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**XB-46 AIRCRAFT, SERIAL NO. 45-59582, PNEUMATIC
SYSTEM AND COMPONENTS TESTS AND INSPECTION**

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AIRCRAFT LABORATORY**

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WRIGHT AIR DEVELOPMENT CENTER

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**XB-46 AIRCRAFT, SERIAL NO. 45-59582, PNEUMATIC
SYSTEM AND COMPONENTS TESTS AND INSPECTION**

*Lt Ralph L. Vick
Aircraft Laboratory*

March 1952

RDO No. 452-495-B

Wright Air Development Center
Air Research and Development Command
United States Air Force
Wright-Patterson Air Force Base, Ohio

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FOREWORD

This report was completed under the research and development Expenditure Order 452-495-B, "System, Hydraulic and Pneumatic, and Components." This project was administered under the direction of the Aircraft Laboratory, Aeronautics Division, Wright Air Development Center, Air Research and Development Command, Capt S. Meiselman and Lt R. L. Vick acting as project engineers. This is the completed report on this project.

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ABSTRACT

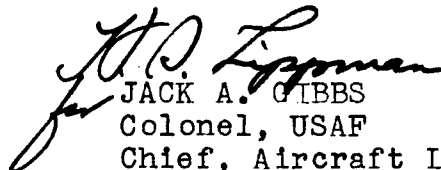
Low temperature operational difficulties in the XB-46 pneumatic system and malfunctioning of the system components due to corrosion made necessary the tests reported herein. Cold temperature functioning tests were conducted at the Air Proving Ground and the conclusions and recommendations are contained in this report. Gun-fire tests, to determine the vulnerability of the air storage containers, and corrosion inspection were conducted by the Aircraft Laboratory at the Wright Air Development Center and the results indicated that the use of tubular structural members as air storage containers is desirable, and components designed for pneumatic systems, along with dehydrators, will reduce the corrosion and freezing of accumulated moisture problems, to allow satisfactory operation of the system.

The title of this report is unclassified.

PUBLICATION REVIEW

Manuscript copy of this report has been reviewed and found satisfactory for publication.

FOR THE COMMANDING GENERAL:


JACK A. GIBBS
Colonel, USAF
Chief, Aircraft Laboratory
Aeronautics Division

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INTRODUCTION

The XB-46 airplane is an experimental, high speed, high altitude, medium bombardment aircraft, powered with four J-35 jet propulsion engines. This airplane was built in 1946. The 1500 psi pneumatic system is utilized to operate the landing gear, bomb bay doors, and brakes. The airplane was manufactured by the Consolidated Vultee Aircraft Corporation, San Diego, California. The test program reported on herein involves the pneumatic system of the airplane.

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SECTION I

PREPARATION FOR TEST

Pneumatic system difficulties under normal operational conditions inspired the tests reported on herein. These difficulties included burning out of solenoid valves due to corrosion on components, malfunction of check valves and other components, due to corrosion, and general poor operation of the system at low temperatures due largely to freezing of moisture in the system. It was decided to run tests in the Climatic Cold Hangar at Eglin Air Force Base, Florida, to determine the operational characteristics of the pneumatic system at low temperatures. The pneumatic system was completely winterized at the Wright Air Development Center by replacing all O-ring packings in the various units with new AN6227 and AN6230 O-rings and lubricating with MLG3620 grease, which was authorized as a suitable substitute for AF-3515 grease. The aircraft was then delivered to the Air Proving Ground at Eglin Air Force Base, Florida, at approximately 1 August 1950, and instrumentation was begun.

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SECTION II

COLD TESTS AT THE AIR PROVING GROUND

The complete scope of the tests is described in report number 400.112, Final Letter Report on APG Project AMC EO-452-495-B, "Functional Test, Climatic Hangar Cold, of the Pneumatic System Installed in XB-46 Aircraft, Serial No. 45-59582".

Tests of the pneumatic system components were conducted at +70°, +20°, -20°, -40°, and -65°F. The results of the tests led to the following conclusions and recommendations:

A. Conclusions:

1. The pneumatic system as used on the XB-46 aircraft is not suitable for operation in ambient air temperatures of +20°F and below.
2. Freezing of moisture in check valves, regulator valves, and lines was the major cause of difficulties encountered at temperatures of +20°F and below.
3. Actuators appeared to operate satisfactorily at all temperatures.
4. No device or technique could be contrived which would permit satisfactory operation of the system at +20°F and below.

