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Cessna

Cessna Aircraft Company
Wichita, Kansas

CONFIDENTIAL

Cessna

DESIGN AND CONSTRUCTION PROJECT

MODEL 309

CONDUCTED FOR

OFFICE OF NAVAL RESEARCH

UNDER

CONTRACT NONR 234(00)

ENGINEERING REPORT
NO. 1309-1

REPORT DATE:	NOVEMBER, 1951
PREPARED BY:	ALLYN HEINRICH
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APPROVED BY:	TOM SALTER

Cessna Aircraft Company
Wichita, Kansas

TABLE OF CONTENTS

SUMMARY

A Cessna Model 170A airplane was modified to receive a circulation control system in accordance with results as furnished from a research program conducted by the University of Wichita. The wing of the airplane was rebuilt from the 50% chord aft to contain an inboard suction slot and duct and connected to an outboard blowing slot and duct by means of a mixing tube which operated as a jet pump. An Airesearch gas turbine compressor was operated as a bleeder compressor to furnish air to a combustion chamber. The hot gases of combustion were ducted to a series of nozzles at the entrance to the mixing tube where the action of the high speed gases pumped air from the inboard suction slot through the outboard blowing slot.

The design problems produced by the installation of a circulation control system did not prove too severe. Wing structure was not seriously altered and did not reduce the strength characteristics or fuel capacity. The external appearance of the airplane was modified only very slightly. While the installation of the gas turbine compressor was entirely experimental no undue problems were encountered and an operating system has been achieved.

Preliminary flight tests have indicated that the system possessed considerable promise from the standpoint of minimum speed performance and increase in controllability. A total of 5 flights have been made demonstrating the airworthiness of the airplane and indicating the type of operations which will be required for a detailed flight test program.

INTRODUCTION

In January of 1951 the Cessna Aircraft Company was awarded a contract by the Office of Naval Research to design and construct a circulation control airplane following the aerodynamic results which were secured by the University of Wichita. Since January of 1949 the University of Wichita has been conducting research on the problems of low speed flight and conducted a series of detailed tests on a reflection plane model at full scale Reynold's numbers. This model was a one-half scale model of the wing of a Cessna Model 170A airplane which had been equipped with suction and blowing slots to provide boundary layer or circulation control. The purpose of the Cessna contract was to: (1) Explore the design problems of incorporating a circulation control system in an actual flight airplane, and (2) To conduct initial flight tests to demonstrate the operating characteristics.

One of the initial goals of this project was economy. The Cessna 170A airplane was chosen for both the wind tunnel and flight program since it would require the modifications of an existing airplane rather than the design of a new aircraft. Also, the problems of installation on a small unit would be considerably less than on a large high performance airplane.

The design procedure was carried on in the Cessna Aircraft Company Engineering Department utilizing the regular personnel who ordinarily perform design work for commercial and military aircraft. The procedures and practices followed in this project differed but little from those followed by the Cessna Aircraft Company in producing other aircraft. The ease with which this system could be installed was felt to be a measure of its utility and considerable attention was paid to retaining the external and internal appearance of the aircraft as closely as possible to the commercial version. The final goal was to secure an airplane which would have the same performance and pay load as the standard commercial aircraft but to superimpose on this unit the performance at low speed as promised by the wind tunnel tests.

DESIGN AND PROCEDURE

The circulation control system as installed in the Cessna Model 170A is shown in Figure 1. (Note: This is a figure which shows the schematic installation of the BLC system) In the circulation system as proposed by the University of Wichita (Reference 1) air is drawn in through a suction slot at the juncture of a plain flap and the body of the airfoil. The entrance to the slot at the juncture of the plain flap and wing is varied in cross-section to regulate the flow quantity and maintain uniformity along the span of the suction flap. The air is drawn into the suction duct which converges into a 4-3/4 x 7 elliptical cross-section mixing tube where the pumping of the jet pump occurs. In the mixing tube the suction air mixes with the high velocity gases which are issuing from four stainless steel nozzles and is diffused into the blowing duct outboard of the mixing tube. From the blowing duct air is discharged through a slot, as shown in cross-section on figure 1, over a modified NACA type 2H slotted flap which is deflected down at 45°. From station 100 to station 139.6 the

DESIGN AND PROCEDURE (Continued) - blowing flap is coordinated with the suction flap while from station 140.125 to station 207 the slotted flap is arranged to be moved as an aileron with differential linkage.

Table 1, which is a list of drawings which were released to the shop for the actual construction furnishes a complete picture of the individual projects which were required.

STRUCTURAL CONSIDERATIONS - All ducting for internal air flow as well as the jet pump was contained in the wing aft of the 50% chord point. The original wing structure of the Cessna Model 170A consisted of a front spar which carried the wing bending load, an .020 aluminum skin which formed a torsion box, and the rear spar which completed the torsion box and transmitted the torsion and drag loads to the fuselage. The wing bending load, carried entirely by the front spar, was the only critical load which was placed upon the wing and modification from the 50% chord aft produced no change in this critical structure. The stresses from torsion and drag loads were adequately carried by the remaining structure forward of 50%.

A new spar was located at the 50% chord point running straight from the wing root to the tip. Lightening holes were eliminated in this spar to permit it to serve as the forward wall of the blowing and suction chamber. The rib structure and skin between the rear and front spar remained essentially the same as the 170A. Some modification of structure was required to permit the fuel tank to extend further in the spanwise direction.

The rear spar, wing skin, and ribs were used wherever possible to form the air ducts to eliminate the need for auxiliary structure. In nearly every case it was possible to have duct components serve as structural members. The basic structure aft of the rear spar consisted of: an .091 magnesium skin, root rib, station 100 rib, tip rib, and the suction and blowing slot beams. Control surface loads and air loads in this area are carried forward to the rear spar by the ribs and the relatively thick skin. The skin was selected to withstand internal pressures up to one pound per square inch. This pressure has not been encountered in preliminary tests and lighter skin gauges can be used for later aircraft where more accurate determination of internal pressures can be secured.

The external wing strut was retained as on the commercial airplane.

Relocation of the rear spar from 75% to 50% chord required a modification of the fuel tanks. The standard tank was cut off

STRUCTURAL CONSIDERATIONS (Continued) - at the 50% chord point with an additional tank being placed immediately outboard from the original installation. The total fuel capacity in both panels was increased from the commercial value of 40 gallons to approximately 50 gallons for the circulation control airplane.

No proof load was run on the completed wing structure since modifications were of a secondary nature and did not affect the primary structural assembly.

AILERONS AND CONTROLS - The 25% chord ailerons extending from station 140.125 to station 207 were of the slotted flap configuration. The leading edge of the aileron as well as the leading edge of the blowing flap were circular arcs with a center at the hinge point. The hinge point was so located that the upper surface of the leading edge of the aileron remained tangent to true airfoil contour as the aileron was deflected downward.

The ailerons were formed of a two-piece .020 aluminum skin with rolled leading edge and formed trailing edge. The skin carried the torsion load with the bending load being carried by an .025 formed spar. The skins were lapped at the spar. The aileron was hinged at inboard and outboard ends with push-pull control rod attaching at the outboard end. This location of the push-pull rod was necessary to avoid passing through the blowing chamber with the surface controls.

The aileron control system within the wing consisted of two cables, just forward of the rear spar, running from the fuselage to a bellcrank at the wing tip. A push-pull rod connected from the bellcrank to the arm on the aileron.

BLOWING FLAPS - The division of the wing into a blowing flap and suction flap panels was determined on the basis of proper blowing and suction coefficients as determined by the University of Wichita. To produce the proper areas a blowing flap of the same configuration as the aileron extended from wing station 100 to wing station 139.6. This blowing flap was actuated simultaneously with the suction flap with a maximum deflection of 45°. No differential control was provided for this blowing flap section.

The blowing flap with .020 aluminum skin and ribs was hinged at the inboard and outboard ends using the same wing hinge bracket at the outboard end as the inboard end of the aileron. Construction and design details of ailerons and flap systems can be secured from drawings 12309-1, 12309-4 and 12309-5 as contained in the appendix to this report.

SUCTION FLAP - The suction flap of plain flap type was hinged at the lower surface of the airfoil contour with a piano type hinge. This flap as shown in drawing 12309-1 consisted of: an .025 skin for torsion loads with eight .020 ribs, and an .025 formed nose skin. The suction slot is closed when the flap is in zero position and open to its maximum value when the flap is deflected 45°. The leading edge of the flap and the trailing edge of the airfoil are designed to form the most effective entrance to the suction slot when the flap is deflected. The flap control system was connected to the inboard end of the suction flap with an interconnection from the suction to the blowing flap at the outboard end of the suction flap. The flap control cable from the fuselage passes over a pulley attached to the root rib and is then connected to a bellcrank which actuates the pushrod to the flap. The flap is spring loaded to return to the UP position.

INTERNAL DUCTS AND SLOTS - The airduct from the suction slot consisted of aluminum walls which converged to the entrance of the mixing tube of the jet pump. Zinc chromate sealing compound was placed in the joints between all duct walls and wing skins to prevent air leakage during operation of the circulation control system. The structure of the wing at the juncture of the flap and wing was preserved by trussing small aluminum tubes across the suction slot opening. The flow into the suction duct was regulated by a variable restriction which was determined from tests on a wooden mockup of the suction chamber. The flat plate type of restriction proved to be more efficient than an internal arrangement of guide vanes.

The walls of the suction duct terminated in a formed aluminum 4-3/4 x 7 elliptical cross-section of the jet pump. This tube 30 inches long provided the necessary length for the mixing of the high energy hot gases with the secondary air. A short diffuser at the outboard end of the mixing tube exhausted into the blowing duct which extended for the entire length of the blowing flap and aileron. Aluminum stay rods were spaced spanwise in the blowing chamber to stiffen the .091 magnesium skins against the internal bursting pressure. Both the suction and blowing ducts were decidedly overstrength as the result of the use of this thick skin and material. Weight reduction can be made by reducing this skin gauge in subsequent models.

The air was ejected from the blowing duct through a slot, which was formed with a gradual converging entrance, over

INTERNAL DUCTS AND SLOTS (Continued) - the upper surface of the blowing flap and aileron as shown in Figure 1.

The width of the blowing slot was first designed as 1.2% of the local airfoil chord. This figure as furnished by the University of Wichita was predicated upon estimated performance of the jet pump. When the jet pump performance of the jet had been more specifically determined the blowing slot width was altered to a value of a .747 percent. The tear drop which formed the lower surface of the blowing slot served as a structural beam at the trailing edge of the airfoil body. This beam was connected to the upper skin by a series of short spacers located at intervels of approximately 5-1/4 inches which governed the width of the blowing slot.

GAS TURBINE AND JET PUMP INSTALLATION

The air which was required to be circulated through the suction and blowing slots was pumped by an induction type pump utilizing hot combustion gases. This induction pump known as a hot jet pump had been developed in an experimental program conducted by the University of Wichita. The design data furnished by the University of Wichita specified a jet pump with four driving nozzles, an L/D ratio of 6, and a mixing tube area of approximately 26 square inches. The outlet of the driving nozzles was to lie in the entrance to the mixing tube with the actual nozzles designed and constructed at the University of Wichita.

Complete test data on the jet pump is available from the University of Wichita. (Reference 2)

The primary fliud for the jet pump consisted of compressed air which had been passed through a combustion chamber in which gasoline had been burned. The temperature of the products of combustion was regulated by controlling the quantity of gasoline.

The compressed air from the aircraft was furnished by an Airesearch Gas Turbine Compressor Model GTC 43/44-7. This gas turbine compressor which weighed 156 pounds was located in the rear compartment of the fuselage, occupying the space normally occupied by the rear seat. The turbine was installed with the axis of the turbine skewed at an angle of 15-1/2 degrees to the longitudinal axis of the airplane. The tailpipe extended from the turbine end of the enclosure at an angle of approximately 28 degrees to the side of the fuselage exhausting through an elliptical opening just forward of station 140. The complete turbine installation is shown in drawings 12309-7 and 12309-8.

INTERNAL DUCTS AND SLOTS (Continued) - the upper surface of the blowing flap and aileron as shown in Figure 1.

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The tanks in the left hand wing panel were connected as a turbine fuel supply. A shut-off valve and strainer were provided in the fuel system before the fuel line was connected to the fitting on the turbine enclosure. The turbine contained its own fuel pump with an external connection for fuel pressure indications. This fuel pump pressure was utilized to furnish the fuel for the burner chamber with the fuel quantity being regulated by an orifice located in the fuel line to the burner chamber.

The Airesearch gas turbine compressor was a completely self-contained unit with the exception of fuel supply and electrical current. The electrical supply was furnished by a 24-volt battery located in the turbine compartment. Since the airplane normally operated on a 12-volt system this battery was independent of the airplane's regular electrical system.

The turbine operation was controlled from a small panel in the pilot's compartment which contained a turbine starting switch, a turbine stop switch, and signal lights for proper turbine operation and fire warning.

The compressed air from the turbine compressor unit passed through a venturi choking nozzle, which limited the maximum bleed output below the safe limit for the compressor unit, through a butterfly valve into the burner chamber. From the burner chamber two inch stainless steel tubes divided into each wing panel and carried the hot combustion gases to the four stainless steel nozzles at the entrance to the mixing tube in each panel. The fuel supply and ignition for the burner chamber were controlled from a single switch on the turbine control panel. The burner chamber was copied after a regular gas turbine burner chamber with the necessary modification to include it into the system as required. An inner perforated liner surrounded by an outer solid shell patterned after conventional gas turbine burner construction gave satisfactory performance on all flights. The burner chamber and the stainless steel tubes leading the jet pump nozzles were covered with an insulating blanket as furnished by the John Foster Company. This blanket of thin stainless steel foil effectively insulated the hot surfaces, which carried gasses up to 1600°F., from the adjoining structure and no overheating has been noted in the hot gas system to date.

A firewall was erected both behind the turbine and ahead of the turbine installation. The firewall behind the turbine consisted of a sheet of aluminum which was fastened to the bulkhead at station 108. The firewall ahead of the turbine was located to just clear the pilot's seat when in the completely aft position. This firewall was designed to accommodate the burner chamber and was heavily insulated with glass wool and fiberglass cloth. Turbine instruments were mounted in a panel on this firewall so that they would be visible to ground test observers. The pilot was unable to observe these instruments while in flight. A handle for controlling the butterfly valve position projected through the firewall within easy reach of the pilot so that he could adjust the bleed output of the turbine at any time in flight. Tailpipe temperature, turbine oil temperature and turbine RPM were indicated on the instrument panel and visible to the pilot at all times.

The fire extinguisher system consisted of a CO_2 bottle installed to deluge the area around the burner chamber and the turbine enclosure. This system was to be operated manually upon the indication of the fire warning signal or other visible evidence of fire.

PRELIMINARY FLIGHT TEST

The first five flights were made with the regular 170A and the GTC instrumentation only. These flights were conducted principally as shakedown flights to substantiate the airworthiness of the airplane. No unusual flight or structural characteristics were found. The airplane was considered ready for extensive flight testing with the additional requirement of further instrumentation.

Actual landing take-off distances were not measured. They will be measured, however, in later tests when the pilot is thoroughly acquainted with the flight characteristics of the airplane.

PILOT REACTIONS

All of the following comments pertain to the aircraft with full flaps, aileron drooped, and circulation control operating. When reference is made to power off or power on, this pertains to the main thrusting engine.

The following stall true indicated air speeds have been measured in flight. Power off, 41 mph; power on, 37 mph. These correspond to lift coefficients of 2.79 and 3.42, respectively. Difficulty exists in reading stall speeds at this low value and differences of 1 mph produce significant changes in lift coefficient. In this speed range, 1 mph corresponds roughly to a lift coefficient of .16.

PILOT REACTIONS (Continued)

A flight has been conducted very close to the ground (about one foot altitude) at an indicated air speed of about 40 mph. No unusual flight tendencies were noticed although the airplane appears to be more sluggish in control response than a normal aircraft. This is not surprising since the controls on the airplane are those of the regular commercial version. Very little power was required to maintain flight under this condition (about 30%). An increase in power would have caused the airplane to climb if air speed were maintained constant.

The pilot is finding it difficult to establish high rates of sink at low air speeds. Maximum rates of sink are being encountered at indicated air speeds of about 70 mph. This verifies the tunnel data which indicated that relatively high L/D values could be secured in this configuration.

Stick force gradients are stable in both power off and power on, configurations, although somewhat less stable with power on. Control forces are light but not excessively light in view of the C. G. location at approximately 31 percent MAC. Aileron control forces are so light that they are almost completely masked by the friction in the control system.

Some evidence exists that the lateral stability may be very poor with full flaps and circulation control. This will have to be determined by detailed flight tests with particular attention paid to aileron position, rate of roll, and angle of bank.

The flow coefficients which are being secured are comparatively low and distribution along the blowing slot should be improved. Blowing velocities of about 120 mph are being secured over the aileron but poor distribution exists over the inboard blowing flap. Pumping capacity for the jet pump improves only about one-third when the burner is turned on as compared to that of using the compressed bleed air only. No effects are noticed when the burner is turned off in flight but a distinct sensation of loss of lift occurs when the turbine is shut off. This sensation of loss of lift is similar to that which occurs when raising a flap but of much shorter duration.

No take-off distances have yet been measured but the pilots reaction is that the distance is extremely short and that continued experience will permit additional improvement by proper piloting technique.

PILOT REACTIONS (Continued)

As a summary statement, the pilot has stated that he has not encountered any conditions in flight which he would classify as dangerous. No attitudes have been encountered which cannot be relieved by ordinary control.

The above statements, in some cases, are not based upon actual data but more upon impressions and reactions.

CONCLUSIONS

The objective of this contract, which was to design and construct an airplane incorporating a circulation control system and to conduct preliminary flight tests, has been successfully attained.

1. The test airplane performed the same as the commercial counterpart (Cessna Model 170) when flown with the circulation control system not operating.

2. When flown under slow-flight conditions with the circulation control system operating, the test airplane was under complete control of the pilot and no adverse characteristics were evident. The aileron affectiveness was good through the stall and elevators were sufficiently effective to execute three-point landings. Apparently the down wash from the flaps was sufficient to counteract the increase in pitching moment obtained at the high lift values.

3. A definite reduction in take-off and landing distance was observed with the circulation control system operating.

4. A definite reduction in stalling speed and increase in climb angle with the circulation control system operating, was observed.

5. The incorporation of the circulation control system into the airplane presented no unusual design problems which could not be solved with standard airplane design practice.

6. No compromise was made with the structural integrity of the airplane in providing for this system.

7. The weight increase (15.5% of the normal gross weight) resulting from the circulation control system was considerably higher than necessary due to the research aspect of the

CONCLUSTIONS (Continued) - project. With the use of more favorable materials from a weight standpoint and an improved pumping method, a carefully designed system could be installed for approximately 5% of the normal gross weight.

8. Considerable flight testing will be required to provide specific information and to point up needed revisions to improve the system.

RECOMMENDATIONS

1. Other pumping methods should be investigated, developed, and tested to obtain a more efficient system both from a weight and air quantity standpoint.

2. Based on the information obtained from the detail flight test program, an "On Purpose" airplane should be designed, constructed and tested. This airplane would incorporate an optimum wing design for the circulation control system, an improved pumping system, and an improved circulation system for more effective circulation control.

REFERENCES

1. Razak, Kenneth, Razak, Virgil, and Bondie, Jr., R. J.: Wind Tunnel Investigation of a Method of Boundary-Layer Control as applied to a Reflection-Plane Model at Full-Scale Reynolds Number. University of Wichita Engineering Report No. 032, Wichita, Kansas, June 1951.

2. Snyder, Mel H. and Rostrelli, L. V.: A Progress Report on Jet Pump Research Conducted at the University of Wichita. University of Wichita Engineering Report No. 049, Wichita, Kansas. August 1951.

DRAWING LIST

Drawing No.	Title	Date Rel.	Change
12309-1	Aileron and Flap Assembly	10-15-51	D
12309-2	Hexcel Skin L.O.	INACTIVE	
12309-3	Structure Assembly - Wing	10-15-51	B
12309-4	Controls - 309 Flap System	10-15-51	A
12309-5	Controls - 309 Aileron System	6-12-51	N/C
12309-6	Compressor and Burner Ducts	10-15-51	B
12309-7	Turbine Installation	10-15-51	D
12309-8	Turbine and Burner Controls	10-15-51	A
12309-9	Shell - Outer Burner	6-12-51	N/C
12309-10	Liner Assembly - Burner	6-12-51	N/C
12309-11	Adapter - Nozzle	INACTIVE	B
12309-12	Suction Slot - Mock Up	6-12-51	N/C
12309-13	2412 Airfoil - Tip	10-15-51	A
12309-14	Jet Pump Assembly and Installation	6-12-51	N/C
12309-15	Fuel Tank Installation	6-12-51	N/C
12309-16	Fuselage Spar Installation & Cabin Reinforcement	6-19-51	N/C
12309-17	Union Assembly - Fuel Restrictor	8-1-51	N/C
12309-18	Union Assembly - Pressure Line Restriction	8-1-51	N/C
12309-19	Elbow Assembly - Pressure Line Restriction	8-1-51	N/C
12309-20	Schematic - Fuel System	10-29-51	A
12309-21	System - Burner Electrical	8-1-51	N/C
12309-22	Adapter - Blowing Slot	8-14-51	N/C
12309-23	Three View - Model 309	10-15-51	N/C
12309-24	Valve Installation - Bleed Air	10-15-51	A

REFERENCE MANUALS

Air Research Operation and Service Instructions Report 3-66	6-9-51	N/C
Air Research Model Specification Gas Turbine SC 242 Compressor	6-9-51	No. 2
Air Research Installation Manual Gas Turbine Compressor Unit	6-9-51	No. 1
Air Research Valve (installation outline) 92750 3 inch shut-off	8-31-51	
Air Research Model Specification Gas Turbine SC 242 Compressor Model GTC 43/44-5 and Model GTC 43/44-7	7-16-51	Rev. 3

LIST OF FIGURES

APPENDIX

PARTIAL WEIGHT BREAKDOWN

Model 309

The following list contains the weight breakdown of the airplane into weights of major components, major installation, and empty airplane weight. The airplane empty weight is compared to the 170B and the gross weight is considered to be the same as the 170B, which is 2200 pounds.

