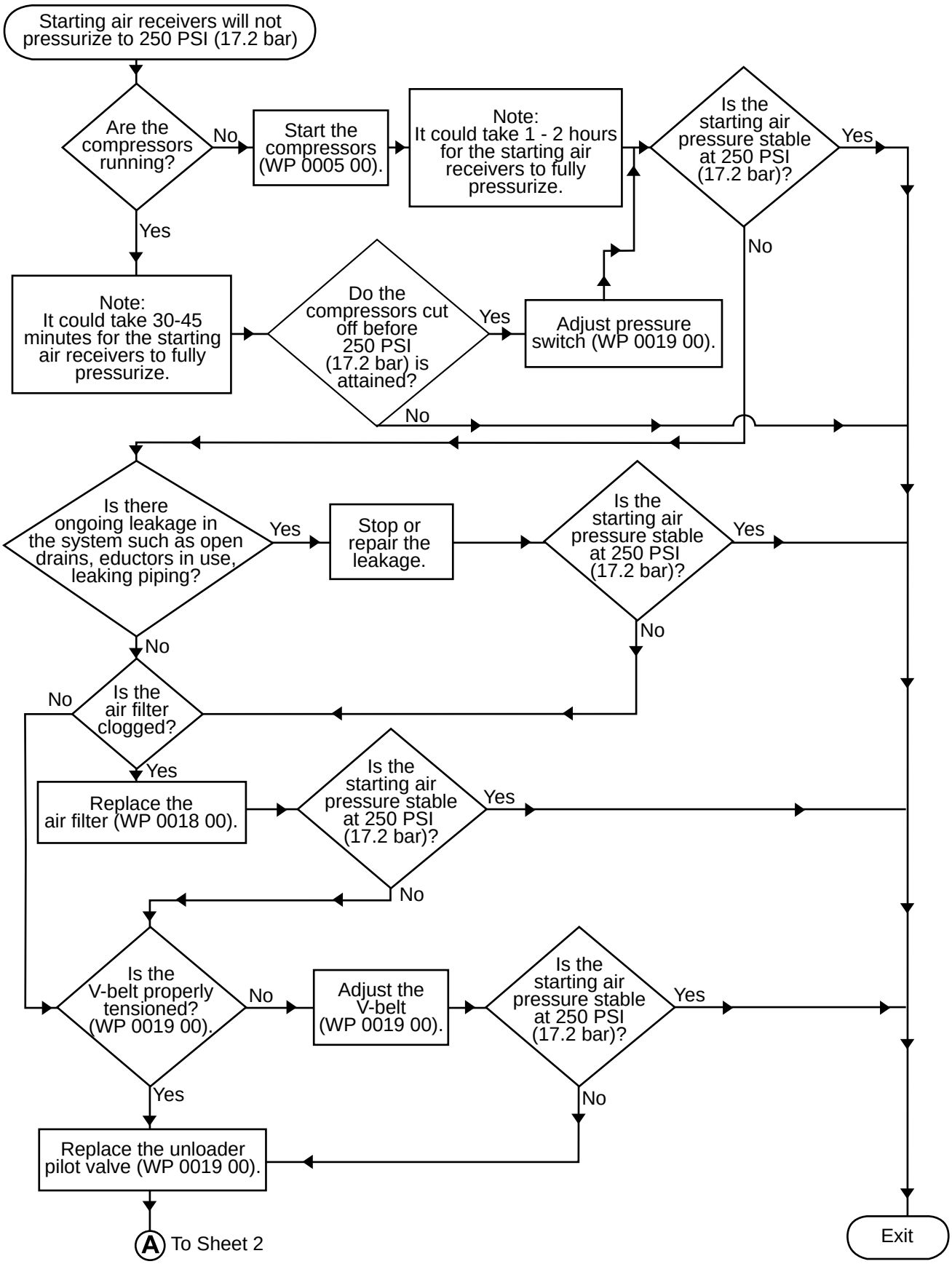
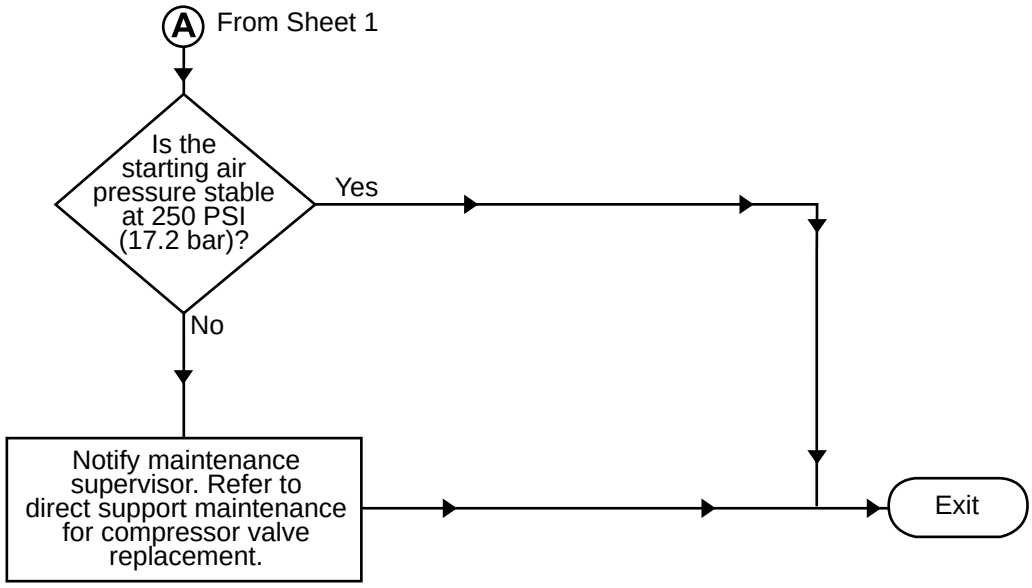


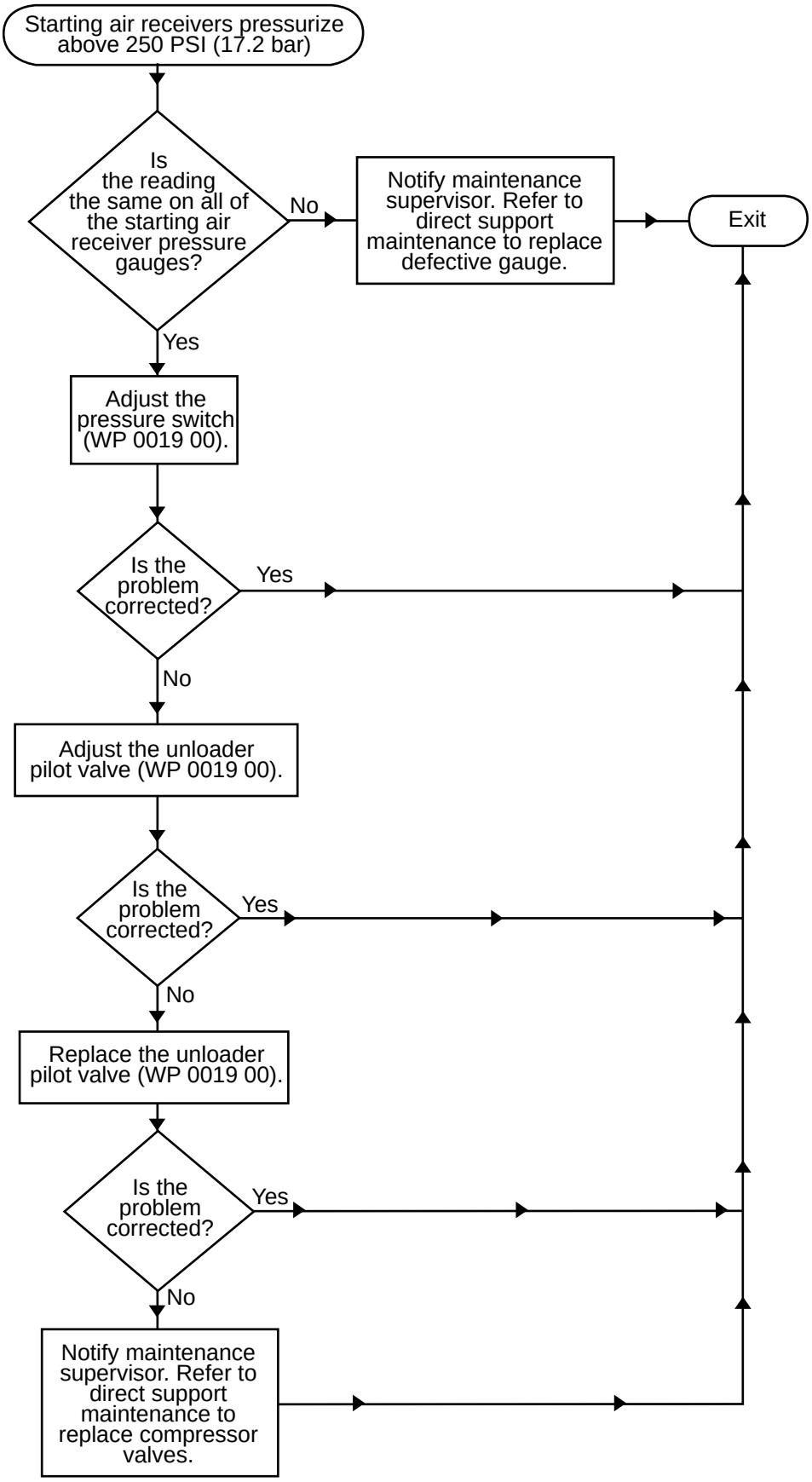
Figure 2. Motor Wiring



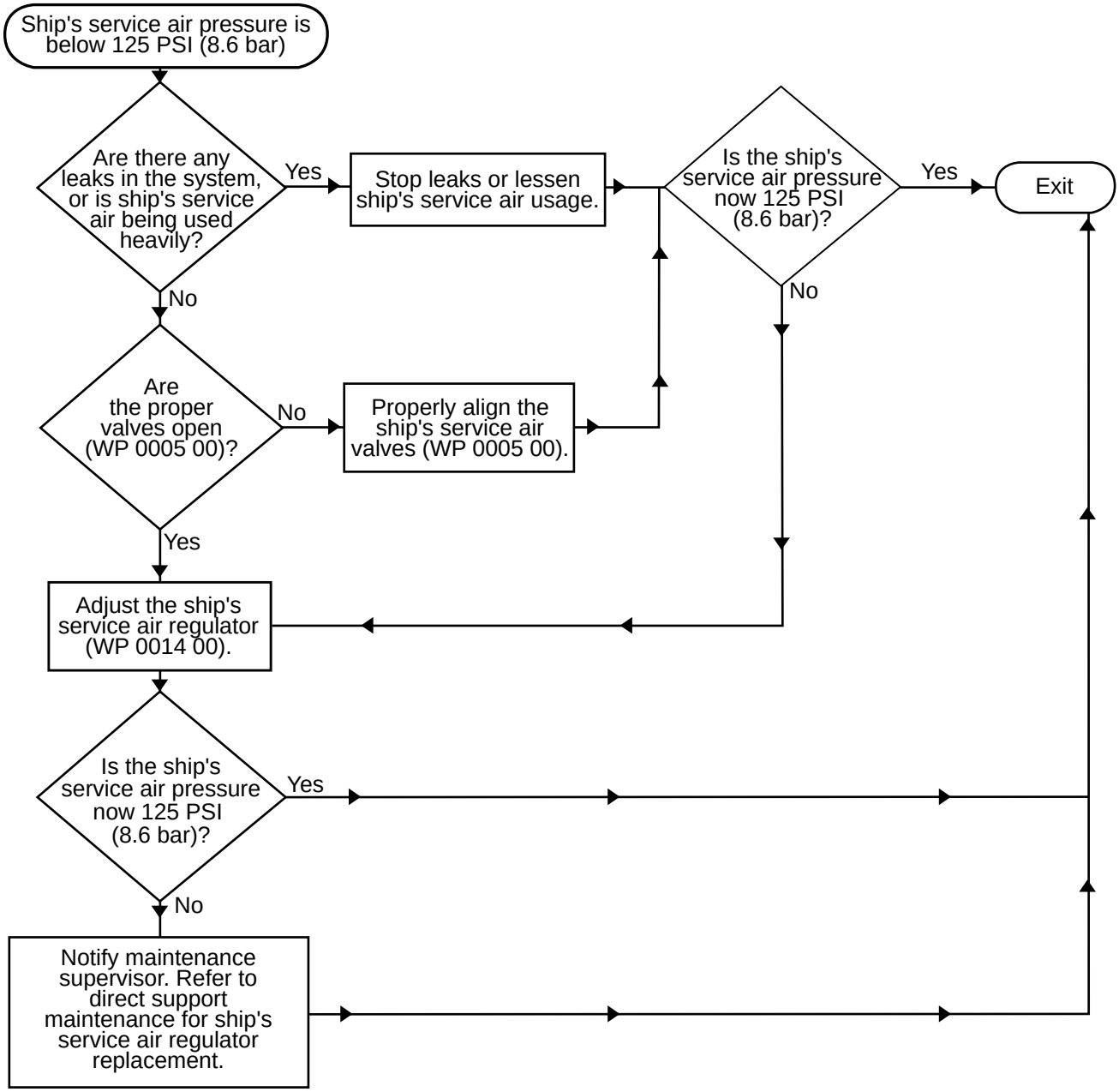
Procedure 2. Starting Air Receivers Will Not Pressurize To 250 PSI (17.2 bar) (Sheet 1 of 2)



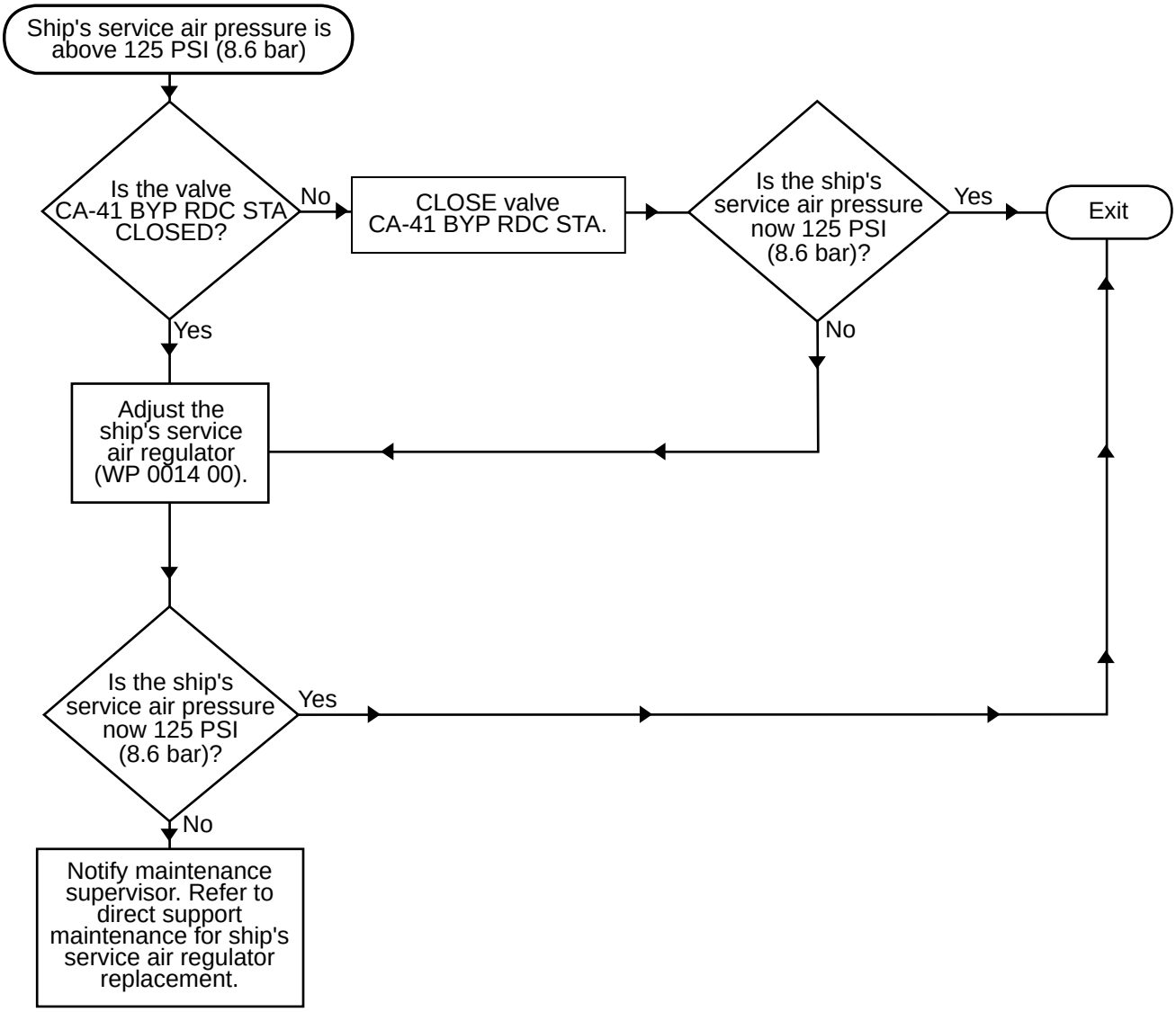
Procedure 2. Starting Air Receivers Will Not PressurizeTo 250 PSI (17.2 bar) (Sheet 2 of 2)



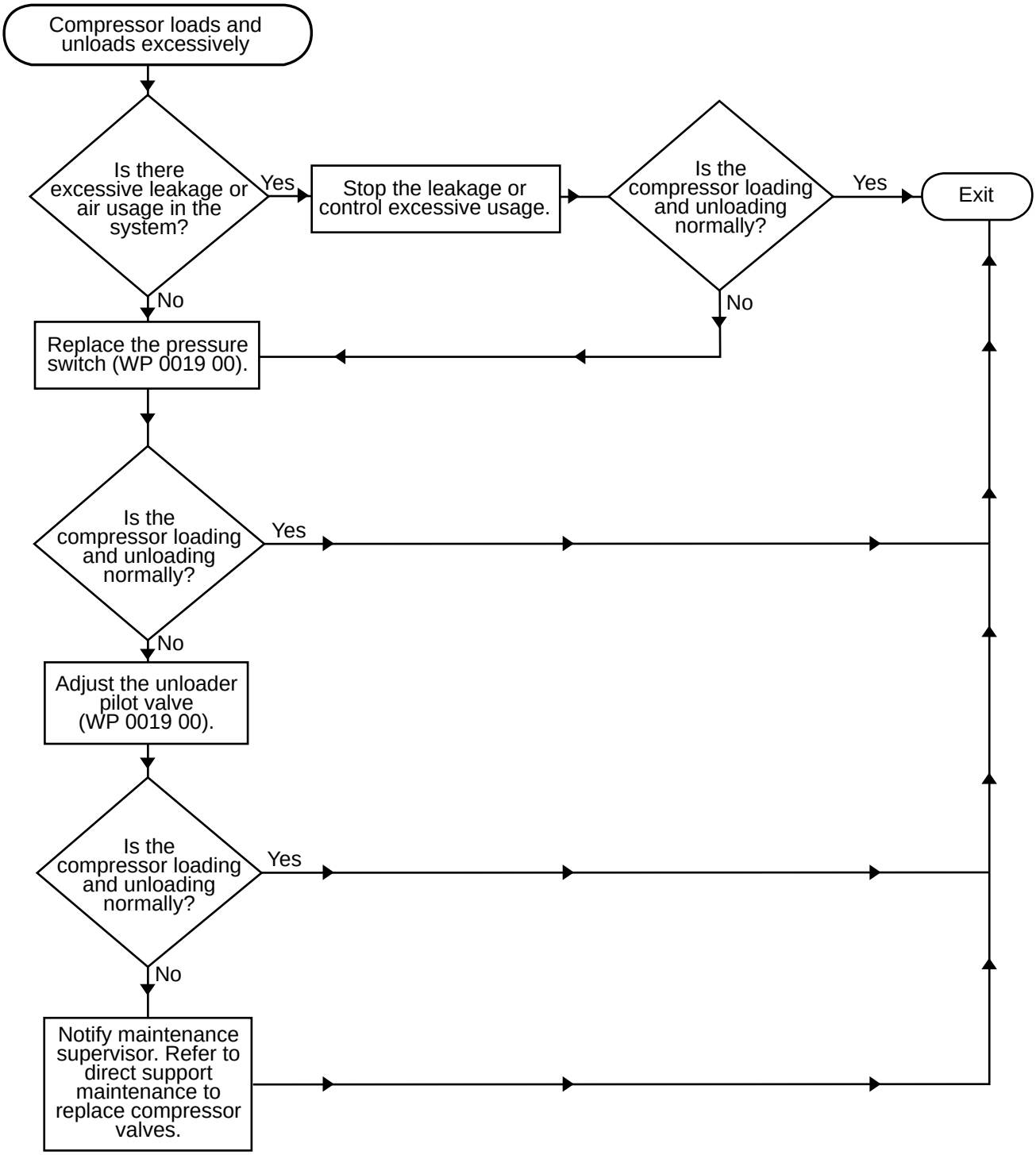
Procedure 3. Starting Air Receivers Pressurize Above 250 PSI (17.2 bar)



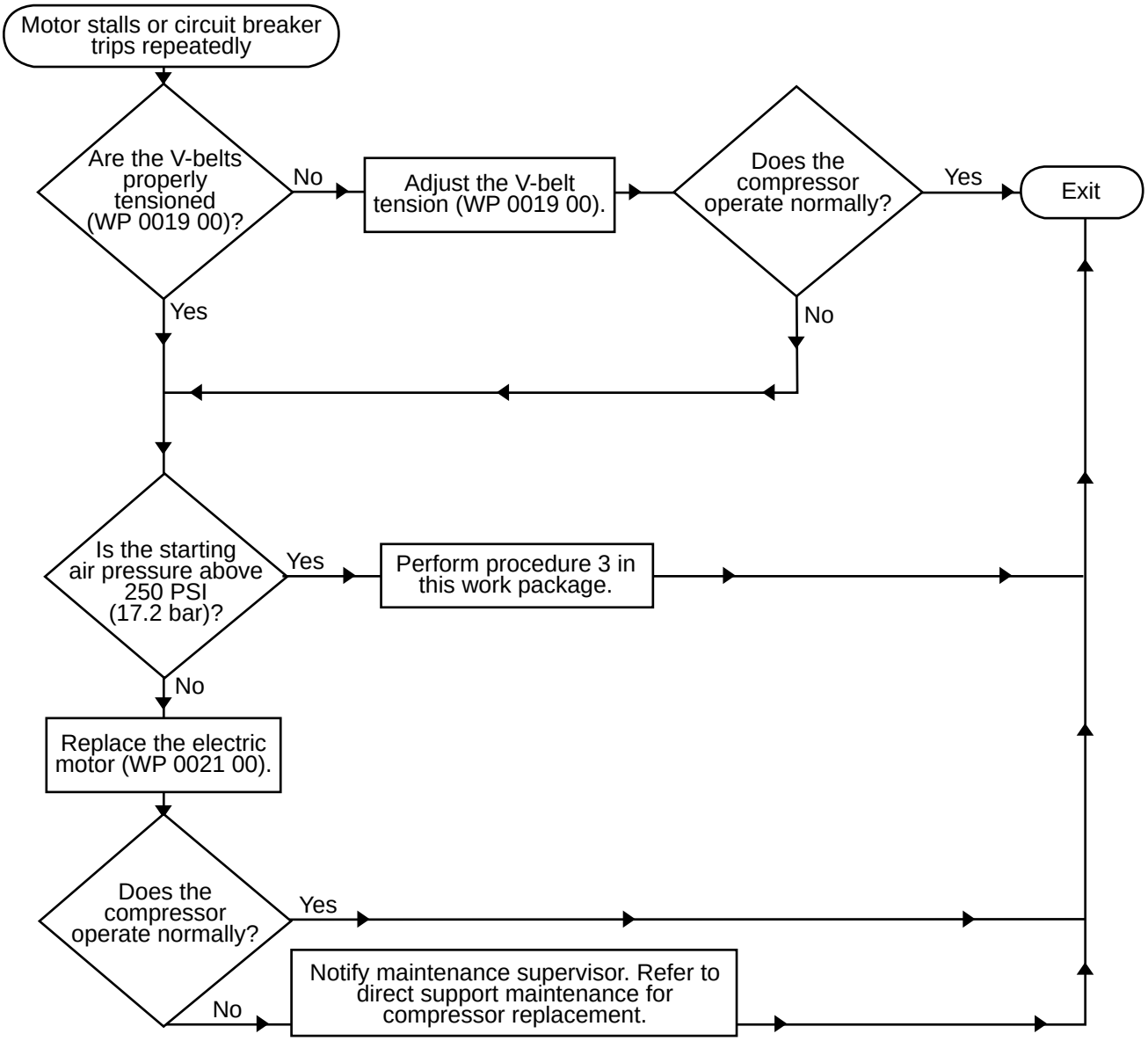
Procedure 4. Ship's Service Air Pressure Is Below 125 PSI (8.6 bar)



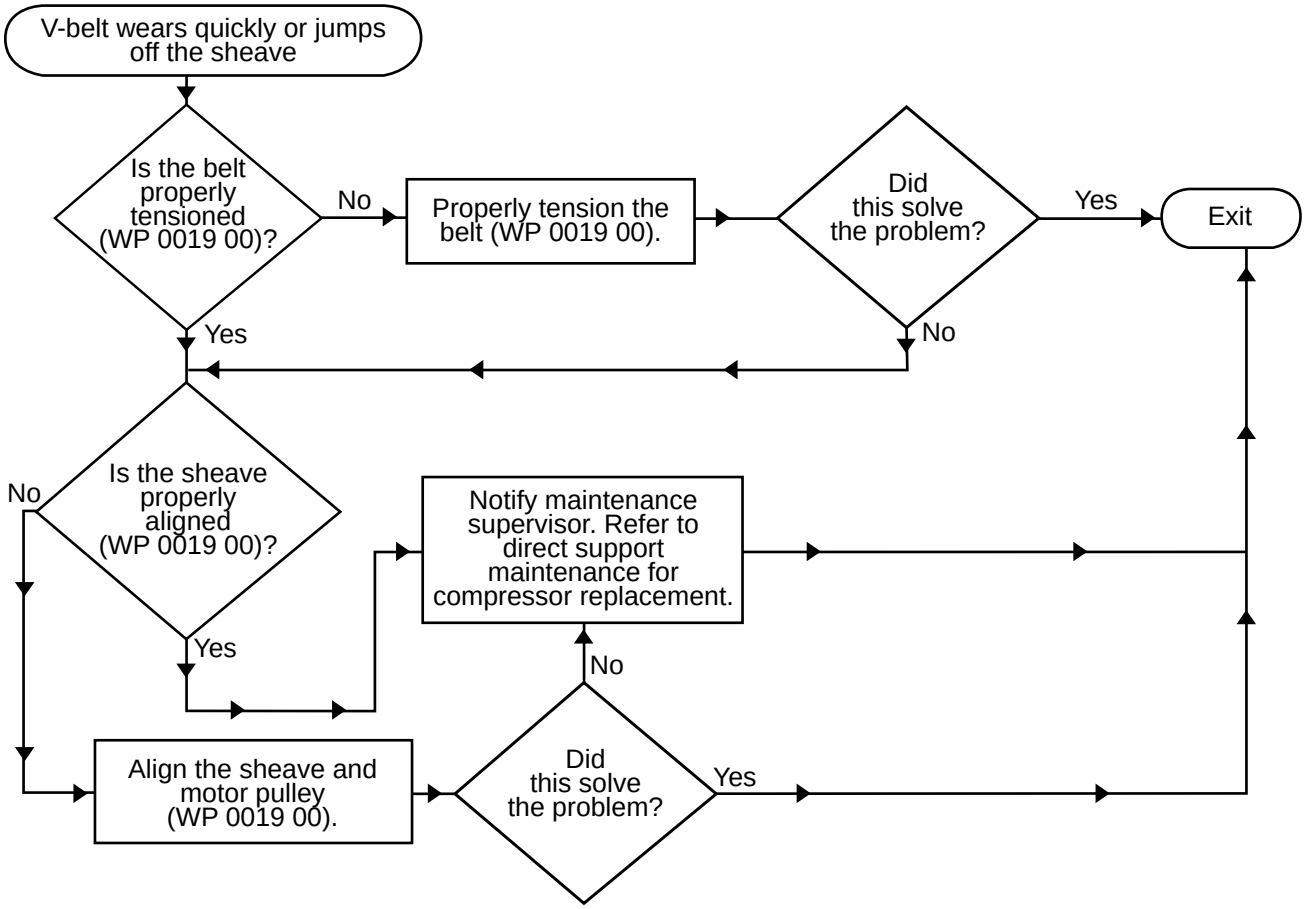
Procedure 5. Ship's Service Air Pressure Is Above 125 PSI (8.6 bar)



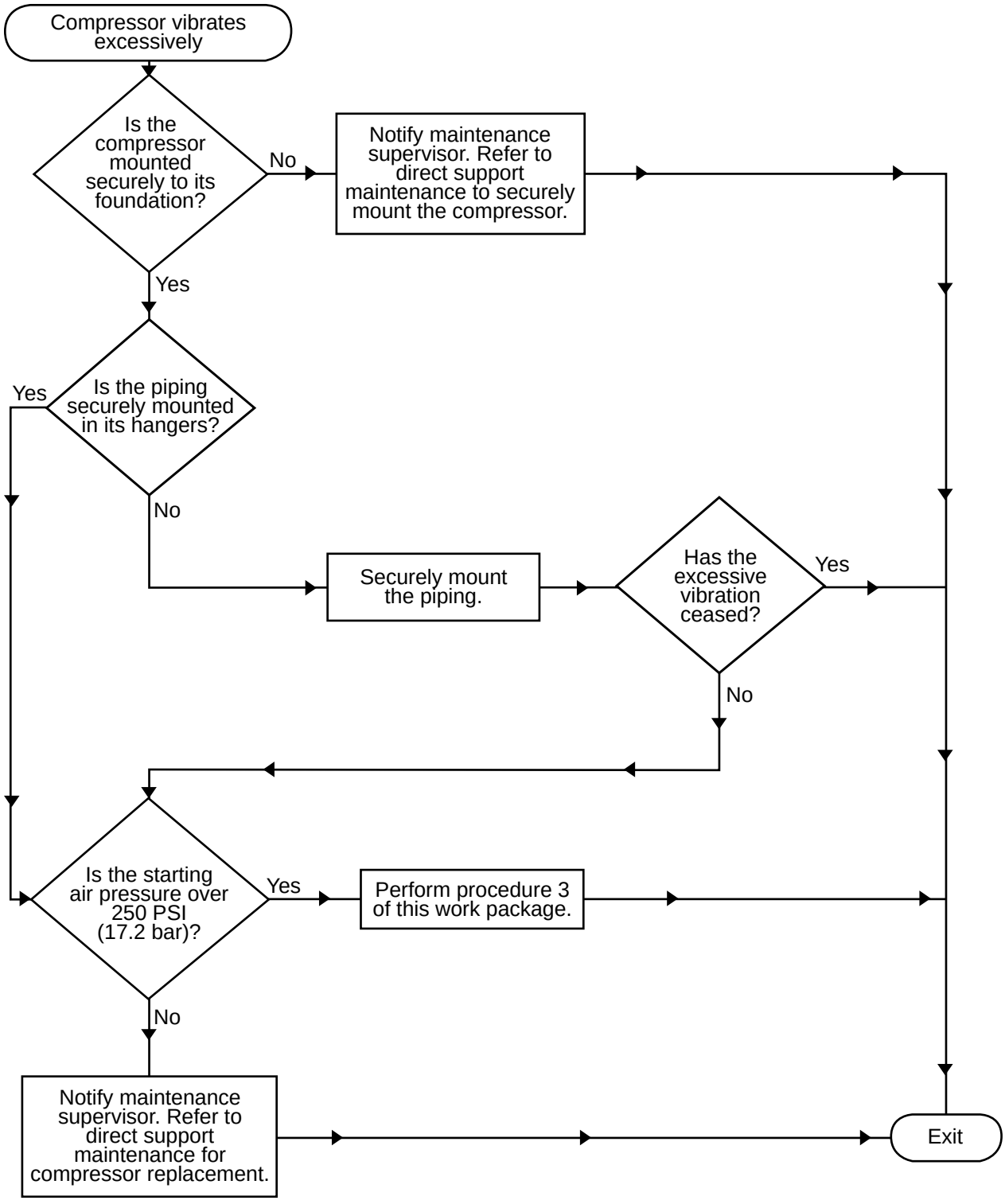
Procedure 6. Compressor Loads and Unloads Excessively



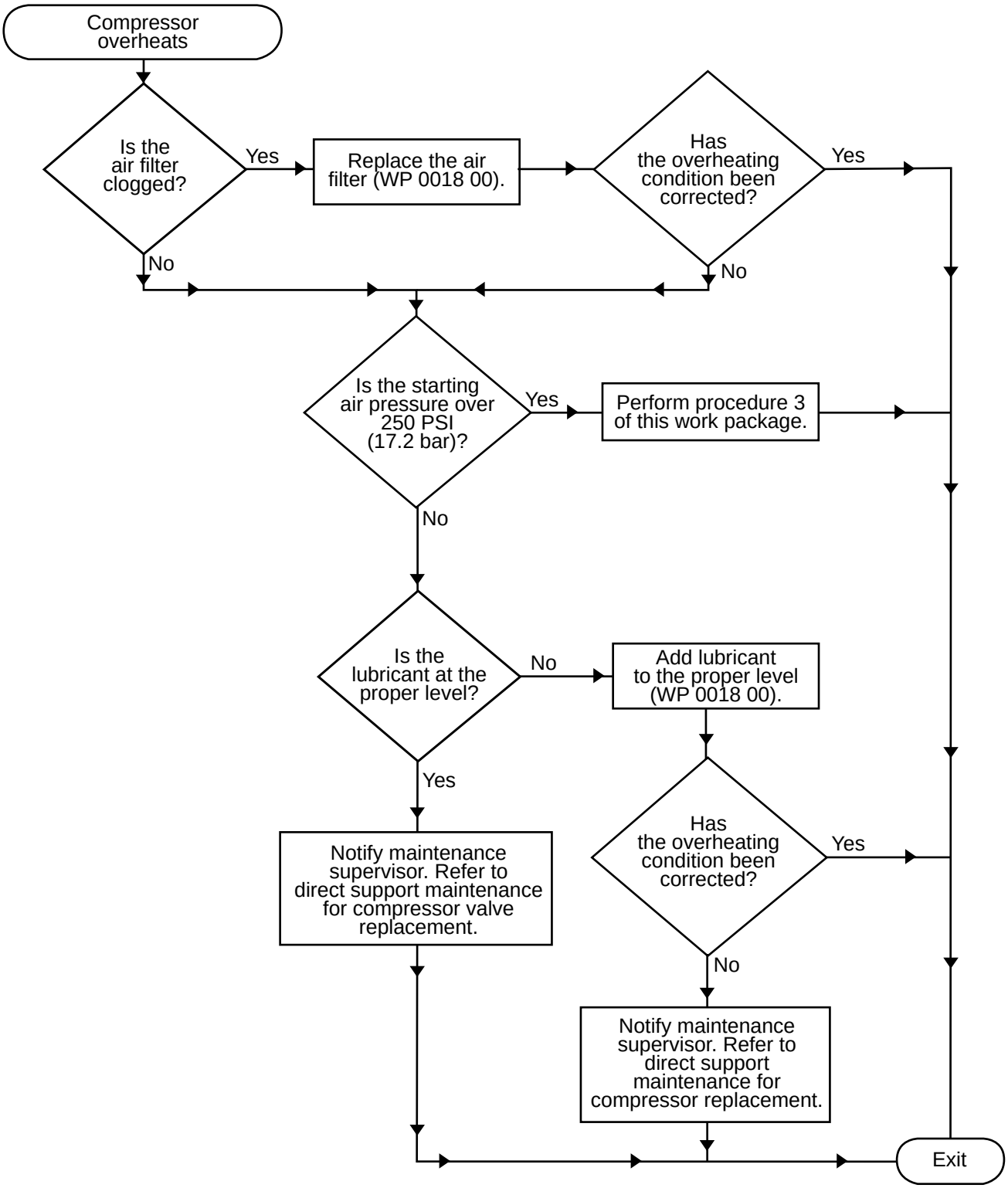
Procedure 7. Motor Stalls or Circuit Breaker Trips Repeatedly



