SAE Aerospace
An SAE International Group

AEROSPACE INFORMATION REPORT

SAE AIR1377 | REV. A

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Superseding AIR1377

Fire Test Equipment for Flexible Hose and Tube Assemblies

RATIONALE

AIR1377A has been reaffirmed to comply with the SAE five-year review policy.

1. SCOPE:

This Aerospace Information Report (AIR) describes equivalent types of equipment that can perform fire tests in accordance with requirements of AS 1055.

2. DESCRIPTION OF TEST EQUIPMENT:

2.1 Burner:

The burner used to produce the flame shall be one of the modified conversion burners listed in Fig. 1.

a. Fuel nozzle, burner, air flow and fuel flow regulation shall be as shown in Fig. 1.

b. A 12-1/2 in. (317.5 mm) stainless steel funnel extension per Fig. 3 shall be added to the burner air tube. The funnel has an oblong exit area 6 in. (152.4 mm) high by 11 in. (279.4 mm) wide - reference Figures 2A, 2B, 2C, and 3.

The air consumed by the burner can be varied by changing the pressure in the air tube. Fuel flow can be regulated by varying fuel pressure to achieve the required 2 gal/hr rate. Fuel will be SAE #2 grade oil, kerosene, or equivalent.

2.2 Vibrating Mechanism:

The vibrating mechanism is shown in Fig. 5. One end of the hose assembly shall be subjected to a total axial or lateral displacement of not less than 1/16 in. (1.59 mm) on each side of neutral at 2000 cpm. The vibrated end of the hose tube assembly shall be subjected to the flame. The vibrating fixture shall be as light as possible to avoid excessive heat transfer or loss through the fixture.

2.3 Bench:

The bench consists essentially of a steel table, 60 in. (1.52 m) wide, 28 in. (711 mm) deep, and 32 in. (813 mm) high. Mounted on this bench are the vibrating mechanism and a hood.

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2.4 Hood:

The hood (see Fig. 5) is 25 in. (635 mm) wide and 25 in. (635 mm) high. The vibrated fitting connection is located 7 in. (178 mm) back of the open front of the hood. The rear end of the hood is ducted to a fan, which draws air through the hood opening at a velocity of 400 fpm (2.03 m/sec) as measured by an Alnor Velometer or equivalent, located at the hose assembly specimen. This air movement aids in keeping the flame horizontal and in exhausting fumes.

2.5 Temperature Measurement and Recording:

The temperature sensing system including the thermocouples and indicator shall have an allowable overall error of ±1% at 2000°F (1090°C). The flame temperature shall be measured 4 in. (101.6 mm) from the end of the burner barrel extension. A sufficient number of the thermocouples shall be used to assure that the specified temperature exists at least along the entire end fitting and the hose or tube for a distance of not less than 5 in. (127 mm) of hose plus the fitting.

2.6 Oil Circulator and Heater:

The oil circulating and heat equipment consists of an electrically driven oil pump and an oil tank with a thermostatically controlled immersion heater. The plumbing of the oil system also includes pressure relief valves, flow indicators, pressure gages, and control and selector valves.

3. TEST BURNER STANDARDIZATION APPARATUS:

In order to standardize the Btu output of the flame utilized in testing, Btu measuring equipment shall be used. The heat transfer surface, which is similar in shape to a hose, may be inserted in the flame from the test burner and a Btu measurement obtained for the portion of the flame to which a hose or tubing test specimen is subjected during a test. Such measurement will enable adjustment of the burner until a standard Btu value of 4500 +200/-100 (1320 +60/-30 watts/hr) per hour, as measured by the standardization device, is obtained.

3.1 Fabrication of Apparatus:

The illustration of the apparatus (Fig. 6) shows the layout of the complete assembly. A 5 ft (1.52 m) constant head of water above the heat transfer tube and a 2 ft (.62 m) drop to the end of the tailpipe are specified so as to obtain consistent flow conditions. A standard 1/4 in. (6.35 mm) metering valve is attached just before the tailpipe for adjustment of the water flow rate. A gallon measuring container or a container and a weighing scale are also required.

3.1 (Continued):

The drawings, Nos. TD-271-1A-B, TD-271-1-A, TD-271-1-B, TD-271-2-B, TD-271-3-B, and TD-271-4-B, specify materials and dimensions for fabrication of the center portion of the device. The materials needed are readily available and inexpensive. Certain of the parts require machining. The mercury thermometers should be inserted into the wells, with the bulb within 1/16 in. (1.59 mm) of bottoming in the asbestos base tubing. The woven copper fabric is manufactured by Metal Textile Corporation, Roselle, N.J. The Chore Girl pot cleaners are currently being manufactured from this type material. The Cenco thermometers can be purchased from Central Scientific Co., 1700 Irving Park Road, Chicago, Ill. 60613. Equivalent items may be substituted.

3.2 Calibration Procedure:

The following preparations are necessary prior to making a measurement:

a. Water should be supplied at a temperature not lower than 50°F (10°C) and not higher than 70°F (21.1°C).

b. The water flow rate should be adjusted to 500 lb (200 kg) per hour, which is approximately equal to 1 gal. (3.8 L) per minute.

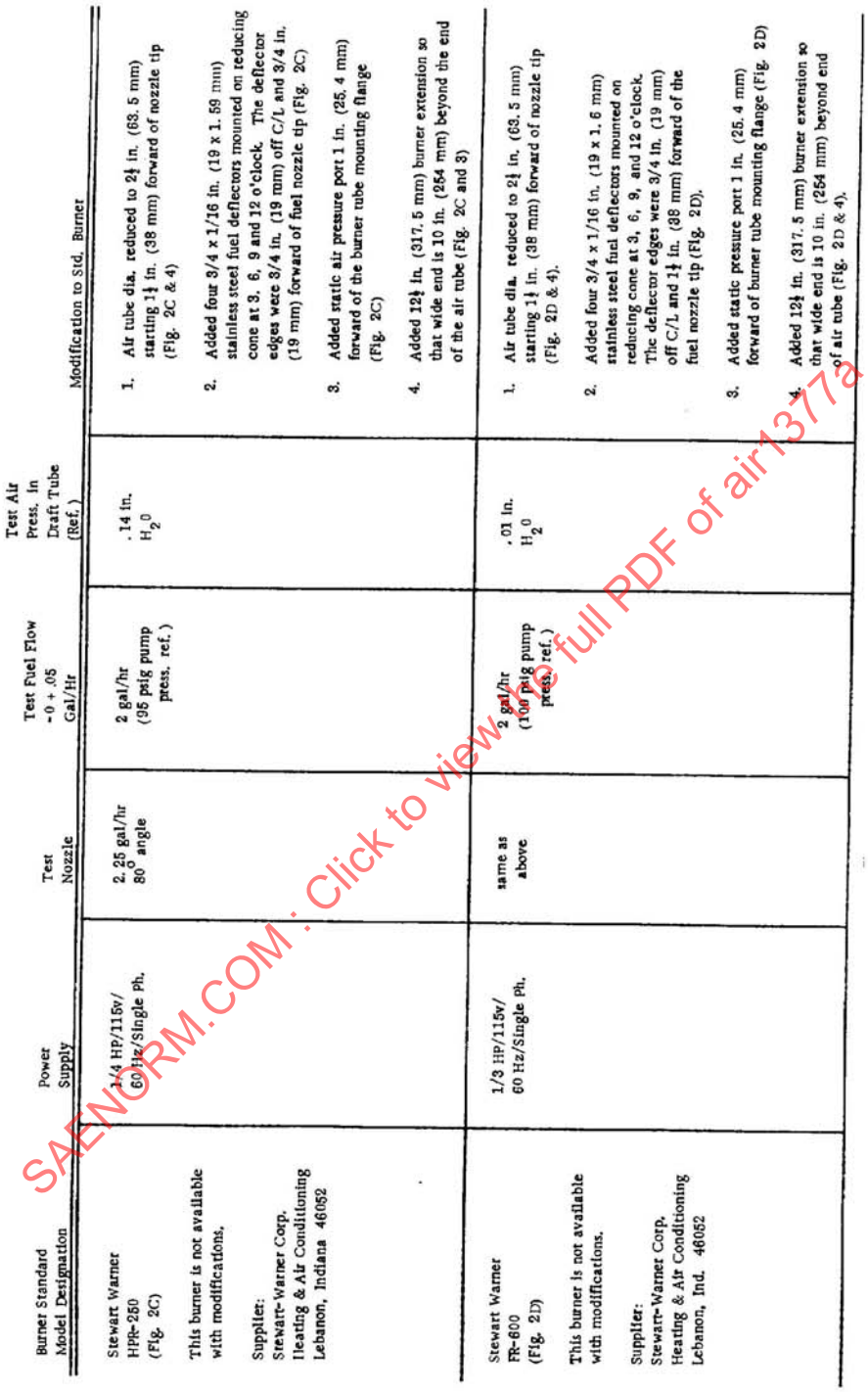
c. The external surface of the copper tubing should be cleaned with fine steel wool before each test. The tubing bore should be inspected for corrosion periodically and scale accumulation should be removed before each test. A .45 Cal. pistol cleaning brush attached to a suitable extension may be used to accomplish this.

