## **TECHNICAL MANUAL**

## OPERATOR AND UNIT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST FOR FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM)

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

\*Supersedes TM 55-1925-218-24&P, 16 August 1991.

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

# HEADQUARTERS, DEPARTMENT OF THE ARMY

## **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.

## **GENERAL SAFETY WARNINGS DESCRIPTIONS**

Failure to follow the warnings below can result in injury or death to personnel and/or damage to equipment.

## FIREFIGHTING EQUIPMENT



Volatile materials must not be brought aboard, electrical circuits must not be energized, fuel tanks must not be topped off, and engines must not be started before firefighting equipment is available and operative.

## FUEL/FUELING



Fuel oil and other petroleum products are highly volatile in extreme heat. To minimize the possibility of an explosion, wipe up all spills at once, see that fuel lines and valves are not leaking, and pump bilges regularly.

## ELECTRICITY



Electricity can cause injury or death to personnel. Do not work on live circuits. Lock out and tag out circuits in accordance with FM 55-502 and warn other personnel not to energize the circuits.

Do not be misled by the term "low voltage." Potentials as low as 50 volts may cause death under adverse conditions. Never work on electrical equipment unless there is another person nearby who is familiar with the operation and hazards of the equipment and who is competent in administering first aid. When the technician is aided by operators, he must warn them about dangerous areas. Whenever possible, the input power supply to the equipment must be shut off, locked out, and tagged out before beginning work on the equipment. Take particular care to ground every capacitor likely to hold a dangerous potential. When working inside the equipment, after the power has been turned off, always ground every part before touching it. Do not operate the equipment without all grilles, guards, louvers, and covers in place and tightly secured.

#### TM 55-1925-283-12&P

## ENGINE ROOM



The diesel engines and various other equipment are excessively noisy. Serious hearing loss or deafness could occur if this equipment is operated without proper hearing protection. Hearing protection must be worn at all times in the engine room when the engines are running. Unprotected and unnecessary personnel must keep out of the engine room.

Be sure engine room ventilators are open and ventilation fans are operating whenever the engines are operating. The engine exhaust gases contain carbon monoxide, which is a colorless, odorless, and poisonous gas. Breathing air with carbon monoxide produces symptoms of headache, dizziness, loss of muscular control, a sleepy feeling, and coma. Brain damage or death can result from heavy exposure. Precautions must be followed to insure crew safety. Be alert at all times during vessel operation for exhaust odors and exposure symptoms. If either is present immediately ventilate the compartment. The field protective mask for nuclear-biological-chemical (NBC) protection will not protect you from carbon monoxide poisoning. The best defense against carbon monoxide poisoning is good ventilation. If symptoms persist remove the affected person to fresh air, keep warm, do not permit physical exercise, and, if necessary, perform rescue breathing. For rescue breathing instructions, refer to FM 4-25.11.

#### **CLEANING SOLVENT**



Cleaning solvent may cause moderate skin irritation, defatting, and possible secondary infection upon contact with the skin; severe eye irritation and conjunctivitis upon contact with the eyes; respiratory tract irritation and central nervous system effect upon inhalation; and vomiting, diarrhea, or death upon ingestion. Always wear chemical protective gloves and goggles when handling cleaning solvent. Clean parts in a well ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. In case of contact with the skin, remove contaminated clothing, wash with soap and water, and get medical attention if irritation develops. In case of eye contact, flush the eyes with fresh water for at least 15 minutes and get medical attention if irritation continues. In case of inhalation, remove to fresh air, give oxygen or perform rescue breathing as the situation dictates, and get medical attention. In case of ingestion, give nothing by mouth, and get immediate medical attention. Do not induce vomiting, lung damage may result from vomiting after ingestion.

#### **DIESEL FUEL**



Diesel fuel may cause skin irritation upon contact with the skin, eye irritation upon contact with the eyes, and illness if ingested. Always wear chemical protective gloves and goggles when handling diesel fuel. In case of contact with the skin, remove contaminated clothing and wash with soap and water. In case of large-scale skin contamination, get medical attention immediately. In case of eye contact, flush the eyes with fresh water for at least 15 minutes and get medical attention immediately. In case of inhalation, remove to fresh air and give oxygen or perform rescue breathing as the situation dictates. In case of ingestion, give two glasses (16 oz.) of water (if the victim is conscious and able to swallow), and get immediate medical attention. Do not induce vomiting, lung damage may result from vomiting after ingestion. If vomiting occurs, give fluids again.

## **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.



**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.

## **EXPLANATION OF SAFETY WARNING ICONS (CONTINUED)**



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.



**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.

## **EXPLANATION OF SAFETY WARNING ICONS (CONTINUED)**



HOT AREA - hand over object radiating heat shows that 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.



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.

## **EXPLANATION OF SAFETY WARNING ICONS (CONTINUED)**



**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.



 $\ensuremath{\text{VAPOR}}$  - human figure in a cloud shows that material vapors present a danger to life or health.

HEADQUARTERS DEPARTMENT OF THE ARMY WASHINGTON, D.C., 30 JULY 2008

#### TECHNICAL MANUAL

#### OPERATOR AND UNIT MAINTENANCE MANUAL INCLUDING REPAIR PARTS AND SPECIAL TOOLS LIST FOR FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM)

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

Distribution Statement A: Approved for public release; distribution is unlimited.

TM 55-1925-283-12&P, 30 November 2005, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Insert pages
Change Transmittal Sheet
Authentication Page
A/B blank
i through iv
0001 00-1 through 0001 00-4
0005 00-1 through 0005 00-8
0006 00-1 through 0006 00-6
0008 00-1 through 0008 00-6
0009 00-1 through 0009 00-2
0013 00-1 through 0013 00-8
0014 00-1 through 0014 00-10
DA Form 2028

2. Retain this sheet in front of the manual for reference purposes.

#### CHANGE

NO. 1

TM 55-1925-283-12&P

By Order of the Secretary of the Army:

GEORGE W. CASEY, JR. General, United States Army Chief of Staff

Official: orne JOYCE E. MORROW

Administrative Assistant to the Secretary of the Army 0819115

Distribution:

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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.

Dates of original issue and changed pages for this manual are:

Original ..... 30 November 2005

Change 1 ..... 30 July 2008

# TOTAL NUMBER OF PAGES FOR FRONT AND REAR MATTER IS 34 AND TOTAL NUMBER OF WORK PACKAGES IS 21, CONSISTING OF THE FOLLOWING:

Page/WP	* Change	Page/WP	* Change
No.	No.	No.	No.
Front Cover	0	WP 0012 00 (2 pgs)	0
Change Transmittal Sheet	. 1	Chp 5 title page	
Authentication Page		WP 0013 00 (8 pgs)	
a-f	. 0	Chp 6 title page	0
Α	. 1	WP 0014 00 (10 pgs)	
B blank	. 1	Chp 7 title page	0
i - iv	. 1	WP 0015 00 (2 pgs)	0
Chp 1 title page	0	WP 0016 00 (4 pgs)	0
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WP 0002 00 (2 pgs)	0	WP 0018 00 (6 pgs)	0
WP 0003 00 (2 pgs)	0	WP 0019 00 (6 pgs)	0
Chp 2 title page	0	WP 0020 00 (4 pgs)	0
WP 0004 00 (4 pgs)	0	WP 0021 00 (2 pgs)	0
WP 0005 00 (8 pgs)	. 1	Glossary-1	0
WP 0006 00 (6 pgs)	. 1	Glossary-2 blank	0
Chp 3 title page	0	Index-1 - Index-5	0
WP 0007 00 (4 pgs)	0	Index-6 blank	0
WP 0008 00 (6 pgs)	. 1	Electronic Form DA 2028	1
WP 0009 00 (2 pgs)	. 1	DA 2028	0
Chp 4 title page	0	Authentication Page	0
WP 0010 00 (2 pgs)	0	Rear Cover	0
WP 0011 00 (4 pgs)	0		

\* Zero in this column indicates an original page.

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

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#### REPORTING ERRORS AND RECOMMENDING IMPROVEMENTS

You can help improve this publication. If you find any errors, or if you would like to recommend any improvements to the procedures in this publication, please let us know. The preferred method is to submit your DA Form 2028 (Recommended Changes to Publications and Blank Forms) through the Internet, on the Army Electronic Product Support (AEPS) website. The Internet address is <a href="https://aeps.ria.army.mil">https://aeps.ria.army.mil</a>. The DA Form 2028 is located under the Public Applications section in the AEPS Public Home Page. Fill out the form and click on SUBMIT. Using this form on the AEPS will enable us to respond quicker to your comments and better manage the DA Form 2028 program. You may also mail, e-mail, or fax your comments or DA Form 2028 directly to the U.S. Army TACOM Life Cycle Management Command. The postal mail address is U.S. Army TACOM Life Cycle Management Command. The postal mail address is U.S. Army TACOM Life Cycle Management Command. The postal mail address is U.S. Army TACOM Life Cycle Management Command. The postal mail address is U.S. Army TACOM Life Cycle Management Command. The postal mail address is U.S. Army TACOM Life Cycle Management Command. The postal mail address is U.S. Army TACOM Life Cycle Management Command. ATTN: AMSTA-LC-LMPP / TECH PUBS, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The e-mail address is <u>tacomlcmc.daform2028@us.army.mil</u>. The fax number is DSN 793-0726 or Commercial (309) 782-0726.

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\* Supersedes TM 55-1925-218-24&P, 16 August 1991

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#### 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 hazard-ous 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 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 the 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.

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.

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.

#### 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 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 and unit) 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 and unit). 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 Fuel Filter/Water Separator (Fuel Transfer System)

Inland and Coastal Large Tug (LT)

#### OPERATOR AND UNIT MAINTENANCE FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) FOR INLAND AND COASTAL LARGE TUG (LT) GENERAL INFORMATION

#### **GENERAL INFORMATION**

#### SCOPE

The information in this manual applies to all Inland and Coastal Large Tugs (LT) with the improved Racor model 800D-20 fuel filter/water separator installation. This manual contains operator instructions and maintenance procedures for the fuel filter/water separator used in the fuel oil transfer system.

#### MAINTENANCE FORMS, RECORDS, AND REPORTS

Department of the Army 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) Website. The Internet address is <u>https://aeps.ria.army.mil</u>. 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 to your comments quicker and to manage the DA Form 2028 program better. You may also mail, fax or e-mail your letter or DA Form 2028 directly to: AMSTA-LC-LMPP / TECH PUBS, TACOM-RI, 1 Rock Island Arsenal, Rock Island, IL 61299-7630. The e-mail address is ROCK-TACOM-TECH-PUBS@conus.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 Ultra Violet (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 System (TAMMS).

#### OZONE DEPLETING SUBSTANCES

There are no Ozone Depleting Substances (ODS) contained in the fuel filter/water separator 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 fuel filter/water separator 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. These systems must be prepared for storage or shipment in accordance with that publication. Additional instructions can be found in WP 0010 00.

