

SPEED CONTROL

GROUP
37
(19000)

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Speed Control System

SECTION
37-01

APPLIES TO E-150 THROUGH E-350 AND F-150 THROUGH F-350, AND BRONCO

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DESCRIPTION AND OPERATION

Speed Control E-150—E-350, F-150—F-350 and Bronco

The speed control system is composed of the OFF-ON switch and the SET-ACCEL, COAST and RESUME switches, a servo (throttle actuator) assembly, a speed

sensor, a clutch position sensing switch (manual transmissions), an amplifier assembly and the necessary wires, linkage, vacuum dump valve vacuum hose to connect the components. The 6.9L diesel engine incorporates a vacuum reservoir with an integrated check valve. The switches are located in the horn pad assembly (Figs. 1 and 2). The amplifier assembly is located under the instrument panel (Figs. 3, 4 and 5). The

servo assembly (throttle actuator) is attached as shown in Figs. 11 through 17. The speed control sensor is located on the left side of the dash panel. To operate the speed control system the engine must be running and the vehicle speed over 48 Km/h (30 mph). Manifold vacuum is constantly supplied when the engine is running. When the ON/OFF switch in the steering wheel is momentarily actuated to the **ON position the system is made ready to accept a set speed signal**. When the vehicle has been accelerated and stabilized at a speed over 48 Km/h (30 mph) and the **ON switch engaged, the operator may momentarily depress and release the SET/ACCEL button. This speed will be maintained until a new speed is set by the operator, the brake pedal is depressed, the clutch pedal is depressed, or the system is turned OFF.**

Decreasing Set Speed

The set speed may be reduced by applying the brake and then re-setting the speed using the preceding method or by depressing the COAST switch. When the vehicle has slowed to the desired speed the COAST switch is released and the new speed is set automatically. If the vehicle speed is reduced below 48 Km/h (30 mph), the operator must manually increase the speed up to 48 Km/h (30 mph) and re-set the system.

Increasing Set Speed

The vehicle set speed may be increased at any time by depressing the accelerator until the higher speed is reached and stabilized, then depressing and releasing the SET/ACCEL button.

Speed may also be increased by depressing the SET/ACCEL switch button, (at speeds over 48 Km/h (30 mph), and holding it in that position. When the desired speed is attained and the button is released, that new set speed will be maintained.

Resume Feature

When the speed control system is deactivated by depressing the brake pedal or clutch pedal, the set speed prior to deactivation may be reestablished by momentarily depressing the RESUME switch. The resume feature is deactivated with the OFF switch, or if the vehicle speed has dropped below 48 Km/h (30 mph). In addition, when the ignition is turned Off, the speed