B. Recommendation:

It is recommended that a positive means of controlling or preventing moisture accumulation and air leakage be incorporated in any pneumatic system considered for installation in future Air Force aircraft.

At the conclusion of the cold tests, the XB-46 airplane was destroyed by previous agreement, and representative pneumatic system components were forwarded to the Wright Air Development Center for additional tests and inspection. The date of receipt was approximately June 1951, and the list of components included the following:

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SECTION II Continued

COLD TESTS AT THE AIR PROVING GROUND

- A. Aft Bomb Door Normal System Accumulator CVAC Part No. 109-0080502 - Volume, 300 cu. in.
- B. Normal Main Landing Gear Accumulator, CVAC Part No. 109-5110102 - Volume, 828 cu. in. with 109-511079.
- C. Normal Main Landing Gear Accumulator, CVAC Part No. 109-511079- Volume, 828 cu. in. with 109-5110102.
- D. Normal Brake Accumulator, Cleveland Pneumatic No. 8537 - Volume, 1810 cu. in.
- E. Main Landing Gear Selector Valve
- F. Bomb Bay Door Selector Valve, Aft.
- G. Pressure Relief Valve
- H. Air Pressure Regulator Valve - R. H.
- I. Check Valve Assembly - Brake System, R. H.
- J. Check Valve Assembly - Brake System, L. H.
- K. Bomb Bay Door Rear Check Valve Assembly

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SECTION III

TESTS AND INSPECTION AT THE WRIGHT AIR DEVELOPMENT CENTER

The normal main landing gear accumulator (Part B) was a nose gear drag brace on the airplane and the normal main landing gear accumulator (Part C) and normal brake accumulator (Part D) composed the main landing gear drag brace and main landing gear fork of the main landing gear shock strut. The aft bomb door normal system accumulator (Part A) was a cylindrical accumulator normal to an aircraft pneumatic system.

All of the accumulators were charged to the normal system pressure of 1500 psi. They were then fired at by 50 caliber armor piercing projectiles at a distance of 50 yards to simulate actual combat conditions when an enemy projectile might pierce the accumulators. The bullets were tumbled to cause the largest possible hole with a 50 caliber bullet.

A projectile was tumbled into and pierced the aft bomb door accumulator as shown in Plate 1 of this report. Two tumbled shots on the main landing gear fork (normal brake accumulator) resulted in two partial penetrations as shown on Plate 2. A straight shot pierced the accumulator as also shown in Plate 2. A straight shot pierced the nose gear drag brace (main landing gear accumulator Part B) as shown in Plate 3, and a straight shot pierced and lodged itself in the main landing gear drag brace (main landing gear accumulator Part C) as shown in Plate 4. The projectiles made clean holes and none of the accumulators shattered, as shown in the photographs.

The accumulators were then cut open to check the internal surfaces as to what damage might have been done by moisture in the air. The Materials Laboratory determined that there was some surface corrosion, but it was considered very slight considering the length of time that the aircraft was in use. It was considered that the amount of corrosion present was not sufficient to cause trouble to the airplane. The projectiles knocked some of the zinc chromate coating from the inside surfaces of the landing gear accumulator as shown in Plate 5. There was some surface corrosion where the zinc chromate was knocked off.

The valves were disassembled completely and checked for corrosion. All appeared in excellent condition with no corrosion except the bomb bay door rear check valve assembly as shown in Plates 6 and 7. This check valve was badly corroded and could not be operated. It should be noted that, at the time when this pneumatic system was built, there were no pneumatic valves available and hydraulic system type valves were used. These units were not considered entirely adequate for pneumatic system use. This check valve was

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SECTION III Continued

TESTS AND INSPECTION AT THE WRIGHT AIR DEVELOPMENT CENTER

a hydraulic system check valve and, whereas the rest of the valves retain their surface grease for protection against corrosion, the flow of air passing through the check valve removes portions of grease, exposing the surface to moisture corrosion. The poppets and springs were not forwarded with the other check valve assemblies. At the present time, valves have been perfected for pneumatic systems, and the use of dehydrators should reduce the corrosion and moisture accumulation problem.