#### WARRANTY INFORMATION

Unit maintenance maintains records of the warranty status of equipment on the fuel filter/water separator 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 ft² ft³/min FGC FLTR FM FM FM FO F.O.	Foot(feet) Square foot(feet) Cubic feet per minute Functional Group Code Filter Field Manual Flow Meter Fuel Oil Fuel Oil

## LIST OF ABBREVIATIONS/ACRONYMS (continued)

Abbreviation/Acronym	Name
GAL	Gallon
GS	General Service
Hg	Mercury
in	Inch(es)
in³	Cubic Inch(es)
kg	Kilogram
L	Liter(s)
L/min	Liters per minute
Ib	Pound(s)
Ib-ft	Pounds Feet (torque)
LT	Large Tug
m	Meter(s)
m²	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

#### LIST OF ABBREVIATIONS/ACRONYMS (continued)

Abbreviation/Acronym	Name
V Vac Vdc	Valve Volts, Alternating Current 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 AND UNIT MAINTENANCE FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) FOR INLAND AND COASTAL LARGE TUG (LT) EQUIPMENT DESCRIPTION AND DATA

## EQUIPMENT CHARACTERISTICS, CAPABILITIES, AND FEATURES

The fuel filter/water separator is comprised of a water detector alarm system, pressure gauges, filter element assembly, and control panel. Depending upon the filter element used, the fuel filter/water separator has filtration capabilities down to two microns to effectively purify diesel fuel. The technical characteristics of this system 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

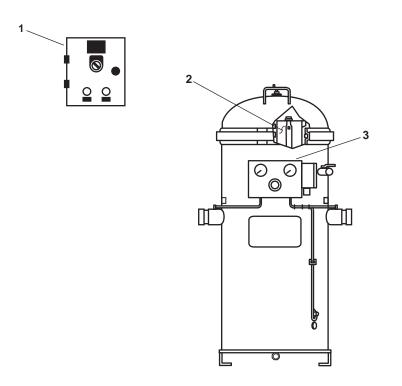


Figure 1. Major Components of the Fuel Filter/Water Separator

- 1. Control panel (figure 1, item 1). This panel controls the power to the fuel filter/water separator. It also contains the fuses that provide circuit protection for the system.
- 2. Filter element assembly (figure 1, item 2). The filter element assembly consists of ten 30-micron filter elements. The filter elements remove solid contaminates from the fuel oil supply before it reaches its final destination. If desired, 10-micron filter elements may be used in place of the 30-micron filter elements. The 10-micron filter elements are the same as the filter elements used for the main engine and Ship's Service Diesel Generator (SSDG) fuel filter/water separators.
- 3. Indicator panel (figure 1, item 3). This panel contains the inlet and discharge pressure gauges as well as the alarm indicator.

## DIFFERENCES BETWEEN MODELS

There are no differences between models for this system.

#### EQUIPMENT DATA

The fuel filter/water separator purifies fuel transferred on the Inland and Coastal Large Tug (LT). The fuel filter/ water separator is permanently mounted on the starboard side of the engine room, outboard, at frame 24. Technical characteristics of the fuel filter/water separator are contained in table 1.

Table 1. Fuel Filter/Water	Separator	Technical	Characteristics
----------------------------	-----------	-----------	-----------------

Item	Data
Model Height	
Housing Diameter Unit Dry Weight Maximum Inlet Fuel Temperature	
Initial Vacuum Drop Maximum Flow Rate Maximum Operating Pressure	
Operating Voltage Transformer Input Transformer Output	

#### OPERATOR AND UNIT MAINTENANCE FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) FOR INLAND AND COASTAL LARGE TUG (LT) THEORY OF OPERATION

## GENERAL

The fuel filter/water separator removes particulates and water from fuel entering the fuel transfer pumps. These contaminants are removed from the fuel by centrifugal separation and by filtration. These processes are explained in depth in the paragraphs below.

The fuel filter water separator also gives an audible/visual alarm to alert the operator when the water level in the unit exceeds safe operating limits. The operating theory for this alarm is discussed in the final paragraph of this work package.

#### **CENTRIFUGAL SEPARATION**

Water and large particulates are removed from the fuel by centrifugal separation. In this process, fuel enters the fuel filter/water separator assembly (figure 1, item 1) through the inlet fitting (figure 1, item 2). The incoming fuel is directed through a set of stationary vanes in the turbine assembly (figure 1, item 3). These stationary vanes cause the fuel to spin as it enters the area below the turbine assembly. As the fuel spins, the water and large particulates (heavier than the fuel), are forced to the outside of the fuel filter/water separator assembly. The water and large particulates strike the sides of the fuel filter/water separator assembly and fall to the bottom of the tank. A drain fitting (figure 1, item 4) is provided to permit removal of the water and large particulates.

The fuel, now free of the water and large particulates, is drawn upward to pass through the filter elements prior to exiting the fuel filter/water separator. This filtration process is explained in the following paragraph.

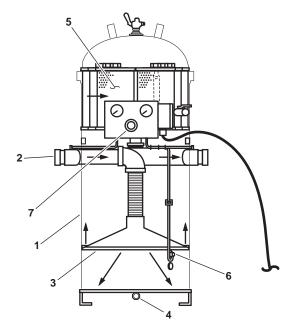


Figure 1. Fuel Filter/Water Separator Operating Principles

## FILTRATION

After the water and large particulates are centrifugally separated from the fuel, the fuel passes upward through a set of 10 removable filter elements (figure 1, item 5), which remove smaller particulates. As the fuel travels through these filter elements, any particulates whose size exceeds the filter elements' rating are trapped in the filter media. These particulates remain trapped in the filter media until the filter elements are replaced. During normal operation, 30-micron filter elements are used in this system. If desired, filter elements with 10- and even 2- micron ratings may be used. However, use of these finer filter elements will reduce the overall service life of the installed filter elements and will decrease the service interval.

#### ALARM

A water sensor probe (figure 1, item 6) is fitted in the lower portion of the fuel filter/water separator assembly. This water sensor probe senses the difference in conductivity between water and fuel. When fuel is in contact with the water sensor probe, no alarm indication is given. When water comes in contact with the water sensor probe, the alarm indicator (figure 1, item 7) illuminates and sounds an audible warning to alert the operator. When the alarm activates, it is up to the operator to secure the fuel filter/water separator and drain the sump. There is no automatic shutdown for this system.

# **Chapter 2**

# Operator Instructions for Fuel Filter/Water Separator (Fuel Transfer System)

# Inland and Coastal Large Tug (LT)

#### OPERATOR AND UNIT MAINTENANCE FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) FOR INLAND AND COASTAL LARGE TUG (LT) DESCRIPTION AND USE OF OPERATOR CONTROLS AND INDICATORS

## FUEL FILTER/WATER SEPARATOR

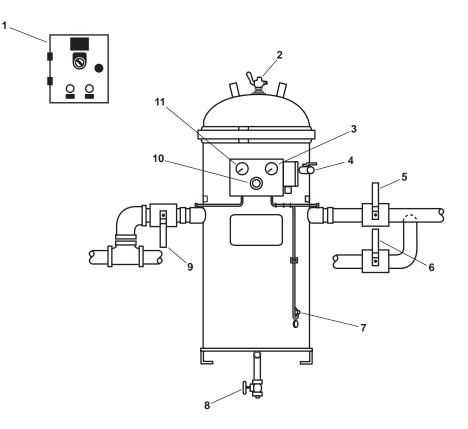


Figure 1. Fuel Filter/Water Separator

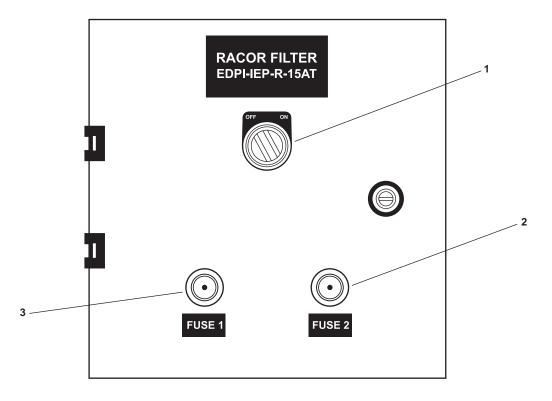
Table 1.	Fuel Filter/Water	Separator	(refer to	figure 1	)

Key	Control/Indicator	Function
1	Control Panel	This control panel contains the ON/OFF switch and fuses for the fuel filter/water separator. Refer to figure 2 for details.
2	Vent Valve	This valve permits the operator to vent air from the fuel filter/water separator during priming.
3	Discharge Pressure Gauge	This gauge indicates the pressure or vacuum present on the dis- charge side of the fuel filter/water separator.
4	Upper Ball Valve	This valve permits the operator to drain the upper portion of the fuel filter/water separator assembly prior to changing filters.
5	FO-17 F.O. FLTR / WATER SEP OUTLET COV	This valve secures the fuel exiting the fuel filter/water separator.

Key	Control/Indicator	Function
6	FO-42 F.O. FLTR / WATER SEP BYPASS COV	When OPEN, this valve permits fuel to bypass the fuel filter/water separator.
7	Water Sensor Probe	This probe senses the water level in the sump and triggers the alarm when the water level exceeds the safe operating level.
8	Drain Valve	This valve permits water and particulates to be drained from the sump area.
9	FO-16 F.O. FLTR / WATER SEP INLET COV	This valve secures the fuel entering the fuel filter/water separator.
10	Alarm Indicator	This indicator illuminates red and sounds an audible signal when the water sensor probe (figure 1, item 7) detects an unsafe water level in the sump.
11	Inlet Pressure Gauge	This gauge indicates the pressure or vacuum present on the inlet side of the fuel filter/water separator.

## Table 1. Fuel Filter/Water Separator (refer to figure 1) (continued)

## **CONTROL PANEL**



## Figure 2. Control Panel

Table 2. (	Control	Panel	(refer	to fig	ure 2)
------------	---------	-------	--------	--------	--------

Key	Control/Indicator	Function
1	ON/OFF Switch	This switch controls the power to the fuel filter/water separator alarm.
2	FUSE 2	This 2-amp fuse provides overload protection for the 110 Vac supply to the fuel filter/water separator.
3	FUSE 1	This 2-amp fuse provides overload protection for the 110 Vac supply to the fuel filter/water separator.

#### END OF WORK PACKAGE

#### OPERATOR AND UNIT MAINTENANCE FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) FOR INLAND AND COASTAL LARGE TUG (LT) OPERATION UNDER USUAL CONDITIONS

#### **INITIAL SETUP:**

#### Materials/Parts:

Gloves, Chemical and Oil Protective (Item 1, Table 3, WP 0020 00) Goggles, Industrial (Item 2, Table 3, WP 0020 00) Rags, Wiping (Item 3, Table 1, WP 0021 00)

#### **Personnel Required:**

One Watercraft Engineer, 88L

#### **References:**

TM 55-1925-273-10 WP 0006 00 WP 0008 00 WP 0013 00 WP 0020 00 WP 0021 00

#### **Equipment Conditions:**

Engine room ventilation fans operating (TM 55-1925-273-10).

#### SECURITY MEASURES FOR ELECTRONIC DATA

There are no required security measures for electronic data. The fuel filter/water separator system components do not use or store any electronic data.

#### **OPERATING PROCEDURES**



The fuel filter/water separator should be primed before every use. Failure to prime the fuel filter/water separator before use can result in fuel transfer pump failure.

Two methods are available for priming the fuel filter/water separator. The preferred method is by priming from a high head. The secondary method is by priming using a fuel transfer pump. Both methods are described below.

