

HYDRAULIC LANDING GEAR - DESCRIPTION AND OPERATION (LJ-1063 and After)

1. Description

WARNING: When performing maintenance on a hydraulically operated landing gear system, be aware that any movement of a hydraulic actuator cylinder can displace hydraulic fluid and cause unanticipated movement of other actuator cylinders in the landing gear retraction system. Servicing of the landing gear hydraulic accumulator can also result in unanticipated movement of an actuator. Either action can result in an unsafe, unlocked landing gear system. Therefore, place the airplane on jacks prior to performing any inspection or maintenance. Cycle the landing gear and ensure that all three landing gears are down and locked prior to removing the aircraft from jacks.

A. Visual indication of the landing gear position is provided by two red in-transit lights, located in the landing gear control switch handle, and a green GEAR DOWN indicator light assembly labeled NOSE - L - R, located adjacent to the landing gear control switch (on the pilot's inboard subpanel). Illumination of the red in-transit lights indicates that the landing gear is extending or retracting; the lights go out when the gear is up. Illumination of a green GEAR DOWN light indicates that the landing gear is down and locked. The red lights in the control handle can be checked by pressing the HDL LT TEST push-button switch located to the right of the landing gear control switch. To check the GEAR DOWN lights, press the light assembly case (Ref. [Figure 1](#)) and (Ref. [Figure 2](#)).

B. Position Lights

- (1) Power for the in-transit and GEAR DOWN lights is drawn from a 5-ampere LANDING GEAR - IND circuit breaker on the right circuit breaker panel. A circuit to the in-transit lights is completed through the drag brace downlock and up-position switches of each landing gear. The up-position switches are located in the upper part of each wheel well. A circuit to the GEAR DOWN lights is completed through the drag brace downlock switches of each landing gear. When the landing gear is in the fully retracted position, each landing gear strut actuates its respective up-position switch to open the circuit to the in-transit lights. The in-transit lights remain illuminated until all three landing gears are fully retracted and all three downlock switches are opened. As soon as the landing gear moves from the fully retracted position, each landing gear strut actuates its respective up-position switch to illuminate the in-transit lights. The in-transit lights go out when the drag brace of each landing gear actuates its respective downlock switch to open the circuit to the in-transit lights and complete the circuit to the GEAR DOWN light; illumination of the nose gear-down light requires that the nose gear actuator downlock switch also be actuated.

C. Warning System

- (1) A landing gear aural warning system is provided to warn the pilot that the landing gear is not down and locked during certain flight conditions. With either or both power levers retarded below 78% to 81% N₁, the warning horn will sound intermittently and the in-transit lights will illuminate. If the flaps are in the UP or APPROACH position, the horn can be silenced by pressing the GEAR WARN SILENCE button adjacent to the landing gear control switch handle; the in-transit lights in the landing gear control switch handle cannot be turned off. If the warning horn has been silenced, the landing gear warning system will be rearmed when the power lever(s) are advanced sufficiently. With the flaps beyond the APPROACH position, the warning horn and in-transit lights will be actuated regardless of the power settings and cannot be cancelled.

D. Safety (SQUAT) Switches

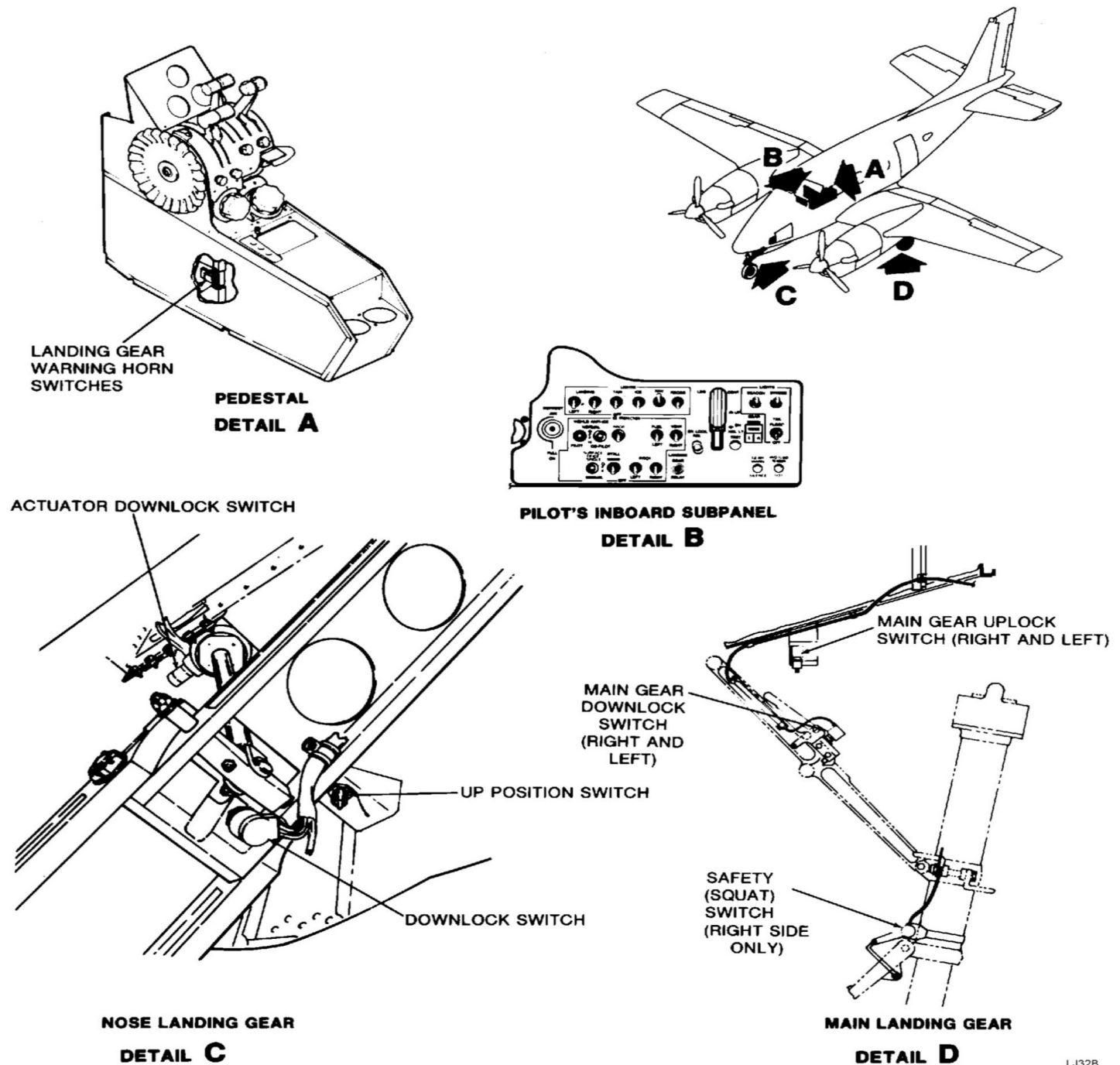
- (1) To prevent accidental gear retraction on the ground, the safety switch on the right main landing gear strut breaks the control circuit whenever the strut is compressed (Ref. [Figure 1](#)).

CAUTION: Never rely on the safety switch to keep the gear down while taxiing or on landing takeoff roll. Always check the position of the landing gear control switch handle.

- (2) The right safety switch also actuates a solenoid-latched downlock hook that prevents the landing gear handle from being placed in the UP position when the airplane is on the ground. The hook automatically unlocks when the airplane leaves the ground, but can be manually overridden by pressing down on the red button placarded DN LCK REL.

Figure 1 : Sheet 1 : Lading Gear Position and Warning System

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Figure 2 : Sheet 1 : Landing Gear Position and Warning System Electrical Schematic

