

DEPARTMENT OF THE NAVY
NAVAL AIR STATION
CORPUS CHRISTI, TEXAS 78404

NAVAL AIR TRAINING COMMAND

LUBRICATION AND PROPELLER SYSTEMS

NATIP SYSTEM UNIT

UC 09 03 03 09 ER



CNAT P-1027 (Rev. 1-79) PAT

**T-28 ENGINEERING
PRIMARY**

1979

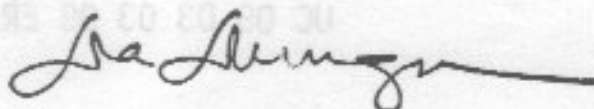
NAVAL AIR STATION . CORPUS CHRISTI, TEXAS

CHIEF OF NAVAL AIR TRAINING
NAVAL AIR STATION
CORPUS CHRISTI, TEXAS 78419

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1. CNAT P-1027 (Rev. 1-79) PAT, "Lubrication and Propeller Systems, Unit UC 09 03 03 09 ER, T-28 Engineering, Primary," is promulgated for information, standardization of instruction, and guidance of instructors and students in the Naval Air Training Command.
2. This publication will be used to implement the academic portion of the Primary curriculum.
3. Recommendations for changes shall be submitted to the Commander, Training Air Wing FIVE.
4. CNAT P-1027 (Rev. 3-77) PAT is hereby canceled and superseded.



D. A. DUNGAN
Assistant Chief of Staff
for Training Operations

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NAVAL AIR TRAINING COMMAND

PRIMARY PHASE

UNIT PLAN

DISCIPLINE: Engineering

COURSE TITLE: Engineering, T-28 (Primary)

UNIT: Lubrication and Propeller Systems, NATIP System Unit

PREREQUISITES: Units 1-8

FOR INSTRUCTIONAL PURPOSES ONLY

- SCOPE: 1. The purpose of this unit is to acquaint the student with the operation of the lubrication system, schematic construction, components, limitations and restrictions imposed.
2. To review the Hamilton Standard Hydromatic Propeller and constant-speed propeller governor and to emphasize the importance of proper propeller operation for safe flight.

SPECIFIC INSTRUCTIONAL OBJECTIVES

Affective Domain

1. To view schematically the T-28 lubrication system (Receiving).
2. To consider the components in the system, their function, limitations and capability (Receiving).
3. To review operation of the hydromatic propeller and the constant-speed propeller governor (Responding).
4. To direct attention to governor operation, functions, limitations and restrictions, and proper RPM operation (Receiving).

Cognitive Domain

Upon completion of this unit the student will:

1. State the capacity of the oil tank for the T-28 (Comprehension).
2. State the type of oil system and method used to lubricate the engine (Comprehension).
3. State the oil temperature and pressure limitations (Comprehension).
4. State the number of pressure pumps and scavenger pumps (Comprehension).
5. State the temperatures that control the thermostatic oil cooler valve (Comprehension).
6. Name the two methods of lubrication used in the T-28 (Knowledge).

7. State what causes the sump plug warning light to illuminate (Comprehension).
8. Determine the correct procedure to use when the sump warning light illuminates (Analysis).
9. State the purpose of the pendulum pickup located in the oil reservoir (Comprehension).
10. State how the propeller changes from low to high pitch (Comprehension).
11. State the pitch of the propeller with too much or too little oil in front of the piston and the action required by the pilot (Comprehension).
12. State the RPM range with a propeller governor linkage failure (Comprehension).
13. State under what conditions the RPM is expected to fluctuate momentarily (Comprehension).
14. State the manifold pressure and RPM for maximum continuous power in low blower (Comprehension).

INSTRUCTIONAL MATERIALS

The instructor in charge must ensure that the following instructional materials are provided for each student:

1. NATOPS Flight Manual.
2. Engine Cutaway, R-1820 and Propeller Cutaway.
3. Wall chart of engine lubrication system.

DIRECTIONS TO STUDENT

- STEP 1 Read the following pages in the NATOPS Flight Manual: pages 1-8, 1-9, 1-12, and power changes on page 1-10.
- STEP 2 Complete the programed text.
- STEP 3 Take criterion test.
- STEP 4 Remedial session prescribed if necessary.

PROGRAM PERFORMANCE VALIDATION RECORD

This instructional sequence was introduced at NAS Whiting Field on 18 May 1971.

The achievements of _____ students completing the program between _____ and _____ are shown below.

N	MEAN CRITERION TEST SCORE (PRE-UNIT)	PERCENT CORRECT	MEAN CRITERION TEST SCORE (POST-UNIT)	PERCENT CORRECT	ESTABLISHED ERROR RATE

Percent of students obtaining 85% or better - _____
 This unit is designed to be completed within _____ minutes.
 The learning time required for this unit was established as follows:

MINIMUM LEARNING TIME REQUIRED	LEARNING TIME REQUIRED BY 80% OF THE POPULATION	MAXIMUM LEARNING TIME REQUIRED
_____ min.	_____ min.	_____ min.