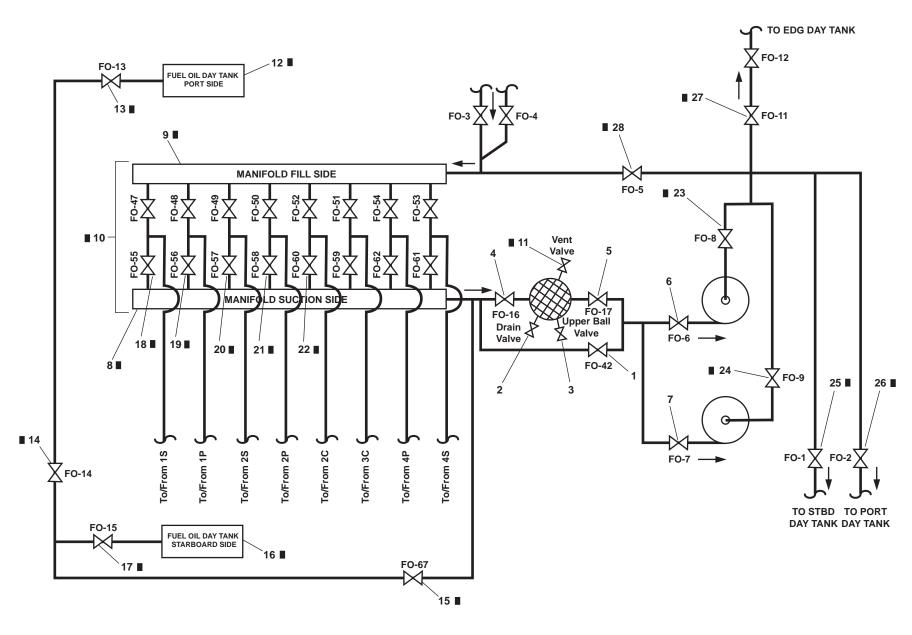
#### PRIMING USING A HIGH HEAD

- 1. CLOSE valve FO-42 F.O. FLTR / WATER SEP BYPASS COV (figure 1, item 1).
- 2. CLOSE the drain valve (figure 1, item 2) and upper ball valve (figure 1, item 3).
- 3. OPEN valves FO-16 F.O. FLTR / WATER SEP INLET COV (figure 1, item 4) and FO-17 F.O. FLTR / WATER SEP OUTLET COV (figure 1, item 5).
- 4. CLOSE valves FO-6 C.O.V. F.O. XFER PMP N0.1 SUCTION (figure 1, item 6) and FO-7 C.O.V. F.O. XFER PMP No.2 SUCTION (figure 1, item 7).
- 5. CLOSE all suction valves on the manifold suction side (figure 1, item 8) and all fill valves on the manifold fill side (figure 1, item 9) of the fuel manifold (figure 1, item 10).









## WARNING



Diesel fuel is flammable and diesel fuel vapors can be explosive. Make sure all work is performed in a well ventilated area. Keep sparks, open flame, and excessive heat away from the work area. Failure to comply with this precaution can result in death or serious injury.

Avoid prolonged exposure of the skin to diesel fuel. Protective nitrile gloves and chemical protective goggles must be worn whenever handling diesel fuel or parts that are saturated with diesel fuel. Failure to comply with this precaution can result in serious injury.

- 6. Place several wiping rags around the vent valve (figure 1, item 11) to catch any fuel that escapes during priming.
- 7. To prime using the port day tank (figure 1, item 12), OPEN valves FO-13 (figure 1, item 13), FO-14 (figure 1, item 14), and FO-67 (figure 1, item 15).
- 8. To prime using the starboard day tank (figure 1, item 16), OPEN valves FO-15 (figure 1, item 17) and FO-67 (figure 1, item 15).
- 9. OPEN the vent valve (figure 1, item 11). You should feel light air pressure coming from the vent valve while it is open. Leave the vent valve OPEN until fuel begins to escape.
- 10. CLOSE the vent valve (figure 1, item 11) as soon as the fuel begins to escape.
- 11. Priming is now complete. CLOSE the valves opened in step 7 or step 8 above and proceed to the Fuel Filter/Water Separator Operation paragraph later in this work package.

## PRIMING USING A FUEL TRANSFER PUMP



Use this priming method only when no fuel tank has a head higher than the vent valve. This priming method requires use of a fuel transfer pump running in a partially dry condition. Extended running in this condition will result in pump failure.

- 1. CLOSE valve FO-42 F.O. FLTR / WATER SEP BYPASS COV (figure 1, item 1).
- 2. CLOSE the upper ball valve (figure 1, item 3) and drain valve (figure 1, item 2).
- 3. OPEN valves FO-16 F.O. FLTR / WATER SEP INLET COV (figure 1, item 4) and FO-17 F.O. FLTR / WATER SEP OUTLET COV (figure 1, item 5).
- 4. OPEN the inlet valve for the desired fuel transfer pump.
  - a. If fuel transfer pump 1 will be used, OPEN valve FO-6 C.O.V. F.O. XFER PMP NO.1 SUCTION (figure 1, item 6).
  - b. If fuel transfer pump 2 will be used, OPEN valve FO-7 C.O.V. F.O. XFER PMP NO.2 SUCTION (figure 1, item 7).

- 5. Determine which fuel tank will be used to prime the fuel filter/water separator. This could be tank 1S, 1P, 2S, 2C, or 2P.
- 6. OPEN the supply valve for the fuel tank selected in step 5 above.
  - a. If tank 1S was selected, OPEN valve FO-55 F.O. TK 1S SUCT (figure 1, item 18).
  - b. If tank 1P was selected, OPEN valve FO-56 F.O. TK 1P SUCT (figure 1, item 19).
  - c. If tank 2S was selected, OPEN valve FO-57 F.O. TK 2S SUCT (figure 1, item 20).
  - d. If tank 2P was selected, OPEN valve FO-58 F.O. TK 2P SUCT (figure 1, item 21).
  - e. If tank 2C was selected, OPEN valve FO-60 F.O. TK 2C SUCT (figure 1, item 22).

## WARNING



Diesel fuel is flammable and diesel fuel vapors can be explosive. Make sure all work is performed in a well ventilated area. Keep sparks, open flame, and excessive heat away from the work area. Failure to comply with this precaution can result in death or serious injury.

Avoid prolonged exposure of the skin to diesel fuel. Protective nitrile gloves and chemical protective goggles must be worn whenever handling diesel fuel or parts that are saturated with diesel fuel. Failure to comply with this precaution can result in serious injury.

- 7. OPEN the discharge valve from the fuel transfer pump selected in step 4 above.
  - a. If fuel transfer pump 1 will be used, OPEN valve FO-8 C.O.V.- F.O. XFER PMP NO.1 DISCHARGE (figure 1, item 23).
  - b. If fuel transfer pump 2 will be used, OPEN valve FO-9 C.O.V.- F.O. XFER PMP NO. 2 DISCHARGE (figure 1, item 24).
- 8. Select a destination day tank for the fuel transfer pump.
  - a. If the starboard day tank (figure 1, item 16) is selected, OPEN valve FO-1 F.O. DAY TK. FILL (figure 1, item 25).
  - b. If the port day tank is selected (figure 1, item 12) OPEN valve FO-2 F.O. DAY TK. FILL (figure 1, item 26).
- CLOSE valves FO-11 F.O. TO E.D.G. DAY TK (figure 1, item 27) and FO-5 F.O.DAY TK EMERG FILL (figure 1, item 28).
- 10. Place several wiping rags around the vent valve (figure 1, item 11) to catch any fuel that escapes during priming.
- 11. OPEN the vent valve (figure 1, item 11).
- 12. Start the fuel transfer pump (TM 55-1925-273-10) selected in step 4 above and closely observe the vent valve (figure 1, item 11).

- 13. Leave the vent valve (figure 1, item 11) OPEN until fuel begins to escape. CLOSE the vent valve as soon as the fuel begins to escape.
- 14. Secure the fuel transfer pump (TM 55-1925-273-10).
- 15. Priming is now complete. CLOSE the valve opened in step 6 above and proceed to the Fuel Filter/Water Separator Operation paragraph below.

# FUEL FILTER/WATER SEPARATOR OPERATION



Only one fuel transfer pump at a time may be operated while using the fuel filter/water separator. Attempting to use two fuel transfer pumps will exceed the capacity of the fuel filter/water separator and could result in damage to the fuel filter/water separator or to the fuel transfer pumps.

- 1. Line up the fuel transfer system's valves to fill the desired tank (TM 55-1925-273-10).
- At the 120V emergency distribution panel No. 1, set the FUEL FILTER/WATER SEPARATOR circuit breaker (LT 803 Only) (figure 2, item 1), or the FUEL FILTER/WATER SEPARATOR-RACOR FILTER circuit breaker (All Other Vessels) (figure 3, item 1) to the ON position.

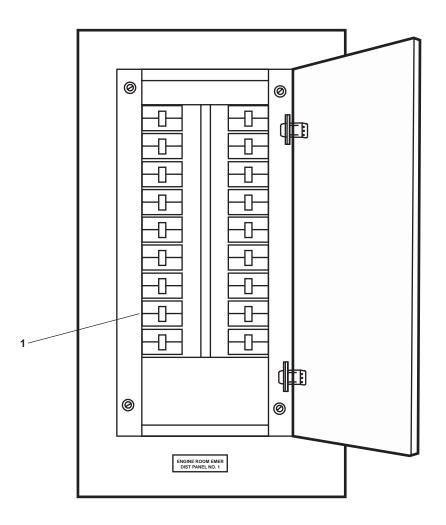


Figure 2. 120V Emergency Distribution Panel No. 1 (LT 803 Only)

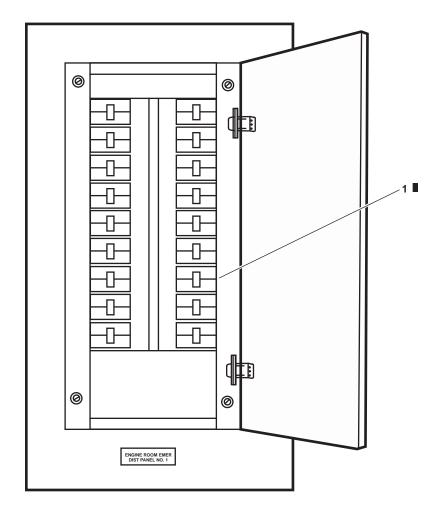
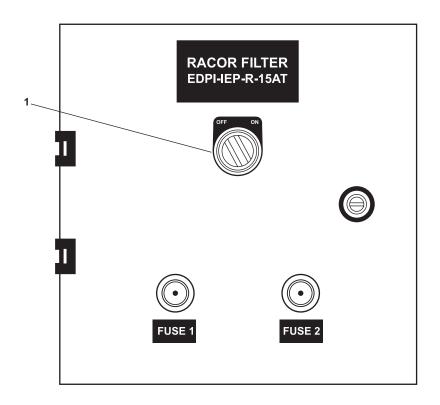


Figure 3. 120V Emergency Distribution Panel No. 1 (All Other Vessels)

# NOTE

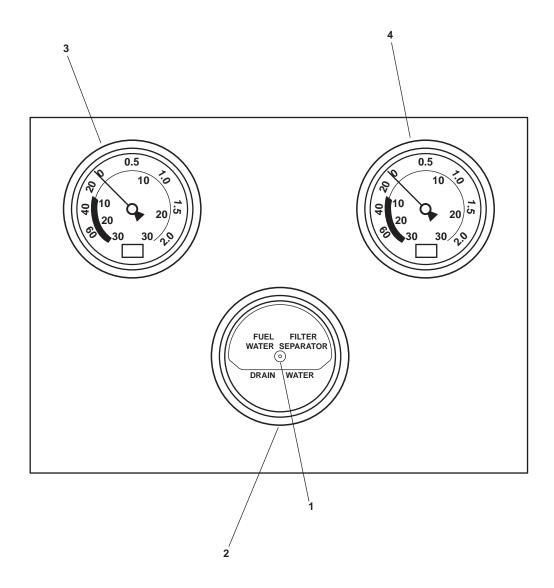
The alarm may be difficult to hear if machinery is running in the engine room.

3. At the control panel, set the ON/OFF switch (figure 4, item 1) to the ON position. When first turned ON, the alarm will self-test. During this self-test, the alarm light (figure 5, item 1) will illuminate and the audible alarm (figure 5, item 2) will sound. The self-test will conclude and the alarms will secure after 3-5 seconds. If the self-test does not function as described above, troubleshoot the alarm (WP 0008 00).



# Figure 4. Control Panel

- 4. Start the desired fuel transfer pump (TM 55-1925-273-10) to begin transferring fuel.
- 5. Observe the readings on the inlet pressure gauge (figure 5, item 3) and discharge pressure gauge (figure 5, item 4). If the differential pressure between these gauges exceeds 10 PSI (0.7 bar) or 10 inHg (254 mmHg), secure from fuel transfer and change the filters (WP 0013 00). If it is necessary to transfer fuel while changing the filters, bypass the fuel filter/water separator (WP 0006 00) to permit continued transfer of fuel.
- 6. Continue operation of the fuel filter/water separator until fuel transfer is complete or until the differential pressure readings exceed the value given in step 5 above. When fuel transfer is complete, shut down the fuel filter/water separator as described in the paragraph below.