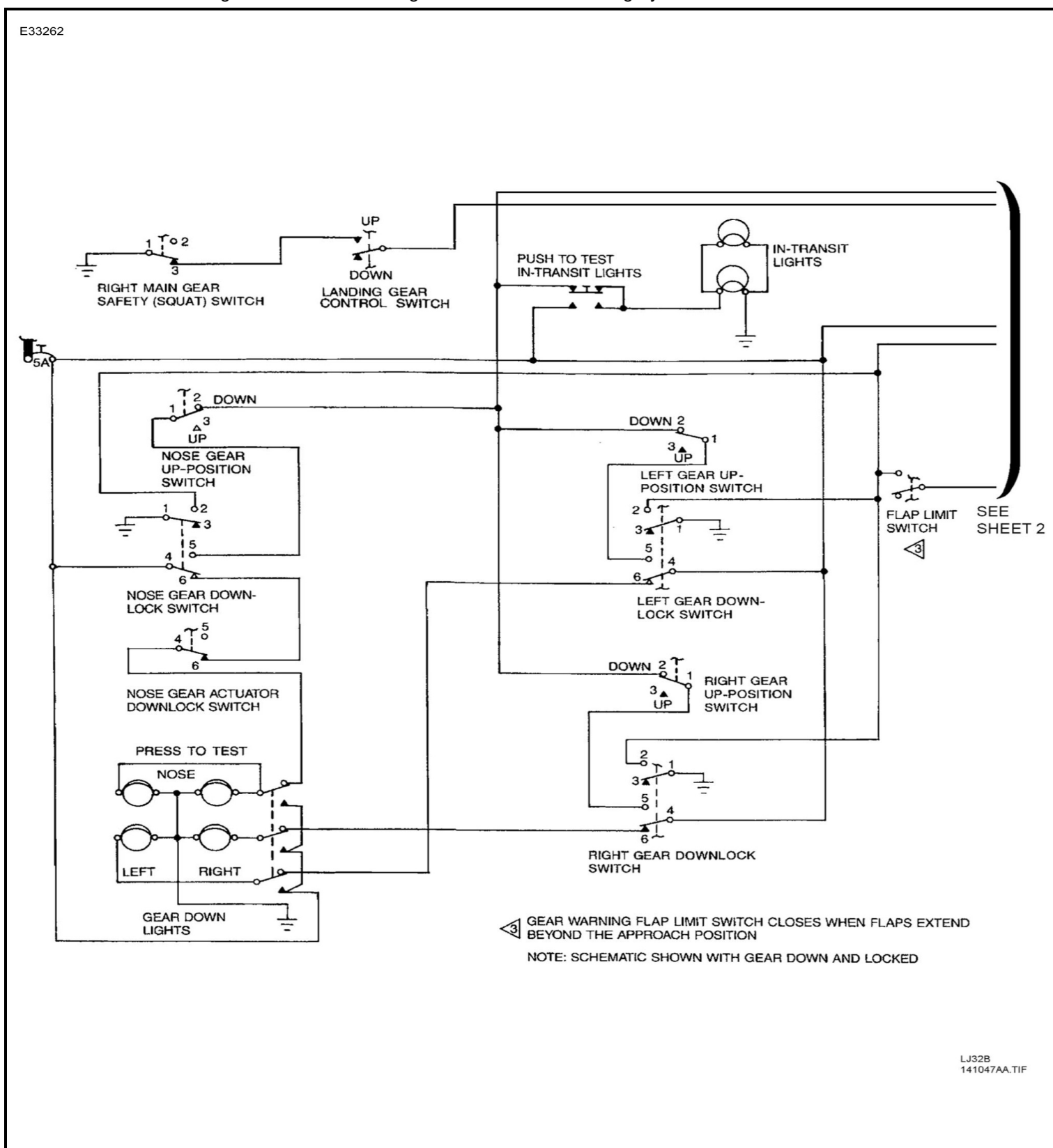
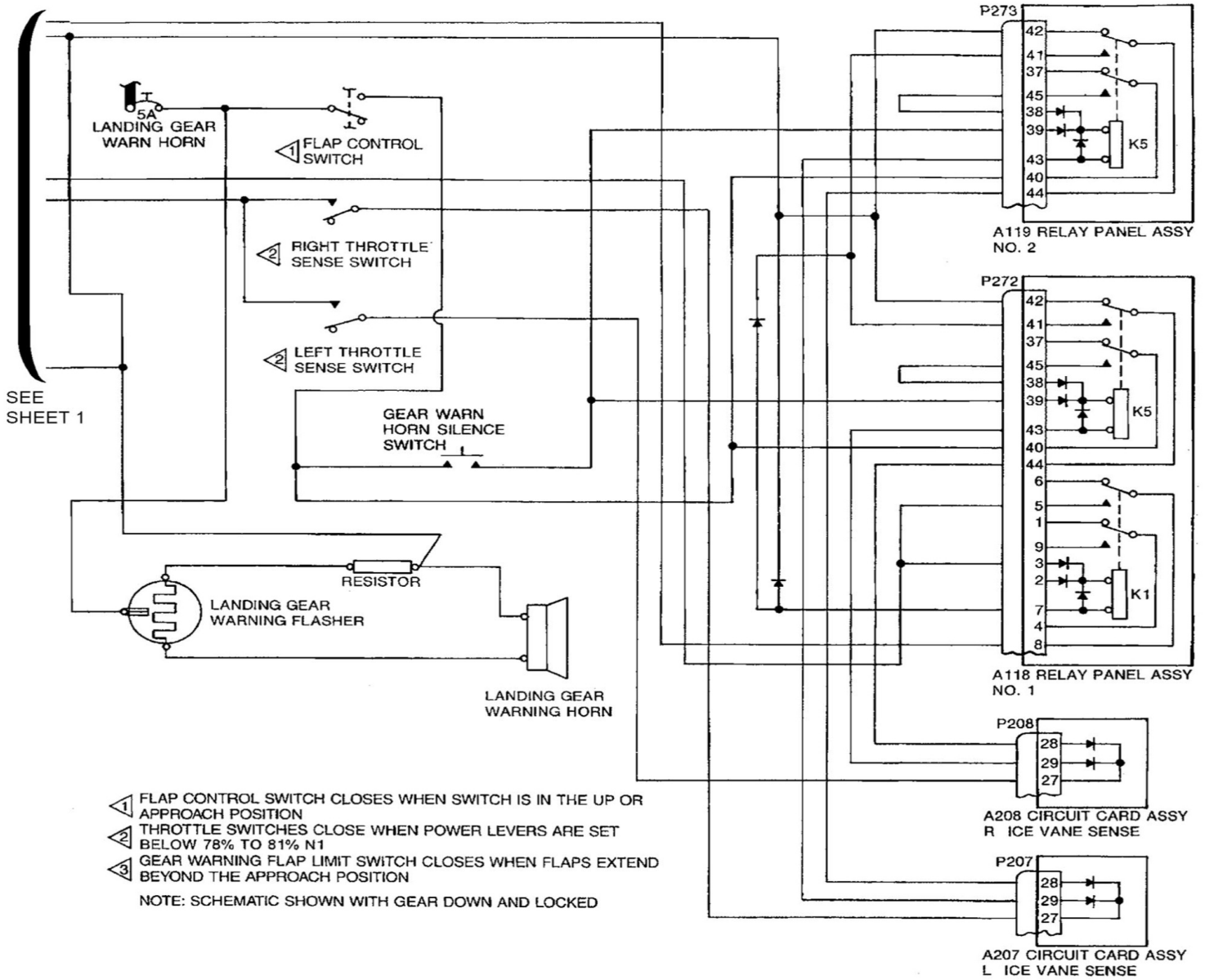


Figure 2 : Sheet 2 : Landing Gear Position and Warning System Electrical Schematic

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LANDING GEAR - DESCRIPTION AND OPERATION (LJ-1063 and After)

1. Information

- A. Refer to Standard Practices - Airframe [Chapter 20-14-00, 201](#), for information on tools and equipment referenced in Table 401. Refer to Standard Practices - Airframe [Chapter 20-15-00, 201](#), for information on recommended materials referenced in Table 401.

Table 1. Tools/Equipment and Recommended Materials

ITEM	TOOLS AND EQUIPMENT	ITEM	RECOMMENDED MATERIALS
		09-044	Lockwire

2. Description

WARNING: When performing maintenance on a hydraulically operated landing gear system, be aware that any movement of a hydraulic actuator cylinder can displace hydraulic fluid and cause unanticipated movement of other actuator cylinders in the landing gear retraction system. Servicing of the landing gear hydraulic accumulator can also result in unanticipated movement of an actuator. Either action can result in an unsafe, unlocked landing gear system. Therefore, place the airplane on jacks prior to performing any inspection or maintenance. Cycle the landing gear and ensure that all three landing gears are down and locked prior to removing the aircraft from jacks.

WARNING: If an EMERGENCY landing gear extension has been made, do not move any landing gear controls or reset any switches or circuit breakers until the cause of the malfunction has been determined and corrected.

A. Landing Gear Controls

- (1) A landing gear control switch handle, placarded UP/DN is located on the pilot's inboard subpanel (Ref. [Figure 1](#)), (Ref. [Figure 2](#)). A solenoid-operated downlock latch prevents the landing gear control handle from being raised while the airplane is on the ground. The landing gear safety (squat) switch releases the latch when the airplane leaves the ground. If necessary, the latch can be manually overridden by pressing down on the red button placarded DN LOCK REL.
- (2) To prevent accidental gear retraction on the ground, a safety (squat) switch on the main struts breaks the control circuit whenever the struts are compressed.

CAUTION: Never rely on the safety (squat) switch to keep the gear down while taxiing, on landing or takeoff roll. Always check the position of the landing gear switch.

- (3) The landing gear control circuit is protected by a 2-ampere circuit breaker located on the pilot's inboard subpanel. Power for the pump motor is supplied through the landing gear motor relay and a 60-ampere relay circuit breaker, both of which are located in the power pack bay. Refer to Chapter 39-20-00 for Maintenance Practices and location of landing gear terminal board TB127, landing gear power pack relay K100 and landing gear circuit breaker CB216. The motor relay is energized by current from the 2-ampere circuit breaker and the downlock switches.

B. Landing Gear Retract Cycle

- (1) When the landing gear control handle is moved to the UP position, the solenoid mounted on the valve body end of the pump is energized to actuate the gear selector valve to allow system fluid under pressure from the pump to flow to the retract side of the system (Ref. [Figure 3](#)). The nose gear actuator will unlock when 200 to 400 psi of hydraulic pressure is applied to the retract port of the nose gear actuator. The landing gear will begin to retract after the nose gear actuator is unlocked. As the actuator pistons move to retract the landing gear, the fluid in the actuators exits through the normal extend port of the actuators and is carried back to the power pack through the normal extend plumbing. When the hydraulic fluid enters the power pack, the gear selector valve directs the return fluid to the primary reservoir. The landing gear is held in the retracted position by positive hydraulic pressure. When the system pressure reaches the high pressure limit, the gear-up pressure switch, mounted on the power pack assembly, will interrupt current to the pump motor. This same pressure switch will actuate the pump motor should the system pressure drop to the low pressure limit. An accumulator precharged to 800 ± 40 psig, located in the left wing inboard of the nacelle, is designed to aid in maintaining the system pressure in the gear-up mode.

C. Landing Gear Extend Cycle

- (1) When the landing gear control handle is moved to the DN position, the solenoid is positioned to allow fluid under pump pressure to flow to the extending side of the system (Ref. [Figure 4](#)). As the actuator pistons move to extend the landing

gear, the fluid in the actuators exits through the normal retract port of the actuators and is carried back to the power pack through the normal retract plumbing. Fluid from the pump opens a pressure check valve in the power pack to allow the return fluid to flow into the primary reservoir. When the actuators fully extend the landing gear, an internal mechanical lock in the nose gear actuator and a mechanical lock on each main gear drag brace will hold the landing gear in the down position. In this position, the internal locking mechanism in the nose gear actuator and the mechanical lock on the main gear drag braces will actuate downlock switches to interrupt current to the pump motor. The motor will continue to run until all three landing gears are down and locked.

D. Vent Valves

- (1) A low pressure vent valve in the power pack (open below 80 psig and closed above 80 psig) relieves any thermal expansion in the retract side of the system when the landing gear is down and locked. Refer to [Figure 3](#) thru [Figure 6](#) for location of vent valves. On airplanes LJ-1220, LJ-1221, LJ-1224, LJ-1226, LJ-1233, LJ-1244, LJ-1255 and After, a vent valve is installed between the landing gear extend line and bleed air/vent line near the left main landing gear. This vent valve permits hydraulic fluid flow to the bleed air/vent system below 105 psig.

