NONRESIDENT
TRAINING
COURSE

August 1989

Aviation Structural Mechanic E 2

NAVEDTRA 14020

Although the words "he," "him," and "his" are used sparingly in this course to enhance communication, they are not intended to be gender driven or to affront or discriminate against anyone.

PREFACE

By enrolling in this self-study course, you have demonstrated a desire to improve yourself and the Navy. Remember, however, this self-study course is only one part of the total Navy training program. Practical experience, schools, selected reading, and your desire to succeed are also necessary to successfully round out a fully meaningful training program.

THE COURSE: This self-study course is organized into subject matter areas, each containing learning objectives to help you determine what you should learn along with text and illustrations to help you understand the information. The subject matter reflects day-to-day requirements and experiences of personnel in the rating or skill area. It also reflects guidance provided by Enlisted Community Managers (ECMs) and other senior personnel, technical references, instructions, etc., and either the occupational or naval standards, which are listed in the *Manual of Navy Enlisted Manpower Personnel Classifications and Occupational Standards*, NAVPERS 18068.

THE QUESTIONS: The questions that appear in this course are designed to help you understand the material in the text.

VALUE: In completing this course, you will improve your military and professional knowledge. Importantly, it can also help you study for the Navy-wide advancement in rate examination. If you are studying and discover a reference in the text to another publication for further information, look it up.

1989 Edition Prepared by
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Sailor's Creed

"I am a United States Sailor.

I will support and defend the Constitution of the United States of America and I will obey the orders of those appointed over me.

I represent the fighting spirit of the Navy and those who have gone before me to defend freedom and democracy around the world.

I proudly serve my country's Navy combat team with honor, courage and commitment.

I am committed to excellence and the fair treatment of all."

CONTENTS

INSTRUCTIONS FOR TAKING THE COURSE

ASSIGNMENTS

The text pages that you are to study are listed at the beginning of each assignment. Study these pages carefully before attempting to answer the questions. Pay close attention to tables and illustrations and read the learning objectives. The learning objectives state what you should be able to do after studying the material. Answering the questions correctly helps you accomplish the objectives.

SELECTING YOUR ANSWERS

Read each question carefully, then select the BEST answer. You may refer freely to the text. The answers must be the result of your own work and decisions. You are prohibited from referring to or copying the answers of others and from giving answers to anyone else taking the course.

SUBMITTING YOUR ASSIGNMENTS

To have your assignments graded, you must be enrolled in the course with the Nonresident Training Course Administration Branch at the Naval Education and Training Professional Development and Technology Center (NETPDTC). Following enrollment, there are two ways of having your assignments graded: (1) use the Internet to submit your assignments as you complete them, or (2) send all the assignments at one time by mail to NETPDTC.

Grading on the Internet: Advantages to Internet grading are:

- you may submit your answers as soon as you complete an assignment, and
- you get your results faster; usually by the next working day (approximately 24 hours).

In addition to receiving grade results for each assignment, you will receive course completion confirmation once you have completed all the assignments. To submit your assignment answers via the Internet, go to:

http://courses.cnet.navy.mil

Grading by Mail: When you submit answer sheets by mail, send all of your assignments at one time. Do NOT submit individual answer sheets for grading. Mail all of your assignments in an envelope, which you either provide yourself or obtain from your nearest Educational Services Officer (ESO). Submit answer sheets to:

COMMANDING OFFICER
NETPDTC N331
6490 SAUFLEY FIELD ROAD
PENSACOLA FL 32559-5000

Answer Sheets: All courses include one "scannable" answer sheet for each assignment. These answer sheets are preprinted with your SSN, name, assignment number, and course number. Explanations for completing the answer sheets are on the answer sheet.

Do not use answer sheet reproductions: Use only the original answer sheets that we provide—reproductions will not work with our scanning equipment and cannot be processed.

Follow the instructions for marking your answers on the answer sheet. Be sure that blocks 1, 2, and 3 are filled in correctly. This information is necessary for your course to be properly processed and for you to receive credit for your work.

COMPLETION TIME

Courses must be completed within 12 months from the date of enrollment. This includes time required to resubmit failed assignments.

PASS/FAIL ASSIGNMENT PROCEDURES

If your overall course score is 3.2 or higher, you will pass the course and will not be required to resubmit assignments. Once your assignments have been graded you will receive course completion confirmation.

If you receive less than a 3.2 on any assignment and your overall course score is below 3.2, you will be given the opportunity to resubmit failed assignments. **You may resubmit failed assignments only once.** Internet students will receive notification when they have failed an assignment--they may then resubmit failed assignments on the web site. Internet students may view and print results for failed assignments from the web site. Students who submit by mail will receive a failing result letter and a new answer sheet for resubmission of each failed assignment.

COMPLETION CONFIRMATION

After successfully completing this course, you will receive a letter of completion.

