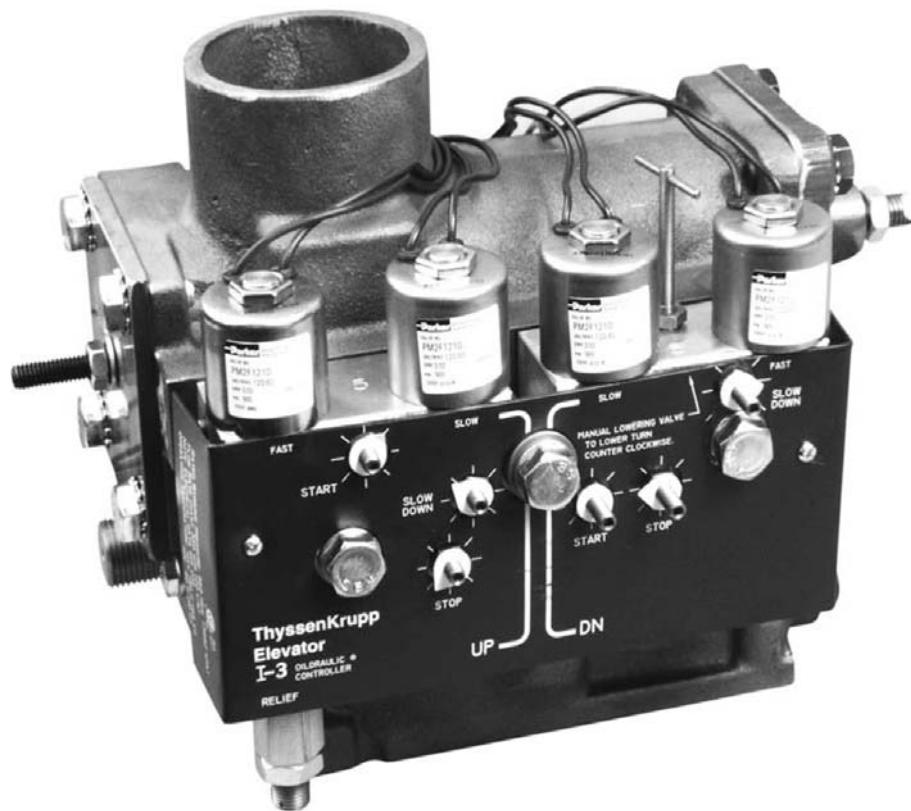




VERTICAL EXPRESS

I-2® / I-3® Valve



Every attempt has been made to ensure that this documentation is as accurate and up-to-date as possible. However, Vertical Express assumes no liability for consequences, directly or indirectly, resulting from any error or omission. The material contained herein is subject to revision. Please report any problems with this manual to Vertical Express, P.O. Box 2019, Memphis, Tennessee 38101.

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I-2 / I-3 Valve

Contents

Safety Precautions	3
General Safety	3
Electrical Safety	3
Mechanical Safety	4
Arrival of Equipment	5
Preliminary Settings	7
Oil Viscosity and Viscosity Control	7
Relief Pressure Setting	7
Low Pressure Setting	8
Lowering and Leveling Speed Setting	9
Quick Reference Guide for Valve Adjustments	10
Preliminary Adjustments	11
Relief Pressure Adjustment	11
Slowdown and Leveling Speed Adjustment	12
Final Adjustments	14
Valve-Up Section	14
Valve-Down Section	15
Performance Check with Full Load	16
Final Relief Pressure with Full Load	16
Troubleshooting Table	
Up Operation	17
Down Operation	18
Replacement Parts	19
Reference Material	20
Troubleshooting Flowcharts	20
Sequence of Events	52

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Safety Precautions

IMPORTANT!

Read this page before any work is performed on elevator equipment. The procedures contained in this manual are intended for the use of qualified elevator personnel. In the interest of your personal safety and the safety of others, do not attempt any procedure that you are not qualified to perform.

All procedures must be accomplished in accordance with the applicable rules in the latest edition of the National Electrical Code, the latest edition of ASME A17.1, and any governing local codes.

Terms in This Manual



CAUTION statements identify conditions that may result in damage to the equipment or other property if improper procedures are followed.



WARNING statements identify conditions that may result in personal injury if improper procedures are followed.

General Safety



Before applying power to the controller, check that all factory wire connections are tight on relays, contactors, fuse blocks, resistors, and terminals on cards and DIN rail terminals. Connections loosened during shipment may cause damage or intermittent operation.

Other specific warnings and cautions are found where applicable and do not appear in this summary. See the *Elevator Industry Field Employees' Safety Handbook* for electrical equipment safety information on installation and service.

Electrical Safety

All wiring must be in accordance with the National Electrical Code and be consistent with all state and local codes.

Use the Proper Fuse

To avoid fire hazards, use only a fuse of the correct type, voltage, and current rating. See the job specific drawings sheet (Power Supplies) for fusing information.

Electric shocks can cause personal injury or loss of life. Circuit breakers, switches, and fuses may not disconnect all power to the equipment. Always refer to the wiring diagrams. Whether the AC supply is grounded or not, high voltage will be present at many points.

Printed Circuit Cards

Printed circuit boards may be damaged if removed or installed in the circuit while applying power. Before installation and/or removing printed circuit boards, secure all power.

Always store and ship printed circuit cards in separate static bags.

Electrical Safety*(continued)***Mainline Disconnect**

Unless otherwise directed, always Turn OFF, Lock, and Tag out the mainline disconnect to remove power from elevator equipment. Before proceeding, confirm that the equipment is de-energized with a volt meter. Refer to the *Elevator Industry Field Employees' Safety and Accident Prevention Program Manual* for the required procedure.

Test Equipment Safety

Always refer to manufacturers' instruction book for proper test equipment operation and adjustments.

Megger or buzzer-type continuity testers can damage electronic components. Connection of devices such as voltmeters on certain low level analog circuits may degrade electronic system performance. Always use a voltmeter with a minimum impedance of 1M Ohm/Volt. A digital voltmeter is recommended.

When Power Is On

To avoid personal injury, do not touch exposed electrical connections or components while power is ON.

Mechanical Safety

See the *Elevator Industry Field Employees' Safety Handbook* for mechanical equipment safety information on installation and service.

Static Protection Guidelines

IMPORTANT!

Read this page before working with electronic circuit boards.

Elevator control systems use a number of electronic cards to control various functions of the elevator. These cards have components that are extremely sensitive to static electricity and are susceptible to damage by static discharge.

Immediate and long-term operation of an electronic-based system depends upon the proper handling and shipping of its cards. For this reason, the factory bases warranty decisions on the guidelines below.

Handling

- Cards shipped from the factory in separate static bags must remain in the bags until time for installation.
- Anti-static protection devices, such as wrist straps with ground wire, are required when handling circuit boards.
- Cards must not be placed on any surface without adequate static protection.
- Only handle circuit cards by their edges, and only after discharging personal static electricity to a grounding source. DO NOT touch the components or traces on the circuit card.
- Extra care must be taken when handling individual, discrete components such as EPROMS (which do not have circuit card traces and components for suppression).

Shipping

- Complete the included board discrepancy sheet.
- Any card returned to the factory must be packaged in a static bag designed for the card.
- Any card returned to the factory must be packaged in a shipping carton designed for the card.
- “Peanuts” and styrofoam are unacceptable packing materials.

Note: Refer to the *Vertical Express Replacement Parts Catalog* to order extra static bags and shipping cartons for each card.

Failure to adhere to the above guidelines will VOID the card warranty!

Arrival of Equipment

Receiving

Upon arrival of the equipment, inspect it for damage. Promptly report all visible damage to the carrier. All shipping damage claims must be filed with the carrier.

Storing

During storage in a warehouse or on the elevator job site, precautions should be taken to protect the equipment from dust, dirt, moisture, and temperature extremes.

Handling

The door operator is packaged in a cardboard box and crated. If possible, leave completely crated when handling.

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Preliminary Settings

Oil Viscosity and Viscosity Control

- The power unit should be located in a room that is ventilated and heated between 50⁰F and 90⁰F.
- Adjust the valve when the oil is at its operating temperature of 100⁰F to 170⁰F.
- Ensure that the unit performance is checked when the oil temperature is at minimum heated range of 100⁰F or above.
- Changes in oil temperature will cause changes in valve behavior.



Be EXTREMELY careful when making adjustments near moving belts. When operating the elevator from the controller, follow all safety precautions.

Relief Pressure Setting



The I-2/I-3 Valve requires a minimum static system pressure of 90 PSI.

- Ensure that the car is empty.
- Turn OFF, Lock, and Tag out the mainline disconnect.
- Lower the car onto the buffers by opening the manual lowering valve. See Figure 1.
- Close the manual lowering valve.
- Install a pressure gauge on the quick connector (located on the far side of the valve).
- Turn the relief pressure adjustment screw OUT until 5/8" extends beyond the relief assembly housing, and tighten the locknut.

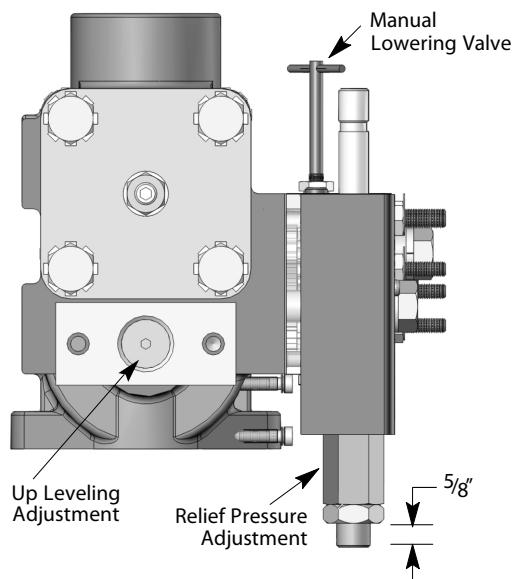


Figure 1 - Relief Pressure Setting

Preliminary Settings

(continued)

Low Pressure Setting

Note: OUT = Counterclockwise, CCW
IN = Clockwise, CW

1. Turn the low pressure adjustment screw OUT $1\frac{3}{4}$ " beyond the cover plate. See Figure 2.
2. Turn the low pressure adjustment screw IN by hand until it touches the regulator piston.
3. Turn the up leveling adjustment screw OUT until it stops.
4. Turn the up leveling adjustment screw IN four (4) turns.

Adjustment Needles

Note: To make adjustments, do not loosen the nuts on the adjustment needle stems. They should be snug against the valve body at all times.

1. Turn the up start, up stop, and up slowdown adjustment needles IN to the fully closed position. See Figure 2.
2. Turn the up start needle OUT nine (9) turns.
3. Turn the up stop needle OUT three (3) turns.

Note: The up slowdown needle should remain closed.

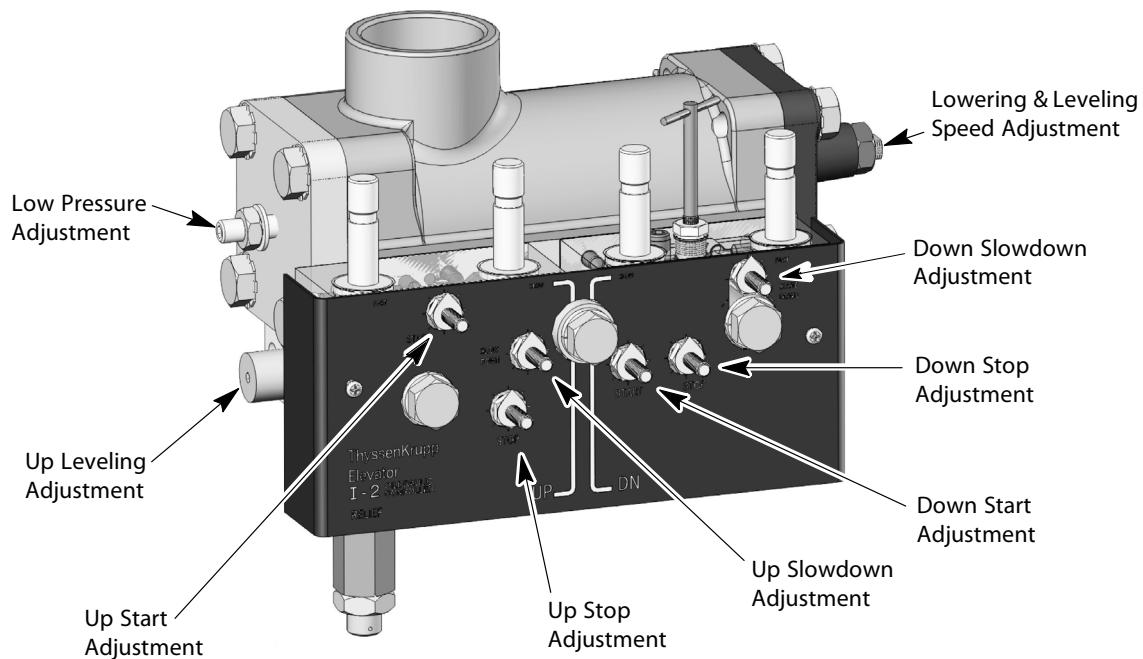


Figure 2 - Low Pressure Setting

Lowering and Leveling Speed Setting



To avoid damage to the piston face and seat, never turn the lowering and leveling speed adjustment unless the car is resting on the buffers or the car is in motion.

1. With the car set on the buffers, adjust the lowering and leveling screw so that 3/4" extends beyond the valve body. See Figure 3.
2. Make sure the flat end of the screw is pointed 45°F counterclockwise to the tank return line.
3. Tighten the locknut.

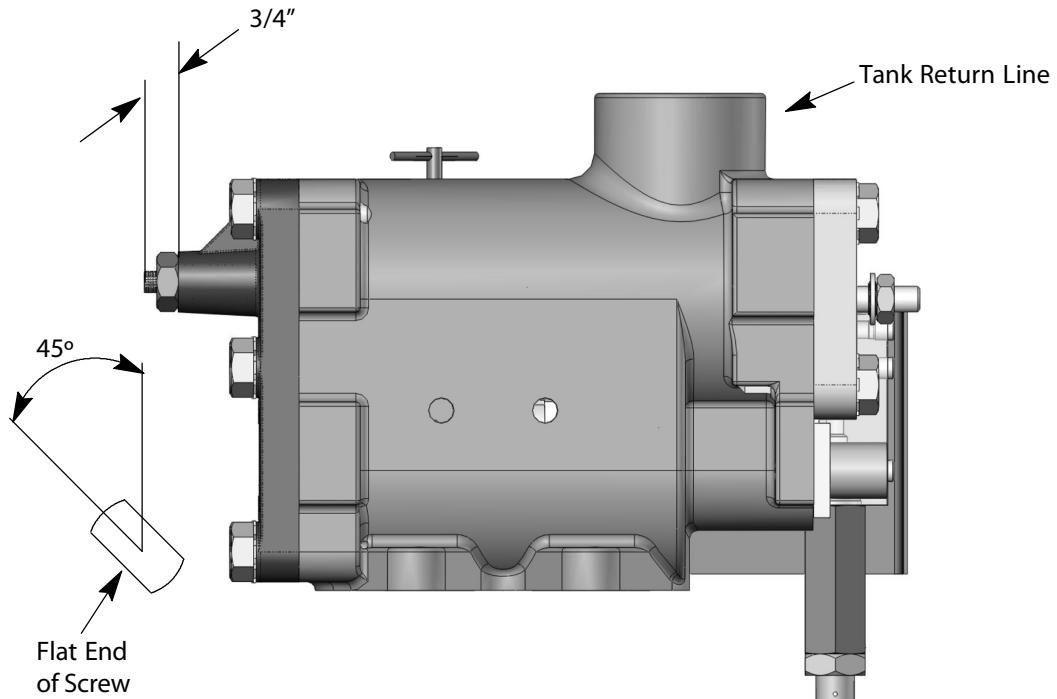


Figure 3 - Lowering and Leveling Speed Setting

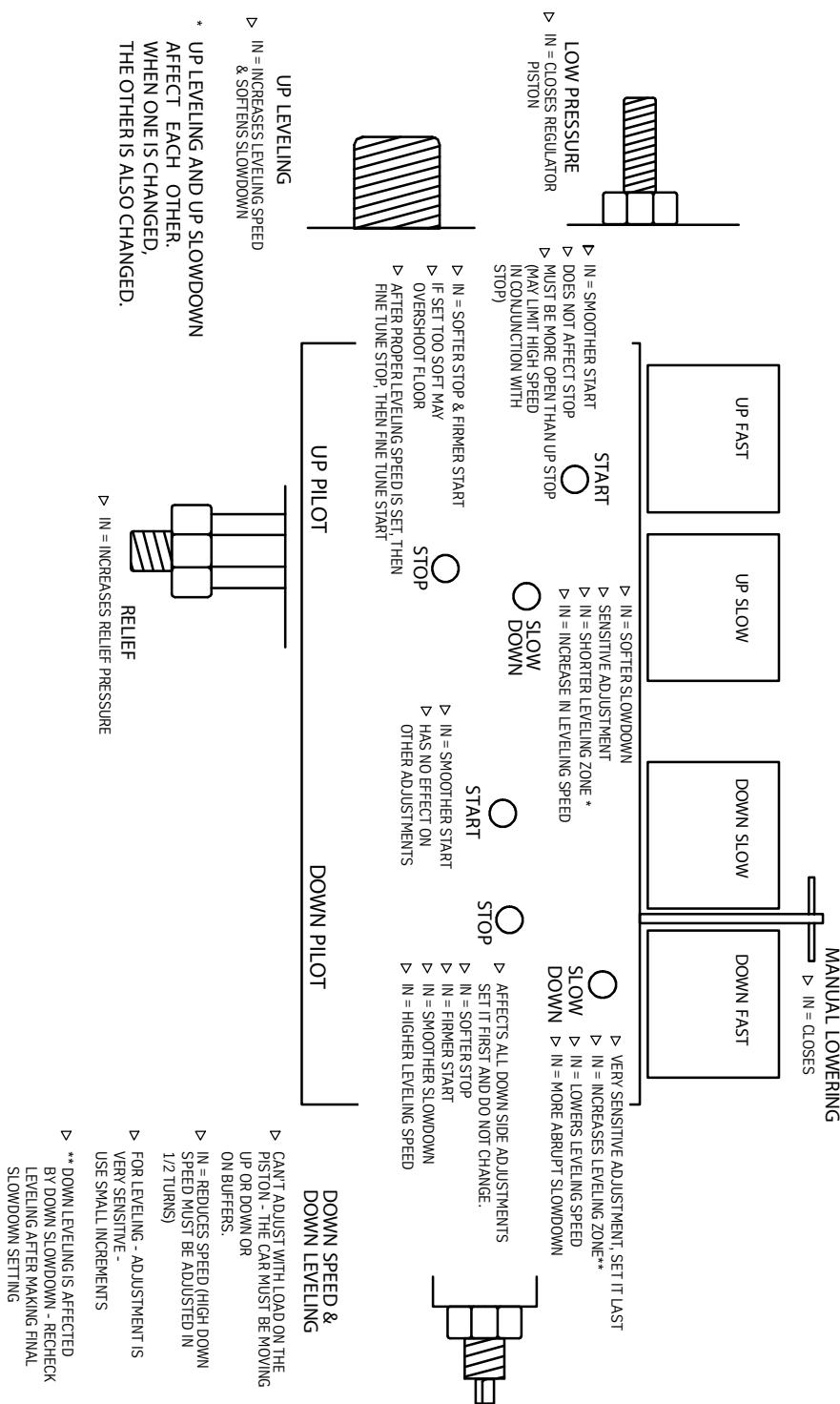
Adjustment Needles

Note: To make adjustments, do not loosen the nuts on the adjustment needle stems. They should be snug against the pilot body assembly at all times.

1. Turn the down start, down stop, and the down slowdown adjustment IN to the fully closed position.
2. Turn the down start adjustment OUT nine (9) turns.
3. Turn the down stop adjustment OUT ten (10) turns.

Note: The down slowdown adjustment must remain closed at this time.

VALVE ADJUSTMENT EFFECTS



Preliminary Adjustments



When operating the elevator from the controller, follow all safety precautions.

1. Ensure that the car is empty and the manual lowering valve is closed.
2. Turn OFF, Lock, and Tag out the mainline disconnect.
3. Disable the up slow solenoid by disconnecting the solenoid wire from the controller. See the appropriate controller diagrams.
4. Disable the up fast solenoid by placing the controller on Inspection Operation.

Note: The type of controller will determine how Inspection Operation is accomplished.

5. Turn the power on, and start the motor.
6. Turn the low pressure adjustment IN just until the car starts to move.
7. Turn the low pressure adjustment OUT until the car movement stops.
8. After the car stops, turn the low pressure adjustment OUT an additional one-half (1/2) turn.
9. Use these instructions on valves marked with SP on the cover plate or the valve nameplate:
Note: The car must be stopped and started to check the setting.
 - a. Turn the low pressure adjustment OUT three (3) turns.
 - b. Check for too much time delay between the motor starting and the car movement.
 - c. Turn the low pressure adjustment IN until excessive delay is eliminated.
10. Tighten the locknut.
11. Stop the motor, and turn the power off.
12. Remove any jumpers that may have been used.
13. Reconnect the up slow solenoid wire to the controller.

Relief Pressure Adjustment

1. Close the line shut-off valve, and install a pressure gauge.
2. With the controller on Inspection Operation, turn the power on, start the motor, and read the pressure.

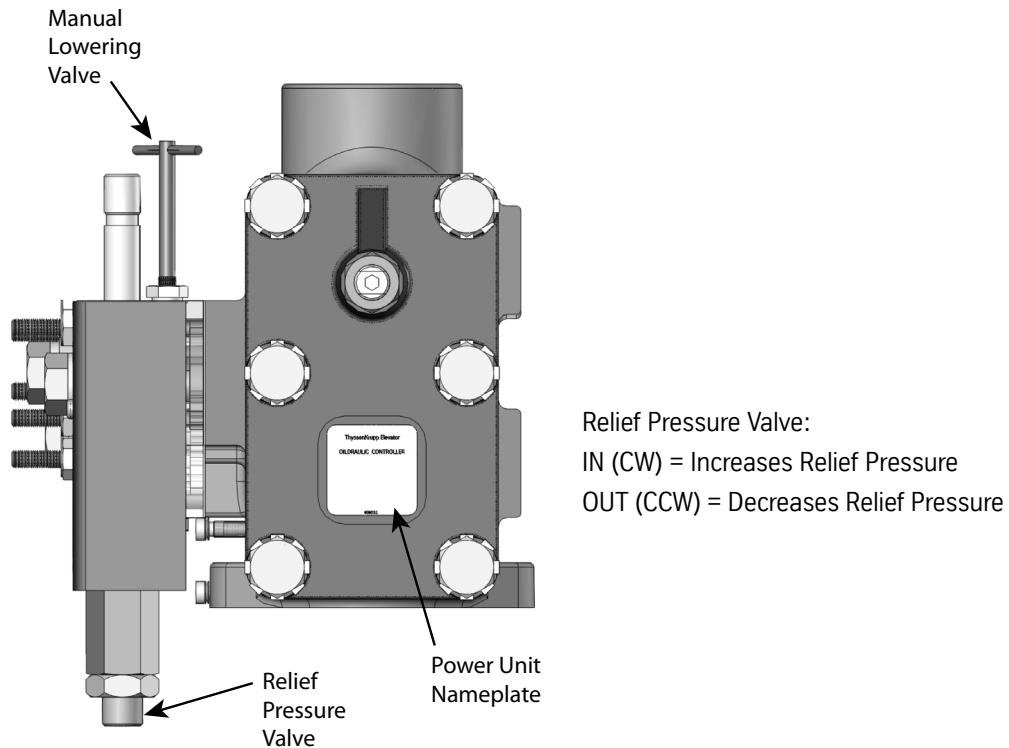


Stop the power unit IMMEDIATELY if pressure exceeds 625 PSI.