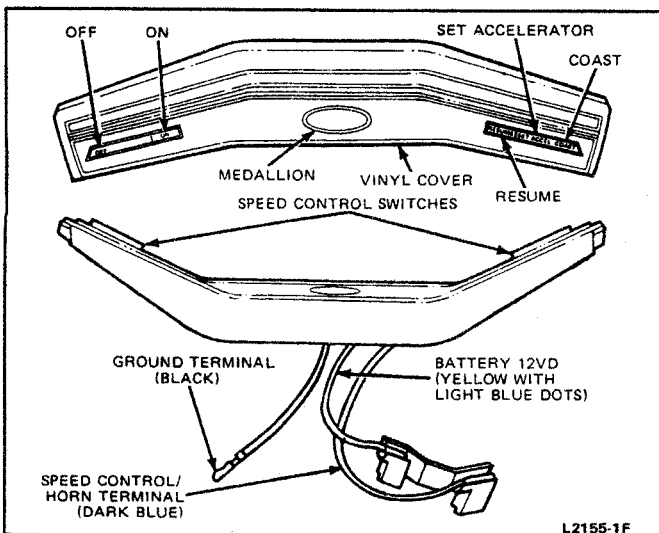


FIG. 1 Control Switch Installation

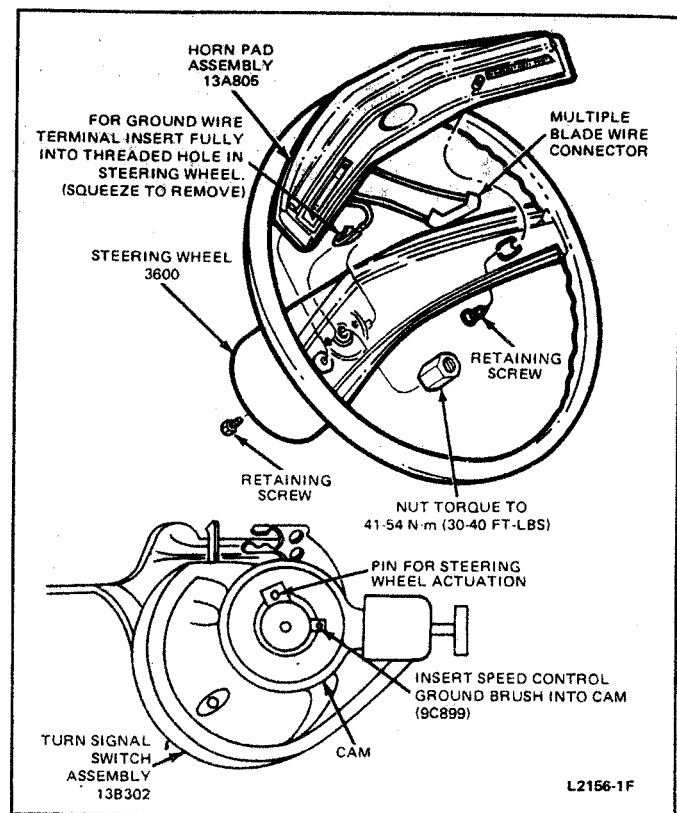


FIG. 2 Horn and Speed Control Switch and Wiring Installation

control memory is erased and the RESUME feature will not function.

Vacuum Dump Valve

The vacuum dump valve provides a backup safety feature in the new system. Normally, when the brake pedal is depressed an electrical signal from the stop lamp switch to the amplifier will return the system to the stand-by mode. In addition, the vacuum dump valve will mechanically release the vacuum in the servo when the brake pedal is depressed, thus releasing the throttle independently of the amplifier control.

Vacuum Reservoir Assembly (6.9L Diesel Engine)

The vacuum reservoir assembly is provided to supply vacuum to the servo during peak demand. The reservoir is located on the right hand apron on Econoline (Fig. 15) and on the left hand apron near the servo on F-Series, Fig. 18. A check valve is integrated with the reservoir to prevent reverse vacuum flow. There are two 5/16 inch diameter vacuum ports on the reservoir. The "VAC" port is connected by a 5/16 inch I.D. vacuum hose to the vacuum source distribution port. The other port is connected by an identical vacuum hose to the speed control servo vacuum source port adjacent to the 6-way electrical connector.

Ground Brush

The speed control ground brush assembly provides an electrical ground path between the steering wheel hub and the turn signal switch when inserted into the turn signal cancelling cam (Fig. 6).

DIAGNOSIS AND TESTING

Speed control system tests should be performed using the Rotunda Tester Model 007-00013 or

