MAINTENANCE INSTRUCTIONS FOR :

AIRCRAFT HEATERS

PART NOS.
C83A28, D83A28
E83A28 & F83A28

TYPE S-50

JANITROL AERO

COLUMBUS , OHIO

HEAT TRANSFER AND CONTROL PRODUCTS FOR THE AEROSPACE INDUSTRY

LITHO IN USA JE 65

TABLE I. LEADING PARTICULARS

Rated output (BTU/hr.)	50,000
Jacket diameter (inches)	7.00
Jacket length (inches)	17.62
Weight (pounds)	13.9
Combustion air connection (inches)	1.625 O.D.
Exhaust connection (inches)	2.00 O.D.
Fuel connection size	1/8-27 NPT
Drain connection size	1/4-18 NPT
Spray nozzle marking -	
C83A28 and F83A28	2.25
D83A28 and E83A28	2.00
Spark gap (inches)	
C83A28 and E83A28	0.188 to 0.125
D83A28 and F83A28	0.312 to 0.250

1. GENERAL.

a. This instruction provides maintenance information for the C83A28, D83A28, E83A28 and F83A28 Aircraft Heaters, Type S-50, manufactured by *Janitrol Aero Division, Midland-Ross Corporation, Columbus, Ohio. (See figure 1.) These heaters are designed to provide heated air for aircraft cabins, cargo spaces, anti-icing systems and instruments.

2. DESCRIPTION.

a. The heater assembly is cylindrical in shape and is fabricated of heat resisting alloy steel. A combustion chamber and radiator assembly, welded gas tight, which forms the principal part of the heater assembly, has at one end the fuel and air inlets and exhaust outlet. At the opposite end, crossover passages connect the combustion chamber to the double-walled radiator which surrounds the combustion chamber. Enclosing the combustion chamber and radiator assembly is a smooth stainless steel "wrap around" jacket with a self-sealing joint. The jacket is removable and is held at a uniform distance from the radiator by spacers welded to the radiator.

b. The spark plug is installed in the combustion head in a manner facilitating access from the end of the jacket.

c. A spray nozzle is mounted in a conical shaped head. A spark plug and ground electrode (also mounted in the head) provides a spark gap.

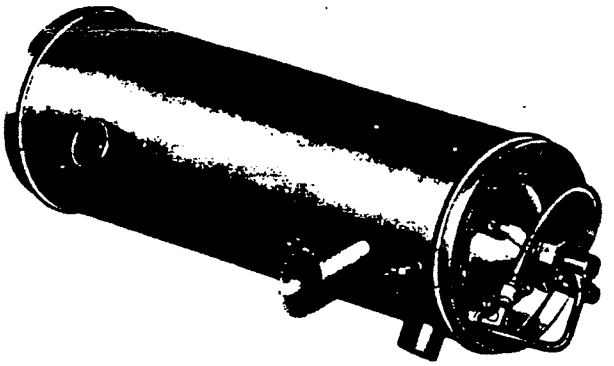


Figure 1. Aircraft Heater Assembly

d. The nozzle aeration line projects into the combustion air stream. The combustion air inlet tube extends straight out through an opening in the jacket.

e. On the C83A28, E83A28 and F83A28 heaters, the exhaust flue is cut off at an angle, whereas the exhaust flue on the D83A28 heater is cut off square.

f. The 83A28 series heaters have two drain connections which extend through the side of the jacket. On the C83A28 and E83A28 heaters, the drain near the outlet end of the jacket is shrouded. There are no drain shrouds in the D83A28 and F83A28 heaters.

Instruction Part No. 30C57
Reissued September 1966

*Reg. U.S. Pat. Off.