# Figure 5. Indicator Panel

#### FUEL FILTER/WATER SEPARATOR SHUTDOWN

- 1. Secure the applicable fuel transfer pump and valves (TM 55-1925-273-10).
- 2. CLOSE valves FO-16 F.O. FLTR / WATER SEP INLET COV (figure 1, item 4) and FO-17 F.O. FLTR / WATER SEP OUTLET COV (figure 1, item 5).
- **3**. At the control panel, set the ON/OFF switch (figure 4, item 1) to the OFF position.

# END OF WORK PACKAGE

# OPERATOR AND UNIT MAINTENANCE FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) FOR INLAND AND COASTAL LARGE TUG (LT) OPERATION UNDER UNUSUAL CONDITIONS

#### **INITIAL SETUP:**

#### **Personnel Required:**

One Watercraft Engineer, 88L

References: TM 55-1925-273-10 WP 0013 00

#### SECURITY MEASURES FOR ELECTRONIC DATA

No electronic data is used or stored in the fuel filter/water separator.

#### UNUSUAL ENVIRONMENT/WEATHER

There are no environmental or weather conditions that prevent the fuel filter/water separator from operating properly.

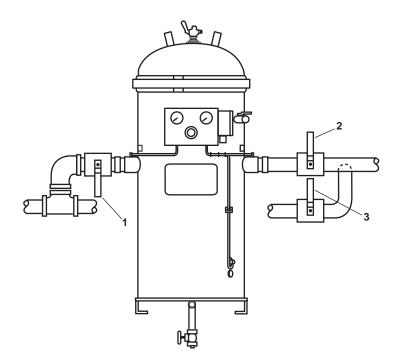
#### **BYPASSING THE FUEL FILTER/WATER SEPARATOR**

- 1. If fuel transfer operations are underway, secure from fuel transfer (TM 55-1925-273-10).
- CLOSE valves FO-16 F.O. FLTR / WATER SEP INLET COV (figure 1, item 1) and FO-17 F.O. FLTR / WATER SEP OUTLET COV (figure 1, item 2).
- 3. OPEN valve FO-42 F.O. FLTR / WATER SEP BYPASS COV (figure 1, item 3).

#### NOTE

If desired, both fuel transfer pumps can be operated simultaneously when the fuel filter/water separator is bypassed.

4. Resume fuel transfer operation (TM 55-1925-273-10).



#### Figure 1. Fuel Filter/Water Separator Valves

0006 00-1

### OPERATING THE FUEL FILTER/WATER SEPARATOR WITH NO ELECTRICAL POWER



Only one fuel transfer pump at a time may be operated while using the fuel filter/water separator. Attempting to use two fuel transfer pumps will exceed the capacity of the fuel filter/water separator and could result in damage to the fuel filter/water separator or to the fuel transfer pumps.

# NOTE

The fuel filter/water separator is capable of normal operation without electrical power. However, the fuel filter/water separator's sump must be frequently checked for water and particulate contamination.

- 1. Line up the fuel transfer system's valves to fill the desired tank (TM 55-1925-273-10).
- At the 120V emergency distribution panel No. 1, set the RACOR FILTER circuit breaker (LT 803 Only) (figure 2, item 1), or the FUEL FILTER/WATER SEPARATOR-RACOR FILTER circuit breaker (All Other Vessels) (figure 3, item 1) to the OFF position.

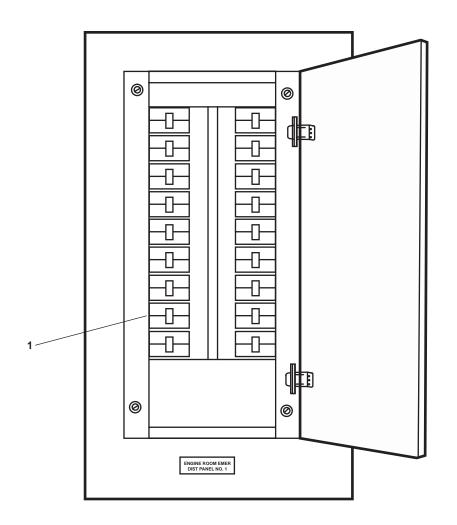


Figure 2. 120V Emergency Distribution Panel No. 1 (LT 803 Only)

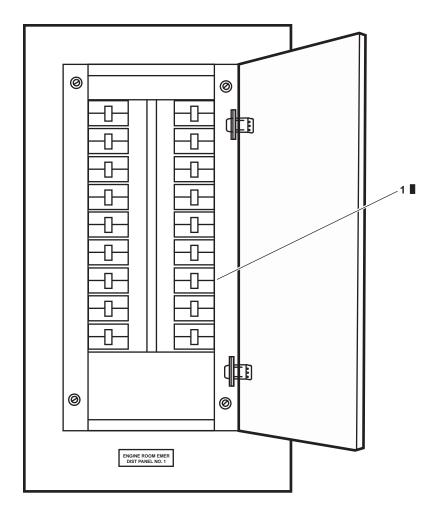


Figure 3. 120V Emergency Distribution Panel No. 1 (All Other Vessels)

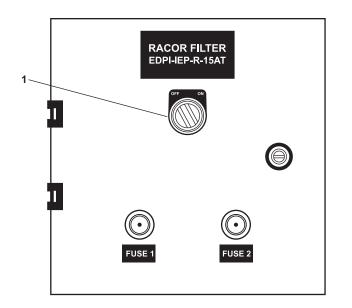
- At the control panel, set the ON/OFF switch (figure 4, item 1) to the OFF position. No self-test will be performed. The alarm light (figure 5, item 1) will not illuminate and the audible alarm (figure 5, item 2) will not sound.
- 4. Start the desired fuel transfer pump (TM 55-1925-273-10) to begin transferring fuel.
- 5. Observe the readings on the inlet pressure gauge (figure 5, item 3) and discharge pressure gauge (figure 5, item 4). If the differential pressure between these gauges exceeds 10 PSI (0.7 bar) or 10 inHg (254 mmHg), secure from fuel transfer and change the filters (WP 0013 00). If it is necessary to transfer fuel while changing the filters, bypass the fuel filter/water separator to permit continued transfer of fuel. The bypass procedure is contained at the beginning of this work package.

# NOTE

The sump drain interval will vary depending upon the level of contamination present in the fuel. The initial sump drain interval should be every 15 minutes. This interval may be adjusted depending upon the level of water and particulates present when the sump is drained.

6. Periodically shut down the fuel filter/water separator as described in the paragraph below. After shutdown, drain the water and particulates from the sump (WP 0013 00).

7. Continue operation of the fuel filter/water separator until fuel transfer is complete or until the differential pressure readings exceed the value given in step 5 above. When fuel transfer is complete, shut down the fuel filter/water separator as described in the paragraph below.





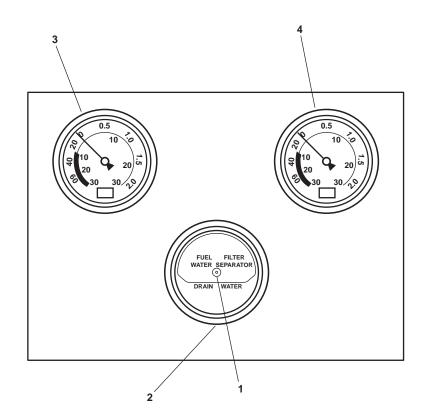


Figure 5. Indicator Panel

# FUEL FILTER/WATER SEPARATOR SHUTDOWN

- 1. Secure the applicable fuel transfer pump and valve (TM 55-1925-273-10).
- 2. CLOSE valves FO-16 F.O. FLTR / WATER SEP INLET COV (figure 1, item 1) and FO-17 F.O. FLTR / WATER SEP OUTLET COV (figure 1, item 2).

# END OF WORK PACKAGE

# OPERATOR AND UNIT MAINTENANCE FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) 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 symptom is corrected.

(	)

Figure 1. Pill Shaped Symbol

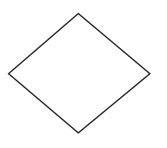


Figure 2. Diamond Shaped Symbol



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	Malfunction	Work Package, Procedure
Fuel Filter/Water Separator	Alarm Does Not Self Test	WP 0008 00, Procedure 3
	Fuel Filter/Water Separator Will Not Prime	WP 0008 00, Procedure 1
	Inlet Pressure Gauge Exceeds 20 inHg (508 mmHg) Vacuum	WP 0008 00, Procedure 4
	No Fuel Flow or Low Fuel Flow	WP 0008 00, Procedure 2

Equipment	Malfunction	Work Package, Procedure
Fuel Filter/Water Separator	Alarm Indicator Light Will Not Illuminate	WP 0009 00, Procedure 1

# Table 2. Unit Troubleshooting Procedures

# OPERATOR MAINTENANCE FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) FOR INLAND AND COASTAL LARGE TUG (LT) OPERATOR TROUBLESHOOTING PROCEDURES

#### **INITIAL SETUP:**

# Personnel Required:

One Watercraft Engineer, 88L

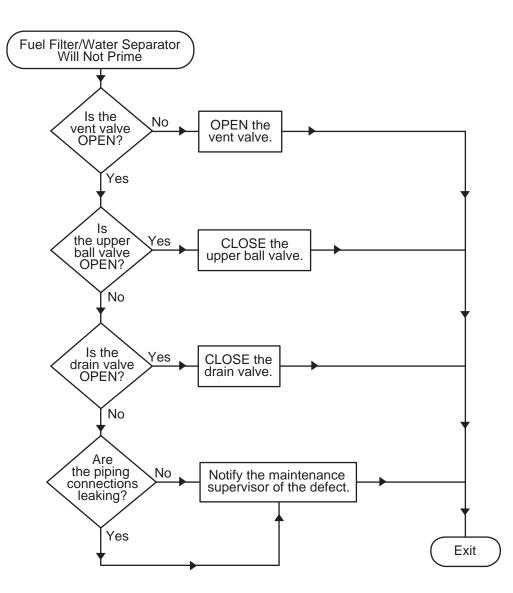
References: TM 55-1925-273-10 WP 0013 00

# INTRODUCTION

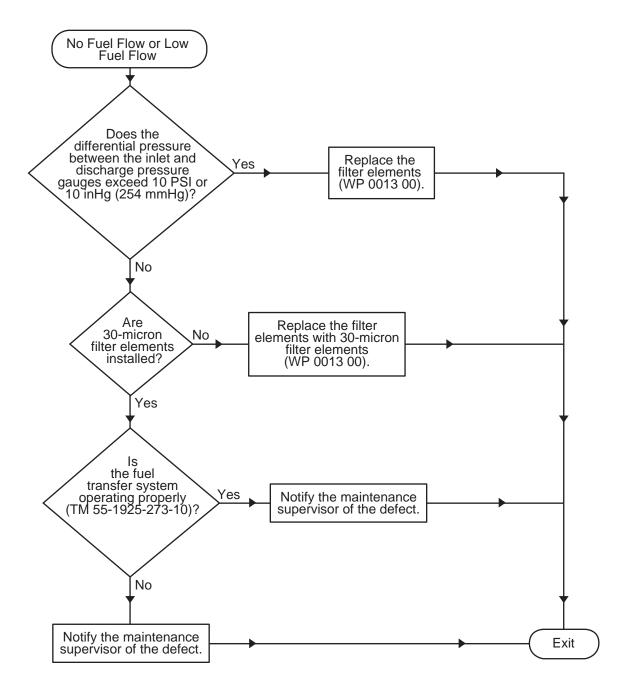
The following troubleshooting procedures are included in this work package:

