Chapter 1 - General Information

Chapter 2 – Landing Gear Systems with Hydraulic Switches (Levers)

2-1 110 Series, Lever-Controlled Landing Gear System

2-2 Hydraulic Switch-Controlled Landing Gear System with Auxiliary Hand Pump

   2-2.1 Hydraulic Switch-Controlled System with Single-Acting Jacks
   2-2.2 Hydraulic Switch-Controlled System with Double-Acting Jacks

Chapter 3 - Landing Gear Systems with Electric Switches

3-1 Touch Panel-Controlled Landing Gear System

3-2 Rocker or Toggle Switch-Controlled Landing Gear System

Chapter 4 - The Auxiliary Hand Pump
CHAPTER 1 - GENERAL INFORMATION

Landing gear systems are available for fifth wheel and tag style trailers. Most of the systems consist of two jacks but there are single jack systems available. The jacks are available as single-acting (power-extend / spring-retract) or double-acting (power-extend / power-retract). The landing gear jacks are available in the following capacities and strokes:

Single-Acting (Spring-Retract) Jacks:
- 6,000# x 14" stroke (tag style trailers only)
- 6,000# x 21" stroke
- 10,000# x 21" stroke

Double-Acting (Power-Retract) Jacks:
- 7,000# x 21" stroke
- 12,000# x 21" stroke
- 12,000# x 24" stroke
- 12,000# x 30" stroke
- 24,000# x 24" stroke

The landing gear jacks can be operated individually with a control valve arrangement for each jack or operated at the same time with one control valve arrangement for both jacks. The single control valve system allows the jacks to lift together but does not allow individual control of the jacks. With the individual control valve arrangement, the jacks can be operated either way. Most systems presently used have a control valve arrangement for each jack.

There are two basic types of control valve systems.

There are the **hydraulic switch systems**, the control valves are lever operated and systems controlled with an electronic switch that controls electric solenoid valves. The newer style systems, including the hydraulic switch controls, will accommodate either single-acting or double-acting jacks. Some of the older systems, especially the older lever controlled systems, would only work with single-acting jacks. The new hydraulic switch control systems have an auxiliary hand pump which is optional with the **electric switch controlled systems**. The landing gear systems with double-acting jacks use a regenerative hydraulic circuit. For a detailed explanation of the regenerative circuit see ML37939 “Regenerative Hydraulic Circuits” under “Advanced Hydraulic Theory” in the HWH® Online Technical School. The following simple schematics will show how the same hydraulic circuit can be used to operate either single-acting or double-acting jacks.

Some equipment used with landing gear systems is designed specifically for non-motorized vehicles and is not compatible with motorized vehicles. It is important the correct equipment is used when installing or repairing systems.
This was the very first control system for a landing gear system. This control system could only be used with single-acting jacks. It will probably be very rare to run into this system.

- The 110 Series system is a two lever valve with an integrated switch and light plate.
- Battery power is supplied to the rocker switch in the light plate.
- With the rocker switch on, power is supplied to a small micro switch in the valve assembly.
- When a lever is pushed to “EXTEND”, the micro switch contacts close, sending + voltage to the pump relay coil.
- When the pump relay is turned on, the relay contacts supply + voltage to the pump motor.
- When the pump motor is running, hydraulic pressure and flow is directed to the valve.
- The lever also depresses a plunger which opens the extend valve for the jack.
- Fluid and pressure is directed to the jack, which extends the jack.
- The jack will continue to extend until the control lever is released or the jack reaches full extension.
- To retract the jack, the control lever is pushed to the “RETRACT” position. The lever depresses a plunger which opens the retract valve for the jack. The pump does not run.
- The jack is equipped with springs to pull the foot up and retract the cylinder.
- When pushing the levers to “EXTEND” or “RETRACT”, the valves can be “feathered” to control the speed of extension or retraction.
- When extending the jacks, it is best to push the levers to the full extend position so the pump motor does not labor unnecessarily.
- The jacks with this system usually were equipped with jack down warning switches.
- The light plate was wired differently than a 110 Series plate for motorized vehicles, this was so the warning light package would only work if the panel rocker switch was on.
This is the system that is presently being used when a lever controlled system is desired. The system works with single-acting or double-acting jacks.