d. The hood ventilating fan shall be turned on and the fire test burner should be carefully adjusted to produce a 2000°F ± 150° (1090°C ± 85°) flame. The temperature shall be determined at a point which is 4 in. (101 mm) beyond the end of the burner barrel extension. The thermocouple shall be removed upon completion of the flame determination.

e. With the water flowing through the device, the heat transfer should be centered in the flame in the same location that a hose or tube assembly would be placed for testing. A 2 min. warm-up period should be allowed to obtain stable conditions before temperature measurements are recorded.

After the warm-up period, the temperatures indicated by the inlet and outlet thermometers are recorded every 1/2 min. during a 3 min. period. The average difference in temperature (°F) of the inlet and outlet water multiplied by the rate of the water flow (500 lb (200 kg) per hr) equals the rate of Btu increase of the water flowing through the device, and this value is an indication of the severity of the portion of the flame in which hose or tubing assemblies are tested.

PREPARED BY
SAE COMMITTEE G-3, AEROSPACE FITTINGS, HOSE AND TUBING ASSEMBLIES



Burner Standard Model Designation	Power Supply	Test Nozzle	Test Fuel Flow - 0 + .05 Gal/Hr	Test Air Press. in Draft Tube (Ref.)	Modification to Std. Burner
Stewart Warner HPR-250 (Fig. 2C) This burner is not available with modifications. Supplier: Stewart-Warner Corp. Heating & Air Conditioning Lebanon, Indiana 46052	1/4 HP/115v/ 60 Hz/Single Ph.	2.25 gal/hr 80° angle	2 gal/hr (95 psig pump press. ref.)	.14 in. H_2O	1. Air tube dia. reduced to 2½ in. (63.5 mm) starting 1½ in. (38 mm) forward of nozzle tip (Fig. 2C & 4) 2. Added four 3/4 x 1/16 in. (19 x 1.59 mm) stainless steel fuel deflectors mounted on reducing cone at 3, 6, 9 and 12 o'clock. The deflector edges were 3/4 in. (19 mm) off C/L and 3/4 in. (19 mm) forward of fuel nozzle tip (Fig. 2C) 3. Added static air pressure port 1 in. (25.4 mm) forward of the burner tube mounting flange (Fig. 2C) 4. Added 12½ in. (317.5 mm) burner extension so that wide end is 10 in. (254 mm) beyond the end of the air tube (Fig. 2C and 3)
Stewart Warner FR-600 (Fig. 2D) This burner is not available with modifications. Supplier: Stewart-Warner Corp. Heating & Air Conditioning Lebanon, Ind. 46052	1/3 HP/115v/ 60 Hz/Single Ph.	same as above	2 gal/hr (100 psig pump press. ref.)	.01 in. H_2O	1. Air tube dia. reduced to 2½ in. (63.5 mm) starting 1½ in. (38 mm) forward of nozzle tip (Fig. 2D & 4). 2. Added four 3/4 x 1/16 in. (19 x 1.6 mm) stainless steel fuel deflectors mounted on reducing cone at 3, 6, 9, and 12 o'clock. The deflector edges were 3/4 in. (19 mm) off C/L and 1½ in. (38 mm) forward of the fuel nozzle tip (Fig. 2D). 3. Added static pressure port 1 in. (25.4 mm) forward of burner tube mounting flange (Fig. 2D) 4. Added 12½ in. (317.5 mm) burner extension so that wide end is 10 in. (254 mm) beyond end of air tube (Fig. 2D & 4).

FIGURE 1 - Test Burner Information

Burner Standard Model Designation	Power Supply	Test Nozzle	Test Fuel Flow -0 +.05 Gal/Hr	Test Air Press. in Draft Tube (Ref.)	Modifications to Std. Burner
Lennox OB-32 (Fig. 2A) (This is now obsolete and cannot be purchased.)		2.25 gal/hr 80° angle	2 gal/hr (80 psig pump press. ref.)	.17 in. H_2O	1. Add 12½ in. (317.5 mm) burner extension (Fig. 3)
Carlin 200CRD (Fig. 2B) This burner is not available with modifications. SUPPLIER: Carlin Co. 912 Silas Dean Hwy. Wethersfield, Conn. 06109	1/4 HP/115v/ 60 Hz/Single Ph.	same as above	2 gal/hr (97 psi pump press. ref.)	.37 in. H_2O	1. Disassemble the burner air tube assembly and remove the throttle ring and the retention ring shown in Figure 2B. 2. Remove the existing fuel nozzle and install a 80°, 2.25 gallon per hour nozzle and after reassembly, adjust the oil delivery rate to 2.04 gallons per hour at 97 pounds per square inch (gauge). 3. Using 1/16" stainless steel material, manufacture and install three deflectors as shown in Figure 2B. 4. Manufacture a flat disc plate to match inside diameter of the burner air tube and random punch ten one-half inch holes as shown. The main purpose of this disc is to center the oil delivery tube. Locate and punch holes for the ignitors and the oil delivery tube. A "pie" shaped segment was cut out for ease of installation and the split baffle mounting bracket was secured to the oil delivery tube with a small hose clamp. Position this flat disc plate four inches aft of the fuel nozzle tip. 5. Manufacture a reducing cone as per the specifications in Figure 4 and install per Figure 2B. The outside diameter of this cone should match the inside diameter of the oil burner air tube. This cone is secured in place with small Allen or socket head screws. 6. Install a static pressure port one inch forward of the air tube mounting flange and adjust the air pressure in the air tube to approximately 0.37 inch of H_2O during operation. 7. Manufacture a twelve and one-half inch burner air tube extension (reference Figure 3) and install this extension so the wide end is ten inches beyond the end of the burner air tube.