Malfunction/Symptom	Procedure
Fuel Filter/Water Separator Will Not Prime	1
No Fuel Flow or Low Fuel Flow	2
Alarm Does Not Self Test	3
Inlet Pressure Gauge Exceeds 20 inHg (508 mmHg) Vacuum	4

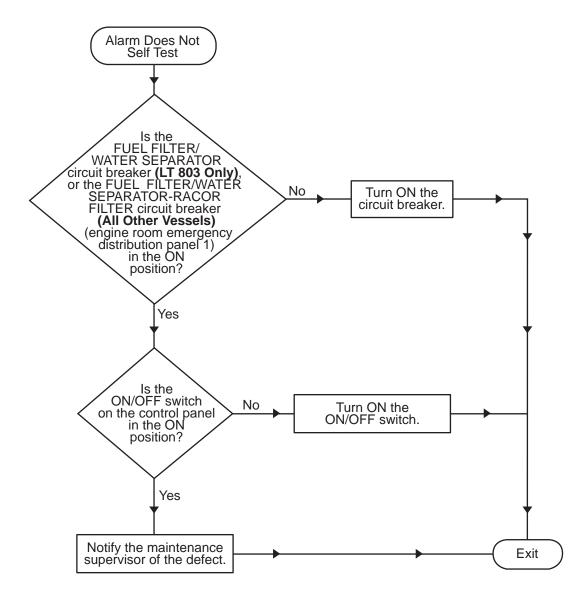
#### **TROUBLESHOOTING PROCEDURES**



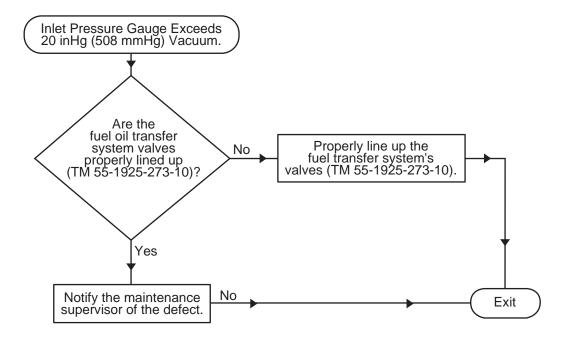
Procedure 1. Fuel Filter/Water Separator Will Not Prime



Procedure 2. No Fuel Flow or Low Fuel Flow



Procedure 3. Alarm Does Not Self Test



Procedure 4. Inlet Pressure Gauge Exceeds 20 inHg (508 mmHg) Vacuum

END OF WORK PACKAGE

# UNIT MAINTENANCE FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) FOR INLAND AND COASTAL LARGE TUG (LT) UNIT TROUBLESHOOTING PROCEDURES

# **INITIAL SETUP:**

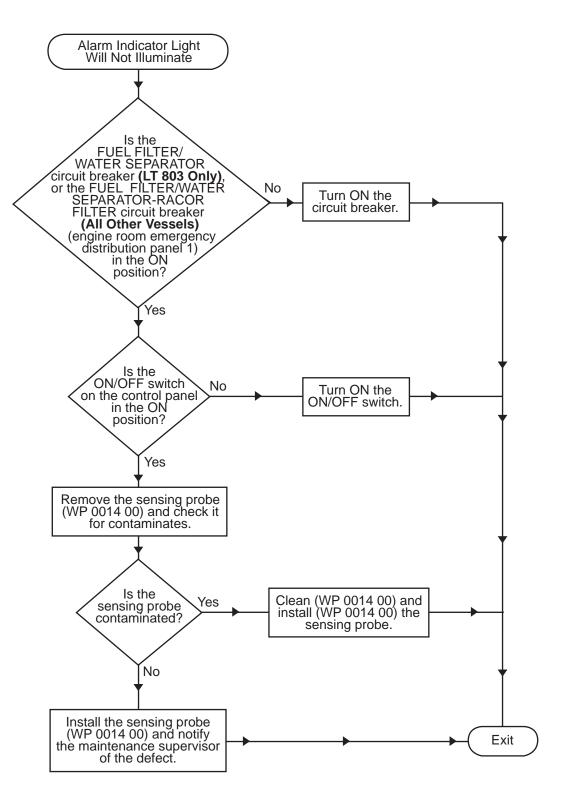
Tools and Special Tools: Tool Kit, General Mechanic's (Item 1, Table 2, WP 0017 00) Multimeter (Item 2, Table 2, WP 0017 00) Personnel Required: Two Watercraft Engineers, 88L

References: WP 0014 00 WP 0017 00

#### INTRODUCTION

The following troubleshooting procedures are included in this work package:

Malfunction/Symptom	Procedure
Alarm Indicator Light Will Not Illuminate	1



Procedure 1. Alarm Indicator Light Will Not Illuminate

# **Chapter 4**

# Maintenance Instructions for Fuel Filter/Water Separator (Fuel Transfer System)

# Inland and Coastal Large Tug (LT)

#### OPERATOR AND UNIT MAINTENANCE FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) FOR INLAND AND COASTAL LARGE TUG (LT) SERVICE UPON RECEIPT AND PREPARATION FOR STORAGE

# INITIAL SETUP:

#### **Personnel Required:**

One Watercraft Engineer, 88L

References: WP 0012 00 TB 740-97-4

#### SERVICE UPON RECEIPT

#### SHELTER REQUIREMENTS

The fuel filter/water separator is installed in the engine room, out of the weather. Despite this, the fuel filter/water separator and its components can still become wet during compartment cleaning or during service of other systems such as potable water piping. If there is a possibility that the electrical components could become wet due to cleaning or equipment maintenance operations, secure the fuel filter/water separator and its components 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 Preventive Maintenance Checks and Services (PMCS) up through, and including, the annual level. Operator PMCS procedures are contained in WP 0012 00. There is no unit PMCS for the fuel filter/ water separator.

#### PREPARATION FOR STORAGE OR SHIPMENT

The fuel filter/water separator 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 and TM 38-470, Storage and Maintenance of Army Prepositioned Stock Materiel.

# OPERATOR AND UNIT MAINTENANCE FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) FOR INLAND AND COASTAL LARGE TUG (LT) PMCS INTRODUCTION

#### PURPOSE AND USE OF PREVENTIVE MAINTENANCE CHECKS AND SERVICES (PMCS) DATA

PMCS is performed to keep the fuel filter/water separator 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 fuel filter/water separator 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

This column indicates the periodicity of the check or service.

- 1. Before operating the fuel filter/water separator do Before PMCS.
- 2. During fuel filter/water separator operation, do During PMCS.
- 3. After fuel filter/water separator 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.
- 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 fuel filter/water separator 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



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 fuel filter/water separator. 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, and REMEMBER: 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 fuel filter/water separator. 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 fuel filter/water separator 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 by 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 (MIL-HDBK-113 and MIL-HDBK-275).

#### LUBRICATION SERVICE INTERVALS - NORMAL CONDITIONS

For safer, more trouble free operations, make sure that your fuel filter/water separator is serviced when it needs it. For the proper lubrication and service intervals, see WP 0012 00.

#### LUBRICATION SERVICE INTERVALS - UNUSUAL CONDITIONS

The fuel filter/water separator 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 FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) FOR INLAND AND COASTAL LARGE TUG (LT) OPERATOR PREVENTIVE MAINTENANCE CHECKS AND SERVICES

ITEM NO.	INTERVAL	MAN- HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
1	Before	0.2	Fuel Filter/WaterPerform an overall visual inspection, ensuring that all hardware and safety guards are in place and tight.		
2	Before	0.1	Pressure Gauges	Check visually for obvious damage.	One or both gauges damaged.
3	Before	0.1	Retainer Clamp	Check that the retainer clamp is snug. Also check for visible signs of fuel oil leakage around the gasket.	Any leakage.
	Suction Pressure Gauge Casket Beneath Clamp) Discharge Pressure Gauge				
4	During	0.1	Pressure Gauges	Check differential pressure between the suction pressure gauge and discharge pressure gauge.	Differential pressure exceeds 10 inHg (254 mmHg) or 10 PSI (0.69 bar).
5	After	0.1	Sump	Drain water from the sump (WP 0013 00).	

ITEM NO.	INTERVAL	MAN- HOUR	ITEM TO BE CHECKED OR SERVICED	PROCEDURE	EQUIPMENT NOT READY/ AVAILABLE IF:
6	Quarterly	2.0	Filter Elements	Change the filter elements (WP 0013 00).	
7	Semiannual	2.0	Sump	Remove solid contaminants and clean the sump (WP 0013 00).	

# **Chapter 5**

# Operator Maintenance Instructions for Fuel Filter/Water Separator (Fuel Transfer System)

# Inland and Coastal Large Tug (LT)

# OPERATOR MAINTENANCE FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) FOR INLAND AND COASTAL LARGE TUG (LT) FUEL FILTER/WATER SEPARATOR, SERVICE

#### **INITIAL SETUP:**

#### **Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2, WP 0017 00) Pipe Wrench, 48 Inch (Item 3, Table 2, WP 0017 00) Suitable Drain Pan

#### Materials/Parts:

Dry Cleaning Solvent (Item 1, Table 1, WP 0021 00) Gloves, Chemical Protective (Item 1, Table 3, WP 0020 00) Goggles, Industrial (Item 2, Table 3, WP 0020 00) Grease, General Purpose (Item 2, Table 1, WP 0021 00) Rags, Wiping (Item 3, Table 1, WP 0021 00) Tag, Danger (Item 4, Table 1, WP 0021 00)

#### **Personnel Required:**

Two Watercraft Engineers, 88L

#### **REPLACE FILTER ELEMENTS**

#### REMOVAL

# References:

FM 55-502 TM 55-1925-273-10 WP 0005 00 WP 0017 00 WP 0020 00 WP 0021 00

#### **Equipment Conditions:**

- Set to OFF the FUEL FILTER/WATER SEPARA-TOR circuit breaker (LT 803 Only), or the FUEL FILTER/WATER SEPARATOR-RACOR FILTER circuit breaker (All Other Vessels) on the 120V emergency distribution panel No. 1. Lock out and tag out (FM 55-502)
- CLOSE valves FO-16 F.O. FLTR / WATER SEP INLET COV and FO-17 F.O. FLTR / WATER SEP OUTLET COV. Lock out and tag out (FM 55-502)
- All engine room ventilation fans operating normally (TM 55-1925-273-10)





Diesel fuel is flammable and diesel fuel vapors can be explosive. Make sure all work is performed in a well ventilated area. Keep sparks, open flame, and excessive heat away from the work area. Failure to comply with this precaution can result in death or serious injury.

Avoid prolonged exposure of the skin to diesel fuel. Protective nitrile gloves and chemical protective goggles must be worn whenever handling diesel fuel or parts, which are saturated with diesel fuel. Failure to comply with this precaution can result in serious injury.

- 1. OPEN the vent valve (figure 1, item 1).
- 2. Position a suitable drain pan beneath the upper ball valve (figure 1, item 2).

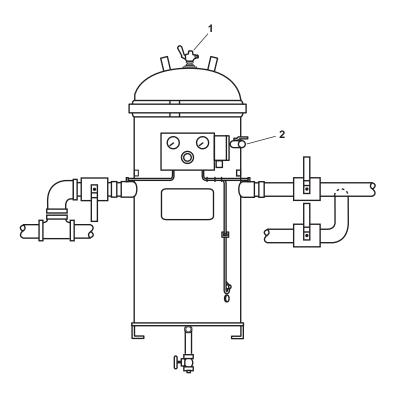


Figure 1. Fuel Filter/Water Separator Valves

#### NOTE

Approximately 6 to 7 gallons (22.7 to 26.5 liters) of fuel will be drained from the upper ball valve. Ensure that sufficient drain capacity is available.

