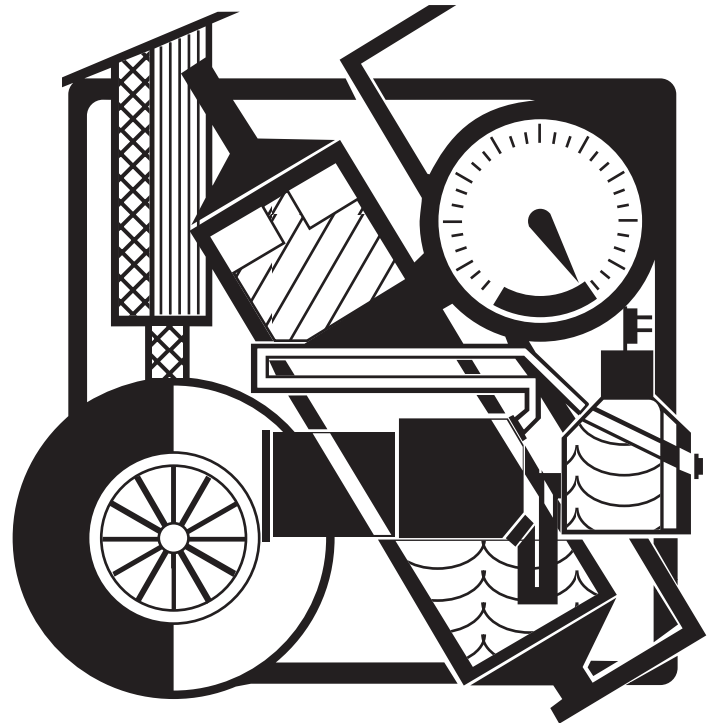




CHAPTER 13

HYDRAULIC POWER SYSTEMS



INTRODUCTION

This chapter provides information on the hydraulic system in the Citation Mustang aircraft. Hydraulic fluid driven by a pump and regulated by valves provides pressure for landing gear and brakes. Operation of these devices is presented in Chapter 14—“Landing Gear and Brakes.” This chapter describes the portions of the hydraulic system used by both subsystems.

GENERAL

The hydraulic system permits the application of substantial force by converting a volume of fluid flow into pressure on a hydraulic piston. Hydraulic fluid lines provide the capability to transmit that force wherever it is required in the aircraft without heavy or complex mechanical linkages.

In the Mustang, a reservoir stores hydraulic fluid for the pump and receives return flow from the system (Figure 13-1). One electrically driven pump supplies hydraulic power.

Hydraulic fluid is routed through lines, regulated by system valves, and cleaned by filters. The hydraulic system responds automatically to the activation of controls for the landing gear and brakes. The engine indicating and crew alerting system (EICAS) indicates system status. Also, landing gear and brakes each have a pneumatic backup system to provide pressure to their respective systems in the event of hydraulic system failure (refer to Chapter 14—“Landing Gear and Brakes”).