. Fuel under pressure passing through the nozzle is converted to a fine atomized spray. Mixed with combustion air, the fuel is ignited by a spark. An ignition unit converts 28 volt dc to high voltage, oscillating current capable of producing a continuous spark at a gap in the combustion head. Ignition unit operates continuously during heater operation. A stream of air from the combustion air inlet is directed around the spray nozzle to minimize nozzle icing and carbon formation under adverse operating conditions.

h. Two drain tube connections are provided in the combustion tube thus providing an escape for any unburned fuel. These drain tubes are threaded on the inside for connecting to a tube that leads to the outside of the airplane. They are so located that a drain is available for various heater orientations.

i. Heat is produced by burning gasoline in the combustion chamber. Fuel from the source of supply usually passes through a fuel filter, fuel pressure regulator, and solenoid valve before entering the heater. These controls are external to the heater itself.

j. Combustion air enters the combustion chamber tangent to its surface. This arrangement imparts a whirling or spinning action to the air. The atomized fuel intermixes with the spinning air, thus producing whirling flame. The resultant flame is stable and sustains combustion under the most adverse conditions because it is whirled around itself many times; thus ignition is continuous and the combustion process is "self-piloting." The burning gases travel the length of the combustion chamber, then pass through four crossover passages into the radiator, then through the radiator into the exhaust outlet.

k. Ventilating air passes through the heater between the jacket and radiator and between the radiator and combustion chamber. Ventilating air thus comes in contact with three heated surfaces.

3. SERVICE INSPECTION.

a. At the end of each 100 hours of heater operation, inspect the fuel and air fittings for any evidence of leakage.

b. Examine the ignition lead connections at the spark plug and the ignition unit for security and possible damage.

4. SERVICE TROUBLES AND REMEDIES.

a. Refer to Table II for trouble shooting instructions.

Table II is based on the heater together with those basic controls that are usually supplied by Janitrol Aero Division.

5. OVERHAUL.

NOTE

It is recommended that the heater be removed from the aircraft and completely overhauled after each 500 hours of operation or at each engine overhaul (whichever occurs first).

6. DISASSEMBLY. (See figure 2.)

a. Disassemble the heater in the same general sequence as the index numbers in figure 2, giving special attention to the following instructions.

b. Disconnect nozzle holder and feed assembly (5) from elbow (11) attached to the combustion air inlet. Remove the elbow (11).

NOTE

When removing the nozzle holder and feed assembly, be careful not to bend the fuel feed and nozzle air tubes in this assembly.

c. Remove nozzle holder and feed assembly (5) from jacket (17) by removing four screws and lock washers (8 and 9). Remove gaskets (10).

d. Carefully remove the spray nozzle (12) and place it in an envelope to protect it from dirt and damage.

e. Remove spark plug (2) with a close-fitting spark plug wrench applied to the large hex of plug.

f. Remove ground electrode (3) and electrode washer (4).

g. Cut safety wire and remove drain plugs (1) from heater.

h. Remove screws and self-locking nuts (18 and 19) that hold heater jacket lockseam in place. Spread jacket (17) enough to clear exhaust, drain thimbles, and combustion air connections and slide off.

i. Remove gasket (22).