	Item	Remarks	WT. LB.
Airplane			
	Model 309	Empty	1530
	Model 170B	Empty	1190
		Total Increase	340
Wing			
	Model 309	One panel - complete	156
	Model 170B	One panel - complete	119
		Increase per panel	37
	Strut		11
Fuselage			
	Model 170B	Fuselage - ready for structural modification and system installation	906
	Air Supply System	Includes controls and minimum required instrumentation	273
	Structure	Additional required for fuselage modification	17
	Model 309	Includes empennage and complete system installation	1196
		Total weight of installation	290

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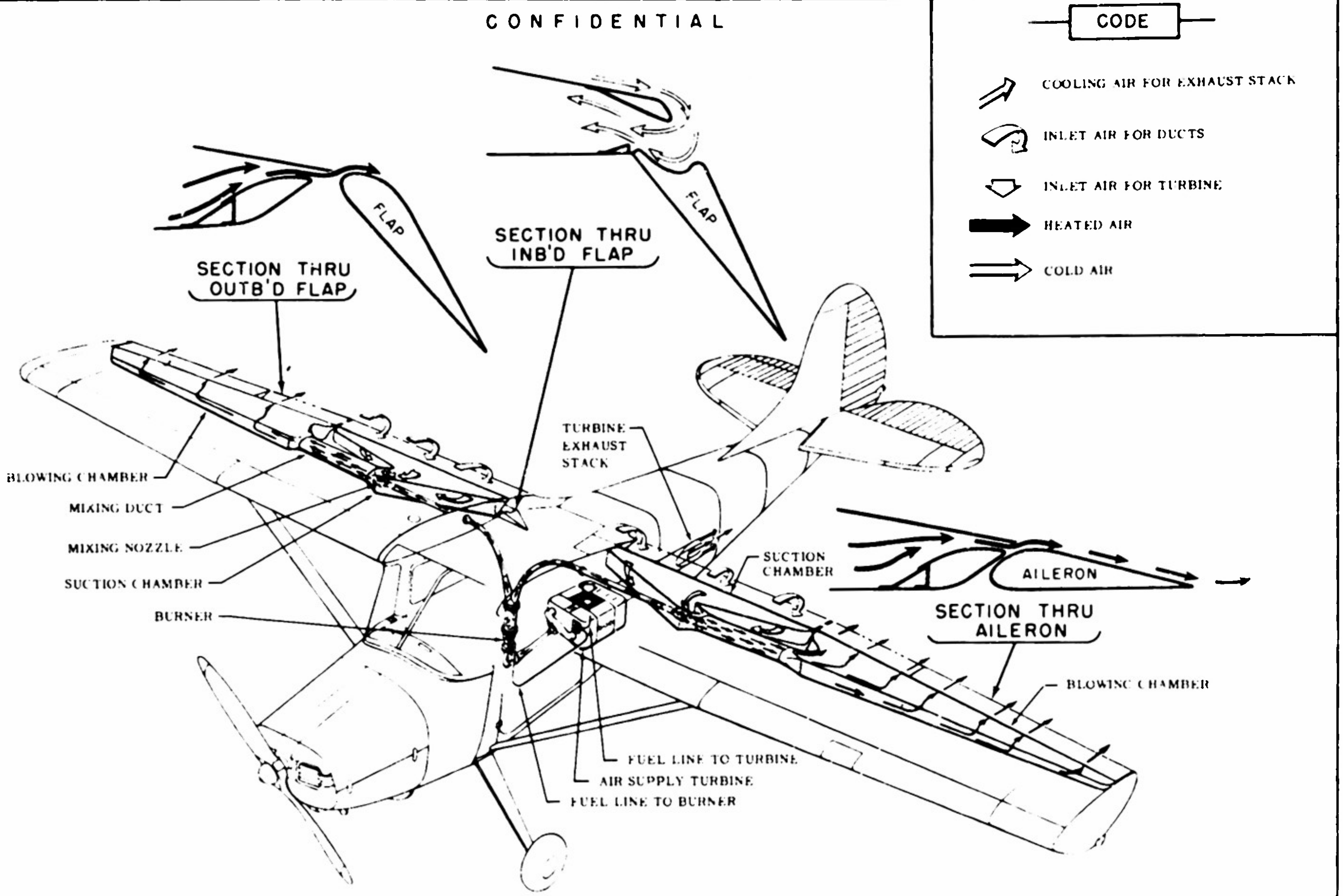
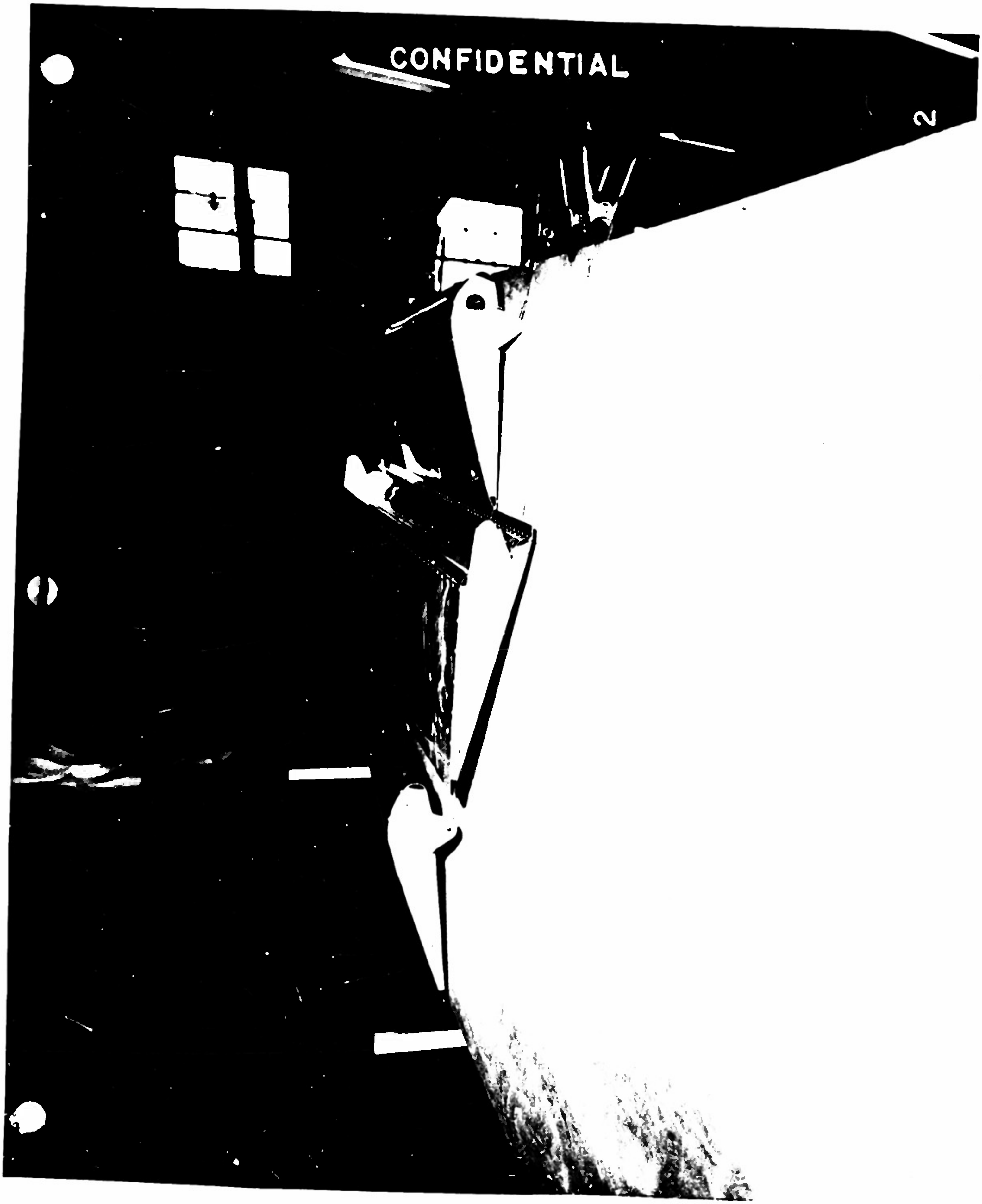


CIRCULATION CONTROL SYSTEM FOR CESSNA MODEL 170A

FIG 1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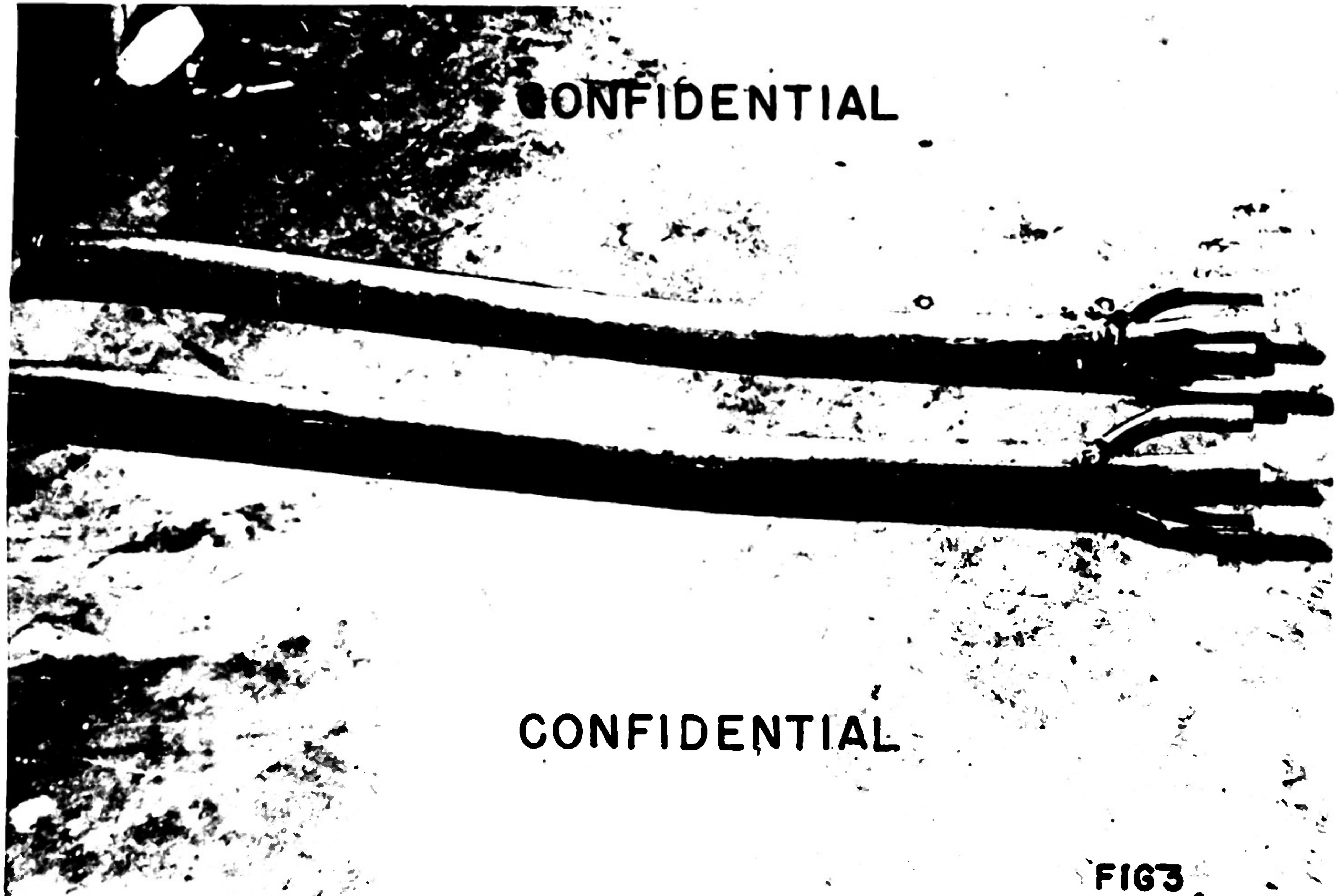

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FIG 3

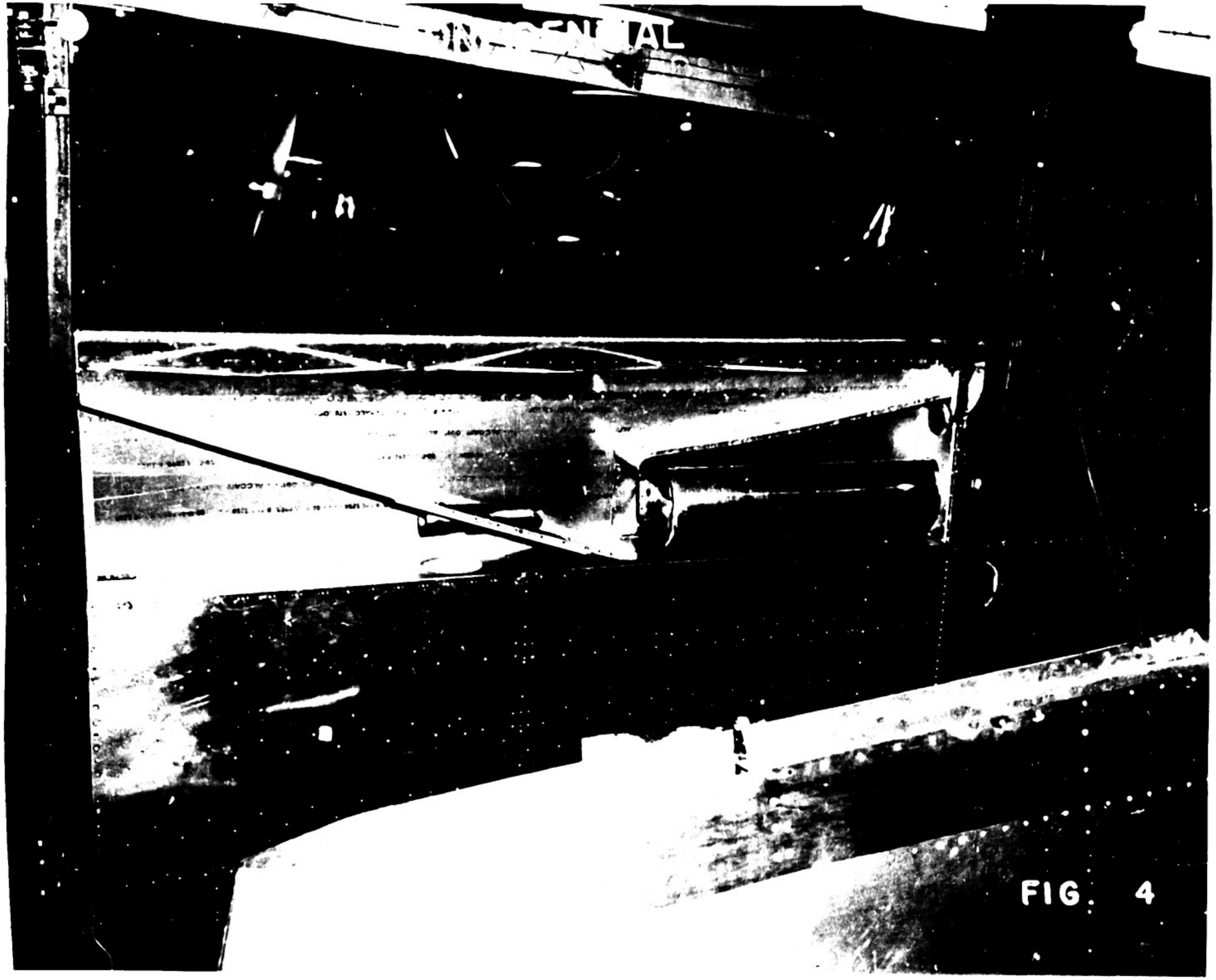

FIG. 4

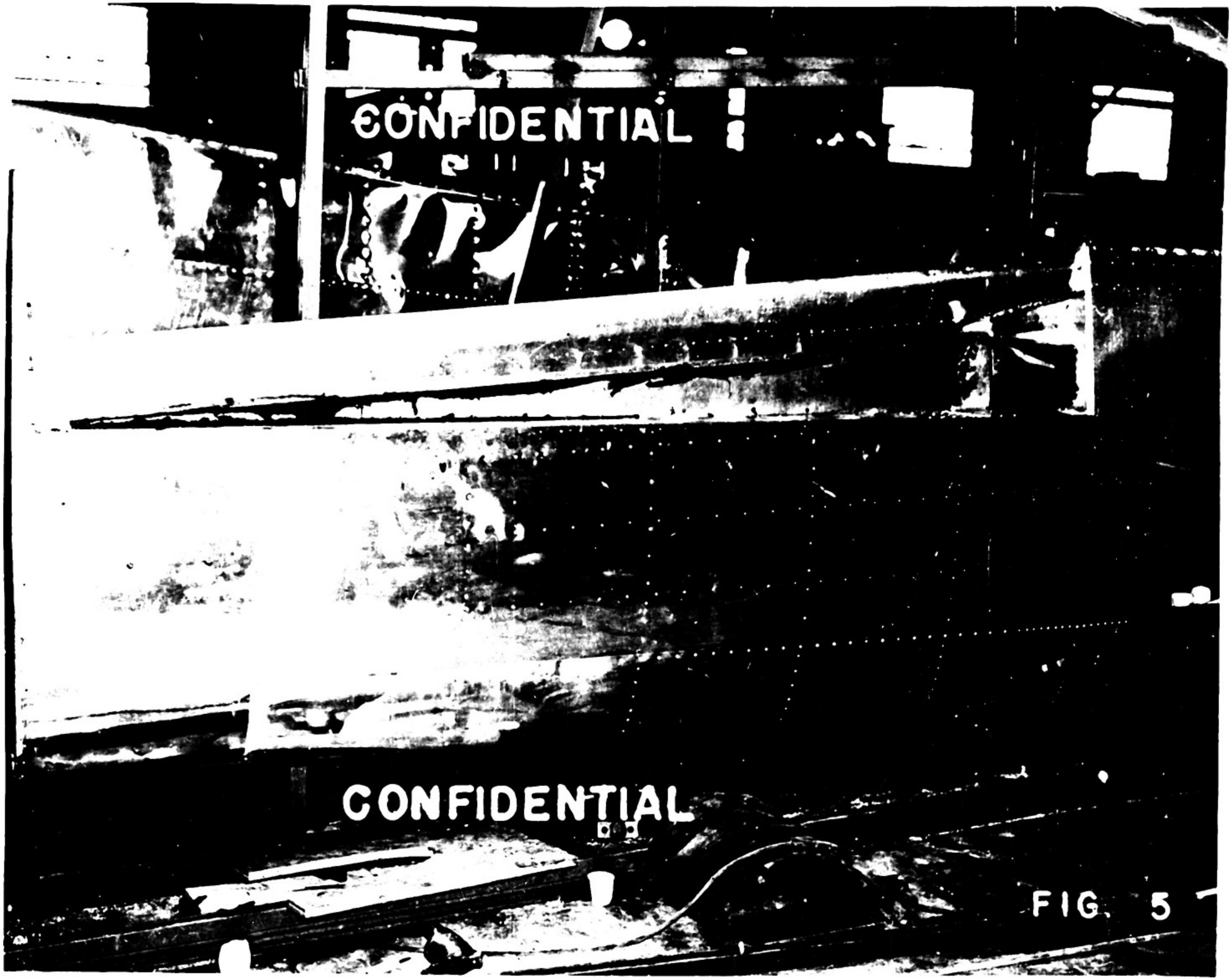

FIG. 5

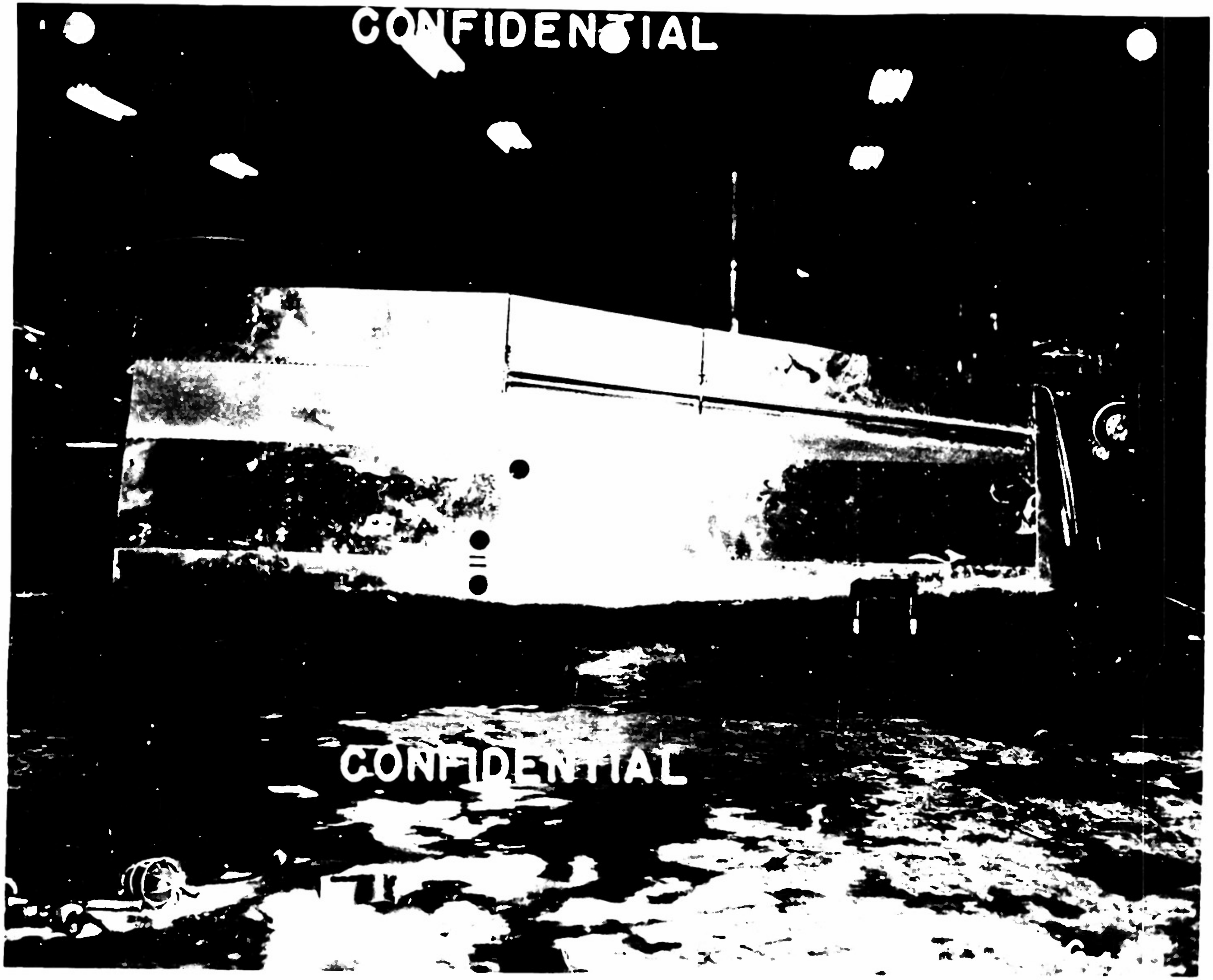
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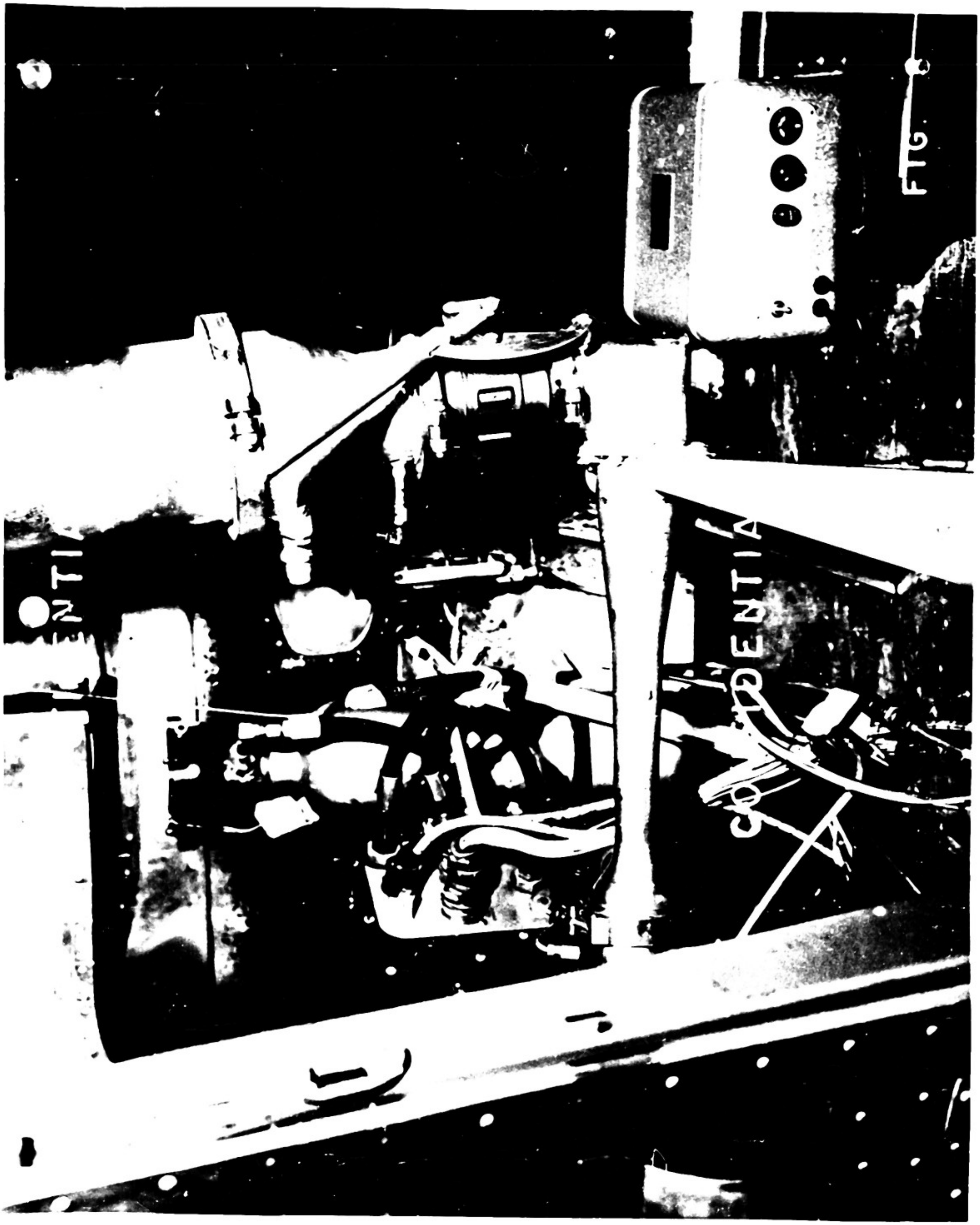
FIG. 7