CITATION MUSTANG OPERATING MANUAL

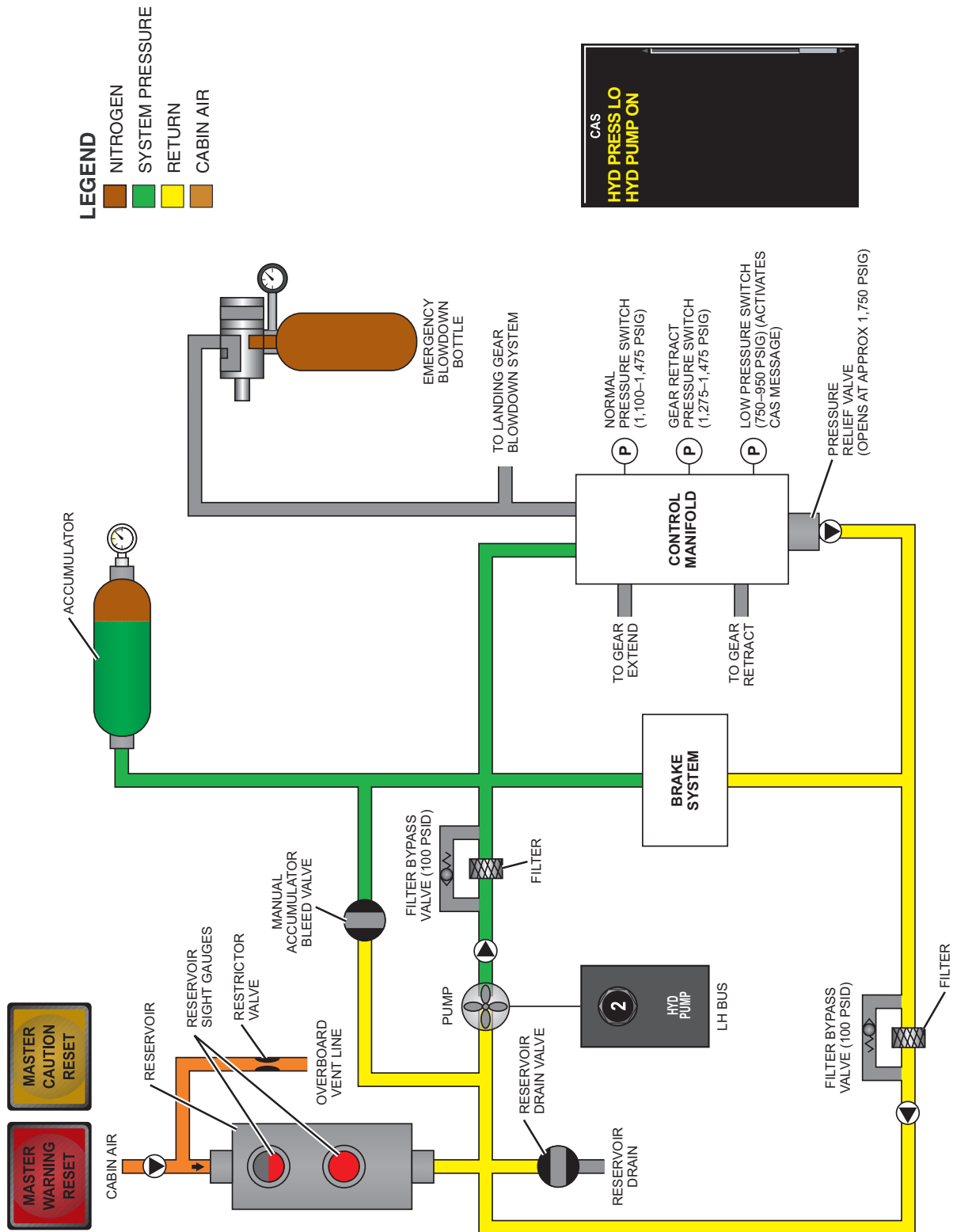


Figure 13-1. Hydraulic System Schematic



DESCRIPTION

The hydraulic system is classified as a “closed center” system. When no subsystems are in use (landing gear or brakes), there is normally no flow in the system, except to maintain accumulator charge.

The Mustang uses hydraulic power for retraction and extension of the landing gear, and operation of the brakes. The system includes a single electrically driven hydraulic pump, which functions to maintain and supplement accumulator pressure.

The LANDING GEAR selector and gear-position sensor switches determine which pressure switch regulates pump operation and resultant system pressure. When the combination of LANDING GEAR selector, weight on wheels, and gear position sensor switches indicate the gear is ready for retraction or is in transit, a gear-retraction pressure switch is automatically selected to regulate the pump to maintain approximately 1,300 psig minimum system pressure. At all other times when the hydraulic system is energized, a normal pressure switch is automatically selected to regulate pressure, maintaining 1,050 psig minimum. (For details about the LANDING GEAR selector and gear-position sensor switches, refer to Chapter 14—“Landing Gear and Brakes”). Both pressure switches limit maximum pressure to approximately 1,550 psig. The system relief valve provides additional protection if system pressure exceeds 1,750 psig.

