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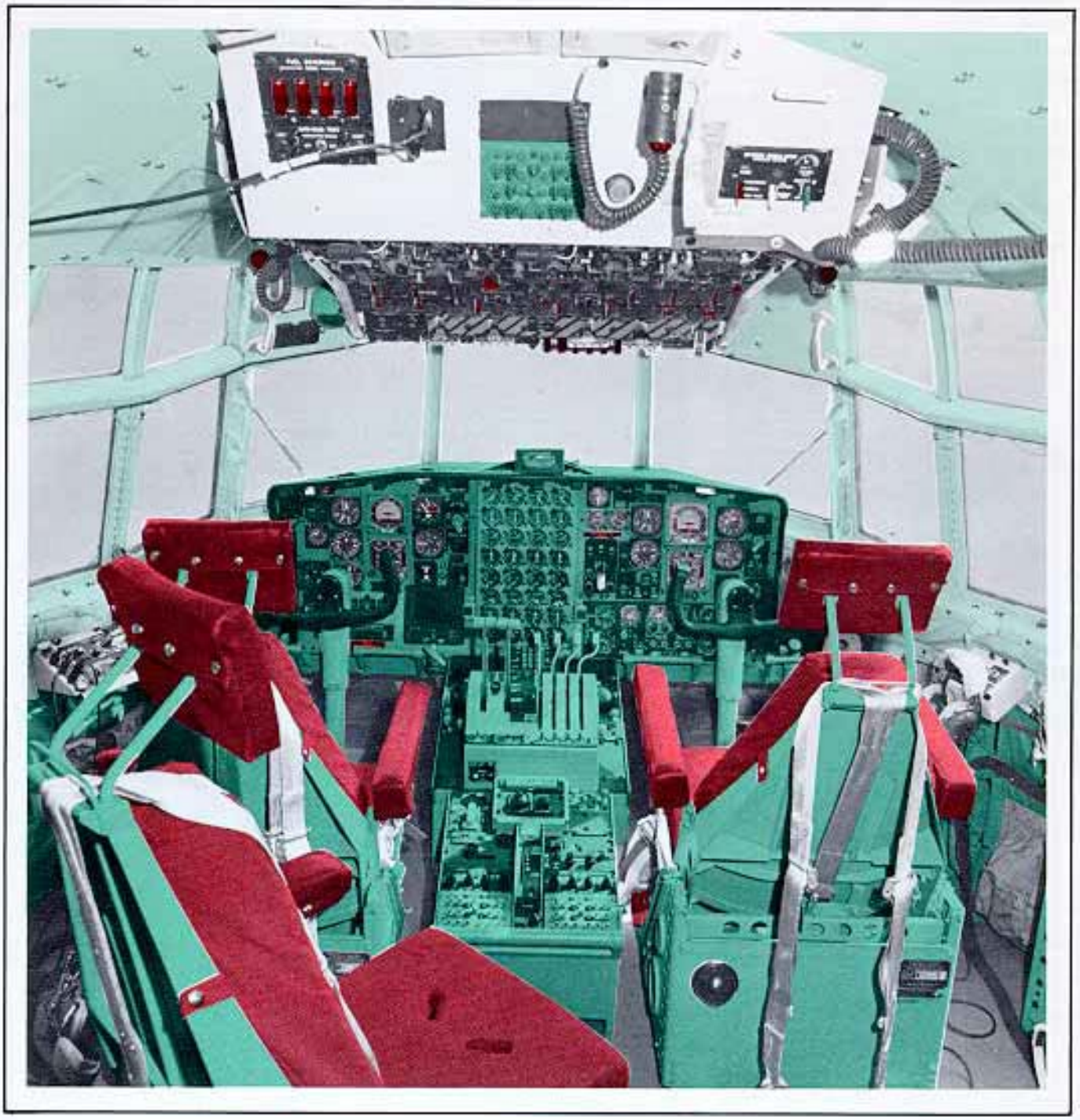
service news

A SERVICE PUBLICATION OF LOCKHEED-GEORGIA COMPANY, A DIVISION OF LOCKHEED AIRCRAFT CORPORATION



Hercules Gets New APU

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service news

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LOCKHEED-GEORGIA COMPANY
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Hercules **Gets New** *APU*

Cover: The Hercules "Front Office" emphasizes spaciousness, comfortable seating and convenient grouping of instruments and controls.

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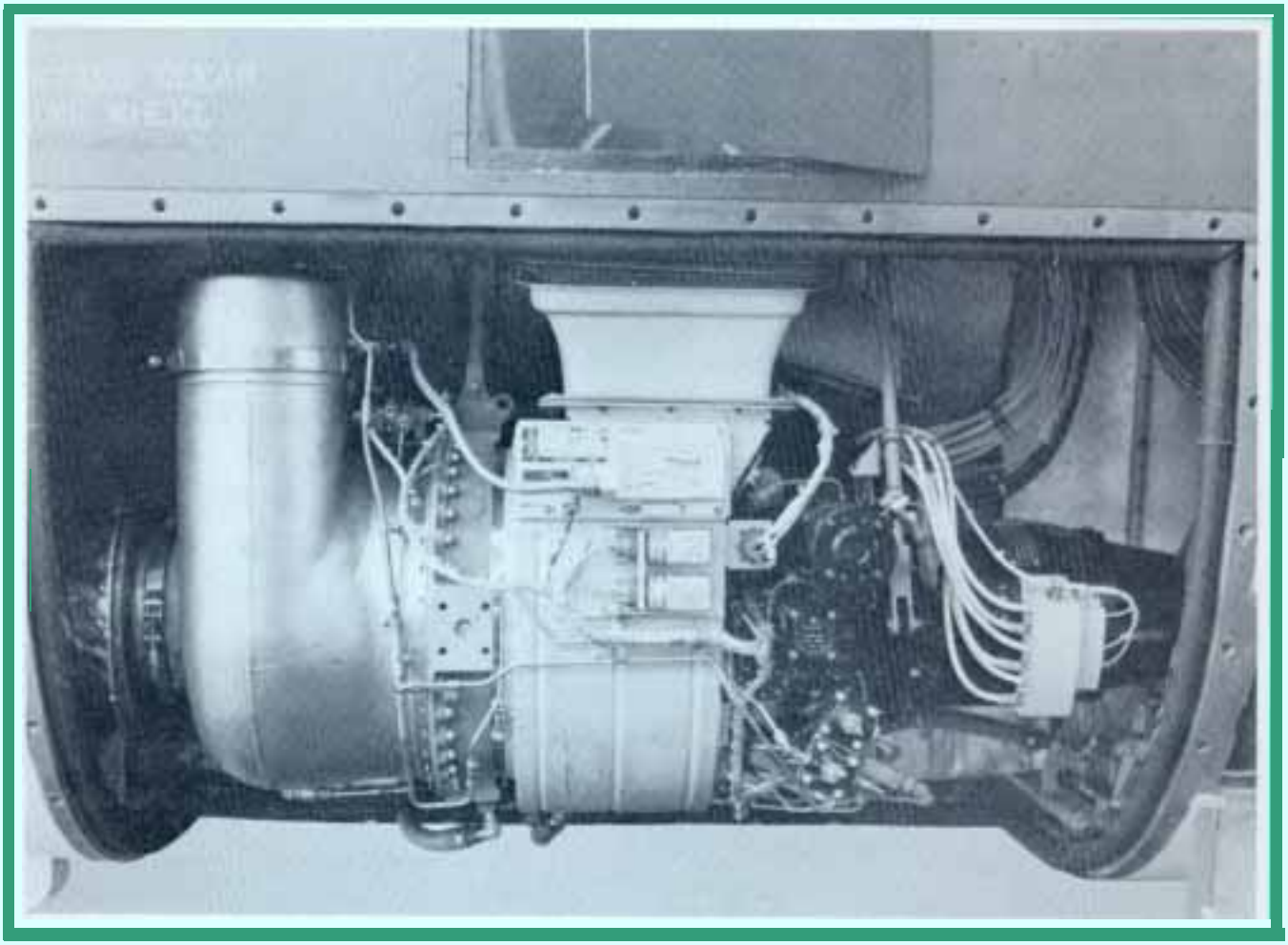
Herky's New APU

The Hercules has proven to be a very versatile airplane. A prime reason for this versatility is its capability to operate into remote, unimproved areas without the need for ground support equipment. Much of this capability is due to an on-board GTC (Gas Turbine Compressor) which provides high pressure bleed air for pneumatic system preflight checks and engine starting. The former GTC has served well for many years, but in our continuing efforts to improve the Hercules, the GTC is being replaced by a more reliable APU (Auxiliary Power Unit) which is identified on C-130H aircraft as GTCP85-180L. and on the L-100 series aircraft as GTCP85-185L. AiResearch, the same manufacturer that provided the GTC for previous Hercules, also supplies the new APU.