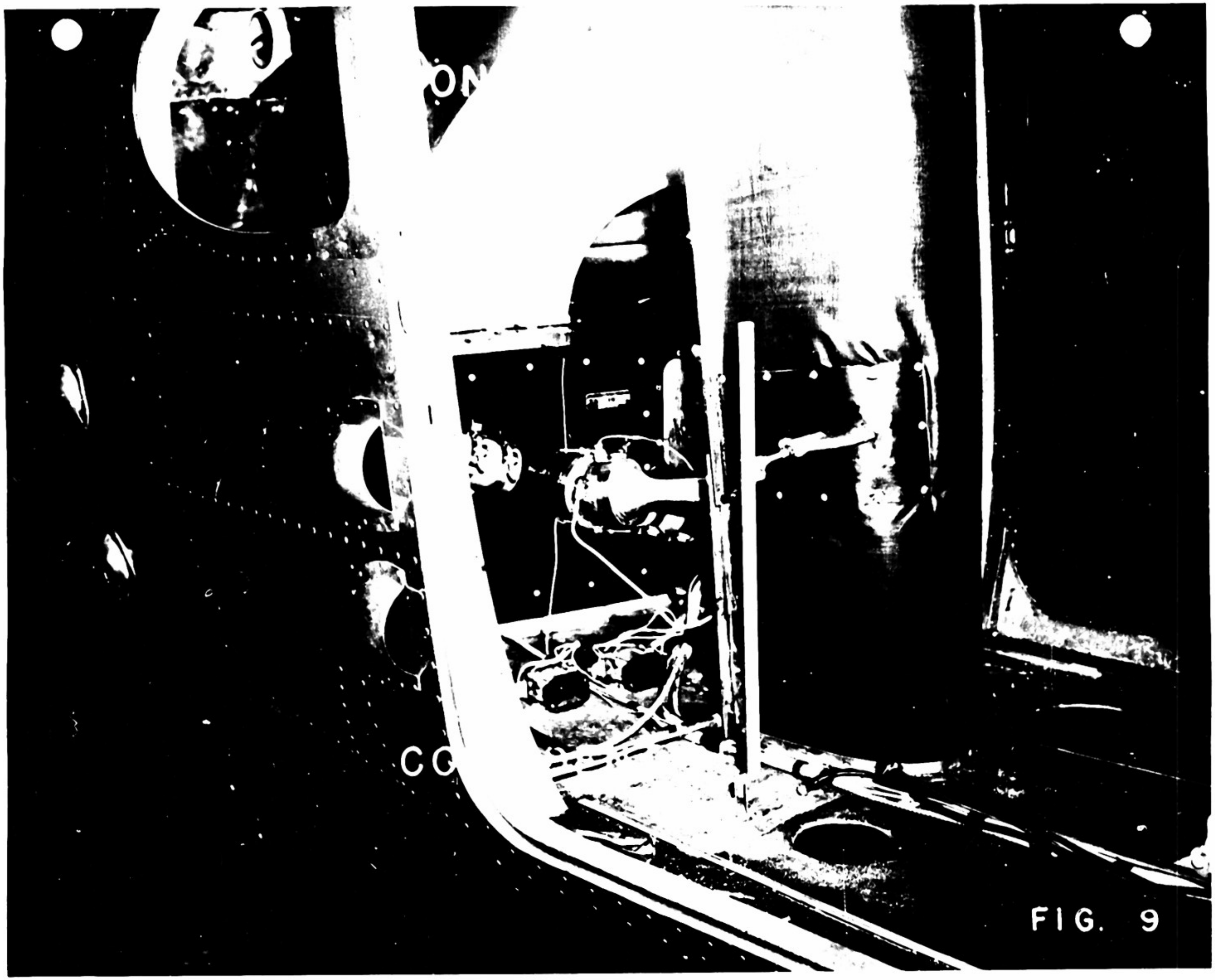


FIG. 9

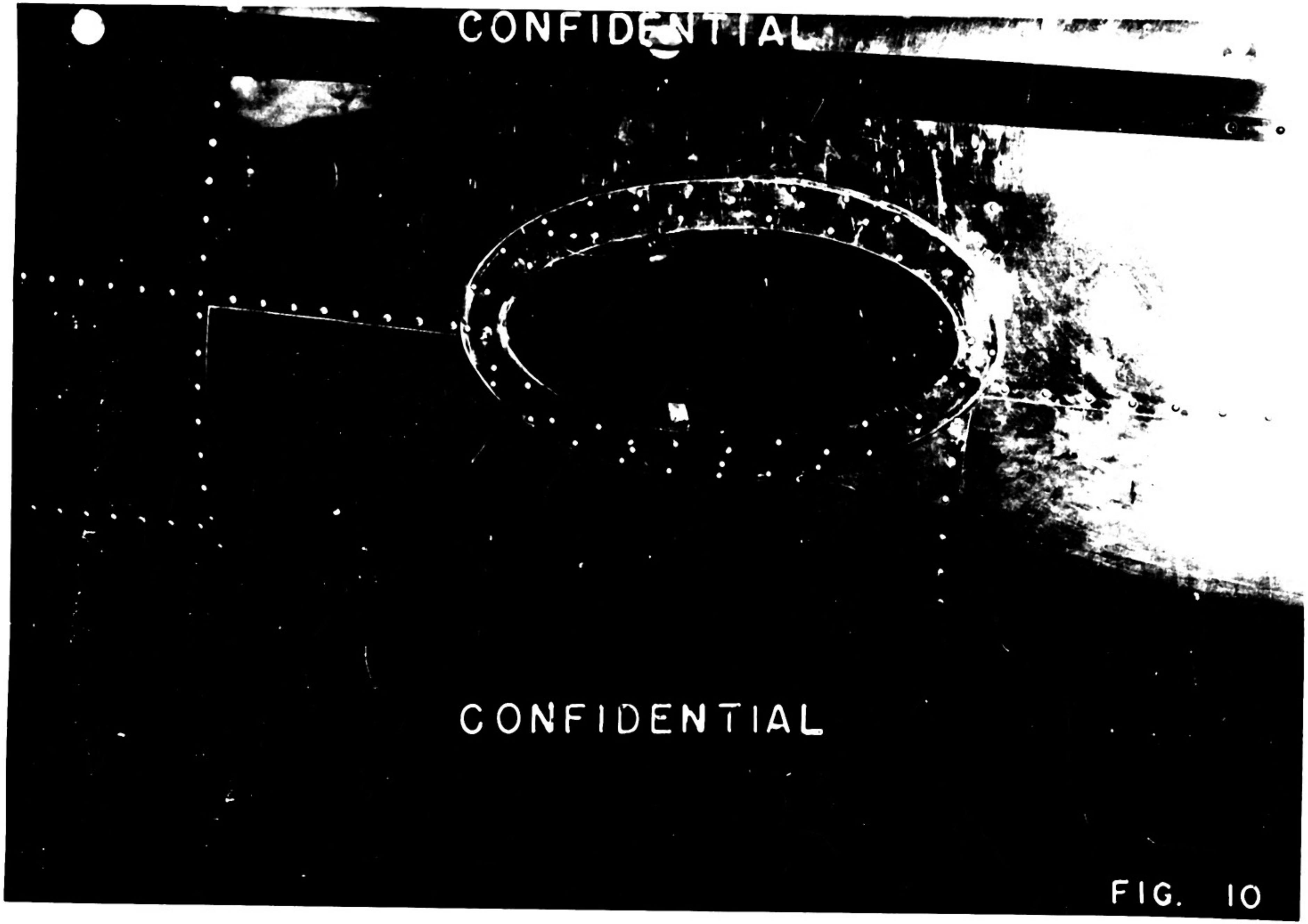


FIG. 10

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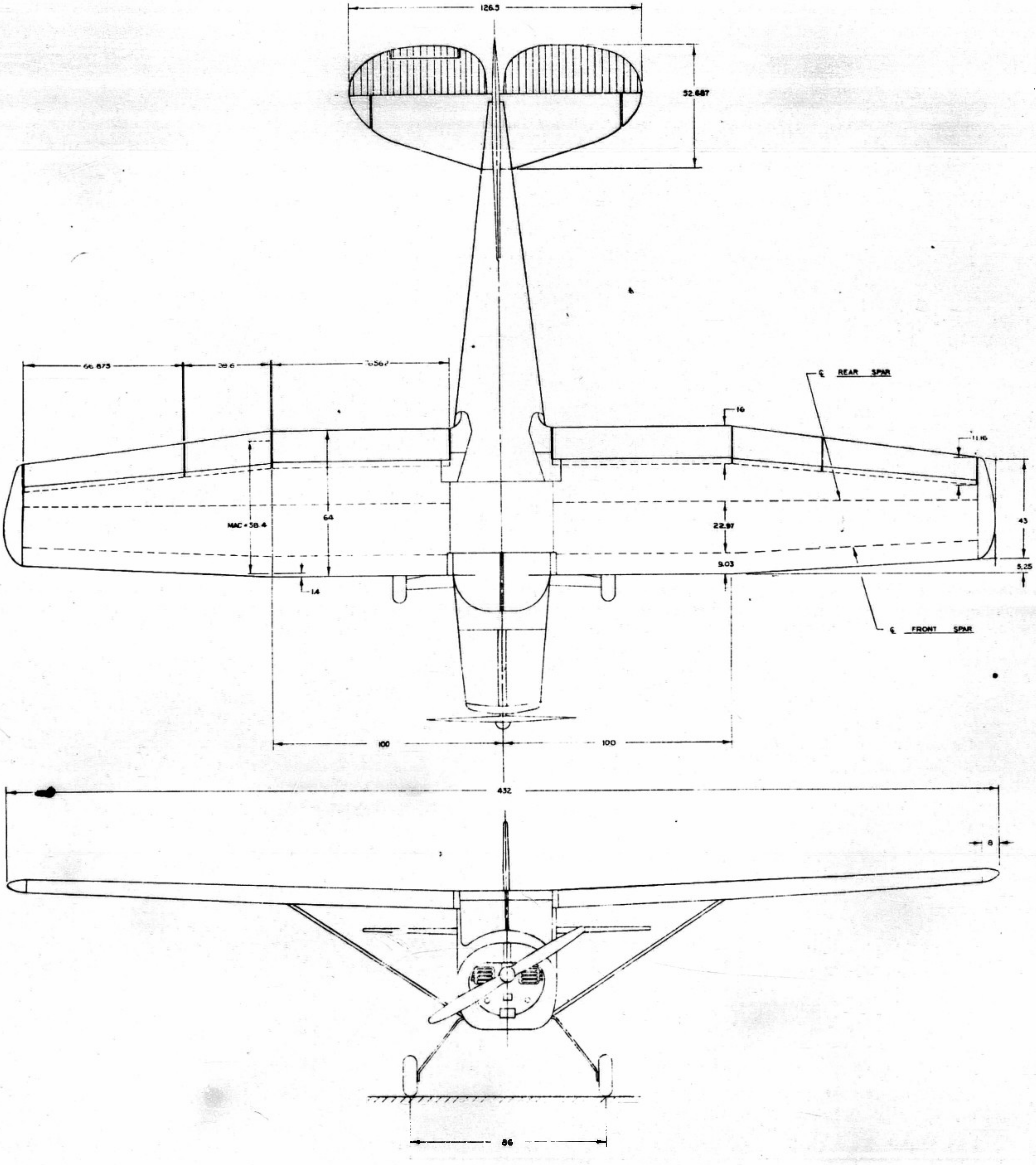

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5

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3

ENGINE

CONTINENTAL MODEL C-145-2

145 HP AT 2700 RPM

CIRCULATION CONTROL SYSTEM

SPECIFICATION NO. 1302-1-1

AREAS

WING (INCLUDING FUSELAGE)	173.84 SQ. FT.
AILERON	11.76 SQ. FT.
FLAP	25.36 SQ. FT.
STABILIZER	18.226 SQ. FT.
FIN	8.76 SQ. FT.
ELEVATOR	15.864 SQ. FT.
RUDDER	9.41 SQ. FT.

CONTROL SURFACE TRAVELS

	UP	DOWN
ELEVATOR	26° +1 -0	20° +1 -0
ELEVATOR TAB	17° +1 -0	25° +1 -0
AILERON	20° ± 1	14° ± 1
AILERON DROOP	0°	-10° -20° -30°
FLAPS	0°	-15° -26° -36° 50°
RUDDER	16° ±1 LEFT	16° ±1 RIGHT

GENERAL DATA

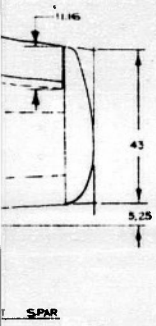
EMPTY WEIGHT	1330 LBS APPROX
GROSS WEIGHT	2200 LBS.
PROP. DIA (MAX.)	78 IN.
WING AIRFOIL	NACA 2412
TAIL SURFACE AIRFOIL	NACA 0006

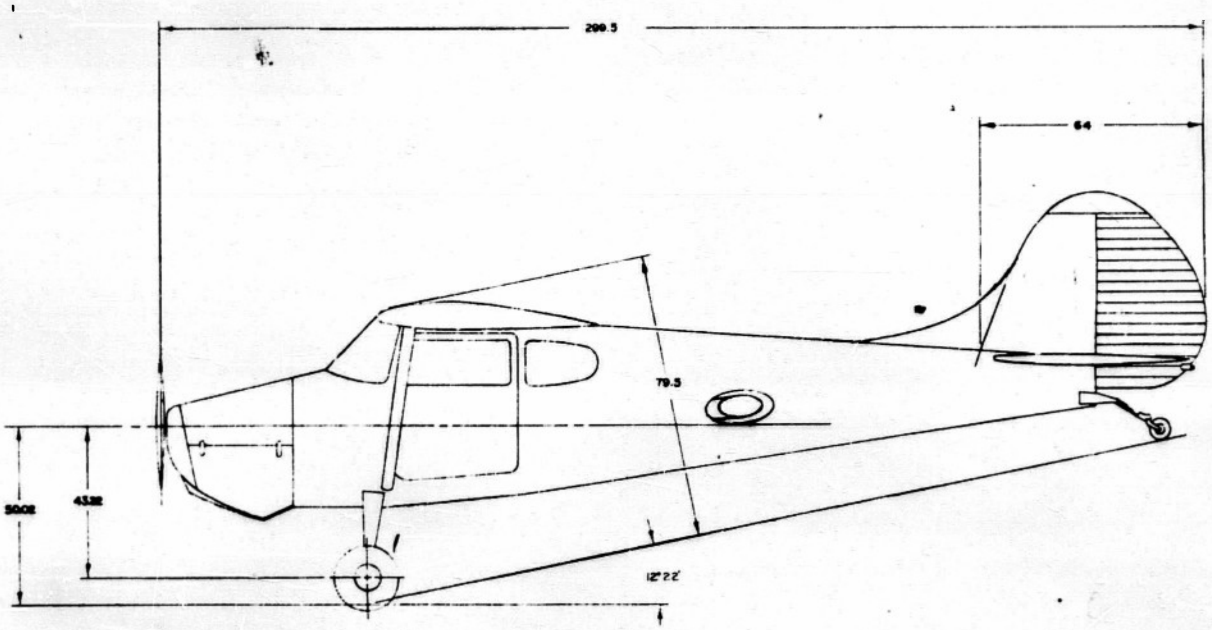
ANGLES OF INCIDENCE

WING — ROOT CHORD	+1° 30'
TIP CHORD	+ 30'
STABILIZER	-4°

DIHEDRAL

WING	+ 30'





2

CONFIDENTIAL

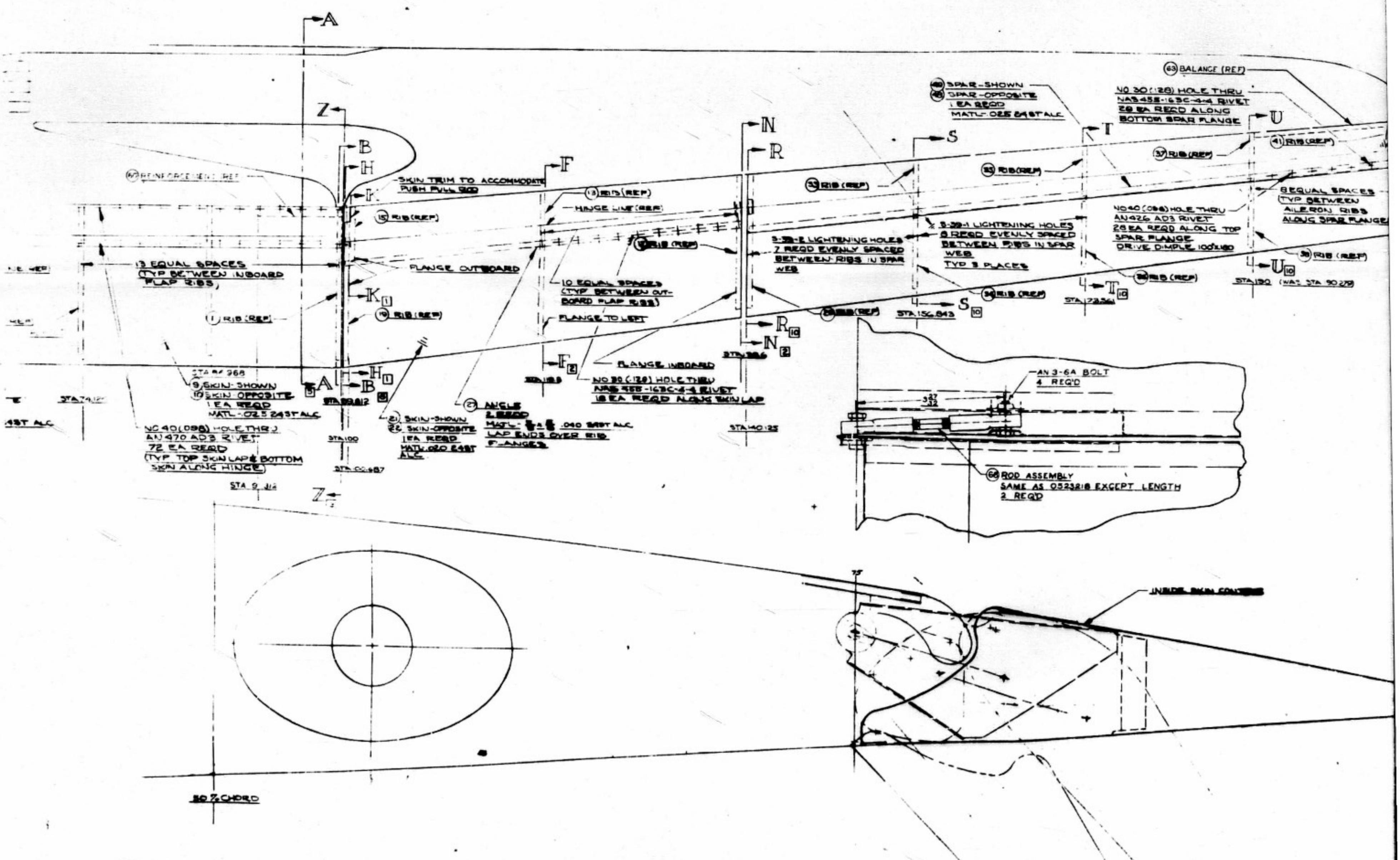
E.A. LAUER	8-16-51	1/16	THREE VIEW
HEINRICH	10-15-51		MODEL 309
			CESSNA AIRCRAFT CO.