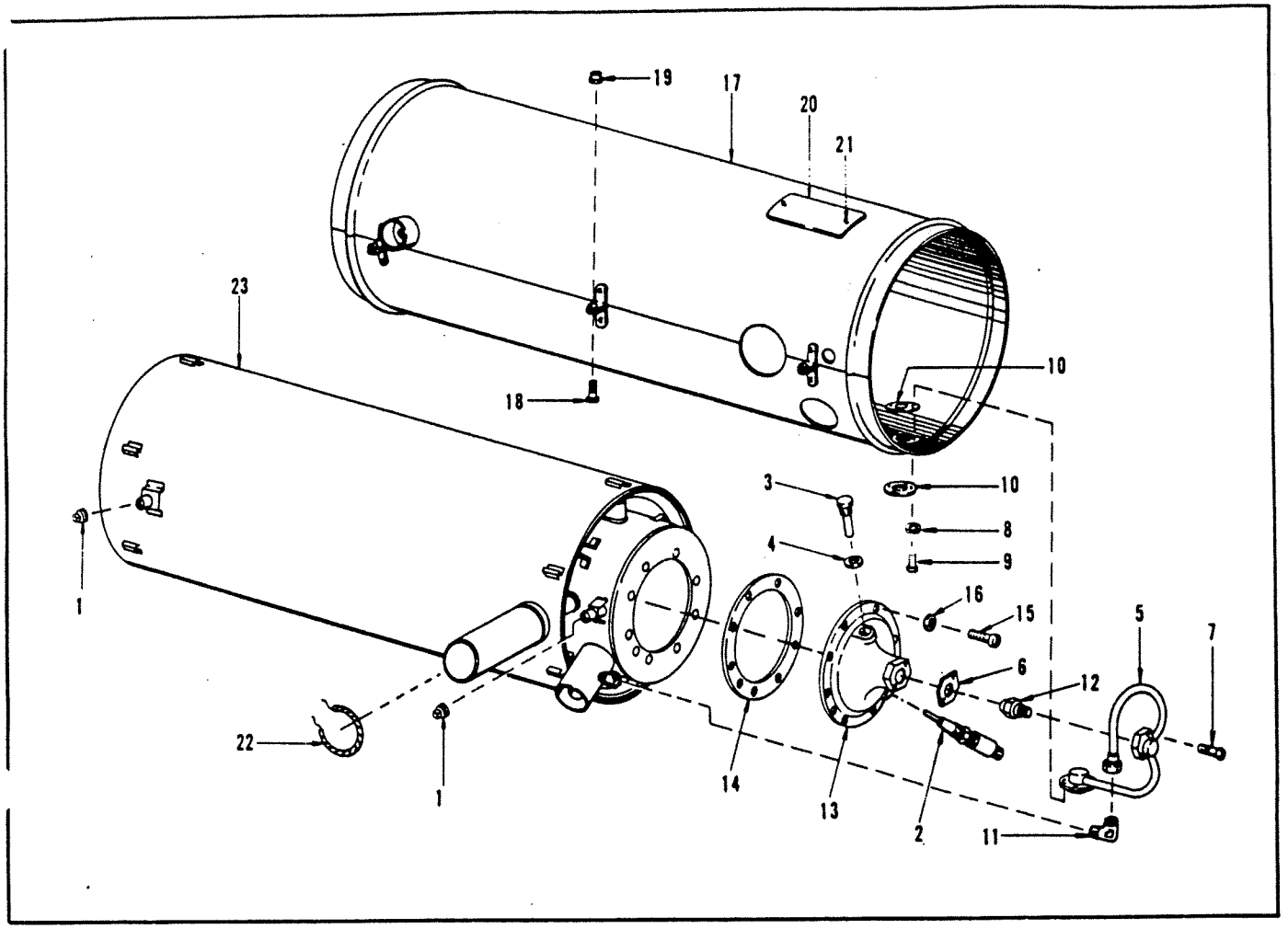
j. Cut safety wire, remove screws (15) and copper washers (16) and lift off combustion head (13) from combustion chamber and radiator assembly (23).

7. CLEANING.

a. All metal parts, except the spark plug and the combustion chamber and radiator assembly should be cleaned by washing them in a dry-cleaning solvent (Federal Specification P-D-680).

TABLE II. TROUBLE SHOOTING

TROUBLE	PROBABLE CAUSE	REMEDY
Heater does not light.	Ignition system failure: 1. No power to ignition unit.	Close switches, replace burned out fuses, repair open circuits.
	2. Inoperative vibrator in ignition unit.	Replace vibrator.
	3. Faulty spark plug.	Replace spark plug.
	4. Faulty shielded lead.	Replace shielded lead.
	5. Worn ground electrode.	Replace electrode.
	6. Ignition unit inoperative.	Overhaul or replace ignition unit.
	Insufficient fuel: 1. Fuel solenoid valve not energized.	Close switches, replace burned out fuses, replace inoperative thermal switches, or repair open circuits.
	2. Fuel supply pressure may be low.	Increase fuel pressure to value required.
	3. Fuel filter clogged.	Replace filter element or clean if new one is not available.
	4. Spray nozzle clogged.	Clean spray nozzle.
	5. Fuel pressure regulator faulty.	Overhaul the regulator.
	6. Fuel solenoid valve inoperative.	Replace solenoid valve.
	Insufficient combustion air: 1. Leaks or obstructions in combustion air supply line.	Repair leaks or remove obstructions.
Heater is cycled off and on by limit switch	Limit switch out of calibration or faulty.	Calibrate or replace switch.
	Cycling switch (if used) out of calibration or inoperative.	Calibrate or replace switch.
	Ventilating air stream may be obstructed.	Remove obstructions.
Backfiring, pulsating combustion, or smoky exhaust.	Fouled spark plug.	Clean or replace spark plug.
	Excessive fuel flow into heater: 1. Spray nozzle dirty or loose.	Overhaul nozzle.
	2. Spray nozzle is oversize.	Check markings on nozzle. Refer to general specifications for correct size. If nozzle is oversize, replace with proper size nozzle.
	3. Fuel pressure regulator may be faulty.	Overhaul regulator.
	Restriction in exhaust line.	Remove restriction.
	Insufficient combustion air.	Correct as instructed above.