The former GTC system provides bleed air to power an ATM (Air Turbine Motor) which in turn, drives an AC generator. The new APU has a 40 KVA, AC generator driven directly from the shaft of the gas turbine compressor. The 40 KVA generator is interchangeable with the engine driven generators of the Hercules. The functions of the new APU are essentially the same as the earlier AiResearch Model GTC 1 with some new advantages. The new APU engine produces approximately 20% more bleed air at a higher pressure which gives better starting of aircraft engines at high temperatures and altitudes. Also, the MTUR (Mean Time to Unscheduled Replacement) of system components is greatly increased.

Figure 1



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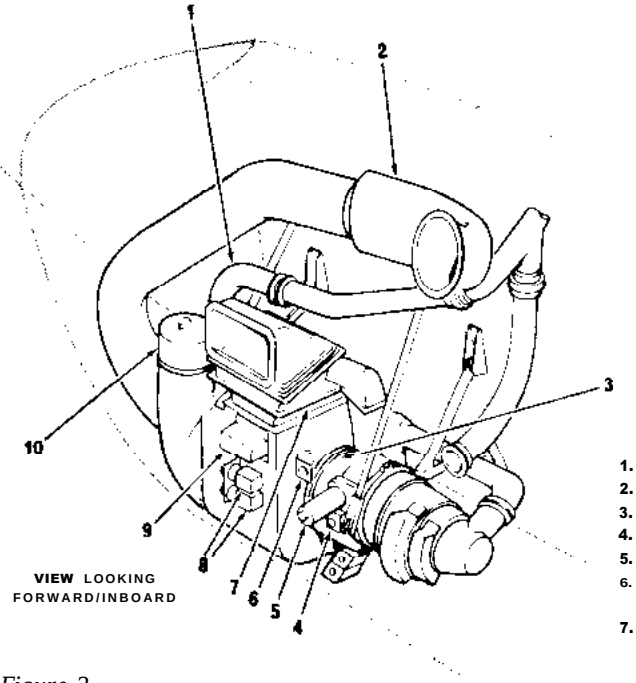
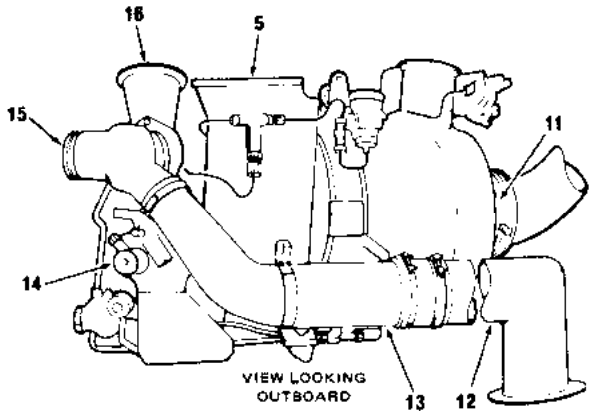




1. BLEED AIR OUTLET
2. ENGINE EXHAUST
3. OUTPUT DRIVE PAD
4. HOUR METER
5. STARTER
6. UNIT CONTROL ELECTRICAL CONNECTION
7. COMPRESSOR AIR INLET DUCT WITH SCREEN
8. RELAYS
9. IGNITION UNIT
10. COMBUSTOR
11. TURBINE EXHAUST FLANGE
12. 0I L COOLER EXHAUST DUCT
13. OIL COOLER
14. TACW GENERATOR
15. GENERATOR COOLING AIR
16. COOLING FAN AIR INLET

Figure 2

AUXILIARY POWER UNIT COMPONENT LOCATIONS

Although there are many similarities between the former GTC system and the new APU, there are also some important differences. Let's take a brief look at the major components and operation of this new APU. (Reference Figure 2.)

APU Control Panel

The APU control panel is located in the flight station overhead control panel. (Reference Figure 3 .) Tachometer and temperature gages have been added for monitoring the speed and temperature of the APU. Although engine operation is automatic, you can decrease the load or turn off the APU if the instruments indicate a problem that could cause permanent damage.

Two toggle switches are located on the APU control panel: one to energize the circuits for starting, running, and stopping the APU; and the other to energize circuits to open or close the bleed air valve.

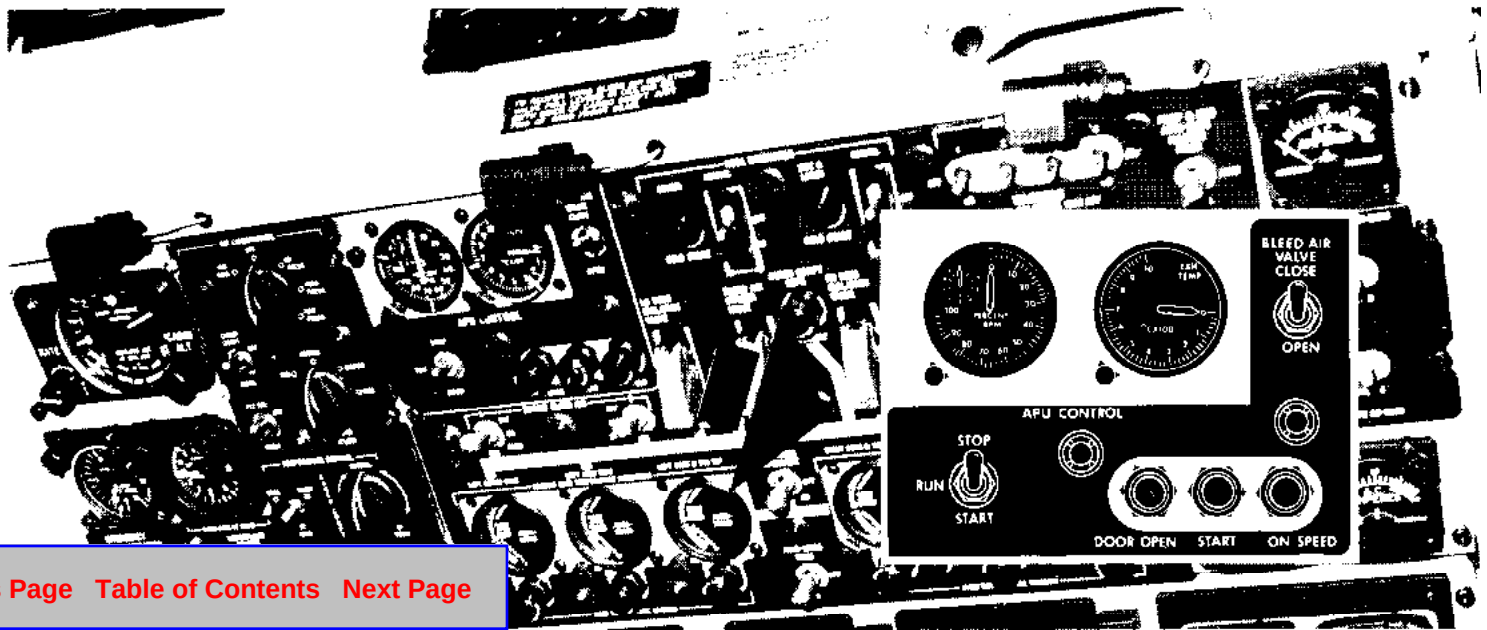
Electrical loads on the generator are controlled from the overhead electrical control panel, which includes a manual control switch for the APU generator.