E. Hydraulic Fluid Low Warning System

- (1) A yellow HYD FLUID LOW annunciator located in the CAUTION/ADVISORY panel will illuminate in the event the hydraulic fluid level in the landing gear power pack becomes critically low (Ref. [Figure 1](#)). When low fluid level is indicated, the landing gear should not be extended or retracted by using the hydraulic power pack; however, the landing gear can be extended with the manual hand pump (Ref. [Figure 4](#)). A sensing unit mounted on the motor end of the power pack provides the necessary switching circuitry to illuminate the low fluid light. The optically operated sensing unit has an integrated self-test circuit. The integral self-test circuit is energized by a switch on the instrument panel and functionally tests the sensing unit's internal circuitry.

F. Manual Operation of Landing Gear

- (1) The landing gear may be manually extended or retracted to aid in the performance of maintenance procedures by use of a manually powered hydraulic system. Refer to [Figure 4](#) and [Figure 5](#). A manual hand pump (Ref. [Figure 8](#)), placarded LANDING GEAR ALTERNATE EXTENSION, is located on the floor between the pilot's seat and the pedestal. The pump is used when manual operation of the gear is required.

(2) Extension:

- (a) Refer to [Figure 1](#) for the location of items referenced. With the airplane placed on jacks and with the landing gear retracted, the landing gear control circuit breaker on the pilot's inboard subpanel is opened and the landing gear control handle is placed in the DN position. The manual pump is operated and hydraulic fluid is drawn from the hand pump suction port of the power pack into the pump and exited under pressure. Fluid under pressure from the pump is routed to the power pack hand pump pressure port and to the shuttle valve in each actuator. Fluid pressure at the shuttle valves will position the valves to allow fluid to flow into the actuator cylinders. As the actuator pistons move to extend the landing gear, the fluid in the actuators exits through the normal retract port of the actuators and is carried back to the power pack through the normal retract plumbing. The fluid routed to the hand pump pressure port of the power pack from the hand pump unseats the internal dump valve of the hand pump to allow the return fluid to flow into the primary reservoir. The manual pump is operated until the green GEAR DOWN indicator lights on the pilot's inboard subpanel illuminate or until the gear is in the desired position. The pump handle is stowed in the fully down position prior to placing the pump handle in the securing clip. When the manual pump handle is stowed, an internal relief valve is actuated to relieve the hydraulic pressure in the pump. Refer to the OPERATING THE LANDING GEAR WITH THE MANUAL HYDRAULIC HAND PUMP procedure in the maintenance practices section of this chapter.

NOTE: Failure to relieve the hydraulic pressure in the pump will prevent the landing gear from retracting electrically.

(3) Retraction:

- (a) Refer to [Figure 1](#) for the location of items referenced. With the airplane on jacks, the red knob on the service valve is placed in the up position, the landing gear control circuit breaker on the pilot's inboard subpanel is closed and external power is applied to the airplane before the landing gear control handle is placed in the UP position and the manual pump is operated to retract the landing gear to the desired position. Refer to the OPERATING THE LANDING GEAR WITH THE MANUAL HYDRAULIC HAND PUMP procedure in the maintenance practices section of this chapter.

G. Service Valve

- (1) A service valve located forward of the power pack may be used in conjunction with the manual hand pump, to raise and

lower the gear for maintenance purposes (Ref. [Figure 9](#)).

WARNING: If the red knob on the service valve is pushed down, while the landing gear is retracted with the electrical power on and the landing gear control handle in the DN position, the landing gear will extend immediately.

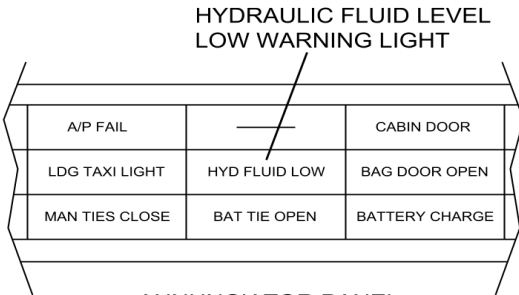
- (2) After the completion of any maintenance where the service valve has been operated, the red knob must be lockwired ([09-044, Table 1](#)) in the down position. If the red knob is not lockwired, normal operation of the landing gear will cause the red knob to move up. When the red knob is up, the landing gear cannot be extended with the power pack or the manual hand pump.

H. Fill Reservoir

- (1) A fill reservoir, located just inboard of the left nacelle and forward of the front spar, contains a cap and dipstick assembly, marked HOT/FILL, COLD/FILL, for convenience of maintaining system fluid level. The fill reservoir is pressurized to 18 to 20 psi from the engine bleed air system while the engines are running. Refer to [Figure 7](#) for bleed air/vent system that pressurizes the reservoir system.

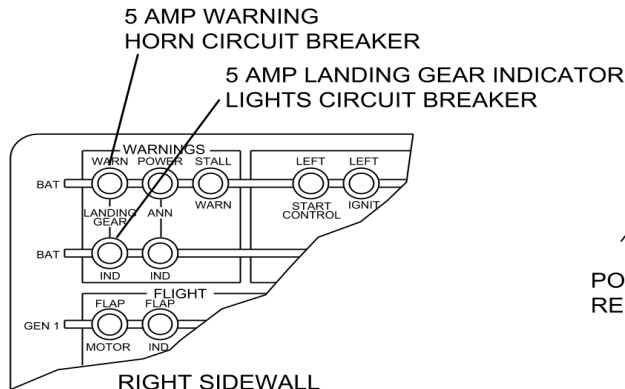
Figure 1 : Sheet 1 : Hydraulic Landing Gear System

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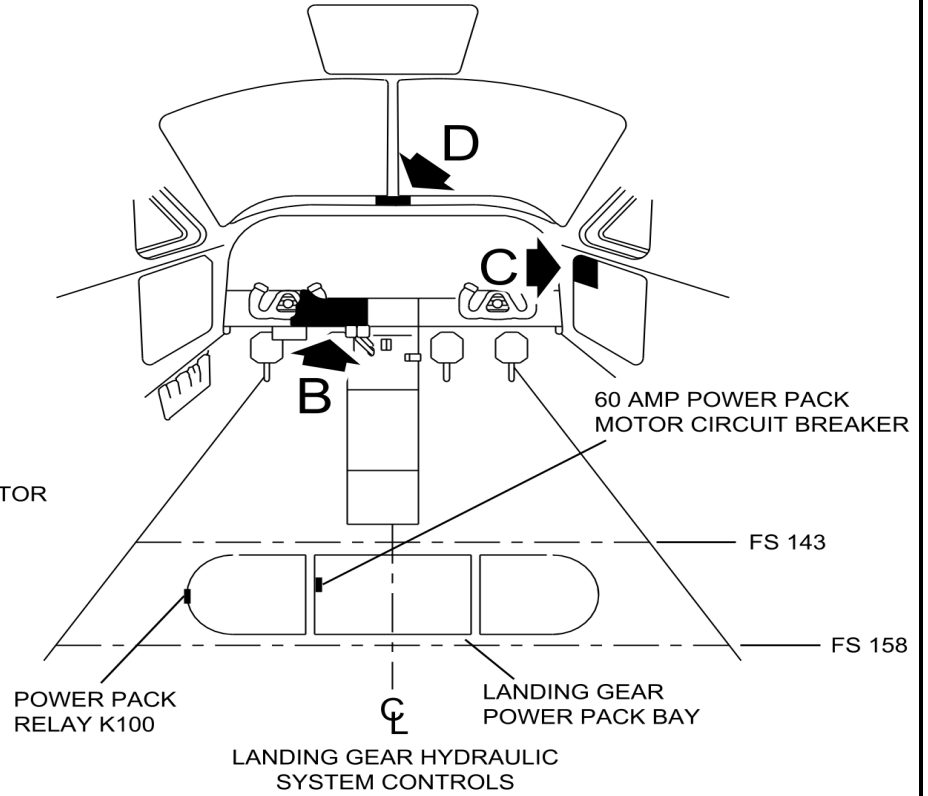
ANNUNCIATOR PANEL

DETAIL D

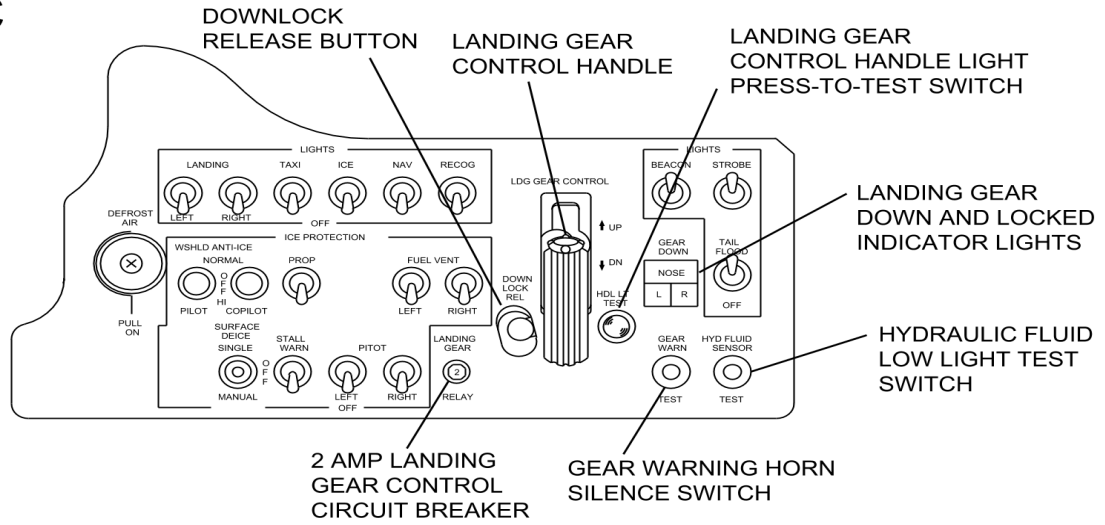


RIGHT SIDEWALL CIRCUIT BREAKER PANEL

DETAIL C



DETAIL A



PILOT'S INBOARD SUBPANEL

DETAIL B

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Figure 2 : Sheet 1 : Hydraulic Landing Gear System