1. Drain plug
2. Spark plug
3. Ground electrode
4. Ground electrode washer
5. Nozzle holder and feed assembly
6. Nozzle holder gasket
7. Screw
8. Lock washer
9. Screw
10. Fuel fitting gasket
11. Elbow
12. Spray nozzle
13. Combustion head
14. Gasket
15. Screw
16. Copper washer
17. Jacket
18. Screw
19. Nut
20. Rating plate
21. Rivet
22. Rope gasket
23. Combustion chamber and radiator assembly

Figure 2. Exploded View of Aircraft Heater Assembly

b. Carefully disassemble the spray nozzle, as shown in figure 3, and immerse the parts in clean solvent. A soft, non-metallic brush may be used to assist in cleaning the nozzle parts. If foreign material clings to the grooves in the core or the orifice in the body, use a soft wood stick (such as a sharpened match stick) to clean the grooves and orifice. Rinse the nozzle parts in clean solvent and dry them with filtered, compressed air. After cleaning, reassemble the spray nozzle and place it in a protective envelope until ready for installation in the heater.

CAUTION

Do not use a metal tool or metal brush for cleaning the nozzle parts, as this could affect the flow characteristics.

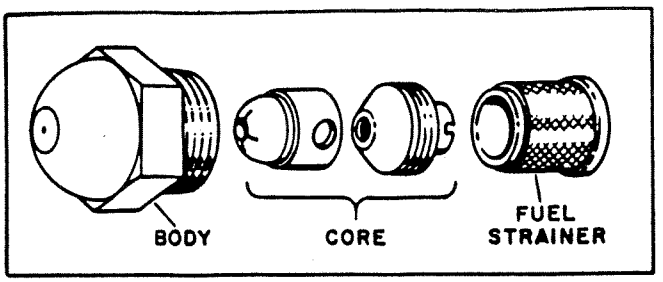


Figure 3. Exploded View of Spray Nozzle

c. Before cleaning the spark plug, examine it for a cracked porcelain and for carbon tracks in the spark plug well. If the porcelain is cracked or broken, discard the spark plug. Carbon tracks in the spark plug well may be caused by shorting of the spark plug or by dirt on the spring connector that seats in the well; in either case the fault must be corrected. Wipe out the spark plug well with a clean cloth to remove grease or carbon deposits. Clean the spark plug electrode and porcelain on an automotive-type sandblast cleaner. Close the well of the spark plug with a stopper to keep out dirt during the cleaning. It may be necessary to use two adapters to accommodate the long porcelain and electrode. Be sure to remove all sand particles with compressed air.

d. The inside of the combustion chamber and radiator can be cleaned by filling it with an Oakite M-3 Stripper Solution and allowing it to soak overnight. This will require closing the combustion air, exhaust and drain openings with tight-fitting metal caps to retain the Oakite solution. The solution is made by mixing one pound of Oakite with each gallon of water used; and should be maintained at 190°F to 210°F during the soaking period. Be sure to rinse the heater thoroughly with water after soaking. (Oakite may be purchased from Oakite Products, Inc., 22 Thames Street, New York, New York.)

e. A sandblast cleaner or a stainless steel brush may also be used to clean the inside of the combustion chamber. After sandblasting or brushing, be sure to remove all sand or loosened foreign material.

CAUTION

Do not use an ordinary steel brush, as it may cause corrosion.

f. Wipe the outside of the jacket with a cloth dampened in dry cleaning solvent and follow up with a clean, dry cloth.

8. INSPECTION.

a. Slight scaling and discoloration of the combustion chamber and radiator is a normal condition for heaters that have been in service. The scale will be mottled, and a blue-gray powder is sometimes present. This condition does not constitute grounds for rejection of the assembly, unless severe overheating has produced soft spots in the metal.

b. Damage to the combustion chamber and radiator can be classified as soft and spongy metal as a result of overheating; deformation as a result of overheating or backfiring; fatigue cracks; and pin holes.