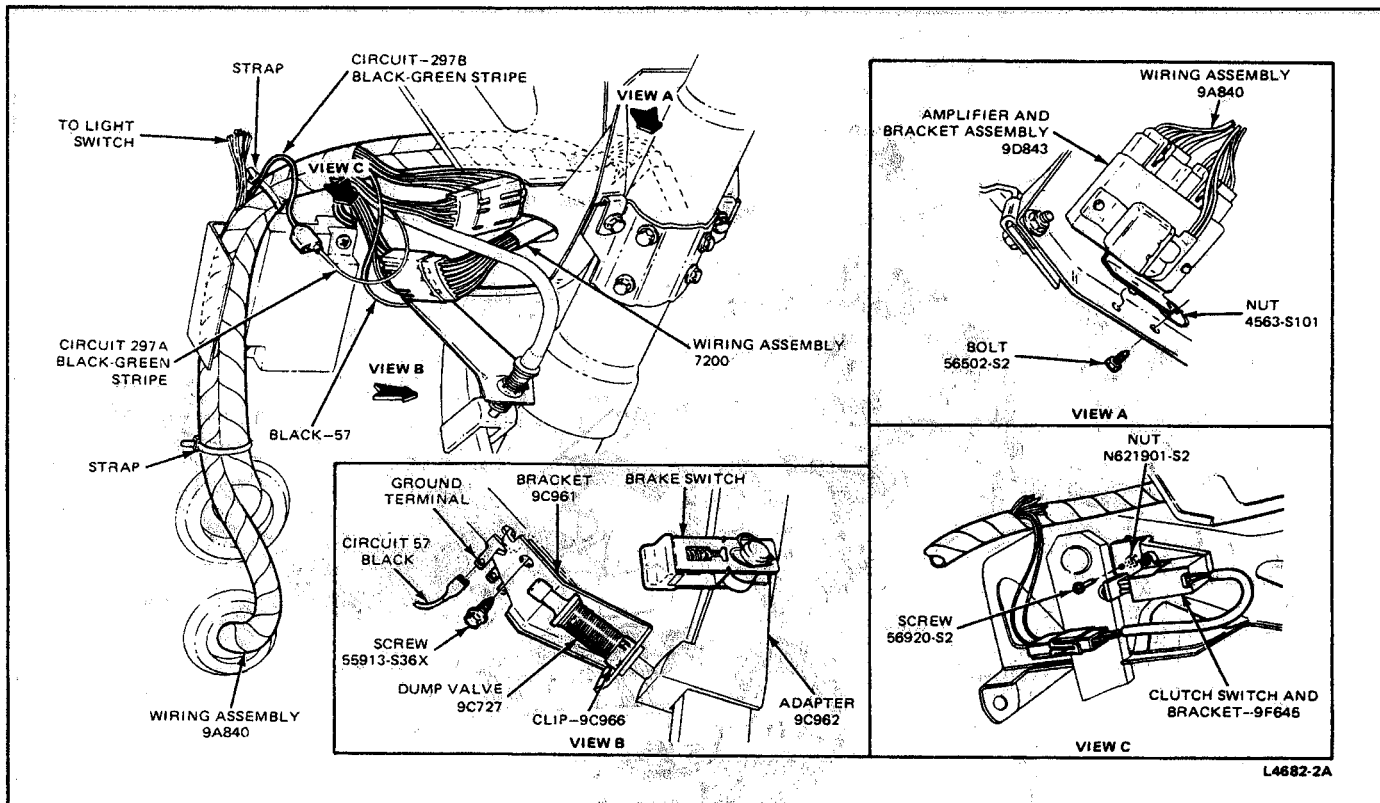


FIG. 3 Speed Control Amplifier and Wiring Installation—E-150—E-350

equivalent. If the Model 007-00013 Tester is not available, use the following procedures.

NOTE: Diagnosis charts are provided at the end of this Section to assist in locating speed control system problems.

Visual Inspection

A visual inspection is an important part of the system test. When performing a visual inspection, check all items for abnormal conditions such as frayed wires and damaged servo vacuum hoses. For the speed control system to function properly, it is necessary that the speedometer cables be properly routed and securely attached to the components. All vacuum hoses must be securely attached and routed with no sharp bends or kinks. The servo (throttle actuator) and throttle linkage should operate freely and smoothly. The bead chain (if so equipped) should have no more than 3.18mm (1/8 inch) free play with the throttle set to hot idle position. The actuator cable (if so equipped) should be adjusted as tight as possible without opening the throttle plate or increasing the idle speed. Electrical connections must be complete and tight. The wiring harness must be properly routed. Look for frayed wiring insulation or evidence of shorts. Any problems revealed by the visual inspection should be corrected before further tests of the speed control system are made.

Control Switches Test

Disconnect the 6-way connector (C-1006 on E-150—E-350 and C-717 on F-150—F-350 and Bronco) at the amplifier from the steering column control switches (Figs. 6 and 7). Then, check the lead (light blue-black hash -151) from the control switches as follows:

1. Check for battery voltage at the lead (light blue-black hash) when the ON switch is depressed. Battery voltage should be available at the lead (light blue-black hash) coming from the control switches. (Refer to the wiring diagram, Figs. 6 through 9).
2. Connect an ohmmeter between the light blue-black hash wire (151) and ground. Check the wire for continuity to ground (0-1 ohm) when the OFF switch is depressed. If a resistance higher than 1 ohm is found, the wiring, slip rings, the copper brushes in the turn signal switch, or the switch is at fault, or the steering column is not properly grounded. To check for proper ground, connect an ohmmeter between any good electrical ground point on the body sheet metal and the steering column upper flange. Scrape away paint in a non-visible spot if necessary for good contact. The resistance should be less than 1/2 ohm. Rotate the steering wheel back and forth and check flexible coupling for resistance of less than 1 ohm. If resistance higher than 3 ohms is noted, clean the horn brush contacts and the ground brush (verify that the ground brush is installed). A resistance of less than 1 ohm must be obtained before performing the remaining tests.
3. With an ohmmeter connected between the light blue-black hash wire (151) and ground, depress and hold the SET/ACCEL switch. A reading of approximately 680 ohms should be indicated on the ohmmeter.
4. With an ohmmeter connected between the light blue-black hash wire (151) and ground, depress and hold the COAST switch. A reading of approximately 120 ohms should be indicated on the ohmmeter.
5. With an ohmmeter connected between the light blue-black hash wire (151) and ground, depress and