3. Adjust the relief valve to relieve at the pressure indicated on the power unit nameplate. See Figure 4 on page 12.
4. Tighten the locknut, and Turn OFF, Lock, and Tag out the mainline disconnect.
5. Relieve the jack pressure by opening the manual lowering valve.
6. Close the manual lowering valve.

Relief Pressure Adjustment

(continued)



Relief Pressure Valve:

IN (CW) = Increases Relief Pressure

OUT (CCW) = Decreases Relief Pressure

Figure 4 - Relief Pressure Adjustment

7. Turn on the power, and recheck the relief pressure.
8. Turn OFF, Lock, and Tag out the mainline disconnect, and repeat Steps 5 and 6.
9. Open the line shut-off valve.

Slowdown and Leveling Speed Adjustment

1. Turn the up slowdown adjustment OUT ten (10) turns (this action ensures that the car does not initially start up). See Figure 5 on page 13 for all steps in this procedure.
2. With the car on Inspection Operation, start the car up. Slowly turn the up slowdown adjustment screw IN until the car moves at 10 to 12 fpm.
3. Recheck the up leveling speed.
4. Verify that the down stop adjustment screw has been turned OUT ten (10) turns (this action ensures the car does not initially start down).
5. Place the car on Inspection Operation, and start the car down. Slowly turn the down stop adjustment screw IN until the car runs down at 15-20 fpm.

Slowdown and Leveling Speed Adjustment

(continued)

6. Turn the lowering and leveling speed adjustment by less than one-quarter turn increments, to adjust the leveling speed to 10-12 fpm. Pause between each change.

Note: If the lowering and leveling speed adjustment is turned too far (more than one-quarter turn) the car will lock in the down direction. If this happens, run the car up on Inspection Operation while another person in the machine room turns the lowering and leveling speed adjustment screw OUT a small amount.

7. Tighten the locknut.
8. If the car does not stop, turn the down stop adjustment screw OUT until the stop is positive.
9. Recheck the down leveling speed.

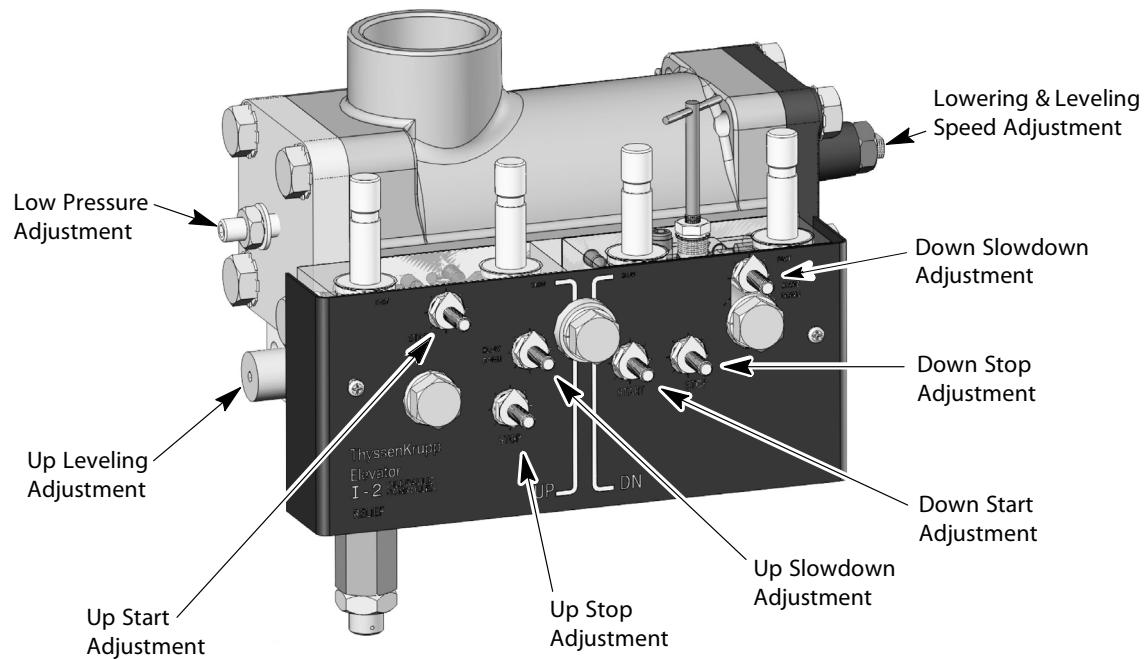


Figure 5 - Slowdown and Leveling Speed Adjustment

Final Adjustments

The manufacturing presets of the valve adjustments are attached to the inside of the controller. These values ensure movement of the car and also reduce final adjustment time. Perform these adjustments in the order given because they affect each other.



To be adjusted, the I-2/I-3 Valve requires a minimum static system pressure of 90 PSI.

Valve-Up Section

Up Slowdown and Up Leveling Speed

1. Verify that the car is empty.
2. Place the controller on Automatic Operation, and send the car to the lowest landing.
3. Run the car to the floor above and observe the leveling zone.
4. Adjust the up slowdown for 3 to 4 inches of leveling.

Up Slowdown - Adjust for 3 to 4 inches of Leveling	
IN (cw)	Shorten Leveling Zone
	Increase Leveling Speed
	Softer Up Slowdown



Each time the up slowdown is adjusted, the up leveling speed must be rechecked.

5. Run the car on Inspection Operation, and adjust the up leveling speed adjuster. The leveling speed should be 10-12 fpm.

Up Leveling -10 to 12 fpm	
IN (cw)	Increase Leveling Speed
	Softer Up Slowdown



When operating the car from the controller, ensure all safety precautions are followed.

6. Place the car on Automatic Operation.
7. Check the leveling zone for 3 to 4 inches, and the leveling speed for 10 to 12 fpm.
8. Continue to adjust the up slowdown needle and the up leveling adjuster until the desired performance is achieved.

Up Stop and Up Start

Because the up stop adjustment affects the up start adjustment, it must be adjusted first.

1. Adjust the up stop for a soft but positive stop.
2. Adjust the up start for a smooth but positive start.
3. Check to be certain full up speed is reached on a one-floor run, which may require the up start to be more positive.
4. Slightly alter the slowdown adjustment to achieve optimum performance, if necessary.

IN (cw)	Up Stop	Up Start
	Stop Softer	Start Smoother
	Start Firmer	Limit High Speed

Valve-Down Section**Lowering Speed**

1. Place the car on Automatic Operation.
2. Set the lowering speed.
 - a. Use an empty car, and turn the lowering speed adjustment in one-half turn increments.
 - b. After each adjustment, leave the flat end of the screw pointed 45°F to the tank return line.

Lowering Speed	
OUT (ccw)	One-half Turn Increments
	Increase Lowering Speed



If no speed change occurs with one full turn on the lowering speed adjuster, DO NOT CONTINUE TO TURN IT OUT. Check for a stop open wider than a start, or a mechanical piston binding.

Down Leveling Speed and Down Stop

The down leveling speed and the down stop adjustment must be performed together since the down stop adjustment affects the down leveling speed. The down leveling speed, however, does not affect the down stop adjustment.

1. Place the controller on Inspection Operation.
2. Adjust the down stop for a positive stop.
3. Adjust the down leveling speed to 10-12 fpm.
4. Tighten the locknut on the down leveling speed adjustment.
5. Recheck the down leveling speed.

Down Stop	
IN (cw)	Stop Softer
	Increase Leveling Speed
Down Leveling Speed	
OUT (ccw)	Less than one-quarter turn increments
	Increase Leveling Speed

Down Start

1. Place the controller on Automatic Operation.
2. Adjust the down start adjustment to obtain a smooth start.

Note: Ensure that the car achieves full speed on a one-floor run. If not, make the down start more positive.

Down Start	
IN (cw)	Start Smoother

Valve-Down Section

(continued)

Down Slowdown

The effect of the down slowdown adjustment is the opposite of the previous adjustments. Turning OUT on the down slowdown adjustment will shorten the leveling zone. Turning IN on the down slowdown adjustment will lengthen the leveling zone. Make this adjustment in small increments as soon as a change is observed in the leveling zone. The car will overshoot the landing if the adjustment is turned OUT too far.

1. Turn the down slowdown adjustment OUT in small increments until the car has a leveling zone of 3 to 4 inches.
2. It may be necessary to slightly alter the point in the hoistway where the slowdown is initiated to achieve optimum valve and car performance.

Note: This action is usually accomplished by either switch location or selector settings.

Performance Check with Full Load

1. Place a capacity load on the car.
2. Run the car on Automatic Operation, and the check performance at all floors. All valve functions will become firmer at upper landings. If adjustments are necessary, it will affect the empty car performance.

Notes:

- The down leveling speed will increase and the down leveling zone will be shorter. It may be necessary to change the down slowdown adjustment to be certain there is at least two (2) inches of leveling.
- If necessary, turn IN on the down slowdown to increase the leveling zone.
- The up leveling speed will increase. The up leveling zone will change between no load and full load. Do not change any adjustments made with no load if there is at least one (1) inch of up leveling zone with a full load.
- If necessary, turn OUT on the up slowdown adjustment to increase the up leveling zone.

3. Verify that the car is obtaining full speed in both directions on a one-floor run.

4. Record the working pressure in the up direction.

Note: The working pressure value will be used in the next procedure.

5. Remove the capacity load from the car.

Final Relief Pressure with Full Load

1. Place the controller on Inspection Operation, and close the line shut-off valve.
2. Start the pump, and read the relief pressure.
3. Add 25% to the working pressure recorded in Step 4 of the previous procedure, and set the relief valve to relieve at this new pressure value.
4. Stop the power unit, and tighten the locknut on the relief pressure adjustment.
5. Recheck the relief pressure.



Stop the power unit IMMEDIATELY if pressure exceeds 625 PSI.

6. Open the line shut-off valve, and place the car on Automatic Operation.

Troubleshooting

Verify the following list before using the troubleshooting tables.

See also "Troubleshooting Flowcharts" in the reference material section starting on page 20.

1. No binding in the hoistway.
2. The proper voltage is being supplied to the power unit.
3. All valve adjustments have been completed as recommended.
4. All vee belts on the power unit have the proper tension.
5. There is no oil on the belts to cause slippage.

Troubleshooting Table - Up Operation

Problem	Solution
Pump runs, but the car does not run at high speed.	<ol style="list-style-type: none"> 1. Check that the line shut-off valve is fully open. 2. Check for the correct motor rotation. 3. Check for the correct relief pressure setting. 4. Check that the up fast solenoid pulls IN.* 5. Turn OUT on the up start adjustment. 6. Turn IN on the up stop adjustment. 7. Make sure that the regulator piston is free. 8. Make sure that the up pilot piston is free.
Car will not slowdown to leveling speed.	<ol style="list-style-type: none"> 1. Check that the up slow solenoid pulls IN.* 2. Check that the up fast solenoid drops OUT.* 3. Turn OUT on the up slowdown adjustment. 4. Check the up leveling speed. Set for 10 to 12 fpm. 5. Make sure that the regulator piston is free. 6. Make sure that the pressure control piston is free.
Car will not make a hydraulic stop.	<ol style="list-style-type: none"> 1. Check that the up slow solenoid drops OUT.* 2. Check for the correct low pressure adjustment. 3. Turn OUT the up stop adjustment. 4. Make sure that the regulator piston is free. 5. Make sure that the up pilot piston is free.
Acceleration, deceleration, leveling speed, or stop is erratic.	<ol style="list-style-type: none"> 1. Make sure that the check valve piston is free. 2. Make sure the spring on the regulator piston does not bind.
Leveling speed slows down or car stalls after slowdown (check if releveling speed slows down).	<ol style="list-style-type: none"> 1. Turn IN on the slowdown adjustment. 2. Replace the leveling adjuster/strainer.

* Check the solenoids for voltage and for damage to the solenoid tube.

Check the plunger for binding.

Do not reseat.

If the seat in the pilot body is damaged, replace the pilot.

Troubleshooting Table - Down Operation

Problem	Solution
Car will not lower	1. Check that the line shut-off valve is fully open. 2. Check the solenoids.* 3. Turn OUT the down start adjustment. 4. Turn IN on the down stop adjustment.
Slow or bouncy down start	1. Turn OUT on the down start adjustment. 2. Turn IN on the down stop adjustment. 3. Bleed the jack of air or loosen packing, if possible.
Abrupt down start	1. Turn IN on the down start adjustment. 2. Turn OUT on the down stop adjustment.
Car will not stop when started down	1. Tighten the manual lowering valve. 2. Turn OUT on the down stop adjustment. 3. Check if the solenoid valve is not closing (residual magnetism).*
Down stop too soft or bouncy	1. Turn OUT on the down stop adjustment. 2. Bleed the jack of air or loosen packing, if possible
Down stop rough	1. Turn IN fully on the down slowdown adjustment. 2. Turn IN on the down stop adjustment. 3. Turn OUT, in small increments, on the down slowdown.
Leveling bouncy	1. Check the leveling speed. Set for 10 to 12 fpm. 2. Bleed the jack of air or loosen packing, if possible.
Car will not slowdown to leveling speed	1. Check the down fast solenoid.* 2. The down slowdown adjustment may be open too much (too soft). 3. The leveling speed may be set too fast. Set for 10 to 12 fpm.
Slowdown rough	Turn OUT on the down slowdown adjustment.
Car settles (leaks) down	1. Run car to lowest position. 2. Inspect oil line, jack, and power unit for leaks. 3. Close the line valve.
Car settles (leaks) down and the oil level in the tank is less than when first set.	1. Tightly close the manual lowering valve, and run the car to the top. 2. Shut off the power and record the car location. 3. Wait 15 minutes, record the car location, and note the amount the car has settled "X". 4. Let car sit for 8 hours, record the car location, and note the amount the car has settled "Y". 5. If "Y" is not more than 25 times "X" arrange for homing to the lowest floor and verify proper performance. 6. Close down the first car location, wait 15 minutes and record the car location. Note the amount the car has settled "Z". 7. If "Z" is less than "X", replace the down pilot body and adjust the down functions. 8. Remove and examine the lowering and check valve pistons. 9. If the piston seat is damaged, reseat the piston and verify proper operation. 10. If the piston seat is not damaged, replace the valve and adjust the job.
<p>* Check the solenoids for voltage and for damage to the solenoid tube. Check the plunger for binding. Do not reseat. If the seat in the pilot body is damaged, replace the pilot.</p>	

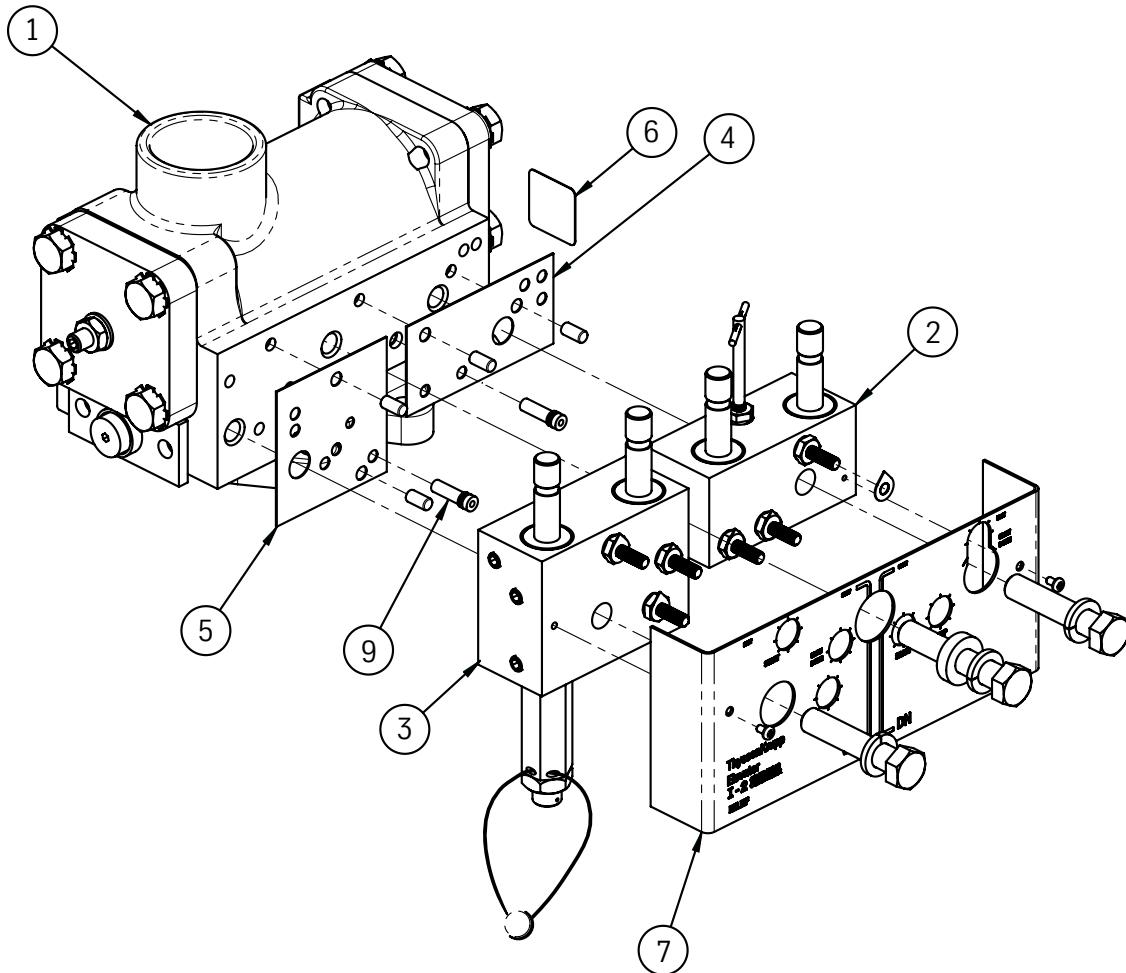
* Check the solenoids for voltage and for damage to the solenoid tube.

Check the plunger for binding.

Do not reseat.

If the seat in the pilot body is damaged, replace the pilot.

Replacement Parts

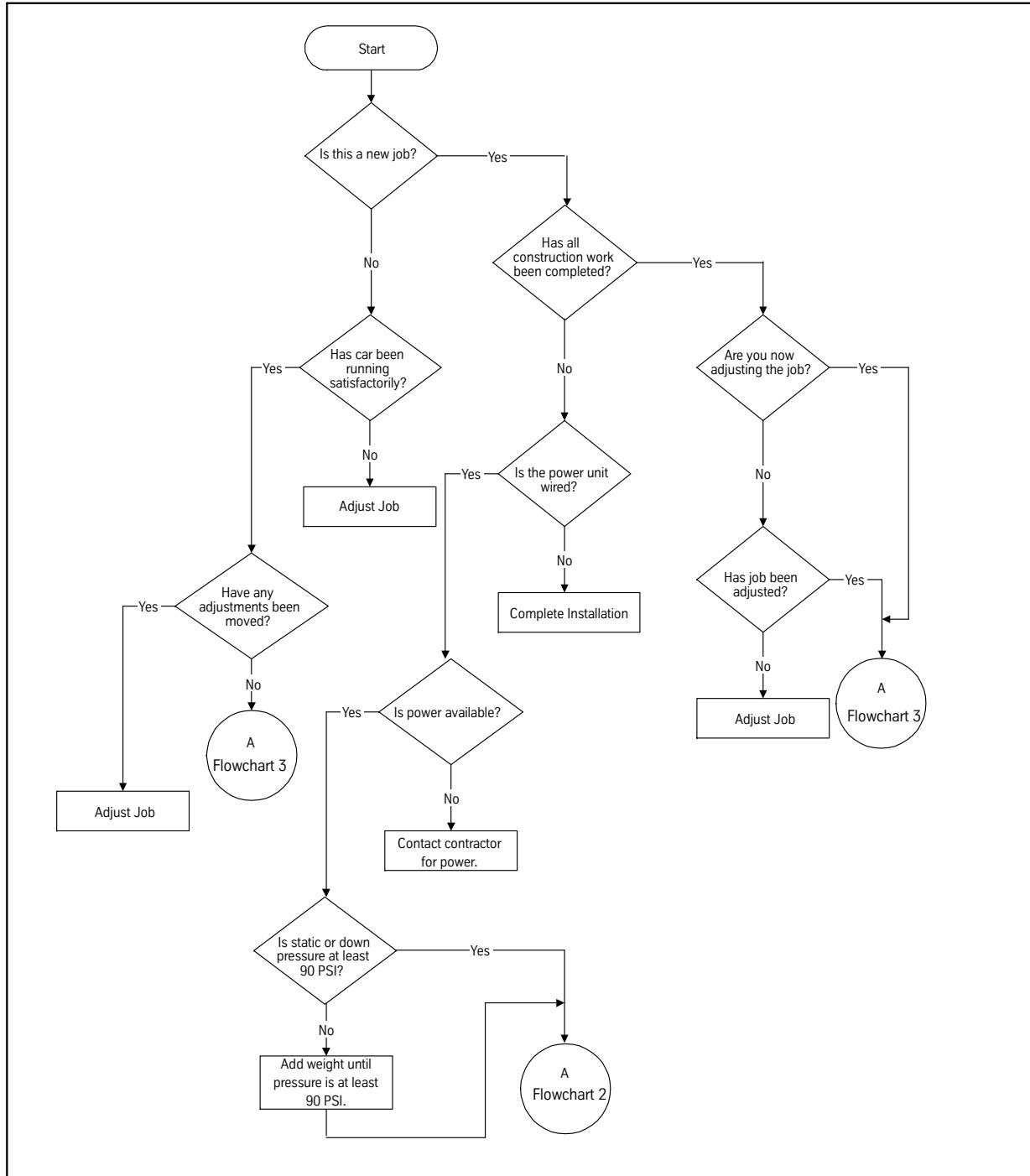


ITEM	PART NO.	PRINT NO.	DESCRIPTION
1		148323 137744 137743 189131 189128 189127 114874	Valve Main Body Assembly, I-2, 125 GPM EP Units Valve Main Body Assembly, I-2, 120-215 GPM Units Valve Main Body Assembly, I-2, 30-100 GPM Units Valve Main Body Assembly, I-2F, 125 GPM EP Units Valve Main Body Assembly, I-2F, 120-215 GPM Units Valve Main Body Assembly, I-2F, 30-100 GPM Units Valve Main Body Assembly, I-3, Down
2		886BC1	Valve Pilot Assembly Down
3		886BD1	Valve Pilot Assembly Up
4	9781493	124213	Gasket, Down Pilot
5	9781481	124214	Gasket, Up Pilot
6		606DG1	Nameplate Valve
7		141EC2 141ED2	Valve Faceplate, I-2, I-2F Valve Faceplate, I-3
8		117327	Indicator Adjustment
9	9824467	799AB1	Strainer Assembly, Stainless Steel

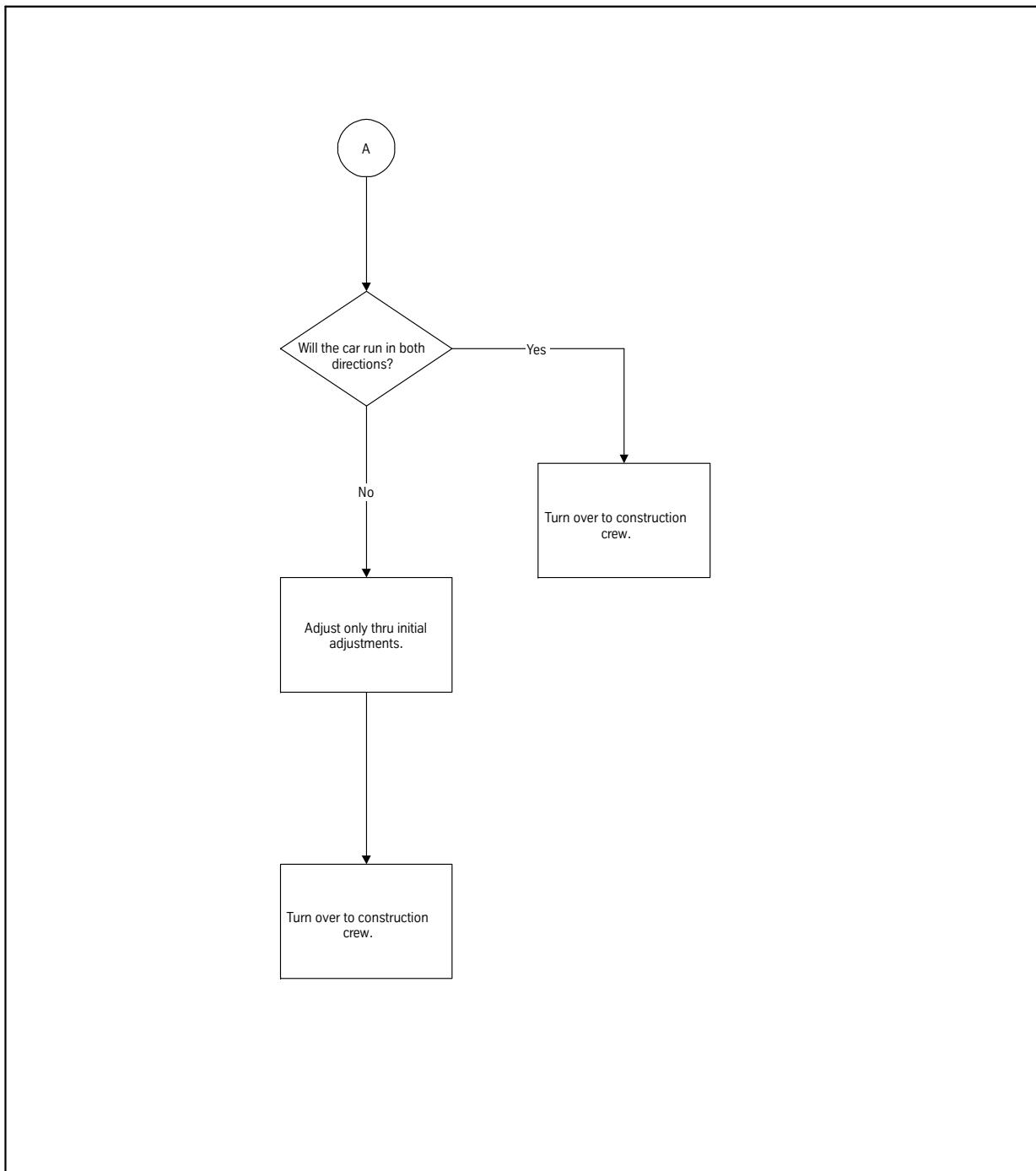
Reference Material

The material included in this section is only for reference and was obtained from the previous publication.
The Technical Publications Department does not update or maintain this information.