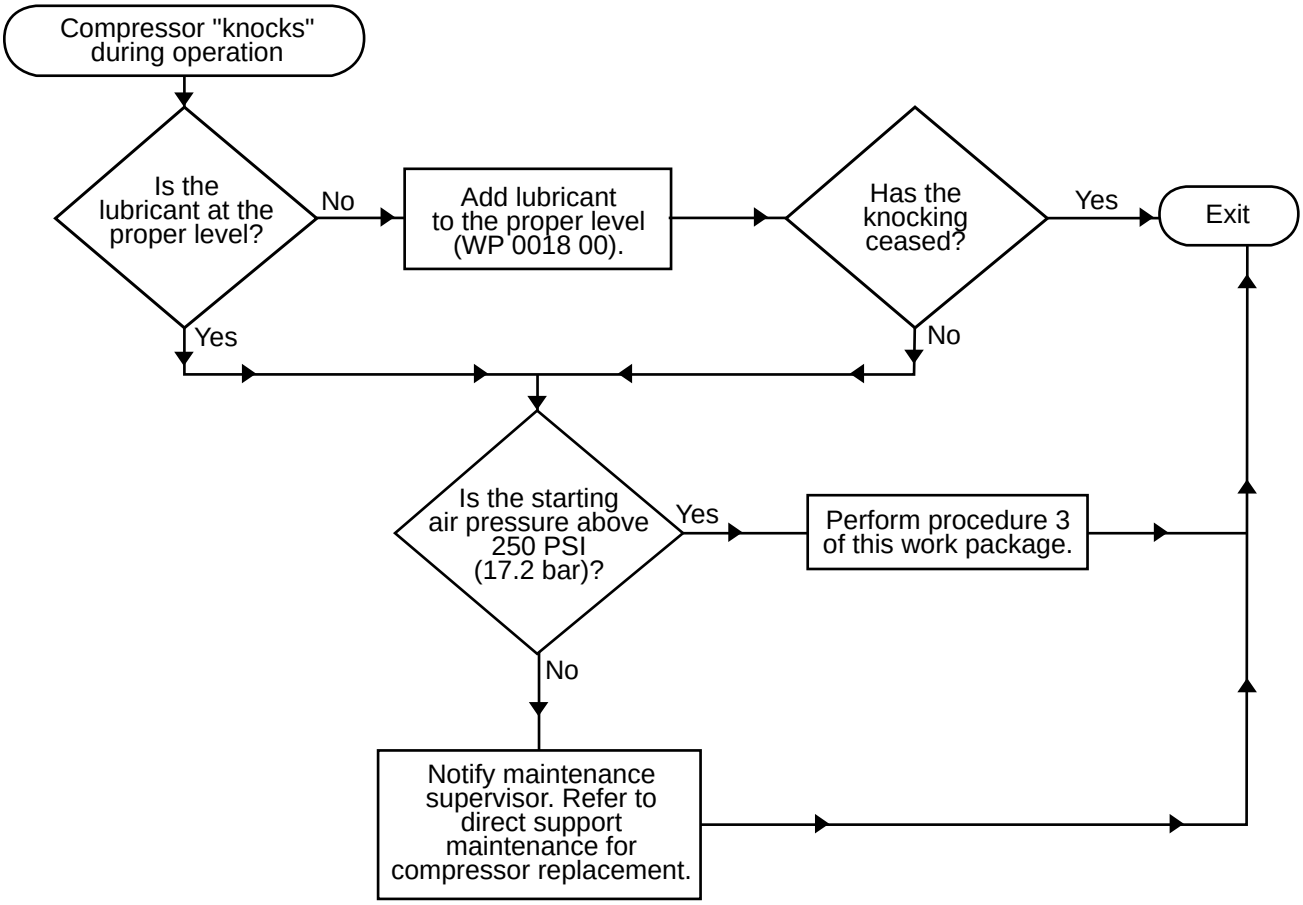
Procedure 8. V-belt Wears Quickly Or Jumps Off the Sheave



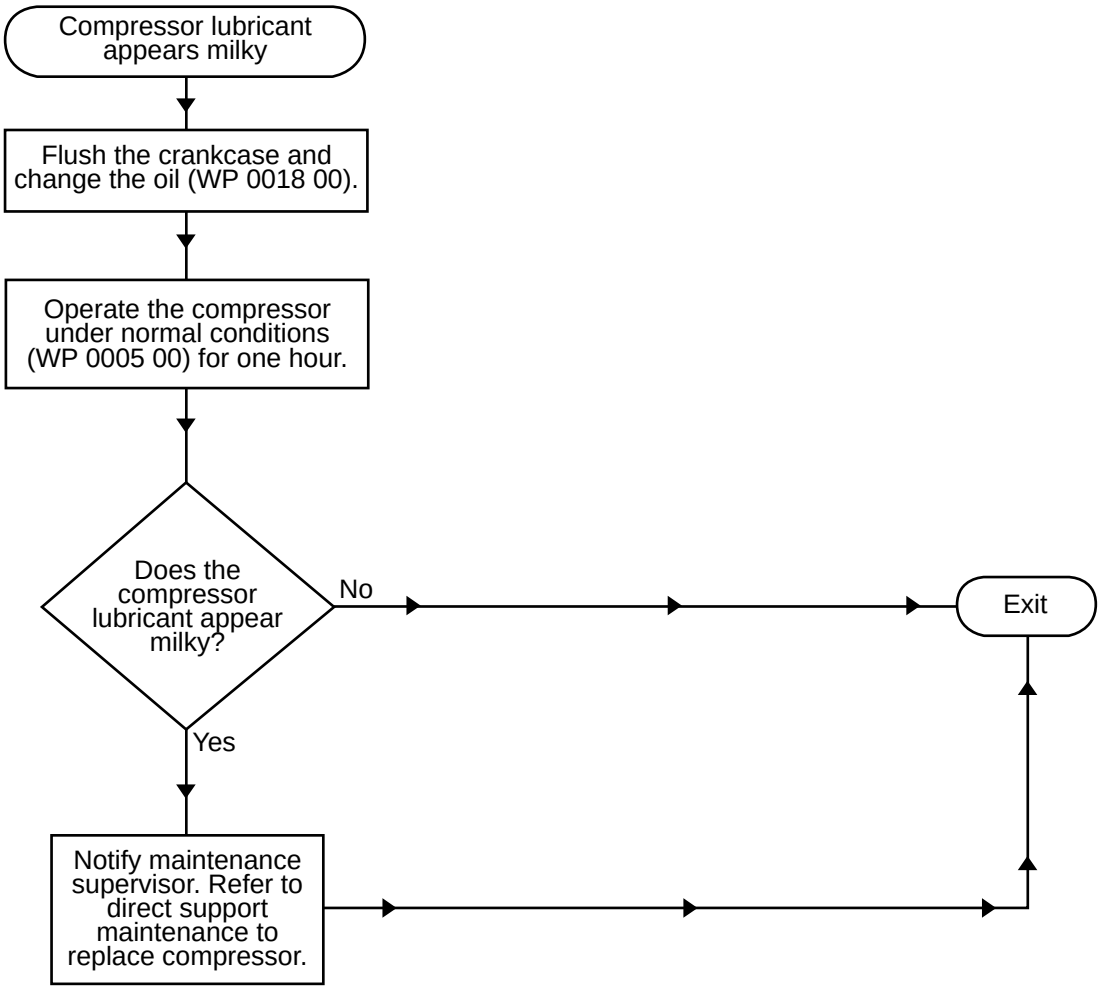
Procedure 9. Compressor Vibrates Excessively



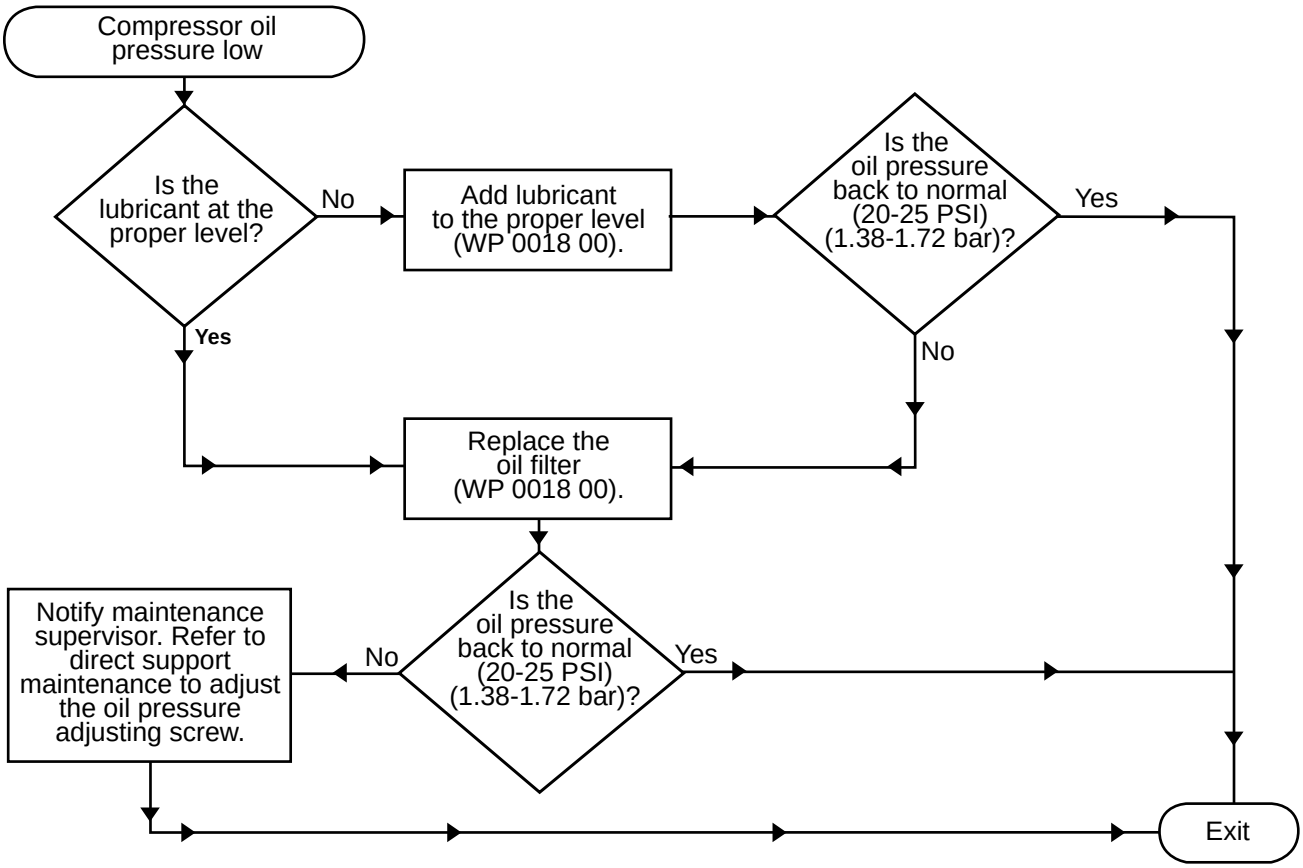
Procedure 10. Compressor Overheats



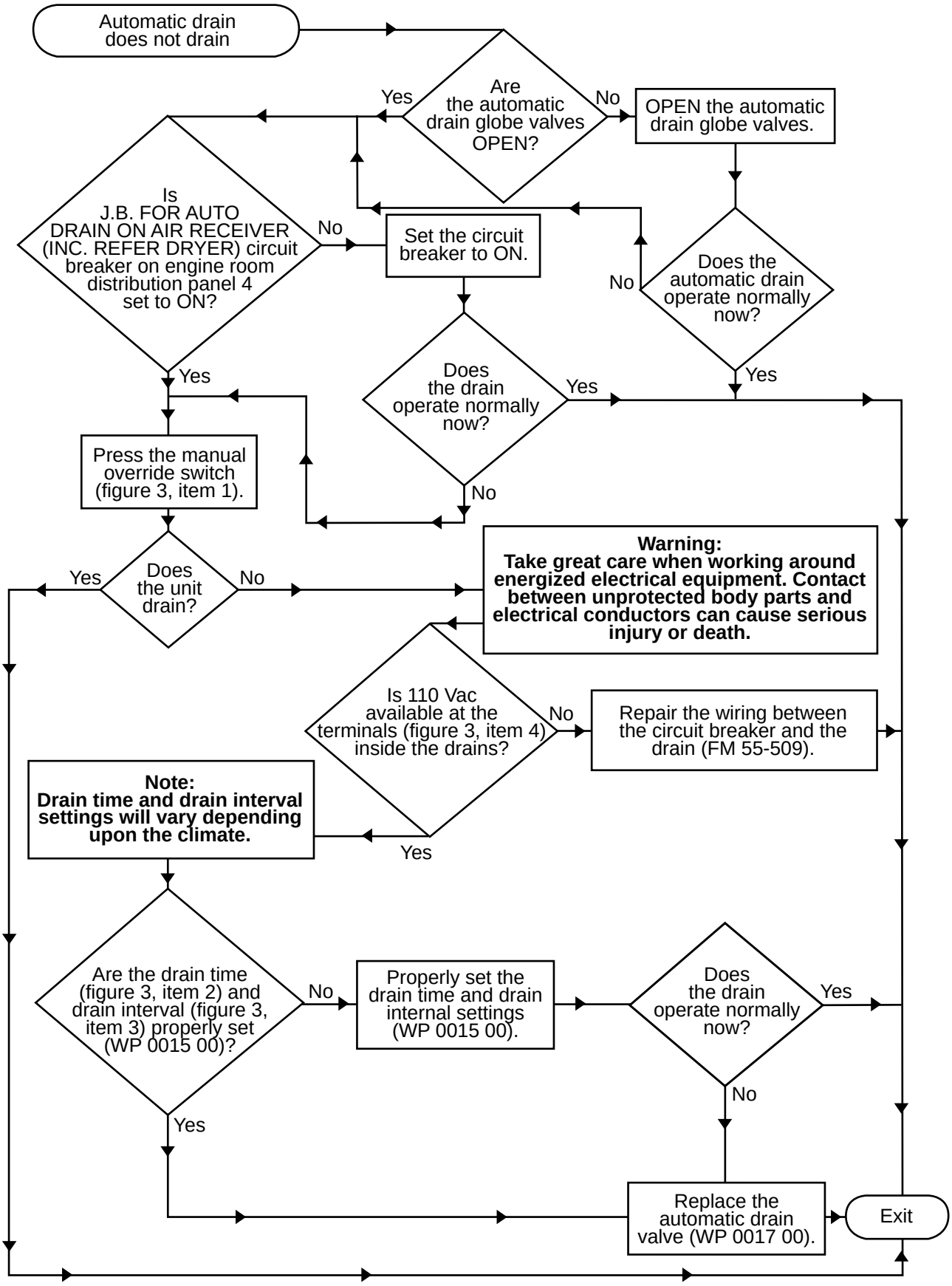
Procedure 11. Compressor "Knocks" During Operation



Procedure 12. Compressor Lubricant Appears Milky



Procedure 13. Compressor Oil Pressure Low



Procedure 14. Automatic Drain Does Not Drain

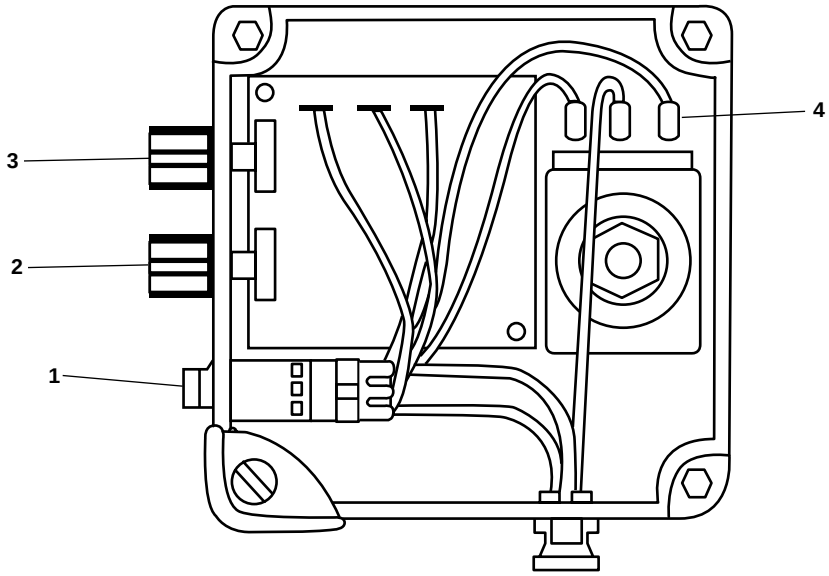
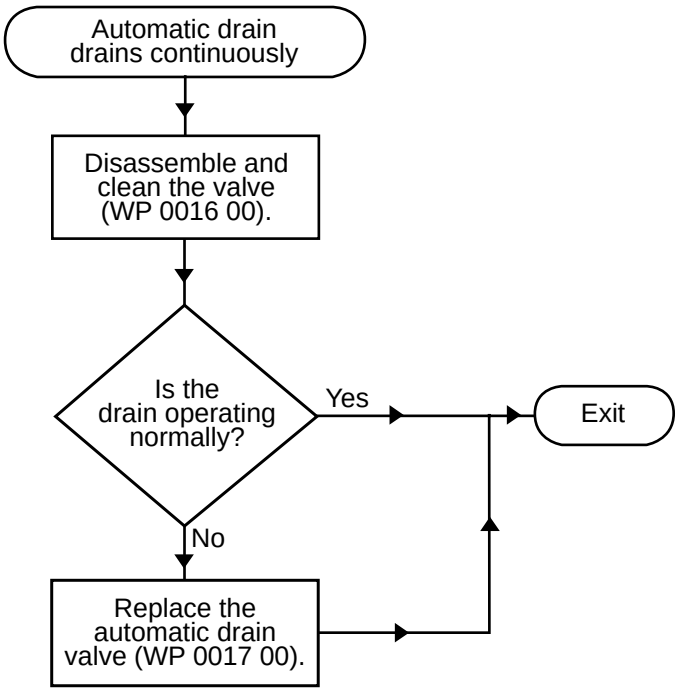


Figure 3. Automatic Drain Valve



Procedure 15. Automatic Drain Drains Continuously

END OF WORK PACKAGE

Chapter 4

Maintenance Instructions for Air Compressor

Inland and Coastal Large Tug (LT)

OPERATOR AND UNIT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
SERVICE UPON RECEIPT AND PREPARATION FOR STORAGE

INITIAL SETUP:

References:
TB 740-97-4
WP 0012 00
WP 0013 00

SERVICE UPON RECEIPT

SHELTER REQUIREMENTS

The compressed air system's air compressors must be kept dry to prevent damage to the units. Although the compressors are mounted in AMS 1, out of the weather, the compressors can still become wet during compartment cleaning or during service of other systems such as the hot water heaters. If there is a possibility that the compressors could become wet due to cleaning or equipment maintenance operations, secure the compressors and cover them with waterproof tarps until cleaning or maintenance is complete.

PRELIMINARY SERVICING OF EQUIPMENT AND PRELIMINARY CHECKS AND ADJUSTMENTS OF EQUIPMENT

Perform all operator and unit PMCS up through, and including, the annual level. Operator PMCS procedures are contained in WP 0012 00. Unit PMCS procedures are contained in WP 0013 00.

PREPARATION FOR STORAGE OR SHIPMENT

The compressed air system is prepared for storage or shipment along with the remainder of the Large Tug. Complete instructions for this preparation are contained in TB 740-97-4, Preservation of Vessels for Storage.

END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) INTRODUCTION

PURPOSE AND USE OF PMCS DATA

PMCS is performed to keep the compressed air system in operating condition. The checks are used to find, correct, and report problems so that defects may be discovered and corrected. PMCS is to be accomplished each day the compressed air system is operated using the appropriate work packages. Pay attention to all WARNINGS, CAUTIONS, and NOTES that precede individual steps. WARNINGS indicate possible danger to personnel. CAUTIONS indicate possible damage to equipment. NOTES are for clarification and additional information. An explanation is prepared for each PMCS check entry, and for any general checks and services common to an entire piece of equipment or system. An explanation of PMCS chart columns follows:

ITEM NUMBER COLUMN

The checks and services are numbered within a specific work package in chronological order.

INTERVAL

Interval column: This column indicates the periodicity of the check or service.

1. Before compressed air system operation, do Before PMCS.
2. During compressed air system operation, do During PMCS.
3. After compressed air system operation, do After PMCS.
4. Once a week do Weekly PMCS.
5. Do Monthly PMCS once a month. If equipment has not been operated in a month, also do During PMCS at the same time as Monthly PMCS.
6. Do Quarterly PMCS once a quarter. If the equipment has not been operated in a quarter, also do After PMCS at the same time as Quarterly PMCS.
7. Do Semiannual PMCS once every six months. If the equipment has not been operated within the last six months, also do the Monthly PMCS at the same time as Semiannual PMCS.
8. Do Annual PMCS once a year.
9. If a deficiency is noted when performing PMCS, fix it, if possible, using troubleshooting procedures and/or maintenance procedures. If the deficiency cannot be corrected, write up the items not fixed on DA Form 2404 for unit maintenance. For further information on how to use this form, see DA PAM 738-750.

MANHOUR

This column indicates the projected amount of time that is expected to take to complete the check or service. Checks and services that require additional personnel include a cumulative amount of time.

ITEM TO BE CHECKED OR SERVICED

This column lists the equipment or item to be checked or serviced.

PROCEDURE COLUMN

This column contains a brief description of how to perform the checks and services, or it contains the reference to the work package or technical manual that contains the procedural information. Carefully follow the instructions. If the necessary tools are not available, or if the procedure tells you to, have organizational maintenance do the work.

EQUIPMENT NOT READY/AVAILABLE IF

Lists the criteria that will limit the use of equipment, or make it not ready for use. Depending on the severity of the limitation, the compressed air system may not be able to operate and perform its primary mission. The terms "ready/available" and "mission capable" refer to the same status: Equipment is on hand and can perform its combat mission. If tools required to perform PMCS are not listed in the work package, notify unit maintenance. Write up items not fixed on DA Form 2404 for unit maintenance. For further information on how to use this form, see DA PAM 738-750.

DOCUMENTATION OF PMCS ITEM FAILURES

PMCS item failures are to be recorded on DA Form 2404, Equipment Inspection, and Maintenance Worksheet, and forwarded to Unit Maintenance via the vessel's Chief Engineer. Documentation of PMCS item failures must include the compartment location and item number within the work package to ensure proper dissemination. All corrected faults will be recorded on DA Form 4640 (Harbor Boat Deck Department Log for Class A&B Vessels) and DA Form 4993 (Harbor Boat Engine Department Log for Class A and C-1 Vessels). All uncorrected faults will be transcribed to a DA Form 2407, Maintenance Request, and the appropriate log entry must be made. The crew will service the LT as outlined by the intervals contained in the PMCS tables.

CORROSION PREVENTION AND CONTROL (CPC)

Corrosion Prevention and Control (CPC) of Army materiel is a continuing concern. It is important that any corrosion problems be reported so that they can be corrected and improvements made to prevent future problems. Corrosion is typically associated with rusting of metals, but it can also include deterioration of other materials, such as rubber and plastic. Unusual cracking, softening, swelling, or breaking of materials may indicate a corrosion problem. Suspected corrosion problems should be reported using SF 368 (Product Quality Deficiency Report). Use of key words such as “corrosion,” “rust,” “deterioration,” or “cracking” will ensure that the information is identified as a CPC problem.

LEAKAGE DEFINITION

⚠ CAUTION

Equipment operation is allowable with minor leakages (Class I or II) except for fuel leaks. Of course, consideration must be given to the fluid capacity of the item or system being checked. When in doubt, ask your supervisor.

When operating with Class I or II leaks, continue to check fluid levels as required in your PMCS. Class III leaks should be reported immediately to your supervisor. It is necessary to know how fluid leakage affects the status of the compressed air system. The following are definitions of the classes of leakage an operator or crewmember needs to know to be able to determine the condition of the leak. Learn and then be familiar with them. When in doubt, ask your supervisor.

LEAKAGE CLASSIFICATIONS I, II, III

Leakage classifications. Leakage definitions for operator/crew PMCS shall be classified as follows:

1. Class I: Seepage of fluid (as indicated by wetness or discoloration) not great enough to form drops.

2. Class II: Leakage of fluid great enough to form drops but not enough to cause drops to drip from the item being checked/inspected.

3. Class III: Leakage of fluid great enough to form drops that fall from the item being checked/inspected.

INSPECTION

Look for signs of a problem or trouble. Senses help here. You can feel, smell, hear, or see many problems. Be alert when on the vessel. Inspect to see if items are in good condition. Are they correctly assembled, stowed, secured, excessively worn, leaking, corroded, or properly lubricated? Correct any problems found or notify unit maintenance. There are some common items to check all over the compressed air system. These include the following:

1. Bolts, clamps, nuts, and screws: Continuously check for looseness. Look for chipped paint, bare metal, rust, or corrosion around bolt and screw heads and nuts. Tighten them when you find them loose. If tools are not available, notify unit maintenance.

2. Welds: Many items on the compressed air system are welded. To check these welds, look for chipped paint, rust, corrosion, or gaps. When these conditions exist, notify unit maintenance on DA Form 2404.

3. Electrical wires, connectors, and harnesses: Tighten loose connectors. Look for cracked or broken insulation, bare wires, and broken connectors. If any are found, notify unit maintenance.

4. Hoses and fluid lines: Look for wear, damage, and leaks, and make sure clamps and fittings are tight. Wet spots mean a leak. A stain near a fitting or connector can also mean a leak. When you find a leak, notify unit maintenance.

GENERAL STATEMENT OF LUBRICATION REQUIREMENTS

Any lubricants called out by PMCS in this manual are identified by standard military symbols IAW MIL-HDBK-113 and MIL-HDBK-275.

LUBRICATION SERVICE INTERVALS - NORMAL CONDITIONS

For safer, more trouble free operations, make sure that your compressed air system is serviced when it needs it. For the proper lubrication and service intervals, see WP 0012 00 and WP 0013 00.

LUBRICATION SERVICE INTERVALS - UNUSUAL CONDITIONS

The compressed air system will require extra service and care when it is operated under unusual conditions. High or low temperatures, long periods of hard use, or continued use in a dirty environment will break down the lubricants and fluids, requiring more frequent service.

LUBRICATION UNIVERSALS

1. Always clean fittings before lubricating them. Failure to do so can force contaminants into the bearing.

2. Always use the PMCS work packages as the guide for lubrication.

3. Never use the wrong type/grade of lubricant.

4. Never use too much lubricant.

END OF WORK PACKAGE

OPERATOR MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES INCLUDING LUBRICATION

Table 1. Operator Preventive Maintenance Checks and Services Including Lubrication

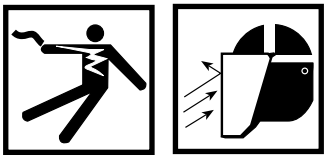
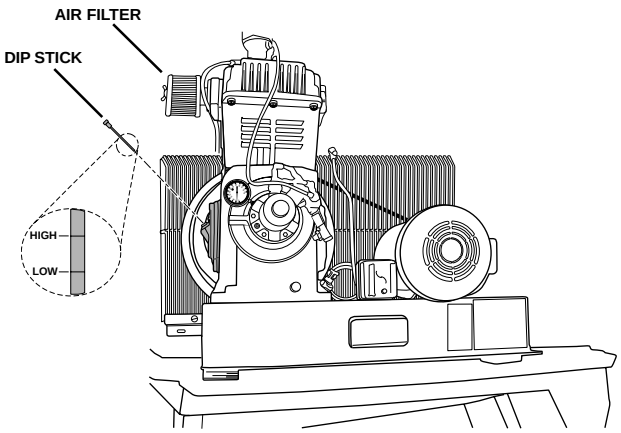
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
1	Before	0.1	Compressor Oil Level	**WARNING**  **Set to OFF AIR COMPRESSOR NO 1 or AIR COMPRESSOR NO 2 circuit breaker in AMS 1 Power Panel NO 4. Lock out and tag out before checking oil. Death or serious injury could result from servicing an energized compressor.** Check that the oil level is between the HIGH and LOW marks on the dipstick. Add oil as necessary. Refer to table 2 for proper oil. 	
2	Before	0.2	Compressor	a. Perform an overall visual inspection, ensuring that all hardware and safety guards are in place and tight. Also check for visible signs of oil leakage. b. Check air filter condition. Refer to maintenance supervisor if filter is dirty.	Class III leak.

Table 1. Operator Preventive Maintenance Checks and Services Including Lubrication (continued)

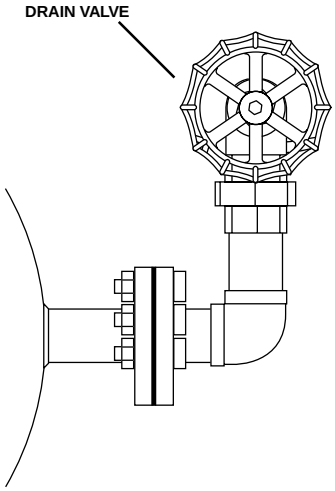
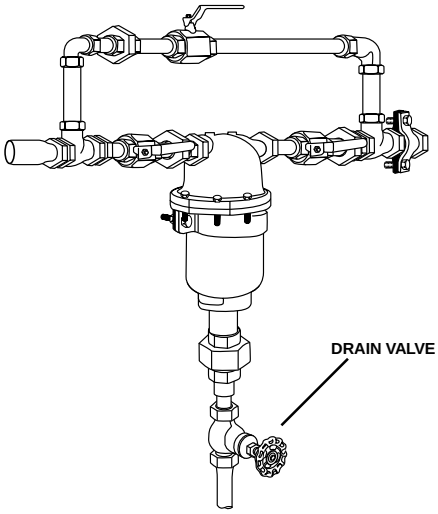
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
3	Before	0.2	Receivers	Drain condensed water from the starting air and ship's service air receivers by slightly opening the drain valve and allowing air and water to drain. Discontinue draining when water stops being discharged. 	
4	Before	0.1	Water Separators	Drain trapped water from the water separators by opening the drain valve. Close the drain valve when water stops being discharged. 	

Table 1. Operator Preventive Maintenance Checks and Services Including Lubrication (continued)

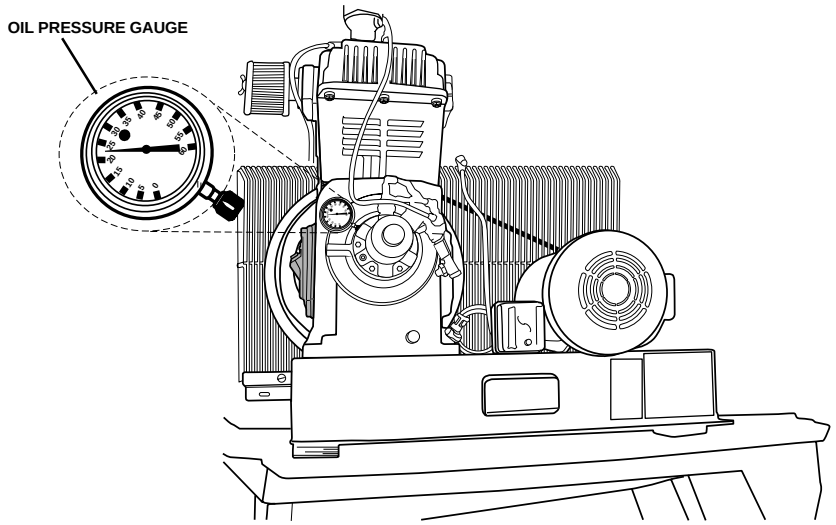
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
5	During	0.1	Air Compressor	a. Check for any unusual noise or vibration. b. Check compressor oil pressure when hot. Pressure should read 22 to 25 PSI (1.5 to 1.7 bar) on the oil pressure gauge.	Both compressors have unusual noise or vibration. Both compressors have oil pressure below 22 PSI (1.5 bar).
					
6	During	0.2	STARTING AIR RECEIVERS	Check that pressure gauges read 220 to 250 PSI (15.2 to 17.2 bar).	Pressure greater than 250 or less than 220 PSI (17.2 or 15.2 bar).
7	During	0.2	SHIPS SERVICE AIR RECEIVER	Check that the pressure gauge reads 125 PSI (8.6 bar).	
8	During	0.2	Piping	Check drop legs and traps in piping for moisture and sediment accumulation.	

Table 1. Operator Preventive Maintenance Checks and Services Including Lubrication (continued)

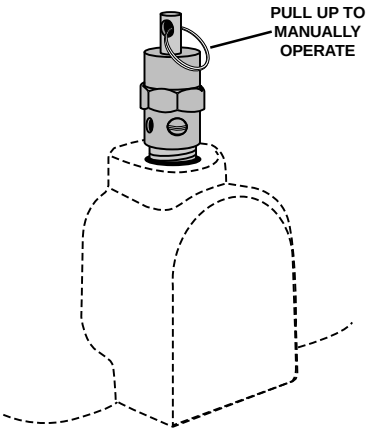
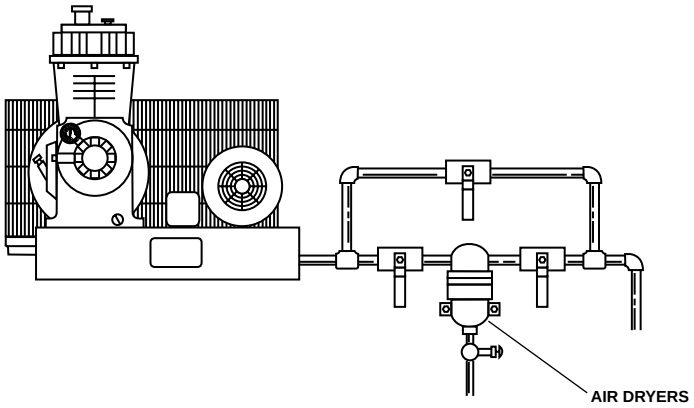
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
9	After	0.2	Compressor	Perform an overall visual inspection, ensuring that all hardware and safety guards are in place and tight. Also check for visible signs of oil leakage.	Class III leak.
10	Weekly	0.3	Relief Valves	Manually operate the pressure relief valves on both air compressors, both starting air receivers, and on the ship's service air receiver to be certain that they are working 	Any pressure relief valve is inoperative.
11	Weekly	0.2	Air Dryers	Check for leaks, loose connections, and damage. 	

Table 1. Operator Preventive Maintenance Checks and Services Including Lubrication (continued)

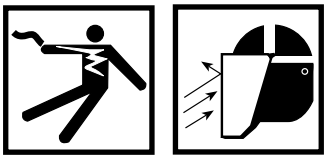
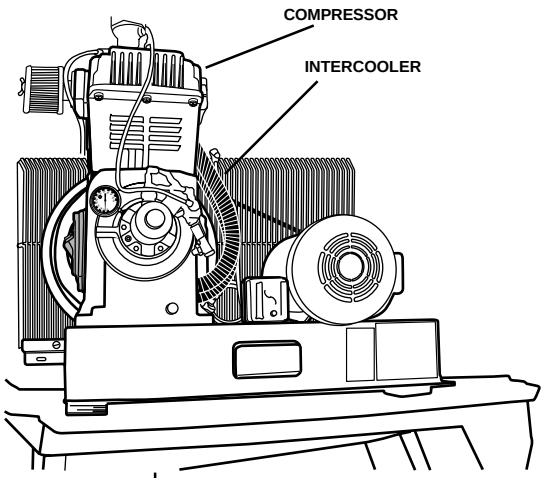
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
12	Weekly	0.5	Air Compressor	**WARNING**  **Set to OFF AIR COMPRESSOR NO 1 or AIR COMPRESSOR NO 2 circuit breaker in AMS 1 Power Panel NO 4. Lock out and tag out before performing cleaning. Death or serious injury could result from servicing an energized compressor.** **Always wear protective gloves and eyewear when cleaning with compressed air and wire brushes. Serious injury could result from failure to comply.** **NOTE** Ensure that the air compressors are returned to the desired readiness state following cleaning. Clean the cooling surfaces of the intercooler and compressor using compressed air and a wire brush as necessary. 	

Table 1. Operator Preventive Maintenance Checks and Services Including Lubrication (continued)

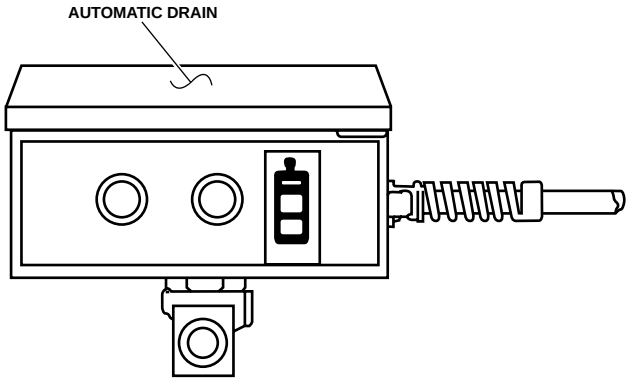
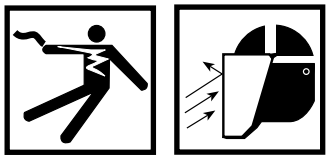
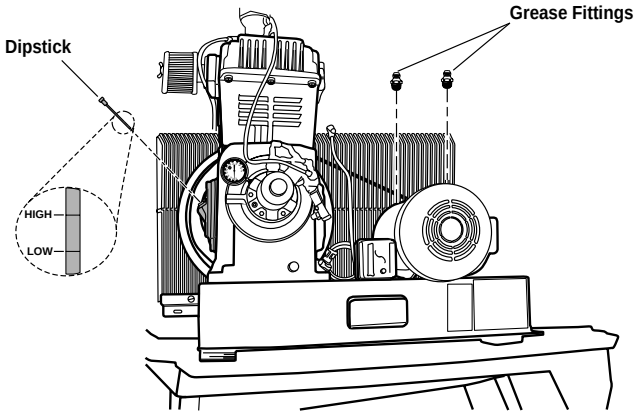
ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
13	Weekly	1.0	Compressed Air Piping	Check the compressed air piping system for leaks.	Any leaks in the piping system.
14	Weekly	0.2	Automatic Drain	Check for leaks, loose connections, damage, and proper operation.	
					