NOTE

A heater showing damage due to overheating has been operating in a system where some control is not functioning correctly. Be sure to check all components of the heating system before placing the heater back into service.

c. Soft and spongy metal can be detected by tapping lightly with a ball-peen hammer. Soft spots will produce a dull sound in contrast to the solid ringing response obtained when tapping on live metal. The soft spots will usually occur opposite the crossover passages. If soft spots are found, the combustion chamber and radiator assembly should be replaced.

d. Deformation as a result of overheating will usually distort the wall of the radiator near the crossover passages. This will be accompanied by evidence of extreme oxidation and is sufficient reason for replacement of the assembly.

e. Deformation as a result of backfiring usually pushes the inner wall of the radiator in toward the combustion chamber. This sometimes occurs in a relatively new heater and does not constitute sufficient reason for replacement, unless it causes an increase of more than 10 percent in the ventilating air pressure drop across the heater.

f. Fatigue cracks can sometimes be detected visually; but slight cracks and pin holes will require a pressure test for detection.

9. TESTING (during overhaul).

a. Install a test head on the combustion chamber and radiator assembly. Close the combustion air inlet opening and the exhaust opening with expansion plugs. Connect a compressed air line to one of the drain fittings with other drains plugged.

b. Submerge the combustion chamber and radiator assembly in a tank of water and apply an air pressure of 6.0 psi to the assembly. Air bubbles will reveal leaks; no leakage is allowable.

NOTE

Be sure to repeat this test after repairs have been made.

REPAIR OR REPLACEMENT.

a. Except for sheet metal parts which can be welded successfully if proper precautions are taken, repairs will consist of replacement of damaged parts.

b. Pin holes and cracks can be welded if they are located in accessible areas. Access holes to damaged areas should never be made, as this would destroy the serviceability of the combustion chamber and radiator assembly. Also, no attempts should be made to weld a part containing soft and spongy metal. If the metal is in good condition, clean the area to be welded either by brushing with a stainless steel brush or by sandblasting. Be sure to remove all sand particles before welding.

c. Wipe the areas to be welded with a 30 percent solution of nitric acid, and weld with stainless steel rod, SAE Type 309. Use Solar No. 16GH flux when welding with an acetylene torch. When welding by the Heliarc method, use Type I or Type B flux. Be sure to use the same type of metal as in the construction of the original part. It is advisable to save scrap heater parts as a source of repair material.

d. After final repair, repeat the leakage test described in paragraph 9.

11. LUBRICATION. None required.

REASSEMBLY. (See figure 2.)

a. Reassemble in reverse order of index numbers assigned to figure 2, observing the following.

b. Before installing the combustion head (13) on the combustion chamber (23), install the spark plug (2), ground electrode (3) and ground electrode washer (4) in the combustion head; then check the spark gap. Tighten spark plug with a torque of 28 foot-pounds applied to the large hex. The correct spark gap measurements are given in Table I.

c. Install the asbestos rope gasket (22) around the exhaust. Spread the jacket (17) and slide it over the combustion chamber and radiator assembly (23). Insert the tongue in the groove and fasten the jacket clips together with screws and self-locking nuts (18 and 19).

d. Install combustion head (13) and gasket (14) on the combustion chamber and radiator assembly using screws and copper washers (15 and 16).

e. Assemble spray nozzle (12) into nozzle holder and feed assembly (5).

f. Attach nozzle holder and feed assembly (with nozzle) on combustion head using gasket (6) and attaching screws (7).

g. Install nozzle holder and feed assembly (5) to the jacket (17) with four screws and lock washers (8 and 9), but do not tighten the screws.

NOTE

Make certain that a fuel fitting gasket (10) is installed on the inside and outside of the jacket.

h. Connect nozzle aeration tube and elbow (11) to combustion air inlet.

i. Install drain plugs (1) removed at disassembly.

j. Tighten all attaching hardware, safety wiring all screws and plugs that have been installed.