FIGURE 1 - Test Burner Information (Continued)

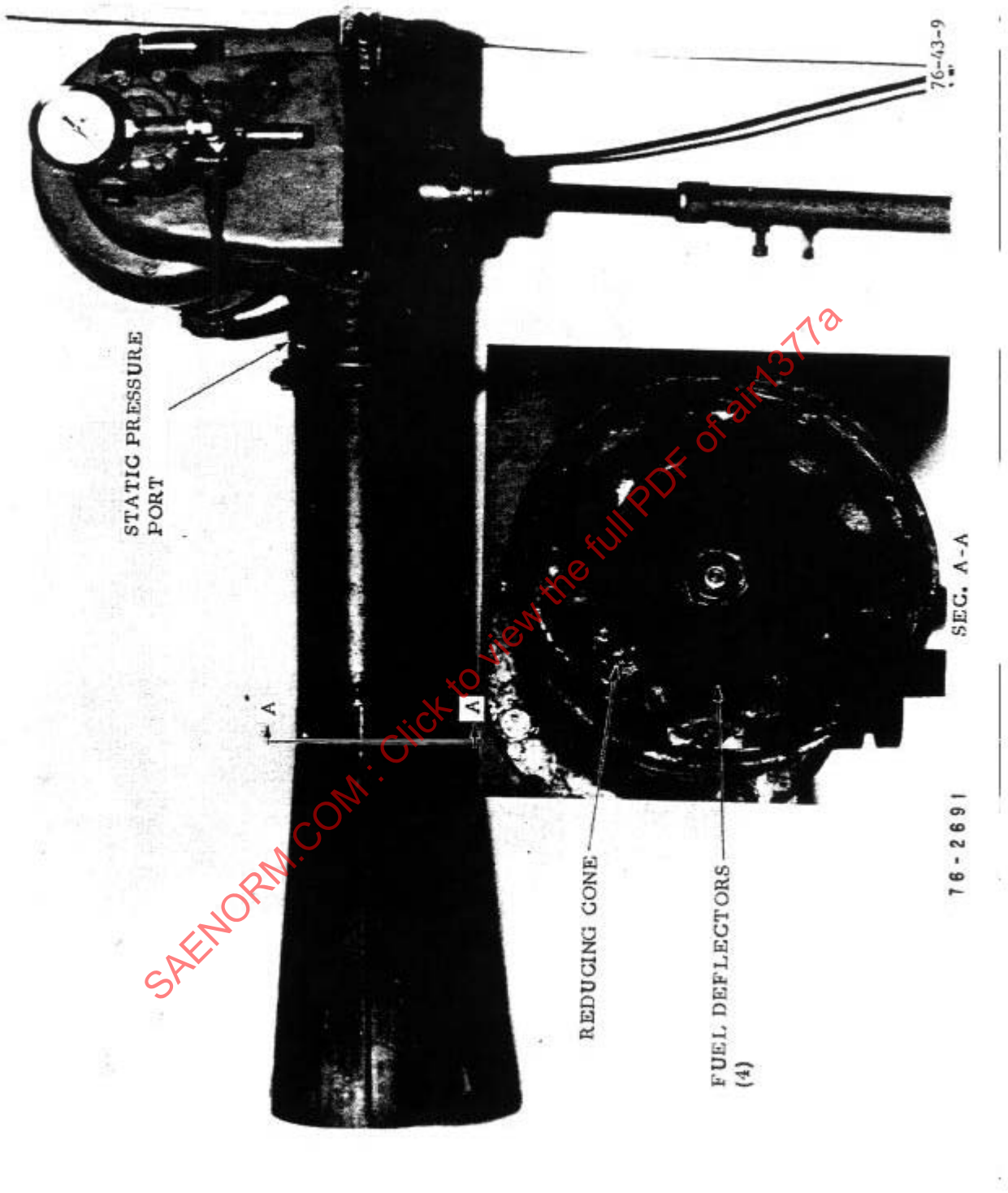


FIGURE 2A - Lennox OB-32 Conversion Oil Burner

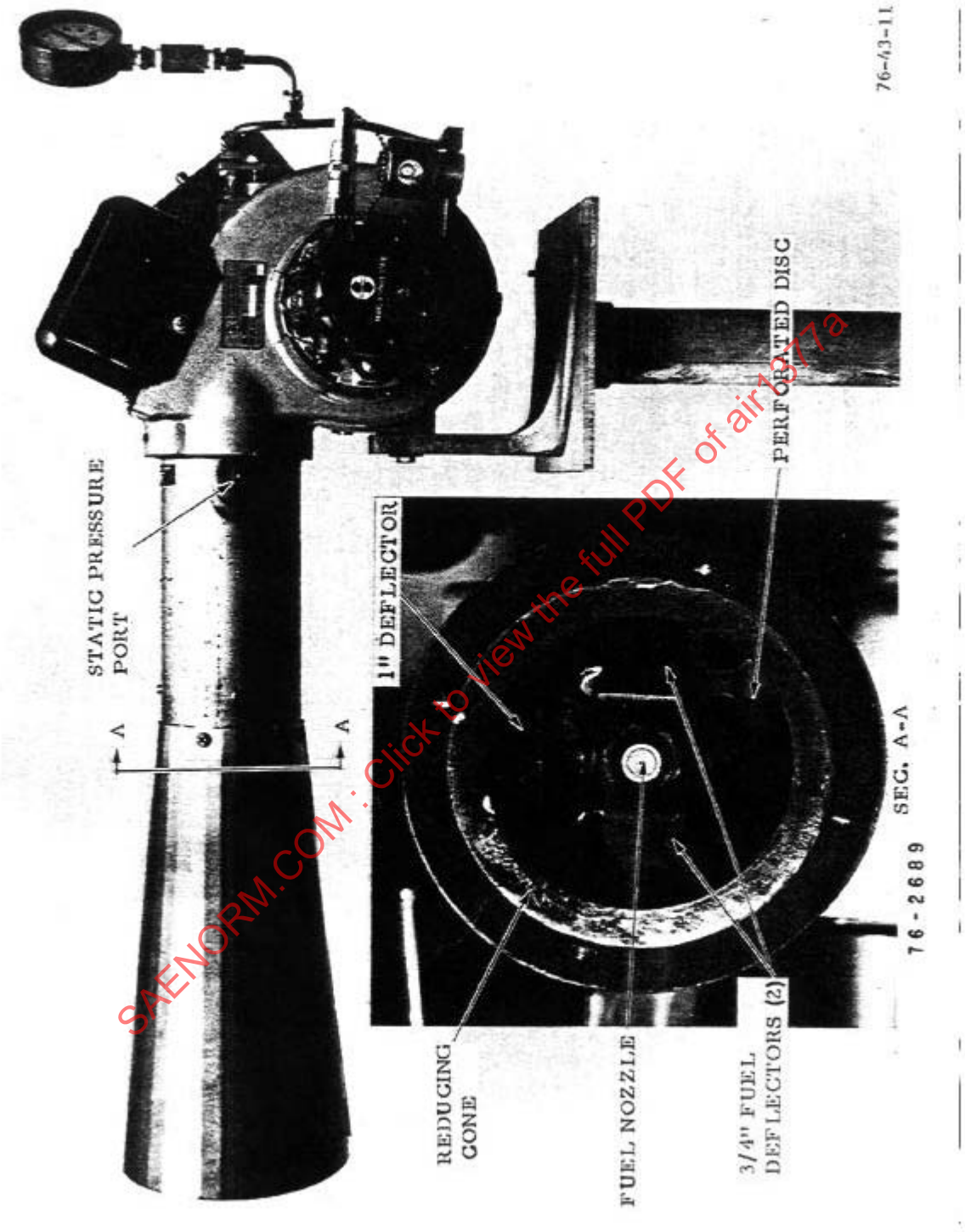