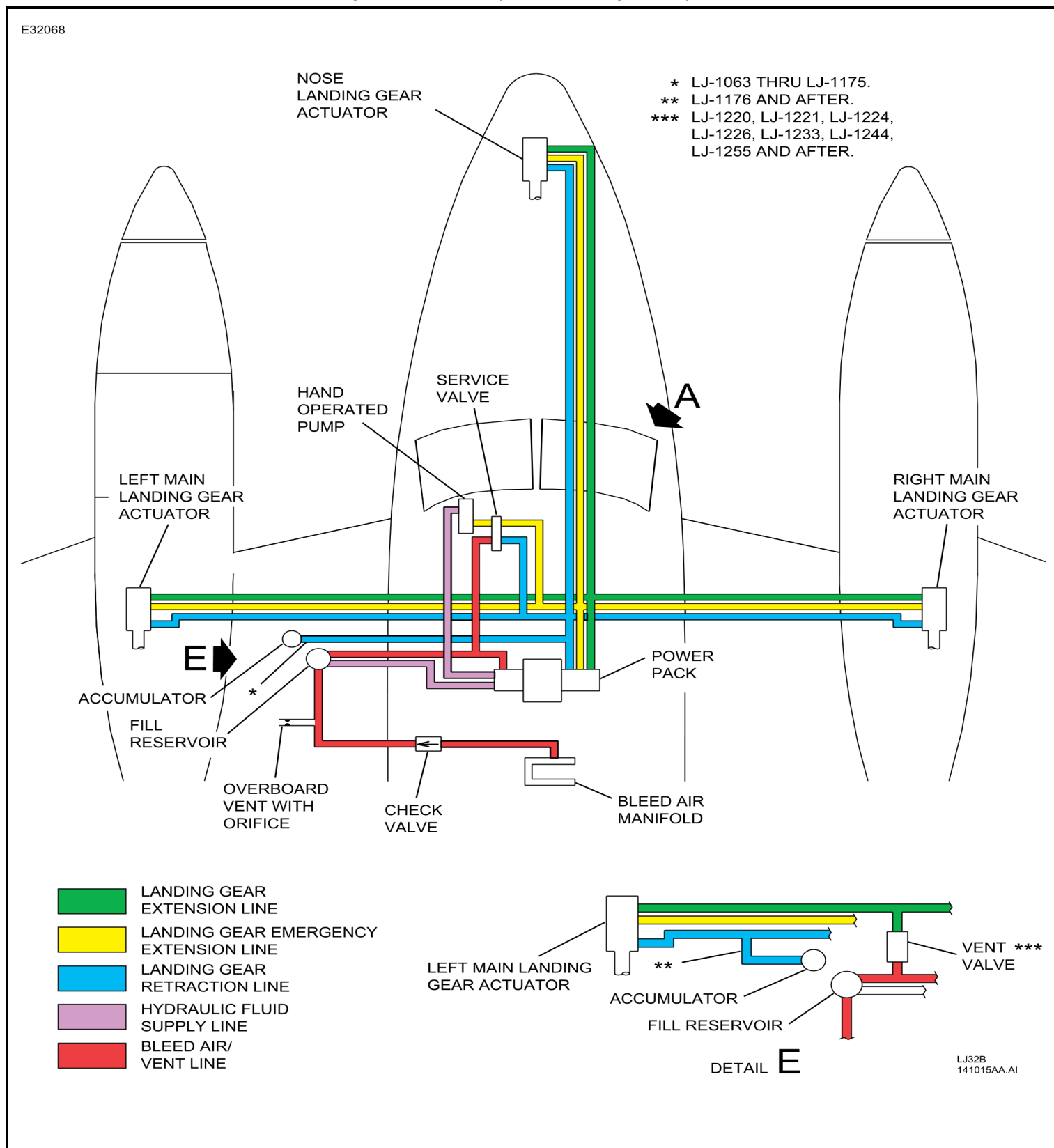


Figure 3 : Sheet 1 : Hydraulic Landing Gear Retracting Schematic

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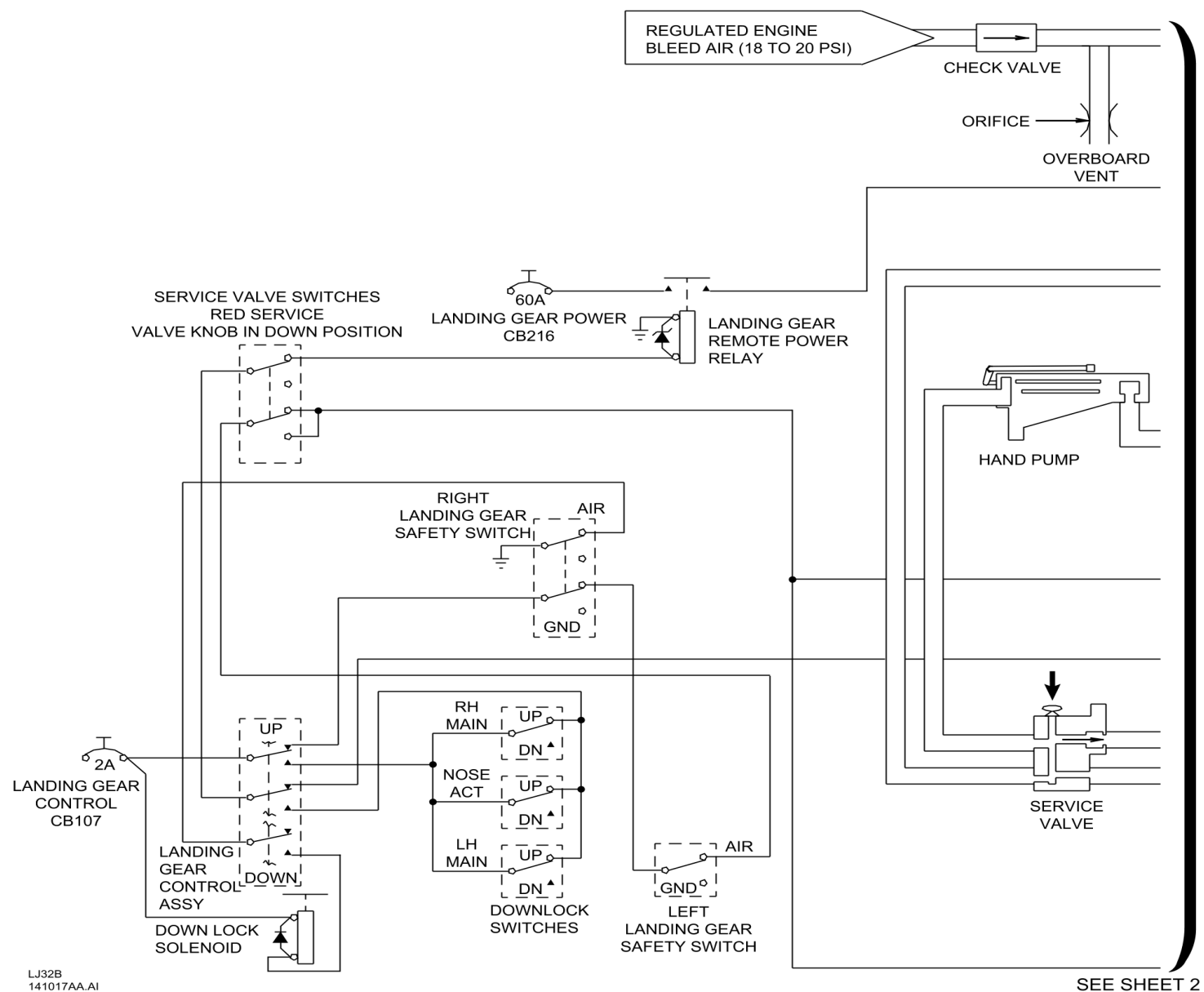