13. TESTING (after overhaul).

14. TEST EQUIPMENT REQUIRED.

a. Blower capable of delivering 1300 pounds per hour at 8.0 inches of water static pressure.

b. Electric power supply of 28 volts dc.

c. A filtered controlled supply of 115 to 145 octane gasoline, delivered at 15 psi is required. The fuel flow shall be 8.0 to 8.8 lbs per hour.

d. Two 12-inch water manometers.

e. An ignition unit (Part No. 11C30) and a shielded lead assembly (Part No. R29C09) for connecting to the heater spark plug.

f. Inlet and outlet sections of duct the same diameter as the heater jacket and four diameters in length. Pressure taps should be located as indicated in figure 4.

15. OPERATIONAL TEST PROCEDURE.

a. Install heater in bench test set-up similar to that shown in figure 4.

b. Close both blast gates and start the blower.

c. Adjust the blast gates to provide combustion air and ventilating air at the pressures given in Table III.

d. Turn on the ignition to the heater. Ignition should occur within 5 seconds. If the heater fails to light within 5 seconds, refer to Table II.

e. Adjust the fuel pressure relief valve to relieve at the pressure given in Table III.

f. After the heater begins operating, readjust the combustion air, ventilating air and fuel pressures to the values given in Table III.

g. Turn the heater on and off several times to check ignition dependability. Wait at least two minutes between ignition trials to insure burning is complete.

16. LEAKAGE TEST OF HEATER ASSEMBLY.

a. After the heater has passed the operational test, it must be subjected to a leakage test as outlined in the following paragraphs.

TABLE III. PRESSURES

Heater Part No.	Combustion Air Pressure (In. of Water)	Ventilating Air Pressure Diff. (In. of Water)	Fuel Supply Pressure (PSI)
C83A28	4.0	1.5	6.0
D83A28	2.0	1.5	7.0
E83A28	4.0	1.5	14.0
F83A28	2.6	1.0	7.0
*F83A28	5.5	1.5	14.0

*Heater Part No. F83A28 will be tested using both pressure ranges shown in Table III. Allow the heater to cool between tests.

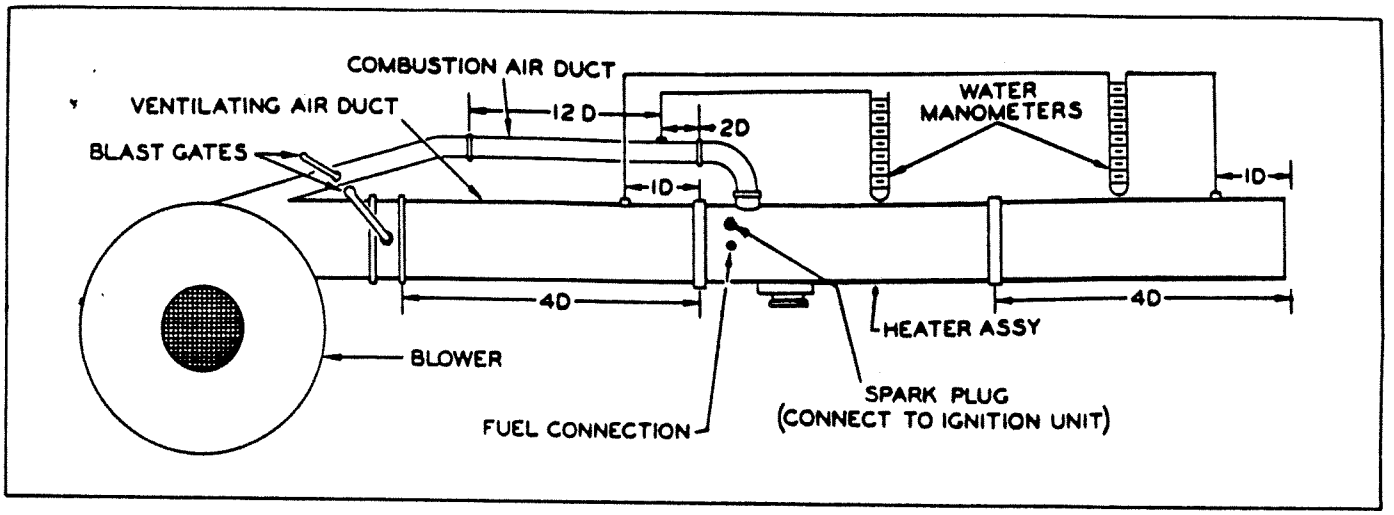


Figure 4. Test Set-Up

17. EQUIPMENT REQUIRED.

a. A source of compressed air capable of exceeding 12 inches of mercury.