A hydraulic reservoir stores hydraulic fluid for the pump and receives return flow from the system. During system operation, an accumulator stores hydraulic fluid under nitrogen pressure to maintain system pressure. Two filters clean the system: one in the pressure flow upstream of the manifold and downstream of the pump, and one in the return flow, upstream of the reservoir.

The system uses red MIL-PRF-87257 hydraulic fluid and is designed for operation in ambient temperatures ranging from -65°F to 160°F (-54°C to 71°C).

COMPONENTS

The majority of the hydraulic system components are in the lower left nose compartment outside the pressure vessel.

RESERVOIR

The hydraulic reservoir is attached to the left forward pressure bulkhead (Figures 13-2 and 13-3) and stores hydraulic fluid for the pump and receives return flow from the system. When fluid flows, the excess hydraulic fluid returns to the reservoir. Cabin air pressurizes the reservoir to reduce foaming and assure positive flow to the pump. A relief valve opens at approximately 10 psi to prevent overpressurization.

There are two sight gauges on the hydraulic reservoir that are visible through the forward baggage compartment liner. The reservoir capacity is approximately 2.2 quarts (2 liters) as indicated by the full mark.

PUMP

The hydraulic pump is powered by normal DC power through the HYD PUMP circuit breaker. The pump operates whenever the pressure drops below the lower set point of the normal gear retract pressure switch. Pump operation discontinues once pressure is restored to the upper set point of the regulating pressure switch.

HYDRAULIC ACCUMULATOR

The hydraulic accumulator receives fluid from the pump and stores a supply of hydraulic fluid under pressure. During pump inactivity this pressurized fluid maintains pressure against normal internal leakage within the system. It is also used to supplement pump flow during landing gear extension and retraction.

PRESSURE SWITCHES

There are a total of three pressure switches in the control manifold. Two of these switches control pressure to the overall system and gear



Figure 13-2. Hydraulic Reservoir and Location



Figure 13-3. Hydraulic Reservoir Sight Gauge

retraction cycle; the third pressure switch provides a warning for low system pressure. The switches are identified as **NORMAL**, **GEAR RETRACTION** and **LOW PRESSURE**. The **NORMAL** pressure switch maintains a constant pressure on the system under no load. The **GEAR RETRACTION** pressure switch provides increased system pressure for the gear retraction cycle. The **LOW PRESSURE** switch alerts the crew to an overall low system pressure through an amber **HYD PRESS LO** message in the CAS window.

NORMAL Pressure Switch

Whenever the **GEAR RETRACTION** pressure switch is not active, the **NORMAL** pressure switch regulates pump operation. It closes to energize the pump whenever system pressure falls below approximately 1,050 psig and opens to deenergize the pump when system pressure rises above approximately 1,550 psig.



GEAR RETRACTION Pressure Switch

When the LANDING GEAR selector is selected UP and the landing gear is not fully retracted (as indicated by uplock sensor switches) or when the LANDING GEAR selector is selected GEAR DOWN and the aircraft is airborne (as indicated by the squat switches), the GEAR RETRACTION pressure switch regulates pump operation. It closes to energize the pump whenever system pressure falls below approximately 1,300 psig and opens to deenergize the pump when system pressure rises above approximately 1,550 psig.

LOW PRESSURE Switch

The LOW PRESSURE switch (750 psig–1,000 psig) signals the HYD PRESS LO message in the CAS window to display. This message advises the crew that the hydraulic pressure is low and that the hydraulic pump failed to operate automatically when signaled by the NORMAL or GEAR RETRACTION pressure switches.

SYSTEM RELIEF VALVE

A mechanical relief valve in parallel with the landing gear and brakes maintains the system pressure at a maximum of 1,750 psig.

FILTERS

The system incorporates two filters: one for filtering fluid leaving the pump and one for filtering return fluid prior to entering the reservoir. Each filter incorporates a bypass valve that opens at 100 ± 10 psid if the filter element clogs. As a bypassed filter is a standard maintenance interval item, there is no cockpit indication or filter indication of bypassing.