FIGURE 2B - Carlin 200 CRD Conversion Oil Burner

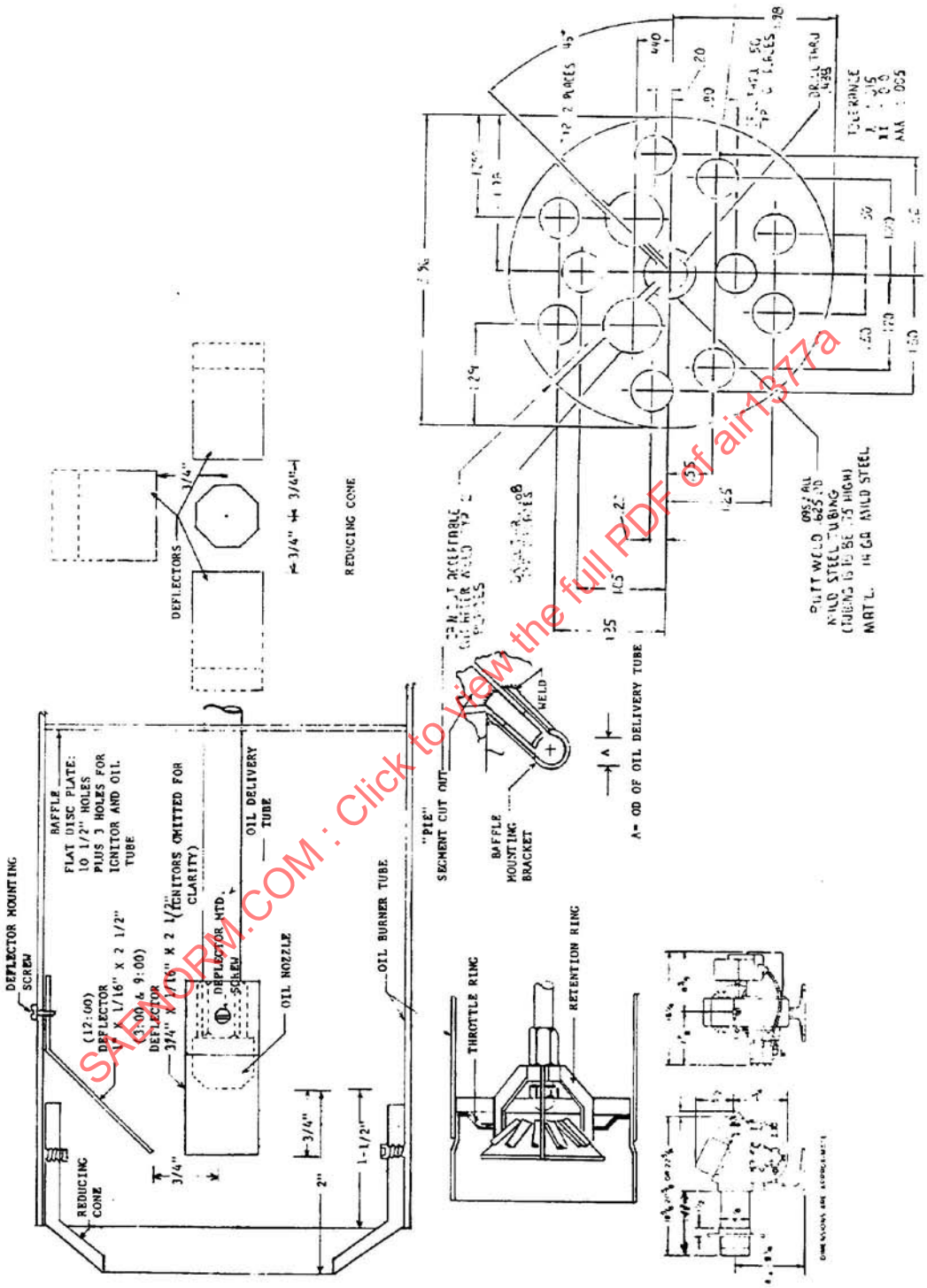


FIGURE 2B - Details

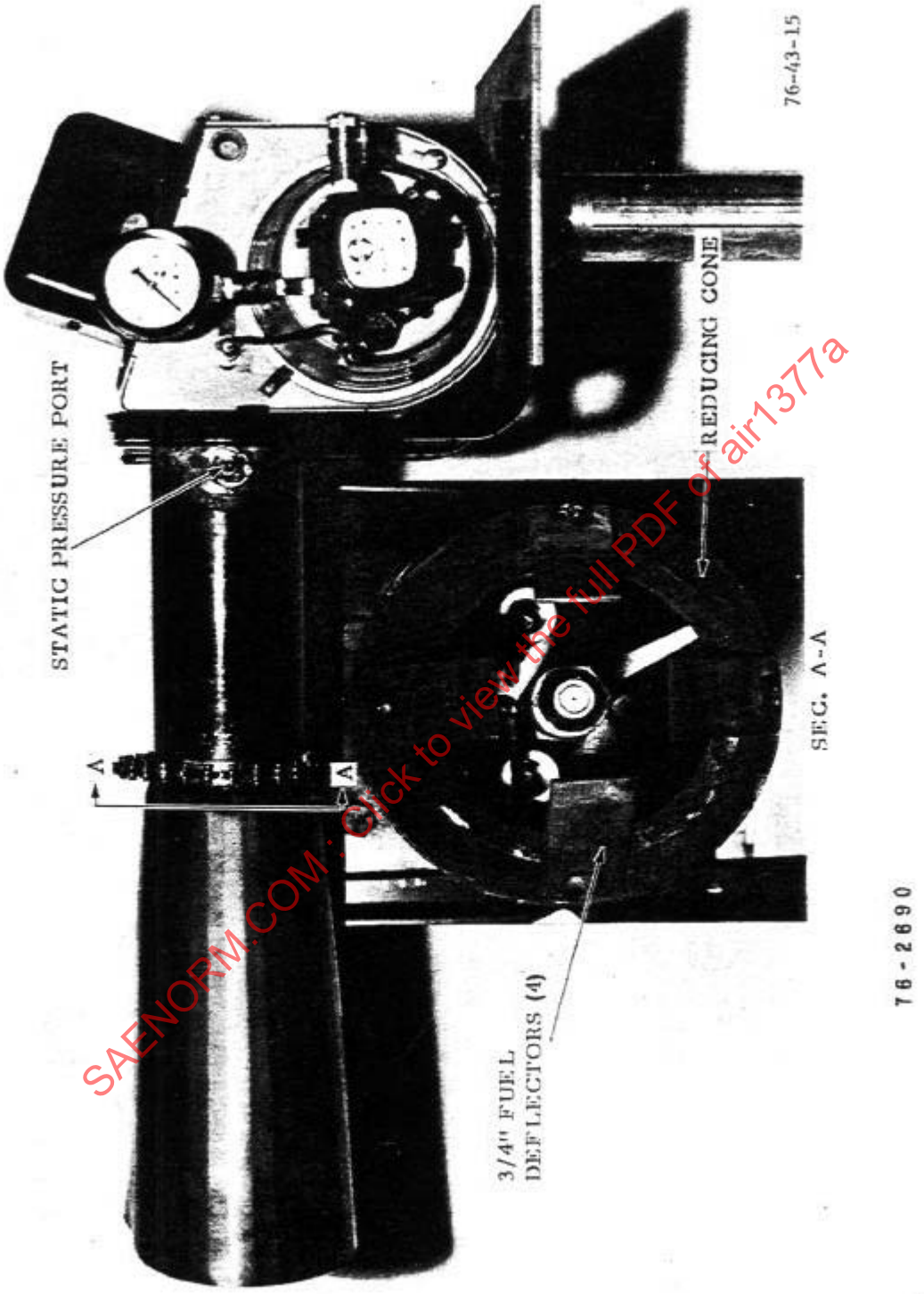