b. Two manual shut-off valves.

c. A 15-inch mercury manometer.

d. Rubber expansion plugs for the combustion air inlet and exhaust outlet openings on the heater.

e. An elbow or nipple for one of the drain openings.

f. Plugs for the other drain openings and the fuel inlet connection.

18. TEST CONNECTIONS.

a. Close the combustion air inlet and exhaust outlet openings on the heater with the rubber expansion plugs.

b. Install the elbow or nipple in one of the drain openings.

c. Plug the other drain openings and the fuel inlet connection.

d. Install the two manual shut-off valves in series in the compressed air line to provide positive shut-off control.

e. Locate the mercury manometer downstream from both valves.

f. Connect the compressed air line to the heater drain fitting.

19. LEAKAGE TEST PROCEDURE.

a. Apply air pressure until a reading of 12.0 inches of mercury is obtained on the manometer.

b. Close both manual shut-off valves to "lock" the air pressure in the combustion chamber and radiator assembly of the heater.

c. Time the pressure drop. The maximum allowable pressure drop in 50 seconds is one inch of mercury.

d. If the pressure drop is greater than specified above, make certain that there are no leaks at the test connections by checking each connection with soap suds.

INDEX NO.	PART NUMBER	DESCRIPTION	UNITS PER ASSY
	C83A28	HEATER ASSEMBLY, Aircraft	1
	D83A28	HEATER ASSEMBLY, Aircraft	1
	E83A28	HEATER ASSEMBLY, Aircraft	1
	F83A28	HEATER ASSEMBLY, Aircraft	1
1	MS20913-2S	. PLUG, Drain	2
2	54A35	. PLUG, Spark	1
3	51A05	. ELECTRODE, Ground	1
4	56A14	. WASHER, Ground Electrode (Used on D83A28 and F83A28)	1
	A56A14	. WASHER, Ground Electrode (Used on C83A28 and E83A28)	1
5	07C56	. NOZZLE HOLDER AND FEED ASSEMBLY	1
6	51A66	. GASKET, Nozzle Holder	1
7	V40A76	. SCREW, Fillister Head	2
8	AN935-10	. WASHER, Spring Lock	4
9	AN501A10-8	. SCREW, Fillister Head	4
10	87A37	. GASKET, Fuel Fitting	2
11	AN821-6	. ELBOW, Flared Tube	1
12	H36A47	. NOZZLE, Spray (Marked 2.25) (Used on C83A28 and F83A28)	1
	G36A47	. NOZZLE, Spray (Marked 2.00) (Used on D83A28 and E83A28)	1
	39A19	. . STRAINER, Fuel	1
13	51A45	. HEAD, Combustion	1
14	52A02	. GASKET, Copper Asbestos	1
15	AN500A8-8	. SCREW, Fillister Head	9
16	45A28	. WASHER, Copper	9
17	B85A82	. JACKET (Used on C83A28 and E83A28) with Drain shroud	1
	C85A82	. JACKET (Used on D83A28 and F83A28) without Drain shroud	1
18	AN500A8-10	. SCREW, Fillister Head	3
19	MS20365-832C	. NUT, Self Locking	3
20	CC99A30	. PLATE, Rating (Used on C83A28)	NSS
	ED99A30	. PLATE, Rating (Used on D83A28)	NSS
	FH99A30	. PLATE, Rating (Used on E83A28)	NSS
	JW99A30	. PLATE, Rating (Used on F83A28)	NSS
21	39A37	. RIVET	2
22	A35A71	. GASKET, Asbestos Rope	1
23	20C97	. COMBUSTION CHAMBER AND RADIATOR ASSEMBLY (Used on C83A28 and E83A28)	1
	45C40	. COMBUSTION CHAMBER AND RADIATOR ASSEMBLY (Used on D83A28 and F83A28)	1

892-86

NSS - Not sold separately.