12309-23

12309-23

3

2



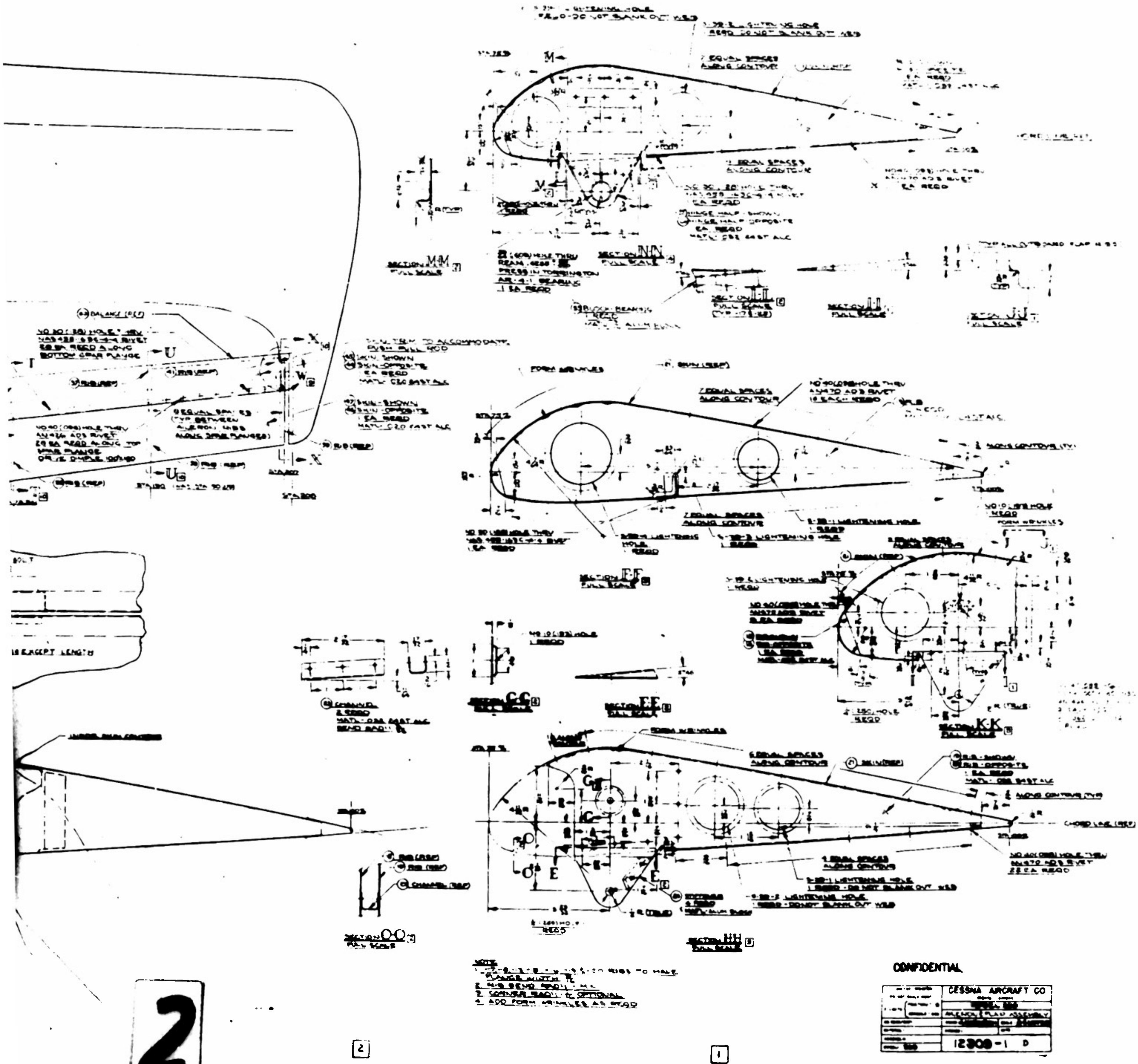
SECTION AA

1

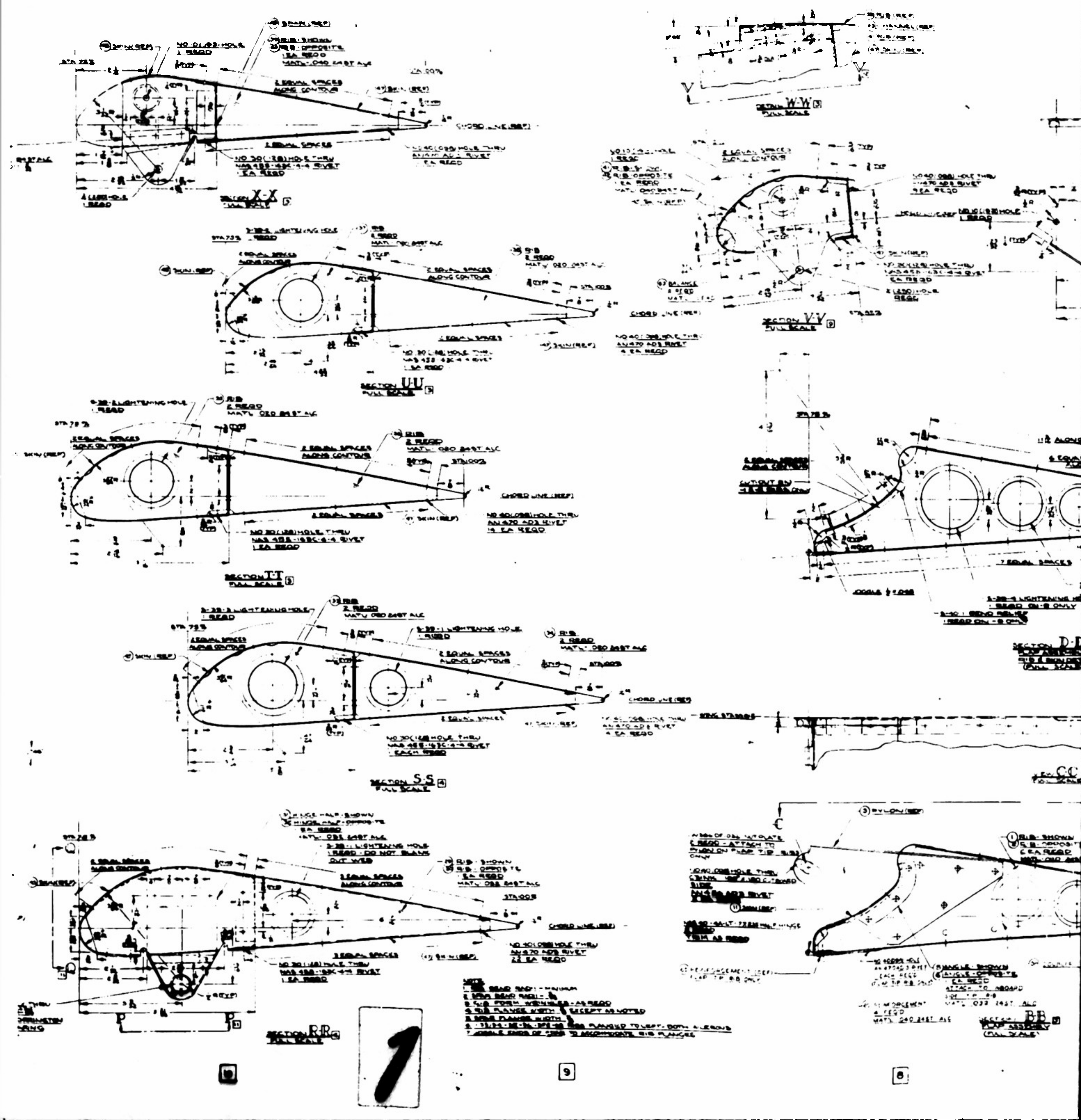
5

4

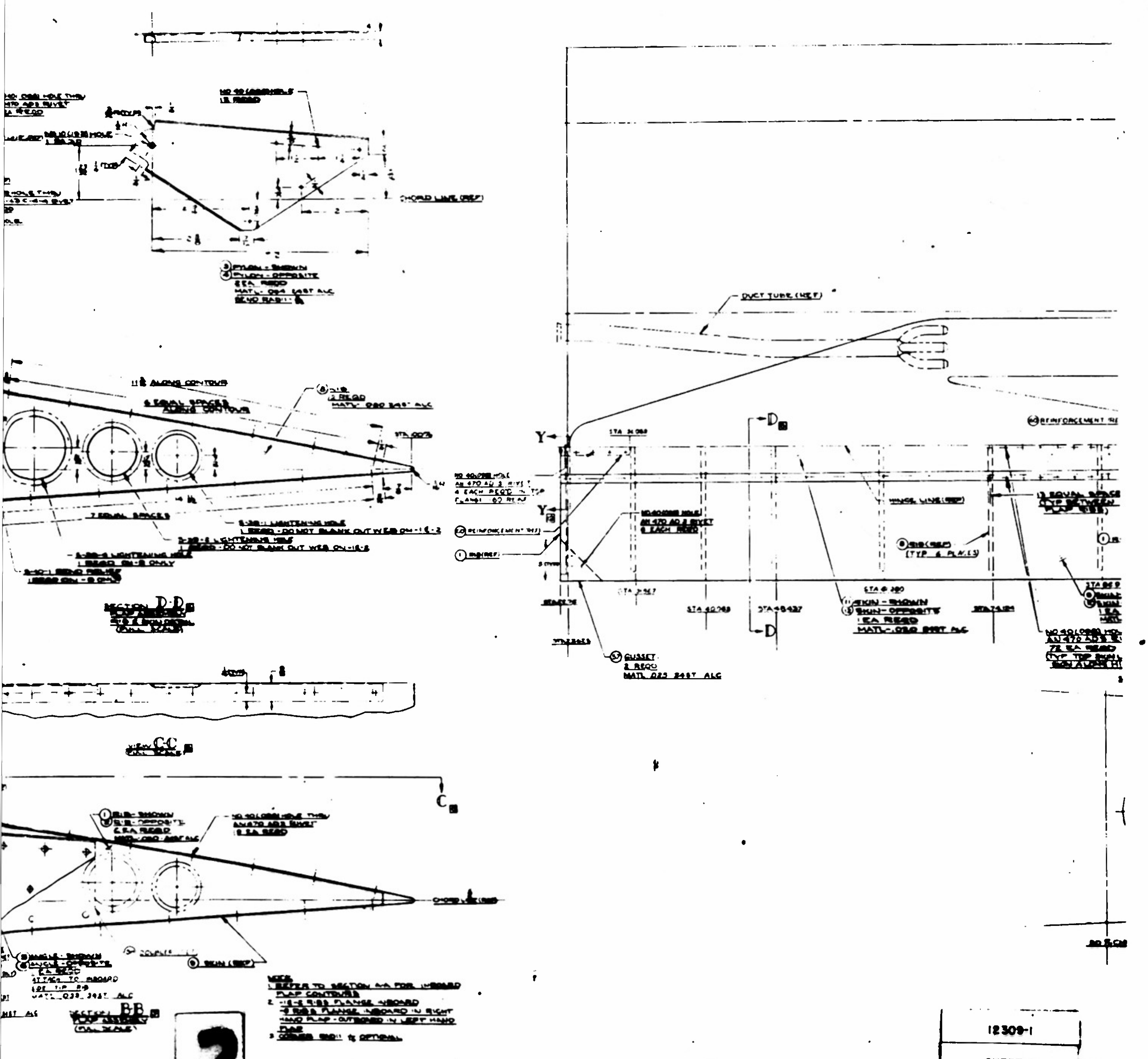
3


SECTION M-M
FULL SCALE
SECTION N-N
FULL SCALE
SECTION E-E
FULL SCALE
SECTION C-C
SECTION F-F
FULL SCALE
SECTION K-K
FULL SCALE
SECTION O-O
FULL SCALE
SECTION H-H
FULL SCALE
CONFIDENTIAL
CESSNA AIRCRAFT CO
AILERON & FLAP ASSEMBLY
12309-1 D

2



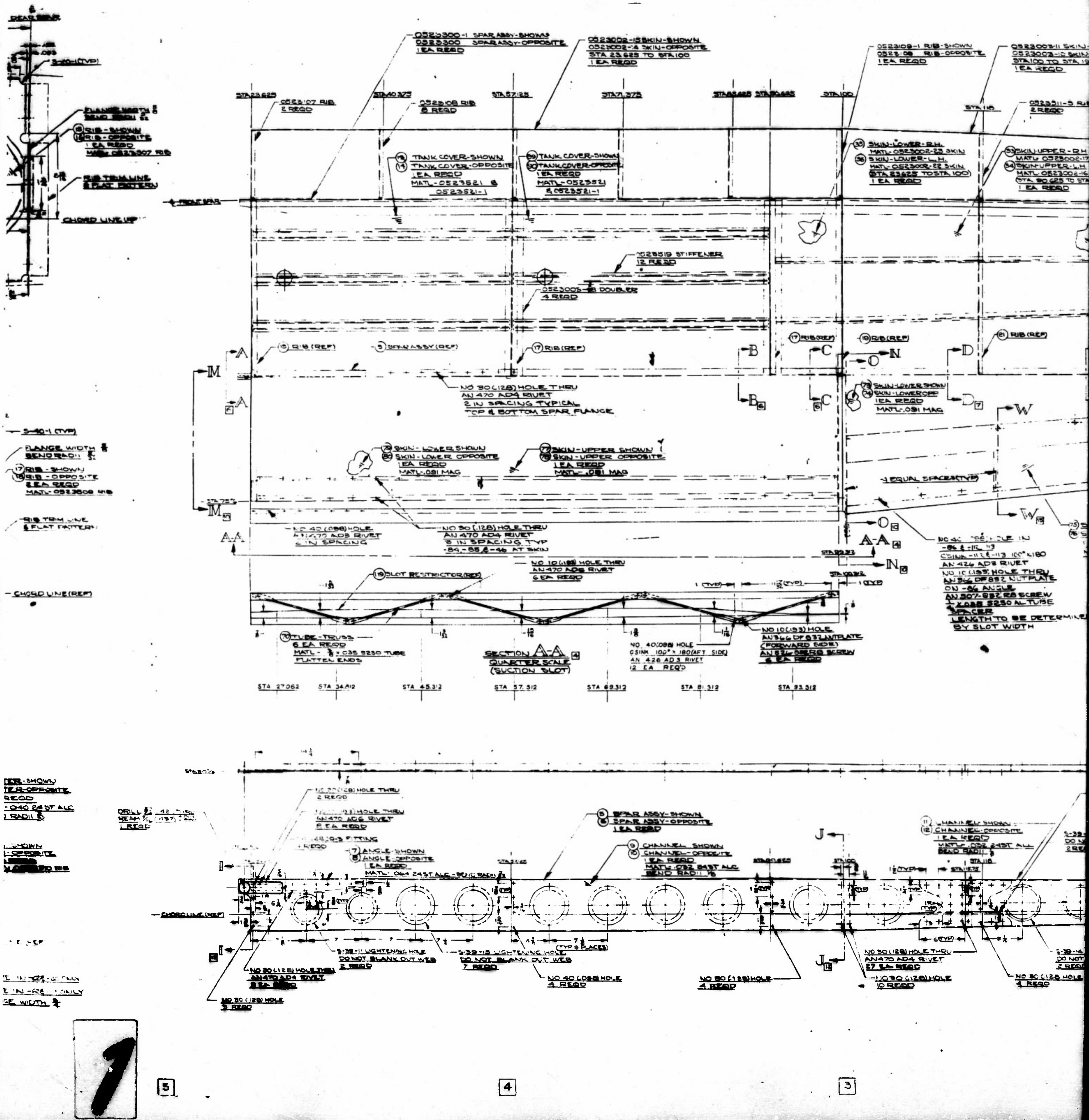
SECTION X-X
SECTION U-U
FULL SCALE
SECTION T-T
FULL SCALE
SECTION S-S
FULL SCALE
SECTION R-R
FULL SCALE
DETAIL W-W
FULL SCALE
SECTION V-V
FULL SCALE
CHORD LINE (REF)
2 EQUAL SPACES
ALONG CONTOUR
NOTES
10
9
8
1

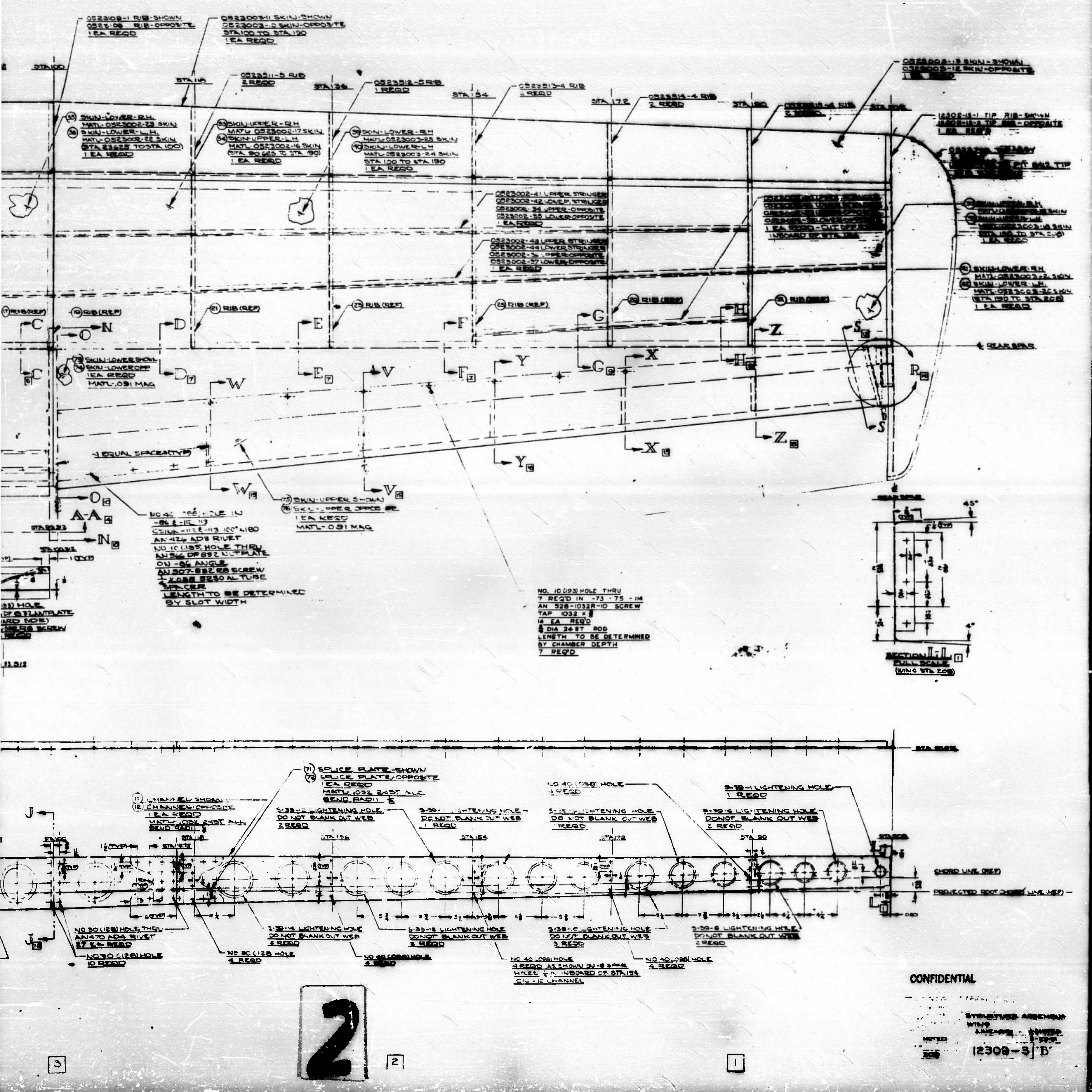


12309-1

SHEET 2

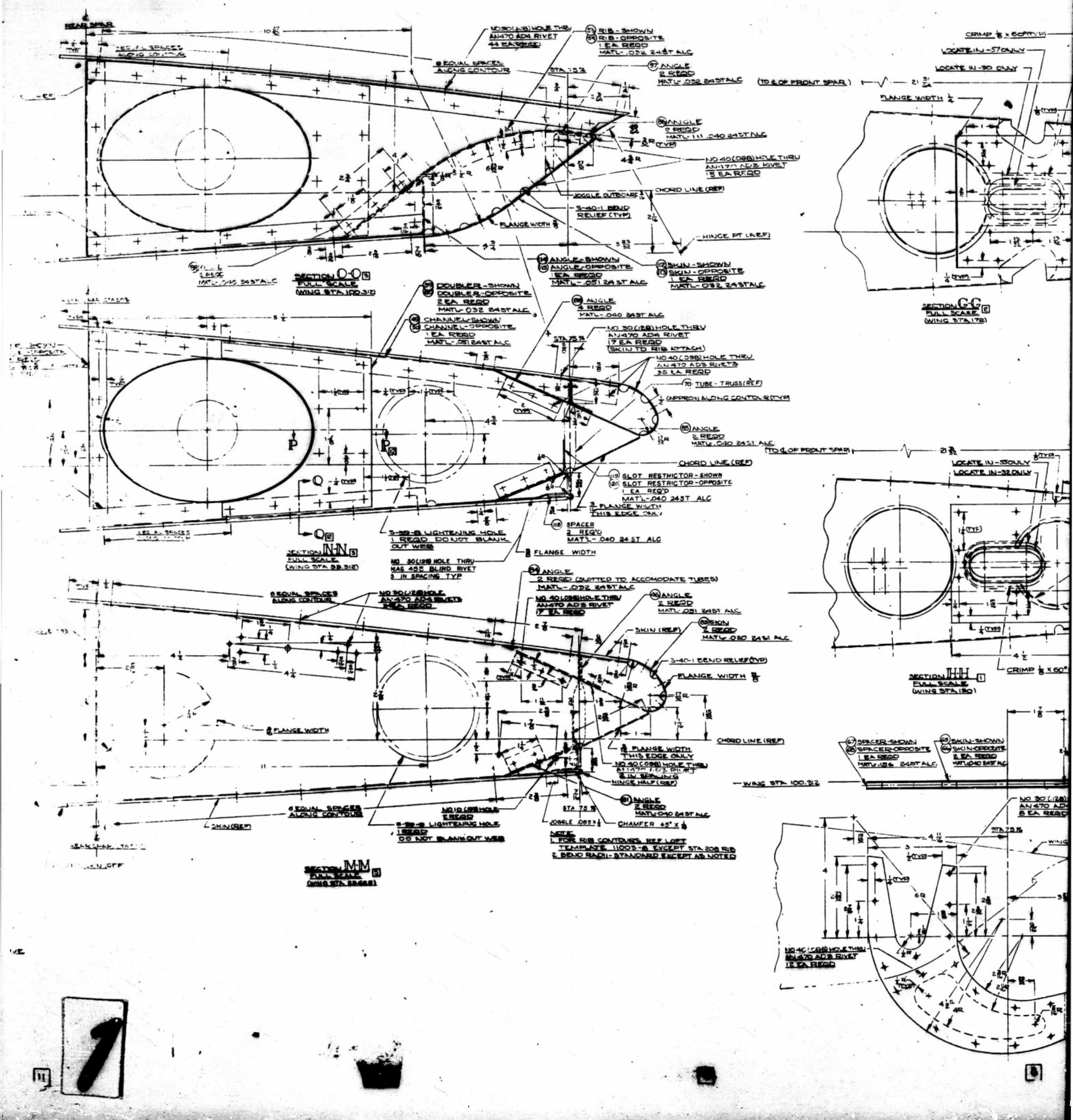
2


0523300-1 SPAR ASSY-SHOWN
0523300 SPAR ASSY-OPPOSITE
1 EA REQD
0523002-15 SKIN-SHOWN
0523002-14 SKIN-OPPOSITE
STA 23.625 TO STA 100
1 EA REQD
0523109-1 RIB-SHOWN
0523109 RIB-OPPOSITE
1 EA REQD
STA 23.625
0523107 RIB
2 REQD
STA 40.375
0523108 RIB
8 REQD
STA 57.125
STA 71.375
STA 100
FRONT SPAR
TANK COVER-SHOWN
TANK COVER-OPPOSITE
1 EA REQD
MATL-0523521 & 0523521-1
SKIN-LOWER-R.H.
SKIN-LOWER-L.H.
STA 23.625 TO STA 100
1 EA REQD
0523519 STIFFENER
12 REQD
DOUBLER
4 REQD
RIB (REF)
SPAR ASSY (REF)
NO 30 (.128) HOLE THRU
AN 470 AD4 RIVET
2 IN SPACING TYPICAL
TOP & BOTTOM SPAR FLANGE
SKIN-LOWER SHOWN
SKIN-LOWER OPPOSITE
1 EA REQD
MATL-.081 MAG
SKIN-UPPER SHOWN
SKIN-UPPER OPPOSITE
1 EA REQD
MATL-.081 MAG
EQUAL SPACES (TYP)
NO 40 (.098) HOLE
AN 470 AD3 RIVET
2 IN SPACING
NO 30 (.128) HOLE THRU
AN 470 AD4 RIVET
3 IN SPACING TYP
NO 10 (.193) HOLE THRU
AN 470 AD6 RIVET
6 EA REQD
SLOT RESTRICTOR (REF)
TUBE-TRUSS
6 EA REQD
MATL - 3/8 x .035 52S0 TUBE
FLATTEN ENDS
SECTION A-A
QUARTER SCALE
(SUCTION SLOT)
NO. 40 (.098) HOLE
CSINK 100° X .180 (AFT SIDE)
AN 426 AD3 RIVET
12 EA REQ'D
NO 10 (.193) HOLE
(FORWARD SIDE)
6 EA REQD
LENGTH TO BE DETERMINED
BY SLOT WIDTH
STA 27.062
STA 34.812
STA 45.312
STA 57.312
STA 69.312
STA 81.312
STA 93.312
CHORD LINE (REF)
RIB-SHOWN
RIB-OPPOSITE
1 EA REQD
RIB TRIM LINE
& FLAT PATTERN
ANGLE-SHOWN
ANGLE-OPPOSITE
1 EA REQD
SPAR ASSY-SHOWN
SPAR ASSY-OPPOSITE
1 EA REQD
CHANNEL-SHOWN
CHANNEL-OPPOSITE
1 EA REQD
LIGHTENING HOLE
DO NOT BLANK OUT WEB
2 REQD
7 REQD
NO 40 (.098) HOLE
4 REQD
NO 30 (.128) HOLE
4 REQD
NO 30 (.128) HOLE THRU
AN470 AD4 RIVET
27 EA REQD
NO 30 (.128) HOLE
10 REQD
5
4
3
1