- There is one control lever (hydraulic switch) for each jack.
- Each lever has an “EXTEND” and a “RETRACT” position.
- Moving the lever in either direction will depress a plunger which opens either the extend or retract valve.
- When the system is equipped with an electric pump motor, the hydraulic switch plate will have two toggle switches, one is an “ON/OFF” maintain switch the other is the pump control switch.
- This is a momentary switch and must be held to the “ON” position to run the pump.
- Some early systems have only the pump control switch.
- Battery + voltage is supplied to the “ON/OFF” switch.
- When this switch is on, + voltage is supplied to the pump control switch.
- When the pump control switch is held to the “ON” position, + voltage is supplied to the pump relay coil to turn the relay on. This supplies + voltage to the pump motor causing the pump motor to run.
- If the system has no motor, the hand pump is used to extend or with double-acting jacks, retract the landing gear jacks. Place the hydraulic switches in the desired position, insert the pump handle and move the pump handle up and down. See “Chapter 4 – The Auxiliary Hand Pump” for a detailed explanation of the hand pump.
2-2.1 Hydraulic Switch-Controlled System with Single-Acting Jacks

With this system, there is only one hose to each jack. When the lever is pushed to the “EXTEND” position and the pump is running, the extend valve directs fluid and pressure to the jack. If both levers are pushed at the same time, the fluid pressure equalizes between the jacks and they lift together. When the levers are pushed to the “RETRACT” position, the retract valves allow fluid to return to the valve from the jacks. The hand pump or the electric pump motor is only used to extend the jacks. Springs are used to retract the jacks. In either the “EXTEND” or “RETRACT” position, the levers can be “feathered” to speed up or slow down the movement of the jacks. This is a useful feature, especially when retracting the landing gear to hitch the trailer to a tow vehicle.
2-2.2 Hydraulic Switch-Controlled System with Double-Acting Jacks

The basic operation of a **hydraulic switch system** with double-acting jacks is same as the system with single-acting jacks (2-2.1) except one thing; the pump must be used to retract the jacks. The double-acting jacks have no return springs. Physically, the valve is the same; but, we run two hoses to the jacks instead of one. Hydraulically, we use a regenerative hydraulic circuit to extend the jacks. The simple explanation for regenerative is; we direct pressure to both sides of the cylinder. This creates a greater force on the cap side of the cylinder and forces fluid from the rod side of the cylinder as the rod extends. This fluid if forced into the cap end of the cylinder, thus, a regenerative cylinder. See [ML37939 Regenerative Hydraulic Circuit](#) under “Advanced Hydraulic Theory” in the HWH® Online Technical School for a detailed explanation of the regenerative hydraulic circuit.

Like with the single-acting jacks, the control levers can be “feathered” to speed up or slow down the speed of the jacks. When hitching the trailer, the weight of the trailer will force the jacks to retract without the pump on when the control levers are pushed to the retract position. The pump will have to run to retract the jacks completely after the weight of the trailer is not on the jacks.
CHAPTER 3 - LANDING GEAR SYSTEMS WITH ELECTRIC SWITCHES

All electric switch controlled landing gear systems, past and present, use a slide-out room extension style manifold with electric solenoid valves. The original landing gear system used the room manifold with the large solenoid valves. These early systems were only available with single-acting jacks equipped with springs. The valve manifold only used one solenoid valve, the retract valve, unless there was a room extension operated with the same manifold. If there were room extensions, the landing gear system used both the extend and retract valves. There was no independent control of the landing gear jacks. If two jacks were used, they were just teed together. The newer systems use a room style manifold with the small solenoid valves and can be used with single or double-acting jacks. The new systems are available with or without an auxiliary hand pump. The latest version of the new system will probably have a large solenoid valve as the “retract” valve. If the system has slide-out room extensions, you will see large and small valves on the same side of the manifold, the large valves being for the landing gear. The new style systems are actually simpler electrically than the older systems. You will see this as we describe the different systems.