THE T-28 LUBRICATION AND PROPELLER SYSTEMS

THE LUBRICATION SYSTEM

FRAME 1

The engine oil system is of the constant pressure dry-sump type. Most of the bearing surfaces throughout the engine are lubricated by oil that reaches them under pressure. Splash and spray lubrication is used for those surfaces that are not lubricated by pressurized oil. The oil used in the T-28 is military grade 22851, type II detergent oil.

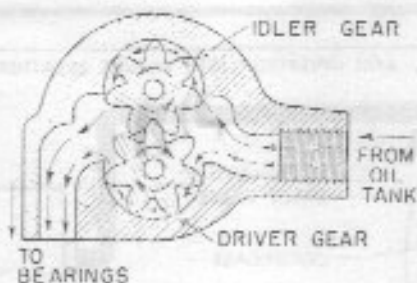
The surfaces not lubricated in the engine by pressure are lubricated by _____ and _____ lubrication. The engine oil system is of the _____ type.

splash
spray
constant pressure dry-sump

FRAME 2

The oil system consists of an oil supply tank, an inverted-flight oil trap tank, an oil pressure pump, two scavenge pumps, a system relief valve, an inlet check valve, and strainers. (See figure 1.) The system also includes an oil cooler with a thermostatic bypass valve, oil pressure and temperature systems, and an oil dilution system. The pressure pump and both sump pumps are gear-type pumps. (See figure 2.)

Locate the components on the following diagram before continuing to the next frame.



Gear-type oil pump.