Three indicator lights are located on the APU control panel. They are:

- DOOR OPEN – When illuminated, this light indicates a response to the start circuit, and that the air intake door is at least partially open.
- START – Illuminates after door opens and the automatic start is initiated – Extinguishes when speed exceeds 35% RPM.
- ON SPEED - Illuminates when the APU is operating above 95% RPM – Indicates that the APU is ready for service to the pneumatic and electrical systems.

Figure 3

APU CONTROL PANEL ON THE OVERHEAD ANTI-ICING CONTROL PANEL



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Airflow Through the APU

The air supply for the APU enters an opening just above the unit in the forward left wheel well fairing. A single door, hinged at the back edge, opens automatically to one of two positions when the APU control switch is turned to START. On the ground the door opens to 35'; in flight it stops at 15' to prevent scooping in too much air from the slipstream, thereby causing a flameout. A screen over the opening prevents entry of objects over 0.250" in size.

The compressor is a two-stage centrifugal type. The first stage has two opposing inlets for two similar impellers positioned back-to-back. The second stage is a single impeller handling less volume at higher pressure. The two stages operate efficiently through a wide range of shaft and bleed air loads.

Centrifugal Speed Switch

The centrifugal speed switch is mounted on the left side of the accessory housing, and contains mechanically driven flyweights which operate three microswitches at approximately 35%, 95% and 110% of the APU rotor speed. Also, air pressure taken from the APU compressor is introduced into the flyweight cavity to actuate the 110% switch for normal shutdown of the APU. The function of the centrifugal speed switch is to control the sequence of operation of the electrical control system components. (See Figure 4.)

Fuel System

Fuel for the APU is gravity fed from the aircraft's No. 2 fuel tank. A motor-operated shutoff valve in the No.2 drybay prevents a standing pressure of fuel to the APU when not needed, and shuts off fuel in an emergency. If

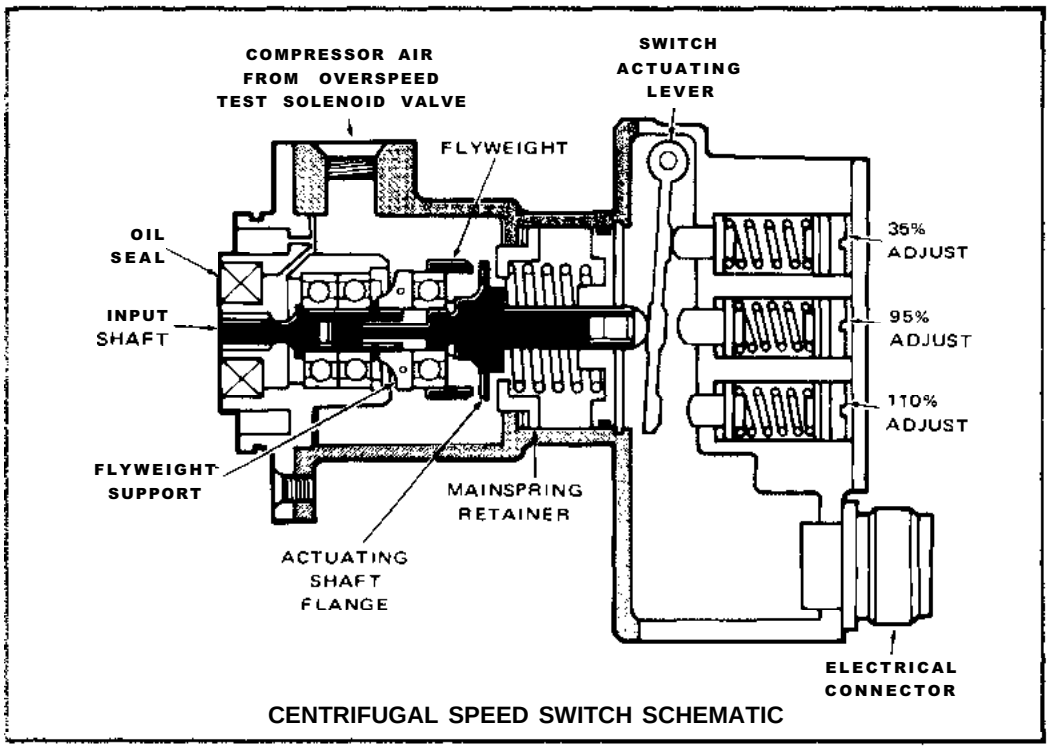

Figure 4

The second-stage discharge air is directed into the turbine plenum. Here some of the air is bled off through the bleed air duct located on the turbine plenum to provide air for the Hercules pneumatic systems. The combination bleed air shutoff and load control valve is located in this duct.

A relatively large diameter exhaust pipe leads forward in the APU compartment, and then turns 180' up and aft to exit about seven feet above ground level. Near this exit a section of the pipe is enlarged to form a ring shaped opening for jet pump action which aids in ventilating and cooling the APU compartment.

circuits in the APU controls are deenergized, the fuel valve closes and the APU shuts down.

Fuel Control

Operation of the fuel system is fully automatic. The fuel control unit, with input from the pneumatic thermostat, protects the turbine from overtemperature during starting and during on-speed operation without a bleed load. Under bleed load operation, the pneumatic thermostat operation is automatically shifted to the bleed air shutoff and load control valve.

During on-speed operation of the APU, the fuel flow is varied so that the power developed by the turbine equals

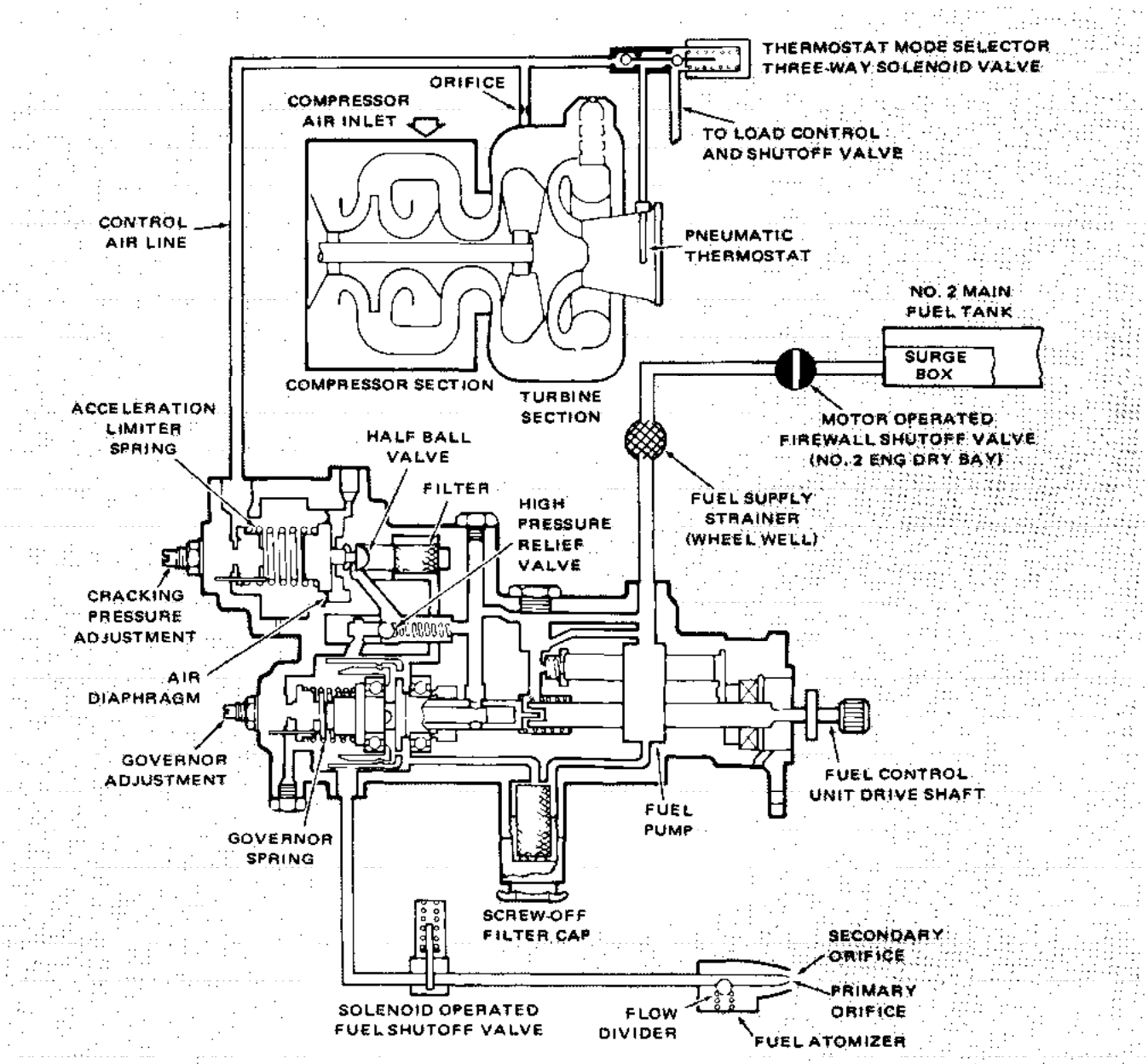

Figure 5 **FUEL CONTROL SYSTEM**

load requirements as determined by an on-speed governor. (Reference Figure 5.)