3-1 Touch Panel-Controlled Landing Gear System

This is the first electric switch controlled landing gear system HWH® produced. The system used a slide-out room extension style manifold with large solenoid valves and one or two single-acting jacks with return springs. The touch panel was usually part of a control pendant but could be mounted permanently. The pendant allowed the operator to stand away from the trailer while lifting or lowering the trailer with the landing gear.

The touch panel has an “ON” button with an On indicator light, a “STORE” button with a Store indicator light, an “EMERGENCY STOP” button, an up arrow button (extend landing gear) and a down arrow button (retract landing gear). Some vehicle manufacturers supply a master power switch for the system to control when the touch panel could be used. For any touch panel function to operate, the ON indicator light must be lit. When the “STORE” button is pushed, the Store indicator light will be on. The following is the function of the panel buttons:

- **ON Button.** This button turns the panel on. The On indicator light will come on when the ON button is pushed. With the On indicator light lit, all of the panel buttons will function.
- **STORE Button.** This button is used to store both jacks. This touch panel has an early version and a later version with a STORE button change. The ON indicator light must be on for the STORE button to function with either version of the panel. On the early version panel, the store function latches in whenever the STORE button is pushed. The jacks retract without holding any buttons. The panel will turn off 2 minutes after the jacks have fully retracted. The later version panel uses jacks that are equipped with pressure switches. The STORE button will not work until the weight of the trailer is off the landing gear jacks. Then the STORE button can be pushed and the store function will latch in. The panel will automatically shut off 2 minutes after the jacks are fully retracted.
- **EMERGENCY OFF Button.** This button will turn the panel off, halting any operation that is in progress. The valves and pump will turn off and any extension or retraction of the jacks would stop.
• **UPARROW Button.** This is a momentary button used to extend the landing gear jacks. The pump will run and both jacks will extend while this button is pushed. When the button is released, the pump will shut off and the jacks will remain in their present position.

• **DOWN ARROW Button.** This is a momentary button used to retract the landing gear jacks. Both jacks will retract while this button is pushed. When the button is released, the jacks will remain in their present position. **This button should be used to hitch the trailer to the tow vehicle with either the early or later version of the touch panel.** Note: This panel can be modified to accommodate double-acting jacks. When modified, the pump will run when the STORE button or the Down Arrow is used. The panel modification can only be done at HWH®.

The following manuals contain operating information, hydraulic diagrams, and electrical diagrams:

- **ML12621 Operator’s Manual** for landing gear system with one or two single-acting jacks.
- **ML17652 Operator’s Manual** for landing gear system with two single-acting jacks with a slide-out room extension.

### 3-2 Rocker or Toggle Switch-Controlled Landing Gear Systems

These are the most common panels that are presently used. These controls can be used with single-acting jacks or double-acting jacks. The difference in the controls is the pump does not run when retracting single-acting jacks. This is accomplished with a simple wiring change at the control switches. The switches used are momentary ON-OFF-ON double pole-double throw switches.

**Figure 7**

<table>
<thead>
<tr>
<th>CONTROL SWITCH WIRING FOR SINGLE-ACTING LANDING GEAR</th>
<th>CONTROL SWITCH WIRING FOR DOUBLE-ACTING LANDING GEAR</th>
</tr>
</thead>
<tbody>
<tr>
<td>+12 VOLT CONTROL FOR EXTEND VALVE</td>
<td>+12 VOLT CONTROL FOR EXTEND VALVE</td>
</tr>
<tr>
<td>+12 VOLT CONTROL FOR RETRACT VALVE</td>
<td>+12 VOLT CONTROL FOR RETRACT VALVE</td>
</tr>
<tr>
<td>+12 VOLT TO COMMON TERMINALS</td>
<td>+12 VOLT TO COMMON TERMINALS</td>
</tr>
<tr>
<td>+12 VOLT TO COMMON TERMINALS</td>
<td>+12 VOLT TO COMMON TERMINALS</td>
</tr>
</tbody>
</table>