Figure 3 : Sheet 2 : Hydraulic Landing Gear Retracting Schematic

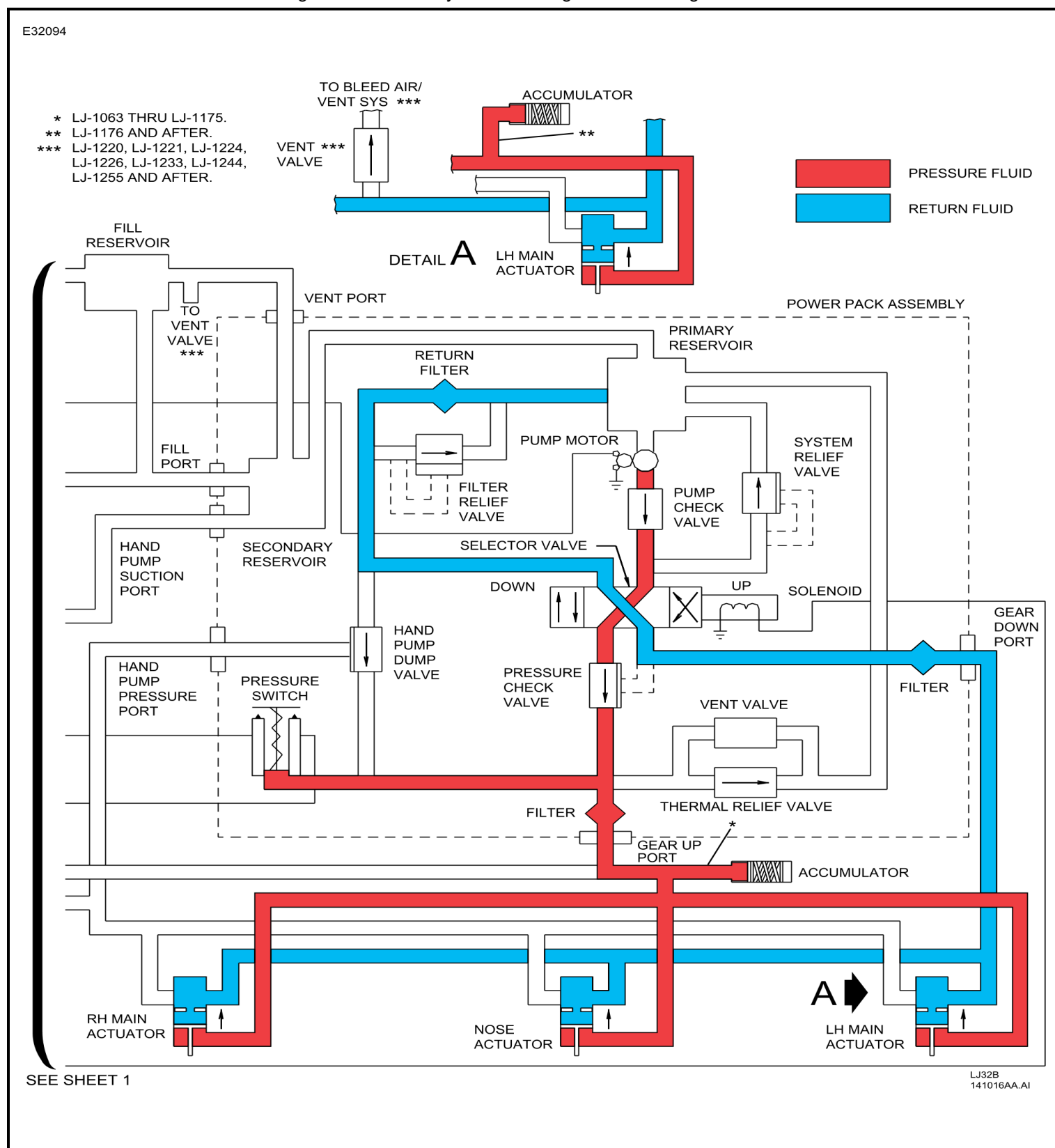


Figure 4 : Sheet 1 : Hydraulic Landing Gear Extending Schematic

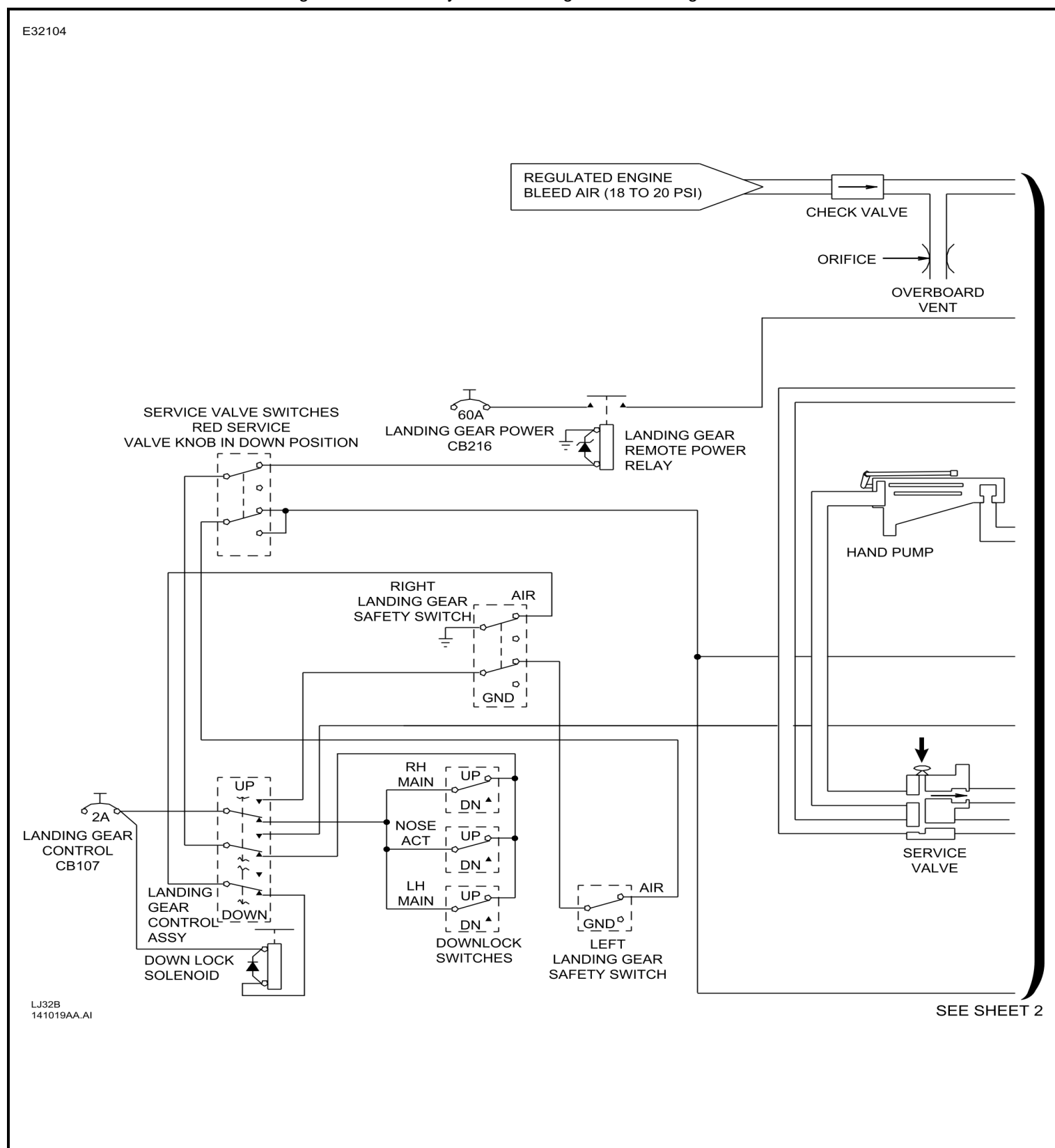
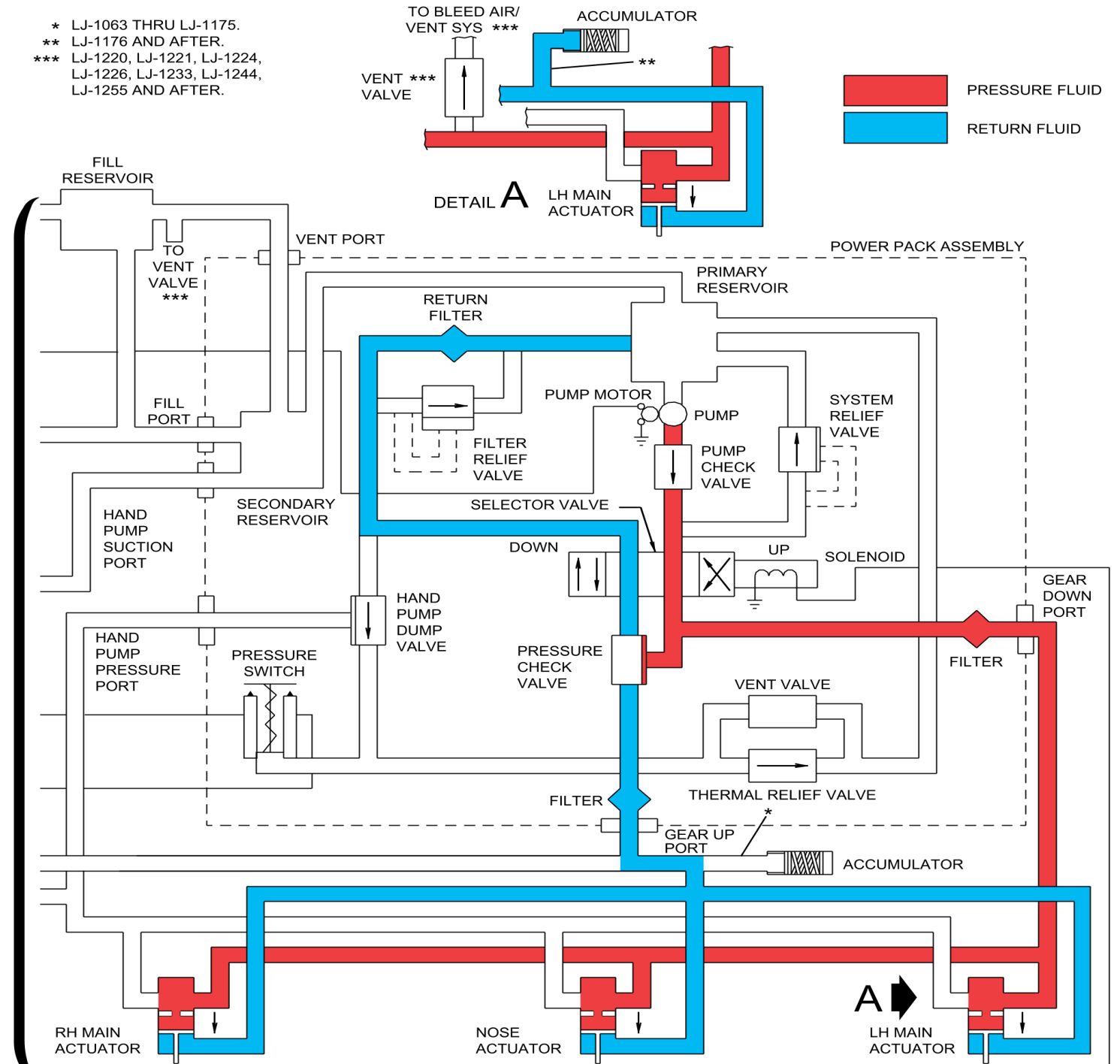


Figure 4 : Sheet 2 : Hydraulic Landing Gear Extending Schematic

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- * LJ-1063 THRU LJ-1175.
- ** LJ-1176 AND AFTER.
- *** LJ-1220, LJ-1221, LJ-1224,
LJ-1226, LJ-1233, LJ-1244,
LJ-1255 AND AFTER.