It is concluded that it is both practicable and desirable to use tubular structural members as air storage containers for aircraft pneumatic systems and that components and dehydrators designed for pneumatic systems should eliminate the corrosion and moisture accumulation problem on these systems.

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Plate 1

AFT BOMB DOOR NORMAL SYSTEM

ACCUMULATOR, PART A

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Plate 2

MAIN LANDING GEAR FORK OF MAIN LANDING

GEAR SHOCK STRUT, NORMAL BRAKE ACCUMULATOR PART D

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PLATE 3

NOSE GEAR DRAG BRACE, NORMAL MAIN

LANDING GEAR ACCUMULATOR PART B

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Plate 4

MAIN LANDING GEAR DRAG BRACE, NORMAL.

MAIN LANDING GEAR ACCUMULATOR, PART C

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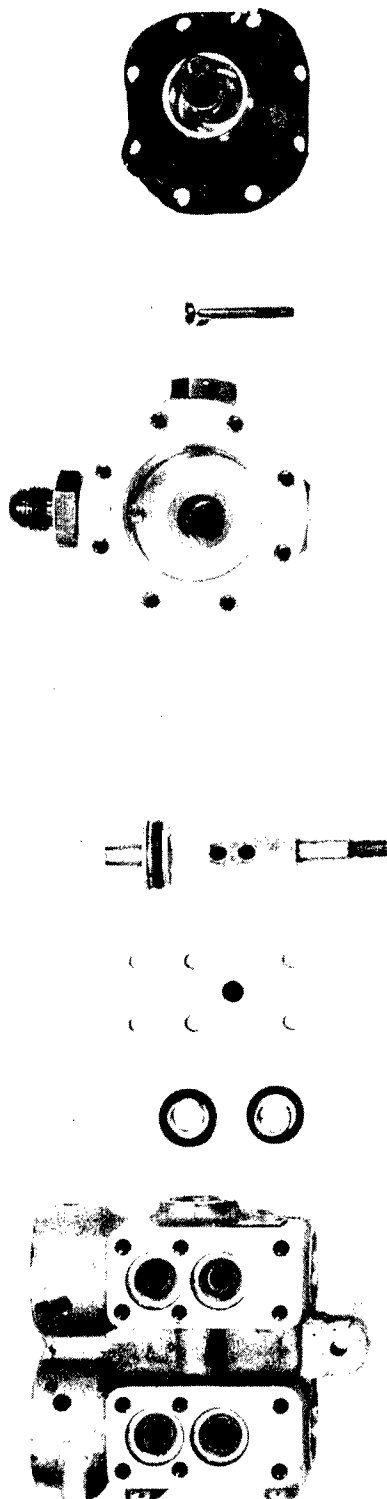
Plate 5
END VIEW OF LEGS ON THE NORMAL MAIN LANDING
GEAR ACCUMULATOR PART NO. 109-5110102. AFTER PIERCING AND CUTTING

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DESIGNED BY: J. F. W. ASSIGNED

REVISION 11/20/52. VIEW OF PARTS ASSEMBLY. THE PARTS ARE SHOWN IN THEIR ASSEMBLED POSITION. THE PARTS ARE NOT TO BE USED IN ANY OTHER POSITION. THE PARTS ARE NOT TO BE USED IN ANY OTHER POSITION.

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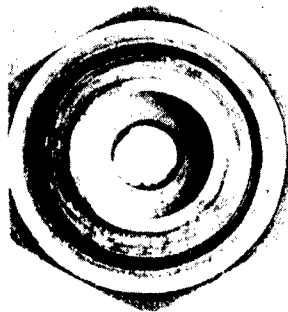
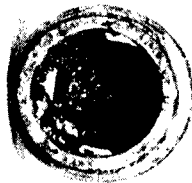
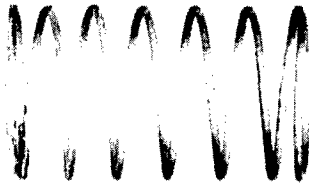


Plate 7

CLOSE-UP OF CORROSION ON BOMB BAY DOOR

REAR CHECK VALVE ASSEMBLY

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