All of the fuel pump output passes through a high pressure fuel filter. The filter element and O-ring seals should be replaced at intervals prescribed in your maintenance manual as there is no bypass. Therefore if the filter should become clogged, it would restrict flow and could result in abnormal APU operation.

Fuel Shutoff Valve

The solenoid-operated fuel shutoff valve is located at the fuel control unit outlet. When the valve is deenergized, it shuts off fuel to the nozzle atomizer in the combustor. During APU starting, the valve opens at approximately 10% APU RPM, and is energized by the oil pressure sequencing switch.

If the APU loses oil pressure or if the APU overspeeds, the valve circuit will be deenergized, closing the valve.

Bleed Air Shutoff and Load Control Valve

This double name for the APU bleed air valve is derived from its versatility: (1) When the bleed air valve switch is in the CLOSE position or the API-J RPM is below 95%, the valve remains closed to prevent bleeding air from the compressor during starting, warmup, and before shutdown.

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(2) When the switch is in the OPEN position, the valve opens and modulates in response to exhaust gas temperatures (EGT) acting as a bleed load control valve. (See Figure 6.)

Pneumatic Thermostat

The pneumatic thermostat is mounted in the exhaust pipe flange and projects into the flow of the exhaust gases to monitor the EGT.

Air Pressure Regulator

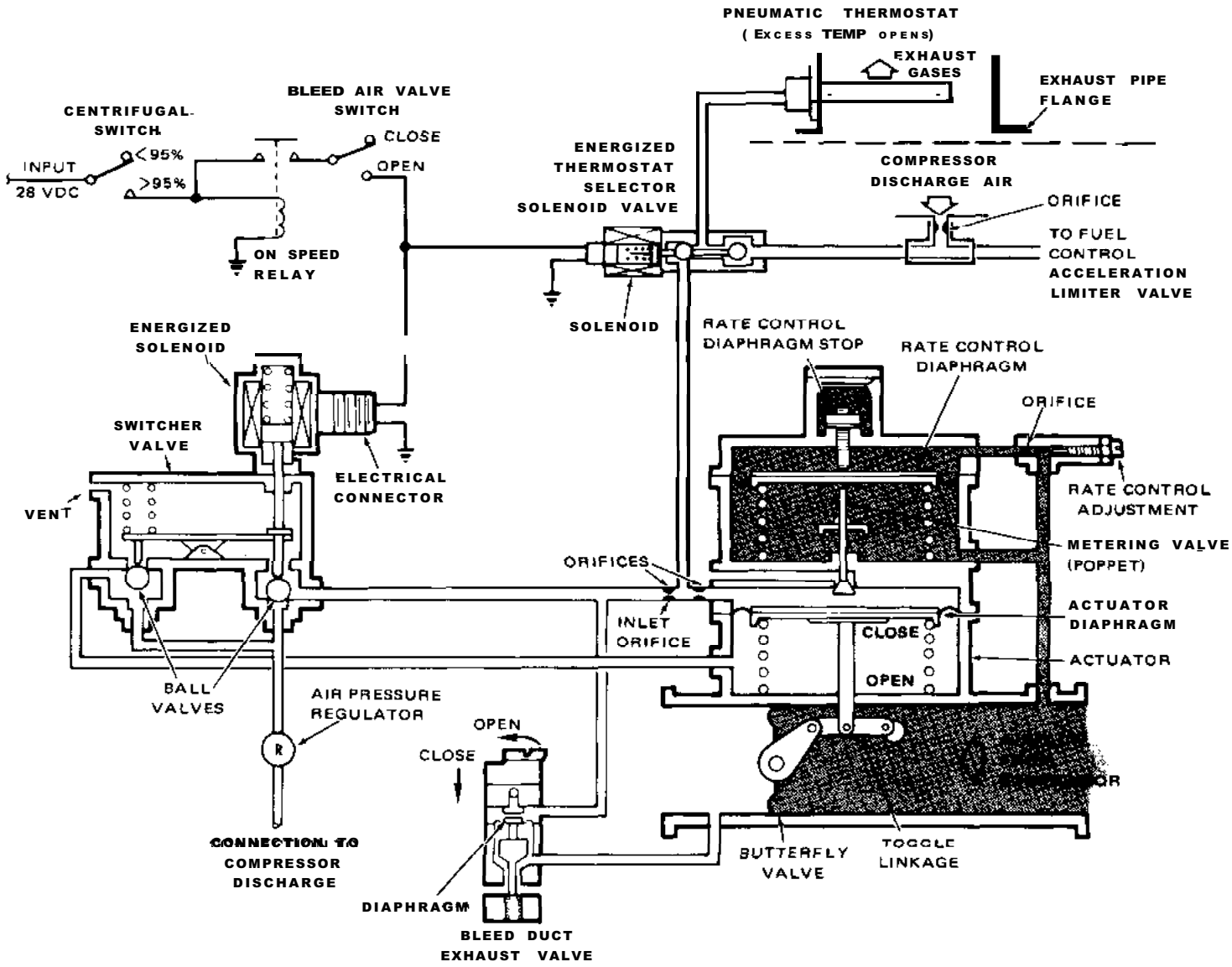
The air pressure regulator controls air pressure supplied to the actuator of the bleed air shutoff and load control valve. This enables the valve to control loading of the APU engine relatively independent of the effect of ambient conditions on the compressor.

Lubrication System

The APU lubricating system is a positive-pressure, dry-sump-type system; and it provides lubrication of the APU main bearings and accessory drive gears. The total volume of the supply tank is 5.28 quarts, allowing for four quarts of oil (MIL-L-23699 or MILL7808) plus expansion space. The oil tank is mounted in the lower aft end of the APU compartment.

The oil pump assembly is mounted on the lower left side of the accessory drive housing. System pressure is limited by a pressure regulating valve which bypasses a portion of the pump output. The pressure regulating valve is set to maintain an operating pressure of 90 PSI+-10 with the APU on speed (100% RPM).