FIGURE 2

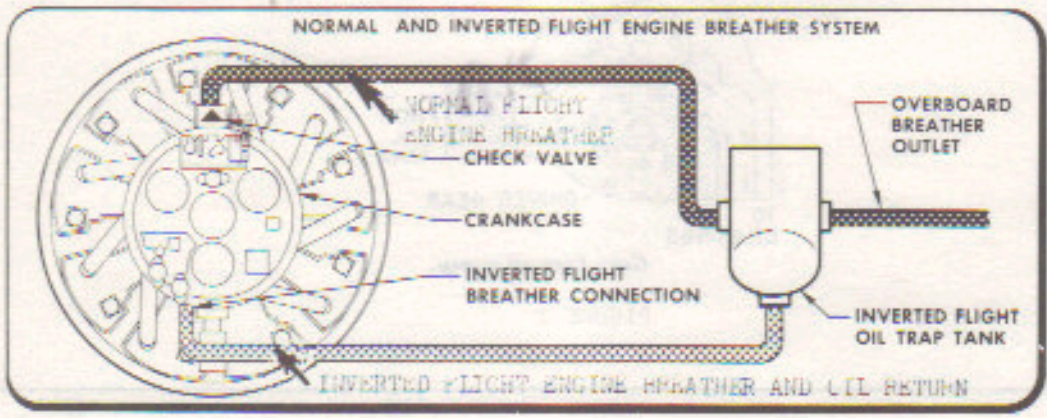
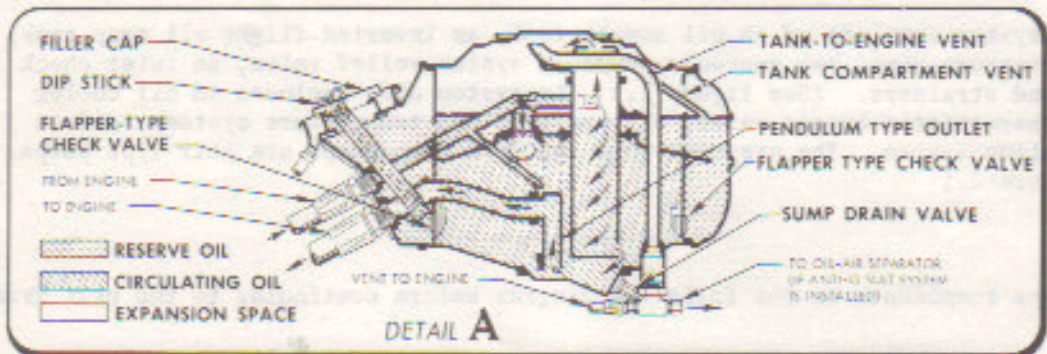
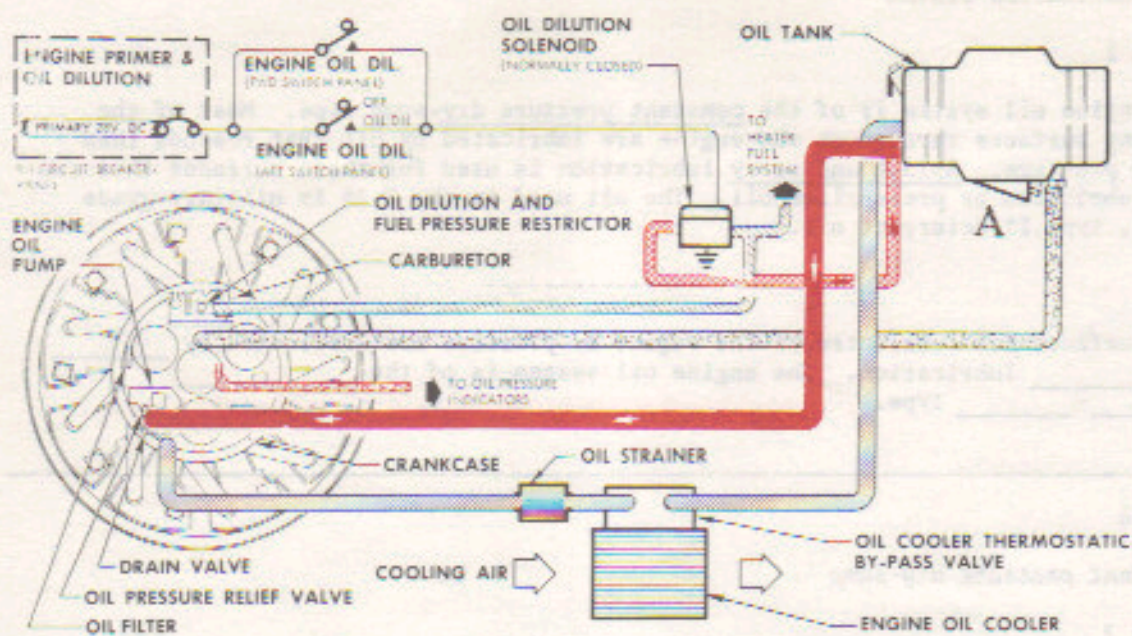
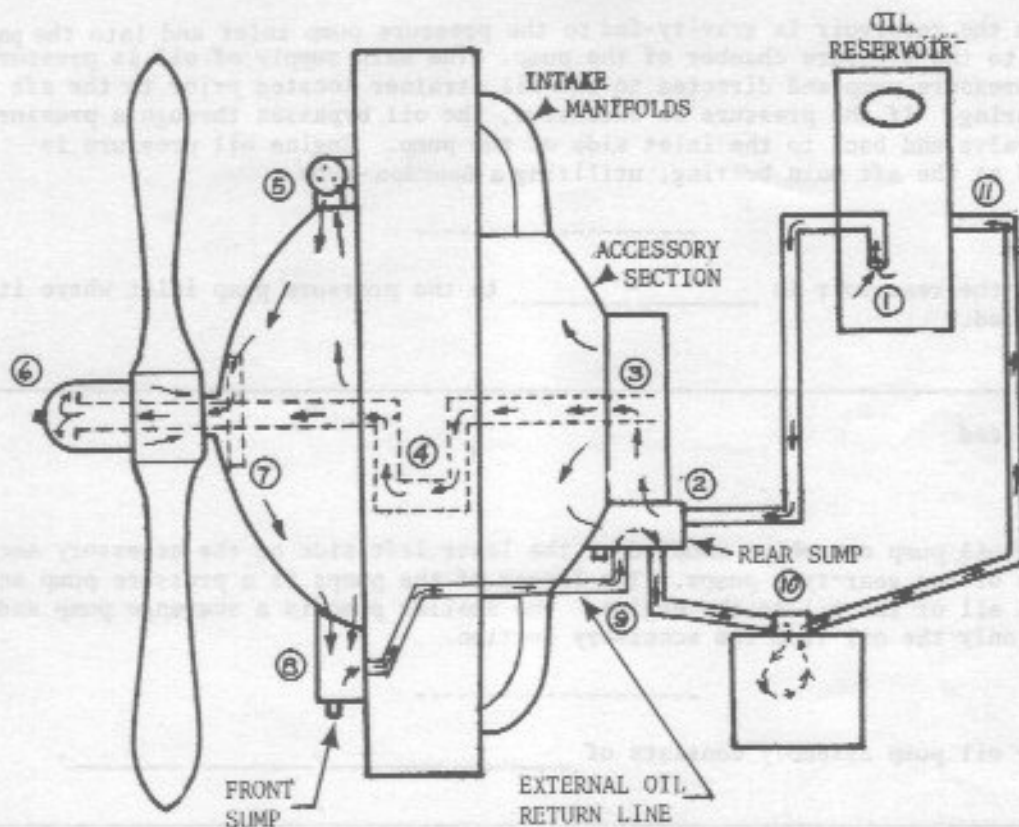


FIGURE 1
2

Study the following diagram (Figure 3) before proceeding.