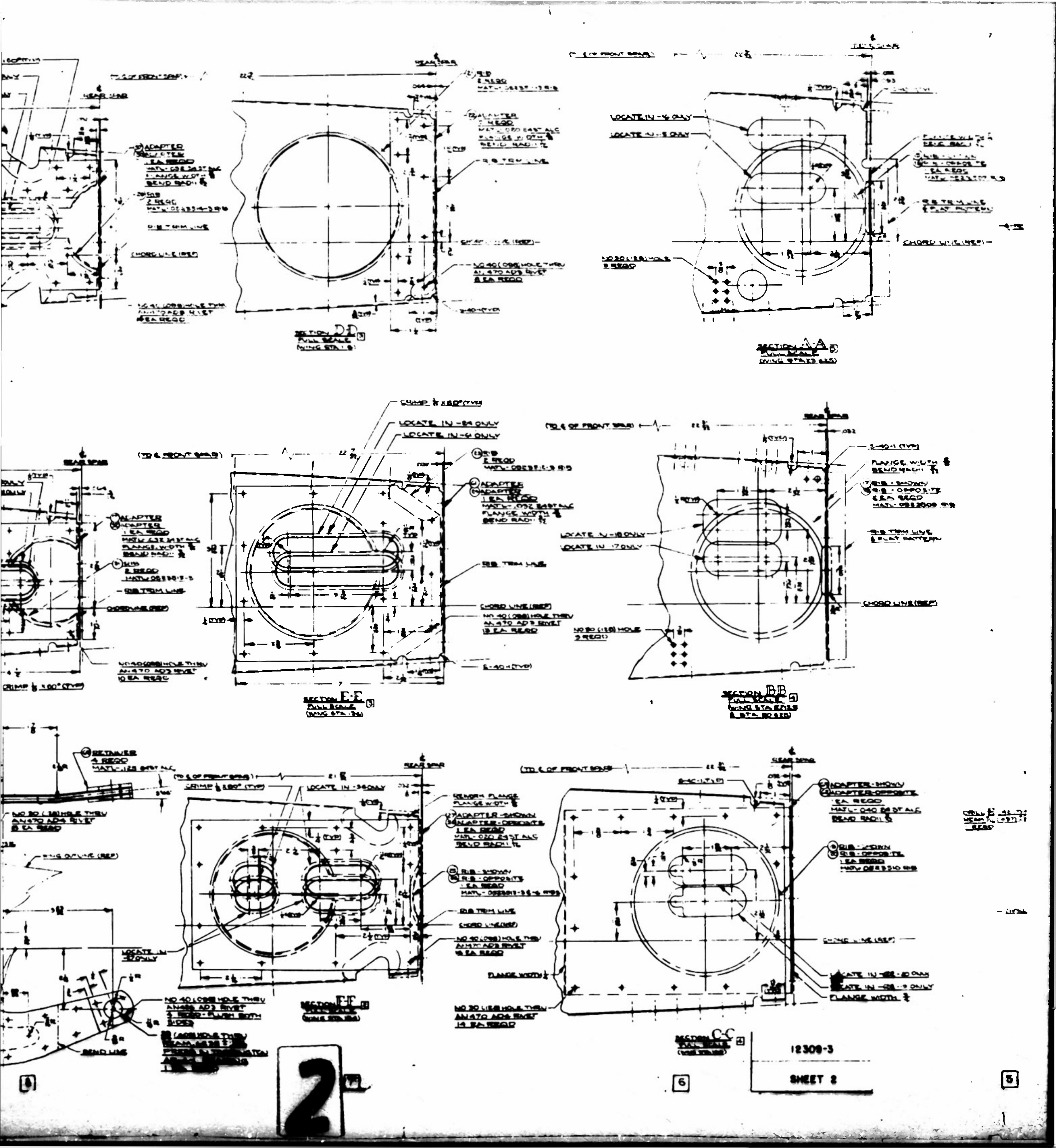


0523109-1 RIB-SHOWN
0523109 RIB-OPPOSITE
1 EA REQD
0523003-11 SKIN-SHOWN
0523003-10 SKIN-OPPOSITE
STA 100 TO STA 190
1 EA REQD
STA 100
STA 118
STA 136
STA 154
STA 172
STA 190
0523511-5 RIB
2 REQD
0523512-5 RIB
1 REQD
0523513-4 RIB
2 REQD
0523514-4 RIB
2 REQD
12309-13-1 TIP RIB-SHOWN
12309-13-2 TIP RIB-OPPOSITE
1 EA REQD
SKIN-LOWER-R.H.
MATL-0523002-23 SKIN
SKIN-LOWER-L.H.
MATL-0523002-22 SKIN
STA 23.625 TO STA 100
1 EA REQD
SKIN-UPPER-R.H.
MATL-0523002-17 SKIN
SKIN-UPPER-L.H.
MATL-0523002-16 SKIN
STA 80 (23) TO STA 190
1 EA REQD
SKIN-LOWER-R.H.
MATL-0523003-25 SKIN
SKIN-LOWER-L.H.
MATL-0523003-24 SKIN
STA 100 TO STA 190
1 EA REQD
0523002-41 UPPER STRINGER
0523002-42 LOWER STRINGER
0523002-34 UPPER-OPPOSITE
0523002-35 LOWER-OPPOSITE
1 EA REQD
0523002-43 UPPER STRINGER
0523002-44 LOWER STRINGER
0523002-36 UPPER-OPPOSITE
0523002-37 LOWER-OPPOSITE
1 EA REQD
1 EA REQD-CUT OFF
INBOARD OF STA 190
STA 190 TO STA 208
1 EA REQD
RIB (REF)
SKIN-LOWER SHOWN
SKIN-LOWER OPP
1 EA REQD
MATL-.051 MAG
REAR SPAR
1 EQUAL SPACES (TYP)
NO 40 (.098) HOLE IN
CSINK
AN 426 AD3 RIVET
NO 10 (.193) HOLE THRU
AN 366 DF 832 NUTPLATE
ON -86 ANGLE
AN 507-832 R8 SCREW
SPACER
LENGTH TO BE DETERMINED
BY SLOT WIDTH
SKIN-UPPER SHOWN
SKIN-UPPER OPPOSITE
1 EA REQD
MATL-.051 MAG
NO. 10 (.193) HOLE THRU
7 REQ'D IN -73 -75 -114
AN 526-1032R-10 SCREW
TAP 1032 x 3/8
14 EA REQD
3/16 DIA 24 ST ROD
LENGTH TO BE DETERMINED
BY CHAMBER DEPTH
7 REQ'D
SECTION L-L
FULL SCALE
(WING STA 208)
45°
4°
SPLICE PLATE-SHOWN
SPLICE PLATE-OPPOSITE
1 EA REQD
MATL-.032 24ST ALC
BEND RADII 1/8
CHANNEL-SHOWN
CHANNEL-OPPOSITE
1 EA REQD
MATL-.032 24ST AL
BEND RADII
S-39-12 LIGHTENING HOLE
DO NOT BLANK OUT WEB
2 REQD
S-39- LIGHTENING HOLE
DO NOT BLANK OUT WEB
1 REQD
NO 40 (.098) HOLE
4 REQD
S-39- LIGHTENING HOLE
DO NOT BLANK OUT WEB
3 REQD
S-39-1 LIGHTENING HOLE
1 REQD
S-39-6 LIGHTENING HOLE
DO NOT BLANK OUT WEB
2 REQD
CHORD LINE (REF)
PROJECTED ROOT CHORD LINE (REF)
NO 30 (.128) HOLE THRU
AN 470 AD4 RIVET
27 EA REQD
NO 30 (.128) HOLE
10 REQD
NO 30 (.128) HOLE
4 REQD
S-39-14 LIGHTENING HOLE
DO NOT BLANK OUT WEB
2 REQD
S-39-13 LIGHTENING HOLE
DO NOT BLANK OUT WEB
2 REQD
NO 40 (.098) HOLE
4 REQD
NO 40 (.098) HOLE
4 REQD AS SHOWN ON -5 SPAR
HOLES 1/4 IN. INBOARD OF STA 154
ON -12 CHANNEL
S-39-10 LIGHTENING HOLE
DO NOT BLANK OUT WEB
3 REQD
NO 40 (.098) HOLE
4 REQD
S-39-8 LIGHTENING HOLE
DO NOT BLANK OUT WEB
2 REQD
CONFIDENTIAL
STRUCTURE ASSEMBLY
WING
NOTED
12309-3 B
3
2
1

2



REAR SPAR
NO 30(.128) HOLE THRU
AN470 AD4 RIVET
44 EA REQD
(53) RIB - SHOWN
(54) RIB - OPPOSITE
1 EA REQD
MATL - .032 24ST ALC
8 EQUAL SPACES ALONG CONTOUR
STA 75 5/8
(57) ANGLE
2 REQD
MATL - .032 24ST ALC
(56) ANGLE
2 REQD
MATL - .040 24ST ALC
NO 40 (.098) HOLE THRU
AN-470 AD3 RIVET
15 EA REQD
JOGGLE OUTBOARD
CHORD LINE (REF)
S-40-1 BEND RELIEF (TYP)
FLANGE WIDTH
HINGE PT (REF)
(14) ANGLE - SHOWN
(15) ANGLE - OPPOSITE
1 EA REQD
MATL - .051 24 ST ALC
(112) SKIN - SHOWN
(113) SKIN - OPPOSITE
1 EA REQD
MATL - .032 24ST ALC
SECTION O-O
FULL SCALE
(WING STA 100.312)
CRIMP 1/8 x 60°(TYP)
LOCATE IN - 57 ONLY
LOCATE IN - 30 ONLY
(TO ℄ OF FRONT SPAR)
FLANGE WIDTH 1/4
SECTION G-G
FULL SCALE
(WING STA 172)
(37) DOUBLER - SHOWN
(38) DOUBLER - OPPOSITE
2 EA REQD
MATL - .032 24ST ALC
(49) CHANNEL - SHOWN
(50) CHANNEL - OPPOSITE
1 EA REQD
MATL - .051 24ST ALC
(66) ANGLE
4 REQD
MATL - .040 24ST ALC
NO 30 (.128) HOLE THRU
AN470 AD4 RIVET
17 EA REQD
(SKIN TO RIB ATTACH)
NO 40 (.098) HOLE THRU
AN 470 AD3 RIVETS
35 EA REQD
(70) TUBE - TRUSS (REF)
(APPROX) ALONG CONTOUR (TYP)
(85) ANGLE
2 REQD
MATL - .040 24ST ALC
(TO ℄ OF FRONT SPAR)
CHORD LINE (REF)
(119) SLOT RESTRICTOR - SHOWN
(120) SLOT RESTRICTOR - OPPOSITE
1 EA REQ'D
MAT'L - .040 24ST ALC
FLANGE WIDTH THIS EDGE ONLY
(118) SPACER
2 REQ'D
MAT'L - .040 24 ST ALC
LOCATE IN - 55 ONLY
LOCATE IN - 32 ONLY
S-59-8 LIGHTENING HOLE
1 REQD DO NOT BLANK OUT WEB
FLANGE WIDTH
NO 30 (.128) HOLE THRU
NAS 455 BLIND RIVET
3 IN SPACING TYP
SECTION N-N
FULL SCALE
(WING STA 33.312)
(34) ANGLE
2 REQD (SLOTTED TO ACCOMODATE TUBES)
MATL - .032 24ST ALC
NO 40 (.098) HOLE THRU
AN470 AD3 RIVET
17 EA REQD
(46) ANGLE
2 REQD
MATL - .051 24ST ALC
SKIN (REF)
(62) SKIN
2 REQD
MATL - .020 24ST ALC
3-40-1 BEND RELIEF (TYP)
FLANGE WIDTH
CHORD LINE (REF)
6 EQUAL SPACES ALONG CONTOUR
NO 30 (.128) HOLE
AN-470 AD4 RIVETS
REQD
FLANGE WIDTH THIS EDGE ONLY
NO 40 (.098) HOLE THRU
2 IN SPACING
HINGE HALF (REF)
(81) ANGLE
2 REQD
MATL - .040 24ST ALC
STA 75 5/8
JOGGLE .085
CHAMFER 45° x 1/8
NO 10 (.196) HOLE
2 REQD
S-59-8 LIGHTENING HOLE
1 REQD
DO NOT BLANK OUT WEB
SKIN (REF)
NOTE:
1 FOR RIB CONTOURS REF LOFT TEMPLATE 11005-8 EXCEPT STA 208 RIB
2 BEND RADII - STANDARD EXCEPT AS NOTED
SECTION M-M
FULL SCALE
(WING STA 53.625)
SECTION H-H
FULL SCALE
(WING STA 130)
CRIMP 1/8 x 60°
(67) SPACER - SHOWN
(68) SPACER - OPPOSITE
1 EA REQD
MATL - .156 24ST ALC
(65) SKIN - SHOWN
(66) SKIN - OPPOSITE
2 EA REQD
MATL .040 24ST ALC
WING STA 100.312
NO 30 (.128)
AN470 AD
8 EA REQD
NO 40 (.098) HOLE THRU
AN 470 AD3 RIVET
12 EA REQD



SECTION D-D
FULL SCALE
SECTION A-A
FULL SCALE
CHORD LINE (REF)
RIB TRIM LINE
REAR SPAR
CRIMP 1/8 x 60° (TYP)
LOCATE IN -24 ONLY
LOCATE IN -4 ONLY
(TO ℄ OF FRONT SPAR)
ADAPTER
1 EA REQD
RIB
2 REQD
BEND RADII
FLANGE WIDTH
NO 40 (.098) HOLE THRU
AN 470 AD3 RIVET
NO 30 (.128) HOLE
SECTION E-E
FULL SCALE
SECTION B-B
FULL SCALE
RETAINER
4 REQD
LOCATE IN -36 ONLY
ADAPTER-SHOWN
ADAPTER-OPPOSITE
RIB-SHOWN
RIB-OPPOSITE
FLANGE WIDTH
BEND LINE
SECTION F-F
SECTION C-C
FULL SCALE
12309-3
SHEET 2
2
6
5

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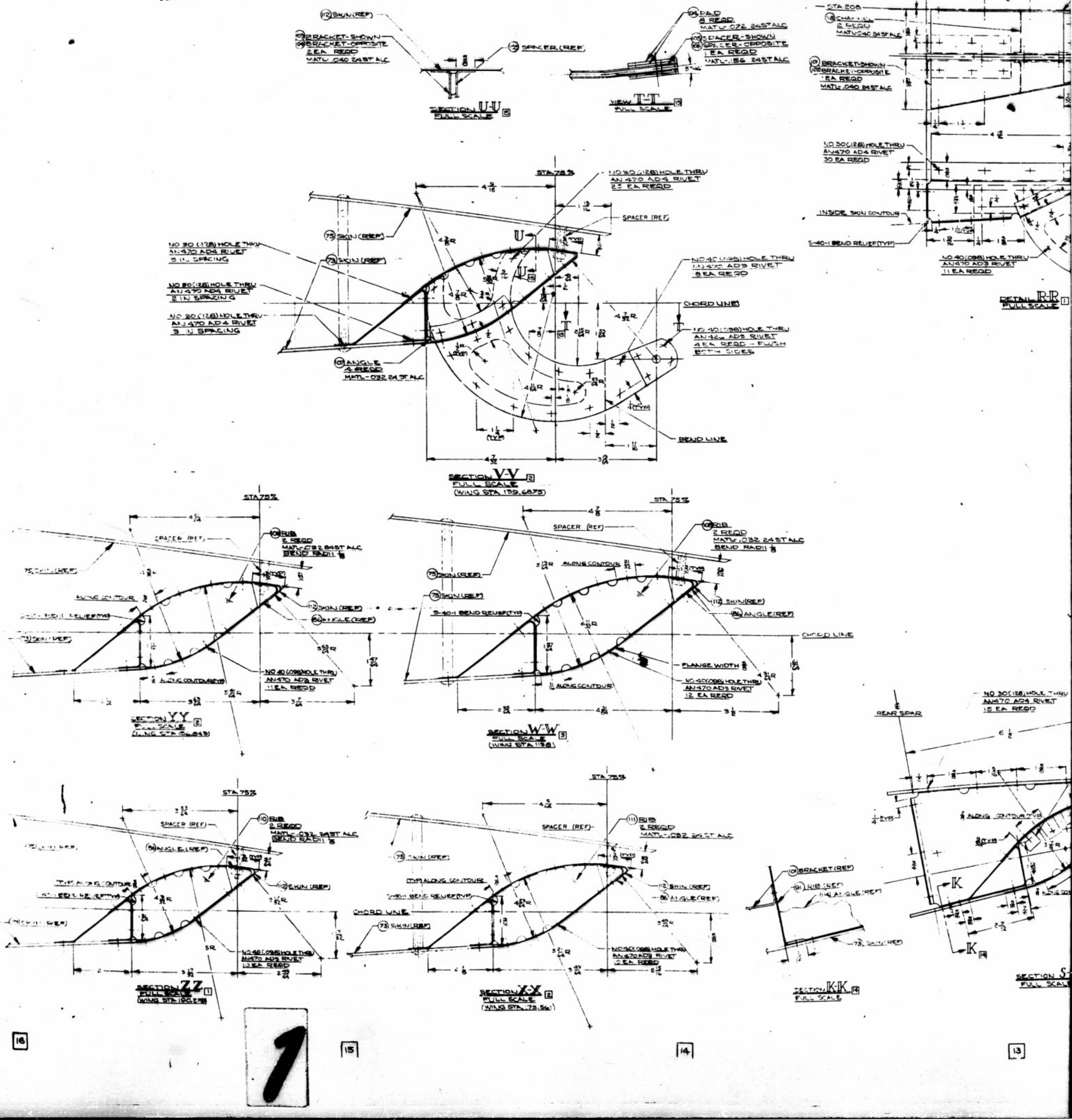
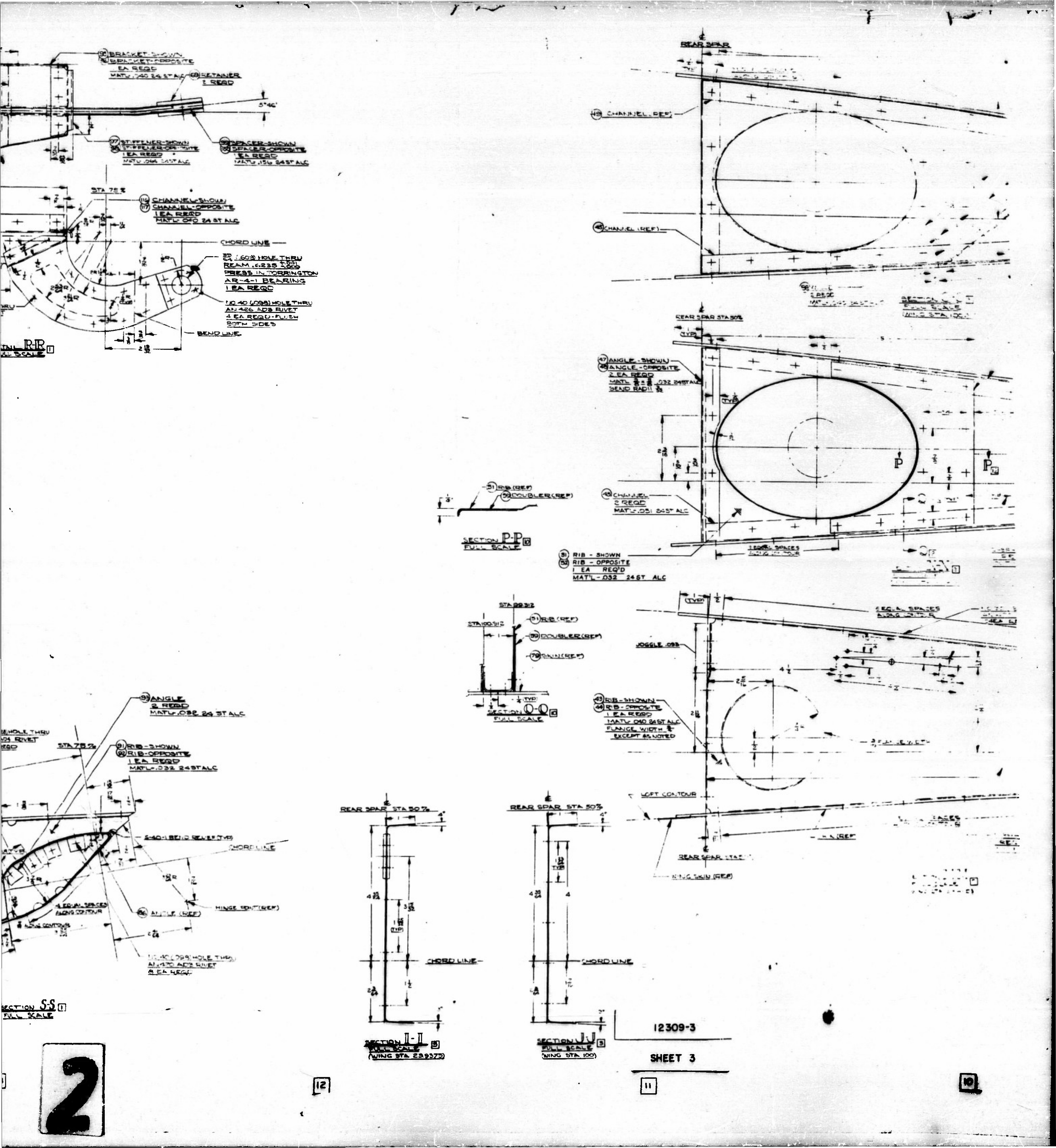
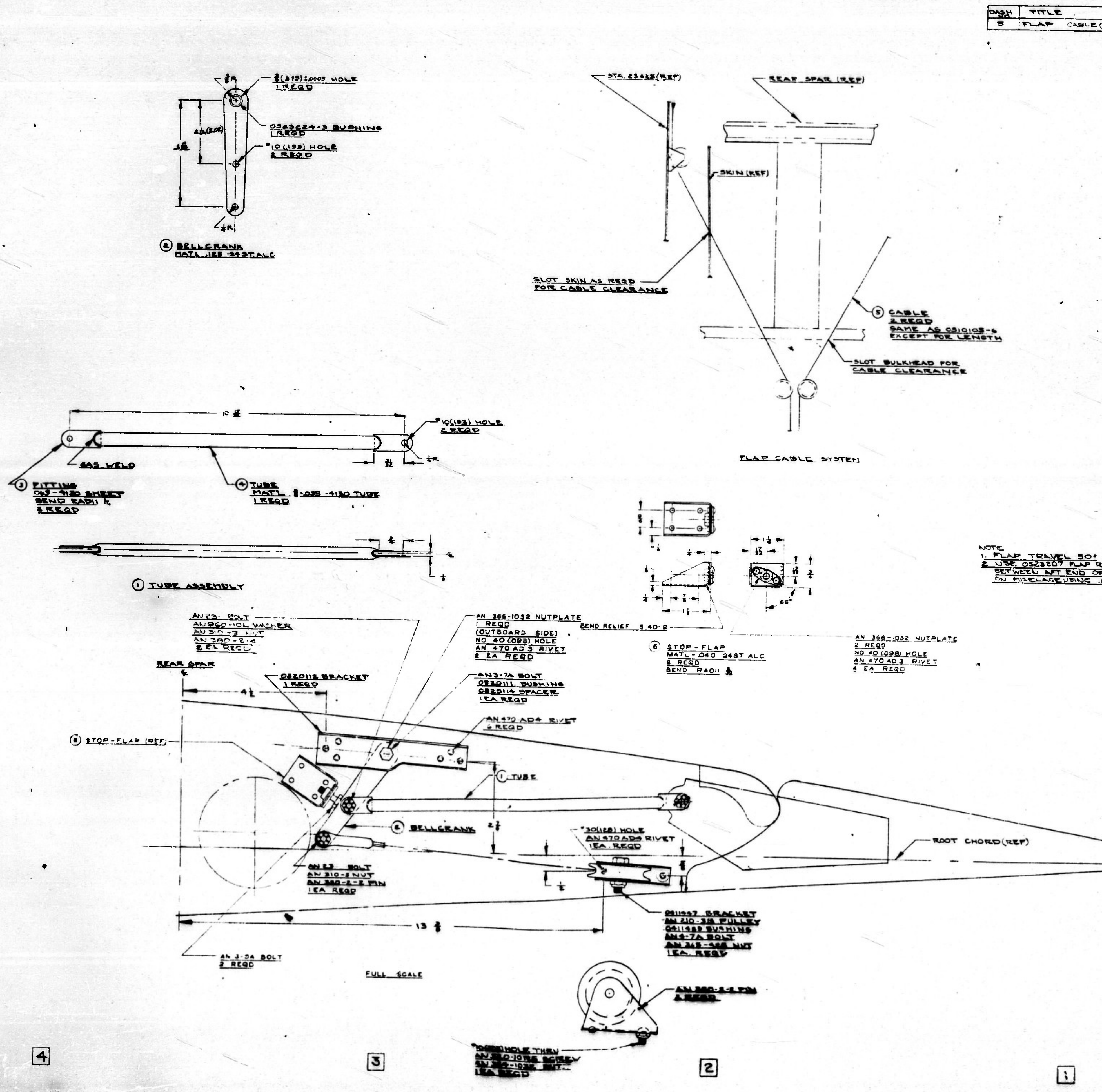