Figure 6 PNEUMATIC LOAD CONTROL SYSTEM



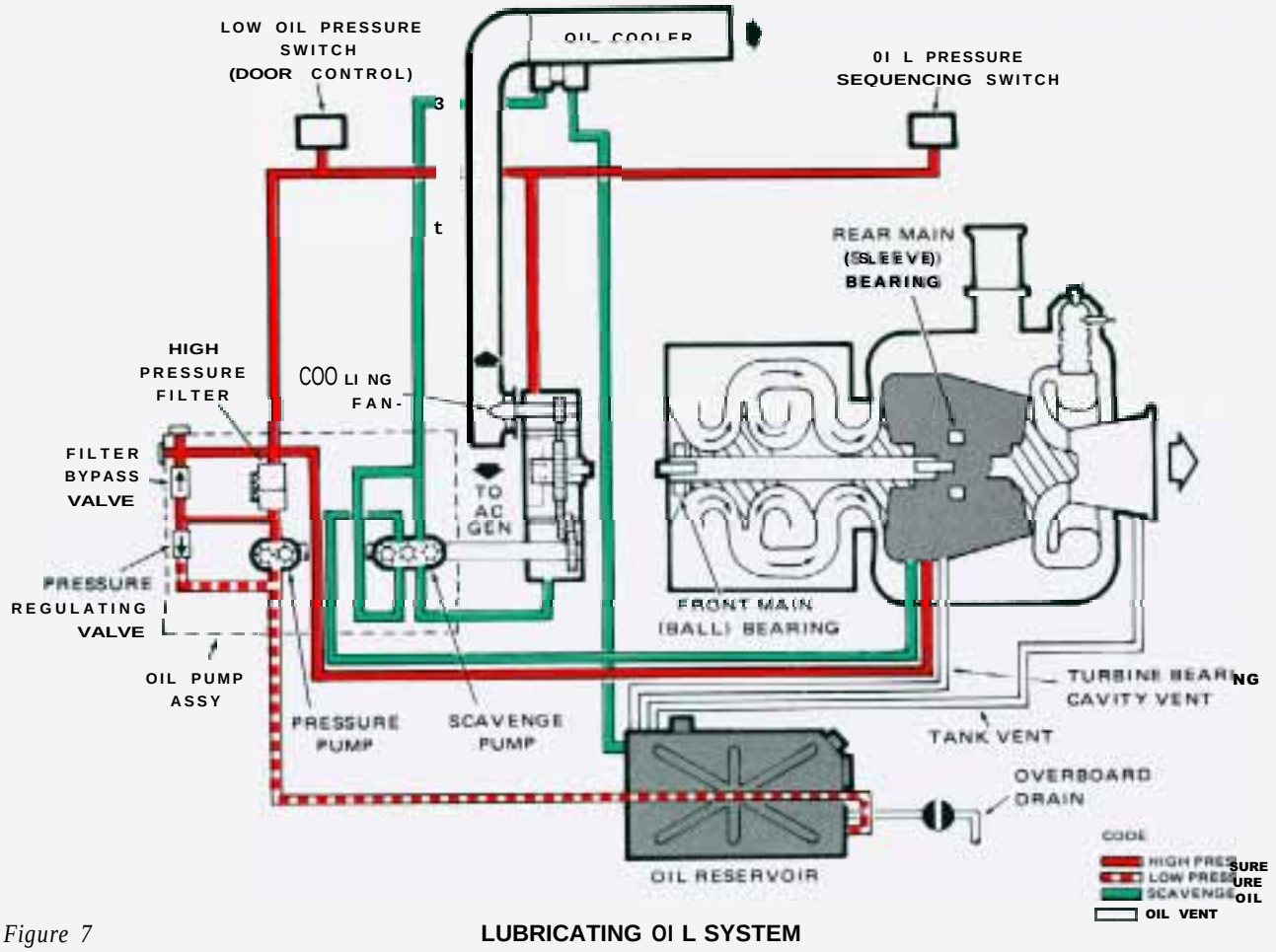


Figure 7 **LUBRICATING OIL SYSTEM**

A micronic paper, oil filter element is located downstream of the pressure pump. A filter bypass valve allows adequate flow in case the filter element becomes clogged to the point of restricting oil flow; and is set to open at approximately 55 PSI differential pressure. (Reference Figure 7.)

Oil **Pressure Switches**

Two oil pressure switches are utilized in the operation and control of the APU: the oil-pressure sequencing switch and door-control oil-pressure switch.

The oil-pressure sequencing switch completes circuits to the fuel solenoid shutoff valve, and to the ignition exciter when the lubricating oil pressure reaches 2.5 to 3.5 PSIG. This sequence prevents starting the engine without lubrication; it also ensures motoring speed to produce adequate airflow for combustion before fuel is introduced and ignition is initiated. The oil-pressure sequencing switch will automatically shut down the APU if loss of lubrication oil pressure occurs.

The air-intake-door actuator circuit includes the door control oil pressure switch. This switch completes the circuit to automatically close the door when the oil pressure decreases to approximately 20 PSI during APU shutdown.

Starting and Running the APU

Before starting the APU and during its run, make sure a fire guard is at hand, and that all equipment and personnel are clear of the area around the APU. Especially avoid the exhaust outlet and the planes of rotation of the turbine and compressor blades. Ensure that foreign objects will not enter the air intake.

Head the airplane into the wind if there is a likelihood that exhaust gas will be blown into the air intake. The use of ground support, external DC power, is preferable to a battery start if the equipment is available. Set electrical controls accordingly. Ensure that the lubricating oil level is to the full mark; that there is a minimum of 2000 pounds of fuel in the No. 2 main tank; and drain the fuel strainer sump.

Circuit breakers to be closed are: APU Control, APU Start, Door Warning, and Touchdown Relay. The APU BLEED AIR VALVE switch should be in the CLOSE position and the APU generator switch turned off.

On the preflight inspection, the air intake opening should be inspected for foreign material with the door open. This can be accomplished by placing the APU control switch in the RUN position which allows the door to open

fully without initiating an engine start. The DOOR OPEN light illuminates. After completion of the inspection, return the switch to the STOP position; the door closes and the DOOR OPEN light extinguishes.

For routine APU starts, move the APU control switch to the START position. The inlet door opens and the open light illuminates. When the door reaches the 15' position, power is supplied to the starter. At 10% RPM, fuel flow and ignition are initiated by the oil pressure switch. The fuel ignites and the APU accelerates. The START light illuminates while the starter is running; it should extinguish in less than 35 seconds, or when the APU reaches 35% RPM. The centrifugal speed switch controls this sequence.

Do not exceed the starter duty cycle of one minute on and four minutes off, and do not reengage the starter while the turbine is rotating.

The ON SPEED light comes on at 95% RPM and stays on. The APU is self sustaining at this point, and the tachometer will indicate 100% RPM +/-2%.

When 100% RPM is reached, the on-speed governor controls and limits turbine speed. If the governor fails, allowing an overspeed to 110% the third centrifugal control switch opens the circuit to the fuel solenoid shut-off valve, shutting off the fuel.

Allow at least one minute running time after the ON SPEED light illuminates before loading the APU.

Stopping the APU

Position the bleed air valve switch to CLOSE and the APU generator switch to OFF. After allowing the EGT to stabilize at approximately 320°C, position the APU control switch to STOP. The APU stops before the intake door closes to prevent negative pressure buildup which could collapse the intake ducts. The intake door starts to close after oil pressure decreases to approximately 20 PSI, which occurs at about 18% RPM. Lights on the APU control panel extinguish after the door is closed.

APU Overspeed Protection

Should some abnormal conditions cause the APU to overspeed 110% RPM, the APU is automatically shut down. When the centrifugal switch moves to the more than 110% RPM position, the following relays are deenergized:

Fuel Holding Relay (fuel is shut off)

On-speed relay (DC power removed from control circuit)

Door control relay (latch type: open · door closes)

APU fuel valve relay (fuel supply is shut off)

One functional difference exists between a normal shutdown of the APU and an actual overspeed shutdown. If an actual overspeed shutdown occurs, the APU air inlet door remains open until the APU control switch is positioned to STOP. Normally, the door starts to close at 18% RPM during deceleration.

Normal Shutdown for the APU

Normal shutdown is accomplished through the same sequence of events as provided for in the automatic shutdown in case of overspeed (more than 110% RPM). Therefore, the same circuits are utilized when the APU control switch is placed in the STOP position.

Before placing the APU switch in the STOP position, remove the pneumatic and electrical loads from the APU and allow the engine to run free for two to three minutes. This will allow normal heat dissipation and a return to a cooler operating temperature.

Place the APU switch in the STOP position. The overspeed test solenoid is energized and this introduces compressor discharge air pressure into the centrifugal switch assembly which actuates the 110% RPM switch to the more than 110% RPM position. This action checks the overspeed switch operation at each shut-down.

When in the STOP position, a switch is closed in series with the low oil pressure (20 PSIG) switch which, in turn, completes the circuit to close the APU air inlet door. The door starts to close when oil pressure drops below 20 PSIG (approximately 18% RPM).