- 3. OPEN the upper ball valve (figure 1, item 2) and drain the fuel until the flow slows to a dribble.
- 4. CLOSE the upper ball valve (figure 1, item 2).
- 5. Press IN on the safety catch (figure 2, item 1) and pull OUT on the release lever (figure 2, item 2) to release the retainer clamp (figure 2, item 3). Set aside the retainer clamp.
- 6. Remove the lid (figure 2, item 4) and O-ring (figure 2, item 5). Discard the O-ring.
- 7. Remove the cap screw (figure 2, item 6) securing the first filter element (figure 2, item 7).
- 8. Remove the first filter element (figure 2, item 7) using a twisting, upward motion.
- 9. Remove the remaining nine filter elements (figure 2, item 7) by repeating steps 7 and 8 above.

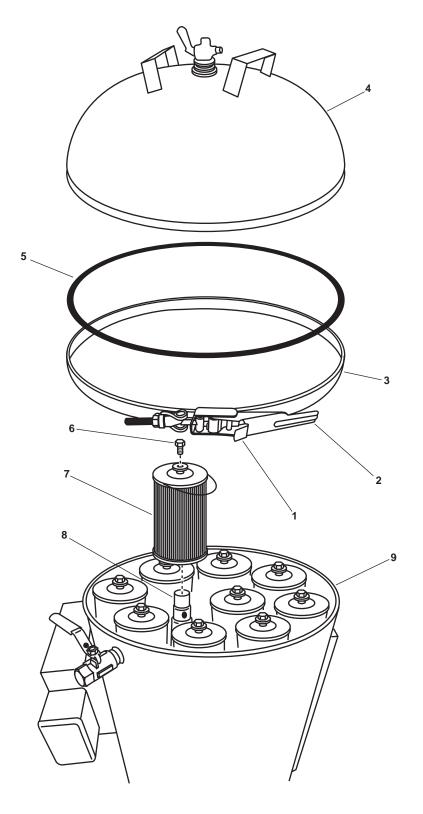


Figure 2. Fuel Filter Replacement

1. Install the 10 new filter elements (figure 2, item 7) by twisting them while pushing them onto the return tubes (figure 2, item 8).



Do not over tighten the cap screws. Over tightening of the cap screws will result in breakage of the return tubes.

- 2. Install the 10 cap screws (figure 2, item 6) and tighten them lightly.
- 3. Install a new O-ring (figure 2, item 5) onto the fuel filter/water separator tank lip (figure 2, item 9). Apply a thin coat of grease on the new O-ring.
- 4. Position the lid (figure 3, item 1) onto fuel filter/water separator tank lip (figure 3, item 2) ensuring that the alignment arrows (figure 3, item 3) are properly aligned.
- 5. Position the retainer clamp (figure 2, item 3) over the joint (figure 3, item 4) between the lid (figure 2, item 4; figure 3, item 1) and the fuel filter/water separator tank lip (figure 2, item 9; figure 3, item 2).

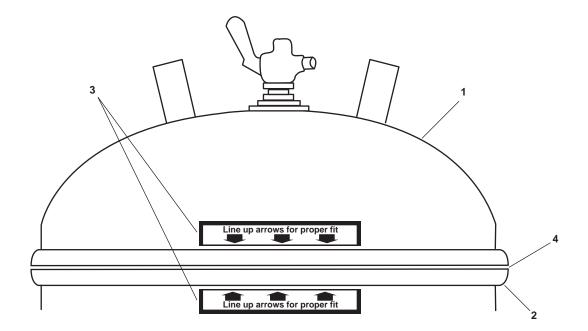


Figure 3. Alignment Arrows

## **CAUTION**

Do not force the release lever into the latched position. Forcing the release lever will result in failure of the retainer clamp.

- 6. Push the release lever (figure 2, item 2) in the LATCHED direction until the release lever locks behind the safety catch (figure 2, item 1). It may be necessary to gently tap the circumference of the retainer clamp (figure 2, item 3) with a hammer during this process. This tapping will aid in seating the retainer clamp and will ease latching of the release lever.
- 7. CLOSE the upper ball valve (figure 1, item 2) and vent valve (figure 1, item 1).
- 8. Perform the Follow-On Service procedure at the end of this work package.

### DRAINING WATER AND PARTICULATES FROM THE SUMP

- 1. OPEN the vent valve (figure 4, item 1).
- 2. Place a suitable drain pan beneath the drain valve (figure 4, item 2).

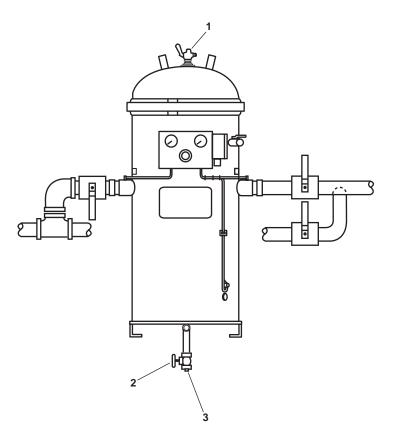
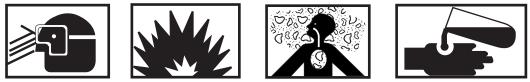


Figure 4. Draining the Sump

## WARNING



Diesel fuel is flammable and diesel fuel vapors can be explosive. Make sure all work is performed in a well ventilated area. Keep sparks, open flame, and excessive heat away from the work area. Failure to comply with this precaution can result in death or serious injury.

Avoid prolonged exposure of the skin to diesel fuel. Protective nitrile gloves and chemical protective goggles must be worn whenever handling diesel fuel or parts, which are saturated with diesel fuel. Failure to comply with this precaution can result in serious injury.

3. Remove the pipe plug (figure 4, item 3) from the drain valve (figure 4, item 2).

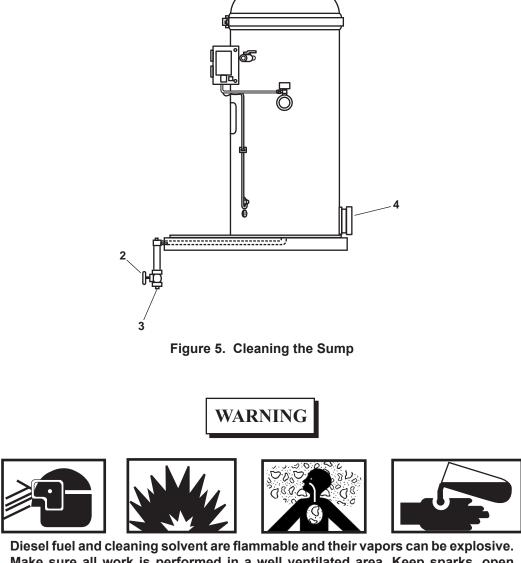
### NOTE

Approximately 20 to 30 gallons (22.7 to 26.5 liters) of fuel may be drained from the drain valve. Ensure that sufficient drain capacity is available.

- 4. OPEN the drain valve (figure 4, item 2) and drain the water and particulates. Continue draining until only clean fuel flows from the drain valve.
- 5. When all the water and particulates have drained, CLOSE the drain valve (figure 4, item 2) and install the pipe plug (figure 4, item 3).
- 6. Perform the Follow-On Service procedure at the end of this work package.

## **DRAIN THE SUMP**

- 1. OPEN the vent valve (figure 5, item 1).
- 2. Place a drain pan beneath the drain valve (figure 5, item 2).



Diesel fuel and cleaning solvent are flammable and their vapors can be explosive. Make sure all work is performed in a well ventilated area. Keep sparks, open flame, and excessive heat away from the work area. Failure to comply with this precaution can result in death or serious injury.

Avoid prolonged exposure of the skin to diesel fuel and cleaning solvent. Protective nitrile gloves and chemical protective goggles must be worn whenever handling diesel fuel and cleaning solvent or parts which are saturated with these substances. Failure to comply with this precaution can result in serious injury.

3. Remove the pipe plug (figure 5, item 3) from the drain valve (figure 5, item 2).

#### NOTE

Approximately 20 to 30 gallons (22.7 to 26.5 liters) of fuel will be drained from the drain valve. Ensure that sufficient drain capacity is available.

- 4. OPEN the drain valve (figure 5, item 2) and drain all the fluid contents from the fuel filter/water separator.
- 5. Perform the Follow-On Service procedure at the end of this work package.

### **CLEAN THE SUMP**

- 1. Drain the sump as described in the Drain the Sump procedure above.
- 2. Remove the clean-out cap (figure 5, item 4). Remove any solid contaminants from the sump.
- 3. Clean the interior of the sump with dry cleaning solvent and clean wiping rags.
- 4. Install the clean-out cap (figure 5, item 4).
- 5. CLOSE the drain valve (figure 5, item 2) and vent valve (figure 5, item 1).
- 6. Install the pipe plug (figure 5, item 3).
- 7. 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. Prime the fuel filter/water separator (WP 0005 00).
- 3. Operate the fuel filter/water separator (WP 0005 00), checking for leaks and proper operation.
- 4. Return the equipment to the desired readiness condition.

# **Chapter 6**

# Unit Maintenance Instructions for Fuel Filter/Water Separator (Fuel Transfer System)

## Inland and Coastal Large Tug (LT)

#### UNIT MAINTENANCE FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) FOR INLAND AND COASTAL LARGE TUG (LT) FUEL FILTER/WATER SEPARATOR, REPAIR

#### Initial Setup:

#### **Tools and Special Tools:**

Tool Kit, General Mechanic's (Item 1, Table 2, WP 0017 00) Multimeter (Item 2, Table 2, WP 0017 00)

#### Materials/Parts:

Rags, Wiping (Item 3, Table 1, WP 0021 00) Tag, Danger (Item 4, Table 1, WP 0021 00) Tape, Antiseizing (Item 5, Table 1, WP 0021 00)

#### **Personnel Required:**

Two Watercraft Engineers, 88L

#### **References:**

FM 55-502 TM 55-1925-273-10 WP 0005 00

#### **REPLACE CONTROL PANEL FUSES**

#### REMOVAL

### **References (continued):**

WP 0013 00 WP 0017 00 WP 0021 00

#### **Equipment Condition:**

- Set to OFF the FUEL FILTER/WATER SEPARA-TOR circuit breaker (LT 803 Only), or the FUEL FILTER/WATER SEPARATOR-RACOR FILTER circuit breaker (All Other Vessels) on the 120V emergency distribution panel No. 1. Lock out and tag out (FM 55-502)
- CLOSE, lock out, and tag out (FM 55-502) valves FO-16 F.O. FLTR / WATER SEP INLET COV and FO-17 F.O. FLTR / WATER SEP OUTLET COV.
- All engine room ventilation fans operating normally (TM 55-1925-273-10)



WARNING

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

- 1. Remove the fuse holder (figure 1, item 1) by pushing it in and turning it approximately 1/8 turn counterclockwise.
- 2. Pull the fuse holder (figure 1, item 1) and fuse (figure 1, item 2) from the socket (figure 1, item 3).
- 3. Pull the fuse (figure 1, item 2) from fuse holder (figure 1, item 1).

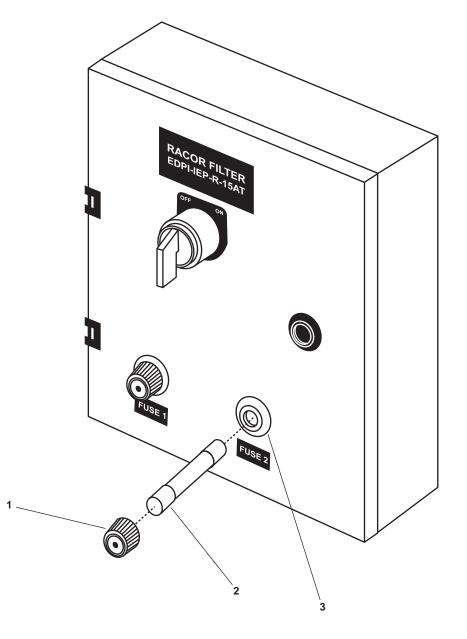


Figure 1. Fuse Replacement



Fuses must be replaced with an identical type with the same rating. Changing a fuse's rating or type can cause serious damage to the circuit or equipment it is meant to protect.