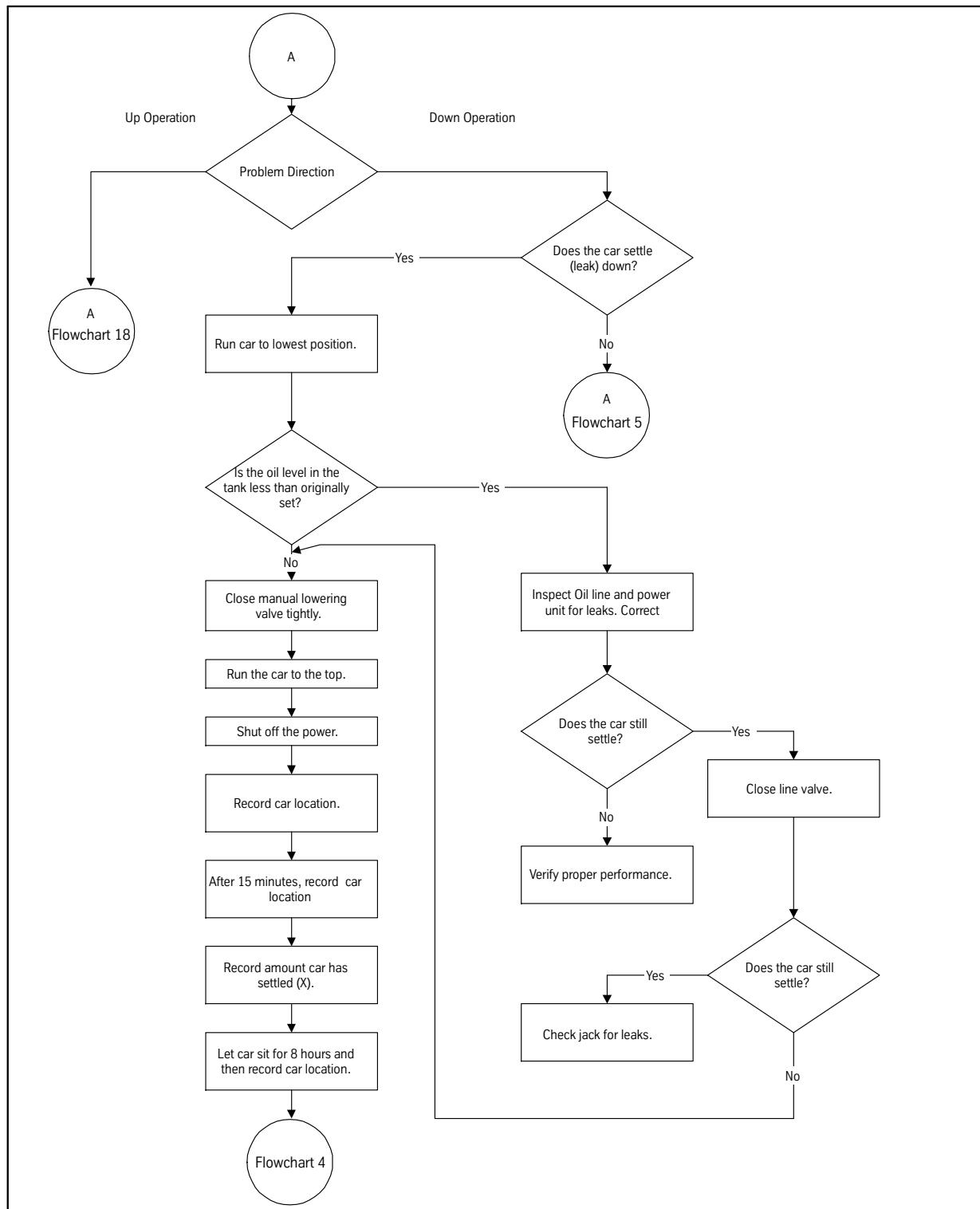
Troubleshooting Flowcharts



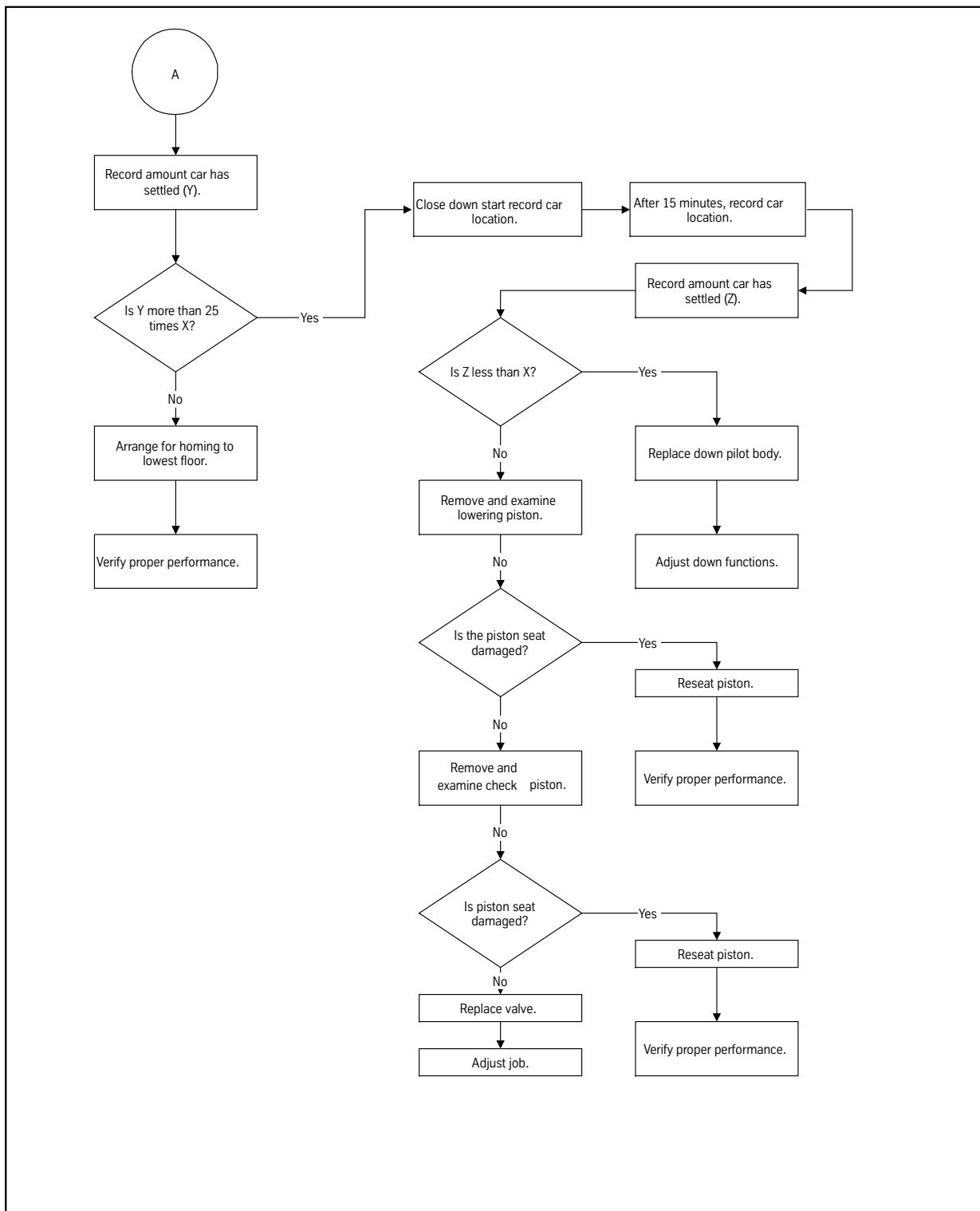
Flowchart 1



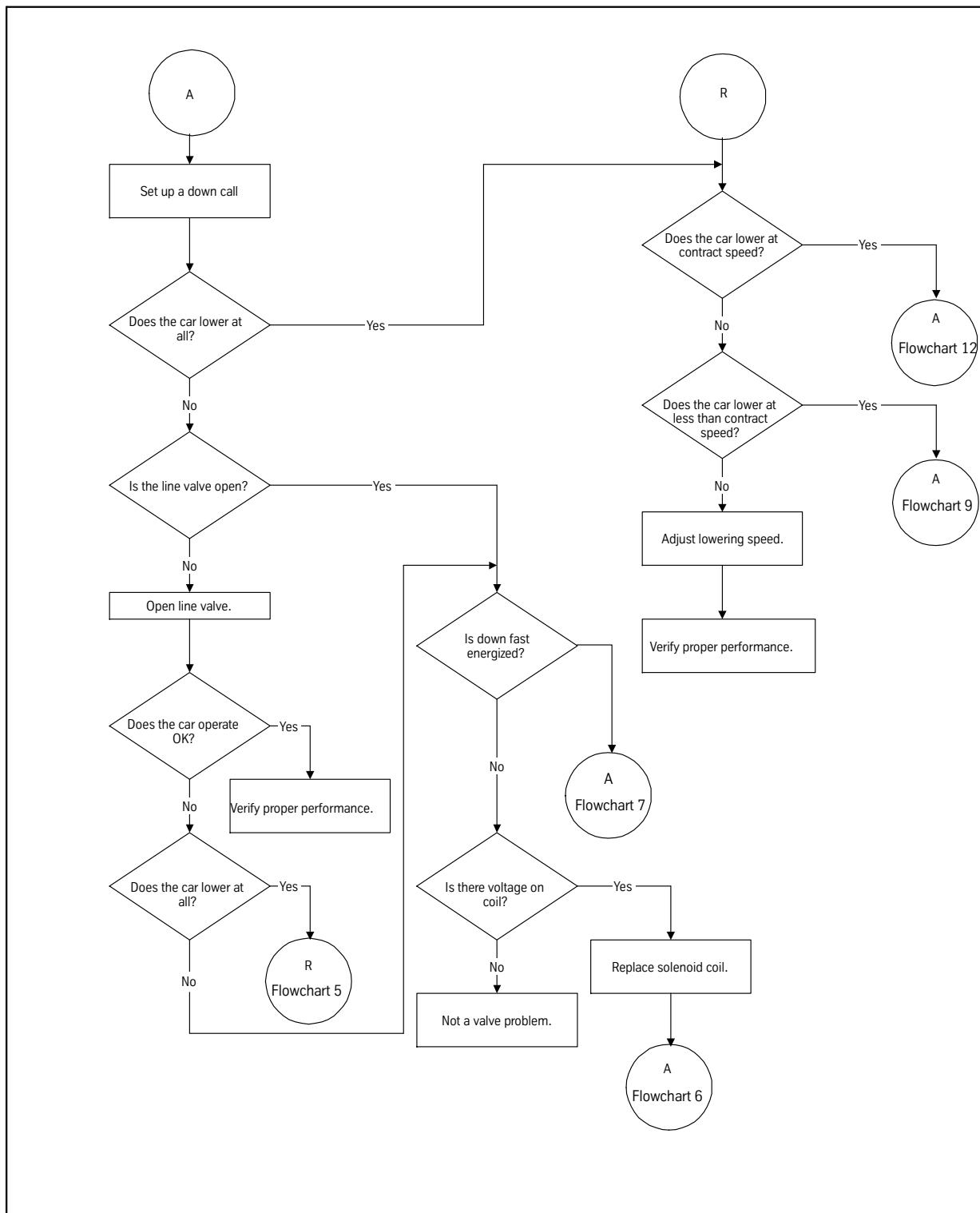
Flowchart 2



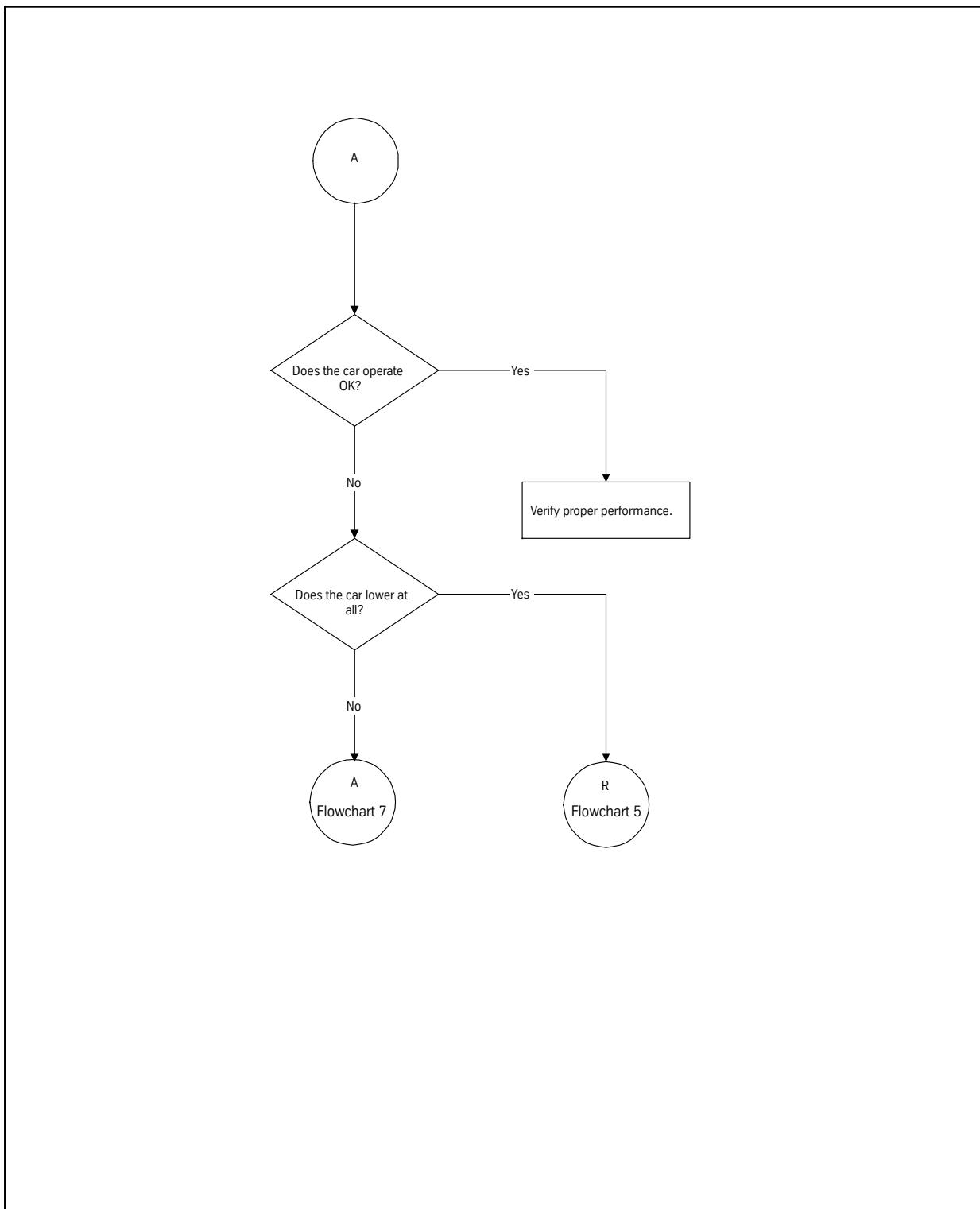
Flowchart 3



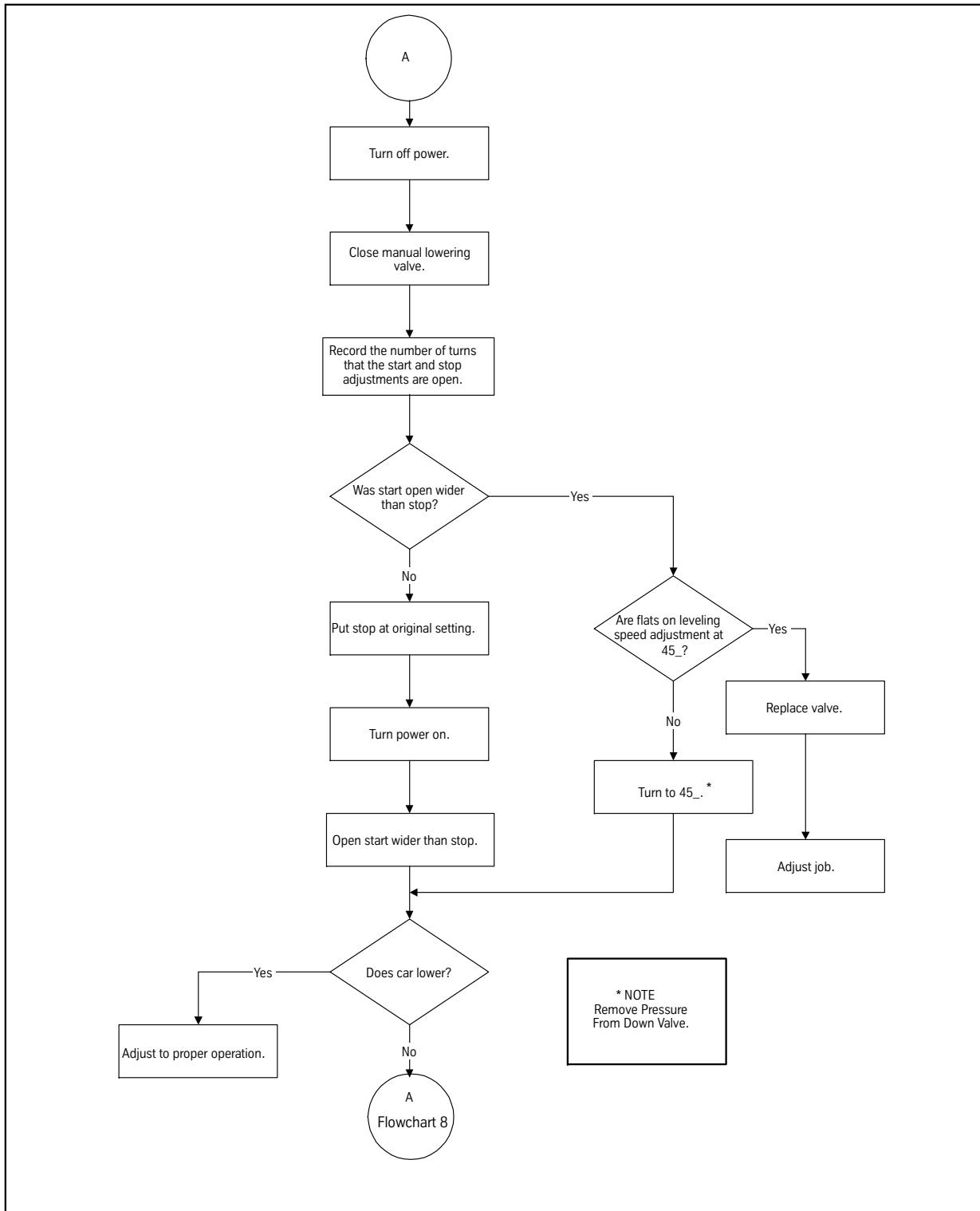
Flowchart 4



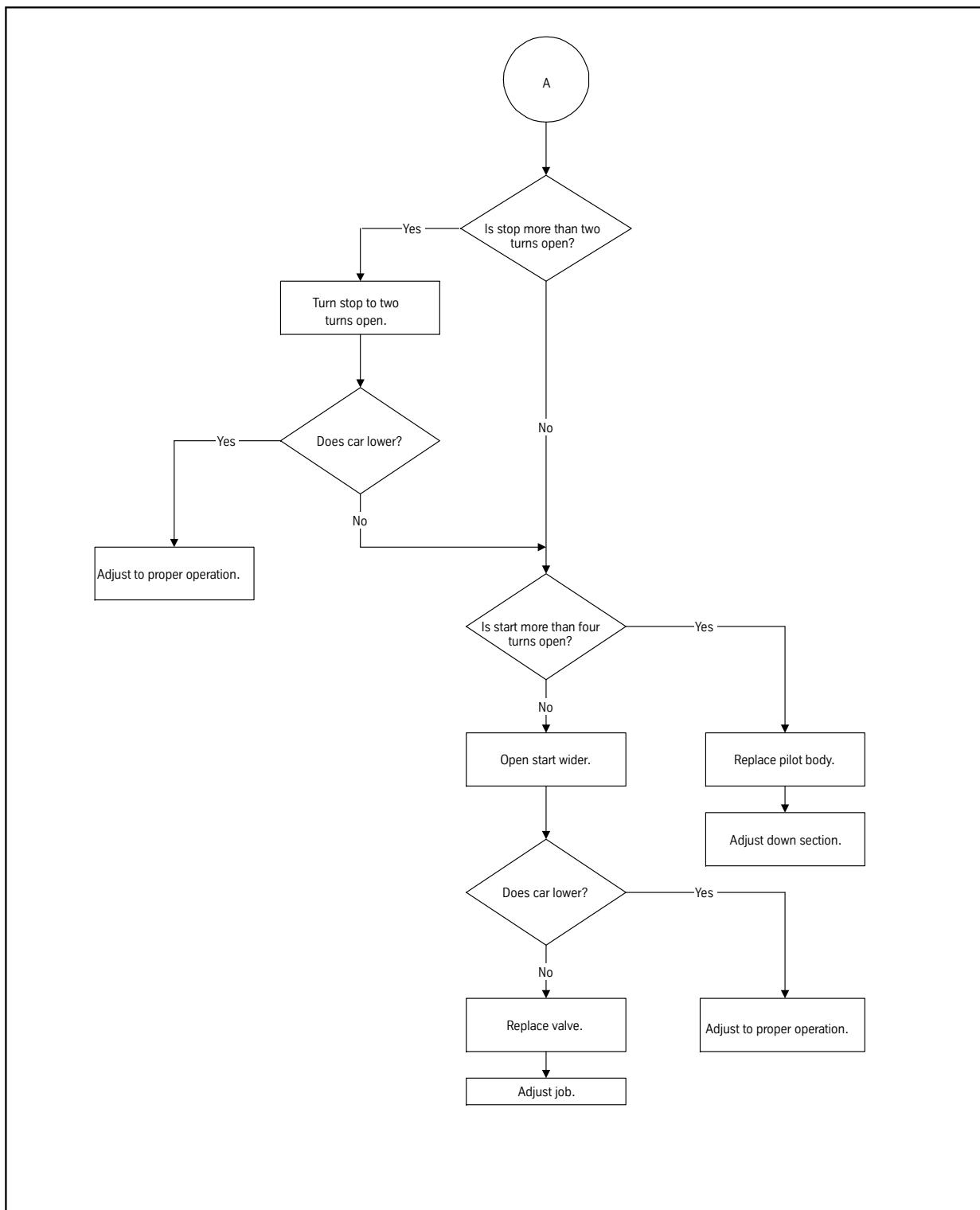
Flowchart 5



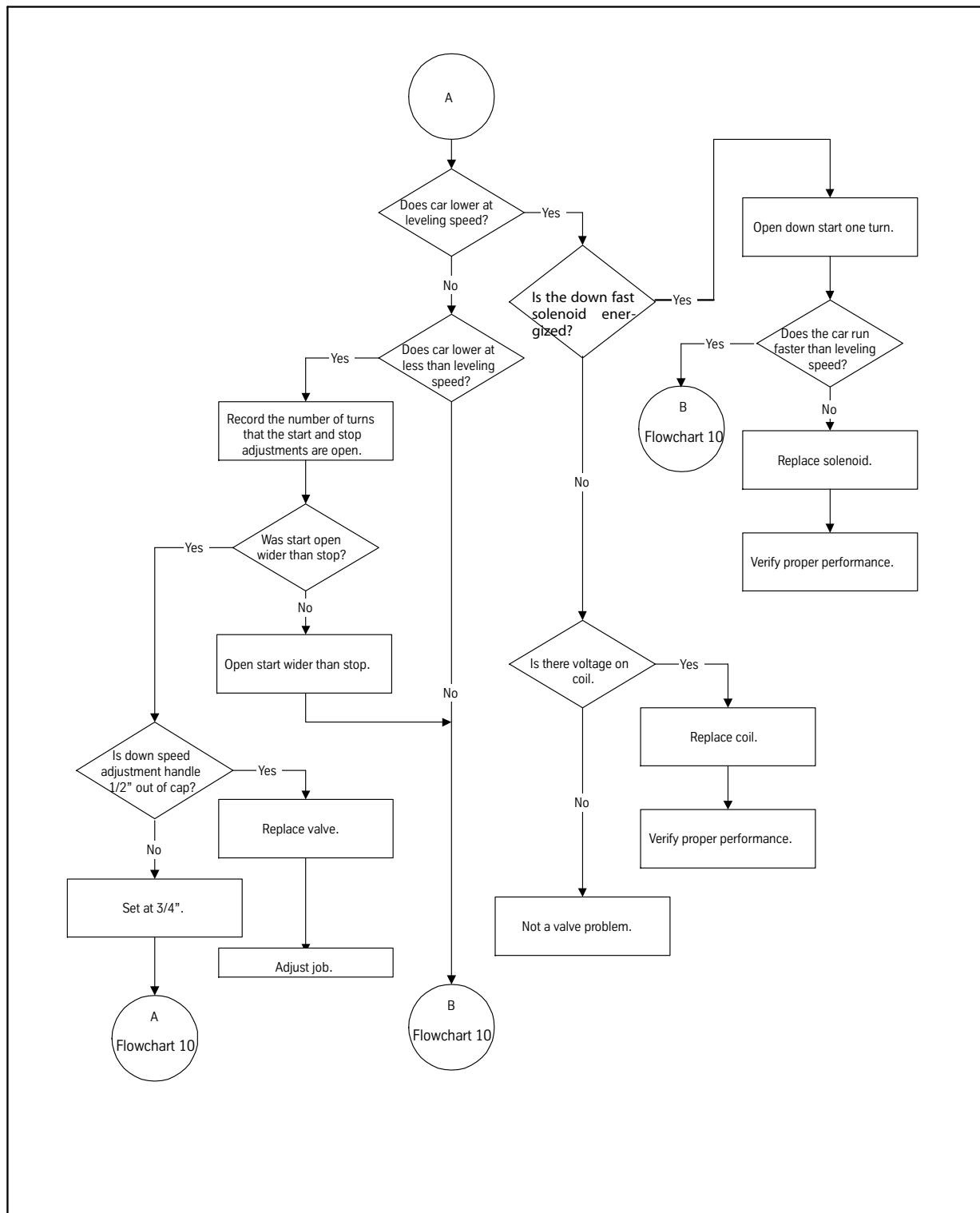
Flowchart 6



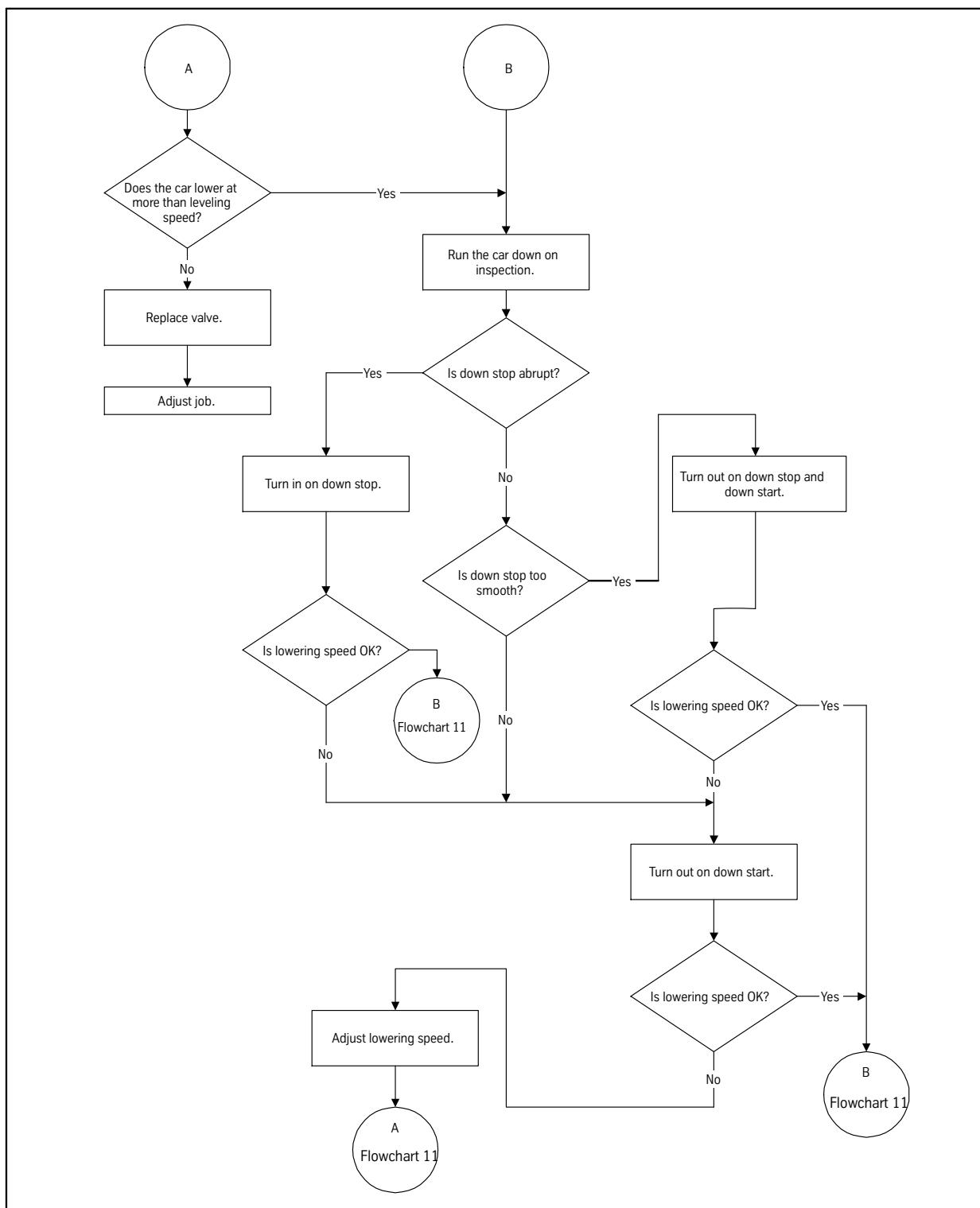
Flowchart 7



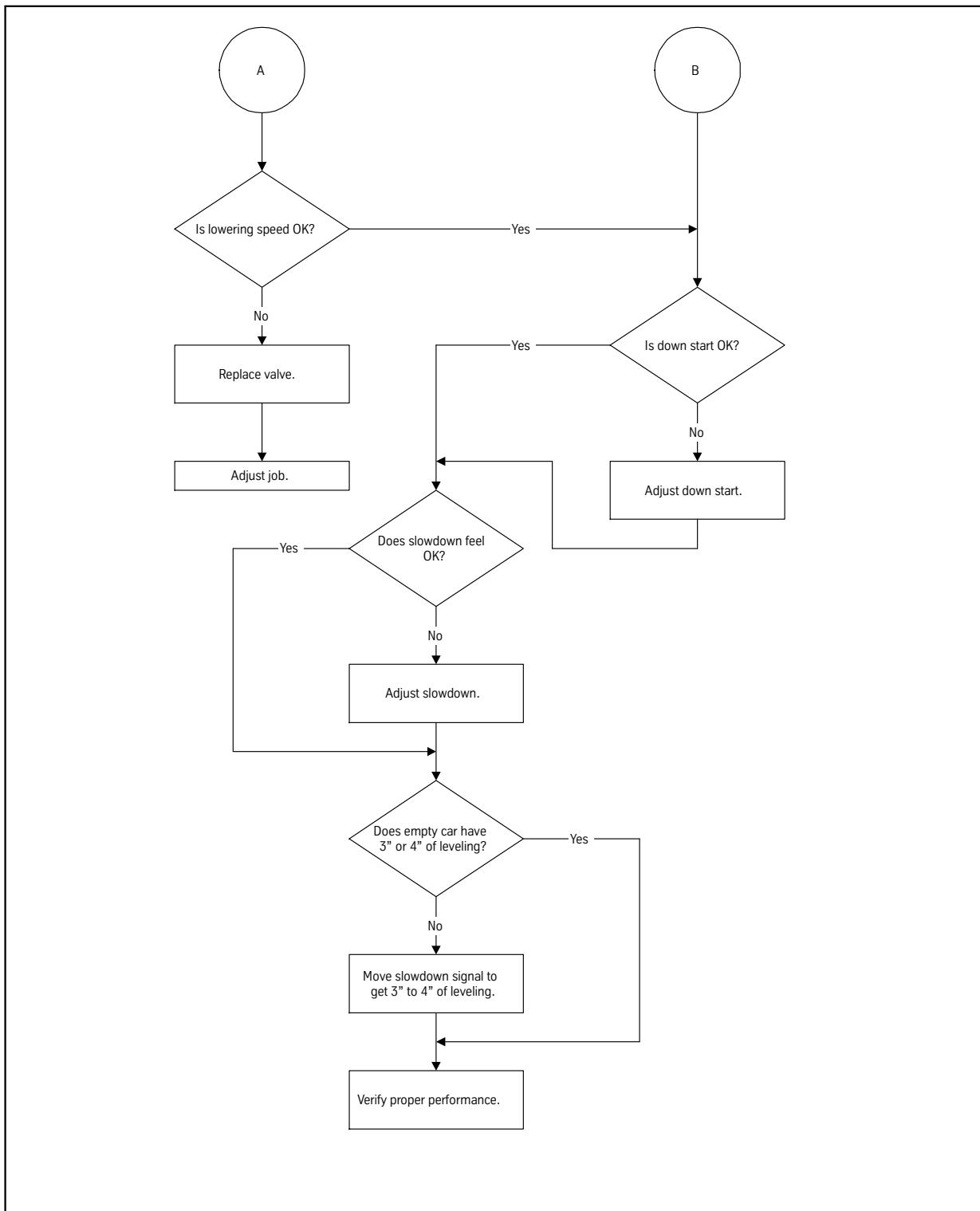
Flowchart 8



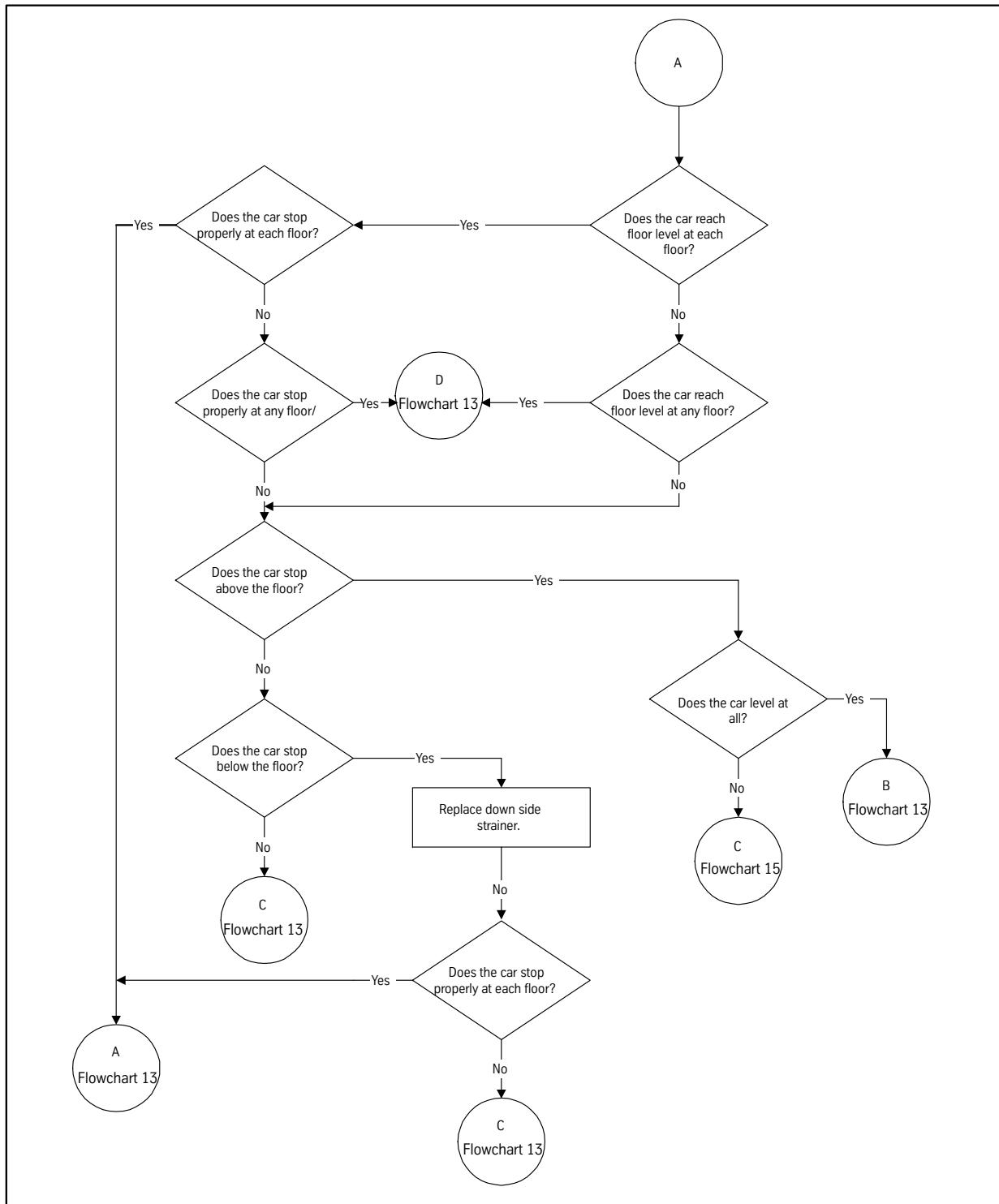
Flowchart 9



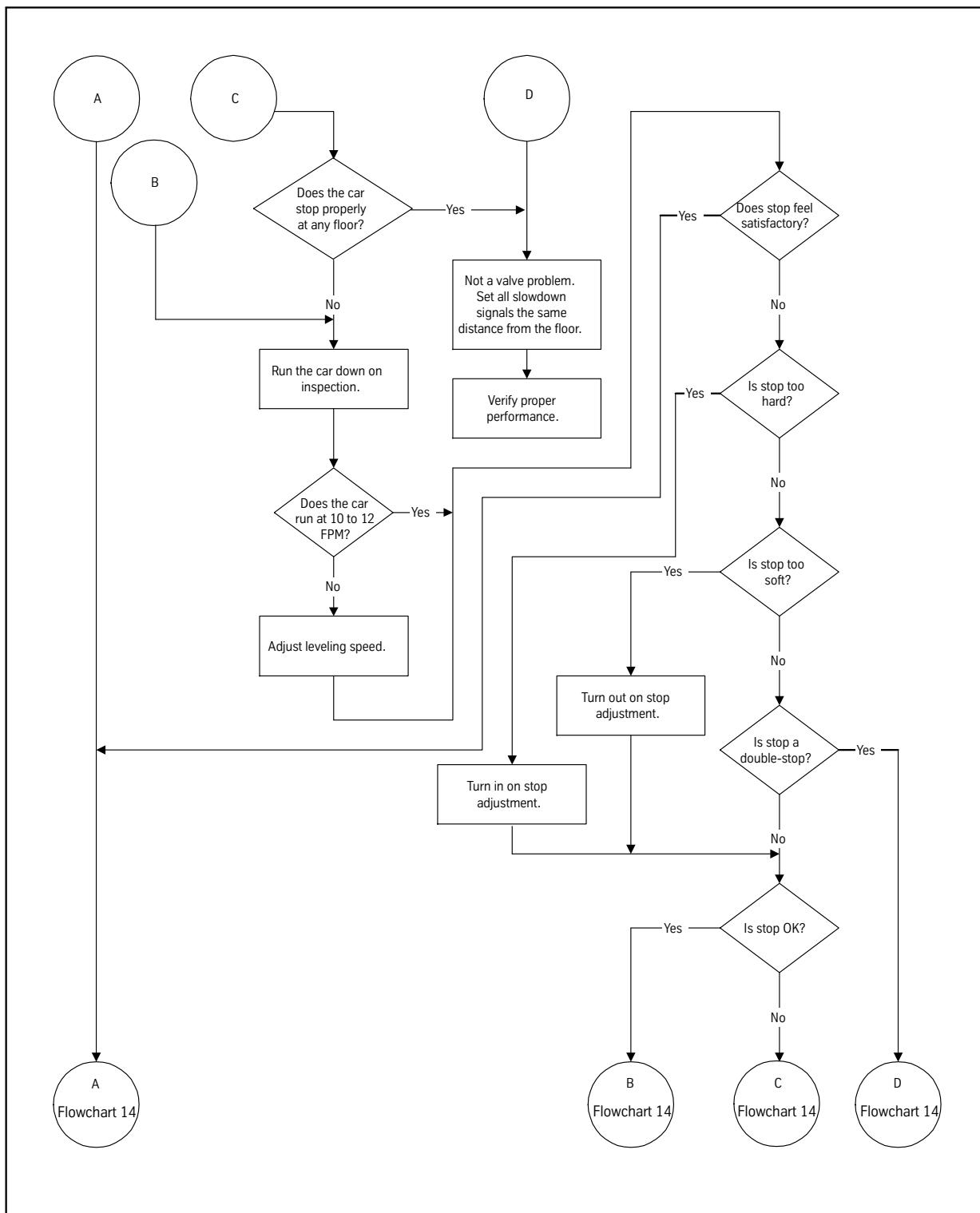