Fire Emergency Handle

A fire warning detector is located in the APU compartment along with the emergency fire extinguishing system. When the APU fire emergency handle is pulled, all DC power is removed from the APU control circuit. At the same time, a circuit is established to close the APU inlet door the same way as during normal shutdown. The fuel shutoff valve closes, immediately shutting off the fuel supply to the APU.

APU Start in Flight

The APU is started in flight only in an emergency; such as, all the main engine-driven generators dropping off the line.

While the Hercules is in flight, the touchdown switch circuit prevents **the flow** of current from the battery to the essential bus. However, battery current is supplied to the APU starter motor from the isolated bus when the APU control switch is positioned to START. The APU controls, starter motor, and door actuator are powered

from the isolated DC bus. The APU air intake door warning light is powered by the main DC bus.

NOTE: Since this APU has not been demonstrated in flight to the FAA or certified for in-flight operation, the commercial flight manual restricts U.S. licensed commercial operators to only ground operation of the APU.

Boor Operation

When the APU control switch is placed to RUN or START, power is supplied to open the APU inlet door. The door opens approximately 35' on the ground and 15' in flight. An oil pressure switch is used to automatically close the door; when the oil pressure decreases to approximately 20 PSI, an electrical circuit is completed which energizes the actuator to close the door.

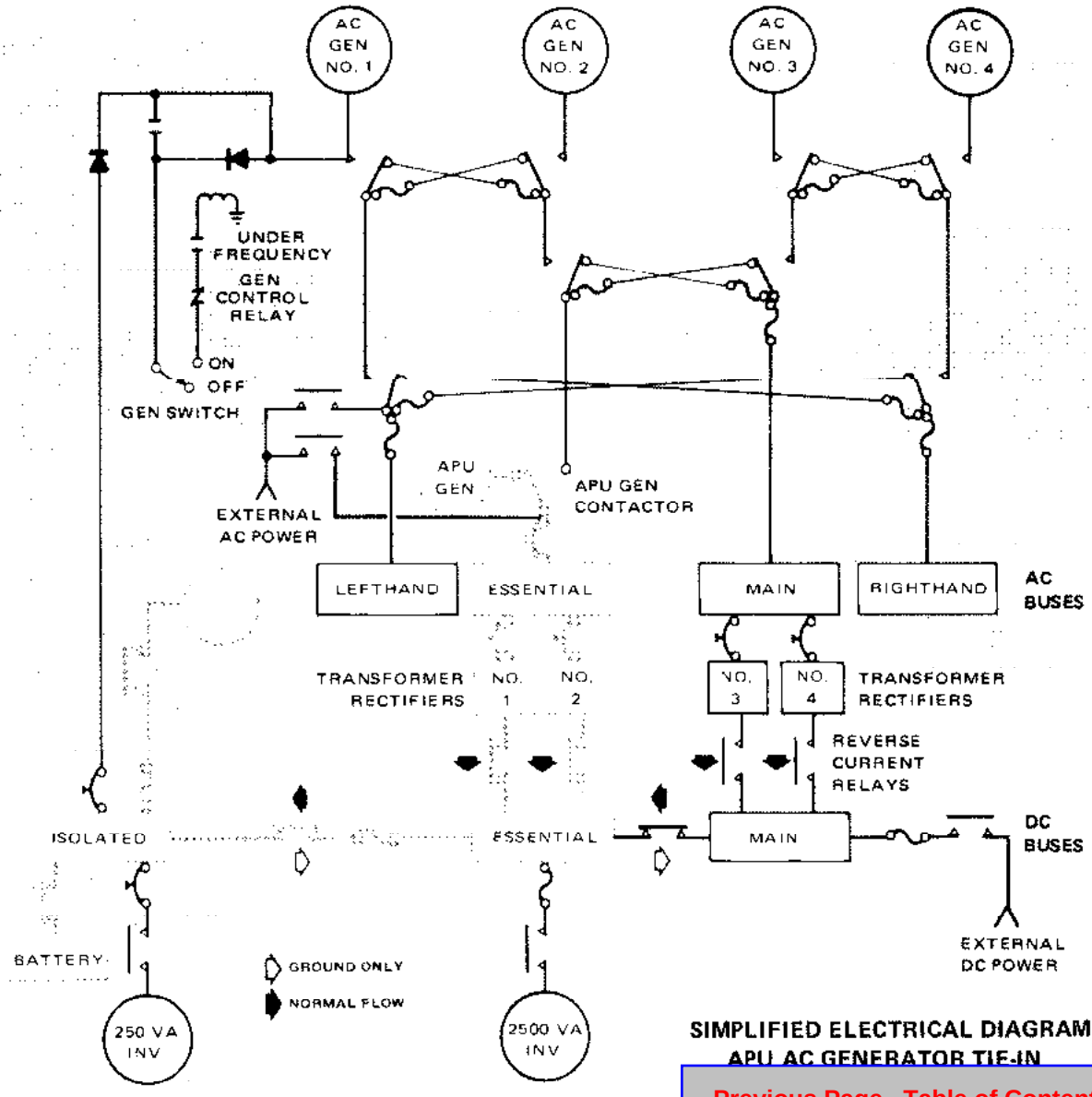
If the door fails open in either the flight (15') or ground (35') position, and there is electrical continuity at the actuator connector, the APU can be safely operated. If the door fails in the closed position on the ground, it can (in an emergency) be opened by removing the actuator access panel; relocating the actuator to the emergency location; and connecting the actuator dummy electrical plug to allow APU starting.

APU AC Generator

The APU driven AC generator supplies 115/200 VAC, 400 Hz, 3-phase power to the aircraft essential AC bus. (Reference Figure 8.) This capability provides for operation of all electrical systems requiring DC power, and of those AC systems that receive power from the essential AC bus.

The APU requires a source of 24 VDC for starting. Routinely, external power is used when available; but when the Hercules operates independent of ground support equipment, starting must depend on the aircraft battery. The battery in turn is recharged by the APU or aircraft generator.

Figure 8



SIMPLIFIED ELECTRICAL DIAGRAM
APU AC GENERATOR TIE-IN

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NOTE: It is very important that the battery be well charged at all times and that battery condition be closely monitored prior to and during aircraft operation at locations where ground support equipment may not be available.

Auxiliary Hydraulic System

Electric output from the APU can power the auxiliary hydraulic system when other sources are not available. The auxiliary hydraulic system operates from a 115/200 VAC, 400 Hz motorpump on the ground or in flight. The auxiliary pump can power the utility system for ground testing of components through a ground test interconnect valve provided for this purpose On the ground the auxiliary hydraulic system electric motorpump output can be switched into the utility hydraulic system by manually positioning the ground test interconnect valve handle to the ground test position.

Specifications

Operation, inspection and maintenance instructions are available in the various technical manuals for commercial and military operators. These manuals should be referred to for complete specifications and instructions.

Service News

StarTip

STARTER SERVICING

by J. H. Hunt, *Service Representative*

For servicing starters on the Hercules, a useful tool can be quickly assembled from a Spectrometric Oil Analysis Procedure (SOAP) sample tube (save the cap) and an ordinary Plews-type oil can. The plastic tubing is installed on the oiler spout and by operating the oiler, the starter is easily serviced without spilling a drop,

Service News

TORQ-SET* SCREWS and TOOLS

A recent request from the field brought to our attention that in many cases there is very little information available on Torq-Set* screws and their installation/removal tools. As these fasteners are used in the JetStar, Galaxy, and - to a limited extent - in the Hercules, we are providing the following information. We hope it proves helpful.

Why Torq-Set*?

The distinctive cross recess of the Torq-Set* fastener was developed for screws requiring very high installation torque. The Torq-Set* recess is designed so that each driving wall is on a radius of the screw. The fact that the removal wall is not on a radius is compensated for to some degree by its substantially increased area. These two factors permit the use of a thicker screwdriver bit without an increase in the overall size of the recess. The walls of the recess are not tapered. Thus, the driver remains seated in the screw head during application of high torque since there is no camming surface tending to force the bit out of the recess.

The basic design for Torq-Set* screws is given in MS33781, Military Design Standard; "Recess-Torq-Set*, Dimensions of Recess, Gage and Driver for". This document is for standardizing basic dimensions and does not identify individual screws by part numbers. National Aerospace Standard (NAS) drawings give complete details on individual screws and assign part numbers.