- 1. Push the fuse (figure 1, item 2) into the fuse holder (figure 1, item 1).
- 2. Install the fuse holder (figure 1, item 1) and fuse (figure 1, item 2) assembly into the socket (figure 1, item 3). Secure the fuse holder by pushing it in and turning it approximately 1/8 turn clockwise.

#### **REPLACE RETURN TUBE**

#### REMOVAL

- 1. Remove the fuel filter element (WP 0013 00) from the return tube (figure 2, item 1) that will be replaced.
- 2. Remove the return tube (figure 2, item 1) by inserting a punch through the upper hole (figure 2, item 2) and turning the return tube counterclockwise until it is free.

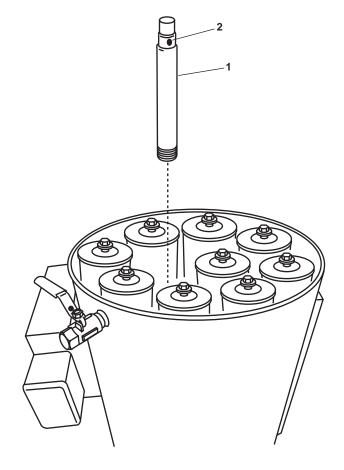


Figure 2. Return Tube Replacement

### INSTALLATION

- 1. Wrap the male pipe threads on the bottom of the return tube (figure 2, item 1) with antiseizing tape.
- 2. Thread the return tube into its opening by hand until hand tight.

## **CAUTION**

Do not use wrenches, pipe wrenches, vise grips, or similar tools to tighten the return tube. Use of these tools will damage the sealing surfaces of the return tube.

- 3. Use a punch inserted through the upper hole (figure 2, item 2) to tighten the return tube (figure 2, item 1) snugly.
- 4. Install the filter element (WP 0013 00) that was removed during the Return Tube Removal procedure above.

### **REPLACE GAUGE**

REMOVAL

# WARNING



Diesel fuel is flammable and diesel fuel vapors can be explosive. Make sure all work is performed in a well-ventilated area. Keep sparks, open flame, and excessive heat away from the work area. Failure to comply with this precaution can result in death or serious injury.

- 1. Drain the sump of the fuel filter/water separator (WP 0013 00).
- 2. Disconnect the discharge pressure gauge line (figure 3, item 1) from the elbow (figure 3, item 2).
- 3. Repeat step 2 above for the inlet pressure gauge line.



Do not permit the indicator panel to hang by its wiring. Allowing the indicator panel to hang by its wiring will cause wiring damage.

- 4. Remove the four screws (figure 3, item 3) securing the indiator panel (figure 3, item 4). Remove the indicator panel from the fuel filter/water separator. Have one crewmember support the indicator panel to prevent damage to the wiring (figure 3, item 5).
- 5. Disconnect the gauge line (figure 4, item 1) from the elbow (figure 4, item 2) for the gauge that will be replaced.
- 6. Remove the elbow (figure 4, item 2) from the gauge (figure 4, item 3) that will be replaced.
- 7. Remove the two retaining nuts (figure 4, item 4) and one retaining clamp (figure 4, item 5) that secure the gauge (figure 4, item 3) into the indicator panel (figure 4, item 6). Remove the gauge from the indicator panel.

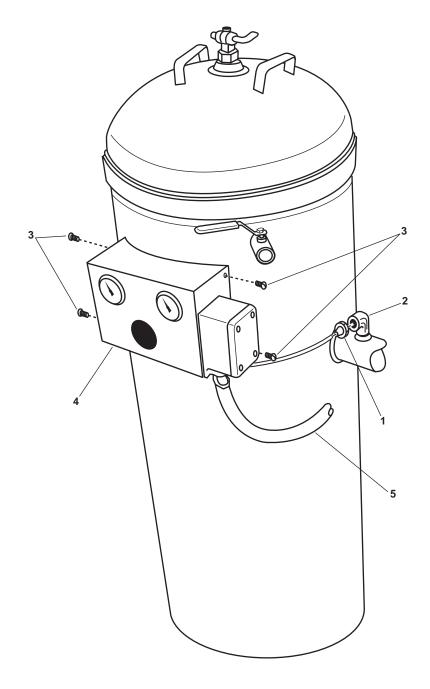


Figure 3. Indicator Panel Removal

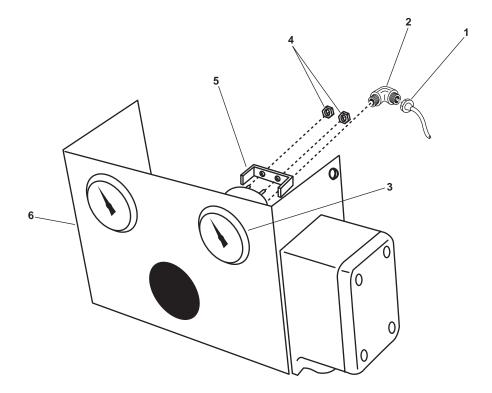


Figure 4. Gauge Replacement

- 1. Position the gauge (figure 4, item 3) in the indicator panel (figure 4, item 6) and secure it with the retaining clamp (figure 4, item 5) and two retaining nuts (figure 4, item 4).
- 2. Wrap the male pipe threads of the elbow (figure 4, item 2) with antiseizing tape and install the elbow into the gauge (figure 4, item 3).
- 3. Install the gauge line (figure 4, item 1) on the elbow (figure 4, item 2).
- 4. Position the indicator panel (figure 3, item 4) on the fuel filter/water separator and secure it with the four screws (figure 3, item 3).
- 5. Install the discharge pressure gauge line (figure 3, item 1) on the elbow (figure 3, item 2).
- 6. Repeat step 5 above for the inlet pressure gauge line.
- 7. Prime the fuel filter/water separator (WP 0005 00) and return it to the desired readiness condition.

#### **REPLACE SENSING PROBE**

REMOVAL



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

- 1. Drain the sump of the fuel filter/water separator (WP 0013 00).
- 2. Use a multimeter to check for voltage at the sensing probe wiring (figure 5, item 1). If no voltage is present, continue with this procedure. If voltage is present, ensure that the proper circuit breaker is secure, locked out, and tagged out (FM 55-502).
- 3. Remove the nut (figure 5, item 2) and wiring (figure 5, item 1) from the sensing probe (figure 5, item 3).
- 4. Unscrew the sensing probe (figure 5, item 3) from its mounting boss (figure 5, item 4).

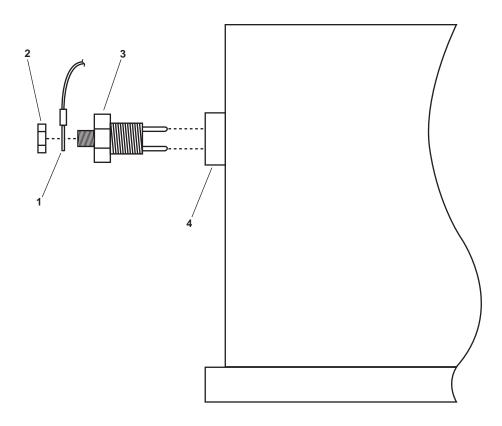


Figure 5. Sensing Probe Replacement

- 1. Wrap the male pipe threads of the sensing probe (figure 5, item 3) with antiseizing tape.
- 2. Install the sensing probe (figure 5, item 3) into its mounting boss (figure 5, item 4).
- 3. Install the wiring (figure 5, item 1) and nut (figure 5, item 2) on the sensing probe (figure 5, item 3).
- 4. Prime the fuel filter/water separator (WP 0005 00) and return it to the desired readiness condition.

#### **CLEAN SENSING PROBE**

- 1. Remove the sensing probe (figure 5, item 3) as detailed in the Replace Sensing Probe procedure above.
- 2. Use a clean wiping rag to remove any accumulated debris from the sensing probe (figure 5, item 3) terminals. If the debris cannot be completely removed, replace the sensing probe as detailed in the Replace Sensing Probe procedure above.
- 3. Install the sensing probe (figure 5, item 3) as detailed in the Replace Sensing Probe procedure above.

### REPLACE VENT VALVE OR UPPER BALL VALVE

#### REMOVAL

## WARNING



Diesel fuel is flammable and diesel fuel vapors can be explosive. Make sure all work is performed in a well-ventilated area. Keep sparks, open flame, and excessive heat away from the work area. Failure to comply with this precaution can result in death or serious injury.

- 1. Drain the sump of the fuel filter/water separator (WP 0013 00).
- 2. If the vent valve (figure 6, item 1) will be replaced, unscrew the vent valve from the lid (figure 6, item 2).
- 3. If the upper ball valve (figure 6, item 3) will be replaced, unscrew the upper ball valve from the fuel filter/water separator body (figure 6, item 4).

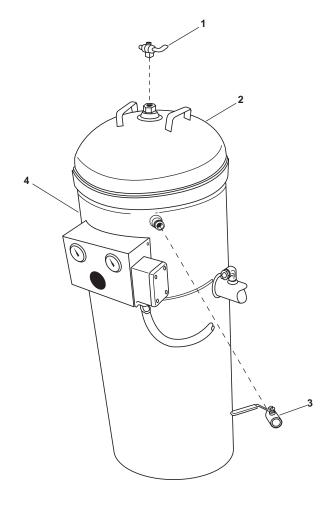


Figure 6. Vent Valve and Upper Ball Valve Replacement

- 1. Wrap the male pipe threads with antiseizing tape.
- 2. If the upper ball valve (figure 6, item 3) is being replaced, thread the upper ball valve into the fuel filter/water separator body (figure 6, item 4) and tighten it snugly.
- 3. If the vent valve (figure 6, item 1) will be replaced, thread the vent valve into the lid (figure 6, item 2) and tighten it snugly.
- 4. Prime the fuel filter/water separator (WP 0005 00) and return it to the desired readiness condition.

#### END OF WORK PACKAGE

# **Chapter 7**

# Supporting Information for Fuel Filter/Water Separator (Fuel Transfer System)

## Inland and Coastal Large Tug (LT)

### OPERATOR AND UNIT MAINTENANCE FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) 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 FM 55-502	First Aid Watercraft Safety		
TECHNICAL MANUALS			
TM 38-470 TM 55-1925-273-10	Storage and Maintenance of Army Prepositioned Stock Materiel Operator's Manual 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 740-97-4	Preservation of Vessels for Storage		
FORMS AND PAMPHLETS			
DA Form 2028 DA Form 2404 DA Form 2407 DA Form 2408-9 DA Form 4640 DA Form 4993 DA PAM 738-750 SF 368	Recommended Changes To Equipment Technical Publications Equipment Inspection and Maintenance Worksheet Maintenance Request Equipment Control Record Harbor Boat Deck Department Log for Class A&B Vessels Harbor Boat Engine Department Log for Class A and C-1 Vessels Functional Users Manual for The Army Maintenance Management System (TAMMS) Product Quality Deficiency Report		
HANDBOOKS AND STAND	ARDS		
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

## OPERATOR AND UNIT MAINTENANCE FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) 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.