CONTROLS AND INDICATIONS

The hydraulic system functions automatically during normal DC power (supplied by generator, battery, or ground power unit).

All inflight indications for the hydraulic system appear as crew alerting system (CAS) messages on the EICAS as displayed on the multifunction display (MFD) or (in reversionary mode) on the primary flight displays (PFDs).

HYD PRESS LO MESSAGE

The low pressure switch in the hydraulic control manifold controls the amber HYD PRESS LO message. As hydraulic system pressure decreases below 750 psig, the HYD PRESS LO message appears, accompanied by MASTER CAUTION lights. As the pump increases system pressure to greater than 1,000 psig, a circuit opens to extinguish the message and the MASTER CAUTION lights.

NOTE

On the ground, MASTER CAUTION lights will not reset as long as the HYD PRESS LO message remains valid. This is to caution against taxiing in this condition and to advise that normal brakes may not be available.

HYD PUMP ON MESSAGE

The amber HYD PUMP ON message indicates that the hydraulic pump has been operating continuously for over 60 seconds. Refer to the checklist.

HYDRAULIC RESERVOIR SIGHT GAUGE

The hydraulic reservoir sight gauge indicates current hydraulic fluid quantity. The gauge is integral to the hydraulic reservoir, and is visible through the aft wall of the nose baggage compartment (see Figure 13-3).

HYDRAULIC ACCUMULATOR PRESSURE GAUGE

A pressure gauge on the accumulator (Figure 13-4) indicates current pressure in the accumulator. The gauge is on the aft wall of the nose baggage compartment, and indicates 0–2,000 psig.

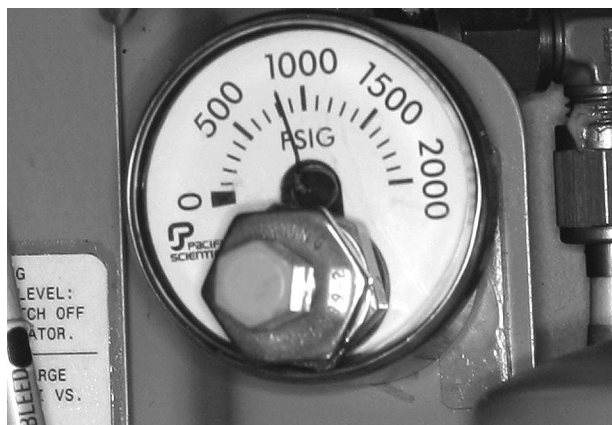


Figure 13-4. Hydraulic Accumulator Pressure Gauge

MANUAL ACCUMULATOR BLEED VALVE

The manually actuated accumulator bleed valve is in the left forward baggage compartment next to the accumulator pressure gauge. It is accessed through a hinged access panel (Figure 13-5). On the ground, it enables the crew to release pressurized fluid from the accumulator to the reservoir. This is done during preflight inspection if the hydraulic system was previously energized to ensure accurate reservoir fluid level and accumulator precharge readings.



Figure 13-5. Manual Accumulator Bleed Valve

OPERATION

PREFLIGHT

Bleed the accumulator prior to checking the accumulator precharge and fluid level in the reservoir. Verify that the accumulator is precharged per the placard and that the hydraulic fluid level is adequate (no air visible in lower sight gauge).

IN FLIGHT

Hydraulic System

The hydraulic system operates automatically to maintain pressure and sends cautionary CAS messages to the crew if there is a fault.

Hydraulic Subsystems

Hydraulically powered subsystems include landing gear and brakes. Application of hydraulic power to the two subsystems is presented in Chapter 14, “Landing Gear and Brakes.”

EMERGENCY/ABNORMAL

For specific information on emergency/abnormal procedures, refer to the appropriate abbreviated checklists or the FAA-approved *Airplane Flight Manual (AFM)*.