15	Semi-annually (1000 operating hours)	8.0	Air Compressor	a. Refer the compressors to the maintenance supervisor to have direct support maintenance remove the compressor valves and check for indications of leakage and/or carbon buildup. b. Refer the compressors to the maintenance supervisor to have direct support maintenance remove and clean the sump strainer screen.	

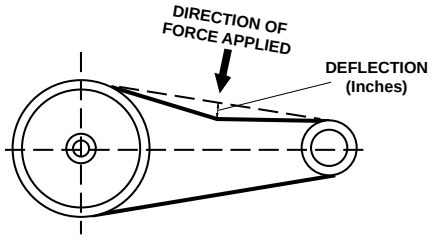
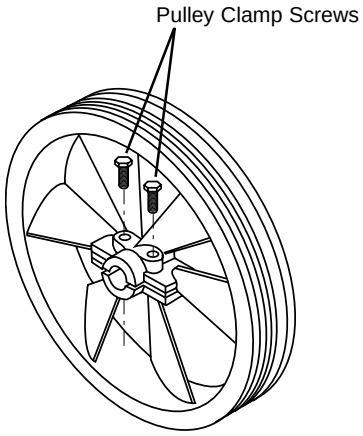
Table 2. Compressor Oil

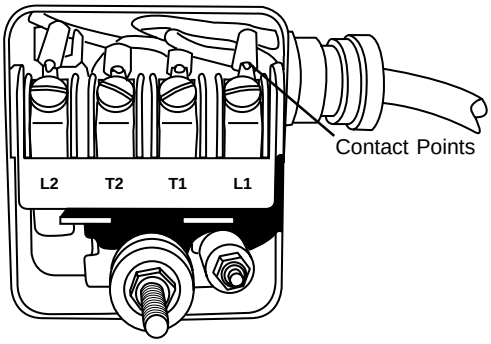
Ambient Temperature	ISO Viscosity	NSN
32-80 °F (0-27 °C)	Non-Detergent, Non-Synthetic 68	9150-00-027-3098
60-104 °F (16 to 40 °C)	Non-Detergent, Non-Synthetic 100	9150-01-158-2881

END OF WORK PACKAGE

UNIT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
UNIT PREVENTIVE MAINTENANCE CHECKS AND SERVICES INCLUDING LUBRICATION

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
1	Weekly	0.5	Air Compressor	**WARNING**  **Set to OFF AIR COMPRESSOR NO 1 or AIR COMPRESSOR NO 2 circuit breaker in AMS 1 Power Panel NO 4. Lock out and tag out before performing cleaning. Death or serious injury could result from servicing an energized compressor.** a. Replace the air filter (WP 0018 00). b. Remove the dipstick and inspect the oil for contamination (e.g., metal flakes, milky appearance). Change the oil and filter (WP 0018 00) if contamination is found. c. Apply two pumps of ball and roller bearing grease (DOD-G-24504) to the grease fittings. Wipe away excess grease from the fittings. 	

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
2	Monthly	0.5	Air Compressor	Check the drive belt tension and adjust as necessary (WP 0019 00). Proper tension is achieved when the belt may be deflected 1/2 inch (13 mm) at its midpoint when applying approximately 4 to 5 pounds (1.8 to 2.3 kg) of force to the belt. A new belt should be tensioned tighter (approximately 3/8 inch (10 mm) deflection). 	
3	Quarterly or Periodic (500 operating hours)	1.0	Air Compressor	a. Change the oil and filter (WP 0018 00). b. Torque the pulley clamp screws 90 lb/ft (122 Nm). 	

ITEM NO.	INTERVAL	MAN-HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
4	Annually	0.1	Pressure Switches	a. Inspect the diaphragm. Listen for leakage or signs of deterioration. Replace the pressure switch (WP 0018 00) when a leaking or deteriorated diaphragm is detected. b. Inspect the contact points for signs of pitting or burning. Replace the pressure switch (WP 0018 00) when burned or pitted contact points are detected. 	

END OF WORK PACKAGE

Chapter 5

Operator Maintenance Instructions for Air Compressor

Inland and Coastal Large Tug (LT)

OPERATOR MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
COMPRESSED AIR REGULATOR, ADJUST

INITIAL SETUP:

Tools and Special Tools:
Tool Kit, General Mechanic's (Item 1, Table 2, WP 0029 00)

References:
WP 0005 00
WP 0029 00

Personnel Required:
Two Watercraft Engineers, 88L

Equipment Conditions:
Air compressors operating under usual conditions (WP 0005 00).

INCREASE AND DECREASE SYSTEM PRESSURE

1. Position one crewmember at the system pressure gauge to observe the reading. The second crewmember will perform steps 2 through 4 below.

2. Place one wrench on the adjusting screw (figure 1, item 1) to hold it stationary.

3. Use a second wrench to loosen the jam nut (figure 1, item 2).

4. To increase system pressure, turn the adjusting screw (figure 1, item 1) slowly clockwise. Stop turning the adjusting screw when the desired system pressure is attained.

5. To decrease system pressure, have one crewmember OPEN and CLOSE an air drain or operate an air component downstream of the pressure regulator (figure 1, item 3), and the second crewmember turn the adjusting screw (figure 1, item1) counterclockwise until the desired air pressure is attained.

6. Use one wrench to hold the adjusting screw (figure 1, item 1) stationary while tightening the jam nut (figure 1, item 2).

7. After tightening the jam nut (figure 1, item 2), confirm that the system pressure has remained at the desired setting. If not, repeat steps 2 through 6 above.

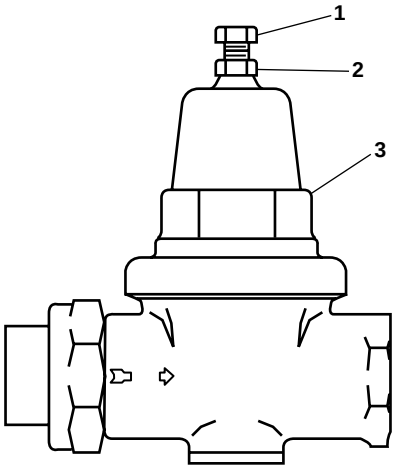


Figure 1. Compressed Air Regulator

END OF WORK PACKAGE

OPERATOR MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
AIR RECEIVERS, SERVICE

INITIAL SETUP:

Tools and Special Tools:
Tool Kit, General Mechanic's (Item 1, Table 2, WP 0029 00)

Materials/Parts:
Gloves, Leather (Item 2, Table 3, WP 0032 00)
Goggles, Industrial (Item 3, Table 3, WP 0032 00)

Personnel Required:
One Watercraft Engineer, 88L
Fire Watch (FM 55-502) (if grinding will take place)

References:
FM 55-502
TB 43-0144
WP 0005 00
WP 0029 00
WP 0032 00

Equipment Conditions:
Air compressors online and operating (WP 0005 00).

SERVICE

1. Press the manual override switch (figure 1, item 1) on the automatic air drains and check that the drain operates properly. The drain should permit water and air to vent when the switch is held down, and the valve should close completely when the switch is released.

2. If an excessively large amount of water is present in the receivers, decrease the automatic drain valve's cycle time rate or increase the drain time using the cycle time adjusting knob (figure 1, item 2) or the drain time adjusting knob (figure 1, item 3) respectively. Turning each knob counterclockwise decreases the functions' time, while turning the knob clockwise increases the time.

3. Inspect the receivers' exteriors for missing paint, rust, or other deterioration. If missing paint, rust, or deterioration is found, touch up the painted area as described below:

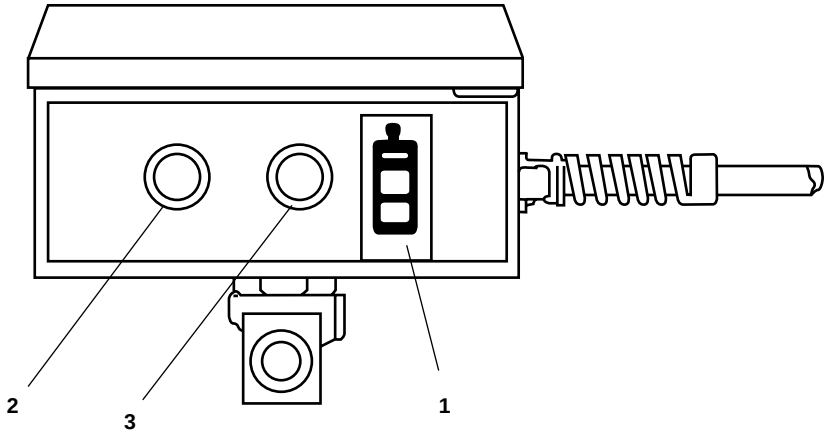
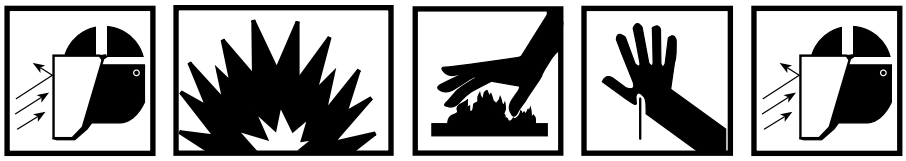


Figure 1. Automatic Drain

WARNING



Cleaning components by means of grinding produces hot, flying particles. These particles can cause serious injury to personnel. These hot particles can also ignite fires in the work area and in adjacent spaces. During and after removal, the work area will be very hot. Protective goggles, gloves, and/or aprons must be worn at all times during grinding operations. A fire watch must be posted whenever grinding operations are taking place. Failure to comply with this warning can result in serious injury or death to personnel and serious damage to the vessel.

Wire brushing produces high velocity flying debris that can become lodged in the skin or in the eyes. Wear protective equipment for eyes and skin.

a. Use a wire brush or grinder to clean the affected area down to bare metal.

b. Prime and paint the affected area (TB 43-0144).

END OF WORK PACKAGE

Chapter 6

Unit Maintenance Instructions for Air Compressor

Inland and Coastal Large Tug (LT)

UNIT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
COMPRESSED AIR SYSTEM, REPAIR

INITIAL SETUP:

Tools and Special Tools:
Tool Kit, General Mechanic's (Item 1, Table 2, WP 0029 00)
Multimeter (Item 4, Table 2, WP 0029 00)

Materials/Parts:
Tag, Danger (Item 6, Table 1, WP 0033 00)

Personnel Required:
Two Watercraft Engineers, 88L

References:
FM 55-502
WP 005 00
WP 017 00
WP 029 00
WP 033 00

Equipment Conditions:
Set to OFF J.B. FOR AUTO DRAIN ON AIR RECEIVER. (INC. REFER DRYER) circuit breaker on 120V distribution panel no. 4. Lock out and tag out (FM 55-502).

DISASSEMBLY

1. Remove the four screws (figure 1, item 1) that secure the cover (figure 1, item 2) to the drain assembly. Remove the cover.

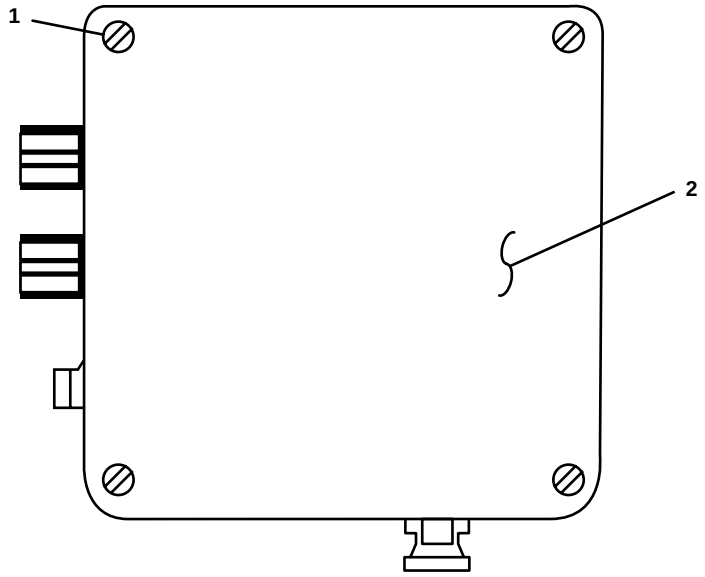


Figure 1. Automatic Drain Valve Cover

WARNING

Take great care when working around energized electrical equipment. Contact between unprotected body parts and electrical conductors can cause serious injury or death. Do not wear jewelry or other conductive items while servicing energized electrical equipment. Failure to comply with these precautions can cause serious injury or death.

Repair the drains only after the affected circuit has been secured, locked out, and tagged out. Performing repairs with the circuit energized may result in injury.

2. Use a multimeter to check for available voltage at the power terminals (figure 2, item 1). If voltage is present, ensure that the proper circuit breaker is OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

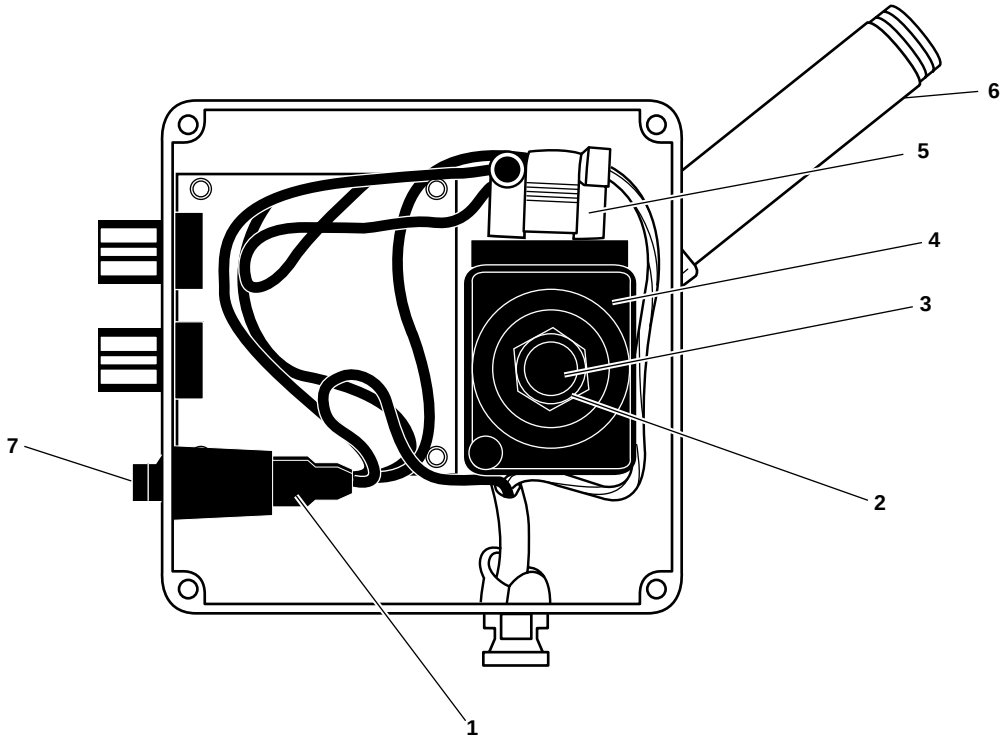


Figure 2. Automatic Drain Valve Components

3. Remove the nut (figure 2, item 2) that retains the solenoid (figure 2, item 3) to the coil (figure 2, item 4).

4. Remove the solenoid (figure 2, item 3), observing the direction of flow indicated on the solenoid (figure 2, item 3) so that it can be reassembled in the same direction.

5. Remove the wiring (figure 2, item 5) from the coil (figure 2, item 4).
6. Remove the drain pipe (figure 2, item 6) from the drain valve assembly (figure 3, item 1).
7. Inspect the drain valve assembly (figure 3, item 1) and remove any foreign material.
8. If damage to the drain valve assembly (figure 3, item 1) is found, replace the drain valve assembly (WP 0017 00). If no damage is noted, continue with the procedure.

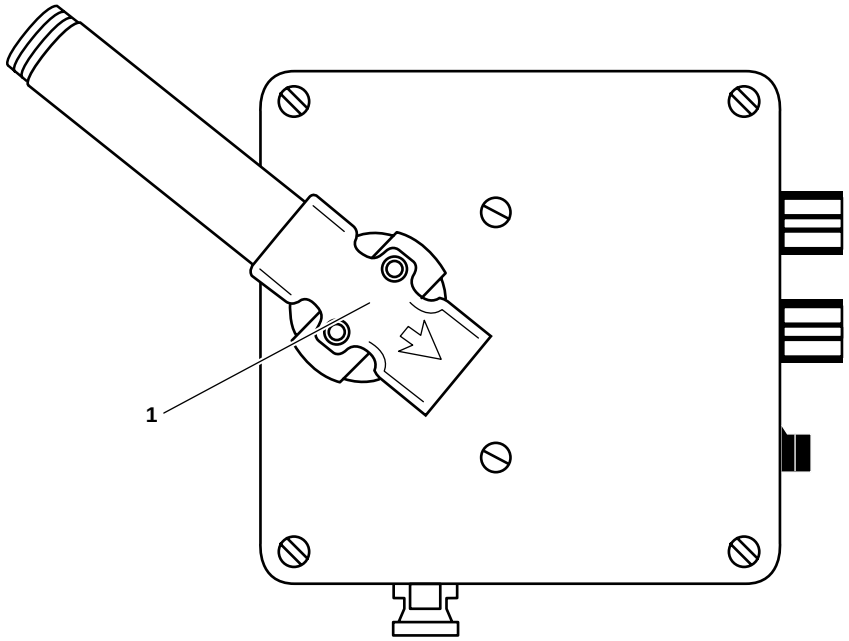


Figure 3. Drain Valve Assembly

ASSEMBLY

1. Install the drain pipe (figure 2, item 6) into the drain valve assembly (figure 3, item 1).
2. Install the wiring (figure 2, item 5) to the coil (figure 2, item 4).
3. Install the solenoid (figure 2, item 3), observing the flow direction noted during disassembly.
4. Secure the solenoid coil (figure 2, item 4) to the solenoid (figure 2, item 3) with the nut (figure 2, item 2).
5. Install the cover (figure 1, item 2) and secure it with the four screws (figure 1, item 1).
6. Remove the lockouts and tagouts (FM 55-502).
7. Operate the system under usual conditions (WP 0005 00).
8. Press the manual override switch (figure 2, item 7) and observe that the valve drains and closes properly.
9. Return the equipment to the desired readiness condition.

UNIT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
COMPRESSED AIR SYSTEM, REPLACE

INITIAL SETUP:

Tools and Special Tools:
Tool Kit, General Mechanic's (Item 1, Table 2, WP 0029 00)
Multimeter (Item 1, Table 4, WP 0029 00)

Materials/Parts:
Tag, Danger (Item 6, Table 1, WP 0033 00)
Tape, Antiseizing (Item 7, Table 1, WP 0033 00)
Drain Valve (Item 4, Figure 3, WP 0031 00)

Personnel Required:
Two Watercraft Engineers, 88L

References:
FM 55-502
WP 0005 00
WP 0029 00
WP 0031 00
WP 0033 00

Equipment Conditions:
CLOSE, lock out, and tag out (FM 55-502) the cut-off valve upstream of the affected drain.
Set to OFF, lock out, and tag out (FM 55-502) J.B. FOR AUTO DRAIN ON AIR RECEIVER (INC. REFER DRYER) circuit breaker on 102v distribution panel no. 4.

REPLACE AUTOMATIC DRAINS

REMOVAL

1. Remove the four screws (figure 1, item 1) that secure the junction box cover (figure 1, item 2). Remove the cover.

Repair the drains only after the affected circuit has been secured, locked out, and tagged out. Performing repairs with the circuit energized may result in injury.

2. Use a multimeter to check for available voltage at the wiring terminals inside the junction box. If voltage is present, ensure that the proper circuit breaker is OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

3. Label and disconnect the wiring (figure 1, item 3) for the affected automatic drain. Loosen the packing gland (figure 1, item 4), and remove the wiring from the junction box.

4. Unscrew the automatic drain valve (figure 2, item 1) from its piping (figure 2, item 2). The valve's wiring (figure 2, item 3) is integral to the valve and is removed with the valve.

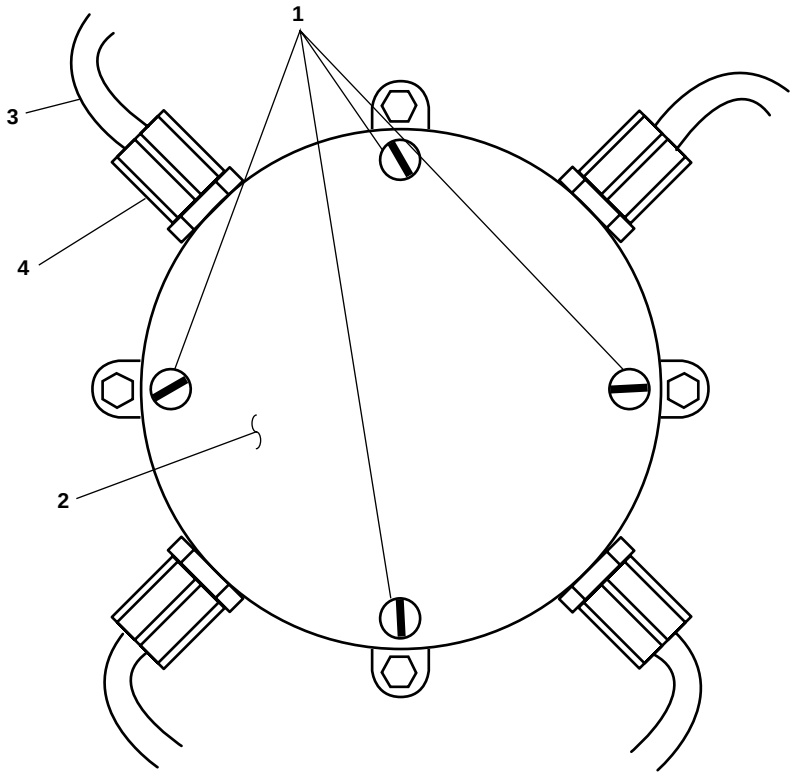


Figure 1. Junction Box

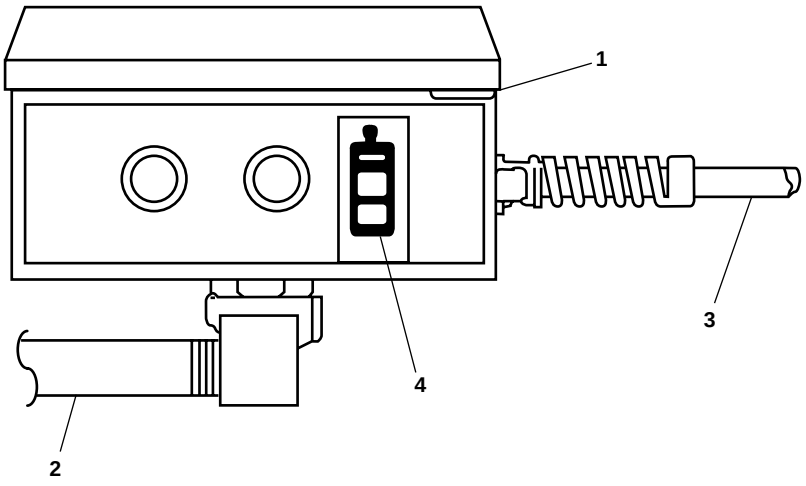


Figure 2. Automatic Drain Valve

INSTALLATION

1. Wrap the male pipe threads of the drain valve piping (figure 2, item 2) with antiseizing tape.
2. Thread the automatic drain valve (figure 2, item 1) securely onto its piping (figure 2, item 2).
3. Route the automatic drain valve's wiring (figure 2, item 3 and figure 1, item 3) through the packing gland (figure 1, item 4) and into the junction box. Securely tighten the packing gland.
4. Connect the wiring (figure 1, item 3) inside the junction box.
5. Install the junction box cover (figure 1, item 2) and secure it with the four screws (figure 1, item 1).
6. Remove the lockouts and tagouts (FM 55-502).
7. Operate the air system under usual conditions (WP 0005 00).
8. Slowly OPEN the cutoff valve upstream of the automatic drain valve, and check for air leakage.
9. Press the manual override switch (figure 2, item 4). Observe that the valve opens and closes normally.
10. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
AIR COMPRESSOR, SERVICE

INITIAL SETUP:

Tools and Special Tools:
Tool Kit, General Mechanic's (Item 1, Table 2, WP 0029 00)
Wrench, Torque, 0-250 ft-lb (Item 5, Table 2, WP 0029 00)
Lubricating Gun, Hand (Item 7, Table 2, WP 0029 00)
Suitable Drain Pan

Materials/Parts:
Dry Cleaning Solvent (Item 1, Table 1, WP 0033 00)
Gloves, Chemical and Oil Protective (Item 1, Table 3, WP 0032 00)
Goggles, Industrial (Item 3, Table 3, WP 0032 00)
Grease, Ball and Roller Bearing (Item 2, Table 1, WP 0033 00)
Lubricating Oil, Air Compressor (Item 3, Table 1, WP 0033 00)

Materials/Parts (continued):
Rag, Wiping (Item 5, Table 1, WP 0033 00)
Tag, Danger (Item 6, Table 1, WP 0033 00)

Personnel Required:
Two Watercraft Engineers, 88L

References:
FM 55-502
WP 0005 00
WP 0029 00
WP 0032 00
WP 0033 00

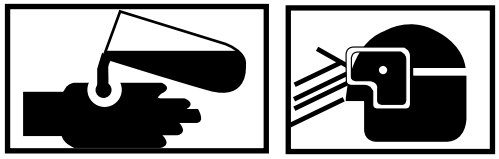
Equipment Conditions:
Set to OFF AIR COMPRESSOR NO. 1 and AIR COMPRESSOR NO. 2 circuit breakers in 440V power panel no. 4, lock out, and tag out (FM 55-502).

CHANGE OIL AND FILTER

DISASSEMBLY

1. Position a suitable drain pan beneath the compressor oil drain plug (figure 1, item 1).

WARNING



Do not allow hydraulic fluid, engine oil, or cleaning solvents to come in contact with unprotected skin or eyes. Prolonged skin contact can cause illness or injury. Eye contact can cause serious injury. Always wear chemical protective gloves and goggles when handling hydraulic fluid, engine oil, and cleaning solvents. Failure to follow these precautions can result in illness or serious injury.

2. Remove the compressor oil drain plug (figure 1, item 1), and permit the compressor oil to drain into the drain pan. Permit the oil to drain until all oil has been drained.

3. Remove the oil filter (figure 1, item 2), and permit its contents to drain into the drain pan.

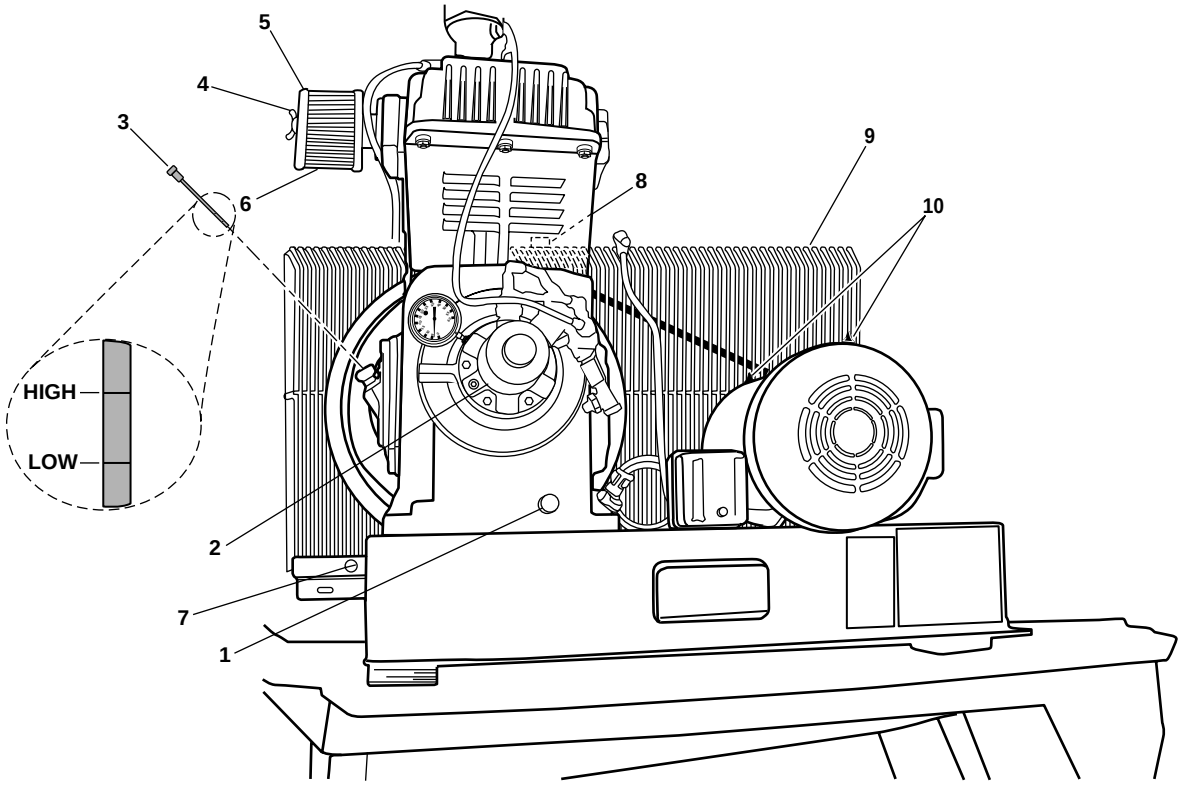


Figure 1. Air Compressor

WARNING

Cleaning solvent is flammable and its vapor is potentially explosive. Do not use cleaning solvent in the vicinity of spark, open flame, or excessive heat. Do not use cleaning solvent in unventilated spaces. Failure to follow these precautions can result in death or serious injury

CAUTION

All remnants of the oil filter's sealing gasket must be removed from the oil filter's mounting base prior to installing a new filter. Oil leakage and subsequent equipment damage can result from failure to comply.

4. Use a clean wiping rag and dry cleaning solvent to clean the oil filter's mounting base. Ensure that no remnants of the oil filter's sealing gasket (figure 2, item 1) remain on the mounting base.

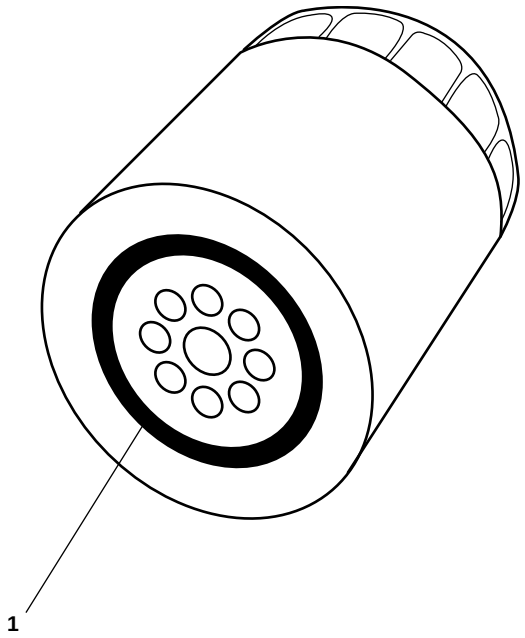


Figure 2. Oil Filter

ASSEMBLY

1. Install the compressor oil drain plug (figure 1, item 1).

2. Apply a thin film of clean air compressor lubricating oil to the oil filter's gasket (figure 2, item 1).

⚠ CAUTION

Do not over tighten the oil filter. Over tightening can lead to filter failure, filter leakage, and subsequent compressor failure.

3. Install the new oil filter and tighten it until its gasket (figure 2, item 1) contacts the mounting base. Tighten the filter an additional 3/4 turn after the gasket contacts the mounting base.

NOTE

Oil is added to the compressor through the dipstick tube.

4. Remove the compressor dipstick (figure 1, item 3), and fill the compressor with clean oil until the oil registers slightly above the HIGH mark on the dipstick. Approximate capacity is 4.75 quarts (4.5 liters). Refer to table 1 for the proper oil.

5. Install the dipstick (figure 1, item 3).

6. Perform the Follow-On Service procedure at the end of this work package.

Table 1. Compressor Lubricants

Ambient Temperature	SAE Viscosity	NSN
32-80 °F (0-27 °C)	SAE 20W	9150-00-027-3098
60-104 °F (16 to 40 °C)	SAE 30W	9150-01-158- 2881

FLUSH THE CRANKCASE

⚠ CAUTION

Crankcase flushing should only be performed if an incorrect lubricant was installed in the crankcase. Serious damage to the compressor can result from failure to closely follow the flushing procedure.

1. Perform the Change Oil and Filter procedure in this work package, ensuring that the crankcase is refilled with the proper lubricant as shown in table 1.
2. Remove the lockouts and tagouts, and operate the air compressor for 15 to 20 minutes.
3. Set to OFF, lock out, and tag out AIR COMPRESSOR NO. 1 and AIR COMPRESSOR NO. 2 circuit breakers.
4. Change the oil and filter again as described in the Change Oil and Filter paragraph of this work package, ensuring that the crankcase is refilled with the proper lubricant.
5. Perform the Follow-On Service procedure at the end of this work package.

REPLACE AIR FILTER

1. Remove the wing nut (figure 1, item 4) and the air filter top cover (figure 1, item 5).
2. Remove the air filter element (figure 1, item 6).
3. Position the new air filter element (figure 1, item 6) on the compressor.
4. Secure the air filter element (figure 1, item 6) to the compressor with the top cover (figure 1, item 5) and wing nut (figure 1, item 4).
5. Perform the Follow-On Service procedure at the end of this work package.

TORQUE PULLEY CLAMP SCREWS

1. Remove the three lower screws (figure 1, item 7) and one upper screw (figure 1, item 8) that secure the belt guard (figure 1, item 9). Remove the belt guard.
2. Use a torque wrench to tighten both pulley clamp screws (figure 3, item 1) to a torque of 90 lb-ft (122 Nm).
3. Install the belt guard (figure 1, item 9) and secure it with the three lower screws (figure 1, item 7) and one upper screw (figure 1, item 8).
4. Perform the Follow-On-Service procedure at the end of this work package.

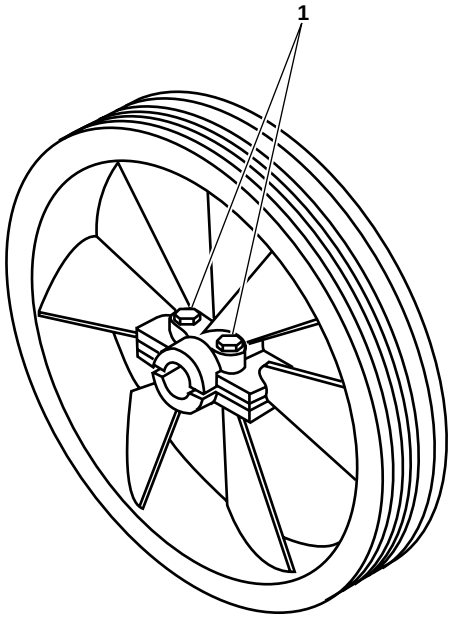


Figure 3. Pulley Clamp Screws

LUBRICATE MOTOR

1. Apply 1-2 pumps of grease to each of the motor's two grease fittings (figure 1, item 10).
2. Wipe away any remaining grease with a clean wiping rag.
3. Perform the Follow-On Service procedure at the end of this work package.

FOLLOW-ON SERVICE

1. Remove the lockouts and tagouts (FM 55-502).
2. Operate the air compressor (WP 0005 00).
3. While the compressors are running, check for any signs of oil leakage, especially in the area of the oil filter.
4. When the compressors have stopped running, check the dipstick (figure 1, item 3) oil level, and top off the oil level as required.
5. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
AIR COMPRESSOR, REPAIR

INITIAL SETUP:

Tools and Special Tools:
Tool Kit, General Mechanic's (Item 1, Table 2, WP 0029 00)
Multimeter (Item 4, Table 2, WP 0029 00)
Wrench, Torque, 0-250 lb-ft (Item 5, Table 2, WP 0029 00)
Suitable Straightedge

Materials/Parts:
Tag, Danger (Item 6, Table 1, WP 0033 00)

Personnel Required:
Two Watercraft Engineers, 88L

References:
FM 55-502
TB 43-0218
WP 0005 00
WP 0032 00
WP 0033 00

Equipment Conditions:
Set to OFF AIR COMPRESSOR NO. 1 and AIR COMPRESSOR NO. 2 circuit breakers in 440V power panel no. 4. Lock out and tag out (FM 55-502).

WARNING

Never reuse locking hardware. Reuse of locking hardware such as lockwashers, locking nuts, cotter pins, and lock wire can result in undetected loosening of fastening hardware causing catastrophic component failure resulting in death, injury, or damage to equipment. In accordance with TB 43-0218, ensure that all locking hardware is discarded upon removal and replaced with new.