FIGURE 2C - Stewart Warner HPR-250 Conversion Oil Burner

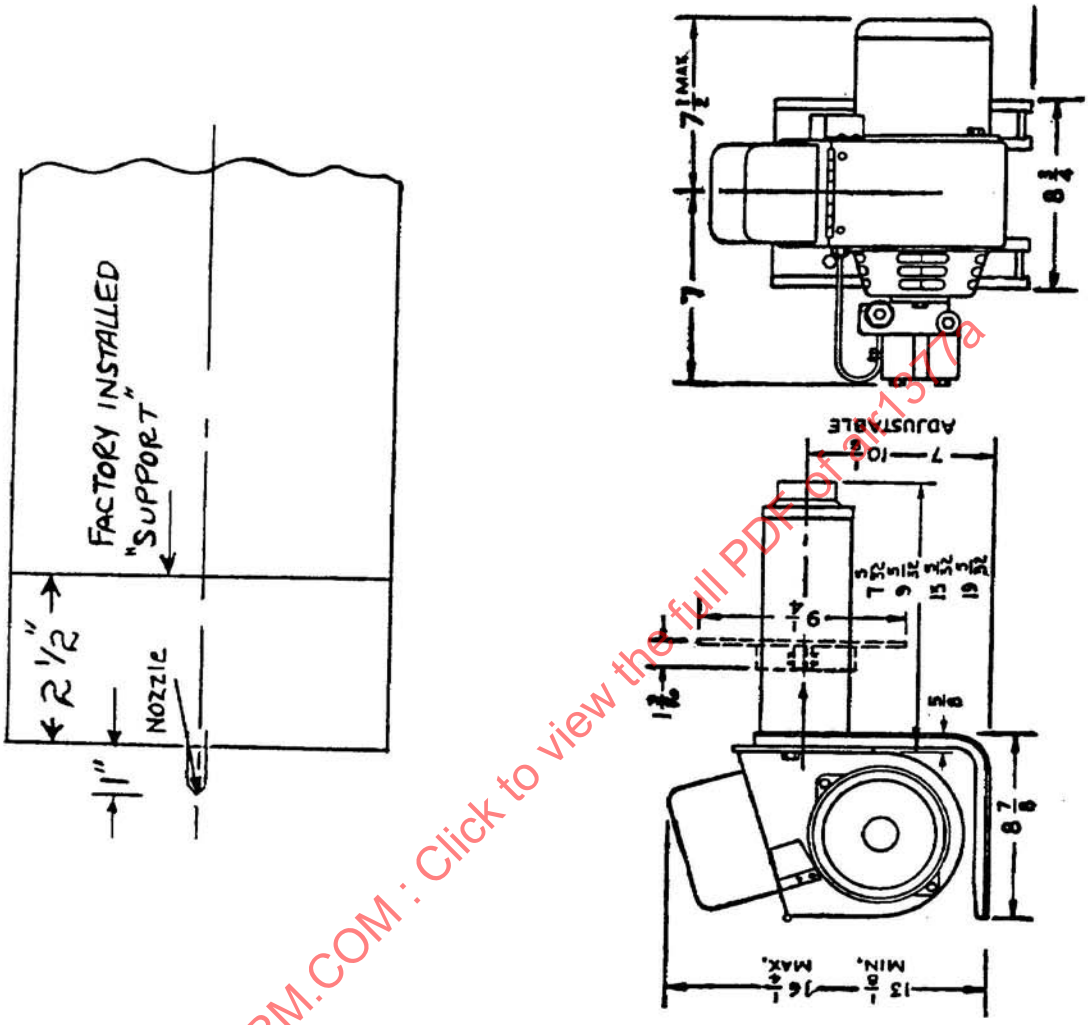


FIGURE 2C - Details