A Word of Caution

Through observation if not experience mechanics in the aerospace industry have discovered how difficult removing a machine screw can be if someone has used the wrong screwdriver in the screw head.

*Torq-Set is a registered trade mark of Phillips international Co., Division of Phillips Screw Co.

Torq-Set* screws look deceivingly enough like other cross recess types that someone not familiar with them might be tempted to use just any cross-point screwdriver - **Don't!** In addition to using the correct type driver, do not underestimate the importance of using the **correct size** Torq-Set* bit for the size of Torq-Set* screw in use.

PHILLIPS REED AND PRINCE TORQ-SET*

Screws designed for high installation torque values will almost certainly be damaged by a tool that doesn't fit. Think about the experience of drilling out a screw and the subsequent problems if you are tempted to make do with the wrong tool.

Here Are the Tools

Reports from some areas say that part numbers for the desired tools are not readily available. The tables provided here include part numbers for Torq-Set* tools necessary for the most commonly used screw sizes.

In Figure 1, the numbers in the first column are the standard screw sizes most commonly found in aircraft. The second column tells you the hex size of the bit and the size that the hex socket must be to accommodate the bit.

The next four columns are driver bit part numbers. The first of these are the dash numbers to the Lockheed Standard Tool Series Number 291B-400. Next are listed part numbers for three other suppliers. The U.S. Federal Stock Numbers are in the last column.

NOTE: There are, no doubt, other suppliers. Data for the ones we list happened to be readily available to us.

The first four digits in a Federal Stock Number (FSN) are the classification number and,in most cases, this number is the same for items that will fall into a specific classification. Most of the Torq-Set* tools listed have the number 5120 as the first (classification) number in the FSN. However, a few of the bits have the number 5130. The numbers following identify the sizes, not by a predetermined pattern, but by arbitrary assignment.

Figure 1

PART NUMBERS FOR TORQ-SET* SCREW BITS

NOTE: ALL DIMENSIONS GIVEN IN INCHES.

	SCREW SIZE	HEX SIZE	LOCKHEED STANDARD TOOL 291 B-400 DASH NO.	VENDOR PART NUMBERS FOR BITS: APEX	AMERICAN SCREW CO.	AIR INDUSTRIES CORP.	FEDERAL STOCK NUMBERS FOR BITS
FOR POWER DRIVERS	NO. 2	1/4	-001 A	170-2	EX1 70-2	A 1 CI 70-2	5130-798-0825
	NO. 3		-002A	-3	-3	-3	-0826
	NO. 4		-003A	-4	-4	4	-0828
	NO. 5		-004A	-5	-6	-5	-0829
	NO. 6		-005A	-6	-6		
	NO. a	1/4	-006A	-a	-a	-6	5130-805-3793
	NO. a	5/16		%A		–	-226-5604
	NO. 10	1/4	-007A	-10	-10	-10	-774-7130
	No. 10	5/16		-1 OA		–	-226-6605
	1/4	7/l 6	-008A	-1/4	-1/4	-1/4	-6728671
	1/4	5/16		-1/4A		–	-226-5607
	1/4	1/4		-1 /4B			5120-226-6606
	5/16	7/16	-O09A	-5/16	-5/16	-5/16	5130-672-8679
	5/16	5/16		-5/1 6A		–	-226-5609
	5/16	1/4	–	-5/1 68			5120-226-5608
	3/8	7/16	-010A	-3/8	-3/8	-3/8	-511-0210
	3/8	5/16	–	-3/8A		–	5130-226-561 1
	3/8	1/4		-3/8 8			5120-226-5610
	7/16	7/16	-011A	-7/16	-7/16	-7/16	-511-0212
	1/2	5/8	-012A	-1/2	-1/2	-1/2	-511-0208
	9/16	5/8	-013A	-9/16	-9/16	-9/16	-51 I-0207
	5/8	5/8	-014A	-5/8	-5/B	-5/8	-624-7973
FOR HAND DRIVERS	NO. 2	1/4	-105A	212-2	EX-212-2	Al C212-2	5120-082-8529
	NO. 3		-110A	-3	-3	A l C212-3	-226-6562
	NO. 4		-115A	-4	-4	-4	-888-5829
	NO. 5		-120A	-5	-5	-5	-7 56-2209
	NO. 6		-125A	-6	-6	-6	-888-5827
	NO. 8		-130A	-8	-a	-8	-5826
	NO. 10		-135A	-10	-10	-10	-5831
	1/4	1/4	-140A	-1/4	-1/4		-5830
	NO. 8	5/16	-145A	-8A	%A	A1C212A-8	
	NO. 10		-150A	-10A	-10A	-10	
	1/4		-155A	-1/4A	-1/4A	-1/4	
	5/16		-160A	-5/l 6A	-5/16A	-5/16	5120-888-5828
	3/8	5/16	-165A	-3/8A	-3/8A		-515-2814

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Combination hand drivers with hex sockets to accommodate interchangeable bits are listed in Figure 2. Torq-Set* hand drivers are listed in Figure 3. Adapters for standard square drive service tools and power tools are shown in Figure 4.

A tool kit for Torq-Set* screws is available under one Apex part number (TS-Kl) or one Federal Stock Number (5180-602-9550) if you wish to avoid ordering the tools separately. The kit includes hand screw drivers and combinations. The bits included in the kit can be used with square drive service or power equipment using standard adapters available separately. If you have been using other standard bits, you may already have suitable adapters.

Complete packaged tool kit including all hand drivers, combination hand drivers and bits, as specified under Federal Stock No. 5180-602.9660

Order by Apex Part Number . . . . TS-Kl

Kit consists of:

6 hand drivers for screw sizes 2, 4,6, 8, 10, 1/4

1 combination hand driver and two 5/16" hex shank bits for screw sizes 5/16, 3/8

1 combination hand driver and five 1/4" hex shank bits for screw sizes 4. 6, 8. 10,1/4

Figure 2

COMBINATION HAND DRIVERS

HEX OPENING	OVERALL LENGTH	BLADE PROJECTION	FEDERAL STOCK NO	VENDOR (APEX) PART NO.
1/4	8-1/8	4-3/8	5120-888-5833	1500-P
	9	3-7/8		1500-W
	8-1/8	4-3/8		M-1500-P
1/4	2-3/4	7/8		1510-P
5/16	10-1/2	6	5120-888-5833	1550-P
5/16	3	1		1555-P

NOTE: ALL DIMENSIONS GIVEN IN INCHES

M - MAGNETIC BIT HOLDER
P - SUPERLOID HANDLE
W - WOOD HANDLE

Figure 3

APEX HAND DRIVERS FOR TORQ-SET" SCREWS

Screw Size	Blade Projection	SUPERLOID HANDLE Overall Length	SUPERLOID HANDLE Federal Stock No.	SUPERLOID HANDLE Part Number	WOOD HANDLE Overall Length	WOOD HANDLE Federal Stock No.	WOOD HANDLE Part Number
0 1	1-1/4	3		268P-o -1			
2 3 4 5	3-l /8	6-1/4	5120-033-9035 5120-714-7400 5120-034-3066	268P-2 -3 -4 -5	8-1/4		268W-2 -3 -4 -5
6 8	4	7-1/2	5120-675-0867 5120-674-9216	-6 -8	9-1/8		268W-6 -8
10	4	7-1 /2	5120-674-9215	268P-10	12-1/8	5120-829-6724	268W-10 ORD.
1/4	6	10-1/8	5120-7 1 Z-0400	268P-1/4		5120-066-4257	268W-1/4
5/16 3/8	8	12-5/8	5120-033-9033	268P-5/16 -3/8	14-3/8	5120-829-6723	268W-5/16 -3/8

NOTE: ALL DIMENSIONS GIVEN IN INCHES.

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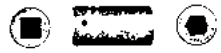
Figure 4

SERVICE DRIVE BIT HOLDERS
FOR POWER EQUIPMENT

NOTE. ALL DIMENSIONS GIVEN IN INCHES.