REPLACE V BELT

REMOVAL

1. Remove the three lower screws (figure 1, item 1) and one upper screw (figure 1, item 2) that secure the belt guard (figure 1, item 3). Remove and set aside the belt guard.

2. Remove the four bolts (figure 1, item 4), four washers (figure 1, item 5), four lockwashers (figure 1, item 6), and four nuts (figure 1, item 7) that secure the motor (figure 1, item 8) to the foundation (figure 1, item 9). Discard the lockwashers.

3. Slide the motor (figure 1, item 8) toward the compressor (figure 1, item 10) until the belt (figure 2, item 1) is loose enough to slide off the motor pulley (figure 2, item 2) and compressor sheave (figure 2, item 3). Remove the belt.

4. Label and remove the wiring from terminal L1 (figure 3, item 1) and L2 (figure 3, item 2). Remove the wiring from the pressure switch (figure 3, item 3).

5. Remove the two bolts (figure 1, item 14) that secure the pressure switch (figure 1, item 13) to the compressor foundation (figure 1, item 9). Remove the pressure switch.

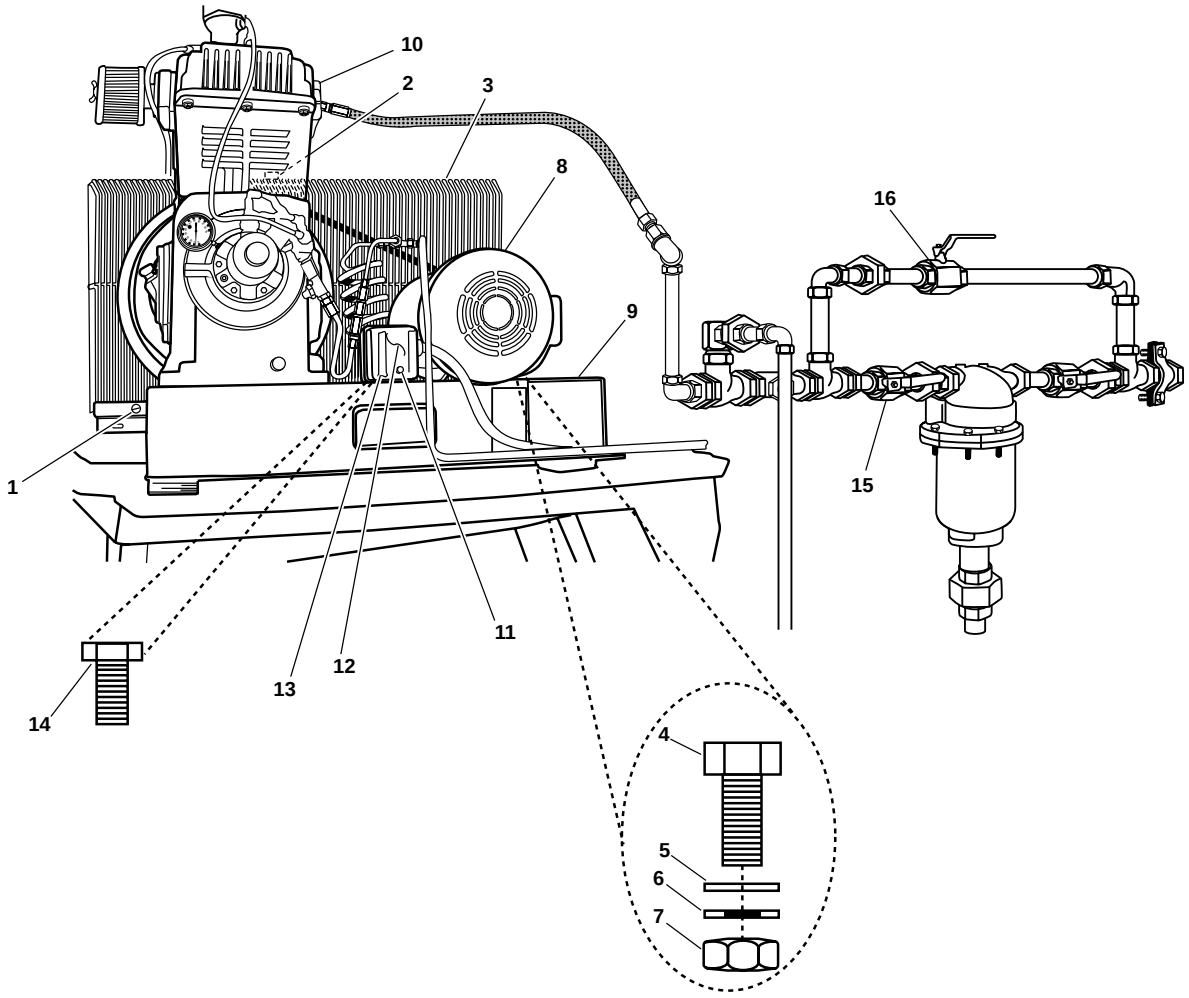


Figure 1. Belt Removal

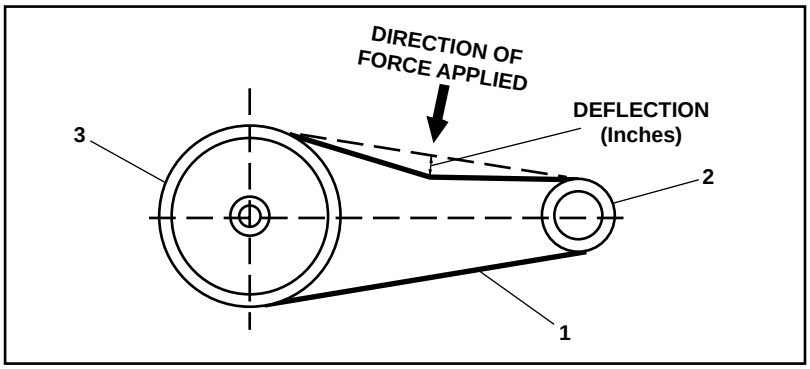


Figure 2. Belt Tensioning

INSTALLATION

1. Install the four bolts (figure 1, item 4), four flat washers (figure 1, item 5), four new lockwashers (figure1, item 6), and four nuts (figure1, item 7) that secure the motor (figure1, item 8) to the foundation (figure 1, item 9). Do not tighten at this time.

2. Position the belt on the compressor sheave (figure 2, item 3) and motor pulley (figure 2, item 2).

3. Slide the motor (figure 1, item 8) away from the compressor (figure 1, item 10) until the proper belt tension is achieved. Proper tension is achieved when the belt may be deflected 1/2 inch (13 mm) at its midpoint(figure 2) when applying approximately 4 to 5 pounds (1.8 to 2.3 kg) of force to the belt. A new belt should be tensioned tighter (approximately 3/8 inch (10 mm) deflection). Tighten the four bolts (figure 1, item 4) and nuts (figure 1, item 7) at this time.

4. Perform the Check Pulley/Sheave Alignment procedure as detailed in this work package.

5. Install the belt guard (figure 1, item 3) and secure it with the three lower screws (figure 1, item 1) and one upper screw (figure 1, item 2).

6. If a new belt was installed, check the belt tension several times during the first 50 hours of operation. Adjust if necessary. Use the procedure detailed in step 3 above for checking tension and adjusting the belt.

7. Perform the Follow-On Service procedure at the end of this work package.

REPLACE PRESSURE SWITCH

REMOVAL

1. Remove the screw (figure 1, item 11) that secures the cover (figure 1, item 12) to the pressure switch (figure 1, item 13). Remove the cover.

Replace the pressure switch only after the affected circuit has been secured, locked out, and tagged out. Performing replacement with the circuit energized may result in death or serious injury.

2. Use a multimeter to check for available voltage at terminal L1 (figure 3, item 1) and L2 (figure 3, item 2). If voltage is present, ensure that the proper circuit breaker is set to OFF, locked out, and tagged out (FM 55-502). If no voltage is present, continue with the procedure.

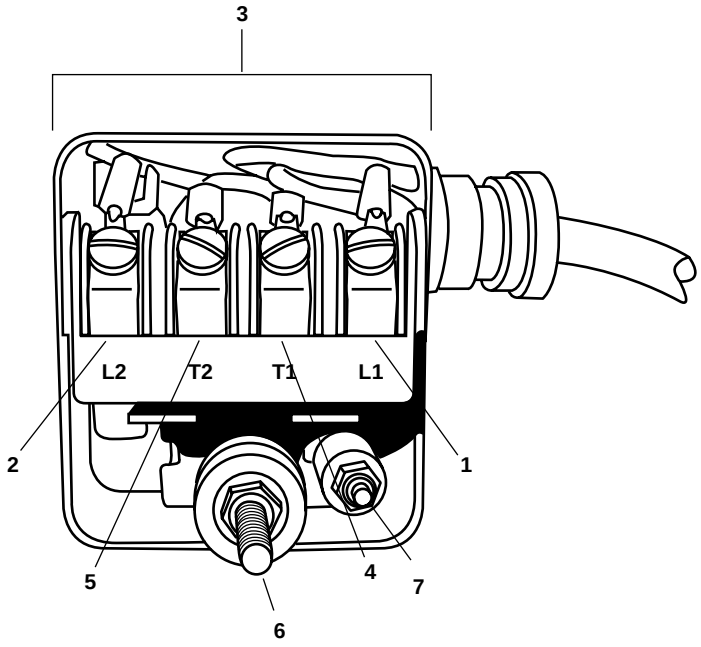


Figure 3. Pressure Switch

INSTALLATION

1. Position the pressure switch (figure 1, item 13) on the compressor foundation (figure 1, item 9), and secure it with the two bolts (figure 1, item 14).

2. If a jumper wire is not already installed between terminals T1 (figure 3, item 4) and T2 (figure 3, item 5), install one.

3. Install the wiring into the pressure switch (figure 3, item 3), then connect the wiring to terminals L1 (figure 3, item 1) and L2 (figure 3, item 2), using the labels from step 3 of Removal as a guide. Remove the labels.

4. Adjust and test the pressure switch as follows:

   a. Remove the lockouts and tagouts (FM 55-502) and return the air compressor to the normal operating condition (WP 0005 00).

   b. If the compressors are not running, drain air from the starting air receivers by opening valves CA-46 and CA-47 STG AIR TK DR until the starting air pressure is below the cut-in pressure of 210 PSI (14.5 bar) to permit the compressors to start. Close the valves when the compressors start.

   c. If the compressor does not start running when the pressure reaches 210 PSI (14.5 bar), adjust the cut-in pressure. To adjust the cut-in pressure, turn the spring loaded adjusting screw (figure 3, item 6) clockwise until the desired cut-in pressure is achieved. To decrease the cut-in pressure, turn the spring loaded adjusting screw counterclockwise until the desired cut-in pressure is achieved.

   d. Observe the compressors as they fill the receivers. The compressors should stop running when the starting air pressure reaches the cutout pressure of 250 PSI (17.2 bar).

e. If the compressors do not stop running when the starting air pressure reaches 250 PSI (17.2 bar), adjust the cutoff pressure. To adjust the cutoff pressure, turn the spring loaded adjusting screw (figure 3, item 7) clockwise until the desired cutoff pressure is achieved. To decrease the cutoff pressure, turn the spring loaded adjusting screw (figure 3, item 7) counterclockwise until the desired cutoff pressure is achieved.

5. Perform the Follow-On Service procedure at the end of this work package.

REPLACE UNLOADER PILOT VALVE

REMOVAL

1. CLOSE, lock out, and tag out (FM 55-502) the applicable COV-COMPR DISCH valves CA-1 or CA-2 (figure 1, item 15) and CA-89 or CA-90 (figure 1, item 16).

2. Remove the compressed air tubing and fittings from the air inlet (figure 4, item 1), the air out to head unloader (figure 4, item 2), the air in from hydraulic unloader (figure 4, item 3), and the compressed air tubing from the air tank (figure 4, item 4).

3. Unscrew the unloader pilot valve (figure 4, item 5) from the compressor (figure 4, item 6).

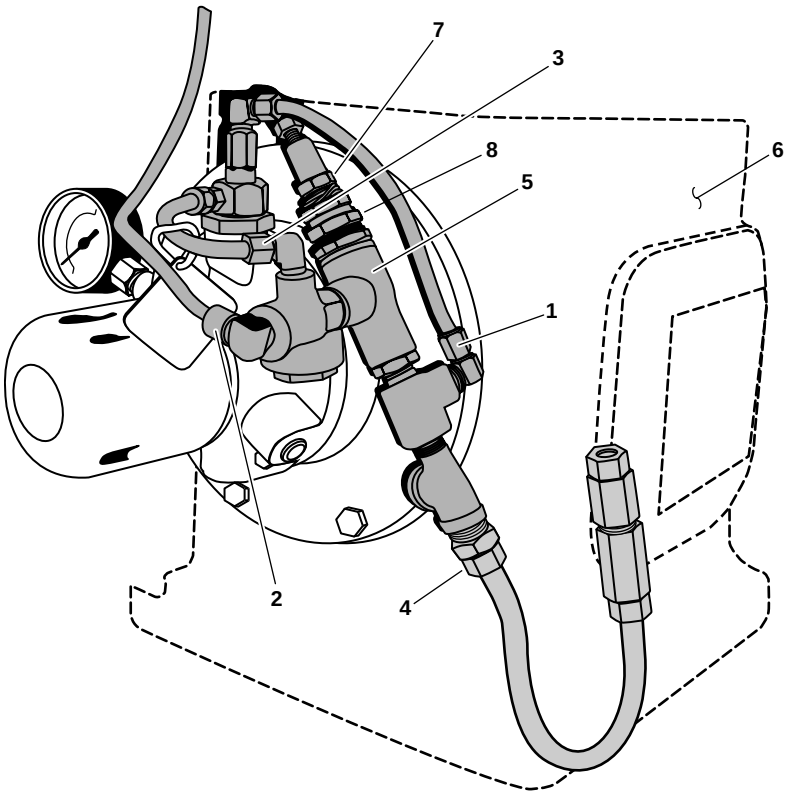


Figure 4. Unloader Pilot Valve

INSTALLATION

1. Install the unloader pilot valve (figure 4, item 5) onto the compressor (figure 4, item 6).

2. Connect the compressed air tubing and fittings from the air tank (figure 4, item 4), the air in from the hydraulic unloader (figure 4, item 3), and the air out to head unloader (figure 4, item 2) to the air inlet sides of the unloader pilot valve (figure 4, item 1).

3. Test and adjust the unloader pilot valve as follows:

   a. Remove the lockouts and tagouts (FM 55-502).

   b. OPEN the applicable COV-COMPR DISCH VALVES CA-1 or CA-2 (figure 1, item 15) and CA-89 or CA-90 (figure1, item 16) and return the air compressor to the normal operation condition (WP 0005 00).

   c. Adjust the pressure switch so that the compressor cutoff pressure is 260 PSI (17.9), as detailed in Pressure Switch Installation of this work package.

   d. With the compressor running and filling the receivers, note the pressure at which the compressors unload. Unloading will be signified by a noticeable change in the sound of the compressors accompanied by a cessation of compressed air delivered to the receivers. The compressors should unload at 250 PSI (17.2 bar).

   e. If the unloading pressure is incorrect, adjust the unloader pilot valve by turning the unload adjustment screw (figure 4, item 7) clockwise to increase the unloading pressure or counterclockwise to decrease the unloading pressure.

   f. Drain the air from the starting air receivers by opening valves CA-46 and CA-47 STG AIR TK DR to allow the air pressure to drop, noting the pressure at which the compressor starts to load. The compressor should start to load at 210 PSI (14.48 bar). Close the valves when the compressor starts to load.

   g. If the loading pressure is incorrect, adjust the differential setting (difference between unloading and loading pressure) by turning the differential adjustment hex nut (figure 4, item 8). Increase the differential pressure by turning the hex nut clockwise, and decrease by turning counterclockwise.

   h. Adjust the pressure switch so that the compressor's cutoff pressure is 250 PSI (17.2 bar), as detailed in Pressure Switch Installation in this work package.

   i. Return the equipment to the desired readiness condition.

CHECK PULLEY/SHEAVE ALIGNMENT

1. Place a suitable straightedge (figure 5, item 1) across the compressor sheave (figure 5, item 2) and the motor pulley (figure 5, item 3). The suitable straightedge should rest firmly across both flanges of the outermost sheave or pulley.

2. With the suitable straightedge (figure 5, item 1) in place, check for both parallel and angular misalignment (figure 6). Maximum permissible parallel misalignment is 1/16 inch (1.6 mm). Maximum permissible angular misalignment is 1/2 degree.

3. If parallel misalignment is found, proceed to step 4. If angular misalignment is found, notify the maintenance supervisor.

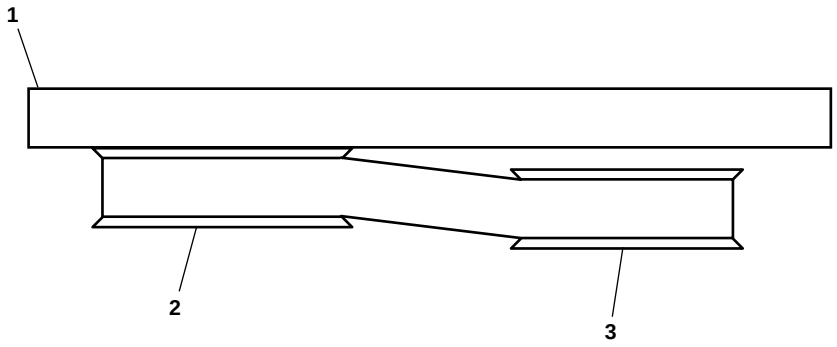


Figure 5. Checking Pulley/Sheave Alignment

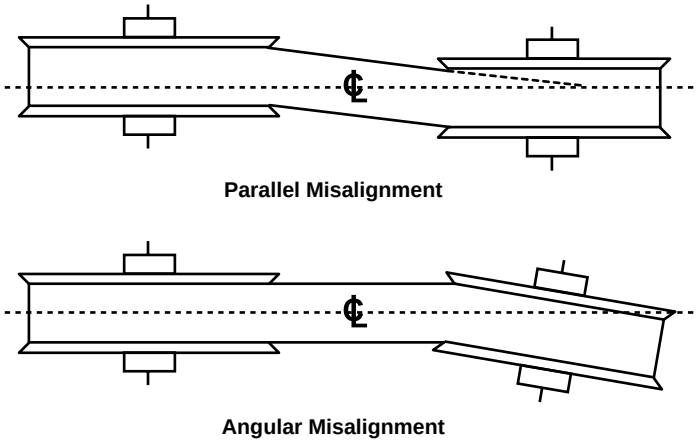


Figure 6. Parallel and Angular Misalignment

4. To correct parallel misalignment:

   a. Loosen the sheave clamp bolts (figure 7, item 1).

   b. Slide the sheave (figure 7, item 2) in or out on the compressor shaft until the proper alignment is achieved.

   c. Torque the sheave clamp bolts (figure 7, item 1) to 90 lb-ft (122 Nm).

   d. Check the alignment. If the alignment is not within specifications, repeat steps a through c.

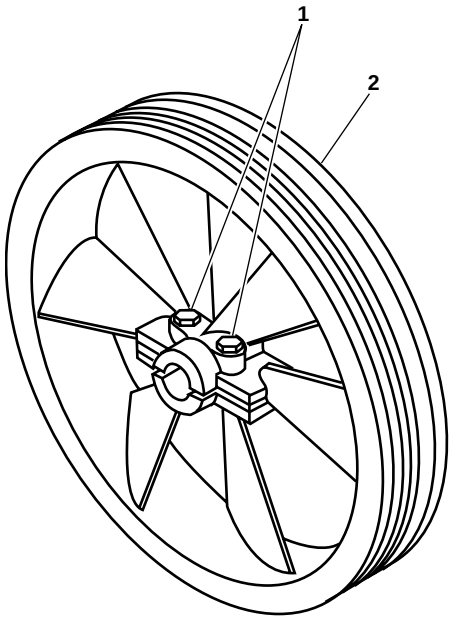


Figure 7. Compressor Sheave Clamp Bolts

FOLLOW-ON SERVICE

1. Remove the lockouts and tagouts (FM 55-502).
2. Return the compressor to normal operating condition (WP 0005 00).
3. Operate the compressor and check for proper operation.
4. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
AIR COMPRESSOR, REPLACE

INITIAL SETUP:

Tools and Special Tools:
Tool Kit, General Mechanic's (Item 1, Table 2, WP 0029 00)
Multimeter (Item 4, Table 2, WP 0029 00)

Materials/Parts:
Tag, Danger (Item 6, Table 1, WP 0033 00)

Personnel Required:
Two Watercraft Engineers, 88L

References:
FM 55-502
WP 0005 00
WP 0029 00
WP 0033 00

NOTE

This work package prepares the air compressor(s) for replacement. Actual replacement of the air compressors is accomplished by direct support maintenance.

REMOVAL

1. Perform system shutdown for the applicable air compressor (WP 0005 00).

2. At 440V power panel no. 4, set to OFF, lock out, and tag out (FM 55-502) the applicable air compressor circuit breaker as shown in table 1.

3. CLOSE, lock out, and tag out the applicable dryer cutoff and bypass valves as indicated in table 1 and figure 1.

WARNING

Replace the air compressor motor only after the affected circuit breaker has been secured, locked out, and tagged out. Performing replacement with the circuit energized may result in injury or death.

4. Use a multimeter to check for available voltage at the motor's wiring (figure 1, item 3). If voltage is present ensure that the proper circuit breaker is set to OFF locked out and tagged out (FM 55-502). If no voltage is present, continue with procedure.

5. Label, disconnect, and remove the motor wiring (figure 1, Item 3) from the air compressor motor (figure 1, item 4).

6. Use a multimeter to check for available voltage at the pressure switch wiring L1 (figure 2, item 1) and L2 (figure 2, item 2). If voltage is present ensure that the proper circuit breaker is set to OFF locked out and tagged out (FM 55-502). If no voltage is present, continue with procedure.

7. Label, disconnect, and remove L1 (figure 2, item 1) and L2 (figure 2, item 2), wiring from the pressure switch (figure 2, item 3).

8. Disconnect the discharge steel braided flex hose (figure 1, item 5) from the compressor at its union (figure 1, item 6).

9. Disconnect and remove the pressure tubing (figure 1, item 7) at its fittings (figure 1, item 8).

10. Notify direct support maintenance that the compressor is ready for removal.

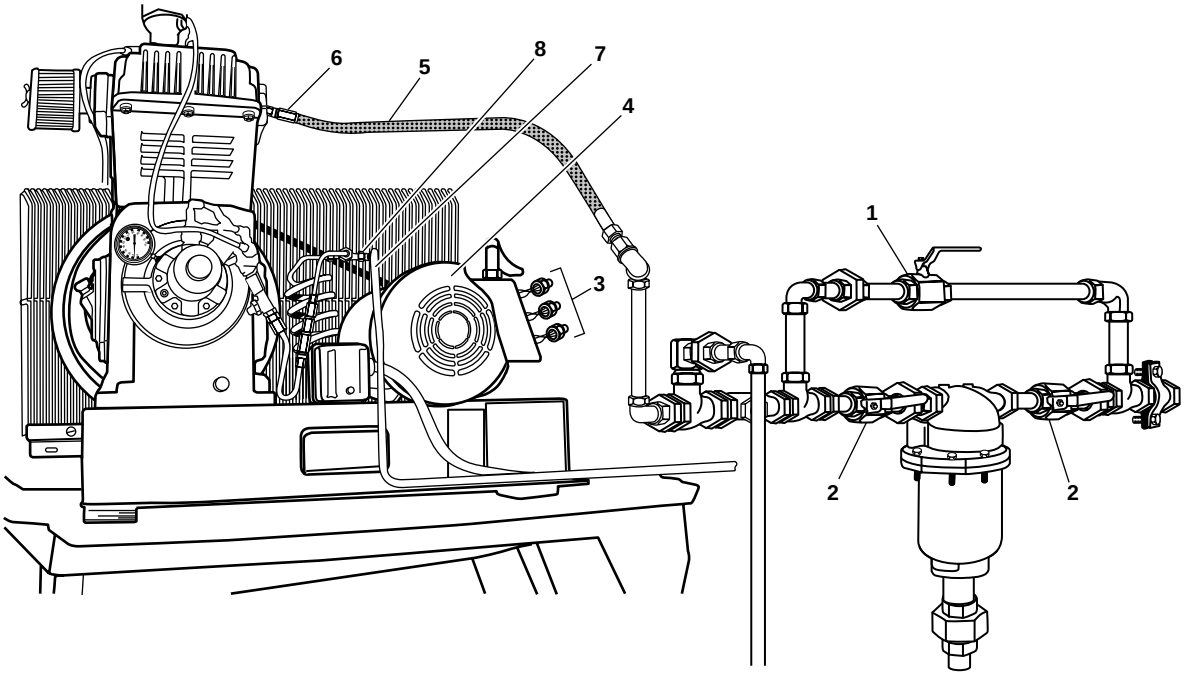


Figure 1. Dryer Cutoff and Bypass Valves

Table 1. Air Compressor Lockout/Tagout Guide

AIR COMPRESSOR	SPECIFIC BREAKER	DRYER CUTOFF (Figure 1, item 1)	BYPASS (Figure 1, item 2)
1	AIR COMPRESSOR NO. 1	COV-COMPR DISCH CA-89	COV-COMPR DISCH CA-1and CA-87
2	AIR COMPRESSOR NO. 2	COV-COMPR DISCH CA-90	COV-COMPR DISCH CA-2and CA-88

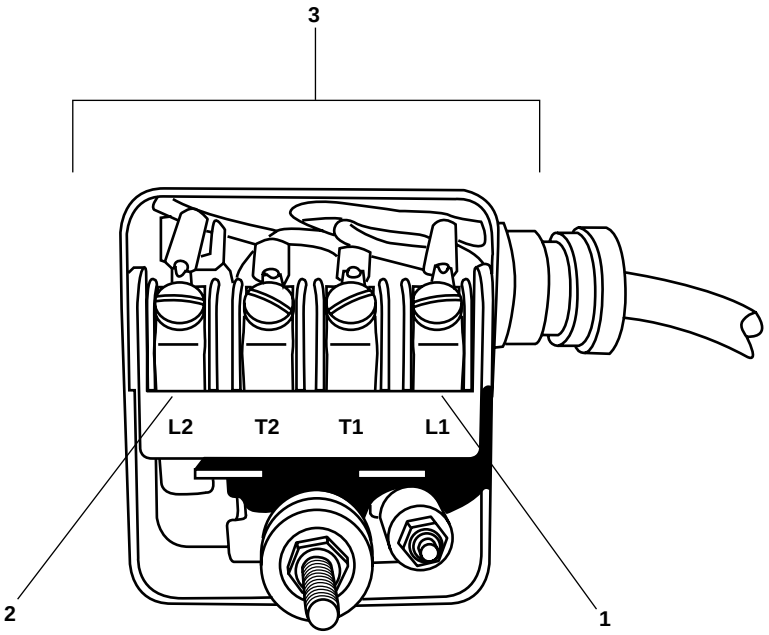


Figure 2. Pressure Switch

INSTALLATION

1. Contact direct support maintenance for installation of the removed compressor.
2. Connect the pressure tubing (figure 1, item 7) at its fittings (figure 1, item 8).
3. Connect the discharge steel braided flex hose (figure 1, item 5) to the compressor at its union (figure 1,item 6).
4. Connect the wiring in the pressure switch (figure 2, item 3), L1 (figure 2, item 1) and L2 (figure 2, item 2), using the labels from step 7 of Removal as a guide. Discard the labels.
5. Connect the motor wiring (figure 1, Item 3) using the labels from step 5 of Removal as a guide. Discard the labels.
6. Remove lockouts and tagouts (FM 55-502).
7. Operate the compressor under usual conditions (WP 0005 00).
8. Observe that the compressor operates normally without any leakage, vibration, or unusual noise.
9. Return equipment to the desired readiness condition.

END OF WORK PACKAGE

UNIT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
ELECTRIC MOTOR, REPLACE

INITIAL SETUP:

Tools and Special Tools:
Tool Kit, General Mechanic's (Item 1, Table 2, WP 0029 00)
Multimeter (Item 4, Table 2, WP 0029 00)

Materials/Parts:
Tag, Danger (Item 6, Table 1, WP 0033 00)

Personnel Required:
Two Watercraft Engineers, 88L

References:
FM 55-502
TB 43-0218
WP 0005 00
WP 0029 00
WP 0033 00

WARNING

Never reuse locking hardware. Reuse of locking hardware such as lockwashers, locking nuts, cotter pins, and lockwire can result in undetected loosening of fastening hardware causing catastrophic component failure resulting in death, injury, or damage to equipment. In accordance with TB 43-0218, ensure that all locking hardware is discarded upon removal and replaced with new.

REMOVAL

1. Perform system shutdown for the applicable air compressor (WP 0005 00).

2. At 440V power panel no. 4, set to OFF, lock out, and tag out (FM 55-502) the applicable air compressor circuit breaker as shown in table 1.

Table 1. AIR COMPRESSOR Lockout/Tagout Guide

AIR COMPRESSOR	Specific Breaker
1	AIR COMPRESSOR NO. 1
2	AIR COMPRESSOR NO. 2

3. Remove the four screws (figure 1, item 1) that secure the junction box cover (figure 1, item 2) to the electric motor (figure 1, item 3). Remove and set aside the junction box cover.

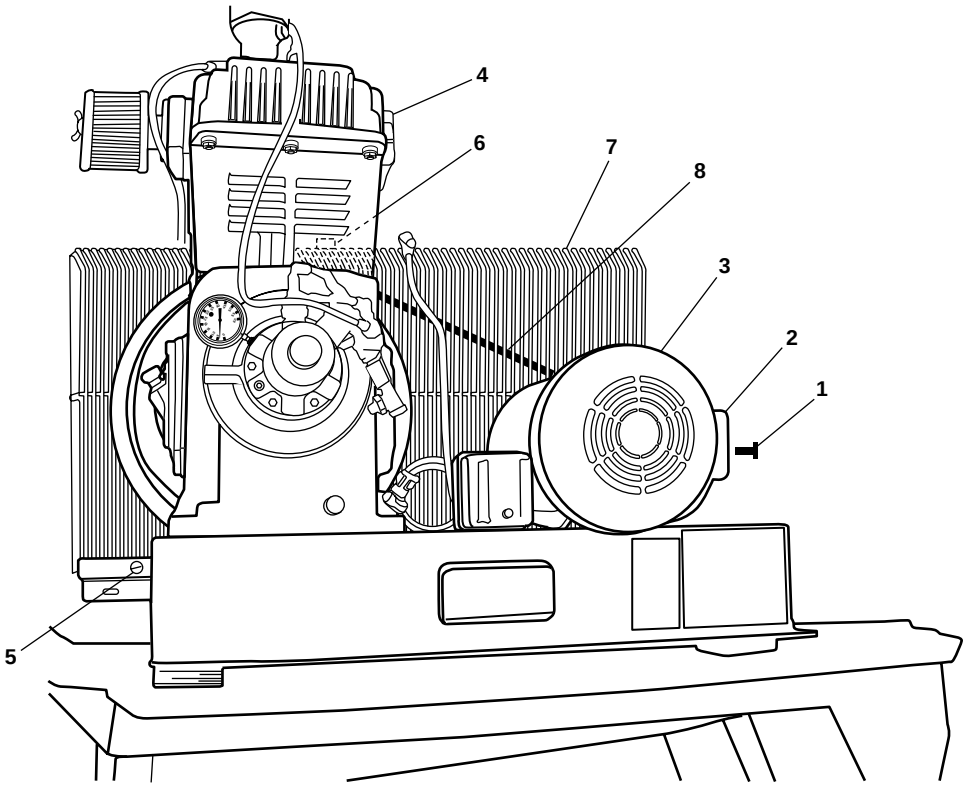


Figure 1. Electric Motor

Replace the air compressor motor only after the affected circuit has been secured, locked out, and tagged out. Performing replacement with the circuit energized may result in injury or death.

4. Use a multimeter to check for available voltage at the motor's wiring (figure 2, item 1). If voltage is available, ensure that the proper circuit breakers are secured, locked out, and tagged out (FM 55-502). If no voltage is available, continue with the procedure.

5. Label, disconnect, and remove the wiring (figure 2, item 1) from the junction box (figure 2, item 2).

6. Loosen the four mounting bolts (figure 2, item 3) and slide the motor (figure 1, item 3) toward the compressor (figure 1, item 4).

7. Remove the three lower screws (figure 1, item 5) and one upper screw (figure 1, item 6) that secure the belt guard (figure 1, item 7). Remove and set aside the belt guard.

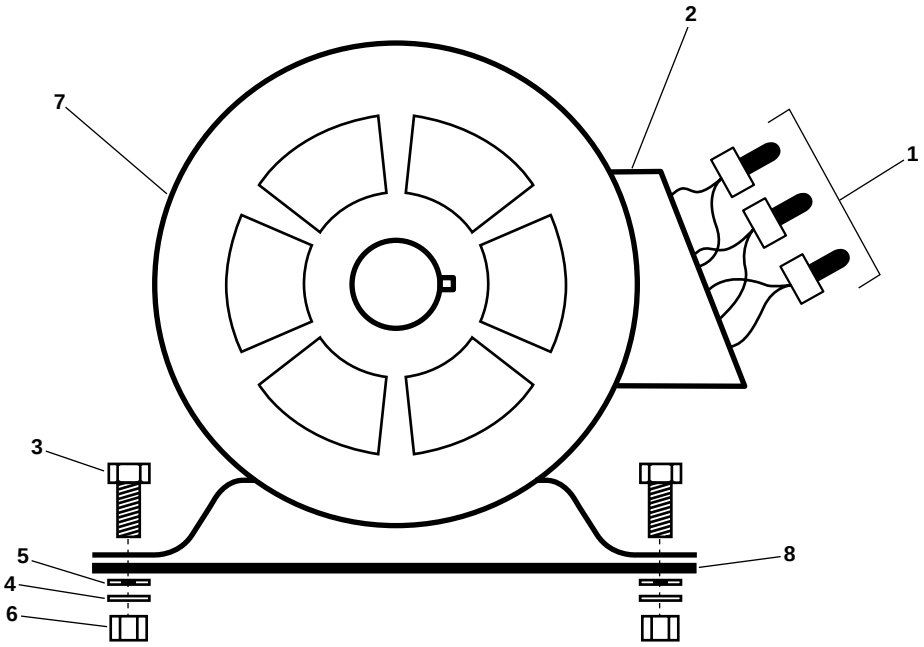


Figure 2. Junction Box

8. Remove the V belt (figure 1, item 8).

9. Remove the four bolts (figure 2, item 3), four washers (figure 2, item 4), four lockwashers (figure 2, item 5) and four nuts (figure 2, item 6) that secure the motor (figure 2, item 7) to the foundation (figure 2, item 8). Remove the motor from the foundation and discard the lockwashers.

INSTALLATION

1. Position the motor (figure 2, item 7) on the foundation (figure 2, item 8) and secure it loosely with the four bolts (figure 2, item 3), four washers (figure 2, item 4), four new lockwashers (Figure 2, item 5), and four nuts (figure 2, item 6). Do not tighten the bolts at this time.

2. Install the wiring (figure 2, item 1) into the junction box (figure 2, item 2) using the labels from step 5 of Removal as a guide. Remove the labels.

3. Install the junction box cover (figure 1, item 2) and secure it with the four screws (figure 1, item 1).

4. Install the V belt (figure 1, item 8) and slide the motor (figure 1, item 3) away from the compressor (figure 1, item 4) until the proper belt tension is achieved. Proper tension is achieved when the belt may be deflected 1/2 inch (13 mm) at its midpoint (figure 3) when applying approximatley 4 to 5 pounds (1.8 to 2.3 kg) of force to the belt. A new belt should be tensioned tighter (approximately 3/8 inch (10 mm) deflection). Once proper tension is achieved, tighten the four bolts (figure 2, item 3).

5. Install the belt guard (figure 1, item 7) and secure it with the three lower screws (figure 1, item 5) and one upper screw (figure 1, item 6).

6. Remove the lockout and tagouts (FM 55-502) and return the air compressor to the normal operating condition (WP 0005 00).

7. Operate the air compressor and check for proprer operation.

8. Return the equipment to the desired readiness condition.

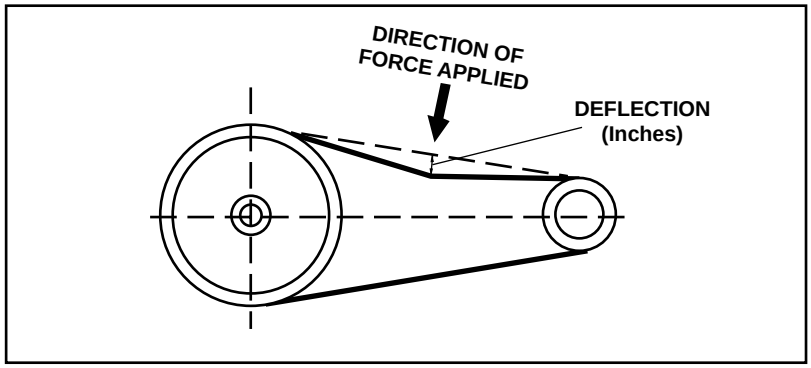


Figure 3. V Belt Midpoint

END OF WORK PACKAGE

Chapter 7

Direct Support Maintenance Instructions for Air Compressor

Inland and Coastal Large Tug (LT)

DIRECT SUPPORT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
COMPRESSED AIR SYSTEM, REPAIR

INITIAL SETUP:

Tools and Special Tools:
Tool Kit, General Mechanic's (Item 1, Table 2, WP 0029 00)

Materials/Parts:
Tag, Danger (Item 6, Table 1, WP 0033 00)
Tape, Antiseizing (Item 7, Table 1, WP 0033 00)

Personnel Required:
Two Watercraft Engineers, 88L

References:
FM 55-502
TB 43-0218
WP 0005 00
WP 0029 00
WP 0033 00

WARNING

Never reuse locking hardware. Reuse of locking hardware such as lockwashers, locking nuts, cotter pins, and lockwire can result in undetected loosening of fastening hardware causing catastrophic failure resulting in death, injury, or damage to equipment. In accordance with TB 43-0218, ensure that all locking hardware is discarded upon removal and replaced with new.