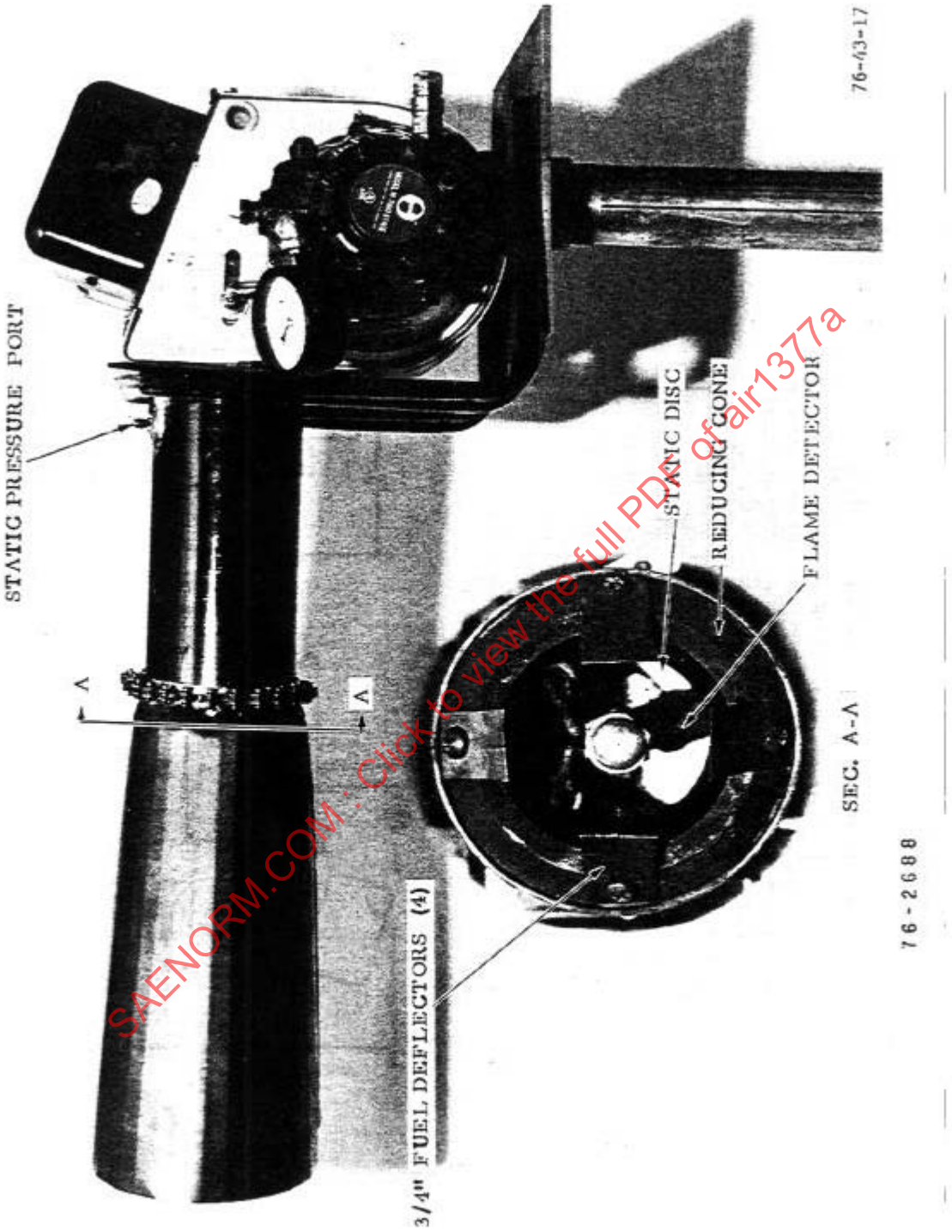


FIGURE 2D - Stewart Warner FR-600 Conversion Oil Burner

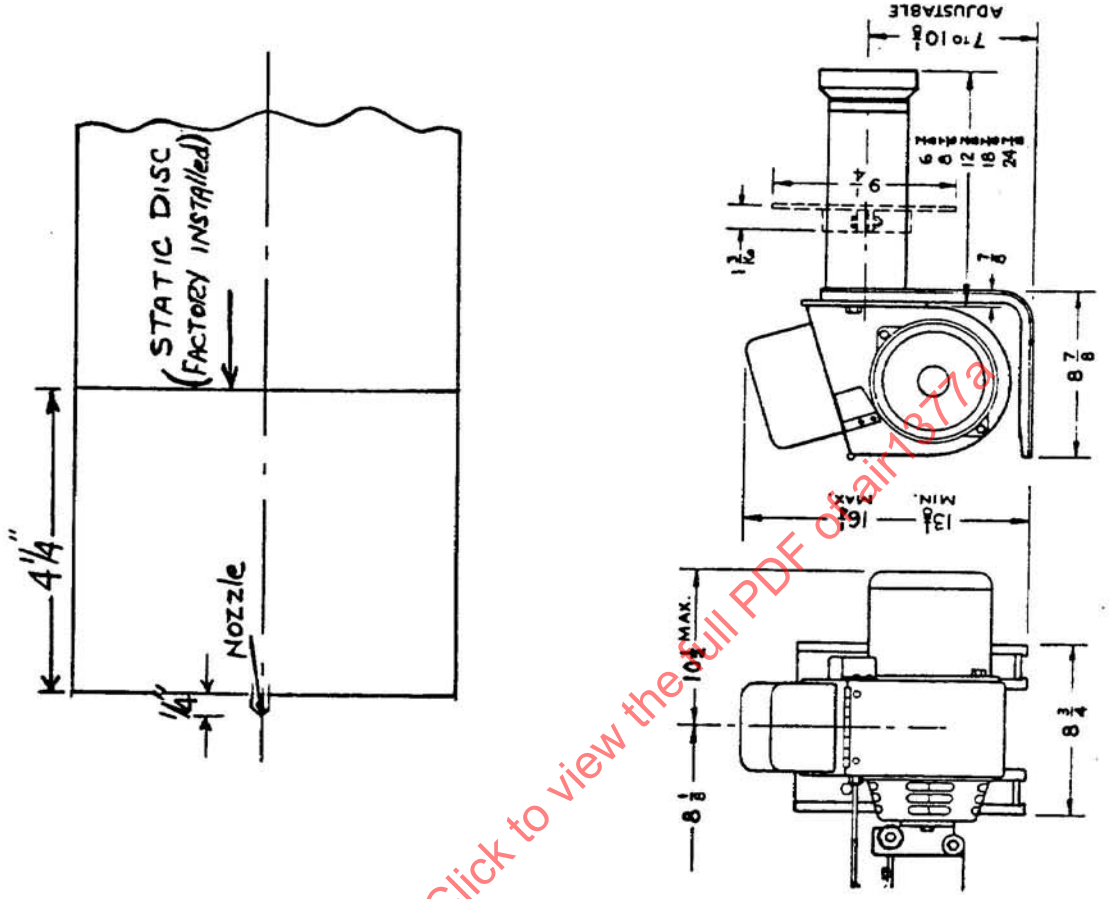


FIGURE 2D - Details