To trace the flow of oil through the engine, begin at point 1, the oil reservoir, and follow the number sequence:

1. Oil reservoir, pendulum pickup.
2. Gear-type pressure pump.
3. Aft main bearing. (Oil pressure measured here.)
4. Master and connecting rod bearings (power section).
5. Prop governor.
6. Prop dome.
7. Thrust plate bearing and reduction section.
8. Forward sump and gear-type scavenge pump.
9. Rear and gear-type scavenge pump, a part of the pressure pump assembly.
10. Oil cooler and thermostatic bypass valve.
11. Reservoir return.

OIL SYSTEM FLOW PATTERN

SIMPLIFIED

FIGURE 3

No response required

FRAME 3

Oil from the reservoir is gravity-fed to the pressure pump inlet and into the passage leading to the pressure chamber of the pump. The main supply of oil is pressurized by the pressure pump and directed to the oil strainer located prior to the aft main bearing. If the pressure is excessive, the oil bypasses through a pressure relief valve and back to the inlet side of the pump. Engine oil pressure is measured at the aft main bearing, utilizing a Bourdon-tube.

Oil from the reservoir is _____ to the pressure pump inlet where it is pressurized.

gravity-feed

FRAME 4

The rear oil pump assembly, mounted at the lower left side of the accessory section, consists of two gear-type pumps. The larger of the pumps is a pressure pump and supplies all of the oil to the engine. The smaller pump is a scavenge pump and removes only the oil from the accessory section.

The rear oil pump assembly consists of _____.

two gear-type pumps

FRAME 5

The oil system strainer is located on the left side of the accessory section housing and filters all oil from the pressure pump. A bypass valve is incorporated in the strainer which will allow the oil to flow in the event the strainer becomes clogged.

The strainer filters all oil from the _____. The _____ allows circulation of oil when the strainer becomes clogged.

*pressure pump
bypass valve*

After passing through the strainer, the oil is directed to the aft main bearing and then to various engine components requiring pressure lubrication. Scavenge oil in the power section drains through holes either into the reduction section and then into the front oil sump and pump assembly or to the supercharger and accessory section and the rear sump and pump assembly, depending on the flight attitude of the aircraft.

The _____ of the aircraft will dictate the flow of scavenge oil after the oil has lubricated the various engine components.

attitude

FRAME 7

The oil in the front sump flows through a finger-type screen across the magnetic sump plug and into the front scavenge pump. The forward sump, located between No. 5 and No. 6 cylinders, is clearly visible during the engine preflight inspection. From the front scavenge pump the oil is directed through an external oil scavenger tube to the "out" port of the rear sump pump assembly. All oil in the accessory section is scavenged through a strainer and across a magnetic sump plug in the lower left side of the accessory section and through the rear scavenge pump.

The front scavenge pump scavenges oil from the _____ while the rear scavenge pump scavenges oil from the _____. The rear sump plug is located on the lower left side of the _____.

reduction section

accessory section

accessory section

FRAME 8

Oil from the two scavenge pumps then flows to the thermostatic bypass valve, which directs the oil either back to the reservoir or through the cooler, depending upon the temperature of the oil.

The _____ directs oil either through the cooler or back to the reservoir depending on the _____ of the oil.

thermostatic bypass valve
temperature

FRAME 9

The oil reservoir is attached to the engine mount crossbar tube by support straps. A dip stick, located adjacent to the filler cap, is calibrated in gallons. The approximate filling capacity (usable oil) is 8.8 gallons. The remainder of the tank is expansion space. (See detail "A" of figure 1.)

Usable oil in the T-28 is _____ gallons.

8.8

FRAME 10

The circulating chamber of the reservoir accelerates the warming of the oil during engine warmup and assists in removing air from the oil.

It is the purpose of the _____ to accelerate the warming of the oil during engine warmup and to assist in removing _____ from the oil.

circulating chamber
air

FRAME 11

A pendulum sump outlet, capable of rotating 360 degrees in a plane parallel to the longitudinal axis, is installed in the reservoir and ensures an adequate supply of oil to the engine during all flight maneuvers. The tank is vented to the atmosphere via the engine crankcase.

The pendulum-type outlet assures an adequate supply of _____ to the engine during acrobatic flight.

oil

FRAME 12

The inverted-flight oil trap tank, located in the reservoir, is incorporated in the system to trap oil lost through the inverted-flight breather. The inverted flight check valve is connected to the normal engine breather and prevents the loss of engine oil during inverted flight.