	SQUARE DRIVE	HEX OPENING	OVERALL LENGTH	FEDERAL STOCK NO.	VENDOR (APEX) PART NO.
	1/4	1/4	1	5120-528-2891	825
	3/8	1/4	1-1/2	5120-528-2892	838
	3/8	5/16	1-1/2	5120-331-5502	835
	1/2	5/16	1-3/4	5120-203-6781	855
ADAPTERS					
	I/4 I/4 3/8 3/8 I/2 I/2	I/4 7/I 6 I/4 7/I 6 7/I 6 5/8	I-I /4 1 I-I /2 I-I /4 I-3/8 I-I /2	5120-735-4805 -203-9618 -062-3372 -203-9619 -565-9751 -203-9620	SC-I 08 -114 -308 -314 -514 HE-3320

Caution should be exercised in the use of power screwdrivers. The time saved by these tools can be more than offset by the damage they can do if one gets out of control. Electric power tools are doubly hazardous because of the possibility of sparks and shocks. Air powered tools are safer but require experience and caution to avoid damage to the screw recess.

The following partial listing gives the NAS numbers for the most commonly used Torq-Set* screws:

NATIONAL AEROSPACE STANDARD (NAS) NUMBERS

NATIONAL AEROSPACE STANDARD NUMBERS	TORQ-SET MACHINE SCREW	
	TYPE HEAD	REMARKS
NAS1IOI	FLAT FILLISTER	FULL THREAD
NASI102	FLAT 100'	FULL THREAD
NASI121 through NASI 128	FLAT FILLISTER	SHORT THREAD, CLOSE TOLERANCE
NAS1151 through NAS1158	FLAT 100'	SHORT THREAD, CLOSE TOLERANCE
NAS 1620 through NASI628	F LAT 100'	SHORT THREAD
NASI630 through NAS1634	FAN	SHORT THREAD

NAS PART NUMBERS ARE FROM NATIONAL AEROSPACE STANDARD DRAWINGS

A more detailed description of these may be obtained from :

National Standards Association, Inc.
132 1 Fourteenth Street, N. W.
Washington, D. C. 20005

TORQ-SET" SCREWS USED ON THE HERCULES

TORQ-SET SCREW	INSTALLATION	
NAS 1101	AIR CONDITIONING	FLIGHT DECK
NAS 1102	SCOOP, AIR CONDITIONING	FLIGHT DECK
	TRANSDUCER	ELEVATOR, HORIZONTAL STABILIZER MOD
	TRANSDUCER	RUDDER, EMPENNAGE MOO
	TRANSDUCER	AILERON, OUTER WING MOD
	FAIRING	LH MLG WHEEL WELL
	ANTENNA, TACAN	CENTER FUSELAGE KIT
	DUCT	APU BLEED AIR SUPPLY KIT
	TAIL CONE	TAIL CONE MOD
NAS 1621	RING SEGMENT	FS245 UPPER FORWARD
	CHINE ANGLE	60 INCH FORWARD FUSELAGE EXTENSION
	CHINE ANGLE	100 INCH FORWARD FUSELAGE EXTENSION
NAS1622	ANTENNA &SUPPORT	HF ANTENNA, FS798, EC-130G
NAS1631	SURGE BOX	EXTERNAL FUEL TANK
NAS 1632	SUPPORT	CONVERTER, LIQUID OXYGEN
	RETAINER	CO2 BOTTLE, LIFE RAFT COMPARTMENT LINER
NAS 1633	TUBE & VALVE	AI R TURBINE MOTOR HEATING KIT

This list gives you an idea of where you will find Torq-Set* screws on your Hercules, depending on its configuration, and the modifications of the components listed. The original Hercules design did not include Torq-Set * screws.

We have tried to provide sufficient data to make your job easier. We hope we have succeeded.

service news

StarTip

SAFETY WIRE FOR HERCULES MLG TORQUE TUBE YOKE ASSEMBLY

Cotter pins and castellated nuts normally go together to provide fasteners with a positive measure of safety. In some approved locations, however, safety wire can be just as effective as cotter pins and may even function better under certain circumstances. Four locations in the Hercules main landing gear (MLG) fit into this category.

The use of safety wire at these locations on the Hercules has been approved by Lockheed engineers. The component drawing now shows the safety wire in place of the cotter pins. Hercules in production at this time have this change incorporated. Operators in the field can make the change at any convenient time. Only the flange assemblies at these specific locations (Illustrated in Figure 1) are involved in this change.

Companion flanges join each MLG vertical torque-tube yoke assembly to the splined socket that fits over the end of the ball screw, one location for each MLG strut. The flanges are held together by four bolts. A continuous length of 0.041 (inches diameter) safety wire passes through each nut and bolt in a circle around the flange yoke (See Figure 1). The ends are twisted and bent back against the yoke.

All Hercules airplanes have removable inspection plates in the wheel well wall that allow access to each of these assemblies in flight if it becomes necessary to lower the gear with the MLG emergency extension wrench. (Emergency extension of the landing gear is covered in your Hercules Flight Manual.)

In each of these flange assemblies the one piece of safety wire, used to safety the four nuts, eliminates the previous requirement for four cotter pins and thereby, the extra work involved in their installation – and in their removal

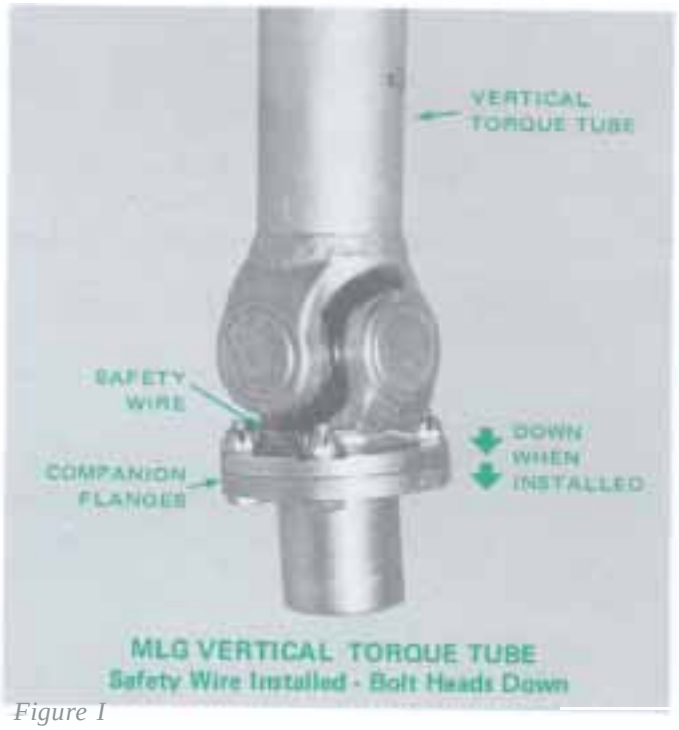


Figure 1

when necessary. Time saved in removing the safety wire instead of pins during a stuck landing gear emergency can be very significant. One or two cuts in the wire allows the lengths to be easily removed from the bolts.

Incidentally, the position of the bolts is head down after installation on the airplane. This unusual position is for conveniency in removal when necessary for inflight emergencies.

Follow the instructions in your Hercules Maintenance Manual for installing and torqueing these nuts and for the safety requirements on all other landing gear assemblies.

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CORRECTION:

Please note the following corrections to the "Hercules New Air Conditioning Units" article in Vol. 3, No. 3, July-September issue of the *Service News*.

Add the following sentence to the first paragraph on page 20: With the master switch in the OFF position, the low limit valve opens, thus unloading the turbine.

The second sentence, last paragraph, page 20, should read: "In the NORMAL position the flight station receives 60% of the air flow and the rest goes to the cargo compartment."

The third sentence, last paragraph, page 20, and continuing onto page 21 should read: "INTMED (intermediate) positions the valve to direct approximately

CUSTOMER SERVICE DIVISION
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A DIVISION OF LOCKHEED AIRCRAFT CORPORATION
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The new JetStar II is shown taking off for its first flight on August 18, 1976, which was the start of a comprehensive flight test program. Although the JetStar II retains those system and design features proven through time and service, it also incorporates new technological advances to provide a quieter, more economical and efficient airplane.

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