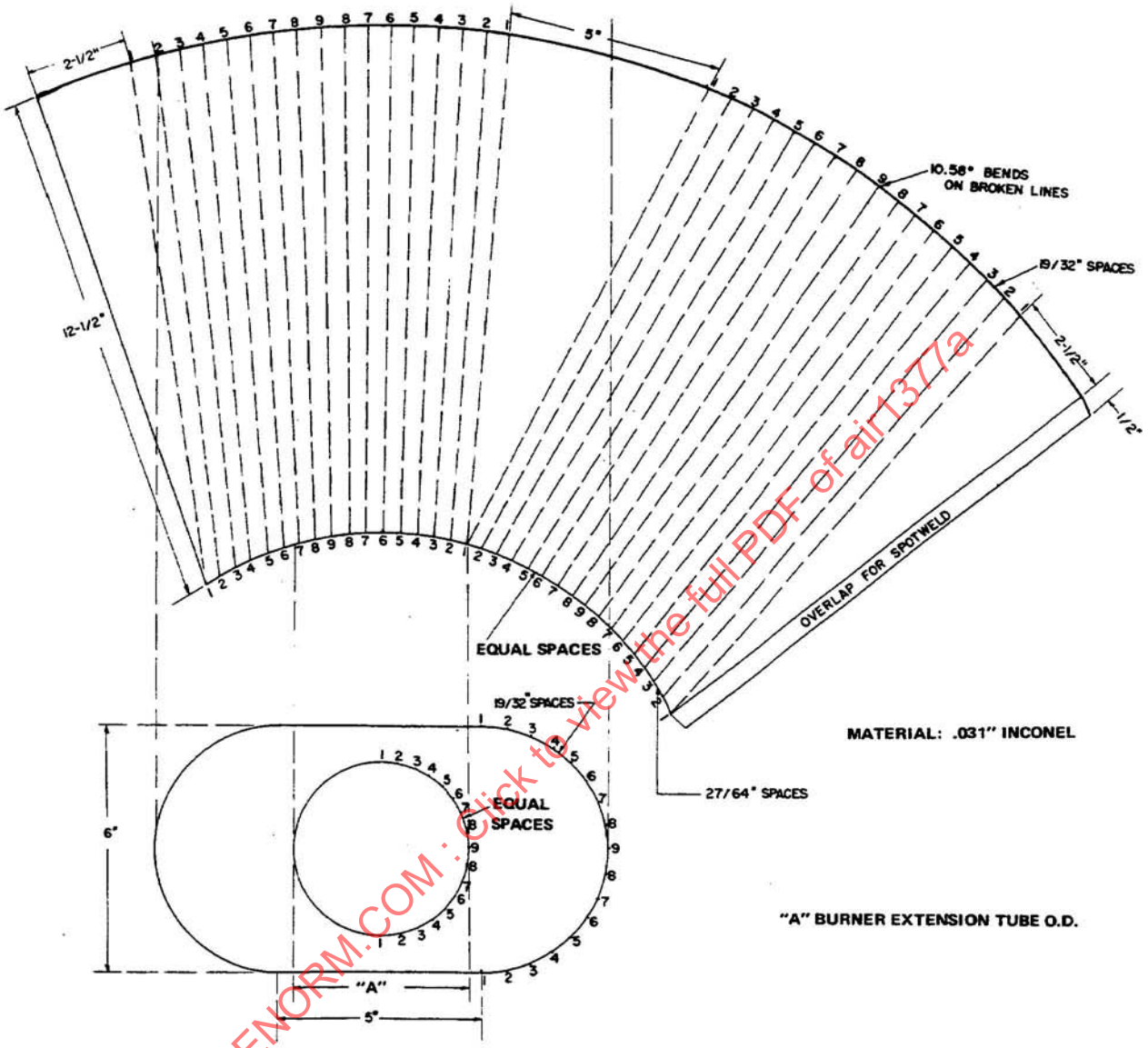


FIGURE 3 - Burner Tube Extension

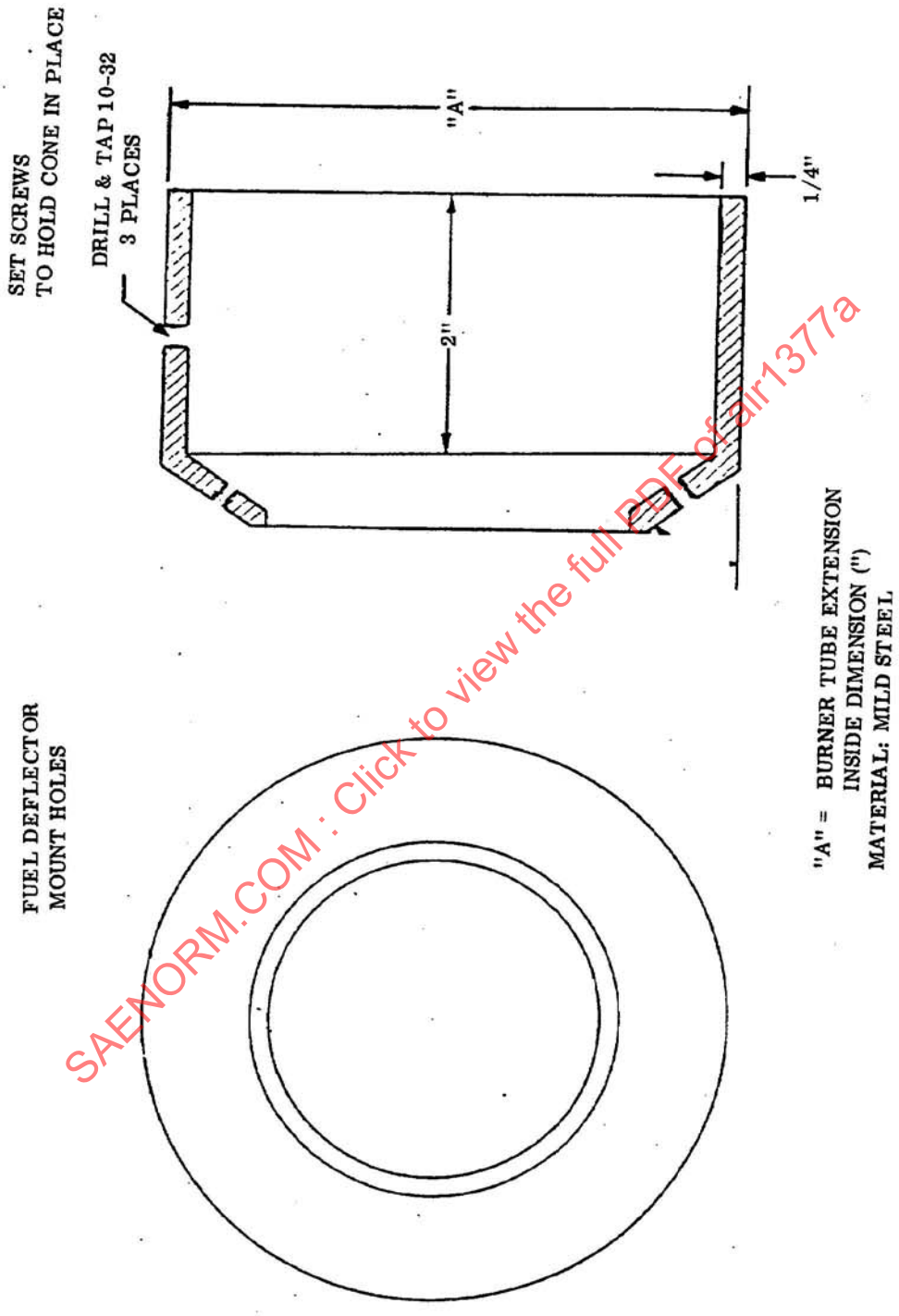


FIGURE 4 - Air Tube Reducing Cone

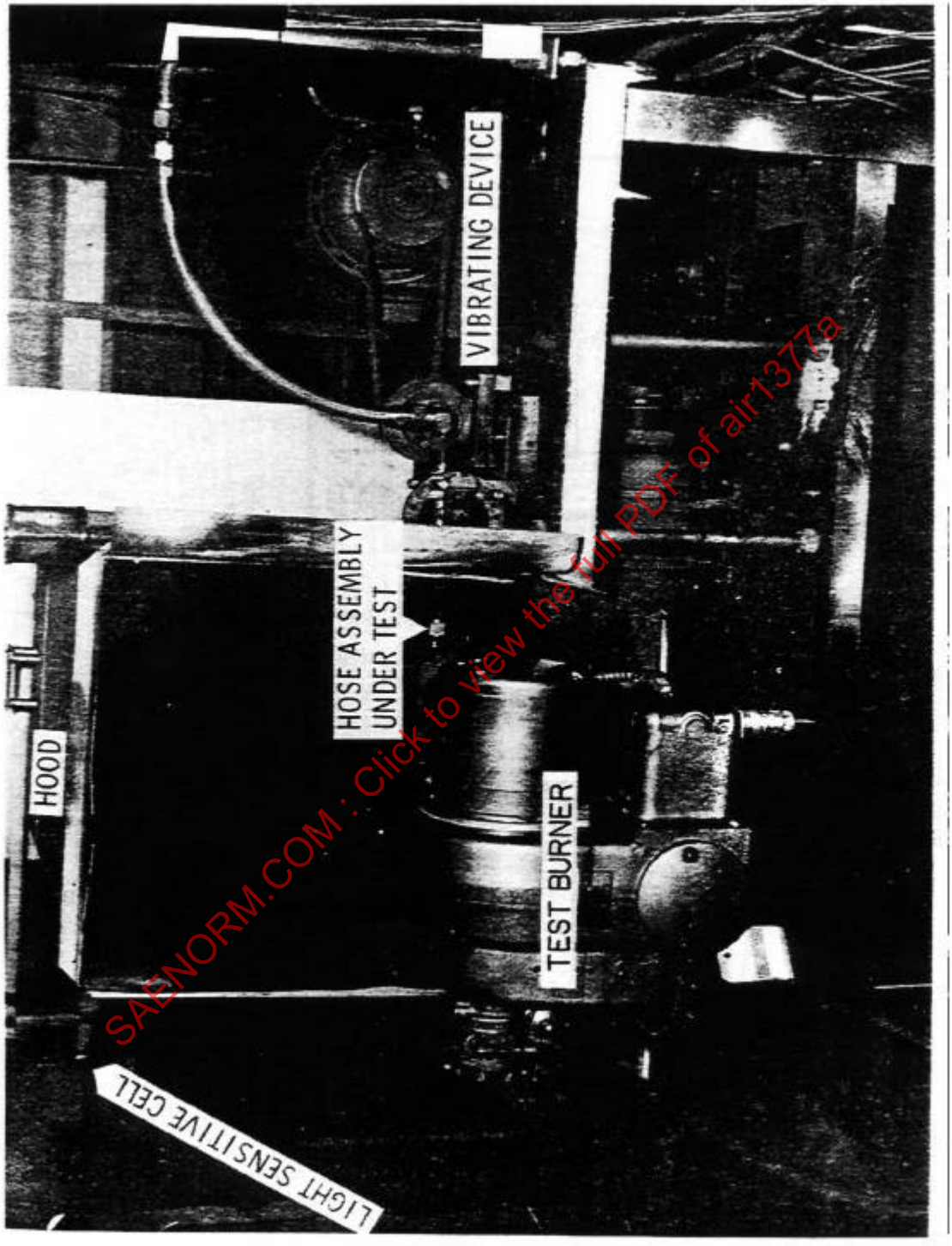