Flowchart 10



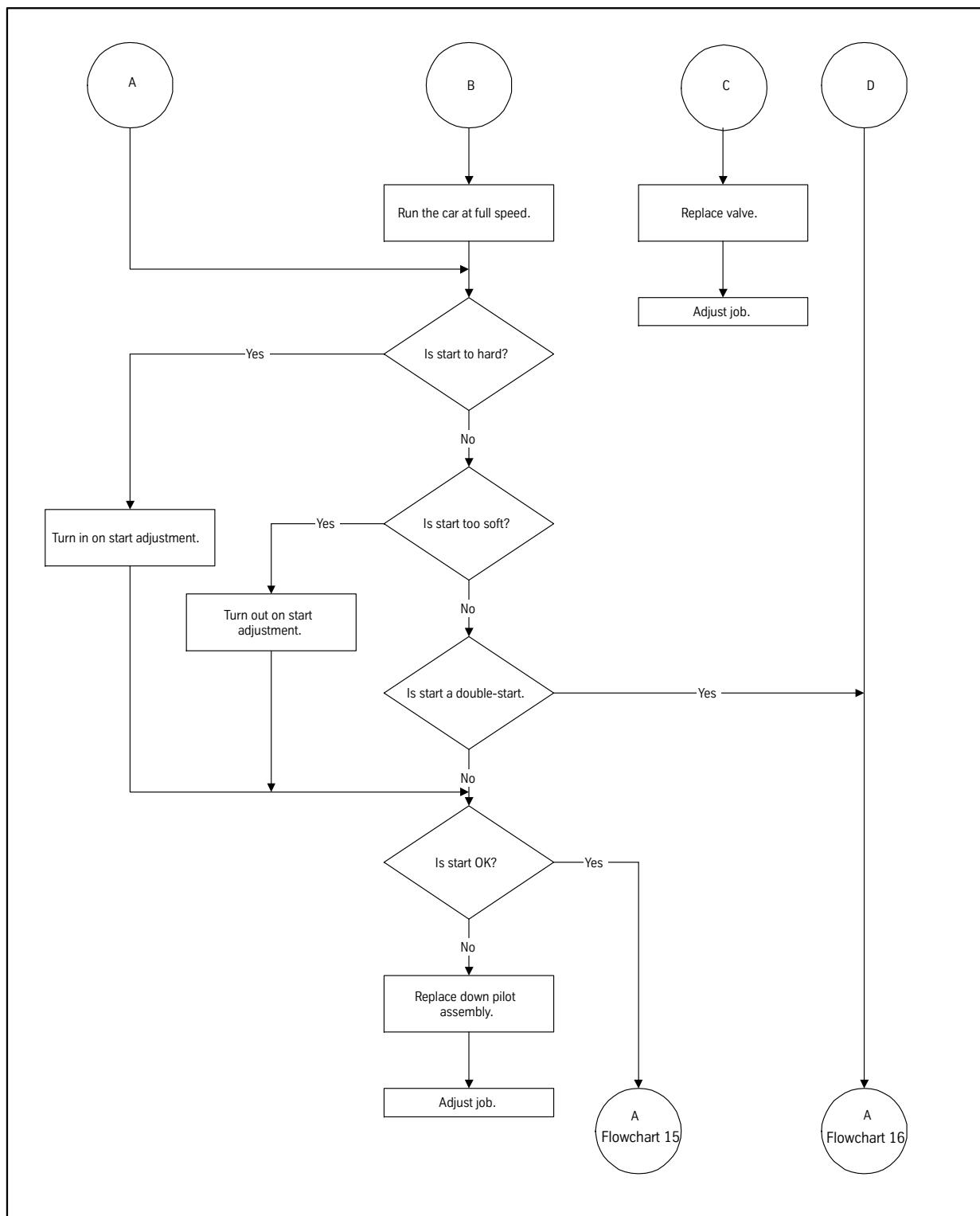
Flowchart 11



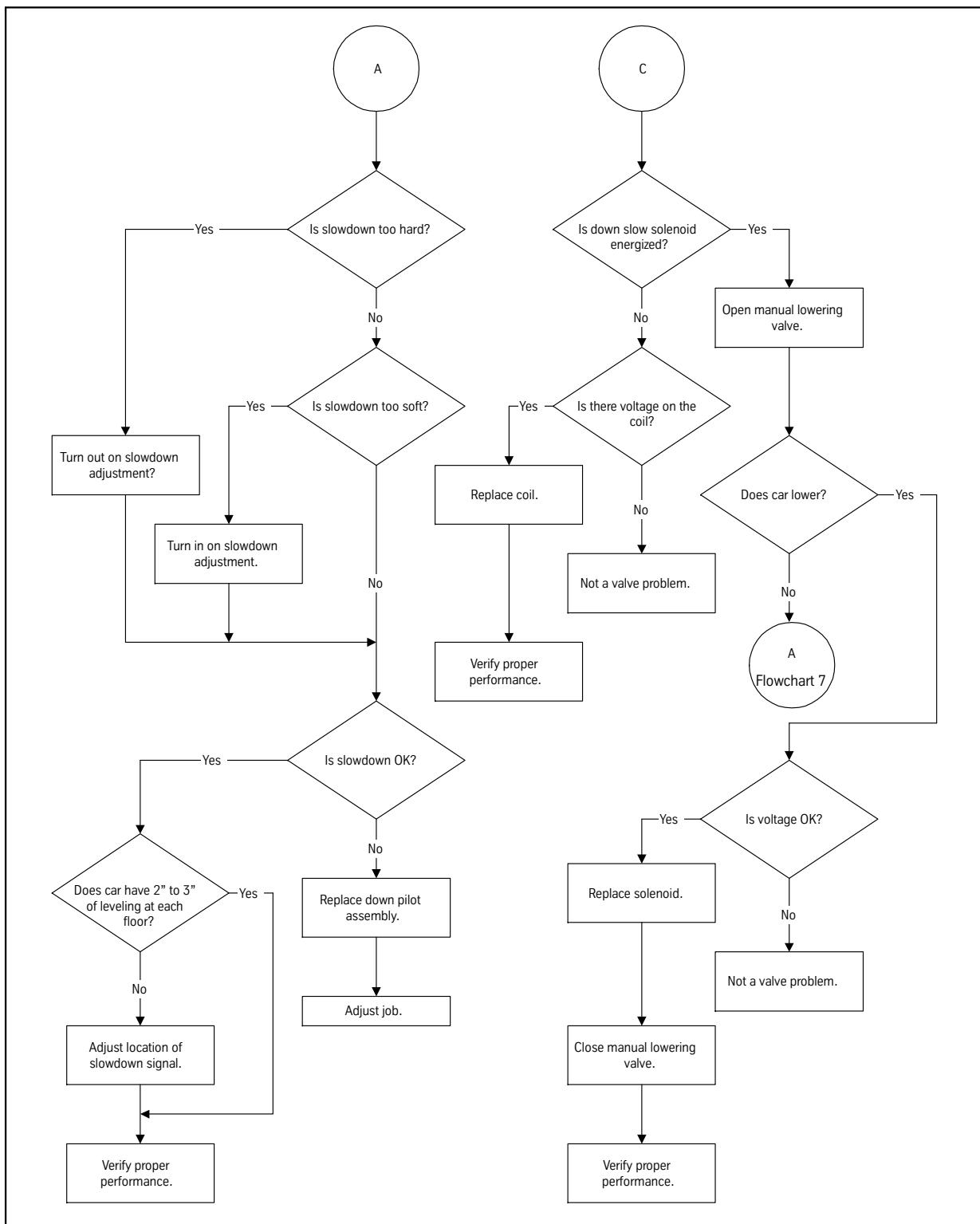
Flowchart 12



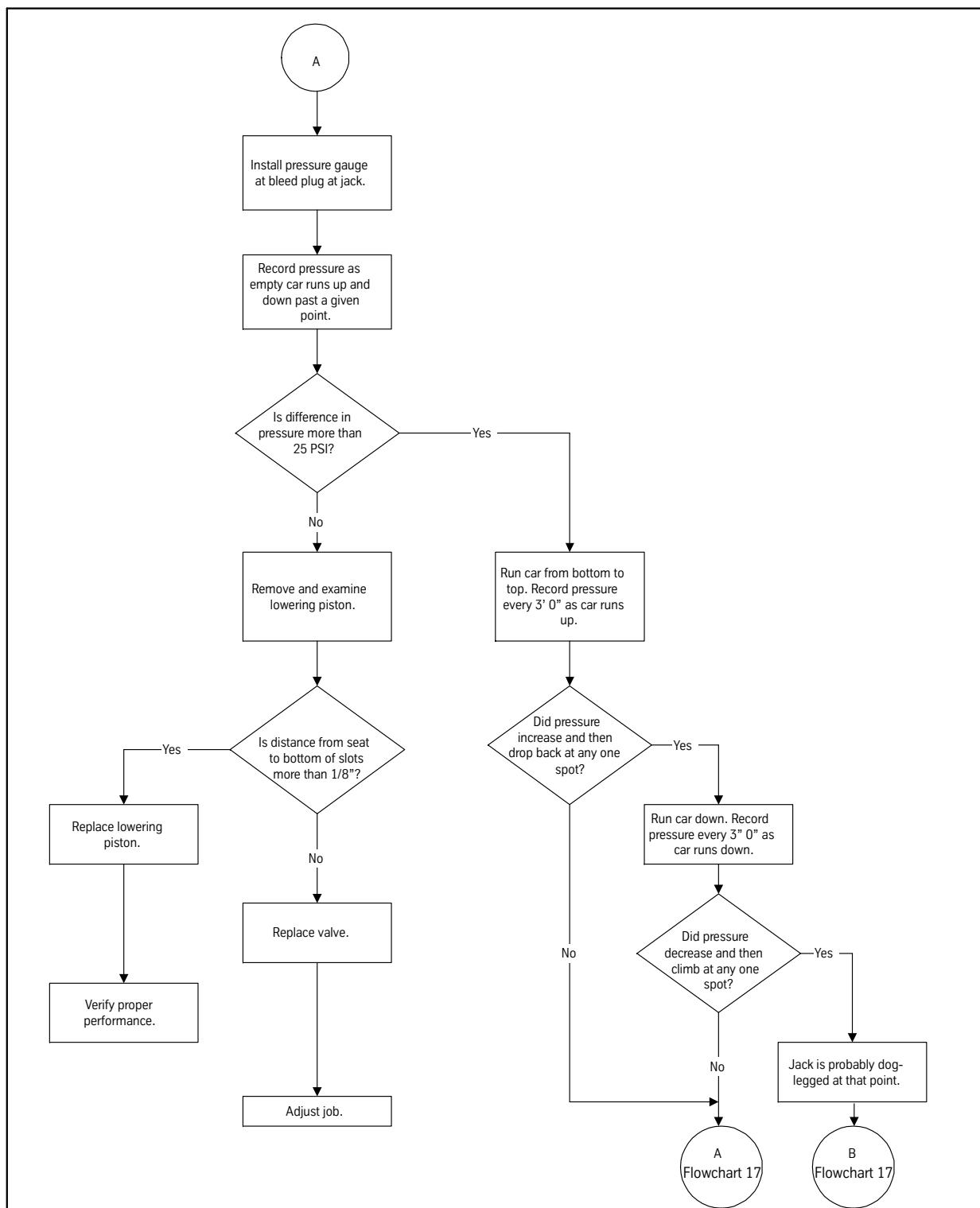
Flowchart 13

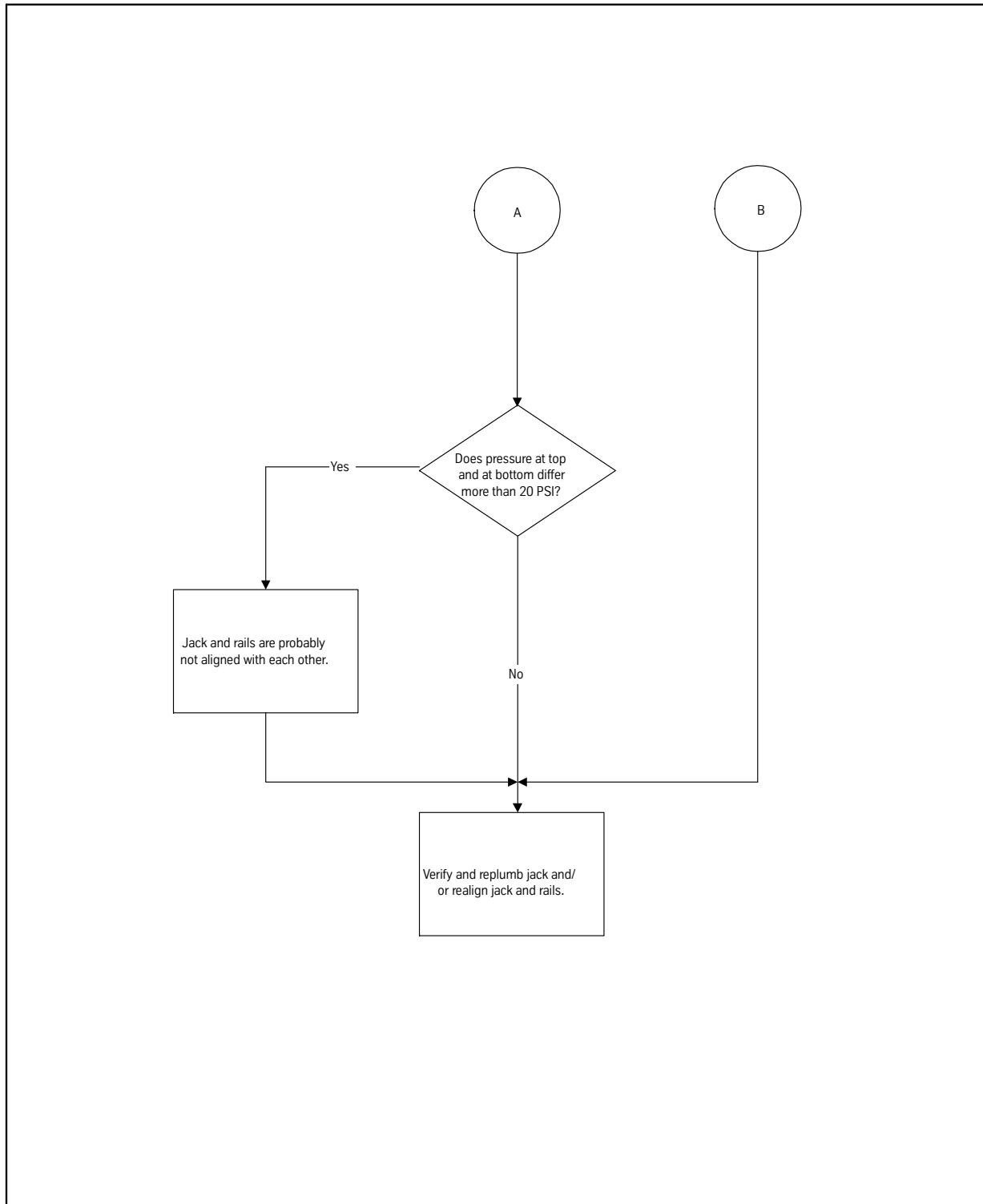


Flowchart 14

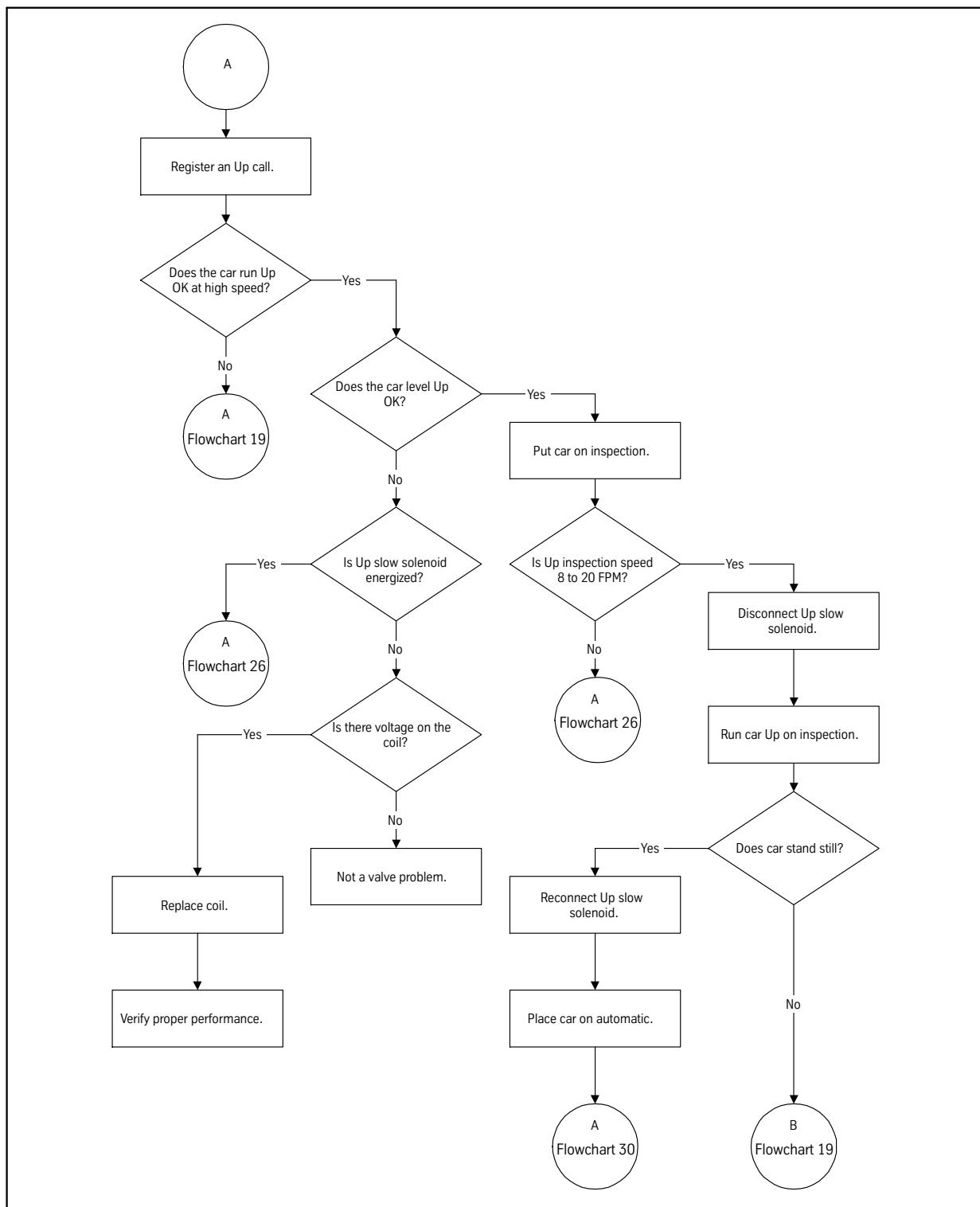


Flowchart 15

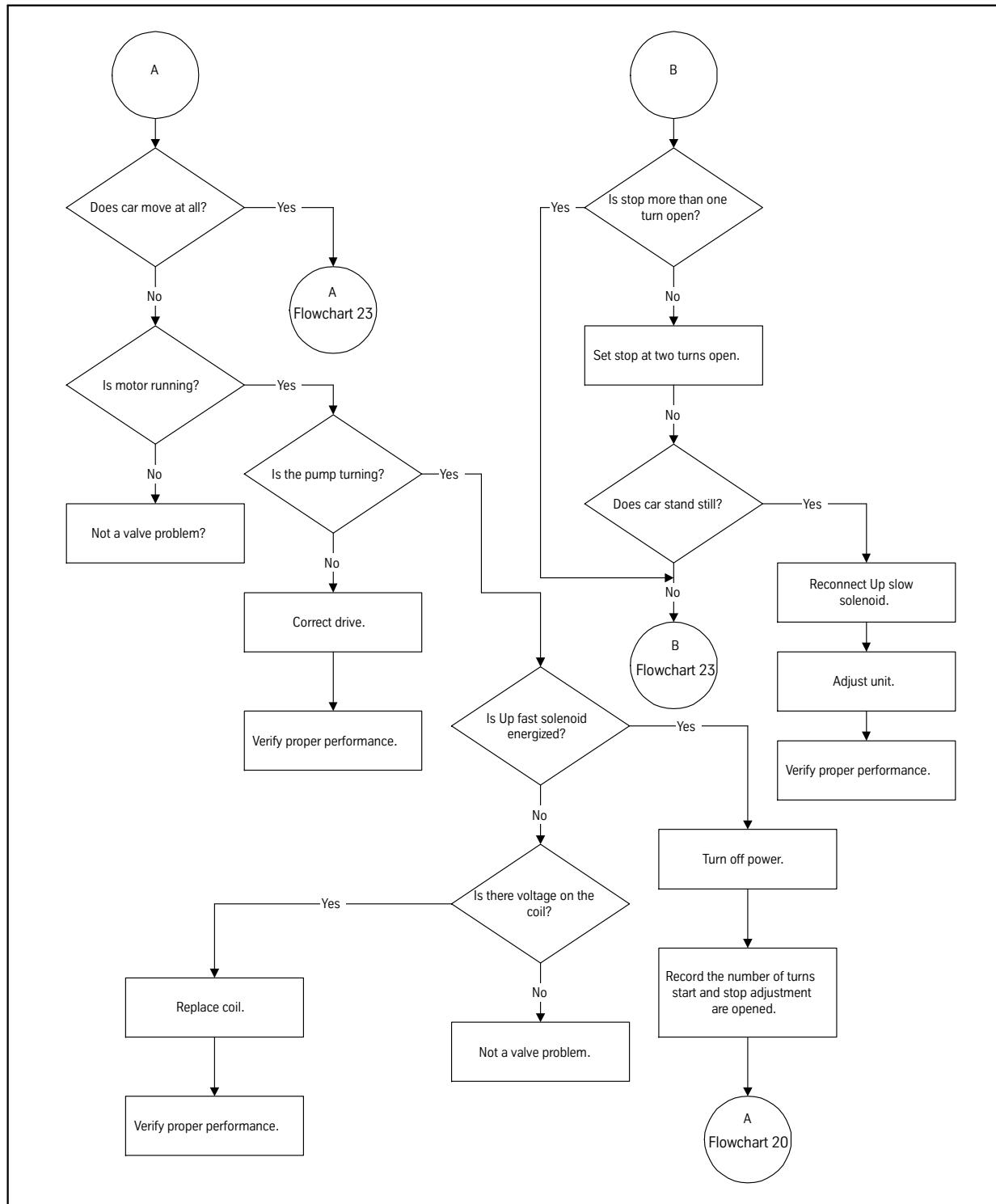




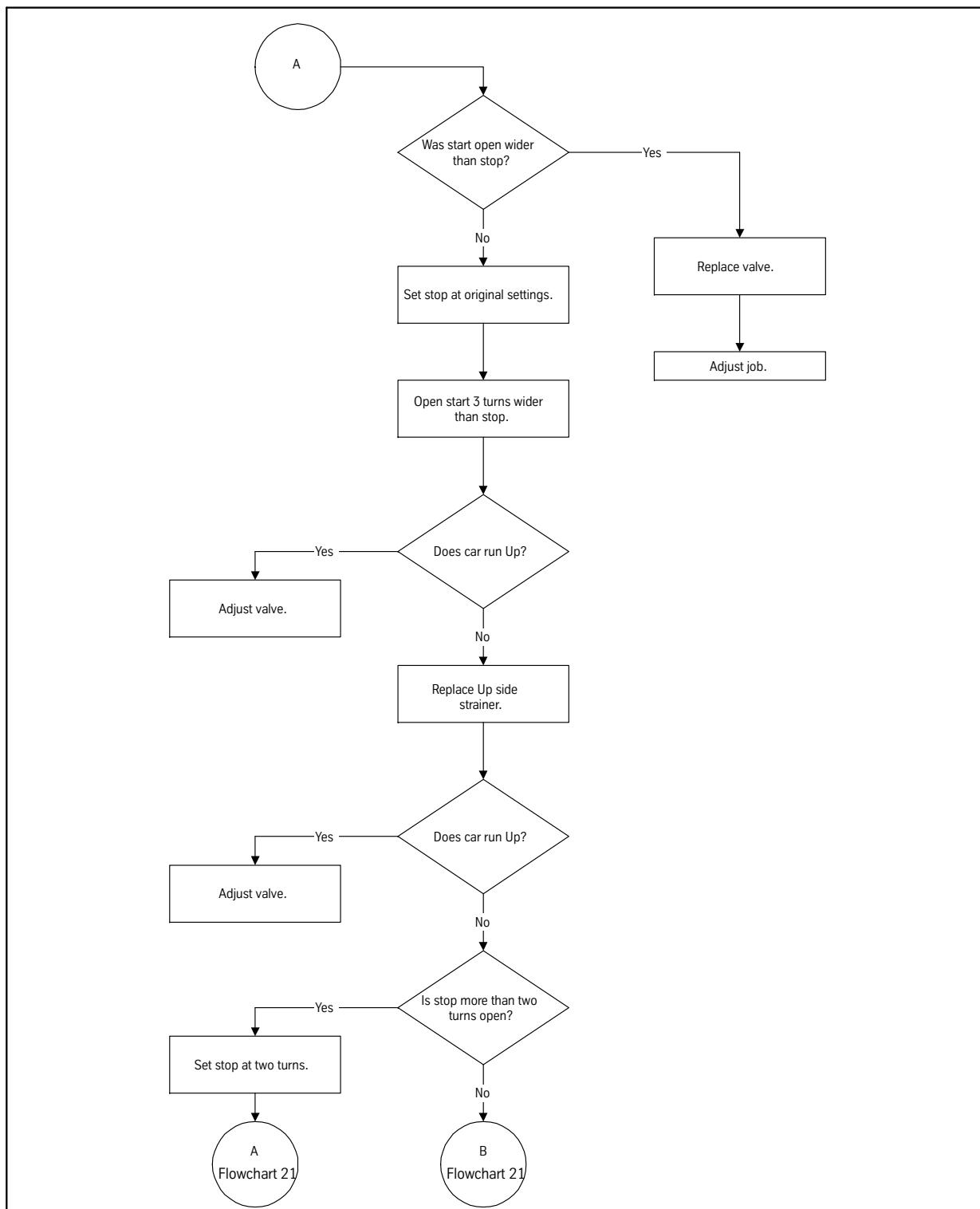
Flowchart 17



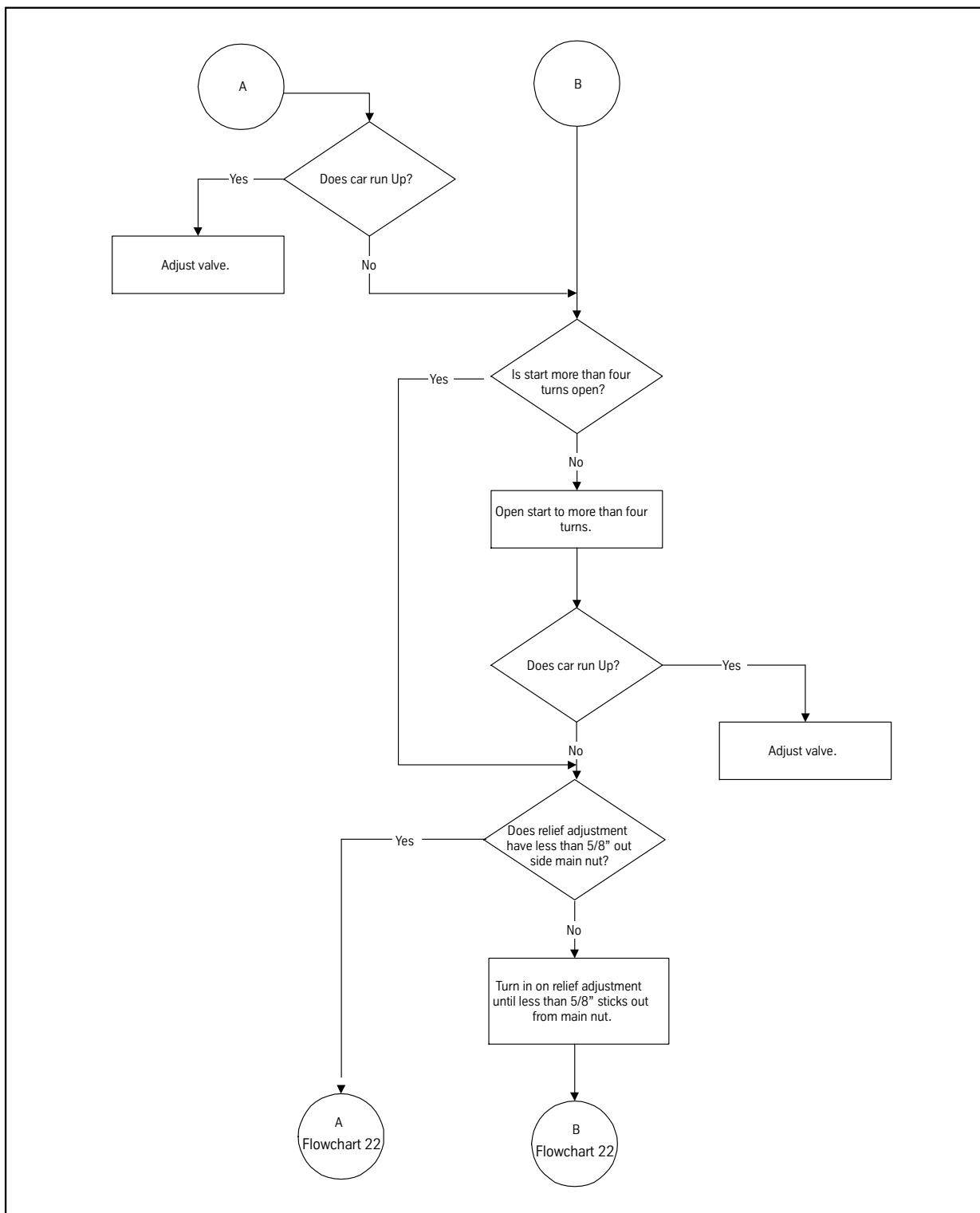
Flowchart 18



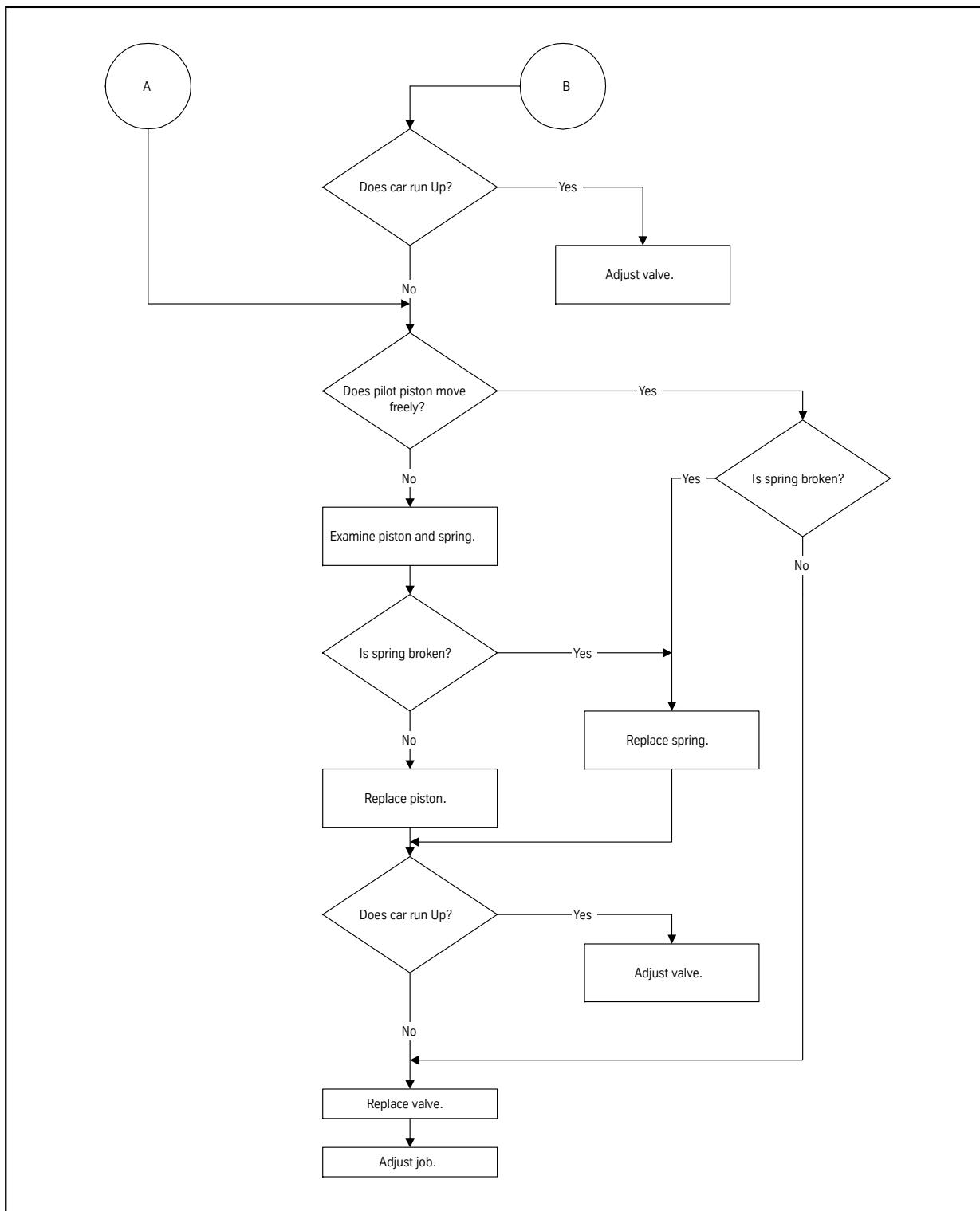
Flowchart 19



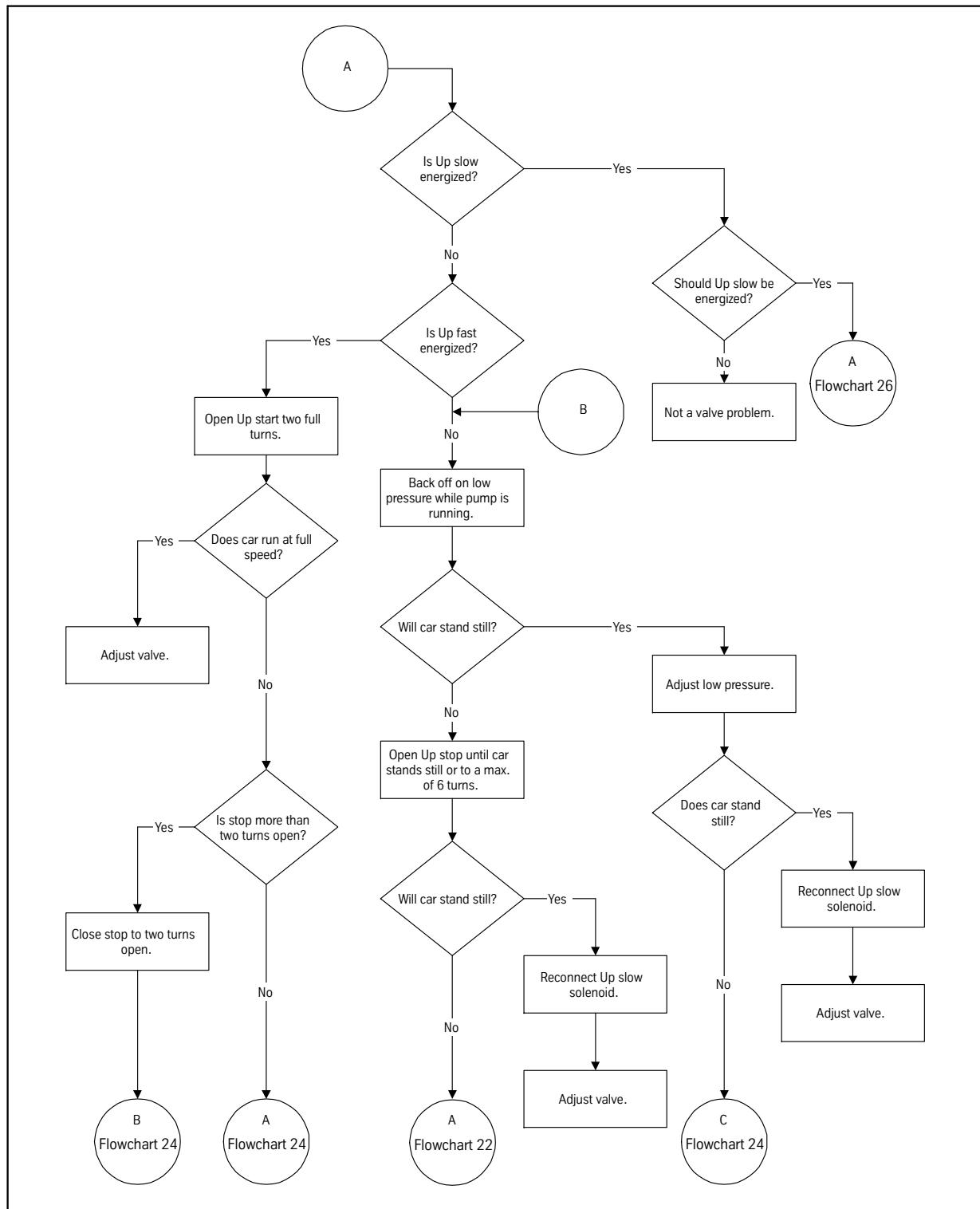
Flowchart 20



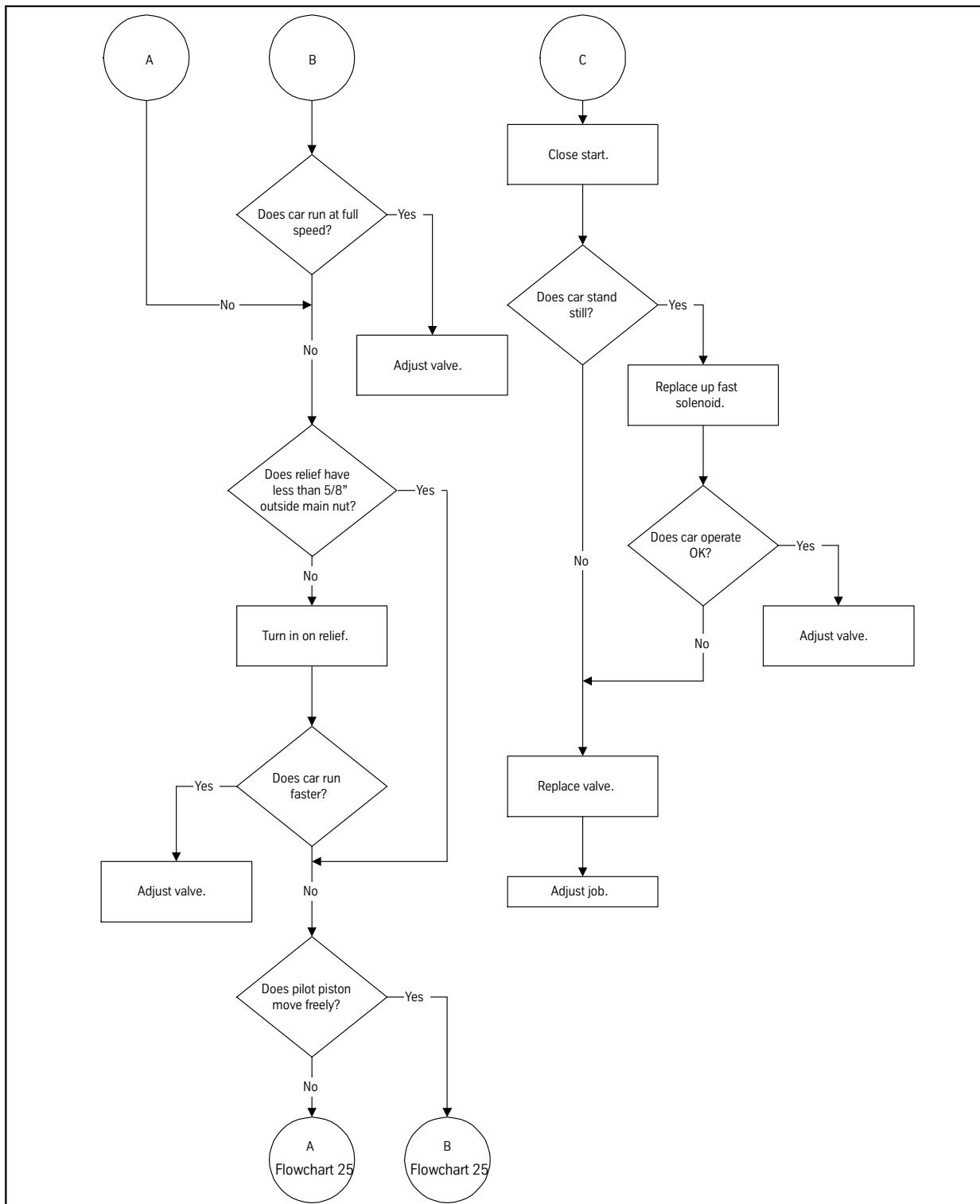