ERRATA

Errata are used to correct minor errors or delete obsolete information in a course. Errata may also be used to provide instructions to the student. If a course has an errata, it will be included as the first page(s) after the front cover. Errata for all courses can be accessed and viewed/downloaded at:

http://www.advancement.cnet.navy.mil

STUDENT FEEDBACK QUESTIONS

We value your suggestions, questions, and criticisms on our courses. If you would like to communicate with us regarding this course, we encourage you, if possible, to use e-mail. If you write or fax, please use a copy of the Student Comment form that follows this page.

For subject matter questions:

E-mail: n315.products@cnet.navy.mil
Phone: Comm: (850) 452-1001, Ext. 1713
DSN: 922-1001, Ext. 1713
FAX: (850) 452-1370
(Do not fax answer sheets.)
Address: COMMANDING OFFICER
NETPDTC (CODE N315)
6490 SAUFLEY FIELD ROAD
PENSACOLA FL 32509-5237

For enrollment, shipping, grading, or completion letter questions:

E-mail: fleetservices@cnet.navy.mil
Phone: Toll Free: 877-264-8583
Comm: (850) 452-1511/1181/1859
DSN: 922-1511/1181/1859
FAX: (850) 452-1370
(Do not fax answer sheets.)
Address: COMMANDING OFFICER
NETPDTC (CODE N331)
6490 SAUFLEY FIELD ROAD
PENSACOLA FL 32559-5000

NAVAL RESERVE RETIREMENT CREDIT

If you are a member of the Naval Reserve, you will receive retirement points if you are authorized to receive them under current directives governing retirement of Naval Reserve personnel. For Naval Reserve retirement, this course is evaluated at 15 points. Points will be credited in units upon satisfactory completion of the assignments as follows:

Unit 1: 12 points upon satisfactory completion of assignments 1 through 7.

Unit 2: 3 points upon satisfactory completion of assignments 8 and 9.

(Refer to *Administrative Procedures for Naval Reservists on Inactive Duty*, BUPERSINST 1001.39, for more information about retirement points.)

COURSE OBJECTIVES

By completing this nonresident training course, you will demonstrate a knowledge of the following subject matter: Utility systems; canopy systems; pressurization and air-conditioning systems; oxygen systems; oxygen support equipment; and ejection seat systems.

Student Comments

Course Title: *Aviation Structural Mechanic E 2*

NAVEDTRA: 14020 **Date**:

We need some information about you:

Rate/Rank and Name: SSN: Command/Unit

Street Address: City: State/FPO: Zip

Your comments, suggestions, etc.:

Privacy Act Statement: Under authority of Title 5, USC 301, information regarding your military status is requested in processing your comments and in preparing a reply. This information will not be divulged without written authorization to anyone other than those within DOD for official use in determining performance.

NETPDTC 1550/41 (Rev 4-00)

CHAPTER 1

UTILITY SYSTEMS

Terminal Objectives: Upon completion of this chapter, you will have a working knowledge of bleed-air, liquid cooling, windshield wiper/washer, rain repellant, fire extinguishing, and thermal radiation protection utility systems.

The utility systems of an aircraft provide an additional measure of flight safety, pilot comfort and convenience, and contributes to the overall mission capability of the aircraft. Those utility systems of primary concern to you that are included in this chapter are the various bleed-air, liquid cooling, fire extinguishing, and thermal radiation protection systems.

AUXILIARY BLEED-AIR SYSTEMS

Learning Objective: Recognize the operating principles and functions of auxiliary bleed-air utility systems.

An aircraft's auxiliary bleed-air system furnishes supply air for air-conditioning and pressurization systems, as well as for electronic equipment cooling, windshield washing, anti-icing, and anti-g systems. The bleed-air system also pressurizes fuel tanks, hydraulic reservoirs, and radar waveguides on several types of aircraft.

The air for these systems is tapped off downstream of the air-conditioning turbine before any cooling takes place, or at various points within the air-conditioning system. Bleed air for these systems can range Up to 400°F (205°C) at pressures of up to 125 psi. Because each type of aircraft has a somewhat different approach in system design, temperatures, and pressures, the systems and components in this manual will be representative of types found throughout the Navy. Under no circumstances should this manual be regarded as the final source of technical data used to perform aircraft maintenance. For the most up-to-date information, refer to the proper Maintenance Instructions Manual (MIM) for the system concerned.

WINDSHIELD ANTI-ICE/RAIN REMOVAL SYSTEM

This system is designed to provide a means of maintaining visibility from the aircraft. The F-18 windshield anti-ice/rain removal system is typical of systems found in jet aircraft. This system supplies controlled temperature air from the air cycle air-conditioning system (ACS) to provide airflow over the external surface of the windshield for rain removal and windshield anti-icing.