REPLACE DRYER

REMOVAL

1. Perform system shutdown for the applicable air compressor (WP 0005 00).

2. At 440V power panel no. 4, set to OFF, lock out, and tag out (FM 55-502) the applicable air compressor circuit breaker as shown in table 1.

3. OPEN, drain, lock out, and tag out the applicable air receiver drain valves as shown in table 1.

Table 1. AIR COMPRESSOR Lockout/Tagout Guide

Air Compressor	Circuit Breaker	Air Receivers	Air TK DR
1	AIR COMPRESSOR NO.1	Starting Air #1	CA-47
2	AIR COMPRESSOR NO.2	Starting Air #2	CA-46
		Ship's Service	CA-48

4. Loosen the dryer's drain piping union (figure 1, item 1) and remove the drain piping (figure 1, item 2) from the bottom of the dryer (figure 1, item 3).

5. Loosen the dryer's inlet piping union (figure 1, item 4) and the discharge piping union (figure 1, item 5) from the dryer (figure 1, item 3).

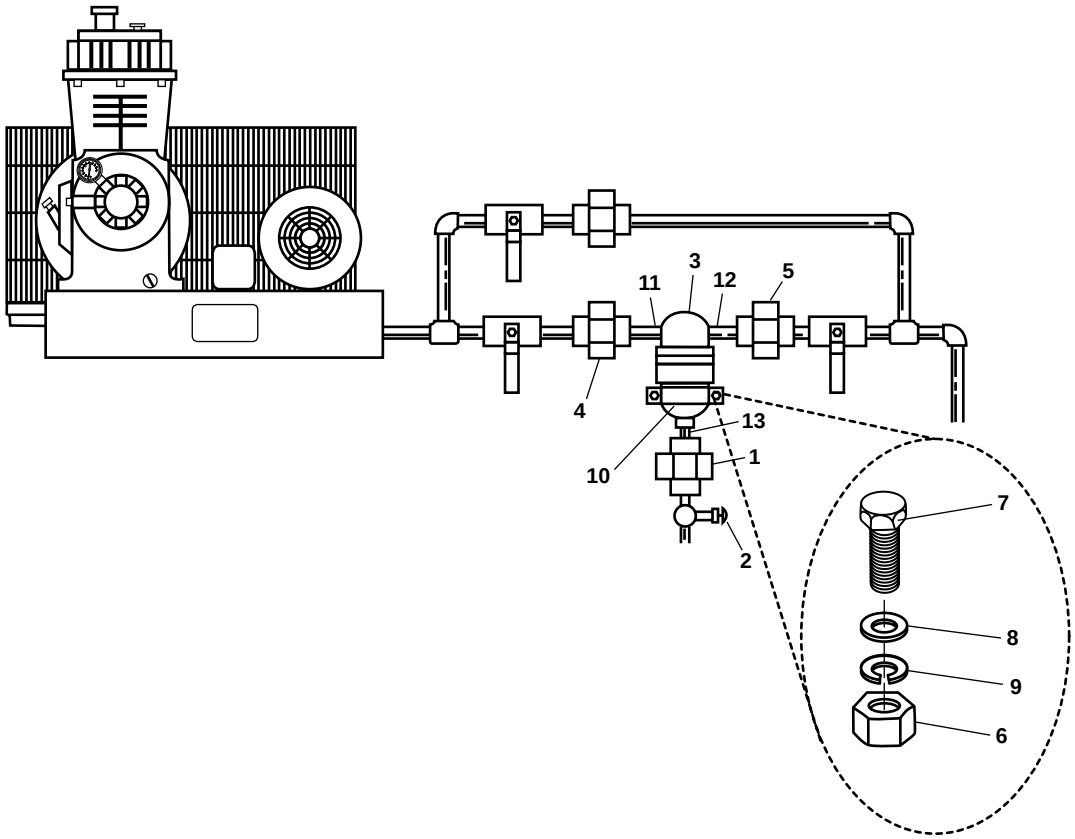


Figure 1. Air Dryer and Piping

6. Remove the two nuts (figure 1, item 6), two bolts (figure 1, item 7), two flat washers (figure 1, item 8), and two lockwashers (figure 1, item 9) securing the mounting strap (figure 1, item 10). Remove the dryer (figure 1, item 3). Discard the lockwashers.

7. Remove and set aside the pipe fittings (figure 1, items 11, 12, and 13) from the dryer (figure 1, item 3).

INSTALLATION

1. Wrap the male pipe threads of the pipe fittings (figure 1, items 11, 12, and 13) with antiseizing tape.

2. Install the pipe fittings (figure 1, items 11, 12, and 13) into the dryer (figure 1, item 3).

3. Position the dryer in its mounting strap (figure 1, item 10) and loosely attach the inlet and discharge pipe unions (figure 1, items 4 and 5). Do not tighten the unions at this time.

4. Loosely attach the drain piping union (figure 1, item 1) to the drain piping (figure 1, item 2). Do not tighten the union at this time.

5. Secure the mounting strap (figure 1, item 10) loosely with the two nuts (figure 1, item 6), two bolts (figure 1, item 7), two flat washers (figure 1, item 8), and two new lockwashers (figure 1, item 9). Do not tighten the fasteners at this time.

6. Tighten the inlet and discharge pipe unions (figure 1, items 4 and 5).

7. Tighten the drain piping union (figure 1, item 1).

8. Tighten the two nuts (figure 1, item 6) and two bolts (figure 1, item 7) that secure the mounting strap (figure 1, item 10).

9. Perform the Follow-On service procedure at the end of this work package.

REPLACE REGULATOR

REMOVAL

1. Close, lock out, and tag out (FM 55-502) SVCE AIR TK INL CA-39 (figure 2, item 1) and SVCE AIR TK INL CA-40 (figure 2, item 2) located in AMS 1 at the forward bulkhead next to the starting air tank 1.

2. Loosen the inlet union (figure 2, item 3) and outlet union (figure 2, item 4) and free them from the regulator

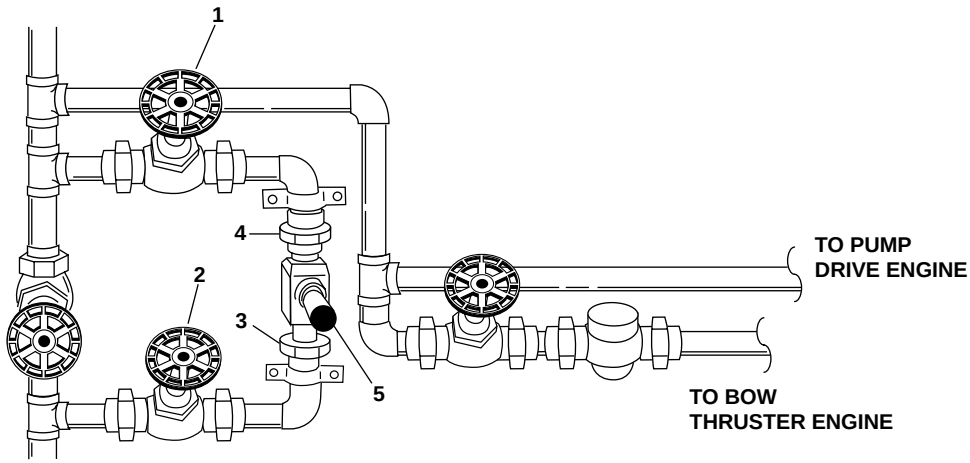


Figure 2. Ship's Starting Air Regulator and Piping

(figure 2, item 5).

3. Remove the regulator (figure 2, item 5) from the system and place it securely in a vise.

4. Remove and set aside the fittings installed in the regulator (figure 2, item 5).

INSTALLATION

1. Wrap the male pipe threads of the removed fittings with antiseizing tape.

2. Install the removed fittings into the regulator (figure 2, item 5).

3. Position the regulator (figure 2, item 5) in its piping.

4. Attach and tighten the inlet union (figure 2, item 3) and outlet union (figure 2, item 4).

5. Remove the lockouts and tagouts (FM 55-502). Open SVCE AIR TK INL CA-39 (figure 2, item 1) and SVCE AIR TK INL CA-40 (figure 2, item 2) located in AMS 1 forward bulkhead next to the starting air tank 1.

6. Perform the Follow-On Service procedure at the end of this work package.

REPLACE LOCAL GAUGE

REMOVAL

1. Close the 1/4 turn ball valve (figure 3, item 1) to stop air flow to the gauge (figure 3, item 2).
2. Remove the gauge (figure 3, item 2) from its piping (figure 3, item 3).

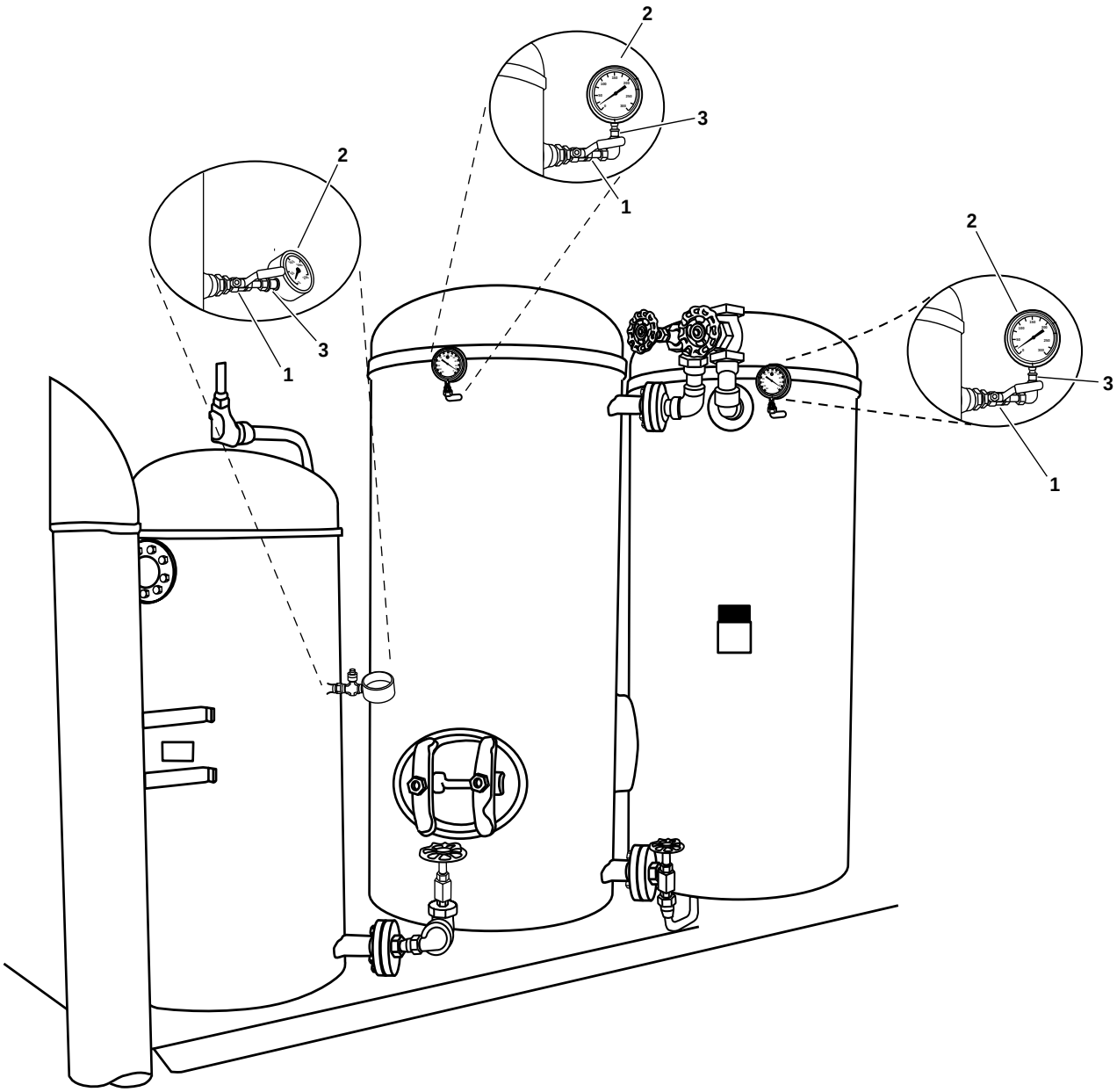


Figure 3. Local Pressure Gauge

INSTALLATION

1. Wrap the male pipe threads of the gauge (figure 3, item 2) with antiseizing tape.
2. Thread the gauge (figure 3, item 2) into its piping (figure 3, item 3) and tighten snugly.
3. Open 1/4 turn ball valve (figure 3, item 1) to allow air flow to gauge.
4. Perform the Follow-On Service procedure at the end of this work package.

FOLLOW-ON SERVICE

1. Remove the lockouts and tagouts (FM 55-502).
2. CLOSE the drain valves as shown in table 1 on the starting air and ship's service air receivers.
3. Return the air compressors to normal operation (WP 0005 00).
4. As the compressors are running, check the system for leakage and for proper operation.
5. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

DIRECT SUPPORT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
COMPRESSED AIR SYSTEM, REPLACE

INITIAL SETUP:

Tools and Special Tools:
Tool Kit, General Mechanic's (Item 1, Table 2, WP 0029 00)

Materials/Parts:
Gloves, Leather (Item 2, Table 3, WP 0032 00)
Goggles, Industrial (Item 3, Table 3, WP 0032 00)
Tag, Danger (Item 6, Table 1, WP 0033 00)
Tape, Antiseizing (Item 7, Table 1, WP 0033 00)

Personnel Required:
Two Watercraft Engineers, 88L

References:
FM 55-502
WP 0005 00
WP 0029 00
WP 0032 00
WP 0033 00

Equipment Conditions:
Set to OFF AIR COMPRESSOR NO. 1 and AIR COMPRESSOR NO. 2 circuit breakers in 440V power panel no. 4, lock out, and tag out (FM 55-502).
OPEN the starting air and ship's service air receiver drain valves CA-46, CA-47, AND CA-48. Lock out and tag out (FM 55-502).

REPLACE THREADED VALVES AND PIPING

REMOVAL

⚠ CAUTION

Never attempt to connect union connections with only one wrench. Damage to the vessel's standing piping could occur. Always use two wrenches.

1. Analyze the valve or piping that must be replaced to determine the best way to remove the affected component. The goal is to permit sufficient room to unthread the affected component. Sometimes it may be necessary to remove an entire section of piping in order to replace a single component. Sections of piping can most easily be removed at flange (figure 1, item 1) or union (figure 1, item 2) joints.

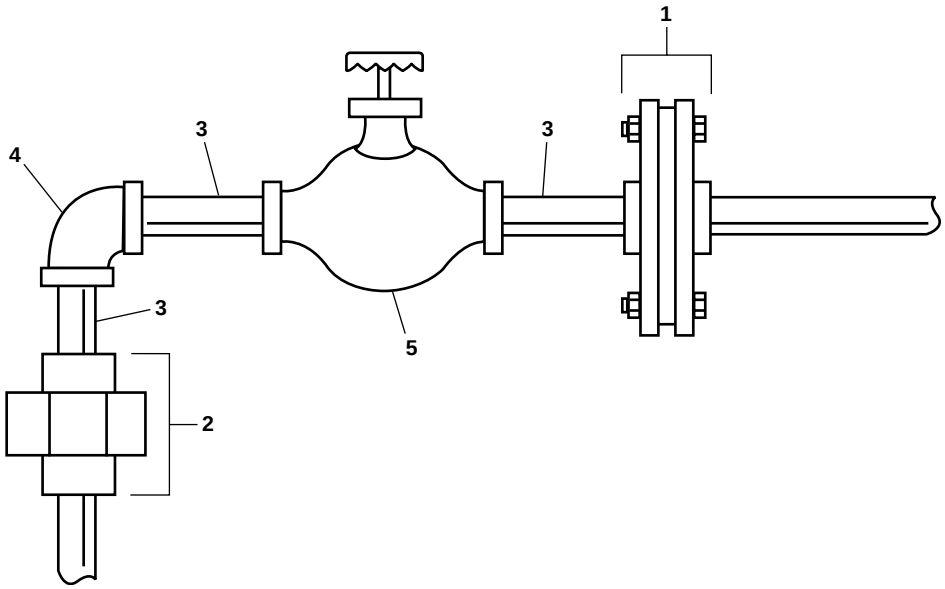
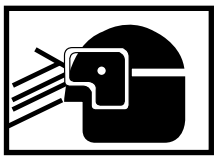


Figure 1. Replace Threaded Piping

2. After the proper approach has been decided upon, unscrew the affected piping (figure 1, item 3), fitting (figure 1, item 4), or valve (figure 1, item 5) from any adjacent components. Set aside any adjacent components for use during installation.

INSTALLATION

WARNING



Wire brushing operations can produce flying debris, which can become lodged in the skin or in the eyes. All personnel working in the area must wear protective eyewear, gloves, and long sleeves when performing wire-brushing operations. Failure to comply can result in serious injury to personnel.

NOTE

Although anitseizing tape is necessary on the valve's connection pipe threads, none will be allowed or necessary on the union threads. Leakage will result from applying antiseizing tape to the union threads.

1. Use a wire brush to thoroughly clean the pipe threads on any components that will be reused. Take care to remove all antiseizing tape from the threads.

2. Wrap all male pipe threads of all new components with antiseizing tape.

3. Thread the components back together, ensuring that all joints are securely tightened and that all components are properly oriented.

4. If a piping section was removed, install the piping section. If the section was removed at a flanged or unioned joint, follow the procedures contained in the paragraphs below.

5. Perform the Follow-On Service procedure at the end of this work package.

REPLACE VALVES AND PIPING, FLANGED

REMOVAL

1. Remove the nuts (figure 2, item 1) and bolts (figure 2, item 2) that secure the flange (figure 2, item 3).

2. Remove the affected pipe section or component from the system. It may be necessary to disconnect multiple flanges to accomplish this.

3. Remove and discard the gaskets (figure 2, item 4).

4. Disassemble the piping section as necessary to isolate the affected part. It may be necessary to follow the procedures contained in the paragraphs for threaded valves and piping of this work package.

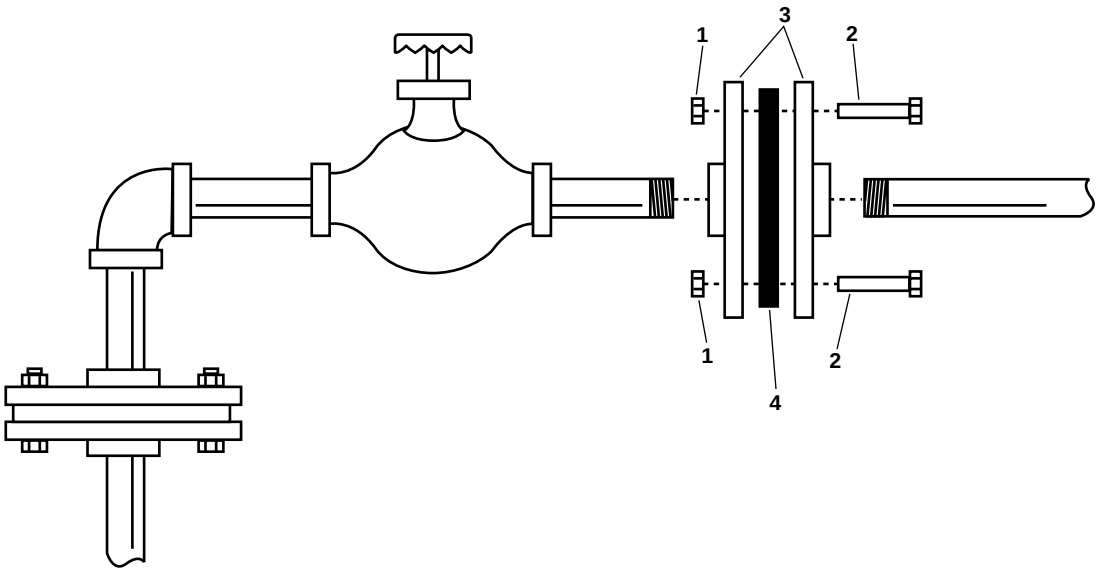


Figure 2. Replace Flanged Piping

INSTALLATION

1. Install all necessary piping that has been removed.

2. Position the piping section or component in place and loosely secure with one nut (figure 2, item 1) and one bolt (figure 2, item 2) in each flange (figure 2, item 3).

3. Insert a new gasket (figure 2, item 4) between the flanged sections and loosely secure with one nut (figure 2, item 1) and one bolt (figure 2, item 2) through the flange (figure 2, item 3) and gasket.

4. Remove the nut (figure 2, item 1) and bolt (figure 2, item 2) installed in step 2 above and position the gasket (figure 2, item 4) properly between the flanges.

5. Install the remaining nuts (figure 2, item 1) and bolts (figure 2, item 2) to secure the flange. Do not tighten the bolts at this time.

6. Repeat steps 4 through 6 above for any remaining flanges.

7. Tighten the nuts (figure 2, item 1) and bolts (figure 2, item 2) that secure the flanges (figure 2, item 3).

8. Perform the Follow-On Service procedure at the end of this work package.

FOLLOW-ON SERVICE

1. Remove the lockouts and tagouts (FM 55-502).

2. CLOSE the receiver drain valves.

3. Return the air compressors to normal operation (WP 0005 00).

4. As the compressors are running, check the system and the replaced component for audible leakage and for proper operation.

5. Return the equipment to the desired readiness condition.

END OF WORK PACKAGE

DIRECT SUPPORT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
AIR COMPRESSOR, REPAIR

IINITIAL SETUP:

Tools and Special Tools:
Tool Kit, General Mechanic's (Item 1, Table 2, WP 0029 00)
Wrench, Torque 0-250 FT-LB (Item 5, Table 2, WP 0029 00)

Materials/Parts:
Dry Cleaning Solvent (Item 1, Table 1, WP 0033 00)
Gloves, Chemical and Oil Protective (Item 1, Table 3, WP 0032 00)
Goggles, Industrial (Item 3, Table 3, WP 0032 00)
Lubricating Oil, Air Compressor (Item 3, Table 1, WP 0033 00)

Personnel Required:
One Watercraft Engineer, 88L

References:
TB 43-0218
WP 0018 00
WP 0019 00
WP 0025 00
WP 0029 00
WP 0032 00
WP 0033 00

Equipment Conditions:
Air compressor removed (WP 0025 00).

WARNING

Never reuse locking hardware. Reuse of locking hardware such as lockwashers, locking nuts, cotter pins, and lockwire can result in undetected loosening of fastening hardware causing catastrophic failure resulting in death, injury, or damage to equipment. In accordance with TB 43-0218, ensure that all locking hardware is discarded upon removal and replaced with new.

REPLACE OIL PUMP/CLEAN OIL PICKUP TUBE

REMOVAL

1. Perform Change Oil and Filter Disassembly (WP 0018 00).

2. Perform Replace Pilot Valve Removal (WP 0019 00).

3. Remove the eight bolts (figure 1, item 1) that secure the bearing carrier assembly (figure 1, item 2) to the compressor. Remove the bearing carrier assembly and gasket (figure 1, item 3). Discard the gasket.

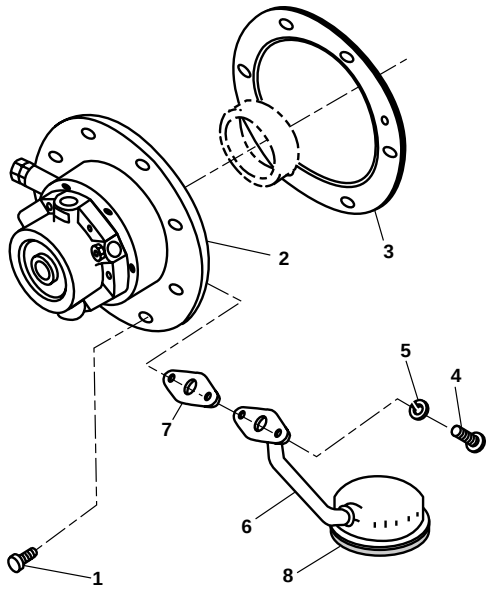


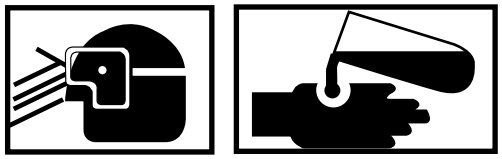
Figure 1. Oil Pump/Oil Pickup Tube Replacement

4. Remove the two bolts (figure 1, item 4) and two lockwashers (figure 1, item 5) that secure the oil pickup tube (figure 1, item 6) to the bearing carrier assembly (figure 1, item 2). Discard the lockwashers.

5. Remove the oil pickup tube (figure 1, item 6) and gasket (figure 1, item 7) from the bearing carrier assembly (figure 1, item 2). Discard the gasket.

CLEANING AND INSPECTION

WARNING



Do not allow compressor oil or cleaning solvents to come in contact with unprotected skin or eyes. Prolonged skin contact can cause illness or injury. Eye contact can cause serious injury. Always wear chemical protective gloves and goggles when handling compressor oil and cleaning solvents. Failure to follow these precautions can result in illness or serious injury.

Wire brushing operations produce high velocity flying debris which can become lodged in the skin or in the eyes. All personnel working in the area must wear protective eyewear, gloves, and long sleeves when performing wire brushing operations. Failure to comply can result in death or serious injury to personnel.

1. Thoroughly clean all metal parts in cleaning solvent. Allow parts to air dry.

2. If the oil pickup tube's (figure 1, item 6) inlet screen (figure 1, item 8) is clogged, a wire brush may be utilized to clean the screen. If cleaning is unsuccessful, replace the oil pump pickup tube.

INSTALLATION

1. Install the oil pickup tube (figure 1, item 6) and new gasket (figure 1, item 7) on the bearing carrier assembly (figure 1, item 2) and secure it with the two bolts (figure 1, item 4) and two new lockwashers (figure 1, item 5).

2. Position the bearing carrier assembly (figure 1, item 2) and new gasket (figure 1, item 3) onto the compressor and secure it with the eight bolts (figure 1, item 1).

3. Perform Replace Pilot Valve Installation (WP 0019 00).

4. Perform Change Oil and Filter Assembly (WP 0018 00).

REPLACE COMPRESSOR VALVES

REMOVAL

1. Remove the four bolts (figure 2, item 1) that secure the suction valve's (figure 2, item 2) valve cover plate (figure 2, item 3). Remove the valve cover plate and gasket (figure 2, item 4). Set aside the valve cover plate and discard the gasket.

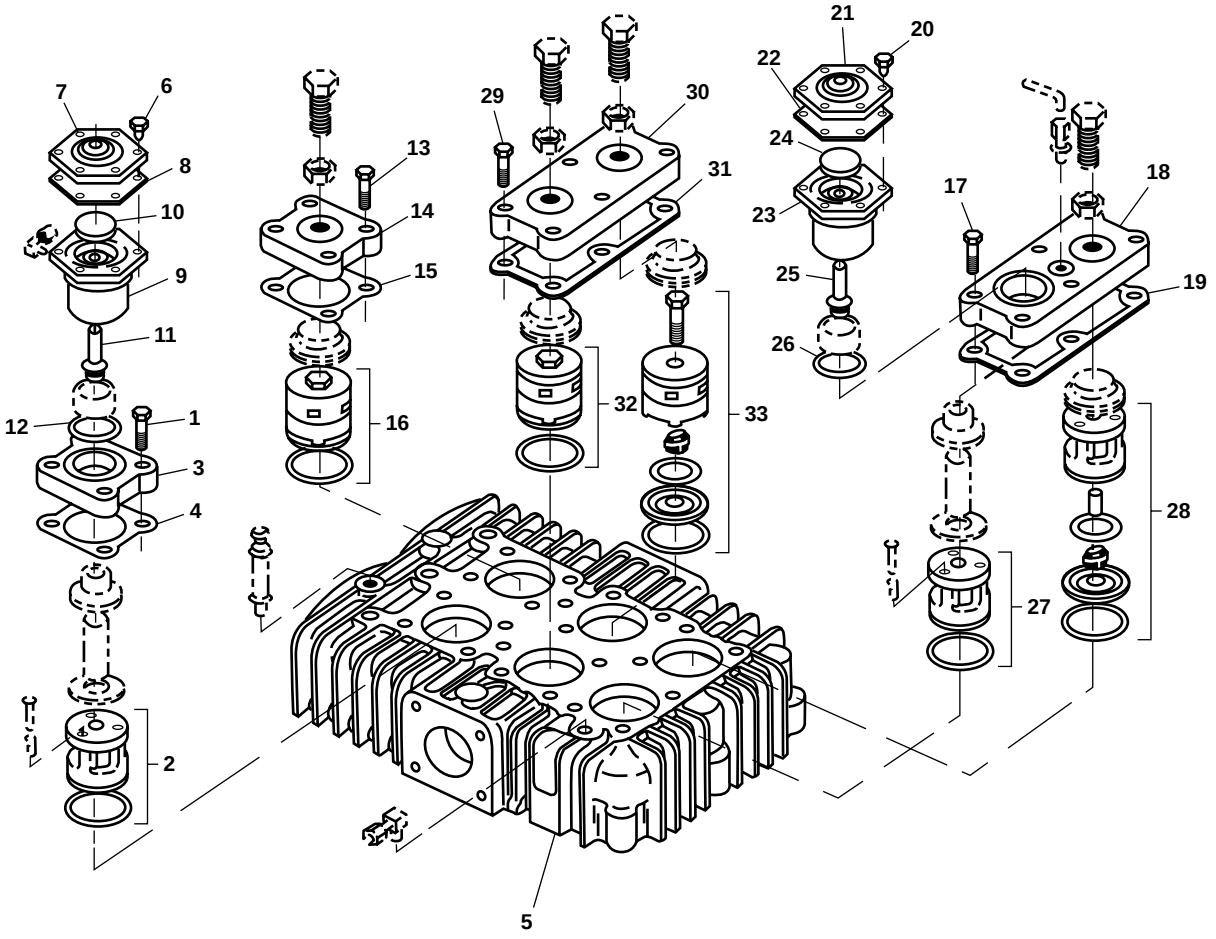


Figure 2. Compressor Valve Replacement

2. Remove the suction valve (figure 2, item 2) from the head assembly (figure 2, item 5).

3. Remove the six bolts (figure 2, item 6) from the diaphragm cover plate (figure 2, item 7). Remove the cover plate and the diaphragm (figure 2, item 8). Discard the diaphragm.

4. Remove the unloader body (figure 2, item 9), diaphragm disc (figure 2, item 10), unloader piston assembly (figure 2, item 11), and spacer ring (figure 2, item 12) from the valve cover plate (figure 2, item 3). Discard the spacer ring.

5. Remove the four bolts (figure 2, item 13) that secure the discharge valve's valve cover plate (figure 2, item 14) to the head assembly (figure 2, item 5). Remove the valve cover plate and gasket (figure 2, item 15). Set aside the valve cover plate and discard the gasket.

6. Remove the discharge valve (figure 2, item 16) from the head assembly (figure 2, item 5).

7. Remove the six bolts (figure 2, item 17) that secure the valve cover plate (figure 2, item 18) to the head assembly (figure 2, item 5). Remove the valve cover plate and gasket (figure 2, item 19). Set aside the valve cover plate and discard the gasket.

8. Remove the six bolts (figure 2, item 20) from the diaphragm cover plate (figure 2, item 21). Remove the cover plate and diaphragm (figure 2, item 22). Discard the diaphragm.

9. Remove the unloader body (figure 2, item 23), diaphragm disc (figure 2, item 24), unloader piston assembly (figure 2, item 25), and gasket (figure 2, item 26) from the valve cover plate (figure 2, item 18). Discard the gasket.

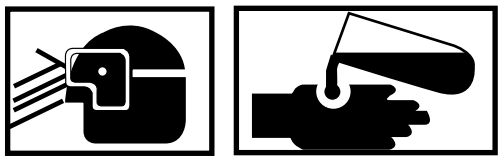
10. Remove the suction valves (figure 2, items 27 and 28) from the head assembly (figure 2, item 5).

11. Remove the six bolts (figure 2, item 29) that secure the valve cover plate (figure 2, item 30) to the head assembly (figure 2, item 5). Remove the valve cover plate and gasket (figure 2, item 31). Set aside the valve cover plate and discard the gasket.

12. Remove the discharge valves (figure 2, items 32 and 33) from the head assembly (figure 2, item 5).

CLEANING AND INSPECTION

WARNING



Do not allow compressor oil or cleaning solvents to come in contact with unprotected skin or eyes. Prolonged skin contact can cause illness or injury. Eye contact can cause serious injury. Always wear chemical protective gloves and goggles when handling compressor oil and cleaning solvents. Failure to follow these precautions can result in illness or serious injury.

1. Thoroughly clean all suction and discharge valves and valve cover plates in cleaning solvent. Allow parts to air dry.

2. Inspect the suction and discharge valves for signs of burning, pitting, scarring or other damage. Replace any burned, pitted, or scarred suction valves.

INSTALLATION

1. Install the discharge valves (figure 2, items 32 and 33) into the head assembly (figure 2, item 5).

2. Install the valve cover plate (figure 2, item 30) and new gasket (figure 2, item 31) on the head assembly (figure 2, item 5) and secure it with the six bolts (figure 2, item 29). Torque the bolts to 50 ft-lbs(67.8 Nm).

3. Install the suction valves (figure 2, items 27 and 28) into the head assembly (figure 2, item 5).

4. Install the unloader body (figure 2, item 23), diaphragm disc (figure 2, item 24), unloader piston assembly (figure 2, item 25), and new gasket (figure 2, item 26) into the valve cover plate (figure 2, item 18).

5. Install the new diaphragm (figure 2, item 22) and secure it with the diaphragm cover plate (figure 2, item 21) and six bolts (figure 2, item 20). Torque the bolts to 6 ft-lbs (8.13 Nm).

6. Install the valve cover plate (figure 2, item 18) and new gasket (figure 2, item 19) on the head assembly (figure 2, item 5) and secure it with the four bolts (figure 2, item 17). Torque the bolts to 50 ft-lbs(67.8 Nm).

7. Install the discharge valve (figure 2, item 16) into the head assembly (figure 2, item 5).

8. Secure the discharge valve's valve cover plate (figure 2, item 14) and new gasket (figure 2, item 15) to the head assembly (figure 2, item 5) with the four bolts (figure 2, item 13). Torque the bolts to 50 ft-lbs(67.8 Nm).

9. Install the unloader body (figure 2, item 9), diaphragm disc (figure 2, item 10), unloader piston assembly (figure 2, item 11), and new spacer ring (figure 2, item 12) into the valve cover plate (figure 2, item 3).

10. Install the new diaphragm (figure 2, item 8) and secure it with the diaphragm cover plate (figure 2, item 7) and six bolts (figure 2, item 6). Torque the bolts to 6 ft-lbs(8.13 Nm).

11. Install the suction valve (figure 2, item 2) into the head assembly (figure 2, item 5).

12. Install the valve cover plate (figure 2, item 3) and new gasket (figure 2, item 4) and secure them with the four bolts (figure 1, item 1). Torque the bolts to 50 ft-lbs(67.8 Nm).

13. Install air compressor (WP 0025 00).

END OF WORK PACKAGE

DIRECT SUPPORT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
AIR COMPRESSOR, REPLACE

INITIAL SETUP:

Tools and Special Tools:
Tool Kit, General Mechanic's (Item 1, Table 2, WP 0029 00)
Sling, Endless (Item 3, Table 2, WP 0029 00)
Chain Hoist, Hand Operated (Item 6, Table 2, WP 0029 00)

Materials/Parts:
Gloves, Leather (Item 2, Table 3, WP 0032 00)

Personnel Required:
Two Watercraft Engineers, 88L

References:
WP 0020 00
WP 0029 00
WP 0032 00

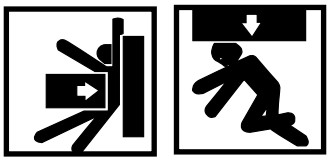
Equipment Conditions:
Air compressor prepared for removal (WP 0020 00)

REMOVAL

1. Remove the four nuts (figure 1, item 1), four bolts (figure 1, item 2), and eight flat washers (figure 1, item 3) that secure the air compressor base (figure 1, item 4) to its foundation (figure 1, item 5).