Flowchart 21



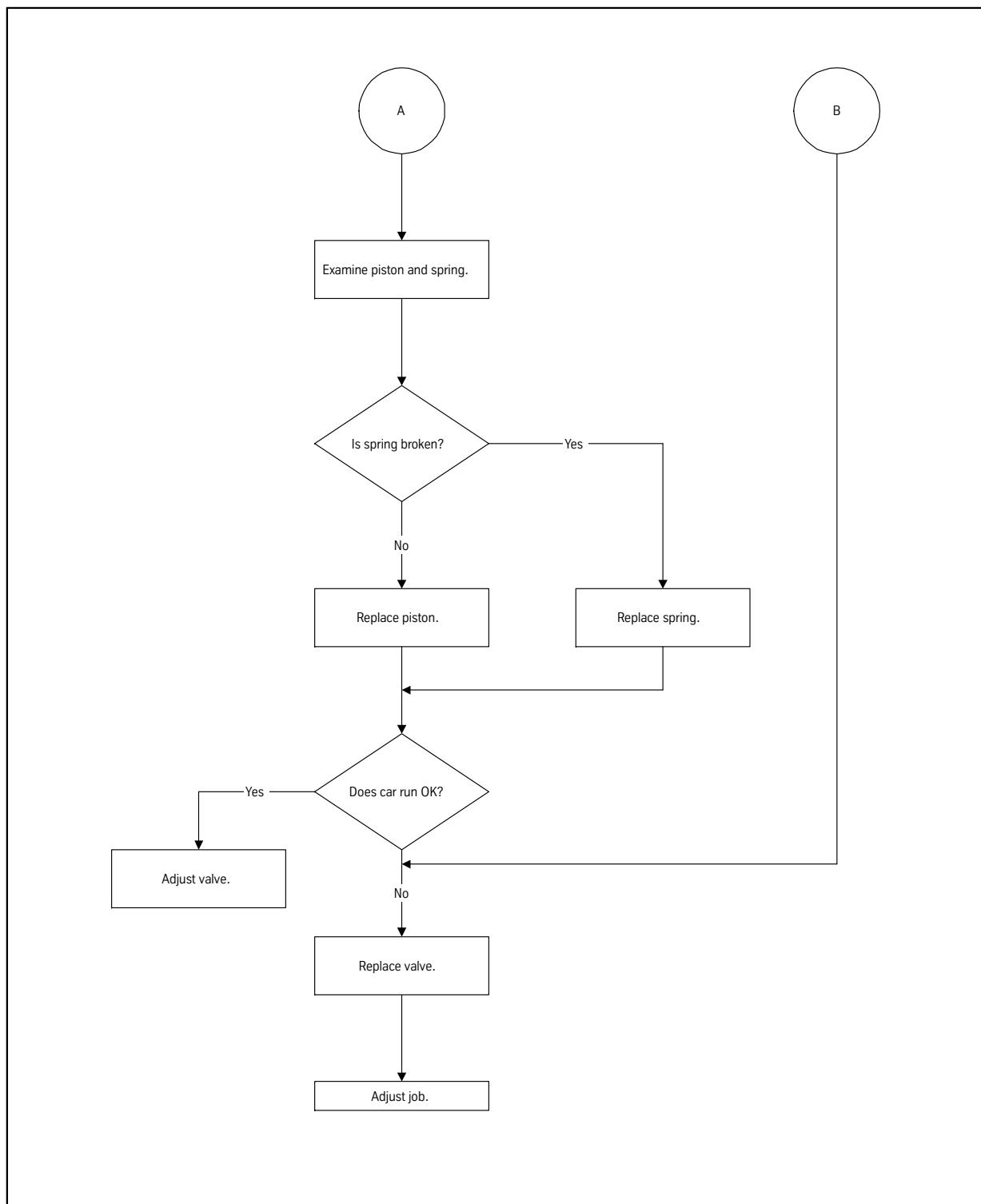
Flowchart 22



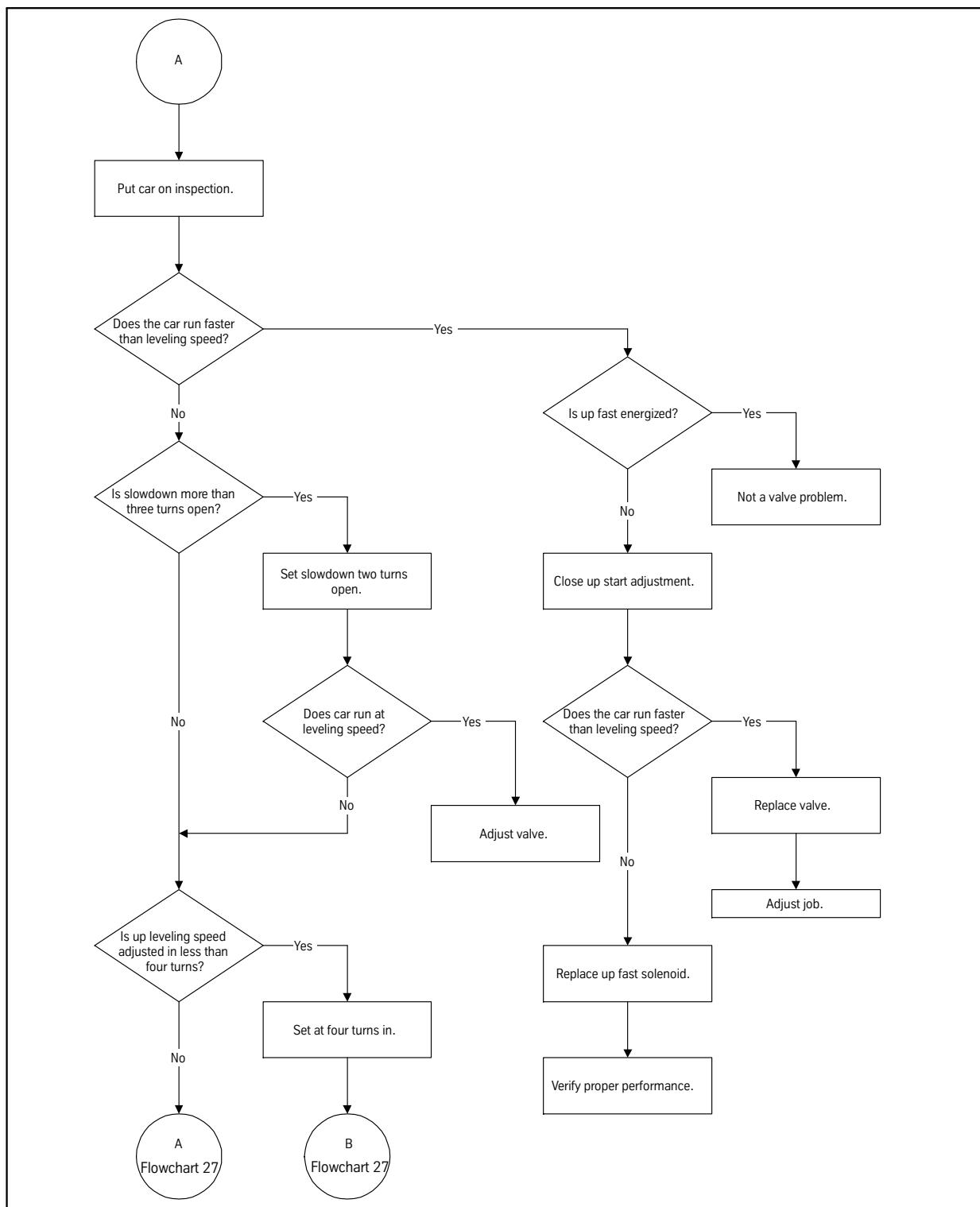
Flowchart 23



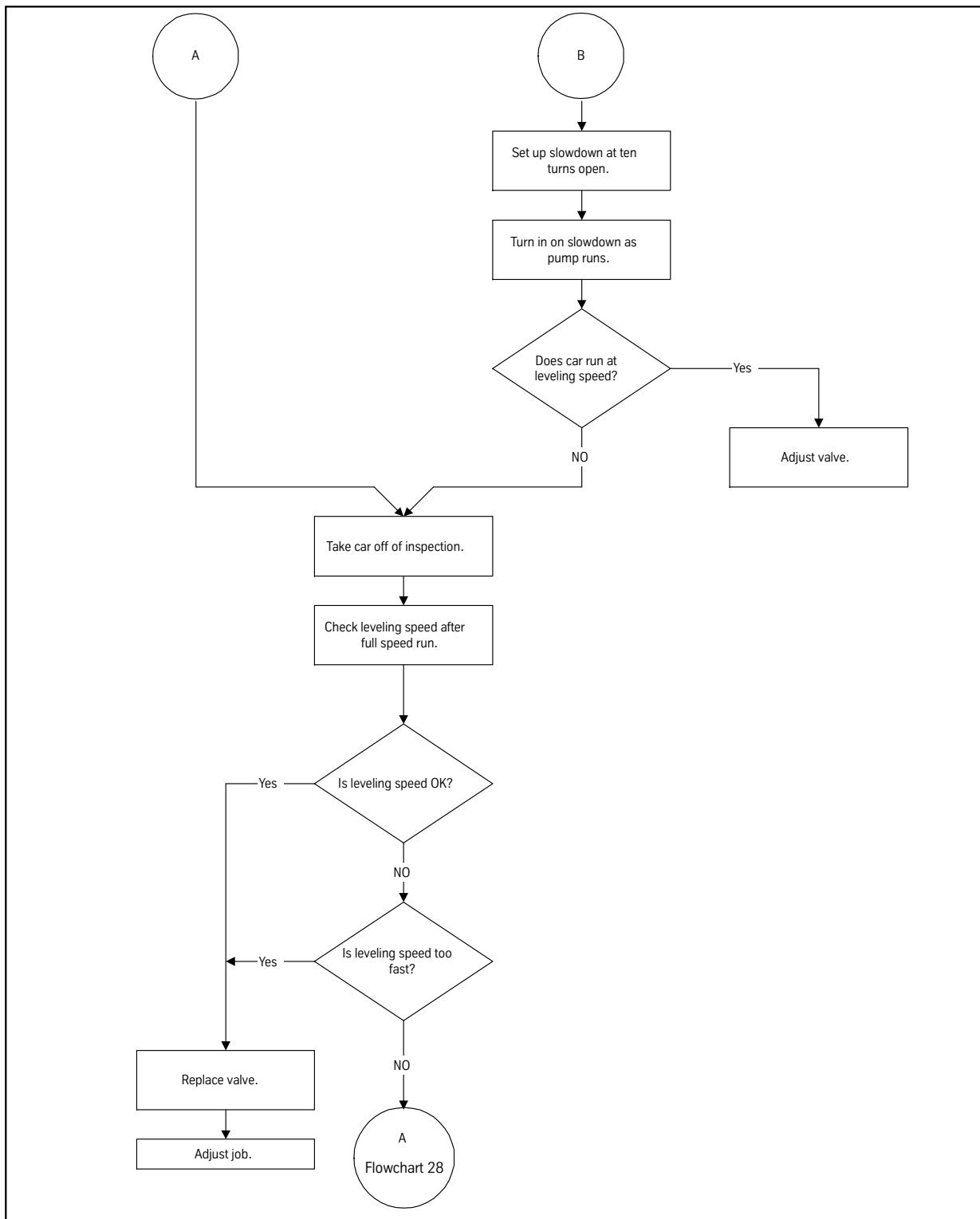
Flowchart 24



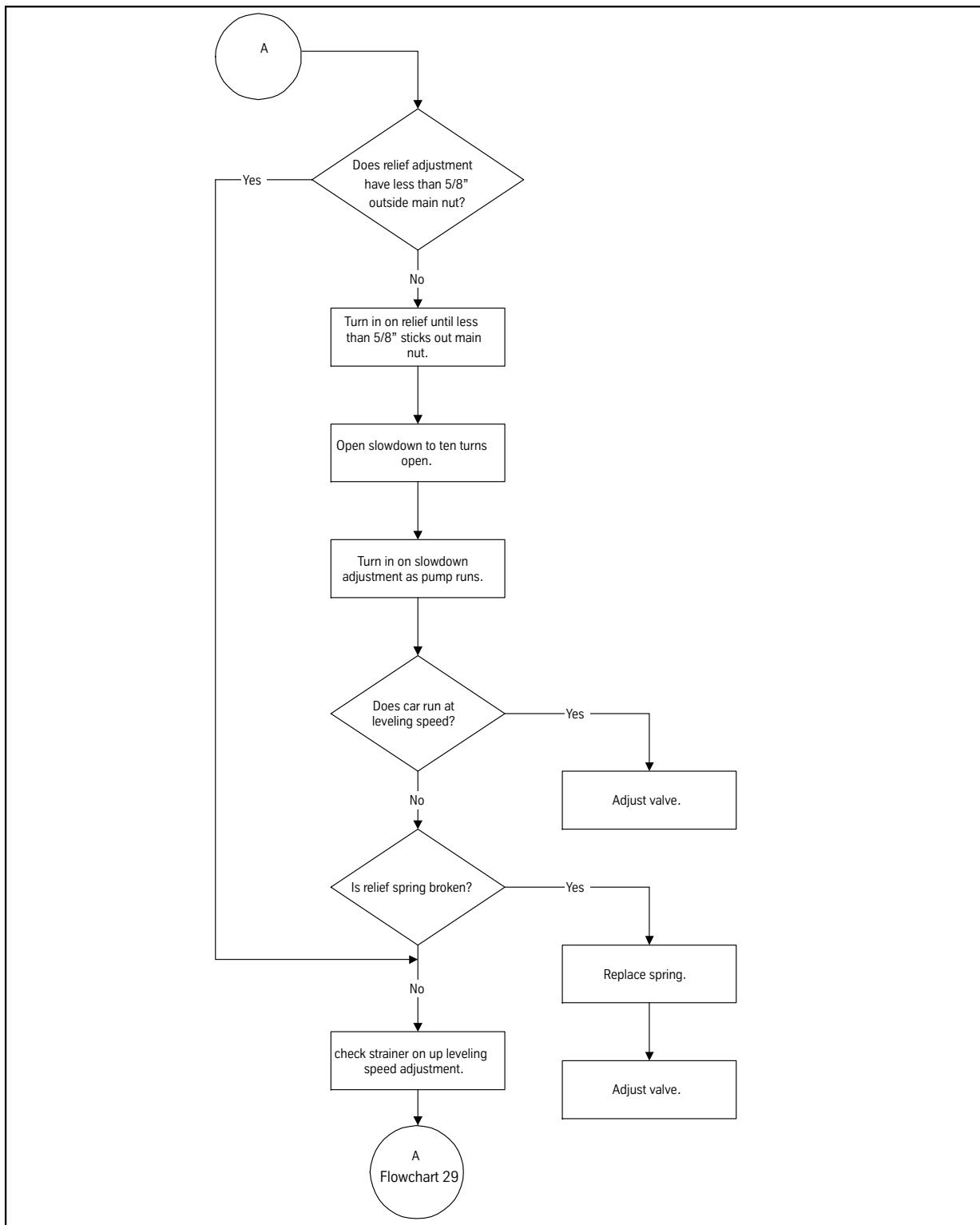
Flowchart 25



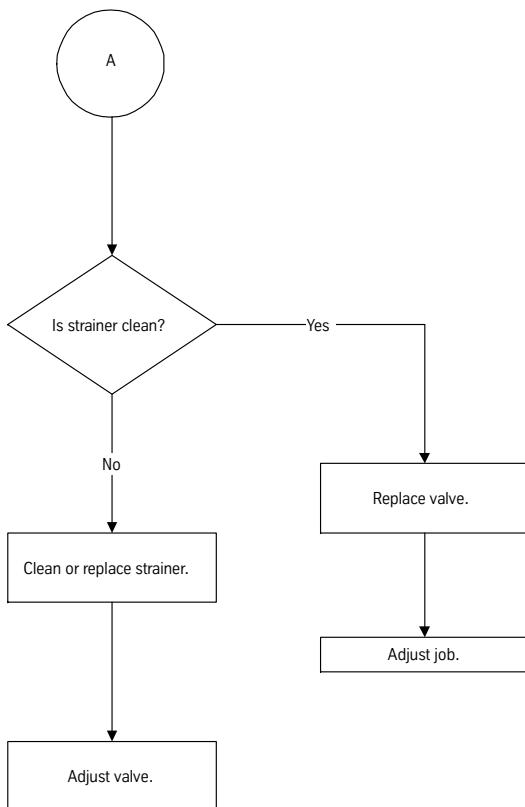
Flowchart 26



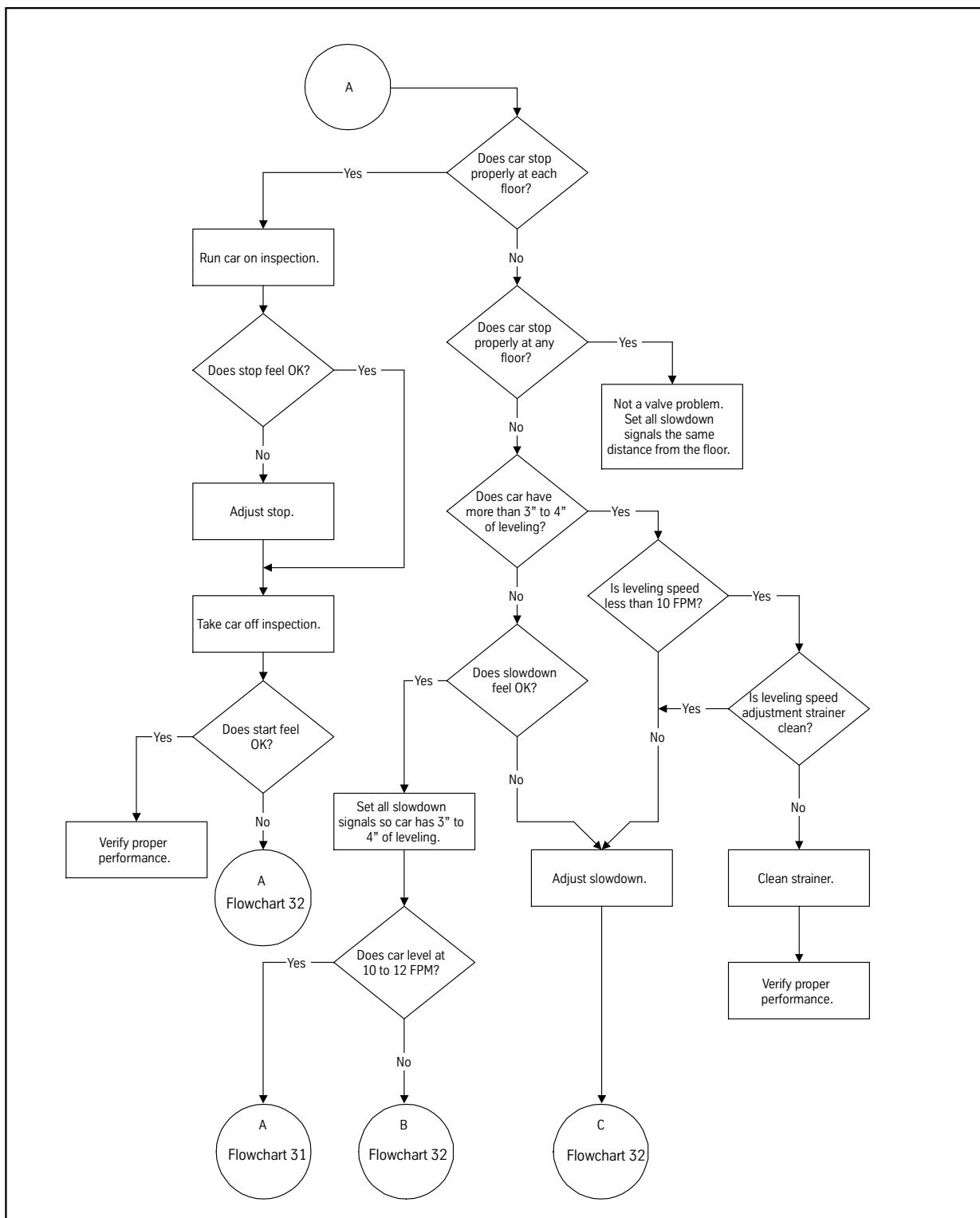
Flowchart 27



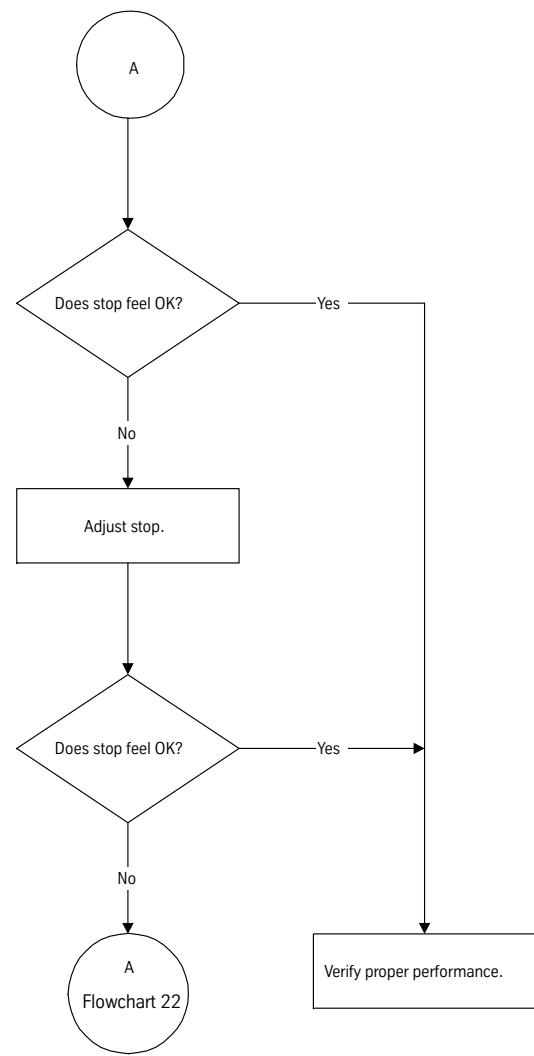
Flowchart 28



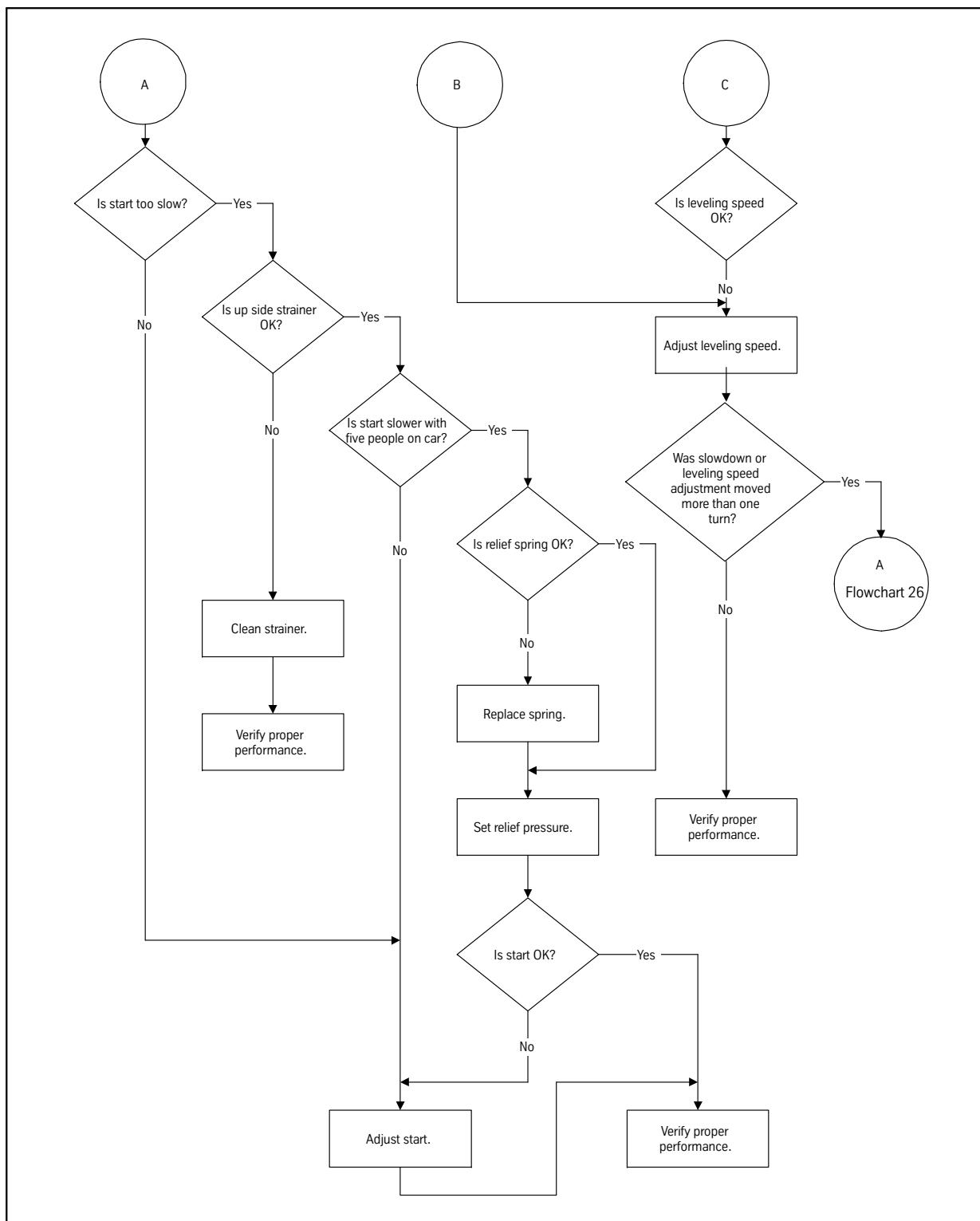
Flowchart 29



Flowchart 30



Flowchart 31



Flowchart 32

Sequence of Events

Up Valve Section

The up valve section consists of an up leveling speed adjustment, a check valve piston, a regulator piston, and a relief valve.