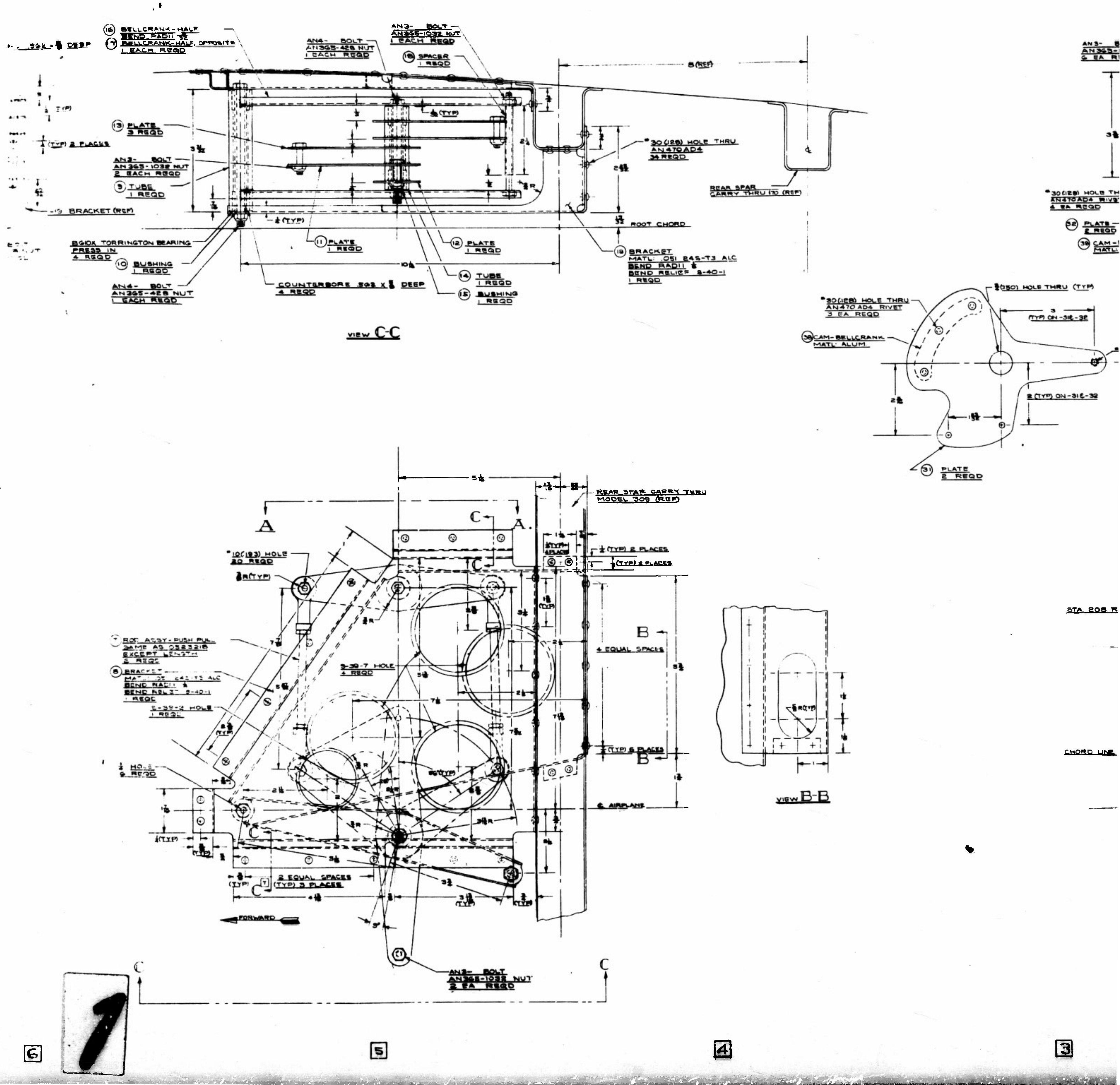


BRACKET-SHOWN
BRACKET-OPPOSITE
EA REQD
RETAINER
2 REQD
STIFFENER-SHOWN
STIFFENER-OPPOSITE
1 EA REQD
SPACER-SHOWN
SPACER-OPPOSITE
1 EA REQD
STA 75%
CHANNEL-SHOWN
CHANNEL-OPPOSITE
1 EA REQD
MAT'L-.040 24 ST ALC
CHORD LINE
PRESS IN TORRINGTON
AR-4-1 BEARING
1 EA REQD
NO 40 (.098) HOLE THRU
AN 426 AD3 RIVET
4 EA REQD-FLUSH
BOTH SIDES
BEND LINE
DETAIL R-R
FULL SCALE
REAR SPAR
CHANNEL (REF)
REAR SPAR STA 50%
ANGLE-SHOWN
ANGLE-OPPOSITE
2 EA REQD
CHANNEL
2 REQD
MAT'L-.051 24ST ALC
RIB - SHOWN
RIB - OPPOSITE
1 EA REQ'D
MAT'L-.032 24ST ALC
RIB (REF)
DOUBLER (REF)
SECTION P-P
FULL SCALE
STA 99.312
STA 100.312
SKIN (REF)
SECTION Q-Q
FULL SCALE
JOGGLE .032
RIB-SHOWN
RIB-OPPOSITE
1 EA REQD
EXCEPT AS NOTED
LOFT CONTOUR
WING SKIN (REF)
ANGLE
2 REQD
MAT'L-.032 24 ST ALC
RIB-SHOWN
RIB-OPPOSITE
1 EA REQD
MAT'L-.032 24ST ALC
CHORD LINE
4 EQUAL SPACES
ALONG CONTOUR
ANGLE (REF)
HINGE POINT (REF)
8 EA REQD
SECTION S-S
FULL SCALE
REAR SPAR STA 50%
CHORD LINE
SECTION I-I
FULL SCALE
(WING STA 239.375)
SECTION J-J
FULL SCALE
(WING STA 100)
12309-3
SHEET 3
12
11
10
2

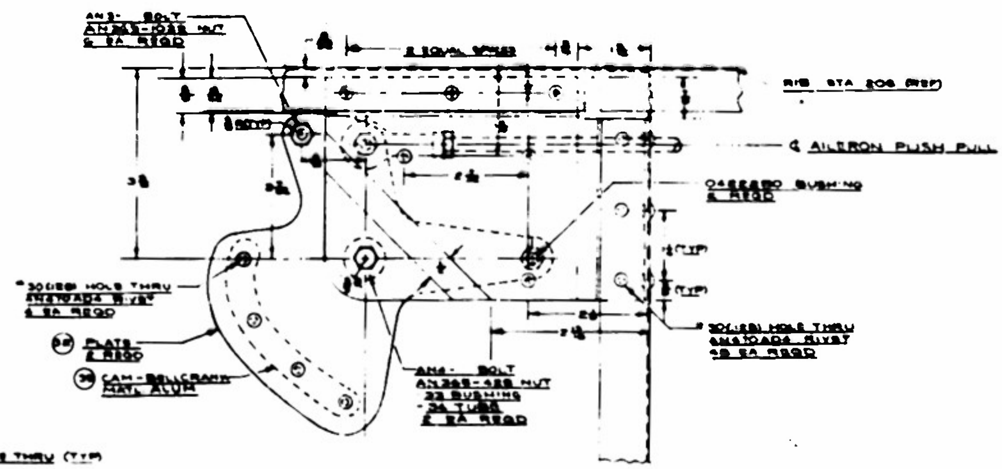
CONFIDENTIAL

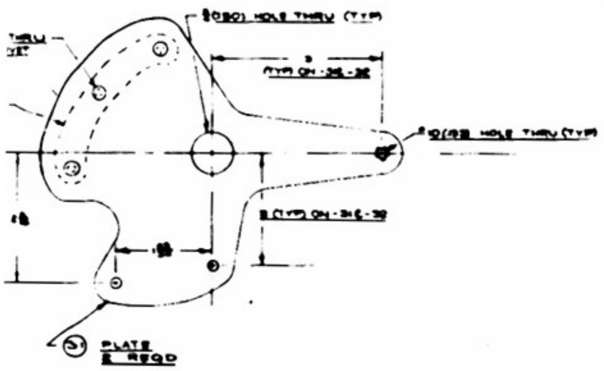


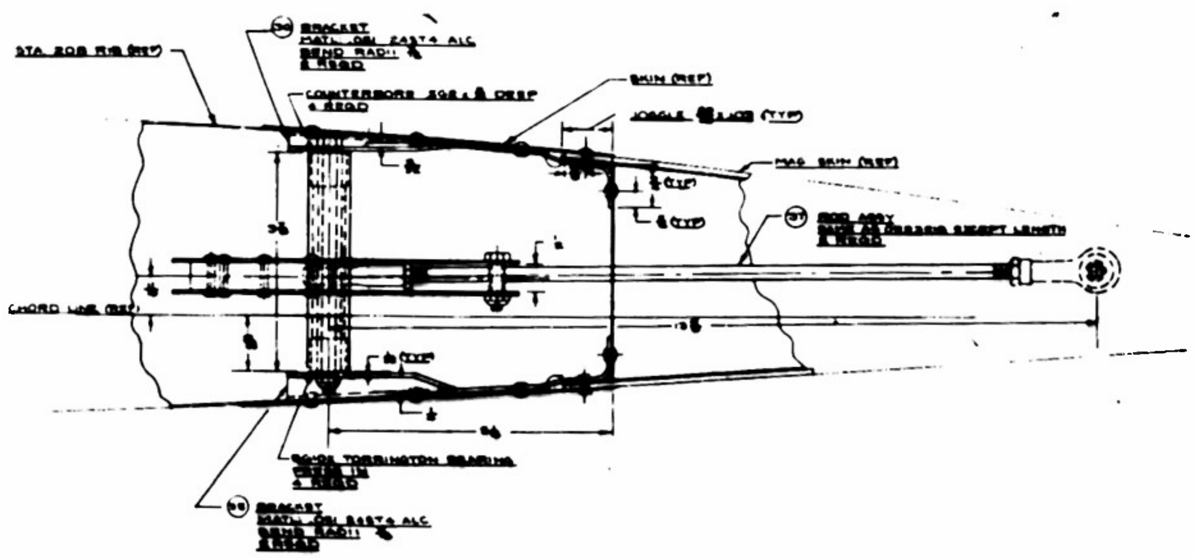
4 3 2 1



BELLCRANK-HALF
BEND RADII
BELLCRANK-HALF, OPPOSITE
1 EACH REQD
AN4- BOLT
AN365-428 NUT
1 EACH REQD
AN3- BOLT
AN365-1032 NUT
1 EACH REQD
SPACER
1 REQD
8 (REF)
PLATE
3 REQD
AN3- BOLT
AN365-1032 NUT
2 EACH REQD
TUBE
1 REQD
BRACKET (REF)
#30 (128) HOLE THRU
AN470AD4
34 REQD
REAR SPAR
CARRY THRU (REF)
ROOT CHORD
B610X TORRINGTON BEARING
PRESS IN
4 REQD
BUSHING
1 REQD
AN4- BOLT
AN365-428 NUT
1 EACH REQD
PLATE
1 REQD
PLATE
1 REQD
TUBE
1 REQD
BUSHING
1 REQD
COUNTERBORE X DEEP
4 REQD
BRACKET
MATL .051 24S-T3 ALC
BEND RADII
BEND RELIEF 8-40-1
1 REQD
VIEW C-C
#30 (128) HOLE THRU
AN470 AD4 RIVET
3 EA REQD
CAM-BELLCRANK
MATL ALUM
(TYP) ON -316-32
2 (TYP) ON -316-32
PLATE
2 REQD
REAR SPAR CARRY THRU
MODEL 309 (REF)
A
C
B
#10 (193) HOLE
20 REQD
(TYP)
4 EQUAL SPACES
2 (TYP) 2 PLACES
(TYP) 2 PLACES
(TYP) 6 PLACES
ROD ASSY - PUSH PULL
EXCEPT LENGTH
2 REQD
BRACKET
BEND RADII
BEND RELIEF 8-40-1
1 REQD
HOLE
1 REQD
HOLE
4 REQD
HOLE
6 REQD
AIRPLANE
2 EQUAL SPACES
(TYP) 3 PLACES
FORWARD
AN3- BOLT
AN365-1032 NUT
2 EA REQD
VIEW B-B
STA. 208
CHORD LINE
6
5
4
3





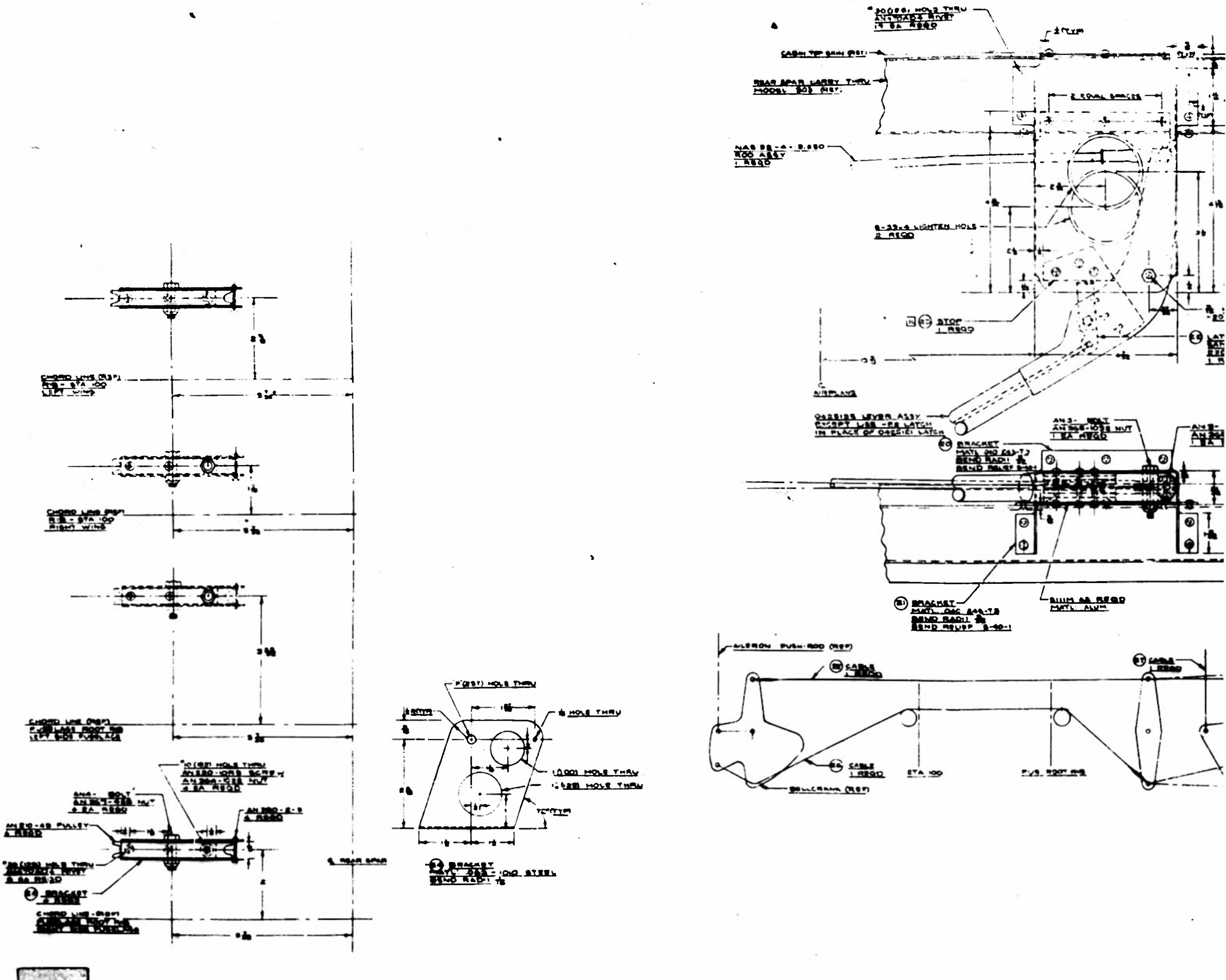


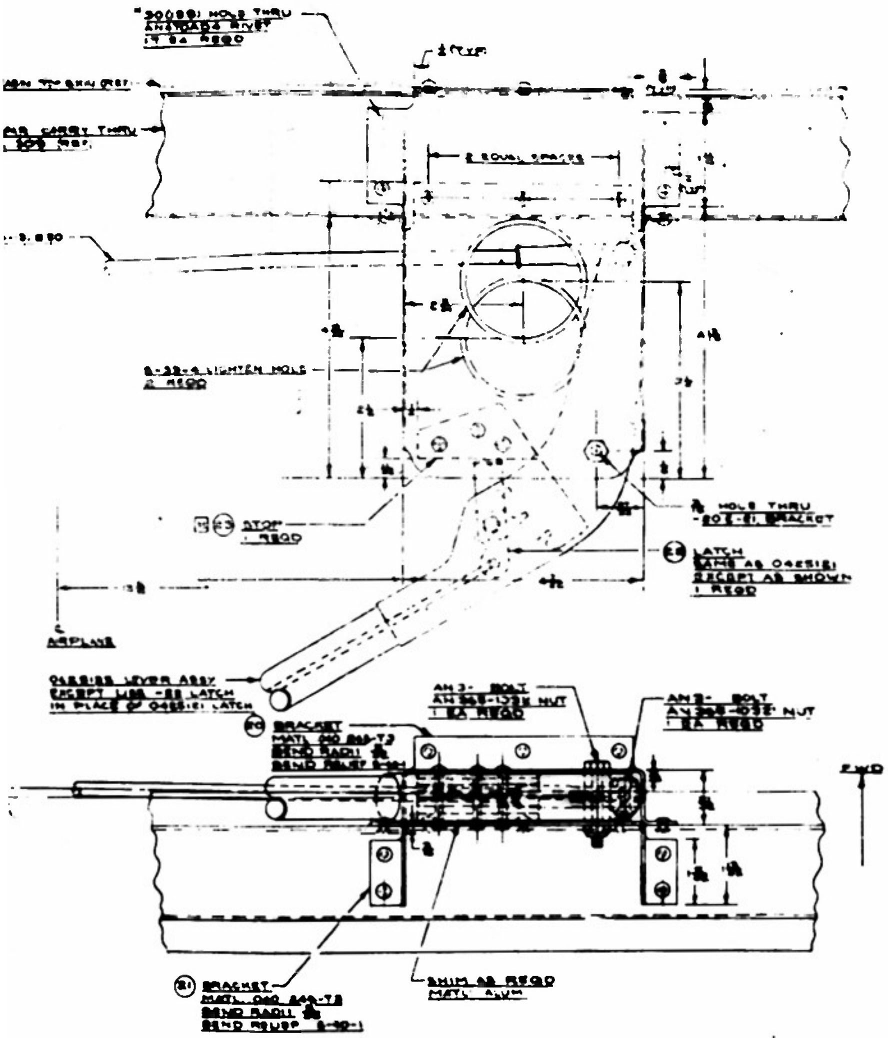
NOTES
1. USE .050-4130 STEEL SHEET FOR -1,-2,[illegible]-12,-13,-15,-38 PLATES AND -16,-17 BELLCRANK-HALFS.
2. USE [illegible] X.120-4130 STEEL TUBE FOR -3,-5,-9,-14 & -24 TUBES
3. BUSHINGS -4,-6,-10,-11,-18,-33 SAME AS 0452250 EXCEPT LENGTH.
4. USE [illegible] X.035-4130 STEEL TUBE FOR -19 SPACER.
5. AILERON TRAVEL - 20° UP & 15° DOWN.
6. AILERON DROOP - 30° TRAVEL IN 10° INCREMENTS
7. PLACE CABLE STOPS [illegible] AN3-6 BOLT AND AN365-1032 NUT) ON -27 & -28 CABLES IN THE VICINITY OF STA 50 FOR STA 109 BULKHEADS.

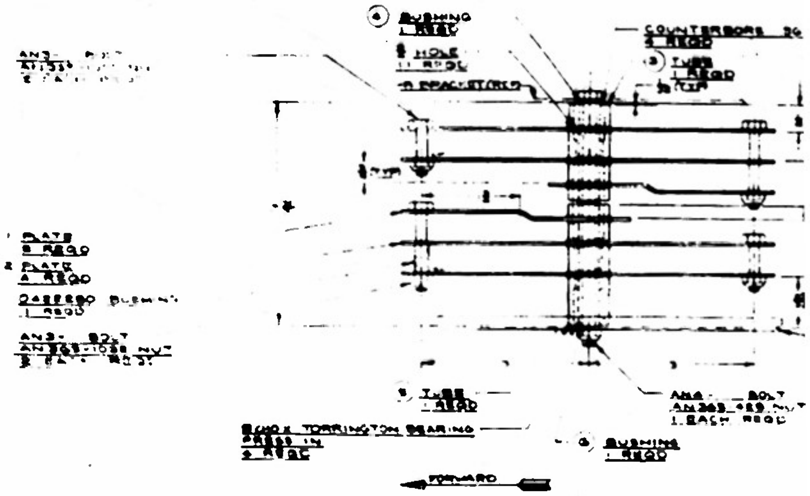
3

2

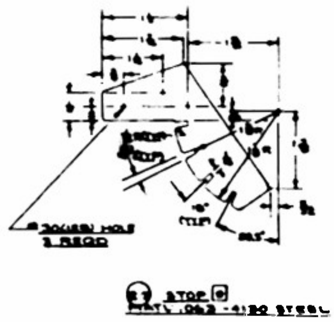
[illegible]	CESSNA A
[illegible]	CONTROLS AILERON
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	1230


CABIN TOP SKIN (REF)
2 EQUAL SPACES
LIGHTEN HOLE
2 REQD
STOP
1 REQD
AIRPLANE
LEVER ASSY
BRACKET
SHIM AS REQD
MATL ALUM
AILERON PUSH-ROD (REF)
CABLE
1 REQD
STA 100
FUS. ROOT RIB
BELLCRANK (REF)
CHORD LINE (REF)
LEFT WING
RIGHT WING
HOLE THRU
REAR SPAR
STEEL



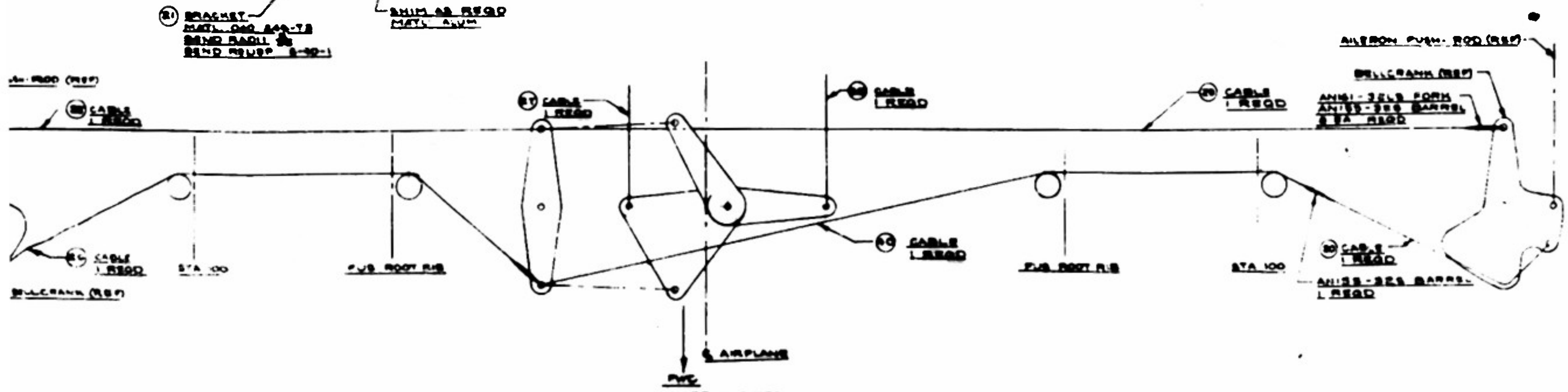


VIEW A-A



DASH NO	SIZE	TERMINAL	TERMINAL
25	[illegible]	[illegible]	AN664-4 [illegible]
26	[illegible]	AN664-4 [illegible]	[illegible]
27	[illegible]	AN664-4 [illegible]	[illegible] OR [illegible]
28	[illegible]	AN664-4 [illegible]	[illegible] OR [illegible]
29	[illegible]	AN664-4 [illegible]	[illegible]
30	[illegible]	[illegible]	AN664-4 [illegible]
40	[illegible]	AN664-4 [illegible]	[illegible]