2. Rig the endless sling to the compressor (figure 1, item 7) and the chain hoist to a secure overhead structure.

WARNING



Heavy loads can crush. Do not allow any body parts to come under the load or between the load and a stationary object. Death or serious injury can result.

3. Use the chain hoist to lift the compressor (figure 1, item 6) from its foundation and lower it to the deck.

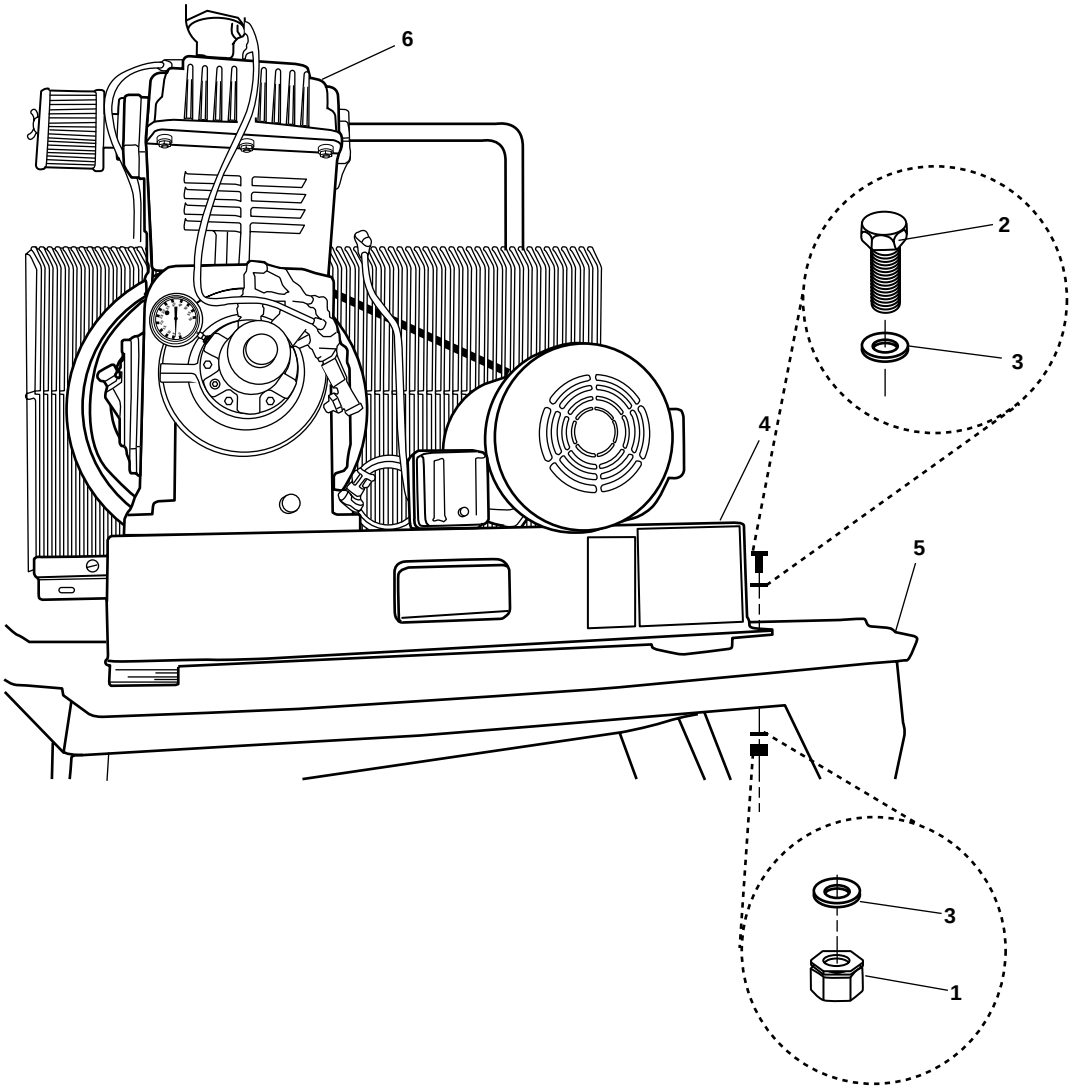


Figure 1. Air Compressor

INSTALLATION

1. Rig the endless sling to the compressor (figure 1, item 6) and the chain hoist to a secure overhead structure.

Heavy loads can crush. Do not allow any body parts to come under the load or between the load and a stationary object. Death or serious injury can result.

2. Use the chain hoist to lift the compressor (figure 1, item 6) from the deck to its foundation (figure 1, item 5).

3. Secure the air compressor base (figure 1, item 4) to its foundation (figure 1, item 5) with the four nuts (figure 1, item 1), four bolts (figure 1, item 2), and eight flat washers (figure 1, item 3).

4. Install the compressor (WP 0020 00).

END OF WORK PACKAGE

DIRECT SUPPORT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
ELECTRIC MOTOR, TEST AND REPAIR

INITIAL SETUP:

Tools and Special Tools:
Tool Kit, General Mechanic's (Item 1, Table 2, WP 0029 00)
Puller, Mechanical, Gear and Bearing (Item 8, Table 2, WP 0029 00)
Ohmmeter (Item 9, Table 2, WP 0292 00)

Personnel Required:
One Watercraft Engineer, 88L

References:
FM 55-509
WP 0021 00
WP 0029 00

Equipment Conditions:
Electric motor removed (WP 0021 00)

REPLACE COOLING FAN

DISASSEMBLY

1. Remove the three screws (figure 1, item 1) that secure the fan cover (figure 1, item 2) to the front endplate (figure 1, item 3). Remove and set aside the fan cover.

2. Loosen, but do not remove the nut (figure 1, item 4) and bolt (figure 1, item 5) that secure the fan (figure 1, item 6) to the rotor's shaft (figure 1, item 7).

3. Slide the fan (figure 1, item 6) off the rotor's shaft (figure 1, item 7).

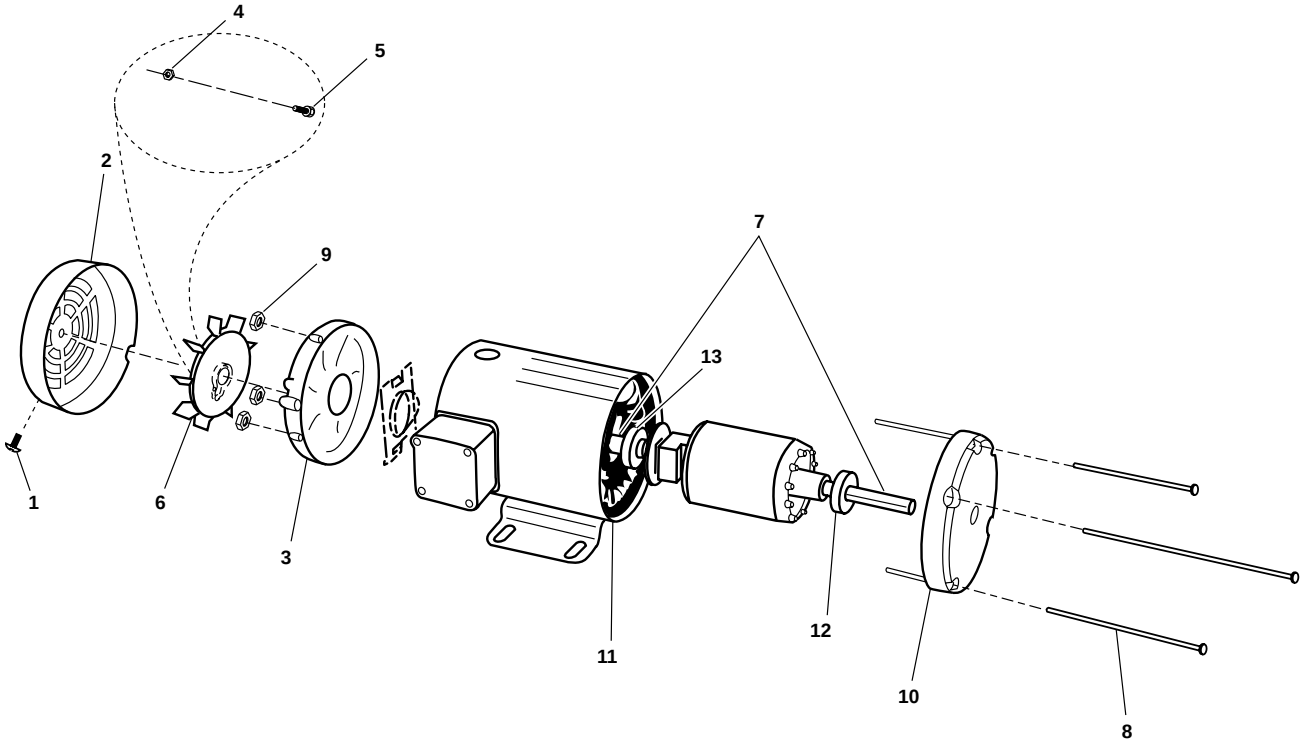


Figure 1. Cooling Fan Motor

ASSEMBLY

1. Slide the new fan (figure 1, item 6) onto the rotor's shaft (figure 1, item 7).

2. Secure the fan (figure 1, item 6) to the rotor's shaft (figure 1, item 7) by tightening the nut (figure 1, item 4) and bolt (figure 1, item 5).

3. Install the fan cover (figure 1, item 2) on the front endplate (figure 1, item 3), and secure it with the three screws (figure 1, item 1).

REPLACE MOTOR BEARINGS

DISASSEMBLY

1. Perform the Replace Cooling Fan Disassembly procedure in this work package.

2. Remove the four through bolts (figure 1, item 8) and four nuts (figure 1, item 9).

3. Remove the pulley endplate (figure 1, item 10) and front endplate (figure 1, item 3) from the rotor’s shaft (figure 1, item 7).

4. Carefully remove the rotor’s shaft (figure 1, item 7) from the motor case (figure 1, item 11).

NOTE

The front and rear bearings are different. Note the position of the bearings during disassembly so that the new bearings are installed in the proper location during assembly.

5. Using a bearing puller, remove the front bearing (figure 1, item 12) and rear bearing (figure 1, item 13) from the rotor’s shaft (figure 1, item 7). Note the position of the bearings so that the new bearings are installed in the proper location on assembly. Discard the old bearings.

ASSEMBLY

1. Install the new front bearing (figure 1, item 12) and new rear bearing (figure 1, item 13) onto the rotor’s shaft (figure 1, item 7).

2. Carefully install the rotor’s shaft (figure 1, item 7) into the motor case (figure 1, item 11).

3. Hold the rotor’s shaft (figure 1, item 7) in position while sliding the front endplate (figure 1, item 3) over the shaft and onto the motor case (figure 1, item 11).

4. Hold the rotor’s shaft (figure 1, item 7) in position while sliding the pulley endplate (figure 1, item 10) over the rotor’s shaft and onto the motor case (figure 1, item 11).

5. Secure the endplates (figure 1, items 3 and 10) with the four through bolts (figure 1, item 8) and four nuts (figure 1, item 9).

6. Perform the Replace Cooling Fan Assembly procedure in this work package.

TEST ELECTRIC MOTOR WINDING

1. Perform the Replace Motor Bearings Disassembly procedure in this work package.

2. Using an ohmmeter (figure 2, item 1), connect one ohmmeter test lead (figure 2, item 2) to a motor winding lead (figure 2, item 3), and the other ohmmeter test lead (figure 2, item 2) to the electric motor housing (figure 2, item 4).

3. Test the electric motor windings (figure 2, item 3) for continuity between the electric motor windings and the electric motor housing (figure 2, item 4) (FM 55-509).

4. Perform step 3 for each of the motor winding leads (figure 2, item 3).

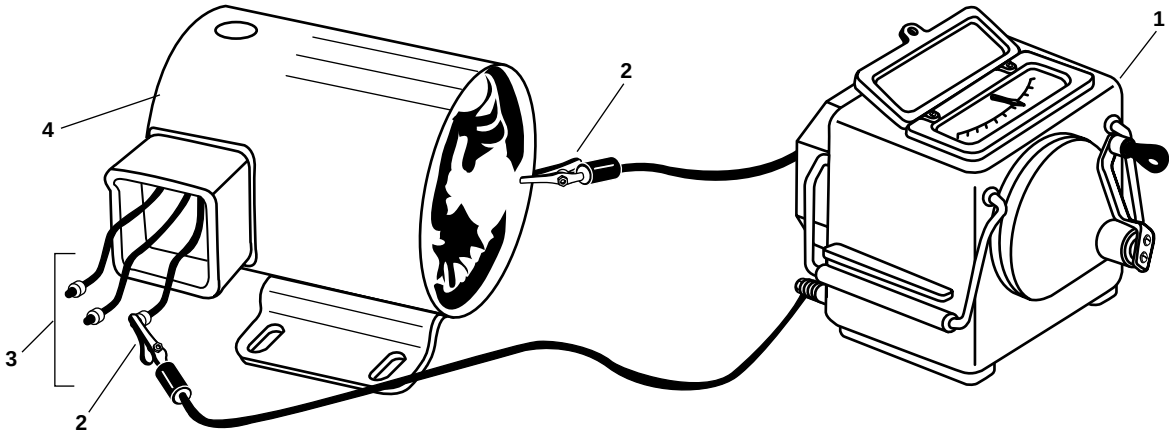


Figure 2. Ohmmeter and Electric Motor Housing

5. There should be no continuity between the motor windings and motor housing. Resistance should be present between the electric motor winding leads and the electric motor housing.

6. If continuity is present, replace the electric motor. If no continuity is present, continue with this procedure

7. Perform the Replace Motor Bearings Assembly procedure in this work package.

END OF WORK PACKAGE

Chapter 8

Supporting Information for Air Compressor

Inland and Coastal Large Tug (LT)

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
REFERENCES

This work package lists all field manuals, forms, technical manuals, and miscellaneous publications referenced in this manual.

ARMY REGULATIONS

AR 700-138	Army Logistics Readiness and Sustainability

FIELD MANUALS

FM 4-25.11	First Aid
FM 55-502	Watercraft Safety

TECHNICAL MANUALS

S9074-AR-GIB-010/278	Requirements for Fabrication Welding and Inspection, and Casting Inspection and Repair for Machinery, Piping, and Pressure Vessels.
TM 38-470	Storage and Maintenance of Army Prepositioned Stock Materiel
TM 55-1925-273-24&P	Unit, Direct Support, and General Support Maintenance Manual including Repair Parts and Special Tools List for Inland and Coastal Large Tug (LT) NSN 1925-01-509-7013
TM 750-244-6	Procedures for Destruction of Tank-Automotive Equipment to Prevent Enemy Use

TECHNICAL BULLETINS

TB 43-0218	Inspection, Use and Tightening of Metal Fasteners Used on Tank-Automotive Equipment
TB 43-0144	Painting of Watercraft
TB 740-97-4	Preservation of Vessels for Storage

FORMS AND PAMPHLETS

DA Form 4640	Harbor Boat Deck Department Log for Class A&B Vessels
DA Form 4993	Harbor Boat Engine Department Log for Class A and C-1 Vessels
DA Form 2028	Recommended Changes to Equipment Technical Publications
DA Form 2404	Equipment Inspection and Maintenance Worksheet
DA Form 2407	Maintenance Request
DA Form 2408-9	Equipment Control Record
DA PAM 738-750	Functional Users Manual for The Army Maintenance Management System (TAMMS)
SF 368	Product Quality Deficiency Report

HANDBOOKS AND STANDARDS

MIL-HDBK-113	Guide for the Selection of Lubricants, Functional Fluids, Preservatives, and Specialty Products for Use in Ground Equipment Systems
MIL-HDBK-275	Guide for the Selection of Lubricant Fluids and Compounds for Use in Flight Vehicles and Components

END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
MAINTENANCE ALLOCATION CHART (MAC)
INTRODUCTION

THE ARMY MAINTENANCE SYSTEM MAC

This introduction provides a general explanation of all maintenance and repair functions authorized at various maintenance levels under the standard Army Maintenance System concept.

The MAC (immediately following the introduction) designates overall authority and responsibility for the performance of maintenance functions on the identified end item or component. The application of the maintenance functions to the end item or component shall be consistent with the capacities and capabilities of the designated maintenance levels, which are shown on the MAC in column (4) as:

Unit — includes two subcolumns, C (operator/crew) and O (unit) maintenance.
Direct Support — includes an F subcolumn.
General Support — includes an H subcolumn.
Depot — includes a D subcolumn.

The tools and test equipment requirements (immediately following the MAC) list the tools and test equipment (both special tools and common tool sets) required for each maintenance function as referenced from the MAC.

The remarks (immediately following the tools and test equipment requirements) contain supplemental instructions and explanatory notes for a particular maintenance function.

MAINTENANCE FUNCTIONS

Maintenance functions are limited to and defined as follows:

1. Inspect. To determine the serviceability of an item by comparing its physical, mechanical, and/or electrical characteristics with established standards through examination (e.g., by sight, sound, or feel). This includes scheduled inspection and gagings and evaluation of cannon tubes.

2. Test. To verify serviceability by measuring the mechanical, pneumatic, hydraulic, or electrical characteristics of an item and comparing those characteristics with prescribed standards on a scheduled basis, i.e., load testing of lift devices and hydrostatic testing of pressure hoses.

3. Service. Operations required periodically to keep an item in proper operating condition; e.g., to clean (includes decontaminate, when required), to preserve, to drain, to paint, or to replenish fuel, lubricants, chemical fluids, or gases. This includes scheduled exercising and purging of recoil mechanisms.

4. Adjust. To maintain or regulate, within prescribed limits, by bringing into proper position, or by setting the operating characteristics to specified parameters.

5. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

6. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments of test, measuring, and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy, to detect and adjust any discrepancy in the accuracy of the instrument being compared.

7. Remove/Install. To remove and install the same item when required to perform service or other maintenance functions. Install may be the act of emplacing, seating, or fixing into position a spare, repair part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

8. Replace. To remove an unserviceable item and install a serviceable counterpart in its place. "Replace" is authorized by the MAC and assigned maintenance level is shown as the third position code of the Source, Maintenance and Recoverability (SMR) code.

9. Repair. The application of maintenance services, including fault location/troubleshooting, removal/installation, disassembly/assembly procedures, and maintenance actions to identify troubles and restore serviceability to an item by correcting specific damage, fault, malfunction, or failure in a part, subassembly, module (component or assembly), end item, or system.

NOTE

The following definitions are applicable to the "repair" maintenance function:

Services. Inspect, test, service, adjust, align, calibrate, and/or replace.

Fault location/troubleshooting. The process of investigating and detecting the cause of equipment malfunctioning; the act of isolating a fault within a system or Unit Under Test (UUT).

Disassembly/assembly. The step-by-step breakdown (taking apart) of a spare/functional group coded item to the level of its least component, that is assigned an SMR code for the level of maintenance under consideration (i.e., identified as maintenance significant).

Actions. Welding, grinding, riveting, straightening, facing, machining, and/or resurfacing.

10. Overhaul. That maintenance effort (service/action) prescribed to restore an item to a completely serviceable/operational condition as required by maintenance standards in appropriate technical publications. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

11. Rebuild. Consists of those services/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero those age measurements (e.g., hours/miles) considered in classifying Army equipment/components.

EXPLANATION OF COLUMNS IN THE MAC

Column (1) Group Number. Column (1) lists FGC numbers, the purpose of which is to identify maintenance significant components, assemblies, subassemblies, and modules with the Next Higher Assembly (NHA).

Column (2) Component/Assembly. Column (2) contains the item names of components, assemblies, subassemblies, and modules for which maintenance is authorized.

Column (3) Maintenance Function. Column (3) lists the functions to be performed on the item listed in column (2). (For a detailed explanation of these functions refer to "Maintenance Functions" outlined above.)

Column (4) Maintenance Level. Column (4) specifies each level of maintenance authorized to perform each function listed in column (3), by indicating work time required (expressed as manhours in whole hours or decimals) in the appropriate subcolumn. This work time figure represents the active time required to perform that maintenance function at the indicated level of maintenance. If the number or complexity of the tasks within the listed maintenance function varies at different maintenance levels, appropriate work time figures are to be shown

for each level. The work time figure represents the average time required to restore an item (assembly, subassembly, component, module, end item, or system) to a serviceable condition under typical field operating conditions. This time includes preparation time (including any necessary disassembly/assembly time), troubleshooting/fault location time, and quality assurance time in addition to the time required to perform the specific tasks identified for the maintenance functions authorized in the MAC. The symbol designations for the various maintenance levels are as follows:

C Operator or crew maintenance
O Unit maintenance
F Direct support maintenance
L Specialized repair activity (SRA)
H General support maintenance
D Depot maintenance

NOTE

The "L" maintenance level is not included in column (4) of the MAC. Functions to this level of maintenance are identified by a work time figure in the "H" column of column (4), and an associated reference code is used in the REMARKS column (6). This code is keyed to the remarks and the SRA complete repair application is explained there.

Column (5) Tools and Equipment Reference Code. Column (5) specifies, by code, those common tool sets (not individual tools), common Test, Measurement and Diagnostic Equipment (TMDE), and special tools, special TMDE and special support equipment required to perform the designated function. Codes are keyed to the entries in the tools and test equipment table.

Column (6) Remarks Code. When applicable, this column contains a letter code, in alphabetical order, which is keyed to the remarks table entries.

EXPLANATION OF COLUMNS IN THE TOOLS AND TEST EQUIPMENT REQUIREMENTS

Column (1) Tool or Test Equipment Reference Code. The tool or test equipment reference code correlates with a code used in column (5) of the MAC.

Column (2) Maintenance Level. The lowest level of maintenance authorized to use the tool or test equipment.

Column (3) Nomenclature. Name or identification of the tool or test equipment.

Column (4) National Stock Number (NSN). The NSN of the tool or test equipment.

Column (5) Tool Number. The manufacturer's part number, model number, or type number.

EXPLANATION OF COLUMNS IN THE REMARKS

Column (1) Remarks Code. The code recorded in column (6) of the MAC.

Column (2) Remarks. This column lists information pertinent to the maintenance function being performed as indicated in the MAC.

END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
MAINTENANCE ALLOCATION CHART

Table 1. MAC for Air Compressors for Inland and Coastal Large Tug

(1) GROUP NUMBER	(2) COMPONENT/ ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE LEVEL					(5) TOOLS AND EQUIP	(6) REMARKS
			FIELD			SUSTAINMENT			
			UNIT		DIRECT SUPPORT	GENERAL SUPPORT	DEPOT		
			C	O	F	H	D		
0513	Compressed Air System	Inspect	0.5						
		Test	1.0					1	A
		Service	1.5					1,2	
		Adjust	2.0					1	
		Repair		2.0	6.0			1,4	
		Replace		0.5	2.0			1,4	
051301	Air Compressor	Inspect	0.5						
		Test	1.0					1	A
		Service		1.0				1,5,7	
		Repair		2.0	6.0			1,4,5	
		Replace		0.5	2.0			1,3,4,6	
05130101	Electric Motor	Inspect	0.5						
		Service	1.0						
		Test		1.0	2.0			1,9	
		Repair			4.0			1,8	
		Replace		2.0				1,4	
051302	Air Receivers	Inspect	0.5						
		Service	1.5					1	
		Replace					--		

Table 2. Tools and Test Equipment for Air Compressor for Inland and Coastal Large Tug

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE LEVEL	NOMENCLATURE	NATIONAL STOCK NUMBER	TOOL NUMBER
1	C	Tool Kit, General Mechanic's	5180-00-629-9783	SC 5180-90-CL-N55 (50980)
2	C	Tool Kit, Electrician's	5180-00-313-3045	MILT11196 (81349)
3	F	Sling, Endless	3940-01-183-9412	3375957 (15434)
4	C	Multimeter	6625-01-265-6000	27 W/ACCE (89536)
5	O	Wrench, Torque 0-250 FT-LB	5120-00-640-6365	B107.14M (05047)
6	F	Chain Hoist, Hand Operated, 3/4 Ton	3950-00-235-4235	MILH904CLASS1 TYPEHSTYLE1 (81349)
7	O	Lubricating Gun, Hand	4930-00-223-3389	7584 (57733)
8	F	Puller, Mechanical, Gear and Bearing, 0 to 7 spread, 5-1/8 Reach	5120-60-288-7710	GGG-P-781 (81348)
9	F	Ohmmeter	6625-01-223-2980	212159 (07239)

Table 3. Remarks for Air Compressor for Inland and Coastal Large Tug

REFERENCE CODE	REMARKS
A	Test: Use Technical Bulletin TB 43-0151

END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE AIR COMPRESSOR FOR INLAND AND COASTAL LARGE TUG (LT) REPAIR PARTS AND SPECIAL TOOLS LIST INTRODUCTION

SCOPE

This RPSTL lists and authorizes spares and repair parts; special tools; special test, measurement, and diagnostic equipment (TMDE); and other special support equipment required for performance of operator, unit, direct support, and general support maintenance of the air compressor for Inland and Coastal Large Tug (LT). It authorizes the requisitioning, issue, and disposition of spares, repair parts, and special tools as indicated by the source, maintenance, and recoverability (SMR) codes.

GENERAL

In addition to the Introduction work package, this RPSTL is divided into the following work packages.

1. Repair Parts List Work Packages. Work packages containing lists of spares and repair parts authorized by this RPSTL for use in the performance of maintenance. These work packages also include parts which must be removed for replacement of the authorized parts. Parts lists are composed of functional groups in ascending alphanumeric sequence, with the parts in each group listed in ascending figure and item number sequence. Sending units, brackets, filters, and bolts are listed with the component they mount on. Bulk materials are listed by item name in FIG. BULK at the end of the work packages. Repair parts kits are listed separately in their own functional group and work package. Repair parts for reparable special tools are also listed in a separate work package. Items listed are shown on the associated illustrations.

2. Special Tools List Work Packages. Work packages containing lists of special tools, special TMDE, and special support equipment authorized by this RPSTL (as indicated by Basis of Issue (BOI) information in the DESCRIPTION AND USABLE ON CODE (UOC) column). Tools that are components of common tool sets and/or Class VII are not listed.

3. Cross-Reference Indexes Work Packages. There are two cross-reference index work packages in this RPSTL: the National Stock Number (NSN) Index work package and the Part Number (P/N) Index work package. The National Stock Number Index work package refers you to the figure and item number. The Part Number Index work package refers you to the figure and item number.

EXPLANATION OF COLUMNS IN THE REPAIR PARTS LIST AND SPECIAL TOOLS LIST WORK PACKAGES

ITEM NO. (Column (1)). Indicates the number used to identify items called out in the illustration.

SMR CODE (Column (2)). The SMR code containing supply/requisitioning information, maintenance level authorization criteria, and disposition instruction, as shown in the following breakout:

Source Code	**Maintenance Code**		**Recoverability Code**
XX	XX		X
1st two positions: How to get an item.	3rd position: Who can install, replace, or use the item.	4th position: Who can do complete repair* on the item.	5th position: Who determines disposition action on unserviceable items.

*Complete Repair: Maintenance capacity, capability, and authority to perform all corrective maintenance tasks of the "Repair" function in a use/user environment in order to restore serviceability to a failed item.

Source Code. The source code tells you how you get an item needed for maintenance, repair, or overhaul of an end item/equipment. Explanations of source codes follow:

Source Code	Application/Explanation
PA PB PC PD PE PF PG	Stock items; use the applicable NSN to requisition/request items with these source codes. They are authorized to the level indicated by the code entered in the 3rd position of the SMR code. **NOTE** Items coded PC are subject to deterioration.
KD KF KB	Items with these codes are not to be requested/requisitioned individually. They are part of a kit which is authorized to the maintenance level indicated in the 3rd position of the SMR code. The complete kit must be requisitioned and applied.
MO-Made at unit/AVUM level MF-Made at DS/AVIM level MH-Made at GS level ML-Made at SRA MD-Made at depot	Items with these codes are not to be requisitioned/requested individually. They must be made from bulk material which is identified by the P/N in the DESCRIPTION AND USABLE ON CODE (UOC) column and listed in the bulk material group work package of the RPSTL. If the item is authorized to you by the 3rd position code of the SMR code, but the source code indicates it is made at higher level, order the item from the higher level of maintenance.
AO-Assembled by unit/AVUM level AF-Assembled by DS/AVIM level AH-Assembled by GS level AL-Assembled by SRA AD-Assembled by depot	Items with these codes are not to be requested/requisitioned individually. The parts that make up the assembled item must be requisitioned or fabricated and assembled at the level of maintenance indicated by the source code. If the 3rd position of the SMR code authorizes you to replace the item, but the source code indicates the item is assembled at a higher level, order the item from the higher level of maintenance.
XA	Do not requisition an "XA" coded item. Order the next higher assembly.(Refer to NOTE below.)
XB	If an item is not available from salvage, order it using the CAGEC and P/N.
XC	Installation drawings, diagrams, instruction sheets, field service drawings; identified by manufacturer's P/N.
XD	Item is not stocked. Order an XD-coded item through normal supply channels using the CAGEC and P/N given, if no NSN is available.
	NOTE Cannibalization or controlled exchange, when authorized, may be used as a source of supply for items with the above source codes except for those items source coded "XA" or those aircraft support items restricted by requirements of AR 750-1.

Maintenance Code. Maintenance codes tell you the level(s) of maintenance authorized to use and repair support items. The maintenance codes are entered in the third and fourth positions of the SMR code as follows:

Third Position. The maintenance code entered in the third position tells you the lowest maintenance level authorized to remove, replace, and use an item. The maintenance code entered in the third position will indicate authorization to the following levels of maintenance:

Maintenance Code	Application/Explanation
C -	Crew or operator maintenance done within unit/AVUM maintenance.
O -	Unit level/AVUM maintenance can remove, replace, and use the item.
F -	Direct support/AVIM maintenance can remove, replace, and use the item.
H -	General support maintenance can remove, replace, and use the item.
L -	Specialized repair activity can remove, replace, and use the item.
D -	Depot can remove, replace, and use the item.

Fourth Position. The maintenance code entered in the fourth position tells you whether or not the item is to be repaired and identifies the lowest maintenance level with the capability to do complete repair (perform all authorized repair functions).

NOTE

Some limited repair may be done on the item at a lower level of maintenance, if authorized by the Maintenance Allocation Chart (MAC) and SMR codes.

Maintenance Code	Application/Explanation
O -	Unit/AVUM is the lowest level that can do complete repair of the item.
F -	Direct support/AVIM is the lowest level that can do complete repair of the item.
H -	General support is the lowest level that can do complete repair of the item.
L -	Specialized repair activity (enter specialized repair activity designator) is the lowest level that can do complete repair of the item.
D -	Depot is the lowest level that can do complete repair of the item.
Z -	Nonrepairable. No repair is authorized.
B -	No repair is authorized. No parts or special tools are authorized for maintenance of "B" coded item. However, the item may be reconditioned by adjusting, lubricating, etc., at the user level.

Recoverability Code. Recoverability codes are assigned to items to indicate the disposition action on unserviceable items. The recoverability code is shown in the fifth position of the SMR code as follows:

Recoverability Code	Application/Explanation
Z -	Nonreparable item. When unserviceable, condemn and dispose of the item at the level of maintenance shown in the third position of the SMR code.
O -	Reparable item. When uneconomically reparable, condemn and dispose of the item at the unit level.
F -	Reparable item. When uneconomically reparable, condemn and dispose of the item at the direct support level.

Recoverability Code	Application/Explanation
H -	Reparable item. When uneconomically reparable, condemn and dispose of the item at the general support level.
D -	Reparable item. When beyond lower level repair capability, return to depot. Condemnation and disposal of item are not authorized below depot level.
L -	Reparable item. Condemnation and disposal not authorized below Specialized Repair Activity (SRA).
A -	Item requires special handling or condemnation procedures because of specific reasons (such as precious metal content, high dollar value, critical material, or hazardous material). Refer to appropriate manuals/directives for specific instructions.

NSN (Column (3)). The NSN for the item is listed in this column.

CAGEC (Column (4)). The Commercial and Government Entity Code (CAGEC) is a five-digit code which is used to identify the manufacturer, distributor, or Government agency/activity that supplies the item.

PART NUMBER (Column (5)). Indicates the primary number used by the manufacturer (individual, company, firm, corporation, or Government activity), which controls the design and characteristics of the item by means of its engineering drawings, specifications, standards, and inspection requirements to identify an item or range of items.

NOTE

When you use an NSN to requisition an item, the item you receive may have a different P/N from the number listed.

DESCRIPTION AND USABLE ON CODE (UOC) (Column (6)). This column includes the following information:

1. The federal item name, and when required, a minimum description to identify the item.
2. P/Ns of bulk materials are referenced in this column in the line entry to be manufactured or fabricated.
3. Hardness Critical Item (HCI). A support item that provides the equipment with special protection from electromagnetic pulse (EMP) damage during a nuclear attack.
4. The statement END OF FIGURE appears just below the last item description in column (6) for a given figure in both the repair parts list and special tools list work packages.

QTY (Column (7)). The QTY (quantity per figure) column indicates the quantity of the item used in the breakout shown on the illustration/figure, which is prepared for a functional group, subfunctional group, or an assembly. A "V" appearing in this column instead of a quantity indicates that the quantity is variable and quantity may change from application to application.

EXPLANATION OF CROSS-REFERENCE INDEXES WORK PACKAGES FORMAT AND COLUMNS

1. National Stock Number (NSN) Index Work Package.

(e.g., 5385-01-574-1476)
NSN
NIIN

STOCK NUMBER Column. This column lists the NSN in National item identification number (NIIN) sequence. The NIIN consists of the last nine digits of the NSN.

When using this column to locate an item, ignore the first four digits of the NSN. However, the complete NSN should be used when ordering items by stock number.

FIG. Column. This column lists the number of the figure where the item is identified/located. The figures are in numerical order in the repair parts list and special tools list work packages.

ITEM Column. The item number identifies the item associated with the figure listed in the adjacent FIG. column. This item is also identified by the NSN listed on the same line.

2. Part Number (P/N) Index Work Package. P/Ns in this index are listed in ascending alphanumeric sequence (vertical arrangement of letter and number combinations which places the first letter or digit of each group in order A through Z, followed by the numbers 0 through 9 and each following letter or digit in like order).

PART NUMBER Column. Indicates the P/N assigned to the item.

FIG. Column. This column lists the number of the figure where the item is identified/located in the repair parts list and special tools list work packages.

ITEM Column. The item number is the number assigned to the item as it appears in the figure referenced in the adjacent figure number column.

Fabrication Instructions. Bulk materials required to manufacture items are listed in the bulk material functional group of this RPSTL. Part numbers for bulk material are also referenced in the Description Column of the line item entry for the item to be manufactured/fabricated. Detailed fabrication instructions for items source coded to be manufactured or fabricated are found in the applicable procedure.

Index Numbers. Items which have the word BULK in the figure column will have an index number shown in the item number column. This index number is a cross-reference between the NSN / P/N index work packages and the bulk material list in the repair parts list work package.

HOW TO LOCATE REPAIR PARTS

1. When NSNs or P/Ns Are Not Known.

First. Using the table of contents, determine the assembly group to which the item belongs. This is necessary since figures are prepared for assembly groups and subassembly groups, and lists are divided into the same groups.

Second. Find the figure covering the functional group or the subfunctional group to which the item belongs.

Third. Identify the item on the figure and note the number(s).

Fourth. Look in the repair parts list work packages for the figure and item numbers. The NSNs and part numbers are on the same line as the associated item numbers.

2. When NSN Is Known.

First. If you have the NSN, look in the STOCK NUMBER column of the NSN index work package. The NSN is arranged in NIIN sequence. Note the figure and item number next to the NSN.

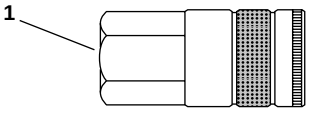
Second. Turn to the figure and locate the item number. Verify that the item is the one you are looking for.

3. When P/N Is Known.

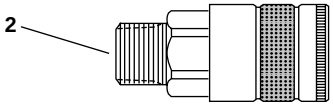
First. If you have the P/N and not the NSN, look in the PART NUMBER column of the P/N index work package. Identify the figure and item number.

Second. Look up the item on the figure in the applicable repair parts list work package.