The valve provides these functions for the car in the Up cycle:

- Acceleration to full speed
- Slowdown to leveling speed
- Hydraulic stopping
- High-pressure relief

Sequence of Events

1. To start the car, the pump starts and the up fast solenoid energizes. See Figure 6 on page 52 and Figure 7 on page 53.
2. The regulator piston is held open by its spring and also the pump pressure on the face of the piston against the low pressure adjustment. At the beginning, all of the oil will bypass to the tank past the regulator piston, through the up start adjustment, and to the up stop adjustment.
3. The up start adjustment is open more than the up stop adjustment, making pressure build behind the regulator piston and causes it to move toward the closed position. The open amount of the up start adjustment governs how fast the regulator piston moves and how rapidly the car starts.
4. As the regulator piston closes, pressure from the pump builds up in the valve and causes the check valve piston to open. This action allows oil to flow from the pump into the jack.

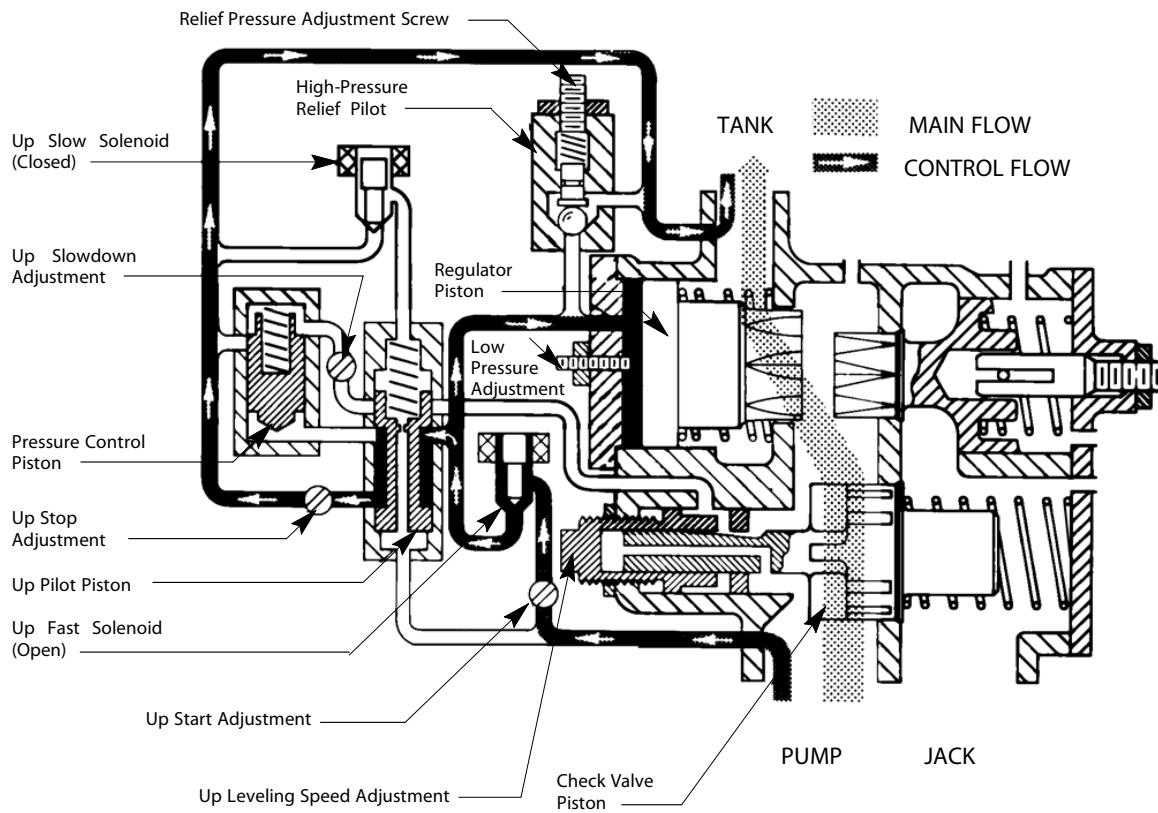


Figure 6 - Up Start Diagram

Up Valve Section (continued)