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Figure 5 : Sheet 1 : Hydraulic Hand Pump Manual Extension

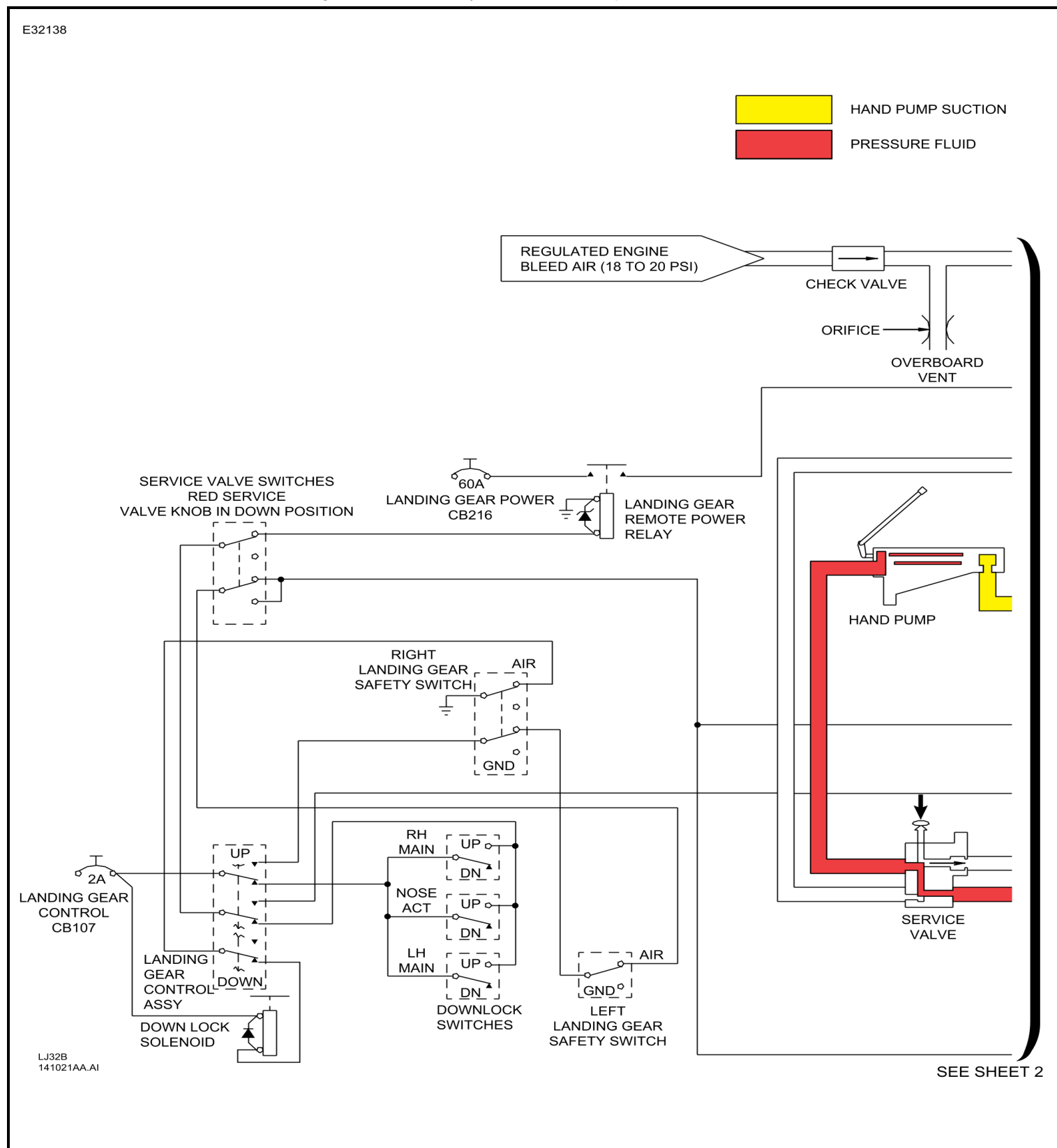
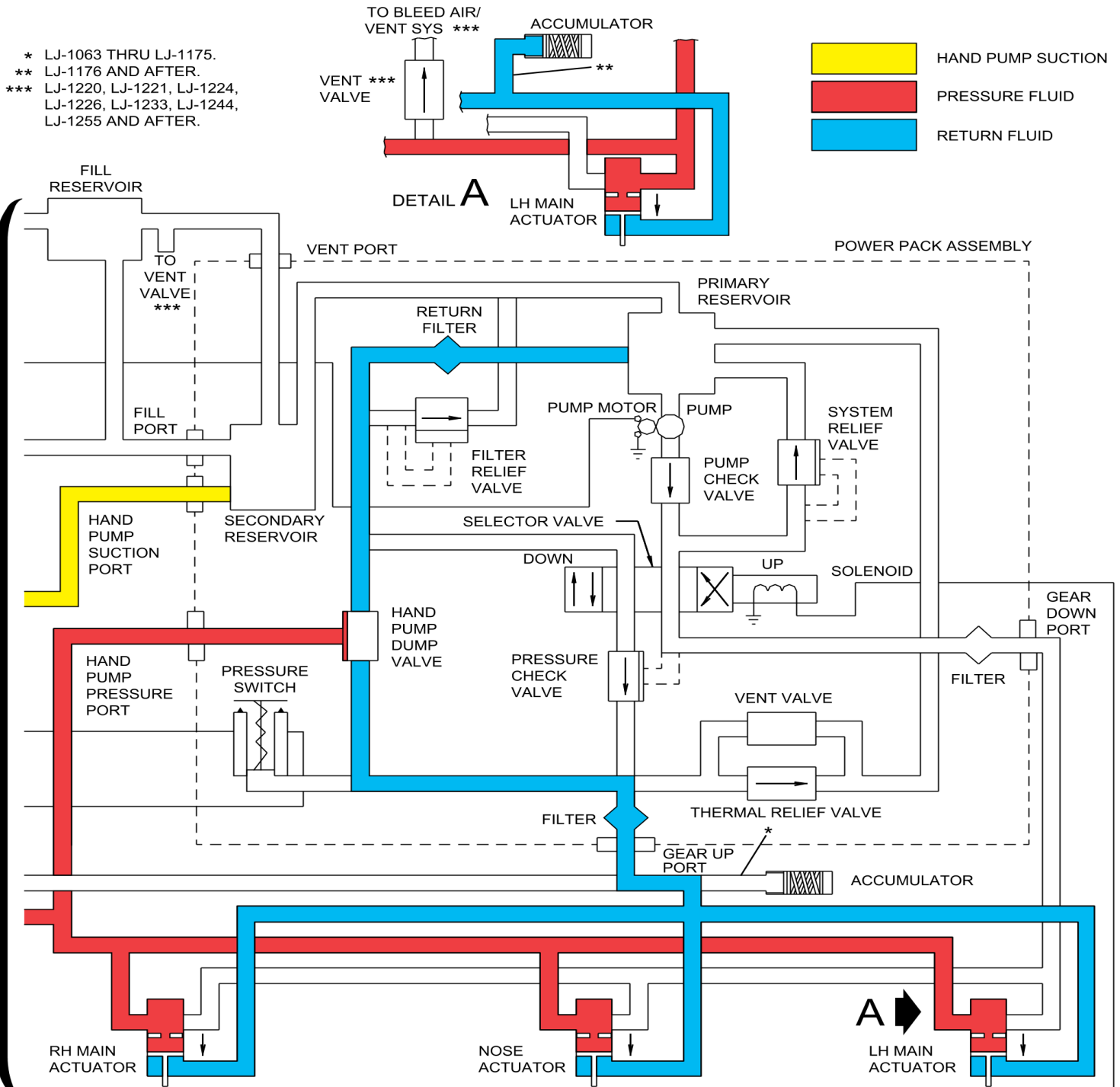


Figure 5 : Sheet 2 : Hydraulic Hand Pump Manual Extension

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Figure 6 : Sheet 1 : Hydraulic Hand Pump Maintenance Retraction