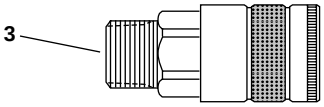
END OF WORK PACKAGE



3/8" FEMALE PIPE THREAD

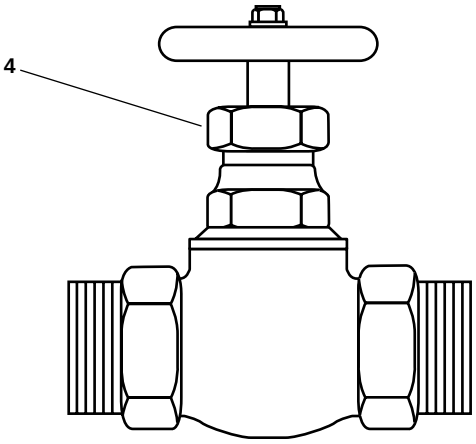


3/8" MALE PIPE THREAD

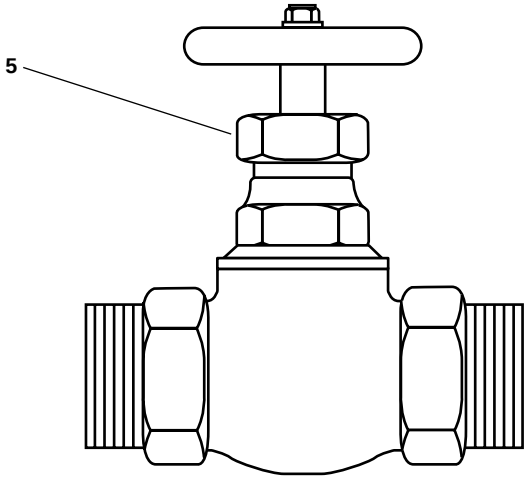


1/2" MALE PIPE THREAD

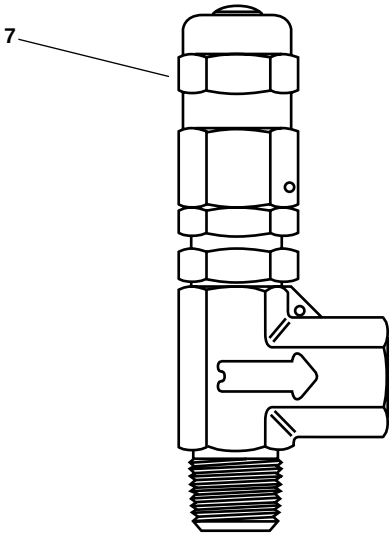
Figure 1. Compressed Air System (Sheet 1 of 5)



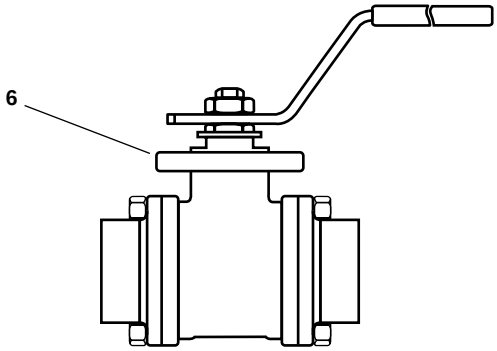
1" GLOBE VALVE, MALE PIPE THREAD



1 1/2" GLOBE VALVE, MALE PIPE THREAD

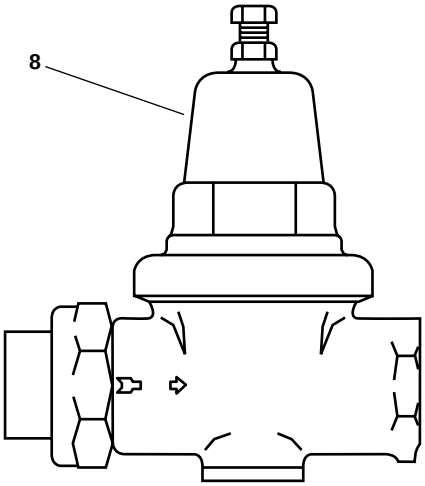


1/2" RELIEF VALVE

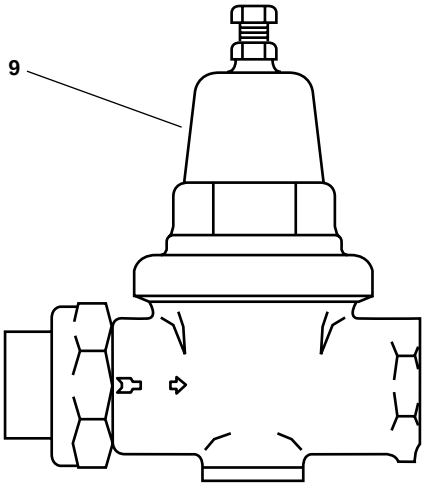


1/4" BALL VALVE, FEMALE PIPE

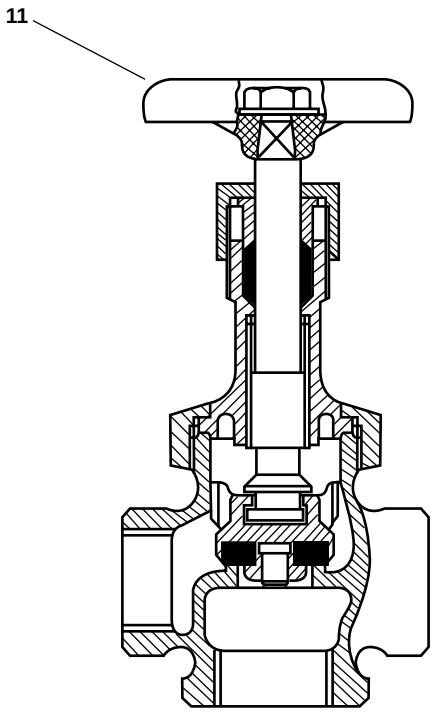
Figure 1. Compressed Air System (Sheet 2 of 5)



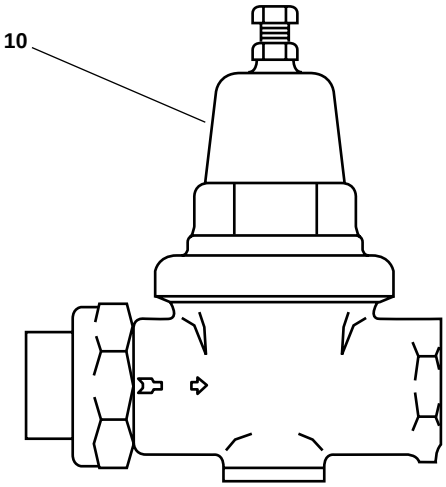
MAIN ENGINE STARTING AIR REGULATOR



BOW THRUSTER AND PUMP DRIVE ENGINE STARTING AIR REGULATOR

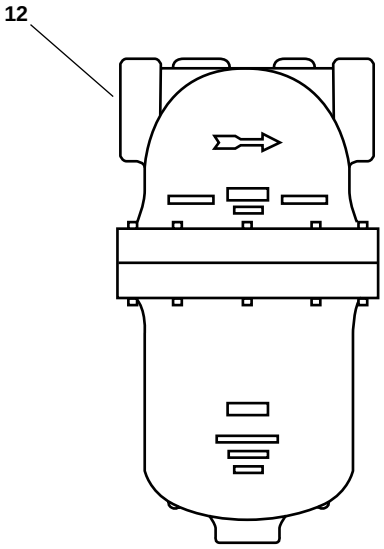


2" ANGLE GLOBE STOP CHECK

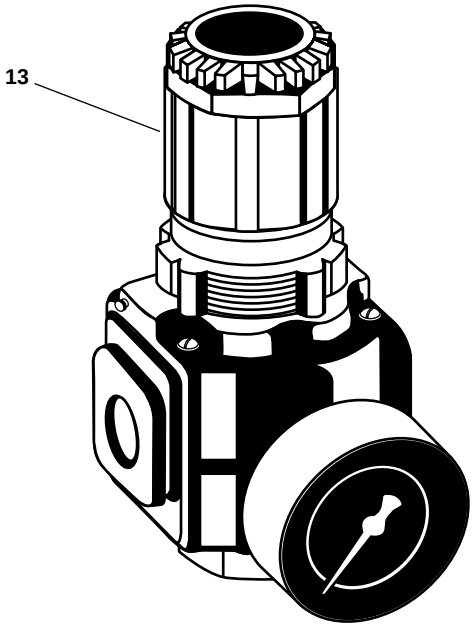


SEA CHEST BLOWDOWN AIR REGULATOR

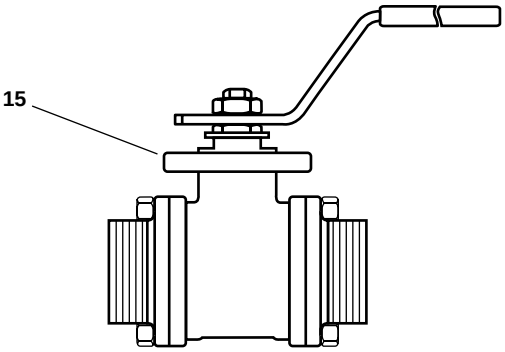
Figure 1. Compressed Air System (Sheet 3 of 5)



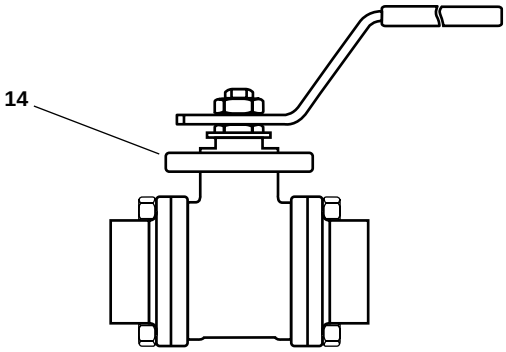
COMPRESSED AIR DRIER



3/8" PRESSURE REGULATOR



3/8" BALL VALVE, EXTERNAL THREADS



3/8" BALL VALVE, FEMALE PIPE

Figure 1. Compressed Air System (Sheet 4 of 5)

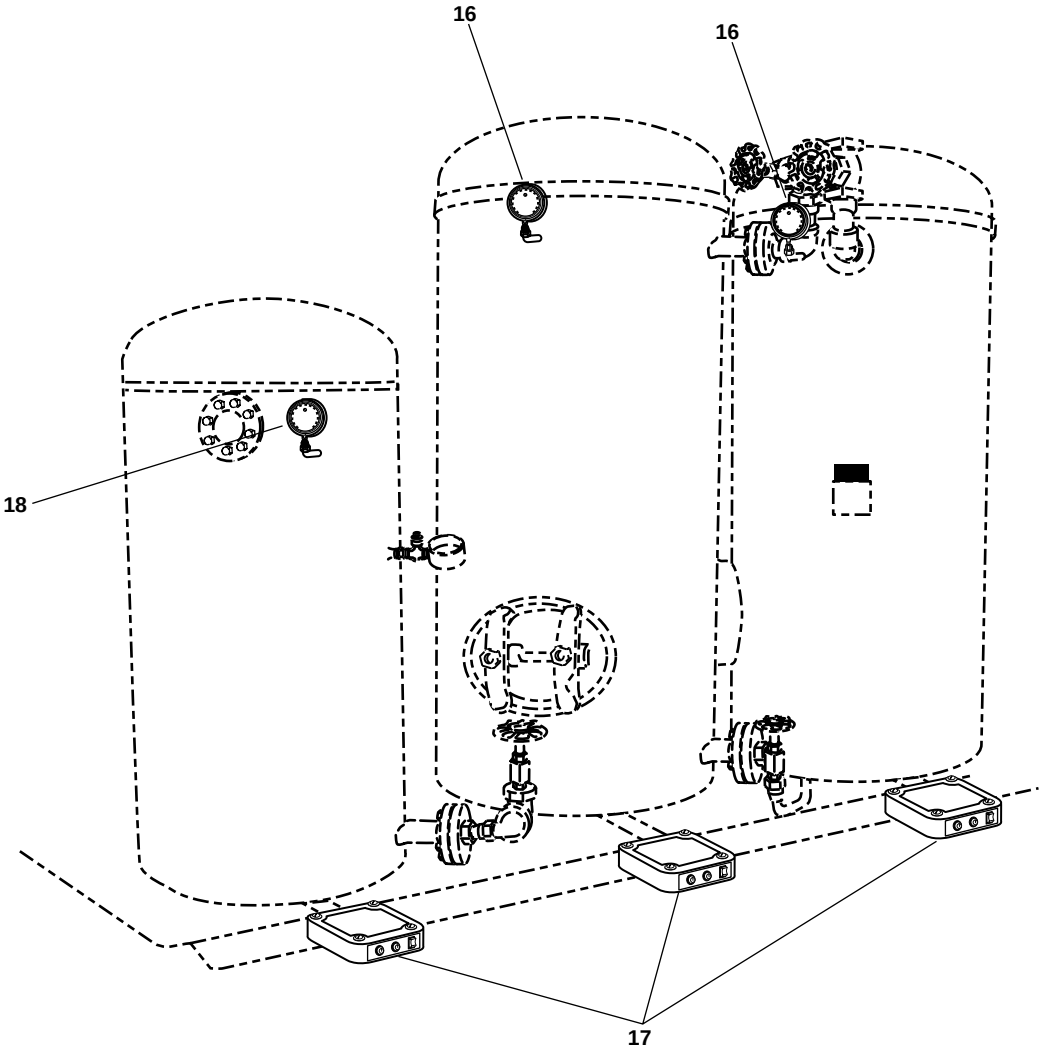


Figure 1. Compressed Air System (Sheet 5 of 5)

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 0513	
					FIG. 1 COMPRESSED AIR SYSTEM	
1	PAFZZ	4730-01-528-3558	0G1H4	BH3E	QUICK DISCONNECT	2
2	PAFZZ	4730-01-528-3555	0G1H4	B24	QUICK DISCONNECT	3
3	PAFZZ	4730-01-528-3545	0G1H4	B16	QUICK DISCONNECT	10
4	PAFZZ	4820-00-190-8751	53711	803-4384536-52A2 2	VALVE,GLOBE	3
5	PAFZZ	4820-00-184-9186	53711	803-4384536-72A	VALVE,GLOBE	2
6	PAFZZ	4820-01-340-1265	14007	T-595Y	VALVE,BALL,1/4"	8
7	PAFZZ	4820-01-100-3408	02570	B-8CPAZ-XXX	VALVE,SAFETY RELIEF	2
8	PAFZZ	4820-01-356-3555	28353	300-250/200	VALVE,REGULATING	2
9	PAFZZ	4820-01-355-7245	28353	300-250/125	VALVE,REGULATING	2
10	PAFZZ	4820-01-355-7244	28353	500-125/25	VALVE,REGULATING	2
11	PAFZZ	4820-00-186-3837	80064	803-4384536-84A	VALVE,ANGLE	2
12	PDFZZ	4730-01-528-3643	73124	1.25TS500S6	SEPARATOR,MOISTURE 1.25" TYPE T GAS/ LIQUID SEPARATOR	2
13	PAFZZ	4820-01-493-5777	4X630	863-410914	VALVE,REGULATING,FL	1
14	PAFZZ	4820-01-470-1909	02570	B43S6	VALVE,BALL	2
15	PAFZZ	4820-01-136-0754	28968	7115G6B	VALVE,BALL	2
16	PAOZZ	6620-01-528-3612	38056	45-1279-S-04-XXX -0/300	GAUGE,PRESSURE	3
17	PDOZZ	4810-01-349-7747	31408	5702	VALVE,SOLENOID	3
18	PAOZZ	6620-01-528-3611	38056	45-1279-S-04-XXX -0/200	GAUGE,PRESSURE	5
					End of Figure	

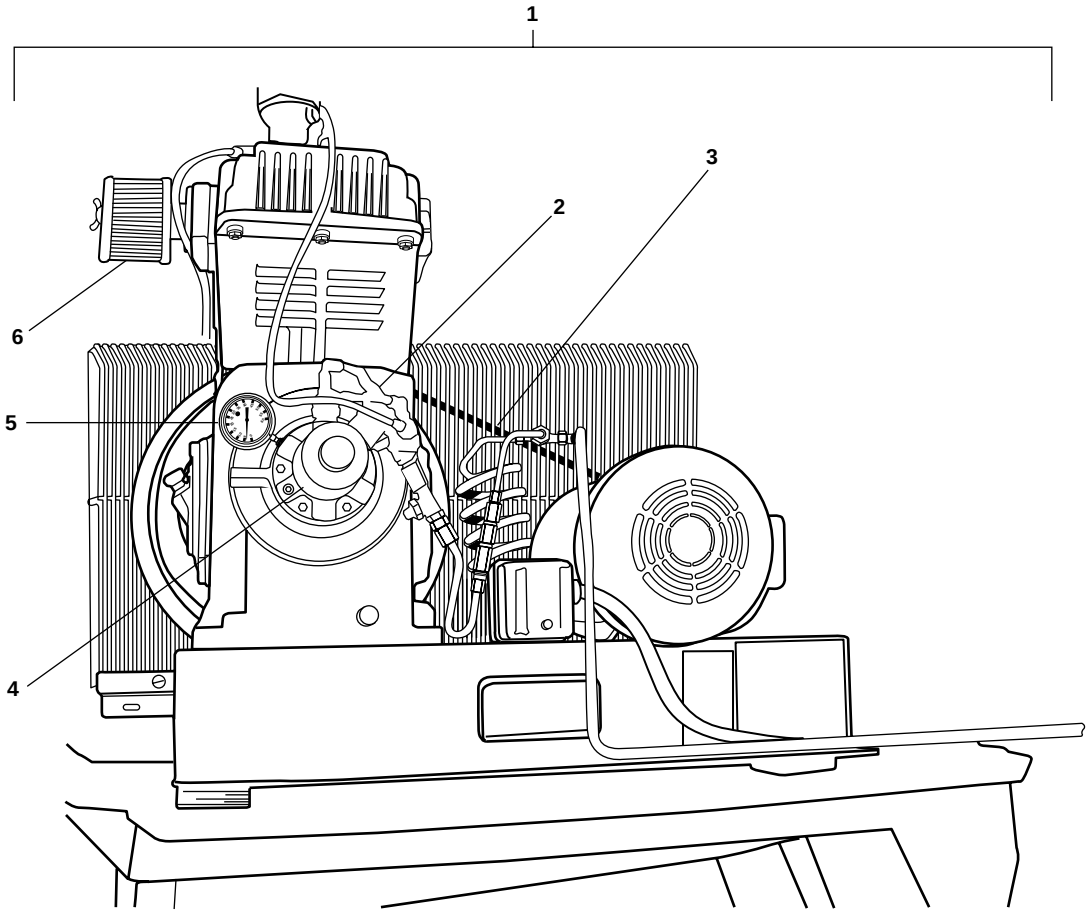


Figure 2. Air Compressor (Sheet 1 of 7)

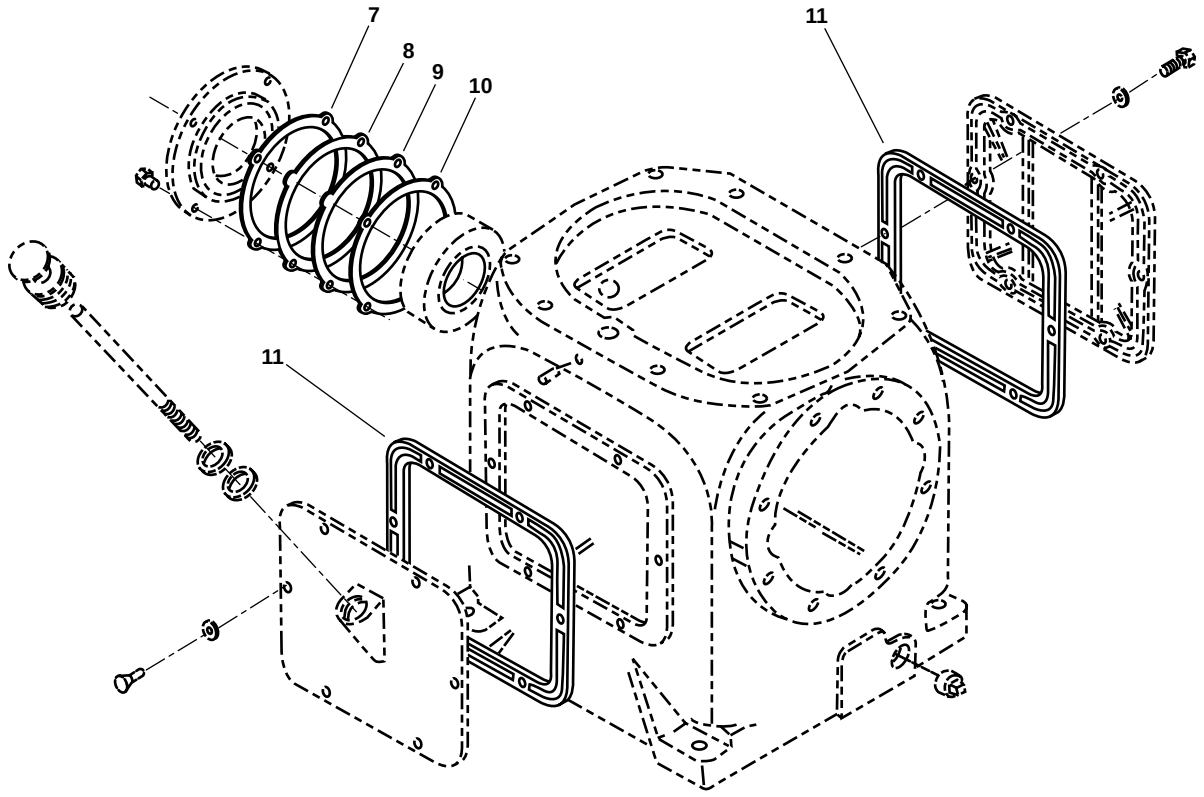


Figure 2. Air Compressor (Sheet 2 of 7)

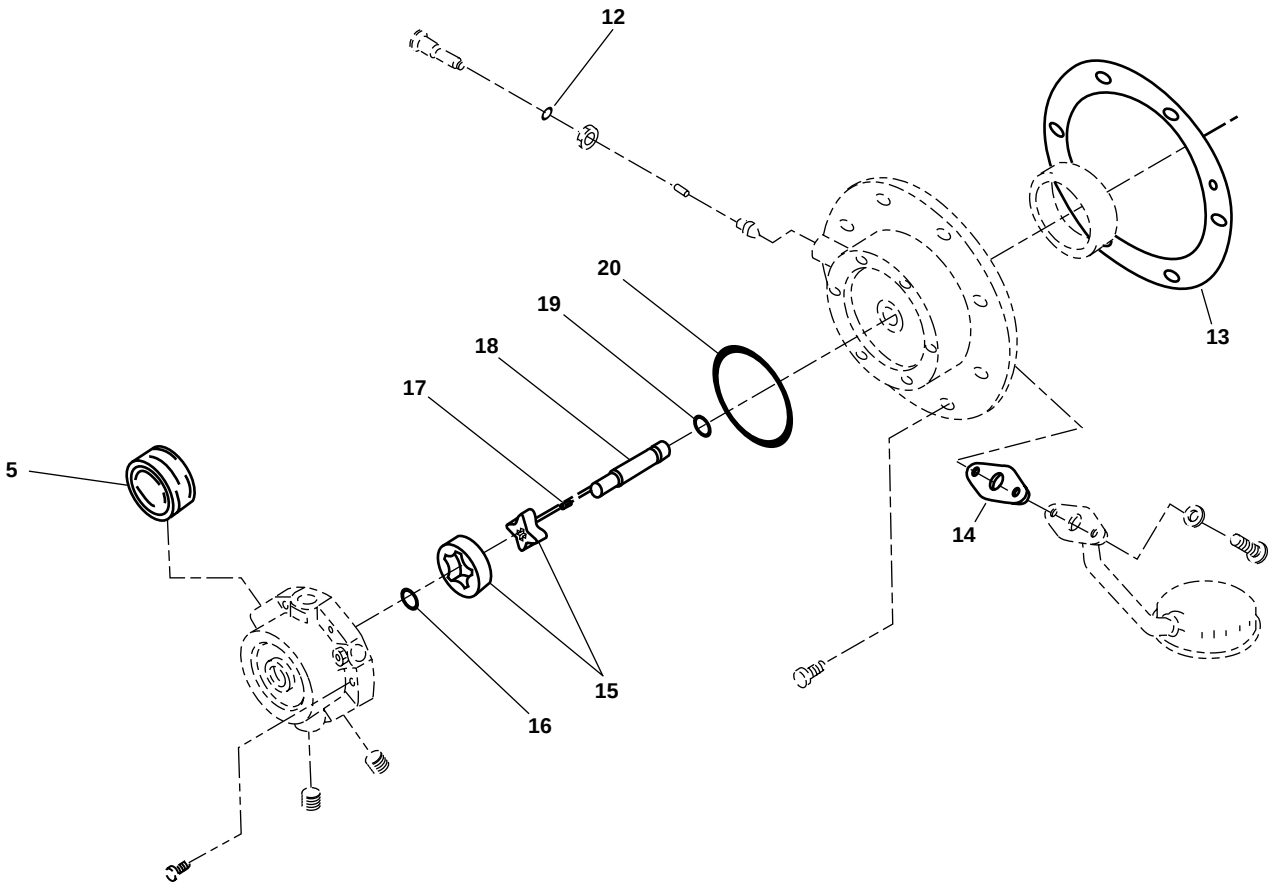


Figure 2. Air Compressor (Sheet 3 of 7)

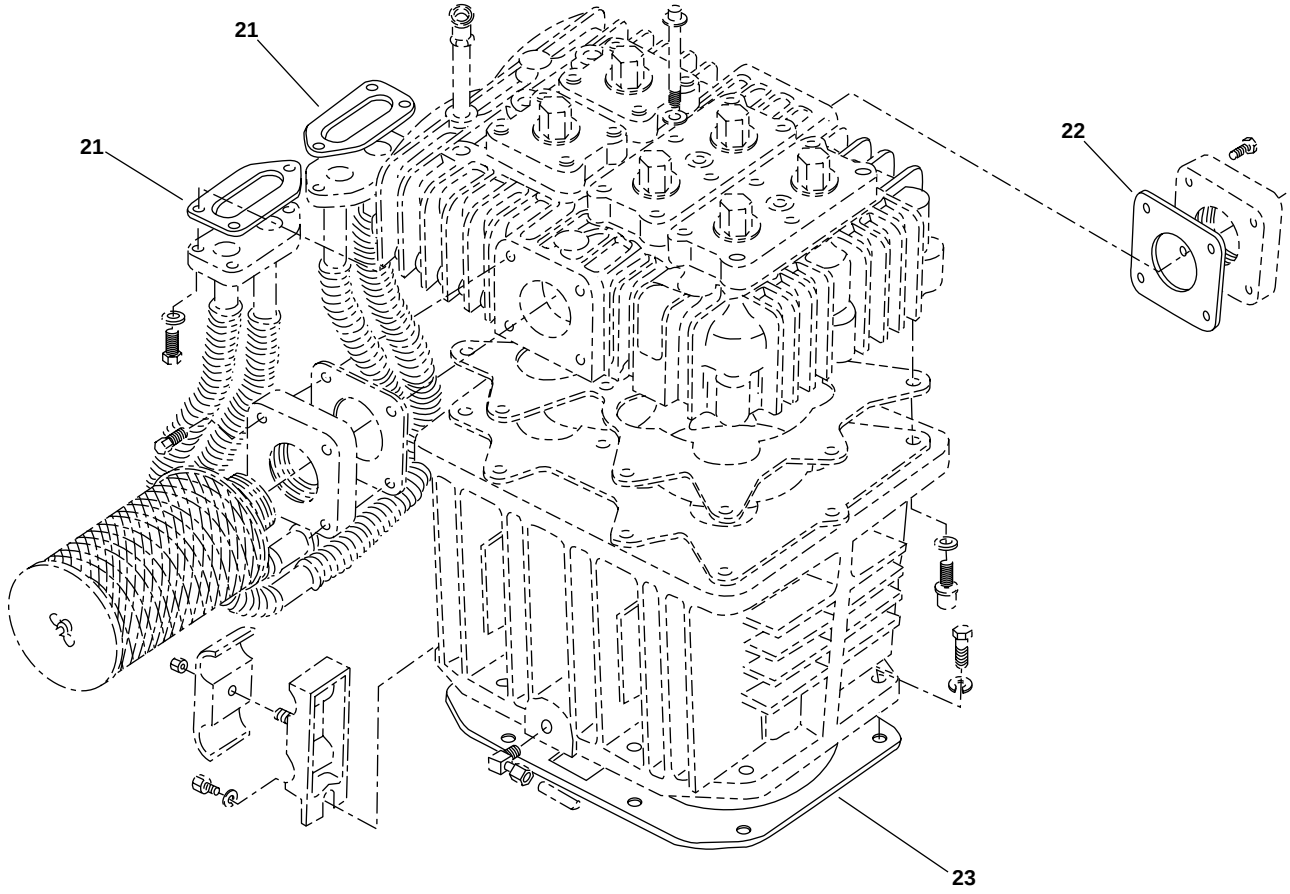


Figure 2. Air Compressor (Sheet 4 of 7)

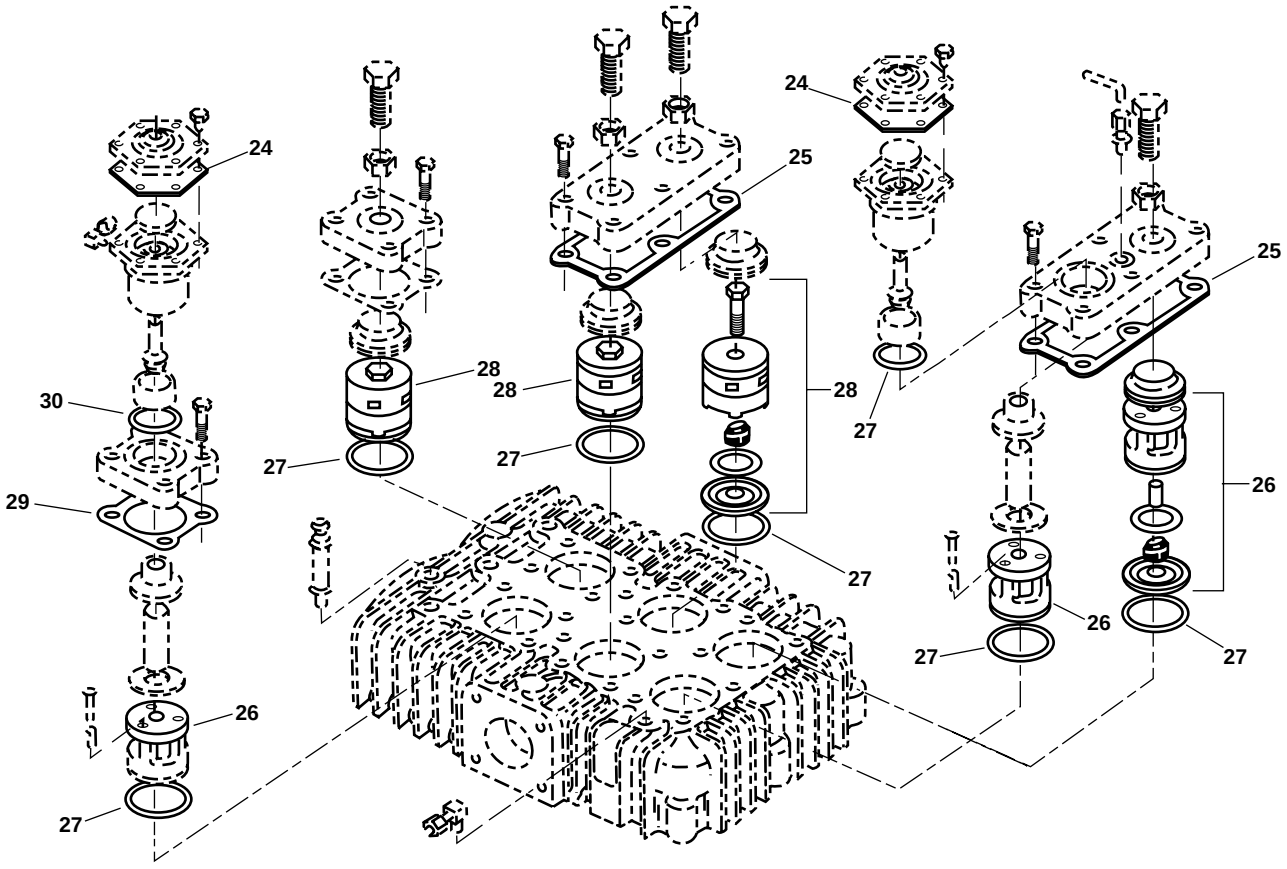


Figure 2. Air Compressor (Sheet 5 of 7)

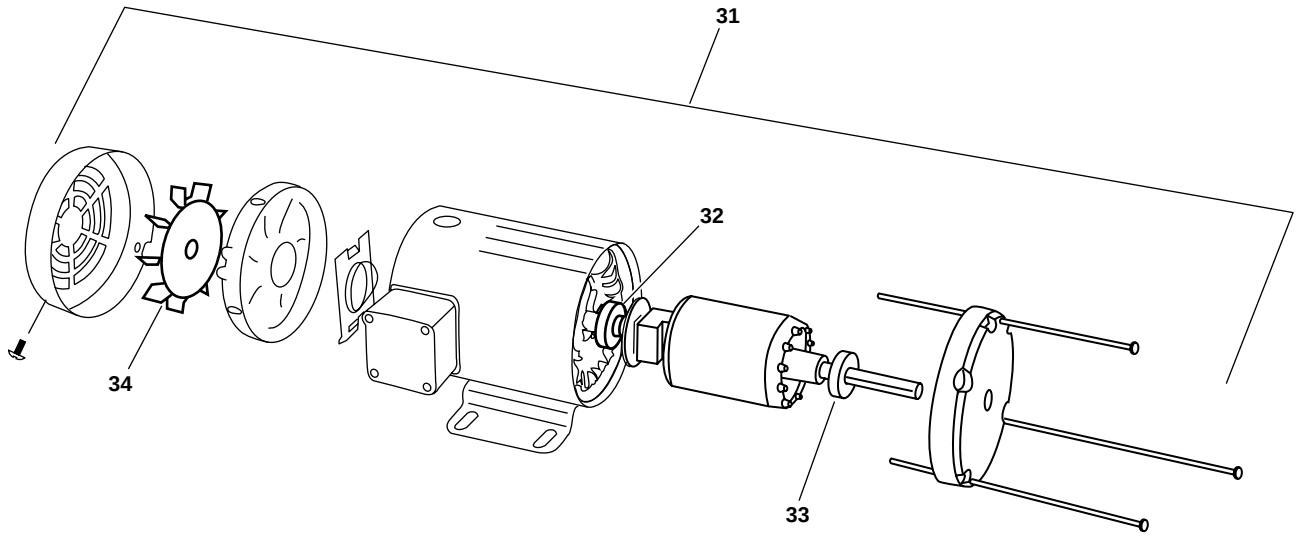


Figure 2. Air Compressor (Sheet 6 of 7)

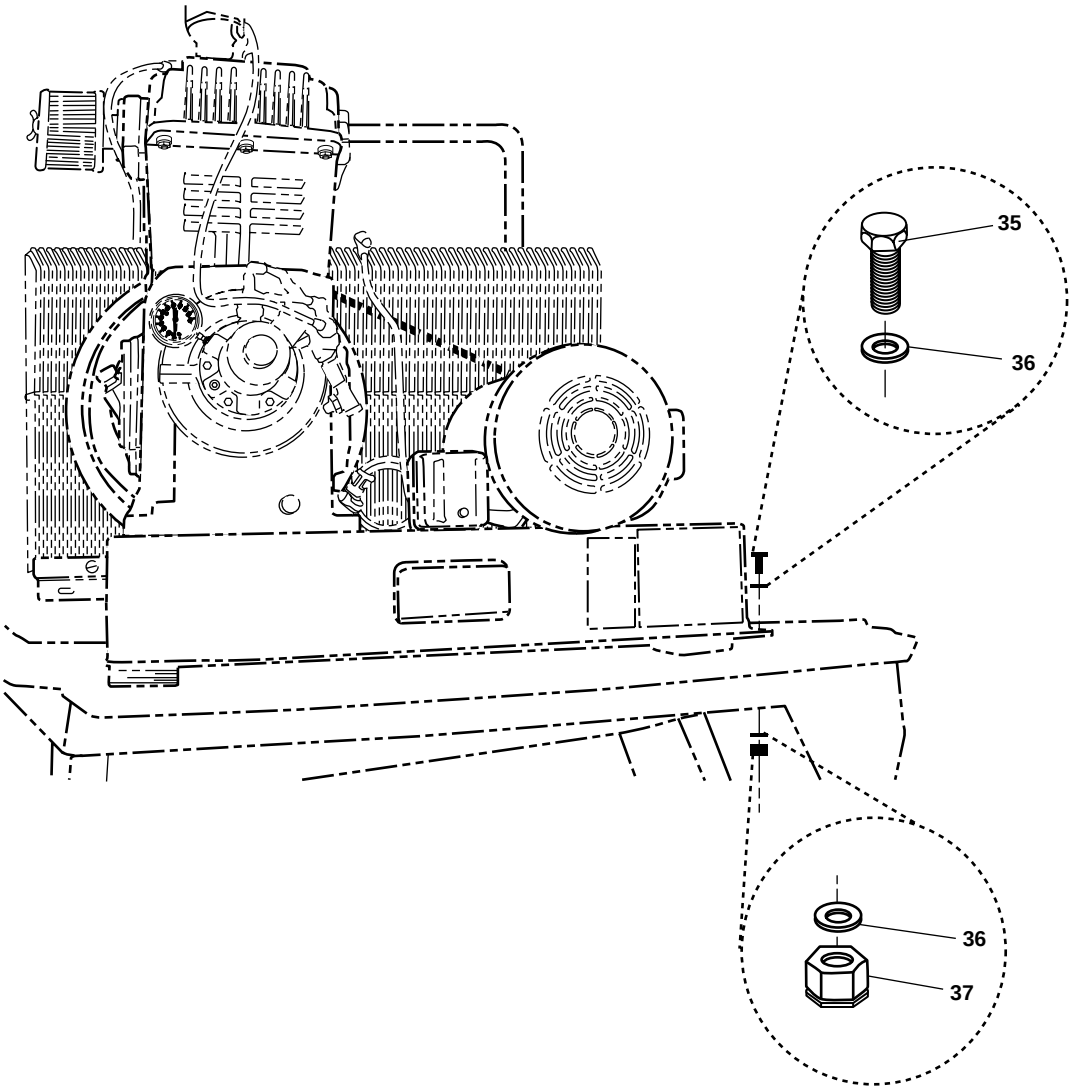


Figure 2. Air Compressor (Sheet 7 of 7)