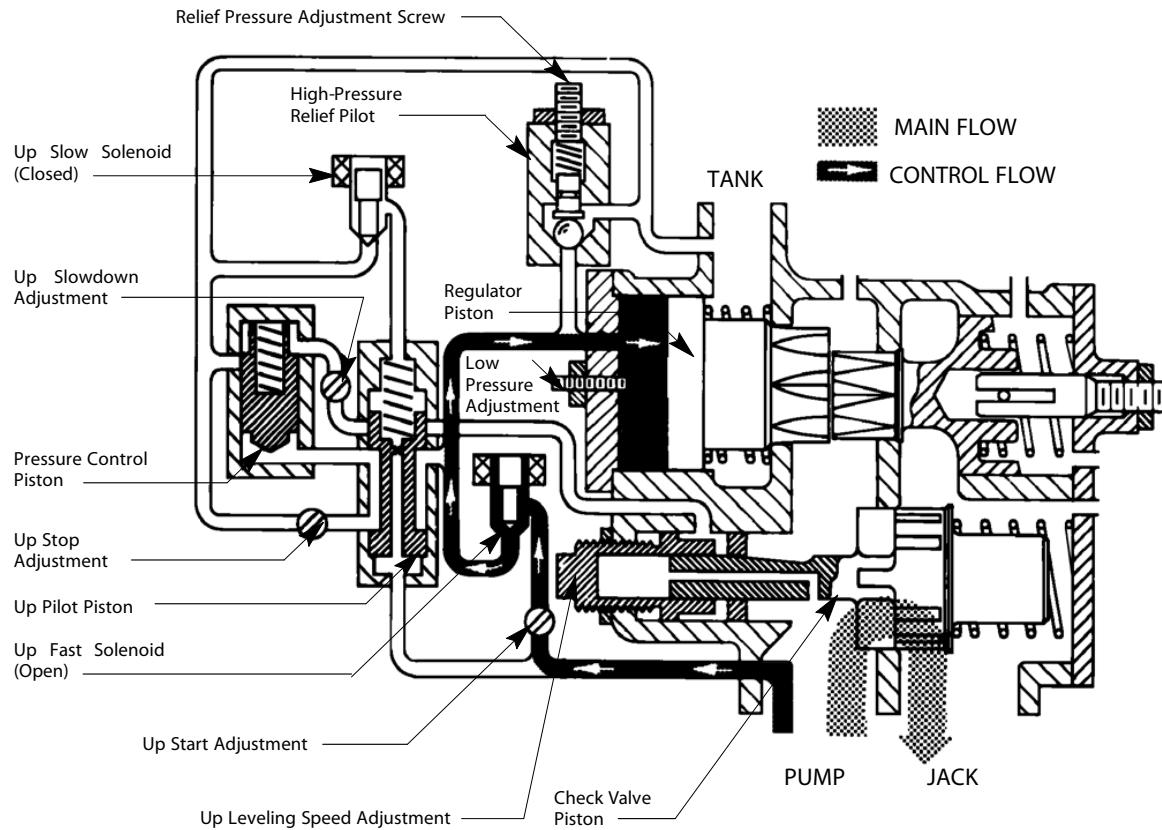
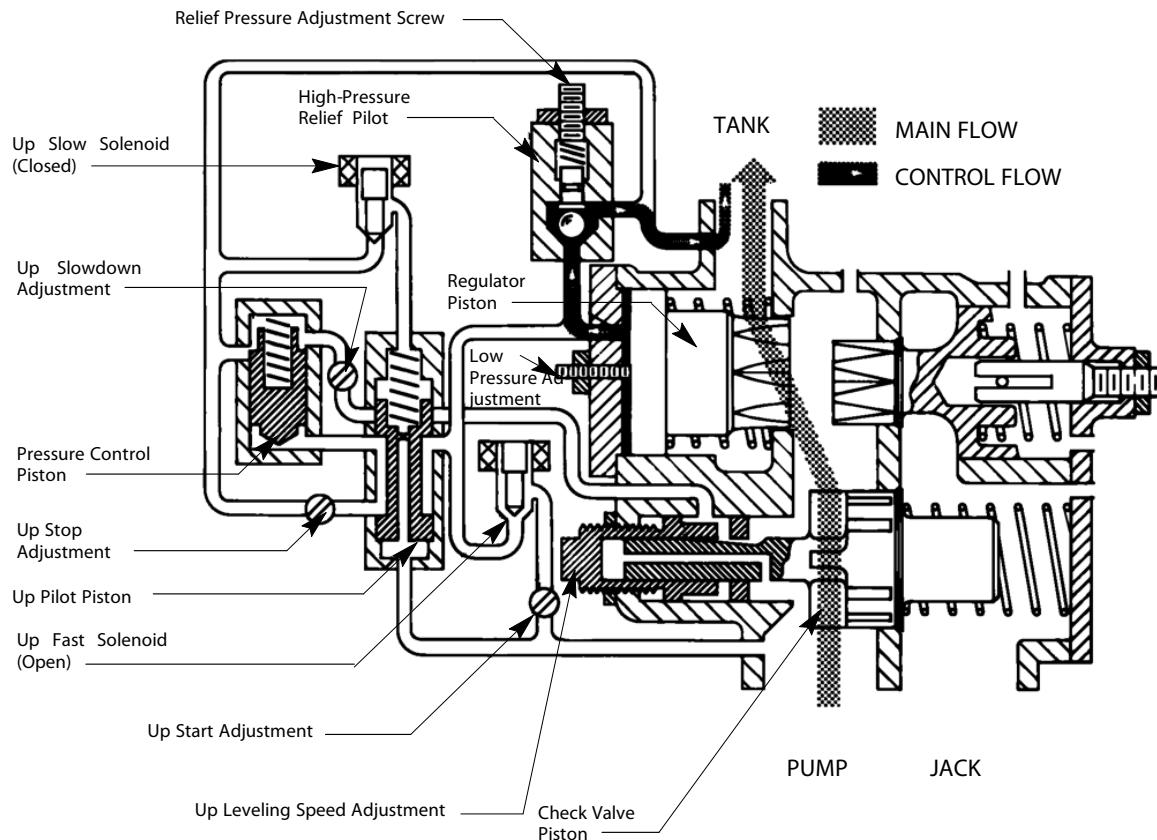


Figure 7 - Full Speed Diagram

High-pressure Relief**Sequence of Events**

1. The oil is transmitted to the high-pressure pilot. See Figure 8.
2. The movement allows the oil in back of the regulator piston and at the high-pressure adjustment to escape to the tank.
3. The regulator piston moves rapidly to the low-pressure stud, allows full bypass from the pump to the tank, and relieves the excess pressure.
4. The system only maintains relief pressure as long as the pump continues to run.

**Figure 8 - High-Pressure Relief Diagram**

Up Slowdown and Leveling Speed

Sequence of Events

1. From slowdown to leveling speed, the up fast solenoid is de-energized and the up slow solenoid is energized. See Figure 9.
2. The pressure on the spring end of the up pilot piston is reduced, and the up pilot piston shifts to the up position.
3. The opening to the up stop adjustment is closed and the opening to the up slowdown and leveling adjuster is opened to the back of the regulator piston.
4. Pressure behind the regulator piston is reduced as the oil flows out through the up slowdown adjustment. The regulator piston starts to open.
5. The opening at the up slowdown adjustment determines the rate of oil flow from the low pressure adjustment end of the regulator piston back into tank which controls the rate of speed change. The wider the opening, the quicker the slowdown.
6. Valve pressure drops as the regulator piston opens. This action causes the check valve piston to begin to close.
7. When the slot on the check valve piston reaches the hole in the leveling speed adjustor, less oil flows from behind the regulator piston.
8. When the slot has opened enough to allow the same amount of oil to flow in the leveling speed adjustor as the amount which flows out through the up slowdown adjustment, the system reaches a hydraulic balance, known as leveling speed.
9. The leveling speed is changed by moving the hole in the leveling speed adjustor.

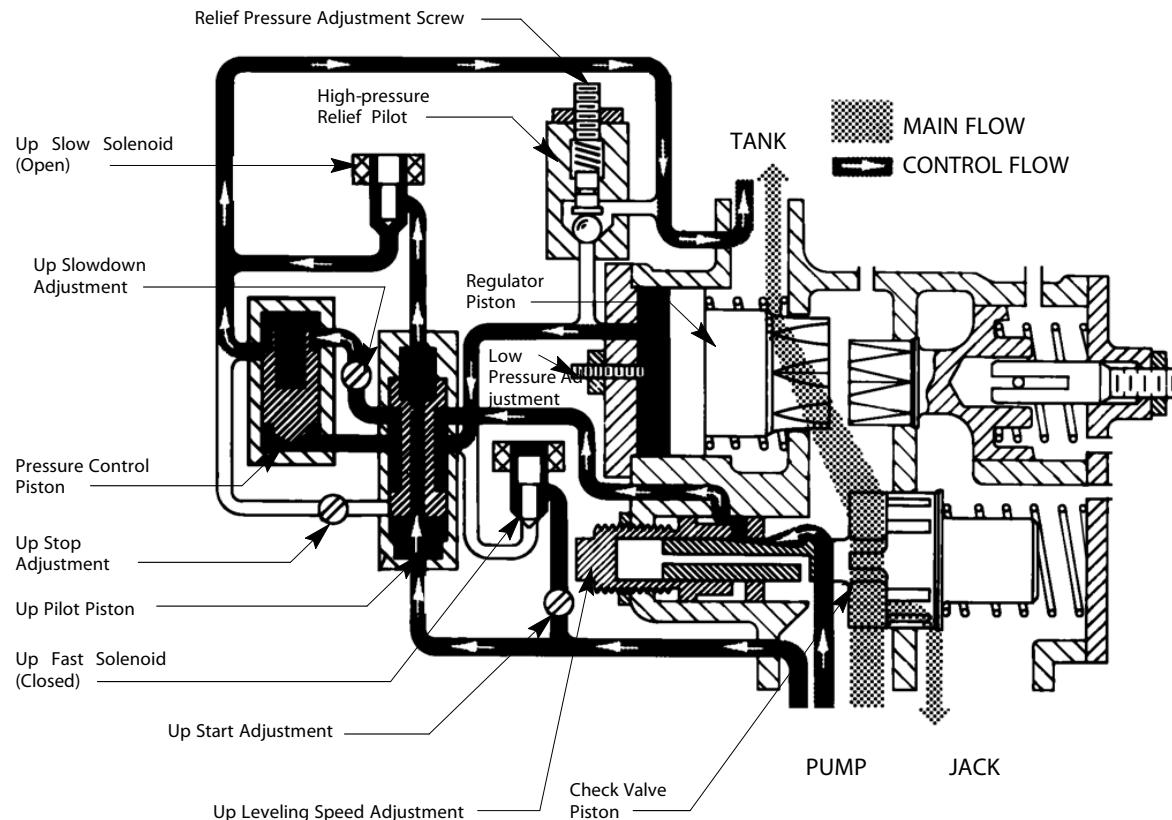
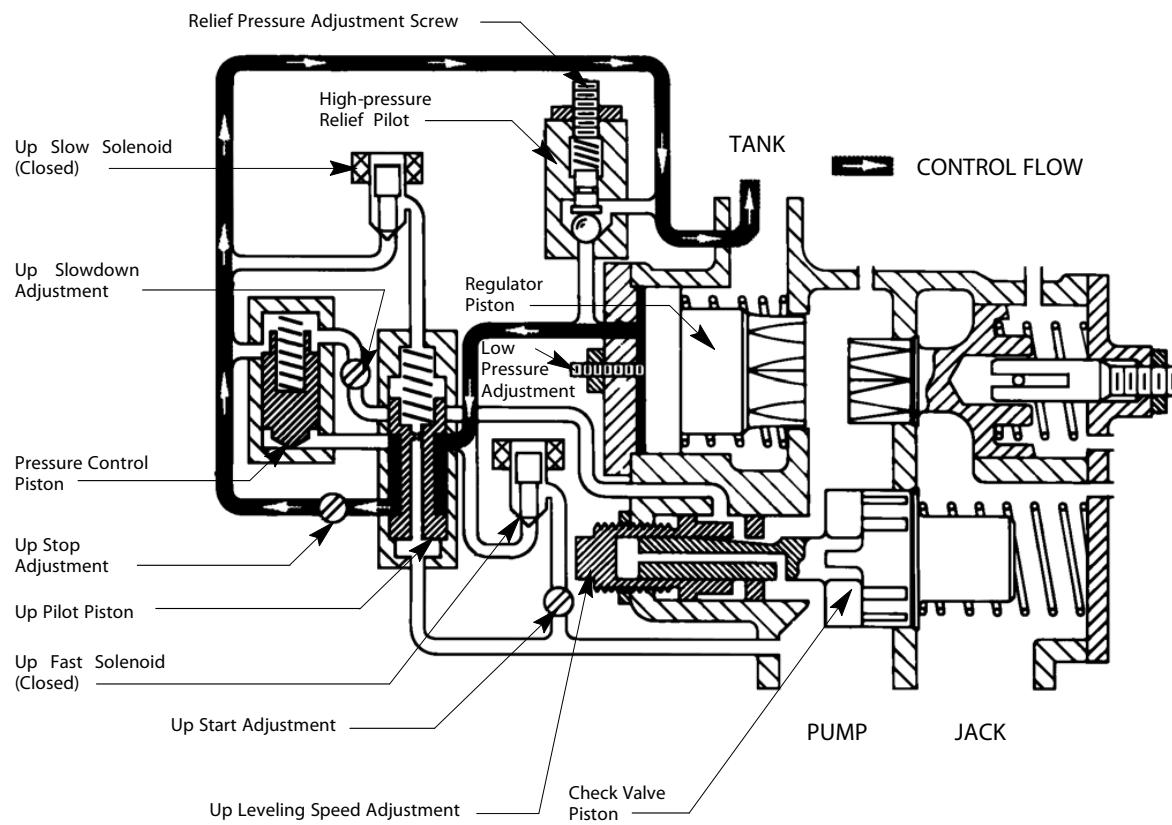


Figure 9 - Up Slowdown and Leveling Speed Diagram

Up Stop**Sequence of Events**

1. The up slow solenoid is de-energized, to stop the car. The pump is kept running slightly longer on a timed delay to provide a valve stop instead of a pump stop. See Figure 10.
2. With pressure equalized on both ends of the up pilot piston, the spring will park the piston in the down position. In this position, the openings of the up slowdown and leveling adjuster will be closed and the opening of the up stop adjustment will be open.
3. The up stop adjustment allows flow out from behind the regulator piston and causes the pressure to drop.
4. Decreased oil pressure on the back of the regulator piston allows pressure from the jack (with the spring force) to push the piston against the low pressure adjustment stud allowing full bypass. At the same time, the check valve piston closes.
5. Stop rate is controlled by the opening at the stop adjustment. The wider the opening, the faster the stop.

**Figure 10 - Up Stop Diagram**

Down Valve Section

The down portion of the valve consists of a piston that seats and can be controlled in these positions:

- Closed to stop the car
- Partially open for slow speed
- Fully open for high speed

Down Start and Full Speed

Sequence of Events

1. To start the car down, the down fast and down slow solenoids are energized simultaneously, allowing the oil behind the piston to flow to the tank through the down start adjustment. See Figure 11.
2. The reduction in pressure behind the piston causes the piston to lift. It is essential that the down start adjustment be open more than the down stop adjustment so that the oil entering through the down stop adjustment can be drained to the tank.
3. The size of the openings will govern how fast the piston moves and how rapidly the car starts. The lowering speed adjustment limits the amount the piston can open, thereby controlling the car down speed.

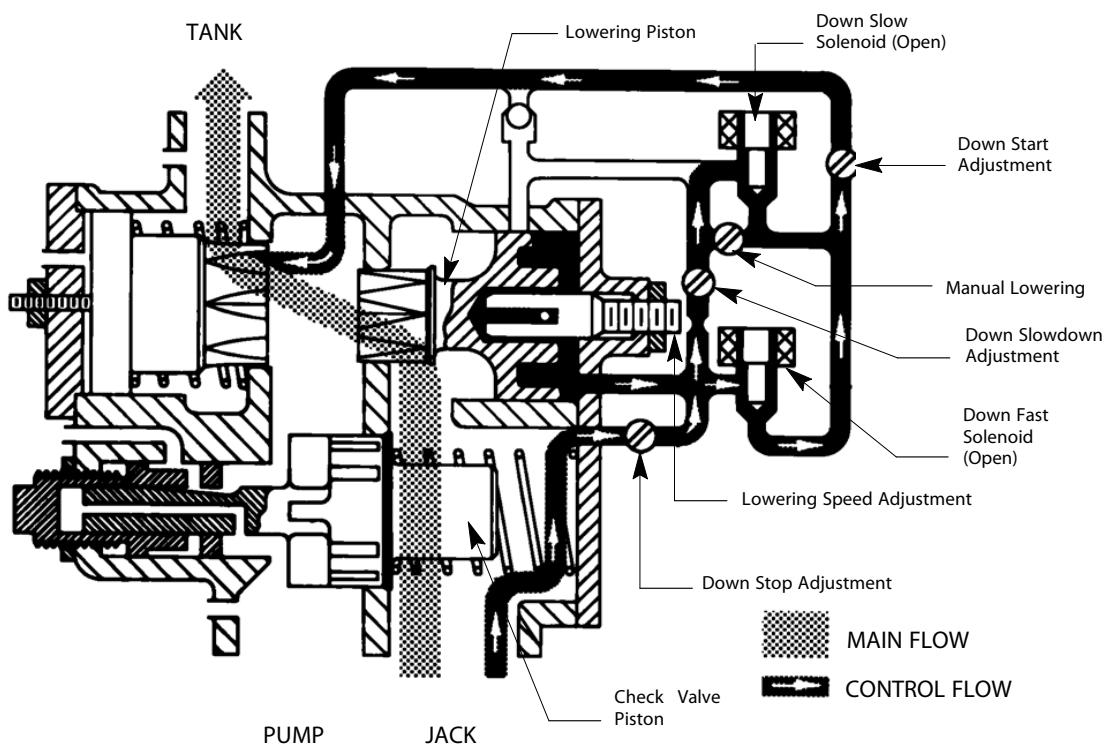


Figure 11 - Down Start and Full Speed Diagram

Down Slowdown and Leveling

Sequence of Events

1. To change to leveling speed, the down fast solenoid is closed. The lowering piston starts in the full open position and the oil passage to the tank is blocked by the piston skirt. See Figure 12.
2. Oil flows in through the down stop adjustment to the rear of the lowering piston, and out through the slowdown adjustment. The down slow solenoid and the down start adjustment, causes the lowering piston to move toward the closed position. The amount that the down slowdown adjustment is closed governs how fast the piston moves and how rapidly the car slows down.
3. The piston will stop once the oil passage to the tank (through the down slow solenoid) is opened by the skirt of the piston.
4. The lowering speed is controlled by turning the lowering and leveling adjustment in increments of full half-turns. The leveling speed is controlled by turning the lowering and leveling adjustment in less than one-quarter-turn increments.

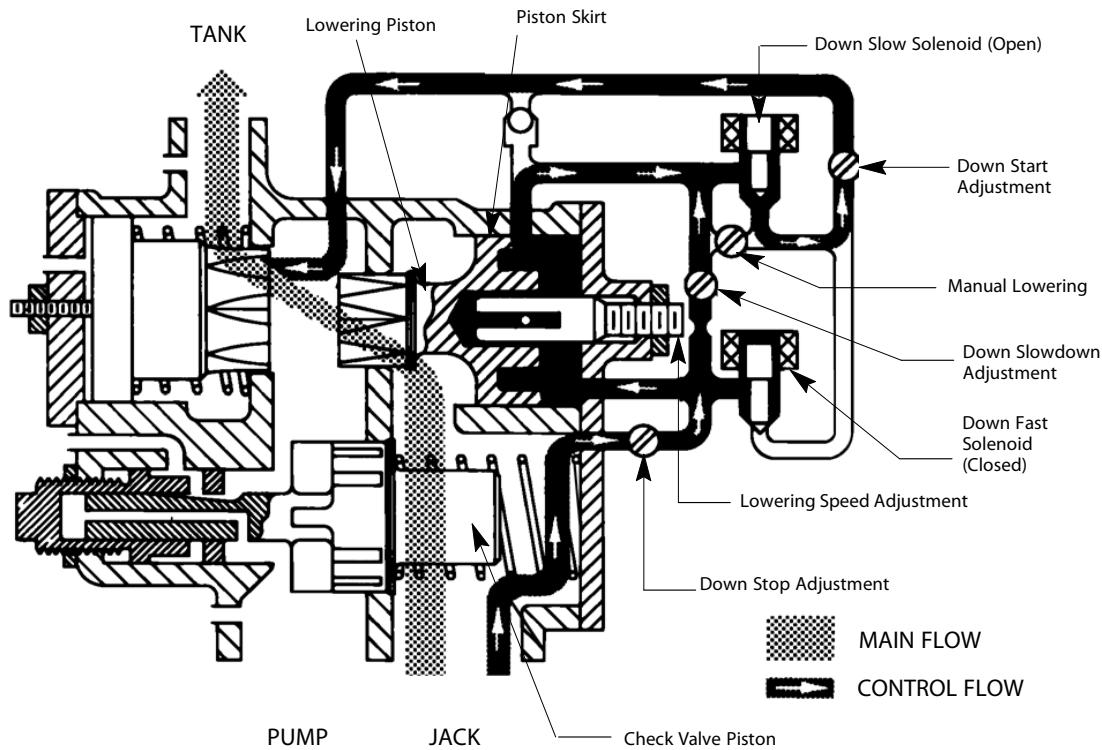


Figure 12 - Down Slowdown and Leveling Diagram

Manual Lowering

The manual lowering valve is parallel to the down slow solenoid and when opened, allows the car to be lowered at leveling speed during emergencies.

Down Stop

1. To stop the car, the down slow solenoid is de-energized, stopping all flow to the tank. Pressure from the jack and the spring will cause the piston to close. See Figure 13.
2. The rate of closing and the smoothness is controlled by the down stop adjustment.

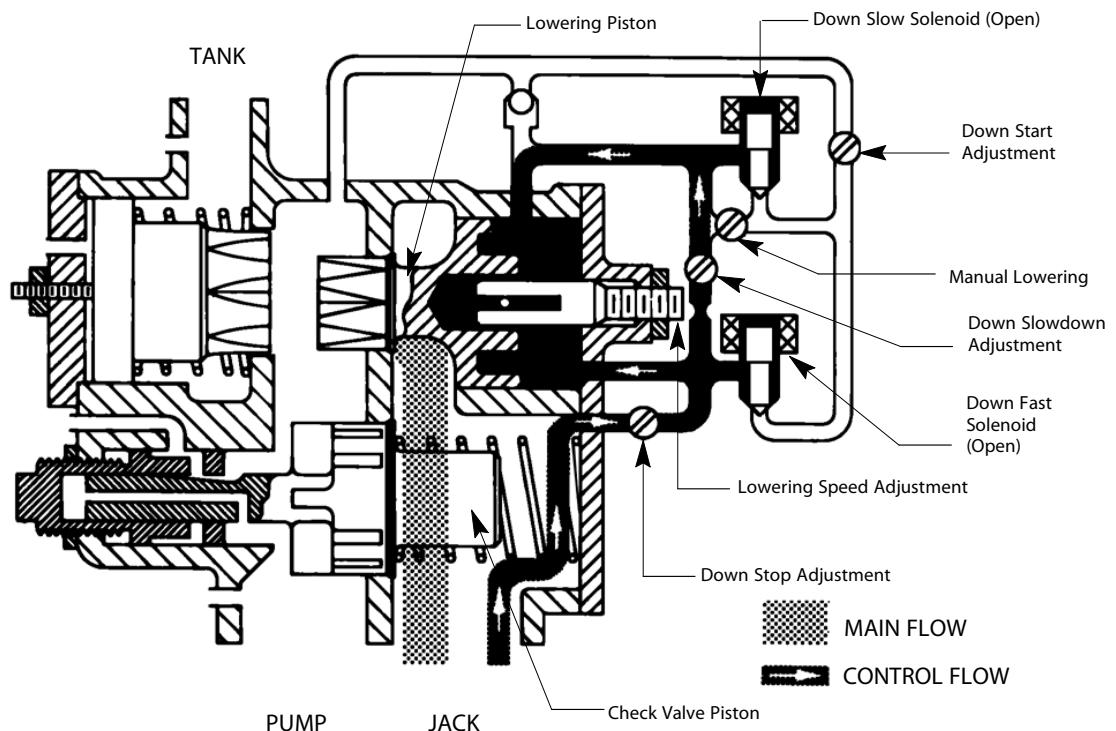


Figure 13 - Down Stop Diagram

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