**Figure 8**

Note: The common terminals of the control switches are sometimes wired with individual power supplies; battery power for the pump side and switched power from the pump relay for the valve control side. The trailers should also have a master power switch for the landing gear/room extensions. This switch may be supplied by the trailer manufacturer or HWH®. This switch will supply battery power to the HWH® control switch panel. Switch wiring depends on the manufacturer and the type of jacks that are used. **Always refer to system electrical schematics for specific wiring information.**

The rocker/toggle switch landing gear systems all use a room extension style manifold. These manifolds can accommodate one or more room extensions along with the landing gear and are available with or without an auxiliary hand pump. At present, these manifolds are equipped with small solenoid valves that have a special manual valve release cam that is not used with motorized vehicle systems. The next generation manifolds will have a large valve for the retract side of the landing gear only. Each landing gear jack has a pair of valves, an extend valve and a retract valve. Systems with single-acting jacks have...
one hose per jack which attaches to the cap side of the jack. Systems with double-acting jacks have two hoses to each jack, one to the cap side of the jack and one to the rod side of the jack. The double-acting landing gear systems operate with a regenerative hydraulic circuit. See ML37939 "Regenerative Hydraulic Circuits" under “Advanced Hydraulic Theory” in the HWH® Online Technical School. The following are hydraulic connection diagrams for electric switch controlled landing gear systems. The valves marked “E” are jack extend valves and the valves marked “R” are the jack retract valves.

The basic operation of the systems is simple. With either single-acting or double-acting jacks, when a rocker or toggle switch is pushed to “EXTEND”, a +12 volt signal from the switch turns the pump relay on. This supplies voltage to the pump motor. The switch also supplies a +12 volt signal to the extend valve. This directs fluid to the cap end of the jack to extend the jack. When the control switch is pushed to “RETRACT”, the switch directs a +12 volt signal to the pump relay and retract valve (double-acting jacks), or to just the retract valve (single-acting jacks). This allows fluid to return to the pump from the cap end of the jack so the jack can retract. This is accomplished by springs pulling the foot of the jack up (single-acting jacks) or the pump directing fluid to the rod side of the jack to force the jack to retract (double-acting jacks).

The variables in how the system is put together do not affect the operation of the system, only how the control switches are powered. If there is a master power switch, it must be on to supply power to the control switch panel. If the HWH® control panel has a key switch, this switch must be on to supply power to the landing gear control switches. Always refer to specific system schematics for wiring information.
The auxiliary hand pump is a backup pump for systems that incorporate an electric pump motor. For systems with the hydraulic switches and no electric motor, the hand pump is the only pump in the system.

- The hand pump can be used to operate the landing gear or room extensions.
- The auxiliary hand pump is a two stage pump. The first stage is high flow and low pressure. The second stage is a low flow with high pressure. This allows the jacks to be extended and retracted at a quick rate but still be able to produce enough pressure to lift the trailer as needed.
- As the jacks meet some resistance such as trying to lift the trailer, the pump handle will seem to “snap” as the pump goes to the second stage.
- The pumping action will seem easier at first as the second stage creates more pressure.

Nothing special has to be done to use the hand pump. Insert the pump handle into the handle receptacle. The handle receptacle swivels to accommodate accessibility issues. Use the valve release cams to open the appropriate valve(s). Move the pump handle in an up and down motion. This produces the flow and pressure to extend or retract the jacks or rooms. Normally the auxiliary pump will not need to be primed, but if for some reason that does become necessary, refer to the owner’s manual. Page [MP44.0009](#) is the instruction sheet for priming the auxiliary hand pump.

Each hydraulic function requires a pair of solenoid valves one each for the extend and retract procedures. The number of functions and the items controlled by each pair of solenoid valves will vary for each system. The diagrams shown here represent a (3) function system of (2) jacks and (1) room as indicated by the labels shown in FIG 1.