ALL CABLES ARE 7x19 STEEL CABLE



AILERON SYSTEM TOP VIEW

SECTION C-C

12309-5

SHEET 2

2

9 8 7 6

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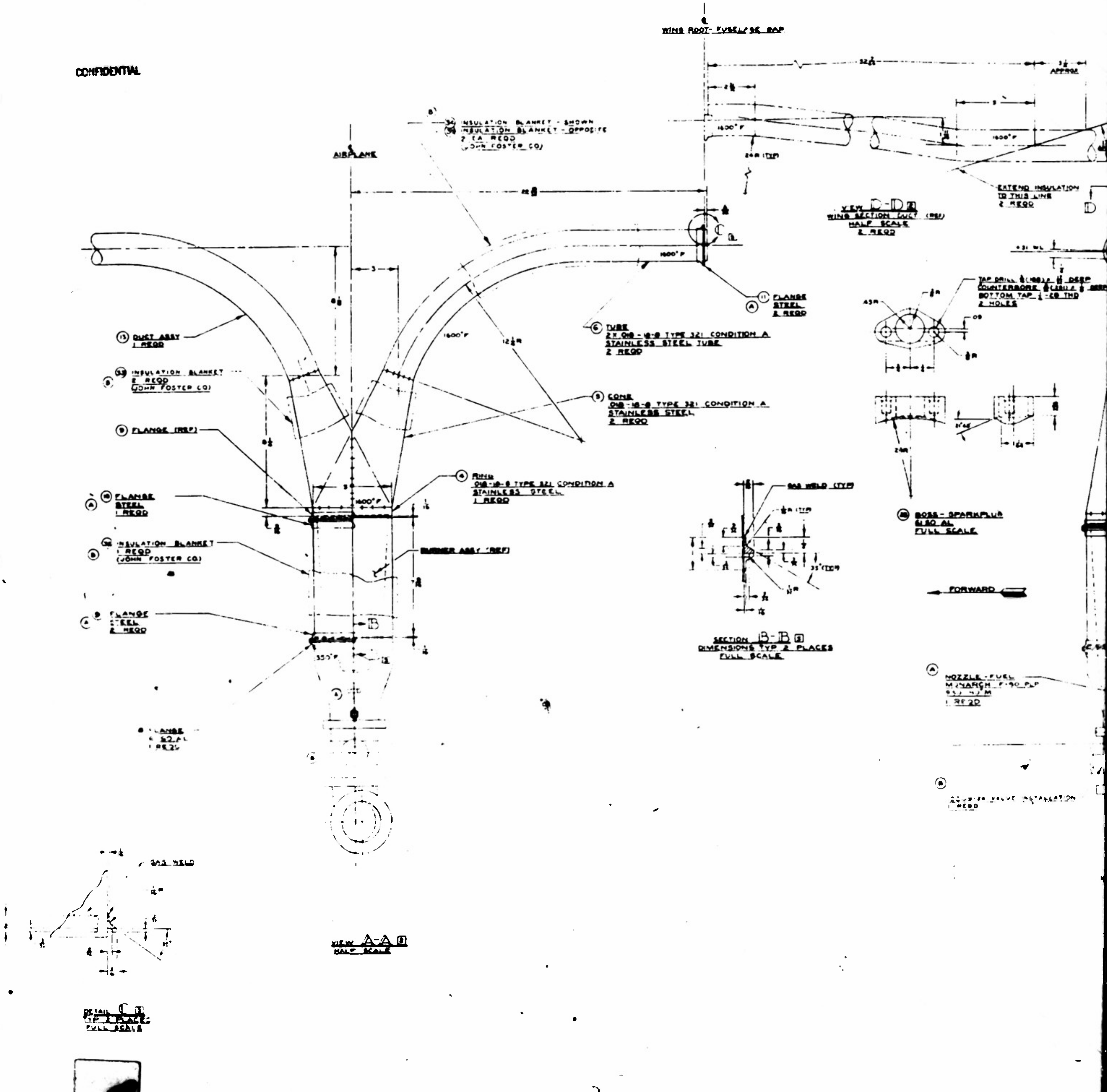

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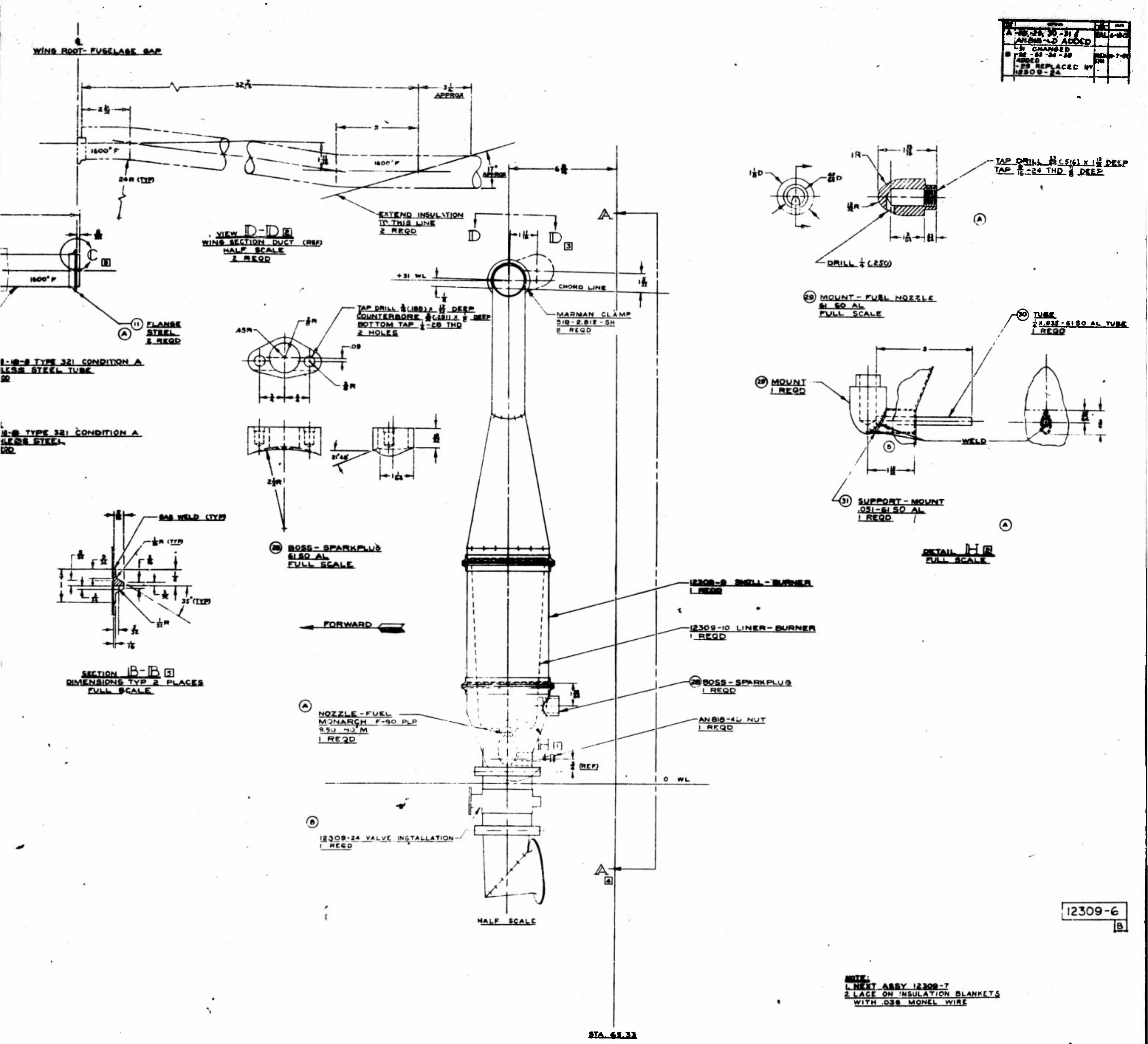
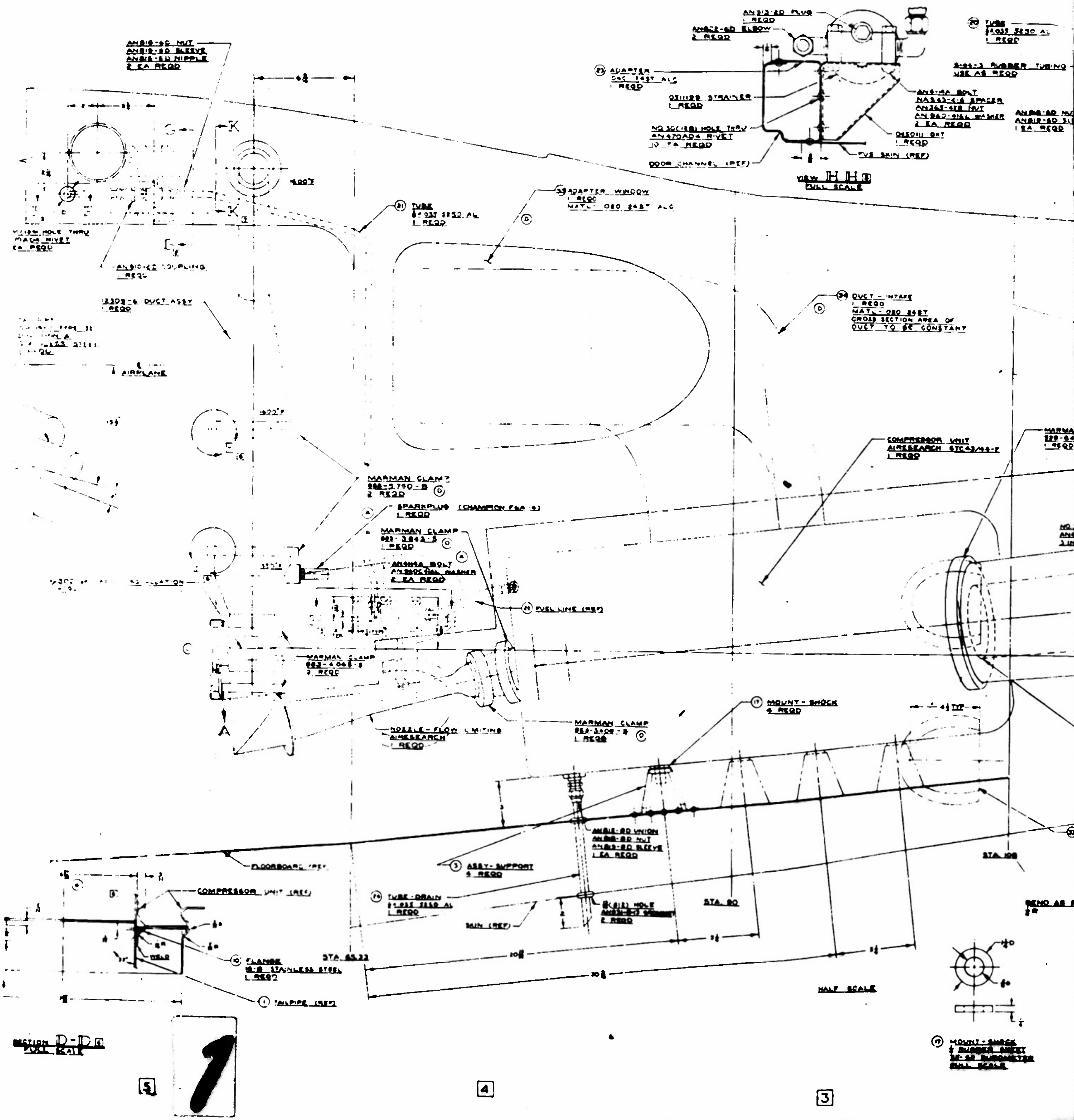


NOTE:
1. NEXT ASSY 12309-7
2. LACE ON INSULATION BLANKETS WITH .032 MONEL WIRE

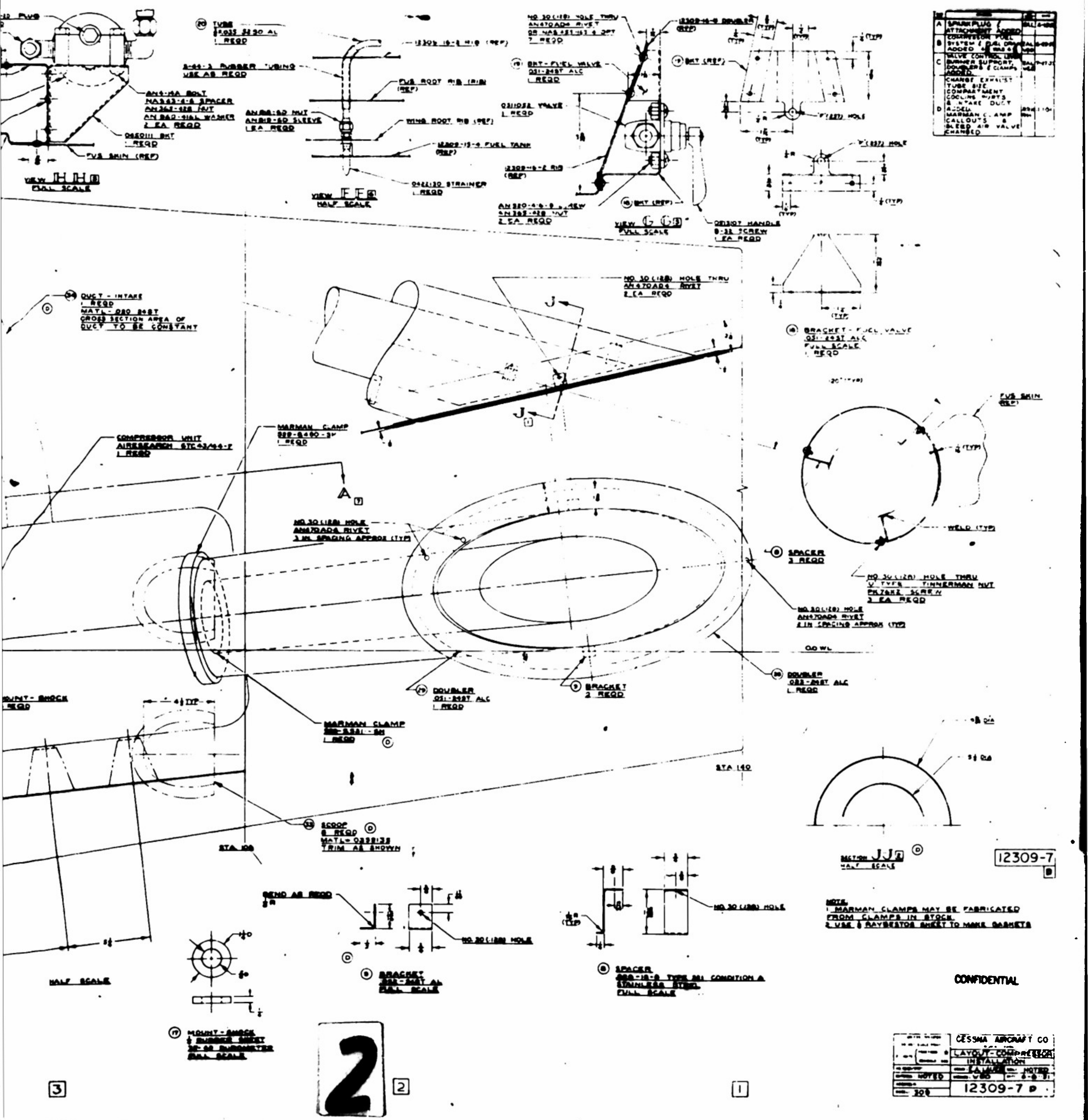
CONFIDENTIAL

CESSNA AIRCRAFT CO.	
LAYOUT - COMPRESSOR & BURNER DUCTS	
DRAWN: E.A. LANGE	SCALE: NOTED
CHECKED: WM	DATE: 5-16-51
MATERIAL: NOTED	
12309-6	

2

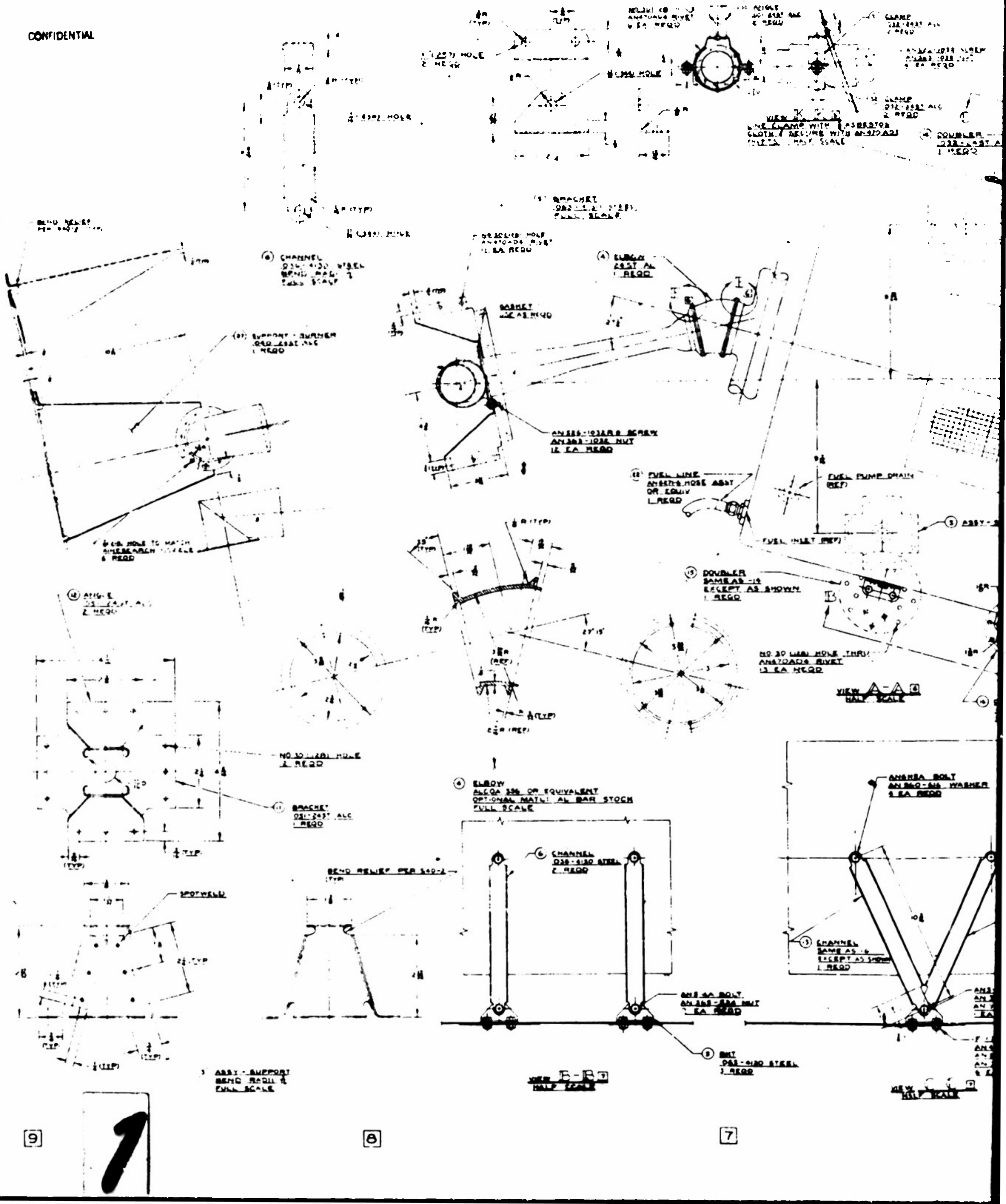


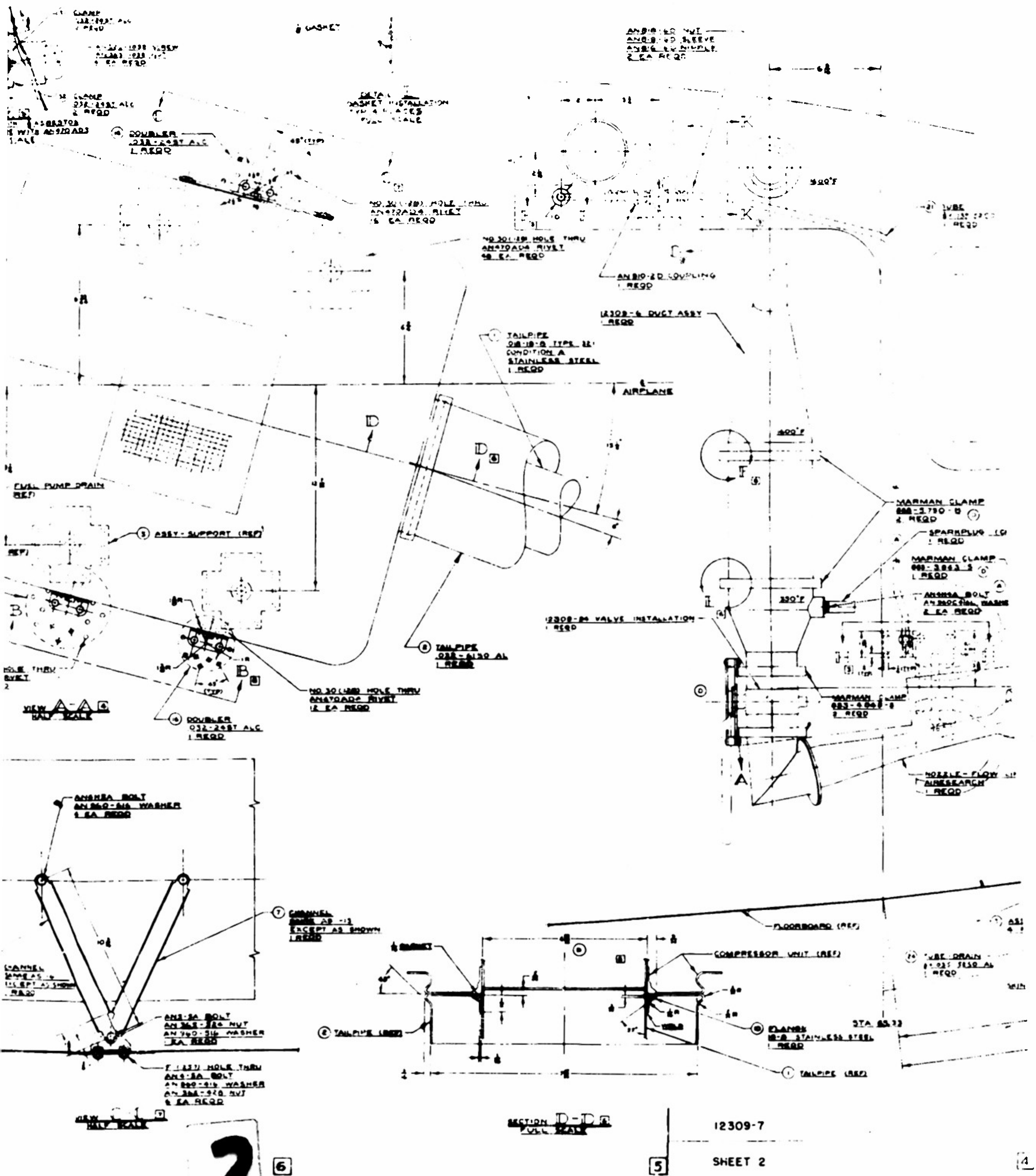
AN815-2D PLUG
1 REQD
AN822-6D ELBOW
2 REQD
ADAPTER
1 REQD
STRAINER
1 REQD
DOOR CHANNEL (REF)
FUS SKIN (REF)
VIEW H-H
FULL SCALE
AN818-6D NUT
AN819-6D SLEEVE
AN816-6D NIPPLE
2 EA REQD
TUBE
1 REQD
ADAPTER WINDOW
1 REQD
MATL .020 24ST ALC
DUCT - INTAKE
1 REQD
MATL .020 24ST
CROSS SECTION AREA OF
DUCT TO BE CONSTANT
AIRPLANE
COMPRESSOR UNIT
AIRESEARCH
1 REQD
MARMAN CLAMP
2 REQD
SPARKPLUG
1 REQD
MARMAN CLAMP
1 REQD
2 EA REQD
FUEL LINE (REF)
MARMAN CLAMP
2 REQD
NOZZLE - FLOW LIMITING
AIRESEARCH
1 REQD
MARMAN CLAMP
1 REQD
MOUNT - SHOCK
4 REQD
A
AN818-8D NUT
1 EA REQD
FLOORBOARD (REF)
ASSY - SUPPORT
4 REQD
TUBE - DRAIN
1 REQD
SKIN (REF)
2 REQD
STA. 80
STA 108
COMPRESSOR UNIT (REF)
WELD
FLANGE
18-8 STAINLESS STEEL
1 REQD
STA. 65.33
TAILPIPE (REF)
HALF SCALE
SECTION D-D
FULL SCALE
MOUNT - SHOCK
FULL SCALE
5
4
3