FIGURE 5 - Hose Assembly Test Bench

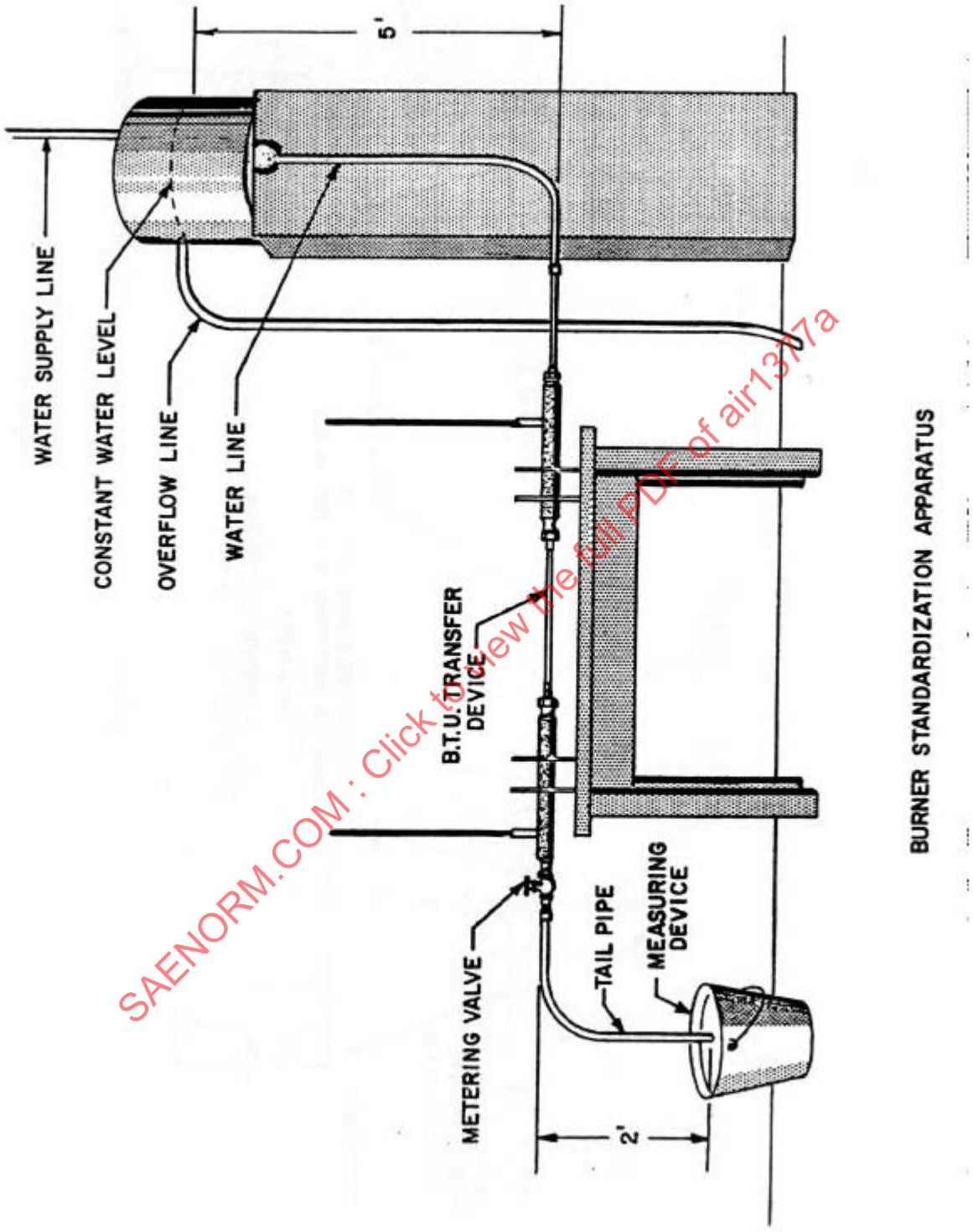


FIGURE 6

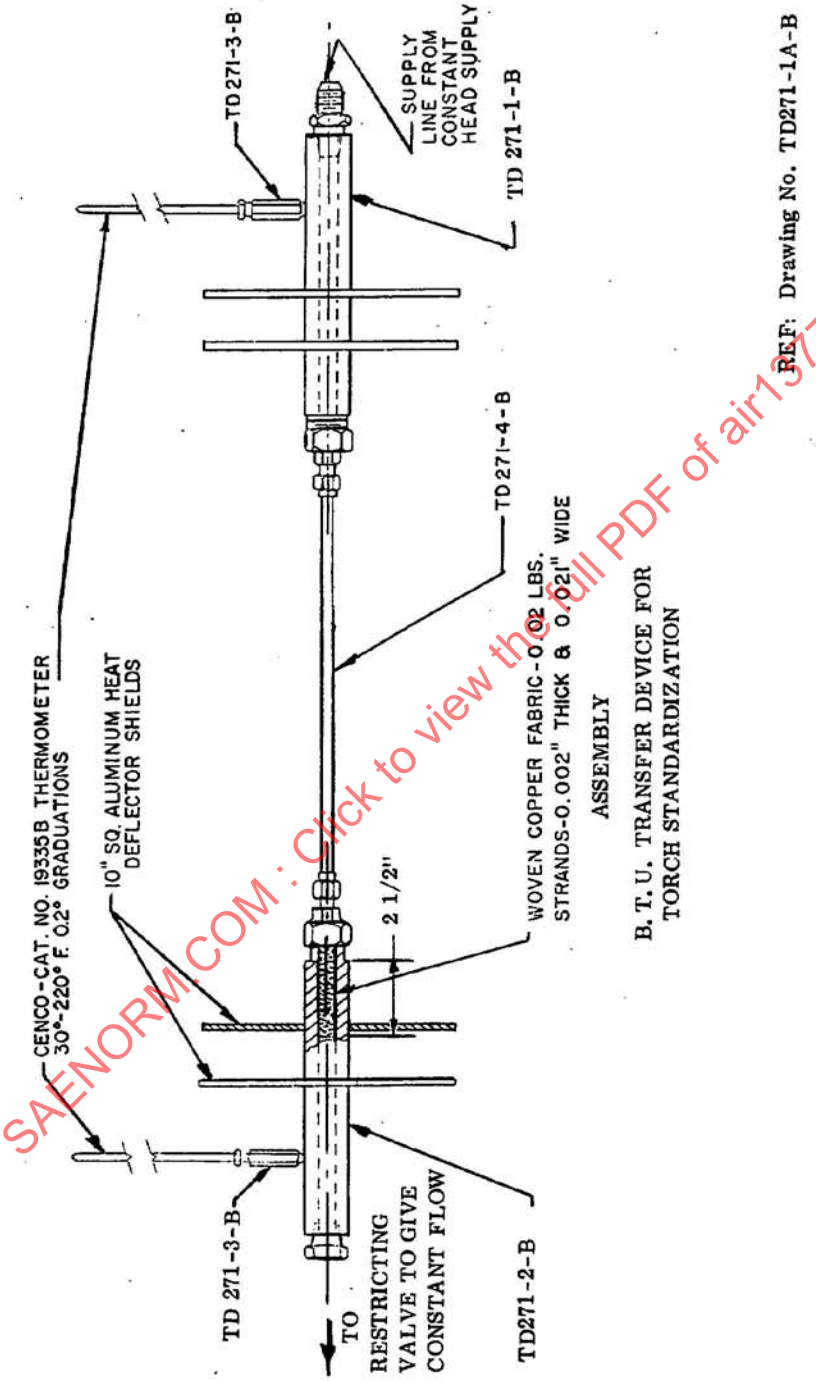


FIGURE 7