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
					GROUP 051301	
					FIG. 2 AIR COMPRESSOR	
1	XDOFF	4310-01-312-1771	49576	MDL340 QR-25	COMPRESSOR UNIT,REC	2
2	XDFZZ	4820-01-320-6550	49576	111423-999	.VALVE,PILOT	1
3	PAOZZ	3030-01-310-4414	49576	110258B082	.BELT,V	1
4	PAOZZ	4330-01-281-5269	49576	110814-001	.FILTER ELEMENT,FLUI	1
5	PAOZZ	6680-01-271-6191	49576	110822	.GAGE, OIL PRESSURE	1
6	PAOZZ	4330-01-252-2687	49576	110377E100	.FILTER ELEMENT,AIR	1
7	KFFZZ	5365-01-277-9924	49576	1383D	..SHIM PART OF KIT P/N 7088	1
8	KFFZZ	5365-00-363-0361	49576	1383B	..SPACER,PLATE PART OF KIT P/N 7088	1
9	KFFZZ	5365-00-363-0360	49576	1383A	..SHIM PART OF KIT P/N 7088	1
10	KFFZZ	5365-01-289-5021	49576	1383	..SHIM PART OF KIT P/N 7088	1
11	KFFZZ	5330-00-415-5957	49576	1315	..GASKET PART OF KIT P/N 7088	1
12	KFFZZ	5331-00-807-1293	49576	123157-011	...O-RING PART OF KIT P/N 160079	1
13	KFFZZ	5330-00-769-1901	49576	5502	..GASKET PART OF KIT P/N 7088	1
14	KFFZZ	5330-00-061-5072	49576	6679	..GASKET PART OF KIT P/N 7088	1
15	KFFZZ	4320-01-252-2684	49576	160003	...GEAR,ROTOR SET,ROTA PART OF KIT P/N 160079	1
16	KFFZZ	5325-01-143-6421	49576	6285	...RING,RETAINING PART OF KIT P/N 160079	1
17	KFFZZ	4320-01-216-6799	49576	160075-001	...RING,WEARING PART OF KIT P/N 160079	1
18	KFFZZ	5331-01-196-3927	49576	160002-001	...SHAFT,SHOULDERED PART OF KIT P/N 160079	1
19	KFFZZ	5331-00-811-4078	49576	123157-112	...O-RING PART OF KIT P/N 160079	1
20	KFFZZ	5331-01-254-2404	49576	123157-152	...O-RING PART OF KIT P/N 160079	1
21	KFFZZ	5330-00-545-3158	49576	5702	..GASKET PART OF KIT P/N 7088	1
22	KFFZZ	5330-00-062-4343	49576	5828	..GASKET PART OF KIT P/N 7088	1
23	KFFZZ	5330-00-769-1902	49576	5827	..GASKET PART OF KIT P/N 7088	1
24	PAFZZ	4820-00-148-5511	49576	1855	.DIAPHRAM,VALVE,FLAT DIAPHRAM, VALVE, UNLOADER	1
25	KFFZZ	5330-00-467-0450	49576	6682	..GASKET PART OF KIT P/N 7088	1
26	PAFZZ	4820-00-871-1799	49576	7277X	.VALVE ASSEMBLY,SUCT	3
27	KFFZZ	5330-00-255-0281	49576	1848	..GASKET PART OF KIT P/N 7088	6
28	PAFZZ	4310-00-824-0384	49576	7271X	.VALVE ASSEMBLY,COMP	3

(1) ITEM NO.	(2) SMR CODE	(3) NSN	(4) CAGEC	(5) PART NUMBER	(6) DESCRIPTION AND USABLE ON CODE (UOC)	(7) QTY
29	KFFZZ	5330-01-408-1806	49576	1852 NON-ASBESTOS	..GASKET PART OF KIT P/N 7088	1
30	KFFZZ	5365-00-205-9014	49576	1556	..SPACER,RING PART OF KIT P/N 7088	1
31	XDFFF	6105-01-010-9248	05472	M3710T	.MOTOR,AC MOTOR, ALTERNATING CURRENT, AIR COMPRESSOR	1
32	XDFZZ	3110-00-554-2975	53035	6206ZZCE1AK2	..BEARING,BALL,ANNULA	1
33	XDFZZ	3110-00-555-5209	21335	307KDDFS160	..BEARING,BALL,ANNULA	1
34	XDFZZ	4140-01-464-7793	05472	37FN3002A01	..IMPELLER,FAN	1
35	PAFZZ	5305-00-021-3801	96906	MS35307-411	.SCREW,CAP,HEXAGON,H	8
36	PAFZZ	5310-00-767-9425	80205	MS15795-818	.WASHER,FLAT	16
37	PAFZZ	5310-00-768-0321	96906	MS51971-5	.NUT,PLAIN,HEXAGON	8
KIT	PAFZZ	4310-01-267-8060	49576	160079	..PARTS KIT,COMPRESSO	1
					GEAR,ROTOR SET,ROTA (1) 2 - 15	
					O-RING (1) 2 - 12	
					O-RING (1) 2 - 19	
					O-RING (1) 2 - 20	
					RING,RETAINING (1) 2 - 16	
					RING,WEARING (1) 2 - 17	
					SHAFT,SHOULDERED (1) 2 - 18	
KIT	PAFZZ	5330-00-467-0451	49576	7088	.GASKET SET	1
					GASKET (1) 2 - 21	
					GASKET (1) 2 - 23	
					GASKET (1) 2 - 29	
					GASKET (1) 2 - 22	
					GASKET (1) 2 - 25	
					GASKET (1) 2 - 13	
					GASKET (1) 2 - 14	
					GASKET (6) 2 - 27	
					GASKET (1) 2 - 11	
					SHIM (1) 2 - 10	
					SHIM (1) 2 - 7	
					SHIM (1) 2 - 9	
					SPACER,PLATE (1) 2 - 8	
					SPACER,RING (1) 2 - 30	

End of Figure

NATIONAL STOCK NUMBER INDEX

STOCK NUMBER	FIG.	ITEM
5305-00-021-3801	2	35
5330-00-061-5072	2	14
5330-00-062-4343	2	22
4820-00-148-5511	2	24
4820-00-184-9186	1	5
4820-00-186-3837	1	11
4820-00-190-8751	1	4
5365-00-205-9014	2	30
5330-00-255-0281	2	27
5365-00-363-0360	2	9
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4820-01-320-6550	2	2
4820-01-340-1265	1	6
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4820-01-355-7244	1	10
4820-01-355-7245	1	9
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7277X	2	26
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END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
COMPONENTS OF END ITEM (COEI) AND BASIC ISSUE ITEMS (BII) LISTS

INTRODUCTION

SCOPE

This work package lists COEI and BII for the air compressor for the Inland and Coastal Large Tug (LT) to help you inventory items for safe and efficient operation of the equipment.

GENERAL

The COEI and BII information is divided into the following lists:

Components of End Item (COEI). This list is for information purposes only and is not authority to requisition replacements. These items are part of the air compressor for the Inland and Coastal Large Tug (LT). As part of the end item, these items must be with the end item whenever it is issued or transferred between property accounts. Items of COEI are removed and separately packaged for transportation or shipment only when necessary. Illustrations are furnished to help you find and identify the items.

Basic Issue Items (BII). These essential items are required to place the air compressor for the Inland and Coastal Large Tug (LT) in operation, operate it, and to do emergency repairs. Although shipped separately packaged, BII must be with the air compressor for the Inland and Coastal Large Tug (LT) during operation and when it is transferred between property accounts. Listing these items is your authority to request/requisition them for replacement based on authorization of the end item by the TOE/MTOE. Illustrations are furnished to help you find and identify the items.

EXPLANATION OF COLUMNS IN THE COEI LIST AND BII LIST

Column (1) Illus Number. Gives you the number of the item illustrated.

Column (2) National Stock Number (NSN). Identifies the stock number of the item to be used for requisitioning purposes.

Column (3) Description, CAGEC, and Part Number. Identifies the Federal item name (in all capital letters) followed by a minimum description when needed. The stowage location of COEI and BII is also included in this column. The last line below the description is the CAGEC (Commercial and Government Entity Code) (in parentheses) and the part number.

Column (4) Usable On Code. When applicable, gives you a code if the item you need is not the same for different models of equipment.

Column (5) Unit of Issue (U/I). Indicates the physical measurement or count of the item as issued per the National Stock Number shown in column (2).

Column (6) Qty Rqr. Indicates the quantity required.

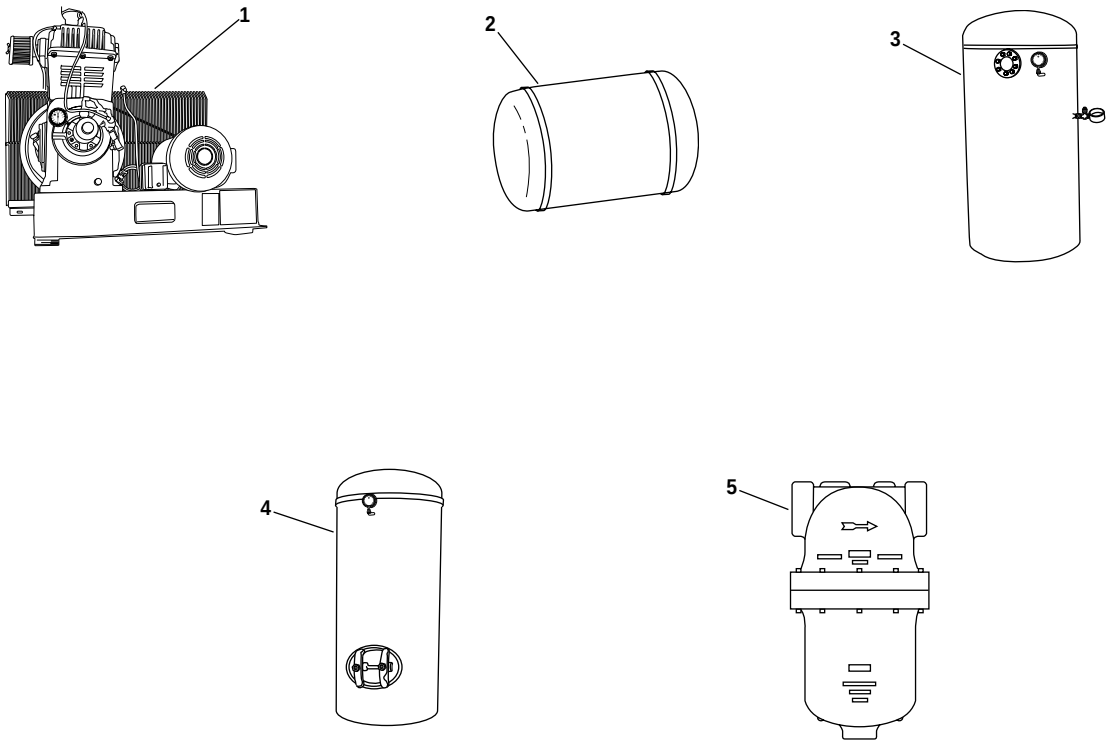

Table 1. Components of End Item List

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC, AND PART NUMBER	(4) USABLE ON CODE	(5) U/I	(6) QTY RQR
1	4310-01-312-1771	AIR COMPRESSOR (AMS1, port) (49576) MDL340 QR-25	128	EA	2
2	5430-01-347-5547	AIR RECEIVER (30 GALLON) (engine room, port) (8G526) 30-5884	128	EA	1
3	4130-01-370-3099	AIR RECEIVER (200 GALLON) (AMS1, port) (8G526) 30-5842	128	EA	1
4	5430-01-347-5548	AIR RECEIVER (400 GALLON) (AMS1, port) (8G526) 30-5843	128	EA	2
5		SEPARATOR, MOISTURE (AMS1, port) (73124) 1.25TS500S6	128	EA	2

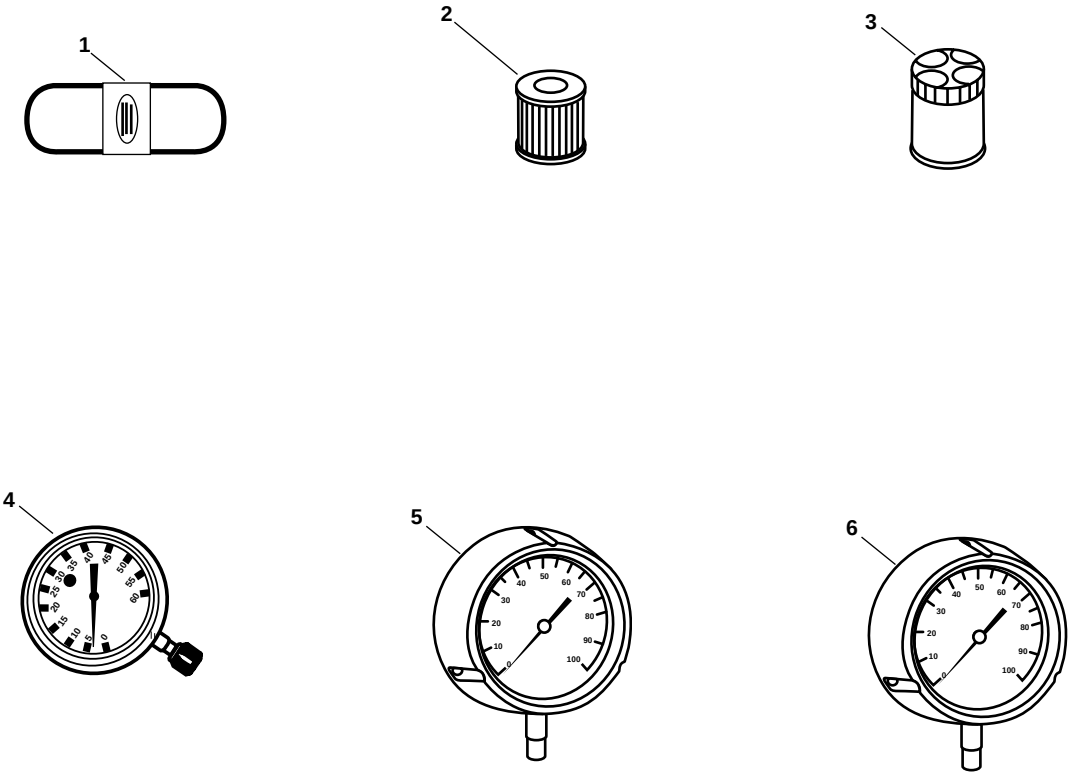

Table 2. On Board Spares List

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC, AND PART NUMBER	(4) USABLE ON CODE	(5) U/I	(6) QTY RQR
1	3030-01-310-4414	BELT, V (bosun's locker) (49576) 110258B082	128	EA	2
2	4330-01-252-2687	FILTER ELEMENT, FLUID (AIR) (bow thruster room) (49576) 110377E100	128	EA	2
3	4330-01-281-5269	FILTER ELEMENT, FLUID (AMS 1) (49576) 110814-001	128	EA	2
4	6680-01-271-6191	GAGE, OIL PRESSURE (bosun's locker) (49576) 110822	128	EA	1
5	6620-01-528-3611	GAUGE, PRESSURE (vestibule VIDMAR) (38056) 45-1279-S-04-XXX-0/200	128	EA	1
6	6620-01-528-3612	GAUGE, PRESSURE (vestibule VIDMAR) (38056) 45-1279-S-04-XXX-0/300	128	EA	1

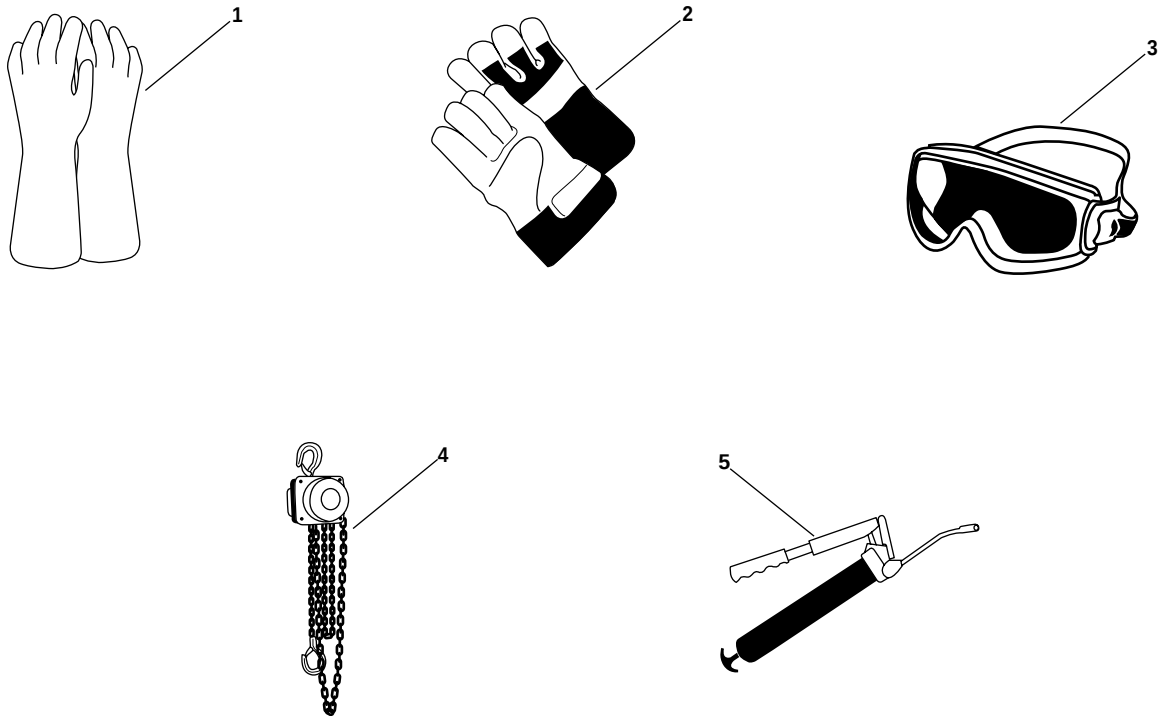

Table 3. Basic Issue Items List

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC, AND PART NUMBER	(4) USABLE ON CODE	(5) U/I	(6) QTY RQR
1	8415-01-013-7384	GLOVES, CHEMICAL AND OIL PROTECTIVE (bosun's locker) (81349) MIL-G-87066	128	PR	1
2	8415-01-394-0215	GLOVES, LEATHER (bosun's locker) (04024) 6170-5	128	PR	1
3	4240-00-190-6432	GOGGLES, INDUSTRIAL (machine shop) (80204) ANSI Z87.1-1989	128	PR	2
4	3950-00-235-4235	HOIST, CHAIN, HAND OPERATED, 3/4 TON (machine shop) (81349) MILH904CLASS1TYPEH STYLE1	128	EA	1
5	4930-00-223-3389	LUBRICATING GUN, HAND (machine shop) (0FKM1) 7584	128	EA	1

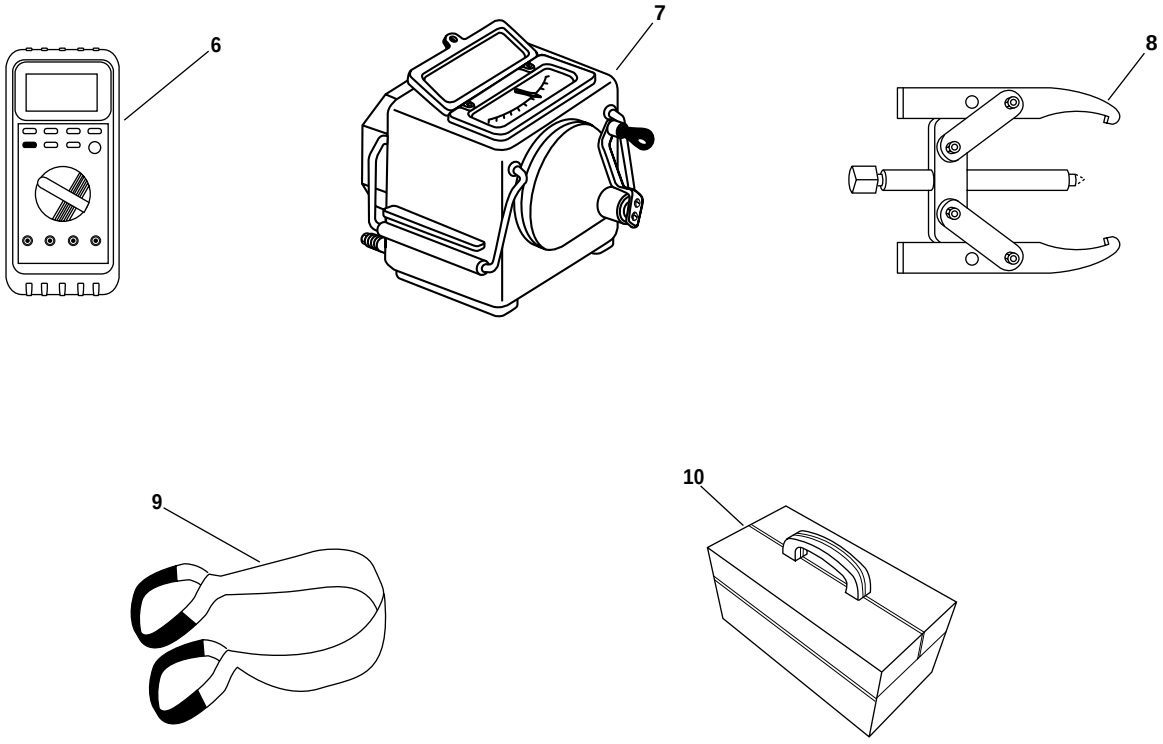

Table 3. Basic Issue Items List (continued)

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC, AND PART NUMBER	(4) USABLE ON CODE	(5) U/I	(6) QTY RQR
6	6625-01-265-6000	MULTIMETER (DC locker) (89536) 27 W/ACCE	128	EA	1
7	6625-01-223-2980	OHMMETER (machine shop) (07239) 212159	128	EA	1
8	5120-00-288-7710	PULLER, MECHANICAL, GEAR AND BEARING, 0 TO 7 SPREAD, 5-1/8 REACH (machine shop) (81348) GGG-P-781	128	EA	1
9	3940-01-183-9412	SLING, ENDLESS (machine shop) (15434) 3375957	128	EA	1
10	5180-00-313-3045	TOOL KIT, ELECTRICIAN'S (AMS 2) (50980) SC5180-90-CL-N35	128	KT	1

Table 3. Basic Issue Items List (continued)

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC, AND PART NUMBER	(4) USABLE ON CODE	(5) U/I	(6) QTY RQR
11	5180-00-629-9783	TOOL KIT, GENERAL MECHANIC'S (machine shop) (50980) SC5180-90-CL-N55 (LIN: W39032)	128	KT	1
12	5120-00-640-6365	WRENCH, TORQUE, (0-250 FT-LB) (tool cage EOS) (05047) B107.14M TY1CLBST1	128	EA	1

END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE AIR COMPRESSOR FOR INLAND AND COASTAL LARGE TUG (LT) EXPENDABLE AND DURABLE ITEMS LIST

INTRODUCTION

SCOPE

This work package lists expendable and durable items that you will need to operate and maintain the air compressor for the Inland and Coastal Large Tug (LT). This list is for information only and is not authority to requisition the listed items. These items are authorized to you by CTA 50-970, Expendable/Durable Items (Except Medical, Class V Repair Parts, and Heraldic Items), or CTA 8-100, Army Medical Department Expendable/Durable Items.

EXPLANATION OF COLUMNS IN THE EXPENDABLE/DURABLE ITEMS LIST

Column (1) Item Number. This number is assigned to the entry in the list and is referenced in the narrative instructions to identify the item (e.g., “Use brake fluid (item 5, WP 0098 00).”).

Column (2) Level. This column identifies the lowest level of maintenance that requires the listed item (include as applicable: C = Operator/Crew, O = Unit, F = Direct Support, H = General Support, D = Depot).

Column (3) National Stock Number (NSN). This is the NSN assigned to the item, which you can use to requisition it.

Column (4) Item Name, Description, Commercial and Government Entity Code (CAGEC), and Part Number (P/N). This column provides the other information you need to identify the item.

Column (5) Unit of Issue (U/I). Indicates the physical measurement or count of the item as issued per the National Stock Number shown in column (3).

Table 1. Expendable and Durable Items List

(1) ITEM NUMBER	(2) LEVEL	(3) NATIONAL STOCK NUMBER (NSN)	(4) ITEM NAME, DESCRIPTION, CAGEC, AND PART NUMBER	(5) U/I
1	C	6850-00-281-1985	DRY CLEANING SOLVENT (02978) PS661	GL
2	O	9450-00-526-4205	GREASE, BALL AND ROLLER BEARING (81349) MIL-G-18709	CN
3	C	9150-01-158-2881	LUBRICATING OIL, AIR COMPRESSOR (96004) GST OIL 100	CN
4	C	9150-00-027-3098	LUBRICATING OIL, GENERAL PURPOSE (77988) DTE HEAVY MEDIUM	QT
5	C	7920-00-205-1711	RAG, WIPING, 50LB BALE (80244) 7920-00-205-1711	BE
6	C		TAG, DANGER (USED FOR LOCKOUT/TAGOUT) (3HPE6) 0116-LF-115-4300	BX
7	O	8030-00-889-3535	TAPE, ANTISEIZING, 1/2 IN X 260 IN (96214) 417043-2	EA

END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
GLOSSARY

Air-cooled compressors	Compressors cooled by atmospheric air circulated around the cylinders or casings.
Capacity	Capacity of a compressor is the full rated volume of flow of gas compressed and delivered at conditions of total temperature, total pressure, and composition prevailing at the compressor inlet. It sometimes means actual flow rate, rather than rated volume of flow.
Check Valve	A valve that permits flow in one direction only. The compressor's check valve allows airflow into the receivers.
Displacement	Displacement of a compressor is the piston volume swept out per unit time; it is usually expressed in cubic feet per minute.
Intercooler	Heat exchangers for removing the heat of compression between stages of a compressor. They usually condense and remove a considerable amount of moisture as well.
Piston Displacement	Net volume actually displaced by the compressor piston at rated machine speed, generally expressed in cubic feet per minute. For multistage compressors, the piston displacement of the first stage only is commonly stated as that of the entire machine.
Pressure, Discharge	The absolute total pressure of the discharge flange of a compressor.
Receiver	Tanks used for the storage of air discharged from compressors. They serve also to damp discharge line pulsations.
Reciprocating Compressor	Machines in which the compression element is a piston having a reciprocating motion in a cylinder.
Sheave	A grooved wheel or pulley over which a drive belt runs.
Stage	Steps in the compression of a gas. In the case of reciprocating compressors each stage usually requires a separate cylinder, and in dynamic compressors, each requires a separate rotor disc; in either case, the gas is passed through the stages in succession.
Two Stage Compressor	Machines in which air or gas is compressed from initial pressure to an intermediate pressure in one or more cylinders or casings.

END OF WORK PACKAGE

OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE
AIR COMPRESSOR FOR
INLAND AND COASTAL LARGE TUG (LT)
ALPHABETICAL INDEX

D

E

By Order of the Secretary of the Army:

PETER J. SCHOOMAKER
General, United States Army
Chief of Staff

Official:

SANDRA R. RILEY
Administrative Assistant to the
Secretary of the Army

0529219

DISTRIBUTION: To be distributed in accordance with the initial distribution requirements for IDN: 255636, requirements for TM 55-1925-286-13&P.

These are the instructions for sending an electronic 2028.

The following format must be used if submitting an electronic 2028. The subject line must be exactly the same and all fields must be included; however, only the following fields are mandatory: 1, 3, 4, 5, 6, 7, 8, 9, 10, 13, 15, 16, 17 and 27.

From: "Whomever" whomever@avma27.army.mil
To: whomever@avma27.army.mil
To: TACOM-TECH-PUBS@ria.army.mil

Subject: DA Form 2028

1. ***From:*** Joe Smith
2. ***Unit:*** home
3. ***Address:*** 4300 Park
4. ***City:*** Hometown
5. ***St:*** MO
6. ***Zip:*** 77777
7. ***Date Sent:*** 19-OCT-93
8. ***Pub no:*** 55-1915-200-10
9. ***Pub Title:*** TM
10. ***Publication Date:*** 11-APR-88
11. ***Change Number:*** 12
12. ***Submitter Rank:*** MSG
13. ***Submitter Fname:*** Joe
14. ***Submitter Mname:*** T
15. ***Submitter Lname:*** Smith
16. ***Submitter Phone:*** 123-123-1234
17. ***Problem:*** 1
18. ***Page:*** 1
19. ***Paragraph:*** 3
20. ***Line:*** 4
21. ***NSN:*** 5
22. ***Reference:*** 6
23. ***Figure:*** 7
24. ***Table:*** 8
25. ***Item:*** 9
26. ***Total:*** 123
27. ***Text:***

This is the text for the problem below line 27.

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS

For use of this form, see AR 310-1; the proponent agency is the US Army Adjutant General Center.

Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).

DATE: Date form is filled out.

TO: *(Forward to proponent of publication or form) (Include ZIP Code)*

Mailing address found on title block page.

FROM: *(Activity and location) (Include ZIP Code)*

Your mailing address.

PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER: TM X-XXXX-XXX-XXX

DATE: Date of the TM.

TITLE: Title of TM.

ITEM NO.	PAGE NO.	PARA-GRAPH	LINE NO.	FIGURE NO.	TABLE NO.	RECOMMENDED CHANGES AND REASON (Exact wording of recommended change must be given)
	0019 00 1	3	1	1		Step No. 2 says to secure doors open with locking bar or hooks from where to what? The bars or hooks are not identified.
	0019 00 4	4	1	1		Step No. 19 states to remove locking bars, pins or hooks from where to what? The bars, pins or hooks are not identified. Where are they stored?

* Reference to line numbers within the paragraph or subparagraph.

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
Doe, John, CPL	755-1313	*CPL John Doe*

TO: *(Forward to proponent of publication or form) (Include ZIP Code)*	FROM: *(Activity and location) (Include ZIP Code)*	DATE:

PART II- REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION/FORM NUMBER:	DATE:	TITLE:
TM X-XXXX-XXX-XXX	Date of the TM.	Title of TM.

PAGE NO.	COLM NO.	LINE NO.	FEDERAL STOCK NUMBER	REFERENCE NO.		FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III - REMARKS *(Any general remarks or recommendations, or suggestions for improvement of publications and* blank forms. Additional blank sheets may be used if more space is needed.)

* Reference to line numbers within the paragraph or subparagraph.

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE
Doe, John, CPL	755-1313	*CPL John Doe*

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RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is OAASA	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
TO: *(Forward to proponent of publication or form) (Include ZIP Code)*	**FROM:** *(Activity and location) (Include ZIP Code)*	

PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 55-1925-286-13&P		OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST FOR AIR COMPRESSOR INLAND AND COASTAL LARGE TUG (LT) NSN 1925-01-509-7013 (EIC XAG)

ITEM	PAGE	PARA-	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO: *(Forward direct to addressee listed in publication)*	FROM: *(Activity and location) (Include ZIP Code)*	DATE

PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE
TM 55-1925-286-13&P		OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST FOR AIR COMPRESSOR INLAND AND COASTAL LARGE TUG (LT) NSN 1925-01-509-7013 (EIC XAG)

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III - REMARKS *(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is OAASA	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
TO: *(Forward to proponent of publication or form) (Include ZIP Code)*	**FROM:** *(Activity and location) (Include ZIP Code)*	

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ITEM	PAGE	PARA-	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO: *(Forward direct to addressee listed in publication)*	FROM: *(Activity and location) (Include ZIP Code)*	DATE

PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE
TM 55-1925-286-13&P		OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST FOR AIR COMPRESSOR INLAND AND COASTAL LARGE TUG (LT) NSN 1925-01-509-7013 (EIC XAG)

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III - REMARKS *(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is OAASA	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
TO: *(Forward to proponent of publication or form) (Include ZIP Code)*	**FROM:** *(Activity and location) (Include ZIP Code)*	

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ITEM	PAGE	PARA-	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO: *(Forward direct to addressee listed in publication)*	FROM: *(Activity and location) (Include ZIP Code)*	DATE

PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

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PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III - REMARKS *(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

RECOMMENDED CHANGES TO PUBLICATIONS AND BLANK FORMS For use of this form, see AR 25-30; the proponent agency is OAASA	Use Part II *(reverse)* for Repair Parts and Special Tool Lists (RPSTL) and Supply Catalogs/Supply Manuals (SC/SM).	DATE
TO: *(Forward to proponent of publication or form) (Include ZIP Code)*	**FROM:** *(Activity and location) (Include ZIP Code)*	

PART I - ALL PUBLICATIONS (EXCEPT RPSTL AND SC/SM) AND BLANK FORMS

PUBLICATION/FORM NUMBER	DATE	TITLE
TM 55-1925-286-13&P		OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST FOR AIR COMPRESSOR INLAND AND COASTAL LARGE TUG (LT) NSN 1925-01-509-7013 (EIC XAG)

ITEM	PAGE	PARA-	LINE	FIGURE NO.	TABLE	RECOMMENDED CHANGES AND REASON

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

TO: *(Forward direct to addressee listed in publication)*	FROM: *(Activity and location) (Include ZIP Code)*	DATE

PART II - REPAIR PARTS AND SPECIAL TOOL LISTS AND SUPPLY CATALOGS/SUPPLY MANUALS

PUBLICATION NUMBER	DATE	TITLE
TM 55-1925-286-13&P		OPERATOR, UNIT, AND DIRECT SUPPORT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST FOR AIR COMPRESSOR INLAND AND COASTAL LARGE TUG (LT) NSN 1925-01-509-7013 (EIC XAG)

PAGE NO.	COLM NO.	LINE NO.	NATIONAL STOCK NUMBER	REFERENCE NO.	FIGURE NO.	ITEM NO.	TOTAL NO. OF MAJOR ITEMS SUPPORTED	RECOMMENDED ACTION

PART III - REMARKS *(Any general remarks or recommendations, or suggestions for improvement of publications and blank forms. Additional blank sheets may be used if more space is needed.)*

TYPED NAME, GRADE OR TITLE	TELEPHONE EXCHANGE/AUTOVON, PLUS EXTENSION	SIGNATURE

Metric Conversion Factors

Mc x F = Cf		
Measurement to be Converted (Mc)	Factor (F)	Converted Measurement (Cf)
Meters (m)	x 39.37	= Inches (in.)
Meters (m)	x 3.281	= Feet (ft)
Meters (m)	x 1.094	= Yards (yd)
Inches (in.)	x 25.40	= Millimeters (mm)
Inches (in.)	x 2.54	= Centimeters (cm)
Inches (in.)	x 0.0254	= Meters (m)
Inches (in.)	x 25400	= Micrometers (µm)
Feet (ft)	x 0.305	= Meters (m)
Square feet (ft^2)	x 0.093	= Square meters (m^2)
Foot-Pounds	x 1.35582	= Newton meters (N m)
Newton meters (N m)	x 0.73756	= Foot Pounds
Yards (yd)	x 0.914	= Meters (m)
Square yards (yd^2)	x 0.836	= Square meters (m^2)
Square Inches (in^2)	x 6.452	= Square Centimeters (cm^2)
Cubic Inches (in^3)	x 16.39	= Cubic Centimeters (cm^3)
Cubic Centimeters (cm^3)	x 0.061	= Cubic Inches (in^3)
Cubic Feet (ft^3)	x 0.028	= Cubic Meters (cm^3)
Gallons (gal)	x 3.785	= Liters (L)
Liters (L)	x 0.2642	= Gallons (gal)
Kilometers (km)	x 0.5397	= Nautical miles (nmi)
Meters (m)	x 0.0005397	= Nautical miles (nmi)
Nautical miles (nmi)	x 1.853	= Kilometers (km)
Fluid Ounces (oz)	x 29.574	= Milliliters (mL)
Pounds (lb)	x 0.4536	= Kilograms (kg)
Kilograms (kg)	x 2.2046	= Pounds (lb)
Kilopascals (kPa)	x 0.145	= Pounds (lb) per Square Inch (psi)
Pounds per Square Inch (psi)	x 6.895	= Kilopascals (kPa)
Degrees Centigrade (°C)	(°C x 1.8) + 32	= Degrees Fahrenheit (°F)
Degrees Fahrenheit (°F)	(°F-32) ÷ 1.8	= Degrees Centigrade (°C)
Bar	x 14.5	= Pounds per Square Inch (psi)
Pounds per Square Inch (psi)	x 0.06894	= Bar
Horsepower (hp)	x 0.746	= Kilowatt (kW)
Kilowatt (kW)	x 1.341	= Horsepower (hp)

PIN: 082859-000