VIEW H-H
FULL SCALE
VIEW E-E
HALF SCALE
VIEW G-G
FULL SCALE
TUBE
1 REQD
RUBBER TUBING
USE AS REQD
FUS ROOT RIB (REF)
WING ROOT RIB (REF)
FUEL TANK (REF)
STRAINER
1 REQD
FUS SKIN (REF)
BKT-FUEL VALVE
1 REQD
VALVE
1 REQD
HANDLE
BRACKET - FUEL VALVE
FULL SCALE
1 REQD
DUCT - INTAKE
1 REQD
CROSS SECTION AREA OF DUCT TO BE CONSTANT
COMPRESSOR UNIT
AIRESEARCH
1 REQD
MARMAN CLAMP
1 REQD
SPACER
3 REQD
DOUBLER
1 REQD
BRACKET
2 REQD
WELD (TYP)
STA 140
STA 108
SCOOP
TRIM AS SHOWN
SECTION J-J
HALF SCALE
HALF SCALE
BEND AS REQD
NO 30 (.128) HOLE
BRACKET
FULL SCALE
SPACER
STAINLESS STEEL
FULL SCALE
MOUNT-SHOCK
FULL SCALE
NOTE
1 MARMAN CLAMPS MAY BE FABRICATED FROM CLAMPS IN STOCK
12309-7
D
CONFIDENTIAL
CESSNA AIRCRAFT CO
LAYOUT-COMPRESSOR INSTALLATION
12309-7 D
2

CONFIDENTIAL



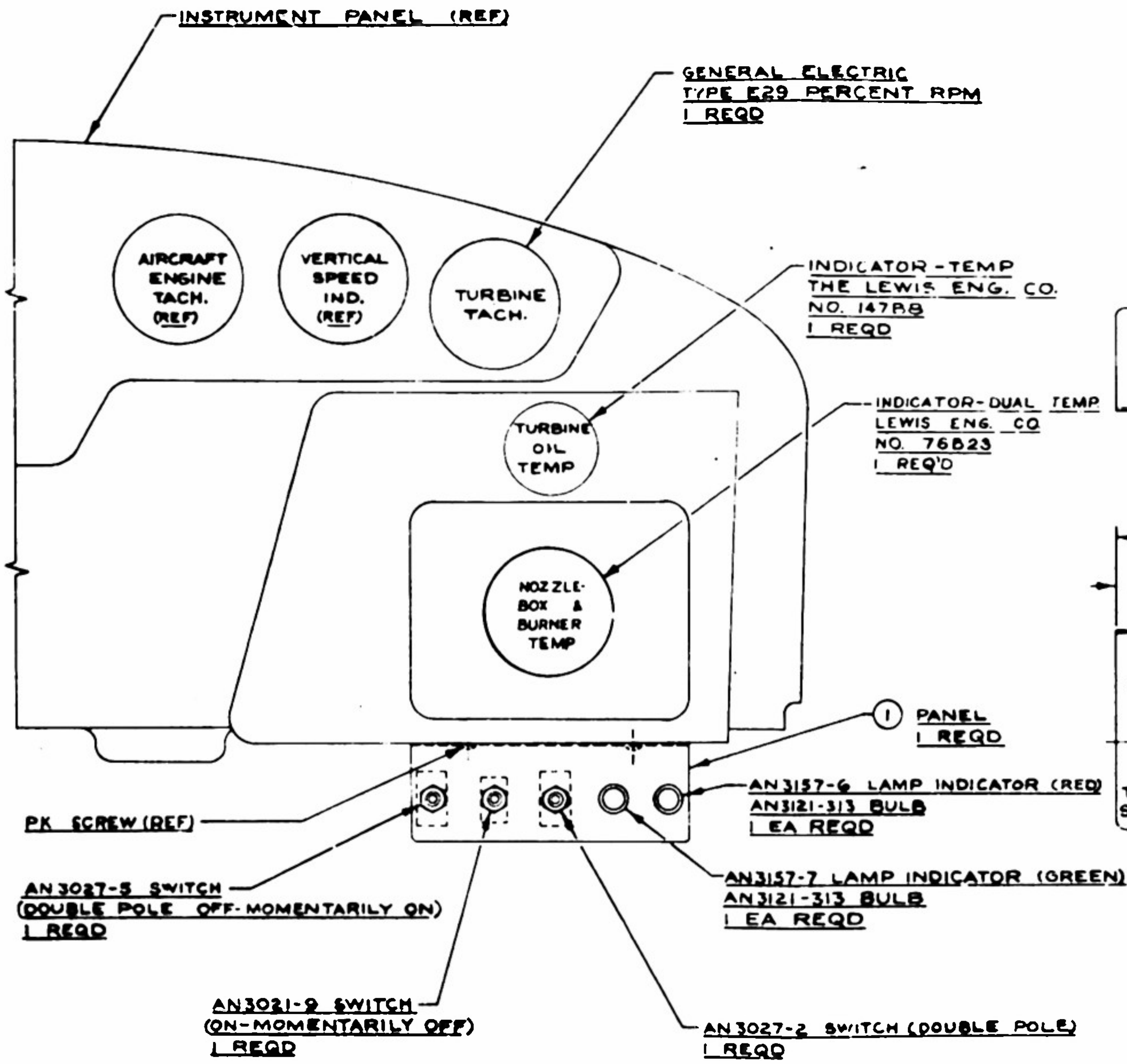


12309-7

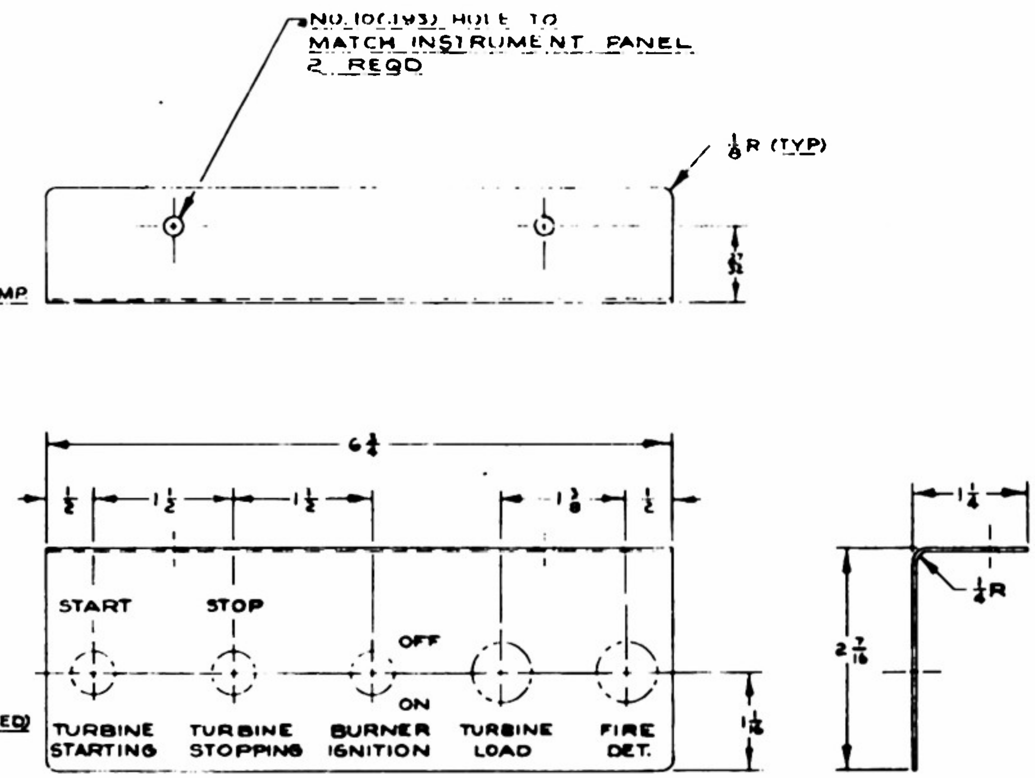
SHEET 2

2

12309-8 A



HALF SCALE



1 PANEL-CONTROL
.051-24S-T3 AL SHT ALC
FULL SCALE

NOTE:
1. ALL PARTS IN -1 PANEL MAY BE SUBSTITUTED BY EQUIVALENT PARTS.
2. HOLES IN -1 PANEL ARE TO MATCH PART USED.
3. INSTALL GUARD OVER TURBINE START SWITCH.
4. REFER TO DWG NO. 12309-21 & AIRESEARCH DWG NO. 47003 FOR COMPLETE WIRING DIAGRAM.

CONFIDENTIAL

DO NOT SCALE PRINT

DRAWN E.A. LAUER	DATE 8-2-51	SCALE NOTED
CHECKED WEO	DATE 8-3-51	
	MATERIAL NOTED	

CONTROLS - TURBINE & BURNER

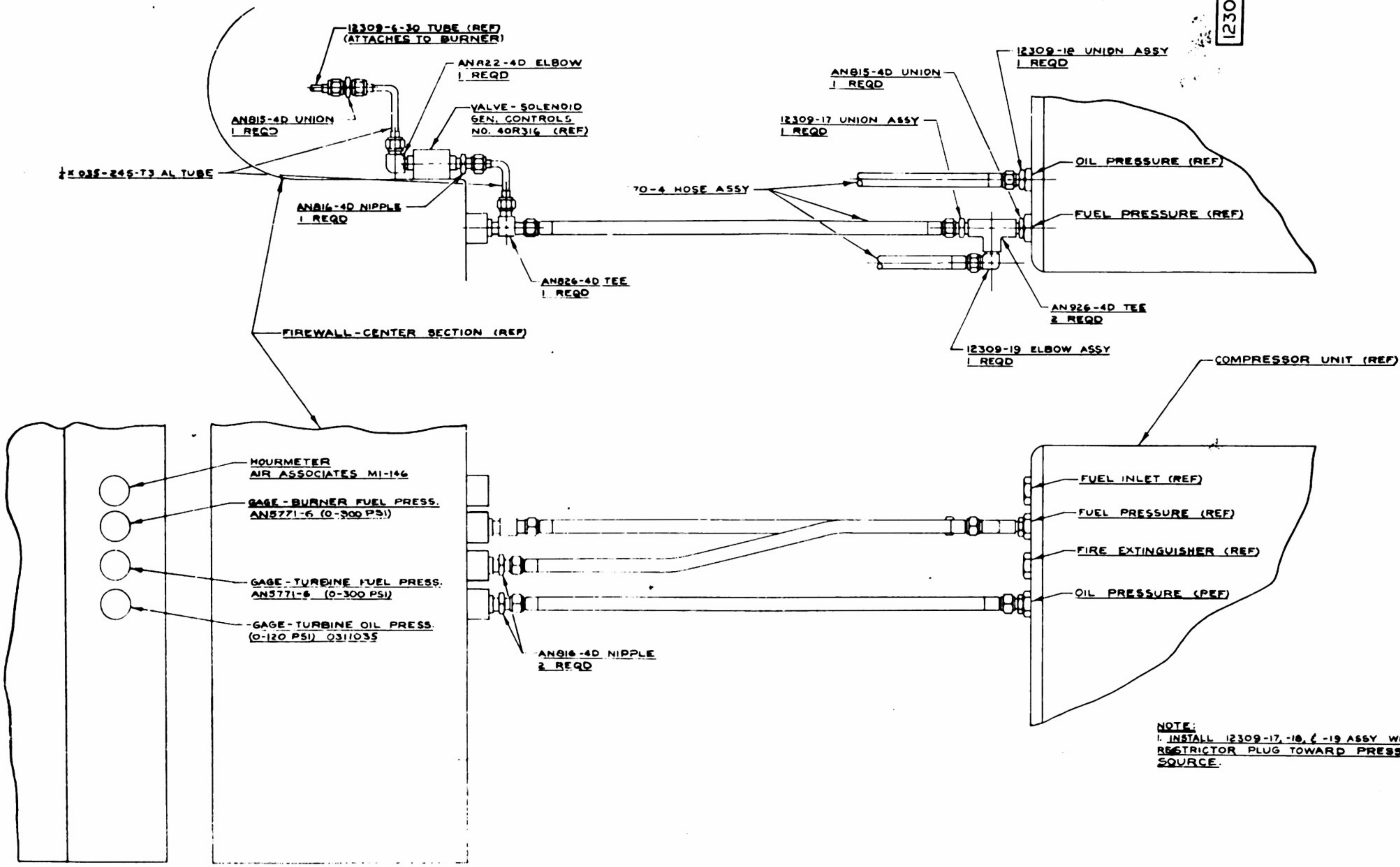
CESSNA AIRCRAFT CO.

309

12309-8 A

CONFIDENTIAL

12309-20 A



NOTE:
1. INSTALL 12309-17, -18, & -19 ASSY WITH RESTRICTOR PLUG TOWARD PRESSURE SOURCE.

CONFIDENTIAL

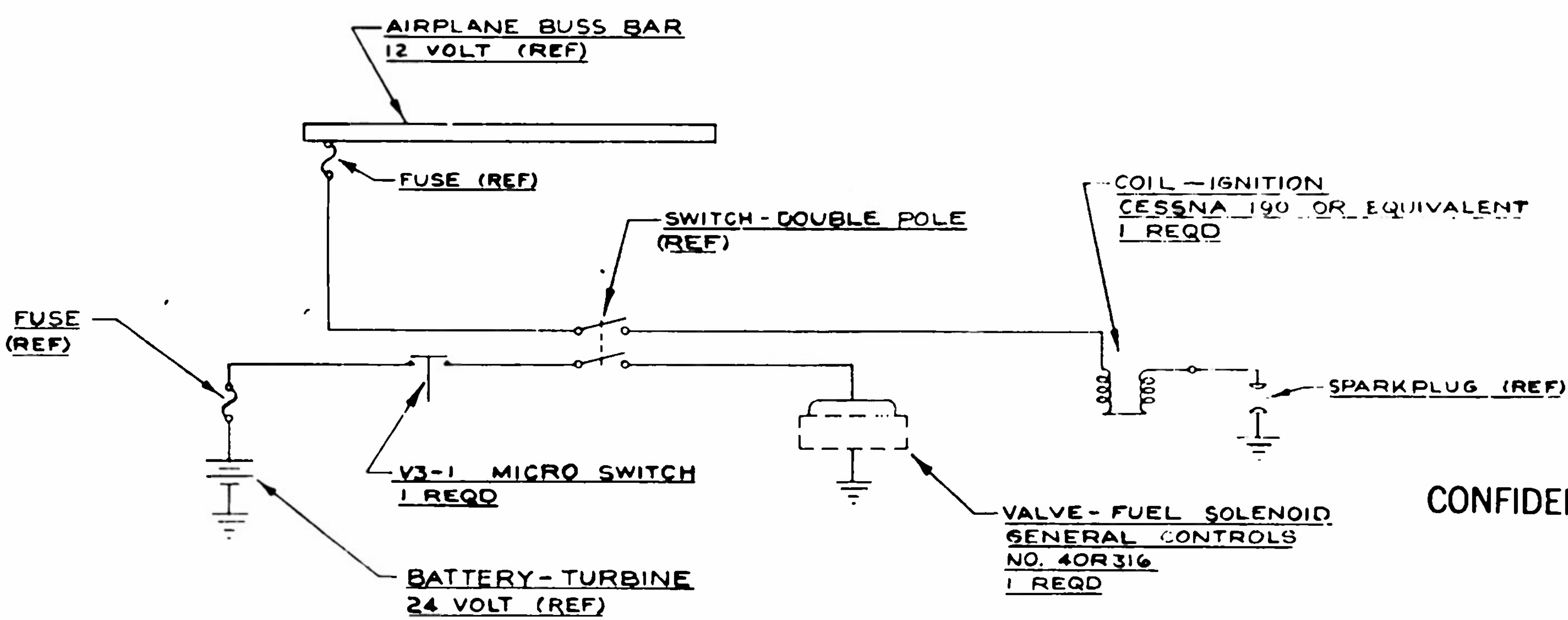
DO NOT SCALE PRINT

MODEL	309
DRAWN	E.A. LAUER
DATE	8-1-51
CHECKED	W E O
DATE	8-2-51
TITLE	SCHEMATIC - FUEL SYSTEM
	CESSNA AIRCRAFT CO.
	WICHITA, KANSAS
DWG. NO.	12309-20A

CONFIDENTIAL

12309-21

CONFIDENTIAL



CONFIDENTIAL

DO NOT SCALE PRINT.

UNLESS OTHERWISE NOTED DIMENSION LIMITS ARE: ANGLES ±½°; DEC. ±.010; FRACT. ±1/64; .031 CORNER RADII ON C'BORES AND SPOT FACES UP TO AND INCL. 1¼ DIA. .062 FOR LARGER. BREAK ALL SHARP EDGES.

NO. ASSY	NO. SHIP	NEXT ASSEMBLY	MODEL	CHG SYM
1	1		309	

WAS | BY CHK | DATE

SUPERSEDES | SUPERSEDED BY | APPLIES TO SERIALS | ESTIMATED WEIGHT | ACTUAL WEIGHT | FINISH | HEAT TREAT | MATERIAL

DRAWN E.A. LAUER DATE 7-19-51
CHECKED HEINRICH DATE 8-2-51
SCALE —

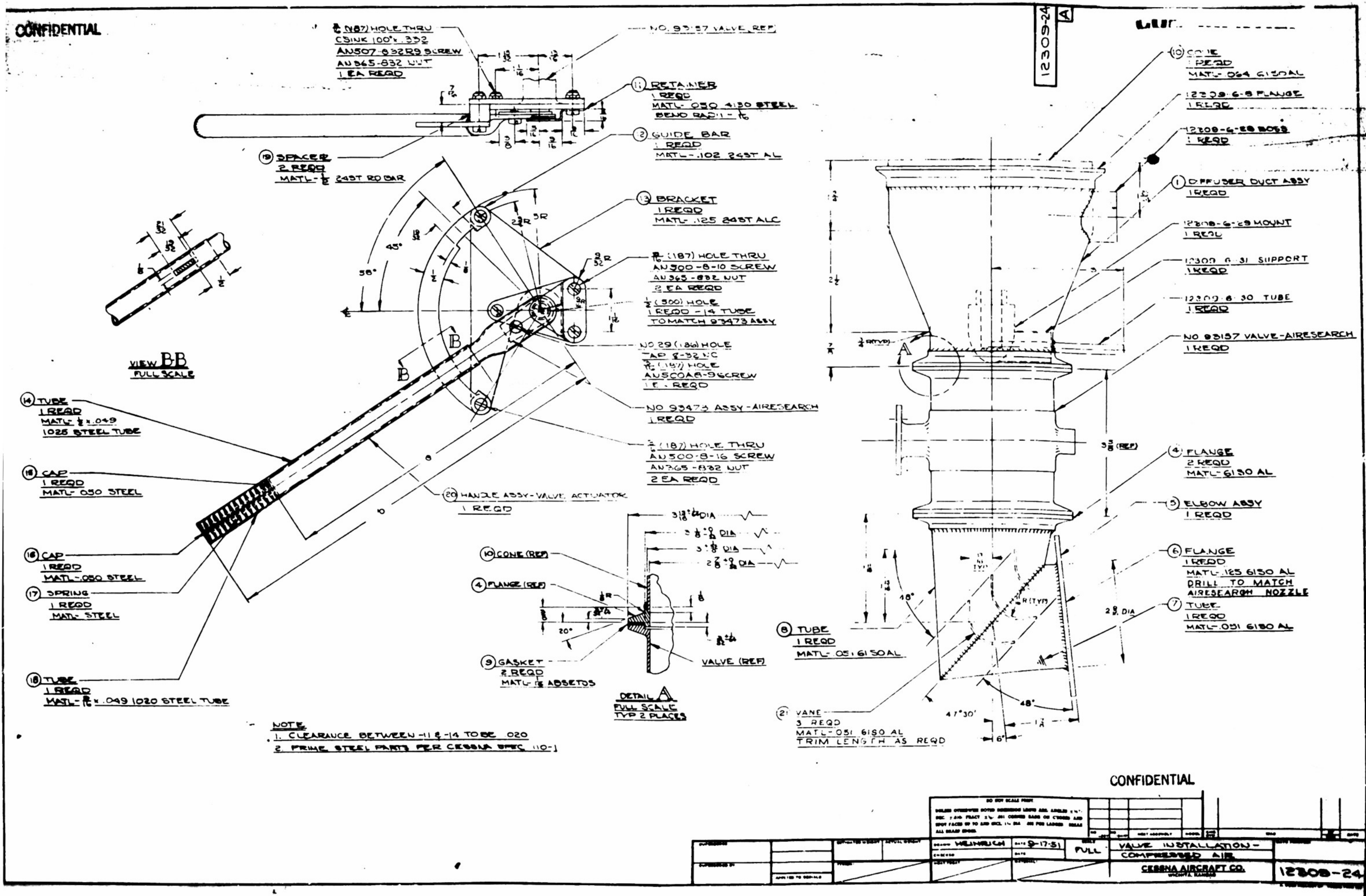
SYSTEM - BURNER
ELECTRICAL

CESSNA AIRCRAFT CO.
WICHITA, KANSAS

DATE PRINTED

12309-21

15-e0e51


CONFIDENTIAL
12309-24 A
3/16 (.187) HOLE THRU
CSINK 100° x .332
AN507-832R9 SCREW
AN365-832 NUT
1 EA REQD
NO. 93157 VALVE REF
(11) RETAINER
1 REQD
MATL-.050 4130 STEEL
BEND RAD 1/16
(2) GUIDE BAR
1 REQD
MATL-.102 24ST AL
(19) SPACER
2 REQD
MATL-1/8 24ST RD BAR
(13) BRACKET
1 REQD
MATL-.125 24ST ALC
3/16 (.187) HOLE THRU
AN500-8-10 SCREW
AN365-832 NUT
2 EA REQD
1/2 (.500) HOLE
1 REQD -14 TUBE
TO MATCH 93473 ASSY
NO.29 (.136) HOLE
TAP 8-32 NC
3/16 (.187) HOLE
AN500A8-9 SCREW
1 EA REQD
NO 93473 ASSY-AIRESEARCH
1 REQD
3/16 (.187) HOLE THRU
AN500-8-16 SCREW
AN365-832 NUT
2 EA REQD
(20) HANDLE ASSY-VALVE ACTUATOR
1 REQD
VIEW B-B
FULL SCALE
(14) TUBE
1 REQD
MATL-1/2 x .049
1025 STEEL TUBE
(15) CAP
1 REQD
MATL-.050 STEEL
(16) CAP
1 REQD
MATL-.050 STEEL
(17) SPRING
1 REQD
MATL-STEEL
(18) TUBE
1 REQD
MATL-5/16 x .049 1020 STEEL TUBE
(10) CONE (REF)
(4) FLANGE (REF)
(9) GASKET
2 REQD
MATL-1/16 ABSETOS
VALVE (REF)
DETAIL A
FULL SCALE
TYP 2 PLACES
(10) CONE
1 REQD
MATL-.064 61SO AL
12309-6-8 FLANGE
1 REQD
12309-6-28 BOSS
1 REQD
(1) DIFFUSER DUCT ASSY
1 REQD
12309-6-29 MOUNT
1 REQD
12309-6-31 SUPPORT
1 REQD
12309-6-30 TUBE
1 REQD
NO 93157 VALVE-AIRESEARCH
1 REQD
(4) FLANGE
2 REQD
MATL-61SO AL
(5) ELBOW ASSY
1 REQD
(6) FLANGE
1 REQD
MATL-.125 61SO AL
DRILL TO MATCH
AIRESEARCH NOZZLE
(7) TUBE
1 REQD
MATL-.051 61SO AL
(8) TUBE
1 REQD
MATL-.051 61SO AL
(21) VANE
3 REQD
MATL-.051 61SO AL
TRIM LENGTH AS REQD
NOTE
1. CLEARANCE BETWEEN -11 & -14 TO BE .020
2. PRIME STEEL PARTS PER CESSNA SPEC 110-1
CONFIDENTIAL
DO NOT SCALE PRINT
HEINRICH
9-17-51
FULL
VALVE INSTALLATION - COMPRESSED AIR
CESSNA AIRCRAFT CO.
WICHITA, KANSAS
12309-24