- 0016 00
- 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 AND UNIT MAINTENANCE FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) FOR INLAND AND COASTAL LARGE TUG (LT) MAINTENANCE ALLOCATION CHART

## Table 1. MAC for Fuel Filter/Water Separator (Fuel Transfer System) for Inland and Coastal Large Tug

				N	(4) IAINTENAN				
				FIE	LD	SUSTAIN	IMENT		
(1) GROUP	(2) COMPONENT/	(3) MAINTENANCE	U	NIT	DIRECT SUPPORT	GENERAL SUPPORT	DEPOT	(5) TOOLS AND	(6)
NUMBER	ASSEMBLY	FUNCTION	С	0	F	н	D	EQUIP	(6) REMARKS
020905	Fuel Filter/Water Separator (Fuel Transfer System)	Inspect Service Replace Repair	0.5 1.0	2.0				1,3 1,2	A

## Table 2. Tools and Test Equipment for Fuel Filter/Water Separator (Fuel Transfer System) for Inland and Coastal Large Tug

TOOL OR TEST EQUIPMENT REF CODE	MAINTENANCE LEVEL	NOMENCLATURE	NATIONAL STOCK NUMBER	TOOL NUMBER
1	С	Tool Kit, General Mechanic's	5180-00-629-9783	(50980) SC5180-90- CL-N55
2	0	Multimeter	6625-01-265-6000	(89536) Model 27 W/ACCE
3	С	Wrench, Pipe, Adj, Heavy Duty, 48 Long, 5 Cap, Type 2, Class C	5120-00-270-4310	(50893) 31040

## Table 3. Remarks for Fuel Filter/Water Separator (Fuel Transfer System) for Inland and Coastal Large Tug

REFERENCE CODE	REMARKS
A	Depot Level Maintenance will be accomplished through the use of commercial activities on an as needed basis, or through the On-Condition-Cyclic-Maintenance (OCCM) Program in accordance with AR 750-1, Para. 5-13.

#### END OF WORK PACKAGE

## OPERATOR AND UNIT MAINTENANCE FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) 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 and unit maintenance of the fuel filter/water separator (fuel transfer system) for the 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 indexes 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 PACK-AGES

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

<sup>\*</sup>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	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.
PF PG	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 DESCRIP-TION 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.
ХА	Do not requisition an "XA" coded item. Order the next higher assembly.(Refer to NOTE below.)
ХВ	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; iden- tified 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.
	<b>NOTE</b> 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 <u>Code</u>	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.
Н-	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 <u>Code</u>	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.
Η-	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.
В-	No repair is authorized. No parts or special tools are authorized for mainte- nance 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 <u>Code</u>	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.

Recoverability	Application / Evaluation
<u>Code</u>	Application/Explanation
F -	Reparable item. When uneconomically reparable, condemn and dispose of the item at the direct support level.
Н-	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. Con- demnation 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 spe- cific reasons (such as precious metal content, high dollar value, critical material, or hazardous material). Refer to appropriate manuals/directives for specific in- structions.
Column (2)) The NICN	I for the item is listed in this column

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.

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.

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

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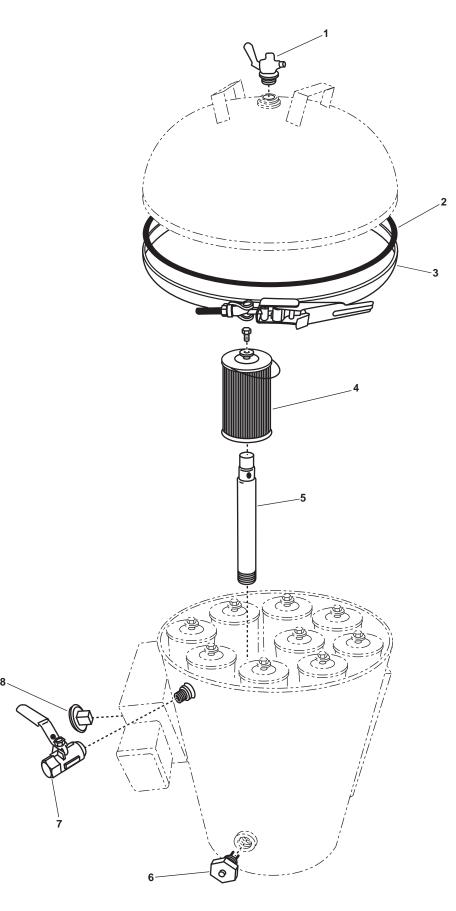


Figure 1. Fuel Filter/Water Separator (Sheet 1 of 2)

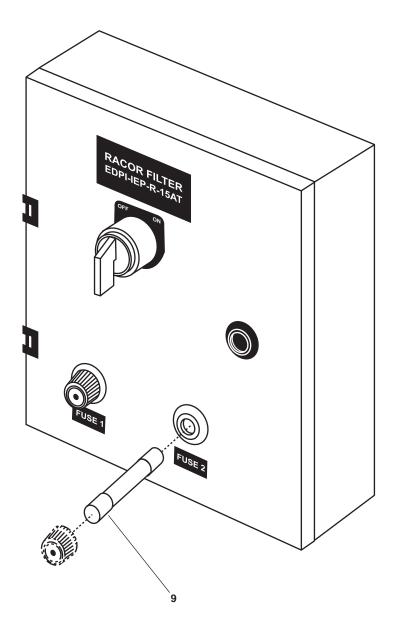


Figure 1. Fuel Filter/Water Separator (Sheet 2 of 2)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
ITEM NO.	SMR CODE	NSN	CAGEC	PART NUMBER	DESCRIPTION AND USABLE ON CODE (UOC)	QTY
					GROUP 020905	
					FIG.1 FUEL FILTER/WATER SEPARATOR	
1	XDOZZ		55752	RK 11042	VALVE,PETCOCK	
2	XDOZZ PAOZZ	5340-01-528-6183	55752 55752	RK 18677 RK 18609	O-RING CLAMP	
4	PAOZZ	2910-01-344-5791	55752 55752	2020 PMOR	FILTER ELEMENT, FLUI	
5	XDOZZ	2010 01 044 0701	55752	RK 11008	RETURN TUBE	
6	PAOZZ	4330-01-528-6826	55752	RK 18225	PROBE ASSEMBLY	
7	XDOZZ		55752	RK 11073	VALVE, BALL	2
8	PAOZZ	6685-01-528-6180	55752	RK 18-1104	GAUGE, VAC	2
9	PAOZZ	5920-01-528-6187	61935	FNB0034.3933	FUSE,2 AMP,NORM BLO	2

END OF FIGURE

	FIG. I	ТЕМ	STOCK NUMBER	FIG.	ľ
-344-5791	1	4	5920-01-528-6187	1	
80	1	8	4330-01-528-6826	1	
	1	3			

#### Table 1. National Stock Number Index

PART NUMBER	FIG.	ITEM	PART NUMBER	FIG.	ITEM
2020 PMOR	1	4	RK 18-1104	1	8
FNB0034.3933	1	9	RK 18225	1	6
RK 11008	1	5	RK 18609	1	3
RK 11042	1	1	RK 18677	1	2
RK 11073	1	7			

#### Table 2. Part Number Index

#### OPERATOR AND UNIT MAINTENANCE FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) 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 fuel filter/water separator (fuel transfer system) 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 fuel filter/water separator (fuel transfer system) 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 fuel filter/water separator (fuel transfer system) 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 fuel filter/water separator (fuel transfer system) 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.

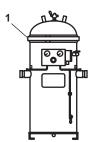
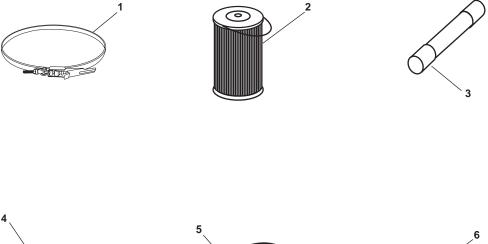


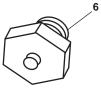
Table 1. Components of End Item List

(1) ILLUS NUMBER	(2) NATIONAL STOCK NUMBER	(3) DESCRIPTION CAGEC, AND PART NUMBER	(4) USABLE ON CODE	(5) U/I	(6) QTY RQR
1		FUEL FILTER/WATER SEPARATOR (engine room, starboard side, aft) (55752) 800D-20	128	EA	1









## 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	5340-01-528-6183	CLAMP (below EOS) (55752) RK 18609	128	EA	1
2	2910-01-344-5791		128	EA	20
3	5920-01-528-6187		128	EA	5
4	6685-01-528-6180		128	EA	2
5		O-RING (vestibule VIDMAR) (55752) RK 18677	128	EA	3
6	4330-01-528-6826		128	EA	1

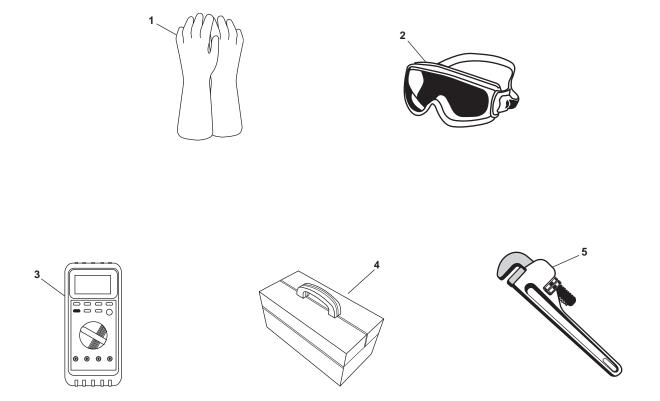


Table 3. Basic Issue Items List

(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	2
2	4240-00-190-6432		128	PR	2
3	6625-01-265-6000		128	EA	1
4	5180-00-629-9783	. ,	128	ΚT	1
5	5120-00-270-4310		128	EA	1

#### END OF WORK PACKAGE

#### OPERATOR AND UNIT MAINTENANCE FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) 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 fuel filter/water separator (fuel transfer system) 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).

#### 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	С	6850-00-281-1985	DRY CLEANING SOLVENT (02978) PS661	GL
2	С	9150-00-180-6381	GREASE, GENERAL PURPOSE (81349) MIL-PRF-24139	CN
3	С	7920-00-205-1711	RAG, WIPING, 50LB BALE (80244) 7920-00-205-1711	BE
4	0		TAG, DANGER (USED FOR LOCKOUT/TAGOUT) (3HPE6) 0116-LF-115-4300	BX
5	0	8030-00-889-3535	TAPE, ANTISEIZING, 1/2 IN X 260 IN (96214) 417043-2	EA

#### Table 1. Expendable and Durable Items List

#### END OF WORK PACKAGE

#### OPERATOR AND UNIT MAINTENANCE FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) FOR INLAND AND COASTAL LARGE TUG (LT) GLOSSARY

Centrifugal Separation	A process by which centrifugal force is used to remove heavier substances from a lighter solution.
Conductivity	The ability of a substance to conduct electricity.
Contaminant	A substance that makes another substance impure. For example, water is a contaminant in diesel fuel.
Filtration	The process of removing solid contaminants from a liquid by passing the liquid through a porous media.
Illuminate	Brightened with light; to light up.
Micron	Unit of length measure that equals one-millionth of a meter. Thirty microns equal 0.03 mm (0.0012 in). The fuel filter/water separator filter element removes particles 30 microns and larger.
Particulate	A substance composed of numerous small particles.
Prime	To put into working order by filling or charging. To fill a unit with liquid, eliminating air or gaseous pockets from the fluid flow before placing the unit in operation.
Sump	A pit at the lowest point in a circulating or drainage system. In the fuel filter/water separator the sump collects water and solid contamination.
Vacuum	A force upon a solid, liquid, or gaseous body by reason of suction.

#### OPERATOR AND UNIT MAINTENANCE FUEL FILTER/WATER SEPARATOR (FUEL TRANSFER SYSTEM) FOR INLAND AND COASTAL LARGE TUG (LT) ALPHABETICAL INDEX

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Warning Summary .....

Warranty Information .....

By Order of the Secretary of the Army:

Official:

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0529216

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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 ( $\mu$ m)
Feet (ft)	x 0.305	= Meters (m)
Square feet (ft <sup>2</sup> )	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 <sup>2</sup> )	x 0.836	= Square meters $(m^2)$
Square Inches (in <sup>2</sup> )	x 6.452	= Square Centimeters $(cm^2)$
Cubic Inches (in <sup>3</sup> )	x 16.39	= Cubic Centimeters (cm <sup>3</sup> )
Cubic Centimeters (cm <sup>3</sup> )	x 0.061	= Cubic Inches $(in^3)$
Cubic Feet (ft <sup>3</sup> )	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)

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