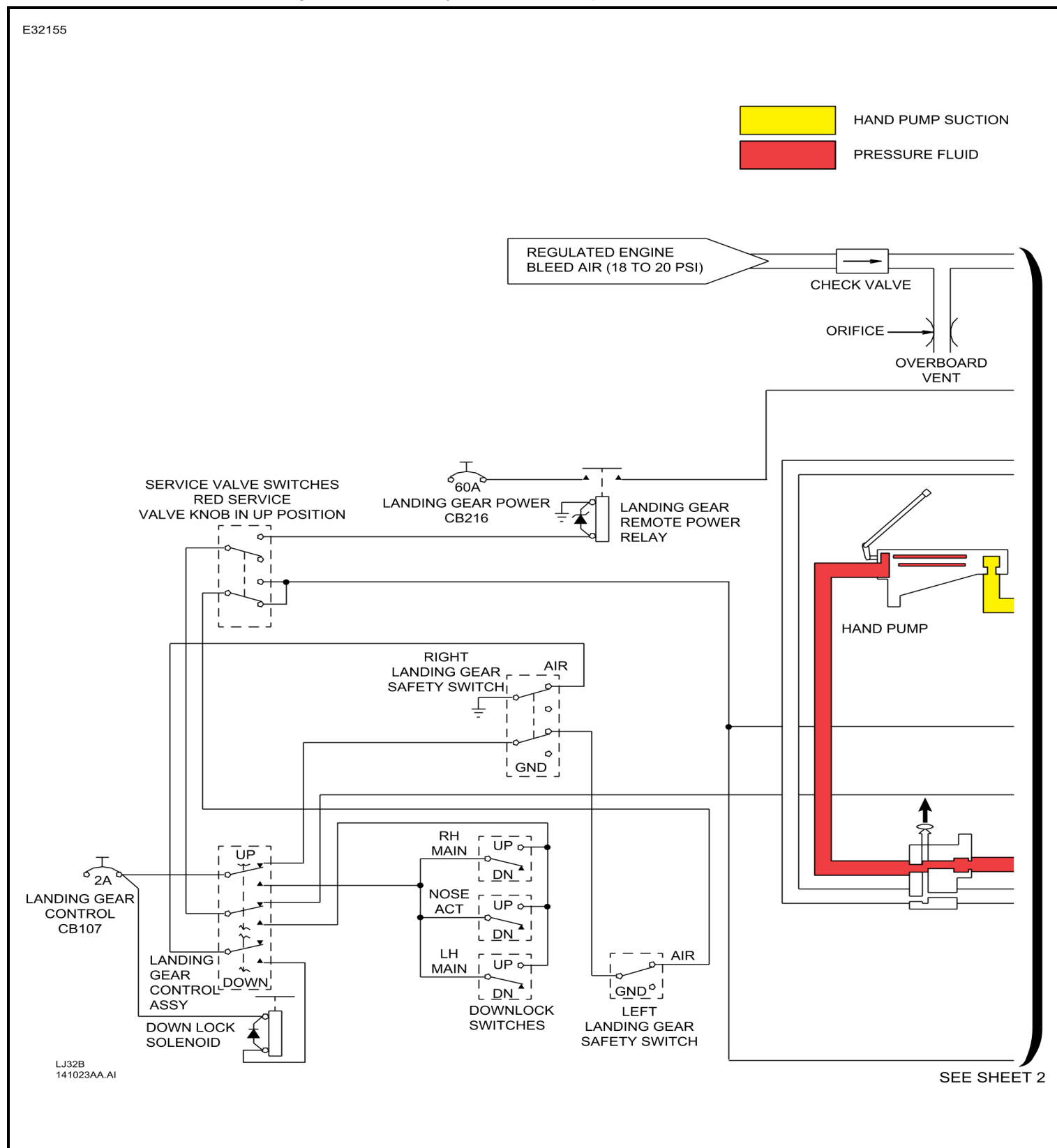
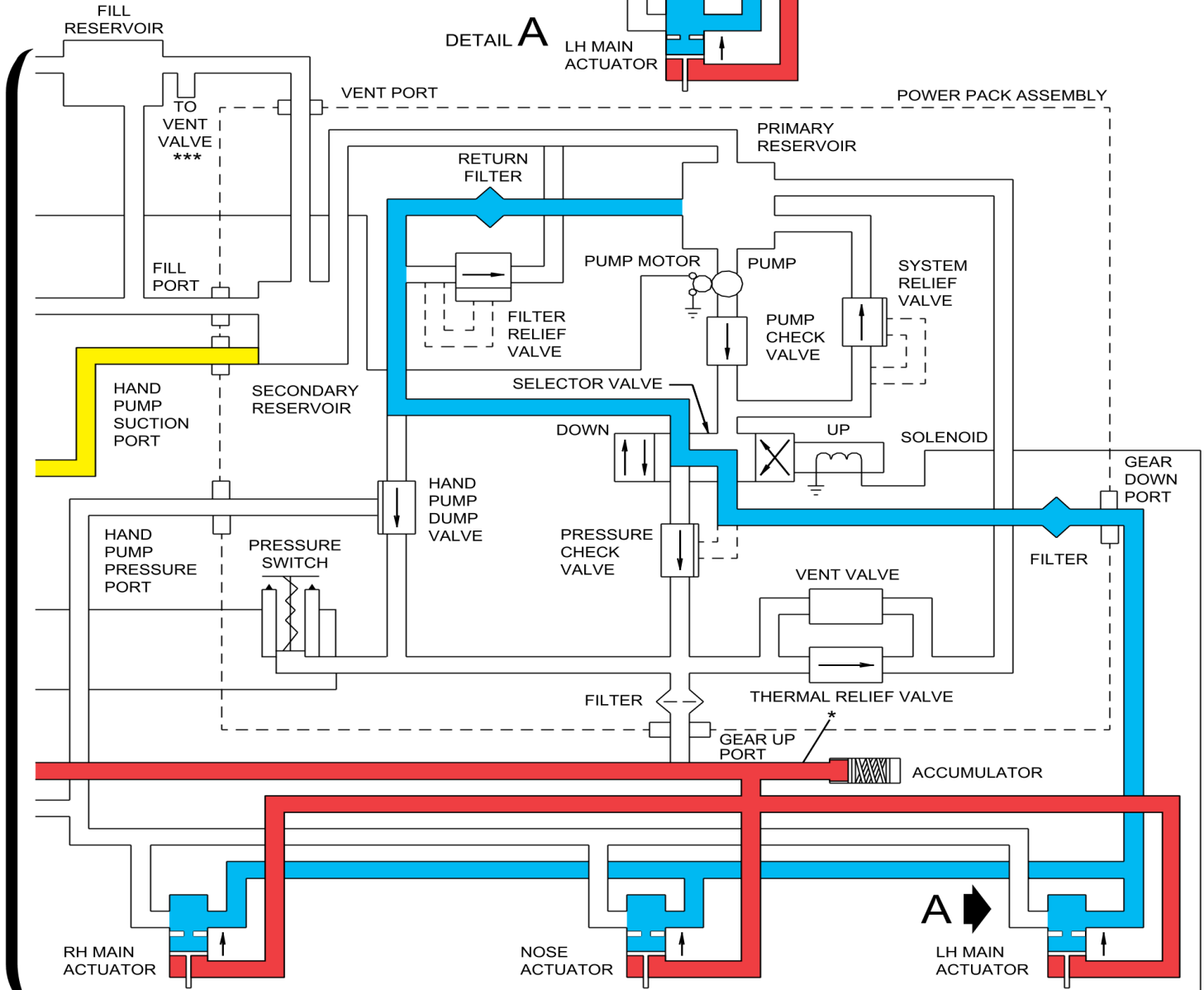
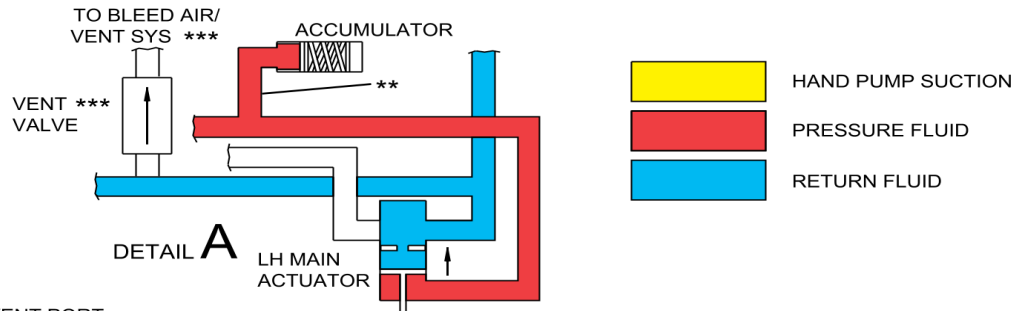


Figure 6 : Sheet 2 : Hydraulic Hand Pump Maintenance Retraction

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- * LJ-1063 THRU LJ-1175.
- ** LJ-1176 AND AFTER.
- *** LJ-1220, LJ-1221, LJ-1224,
LJ-1226, LJ-1233, LJ-1244,
LJ-1255 AND AFTER.

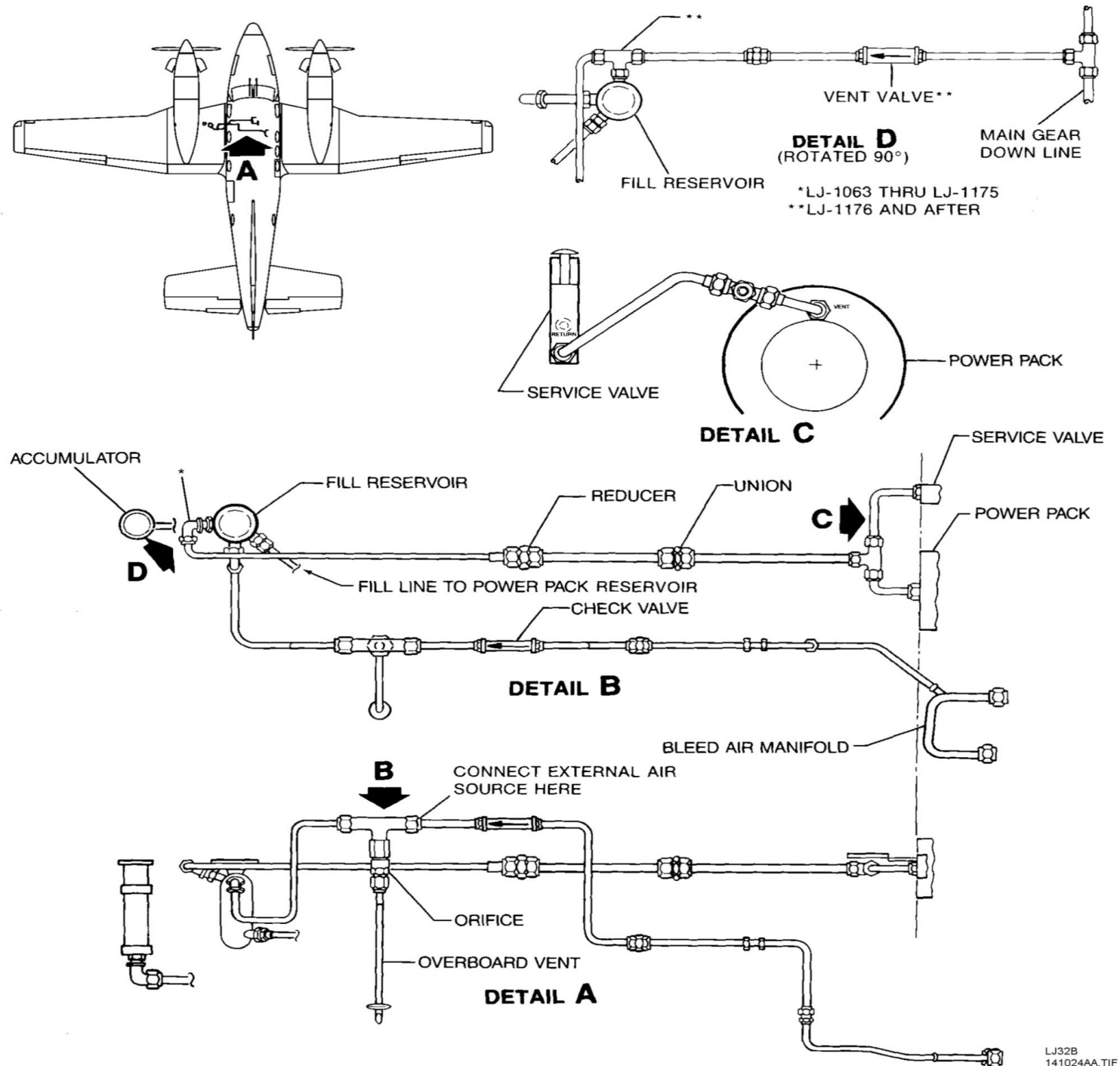


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Figure 7 : Sheet 1 : Hydraulic Landing Gear Bleed Air System