System Control

The system is electrically controlled and pneumatically operated. There are three modes of operation controlled by the windshield anti-ice/rain removal switch.

1. OFF. The anti-ice/rain removal air control regulating valve is closed, and there is no airflow over the windshield.

2. RAIN. Low-pressure (2.5 psig) and low-volume (20 lbs/min) air at 250°F directed across the windshield through the anti-ice/rain removal nozzle.

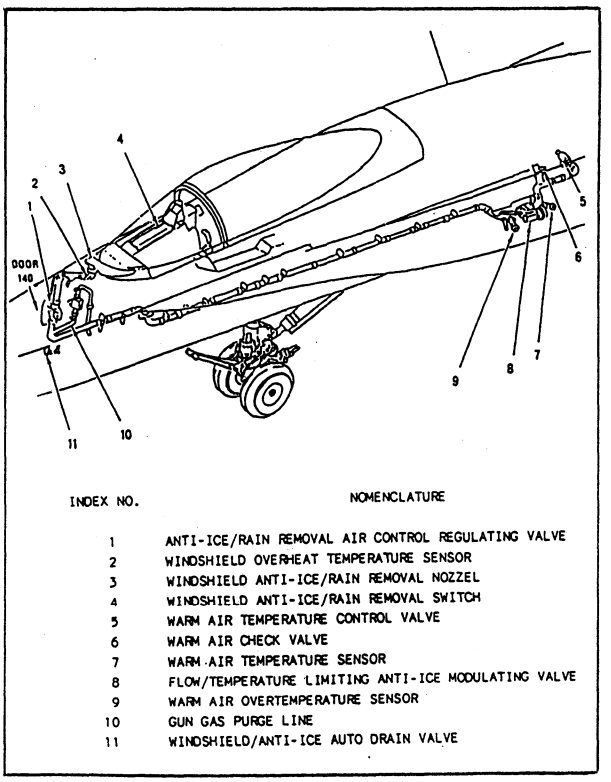
3. ANTI-ICE. High-pressure (16 psig) and high-volume (57 lbs/min) air at 250°F directed across the windshield through the anti-ice/rain removal nozzle.

Low Limit Temperature Control

Refer to figure 1-1 for component location. The supply air temperature is controlled to a lower limit of 290°F by the warm air temperature control valve and the warm air temperature sensor. If air temperature supplied by the air cycle ACS exceeds 290°F, the warm air temperature control valve will close and stop airflow from the bleed-air system. The 290°F supply temperature is cooled as it passes through the ducting to approximately 250°F at the nozzle. The 250°F temperature provides enough heat for windshield deicing, yet is low enough to prevent damage to the windshield.

High Limit Temperature Control

The warm air overtemperature sensor actuates when supply air temperature reaches 375°±25°F and signals the flow/temperature limiting anti-ice modulating valve. This valve regulates airflow supply, which reduces bleed airflow through the primary heat exchanger and reduces airflow supply temperature to below 375°±25°F. The combined action of the warm air overtemperature sensor and flow/temperature limiting anti-ice modulating valve also provides the required protection against a defective warm air temperature control valve.



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3	WINDSHIELD ANTI-ICE/RAIN REMOVAL NOZZEL
4	WINDSHIELD ANTI-ICE/RAIN REMOVAL SWITCH
5	WARM AIR TEMPERATURE CONTROL VALVE
6	WARM AIR CHECK VALVE
7	WARM AIR TEMPERATURE SENSOR
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10	GUN GAS PURGE LINE
11	WINDSHIELD/ANTI-ICE AUTO DRAIN VALVE

Figure 1-1.—Windshield Anti-ice and rain removal system component locator.

Anti-Ice/Rain Removal Air Control Regulating -Valve

The anti-ice/rain removal air control regulating valve completes the final pressure regulation and flow control before airflow reaches the anti-ice/rain removal nozzle. The valve regulates pressure and flow rate depending on the position of the windshield anti-ice/rain removal switch.

Windshield Overheat Temperature Sensor

The windshield overheat temperature sensor, located downstream of the anti-ice/rain removal air control regulating valve, is a temperature-activated switch, which opens if airflow temperature reaches 290°± 5°F. It closes when airflow temperature drops to 280°±5°F. When the switch is open, a ground is lost to the signal data converter and the signal data computer, which causes the digital display indicator to display a (WDSHLD HOT) caution message.

ANTI-G SYSTEM

The anti-g system supplies and controls the flow of air pressure to the pilot's anti-g suit to compensate for forces exerted upon the human body during flight conditions. This system is designed to accomplish the following:

1. Provide protection against grayout, blackout, and unconsciousness

2. Alleviate fatigue and decreased mental alertness, which may result from repeated accelerations below the blackout level

3. Provide a method by which the pilot may relieve leg stiffness and physical tension during flight