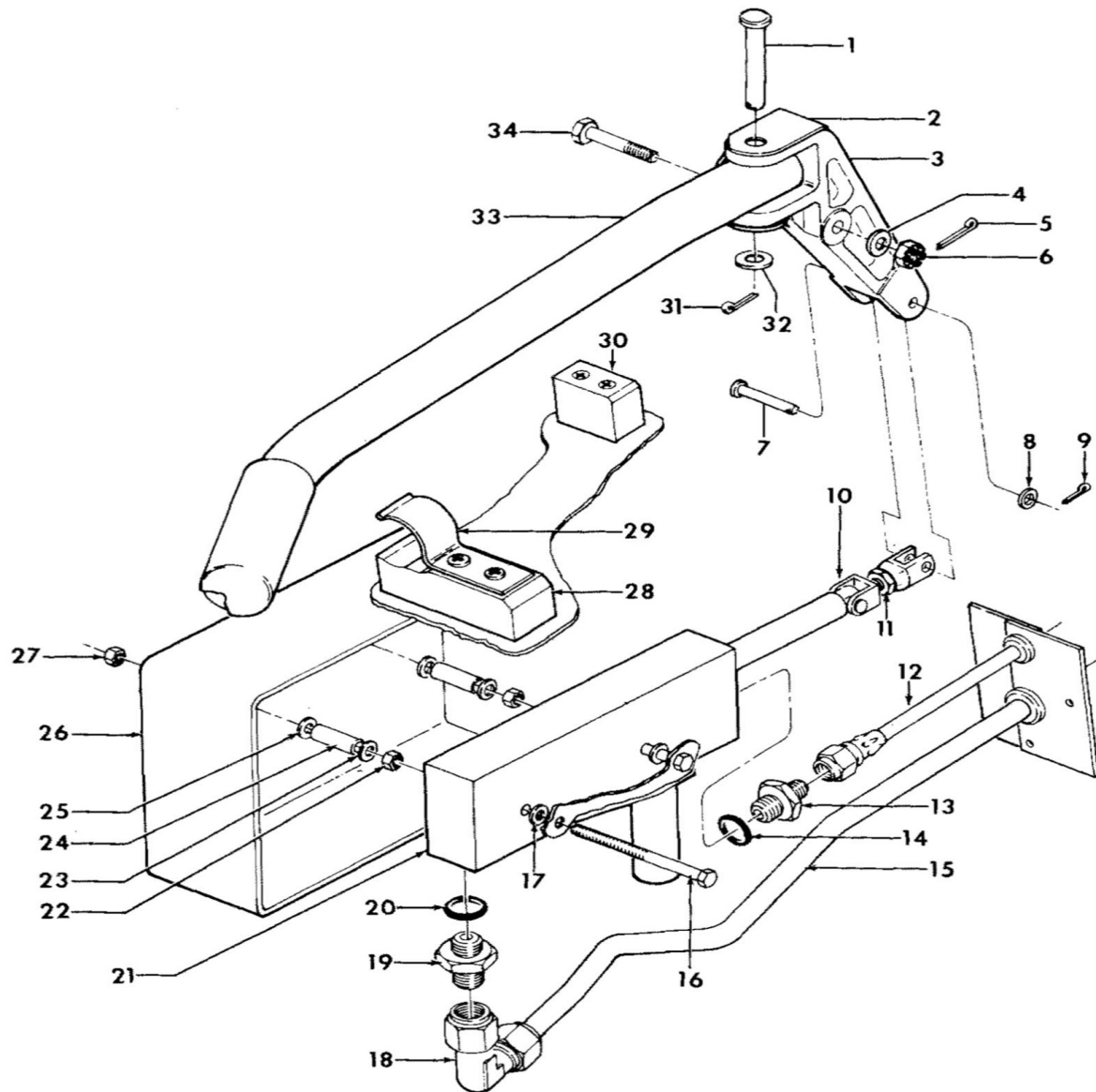
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Figure 8 : Sheet 1 : Hydraulic Landing Gear Manual Hand Pump

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1. CLEVIS PIN
2. STOP
3. PIVOT
4. WASHER
5. COTTER PIN
6. NUT
7. CLEVIS PIN
8. WASHER
9. COTTER PIN
10. LINK ASSEMBLY
11. JAM NUT

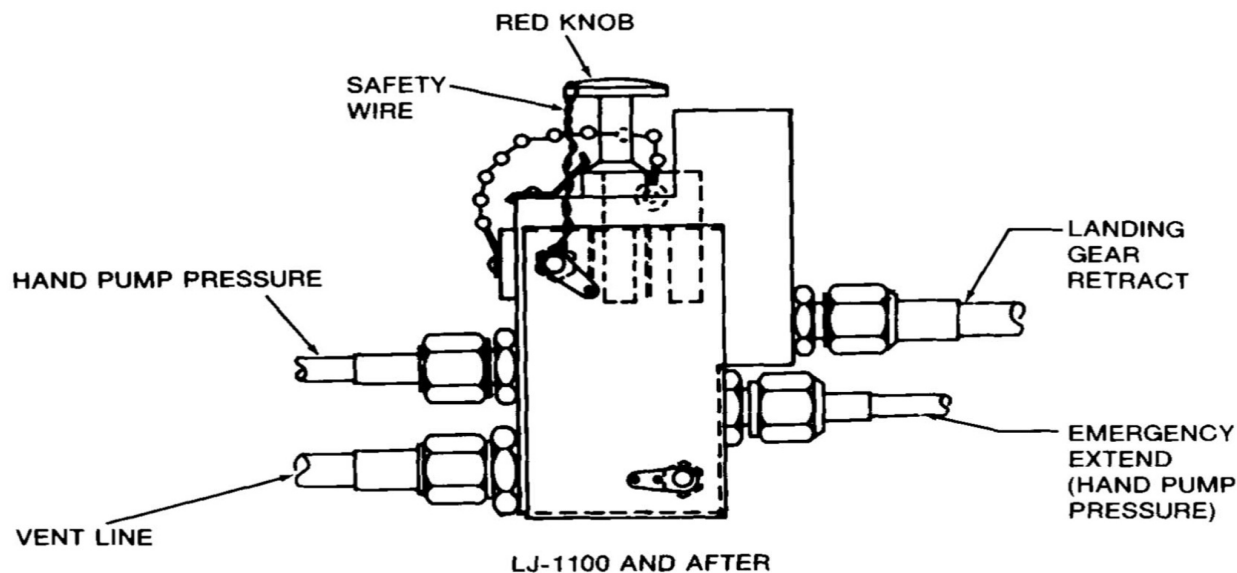
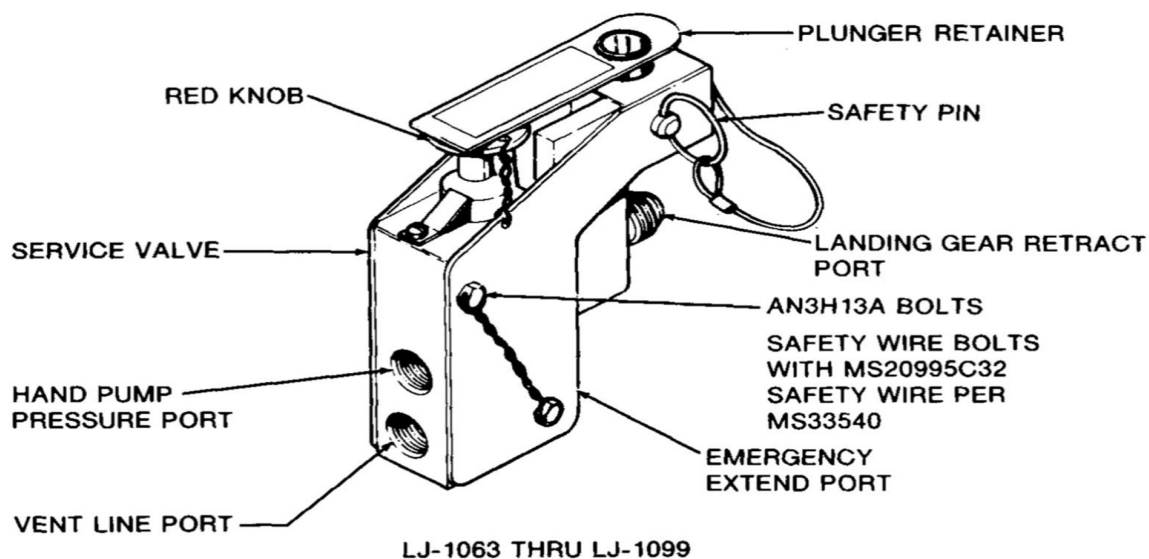
12. HAND PUMP PRESSURE TUBE ASSEMBLY
13. REDUCER
14. O-RING
15. HAND PUMP SUCTION TUBE ASSEMBLY
16. BOLT
17. WASHER
18. SWIVEL ELBOW
19. REDUCER
20. O-RING
21. HAND PUMP
22. NUT
23. WASHER

24. SPACER
25. WASHER
26. SHIELD
27. NUT
28. STOW BLOCK
29. STOW CLIP
30. STOP BLOCK
31. COTTER PIN
32. WASHER
33. HANDLE
34. PIVOT BOLT

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Figure 9 : Sheet 1 : Service Valve

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