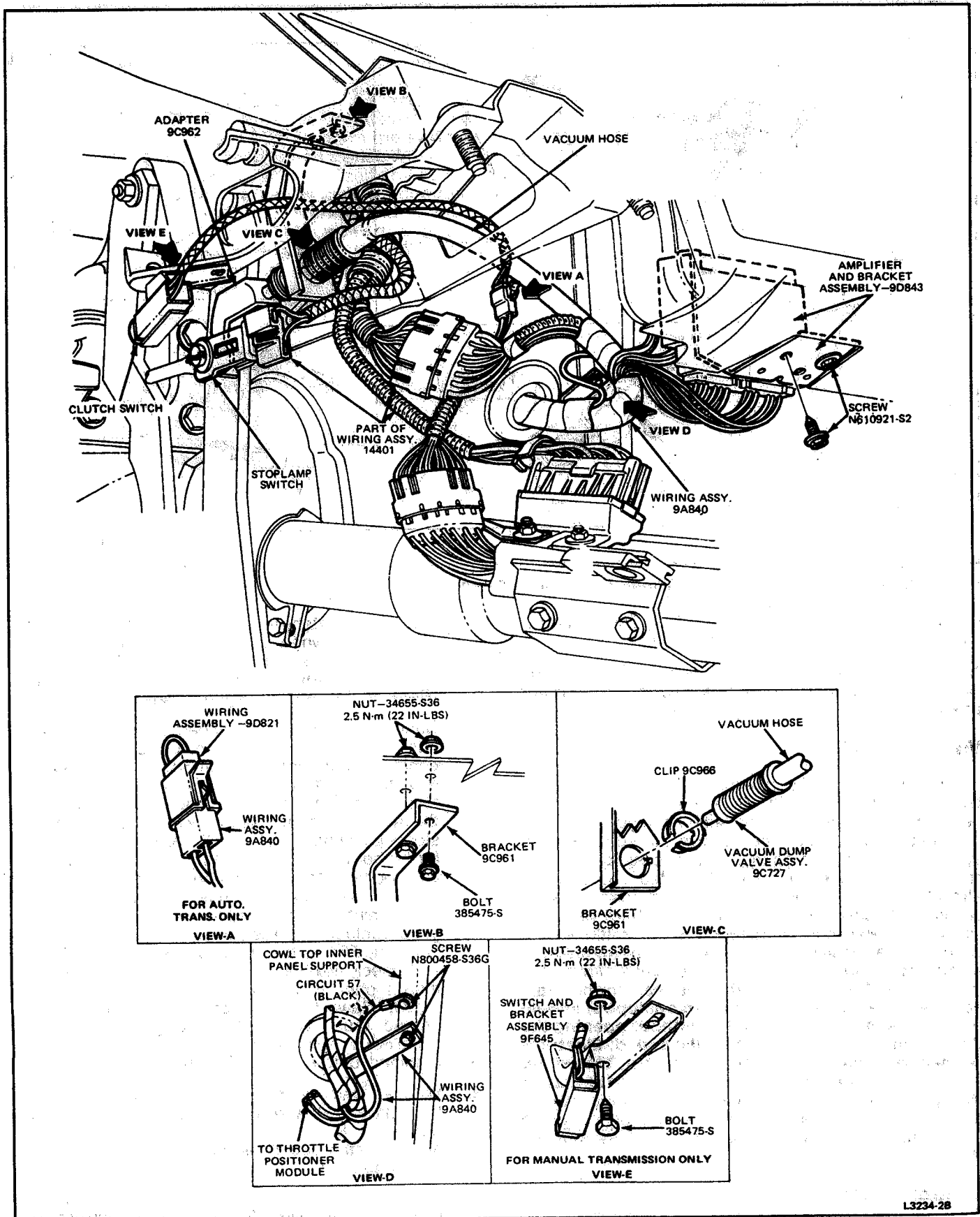


FIG. 4 Speed Control Amplifier and Wiring Installation—F-150—F-350 and Bronco—Non-EEC IV

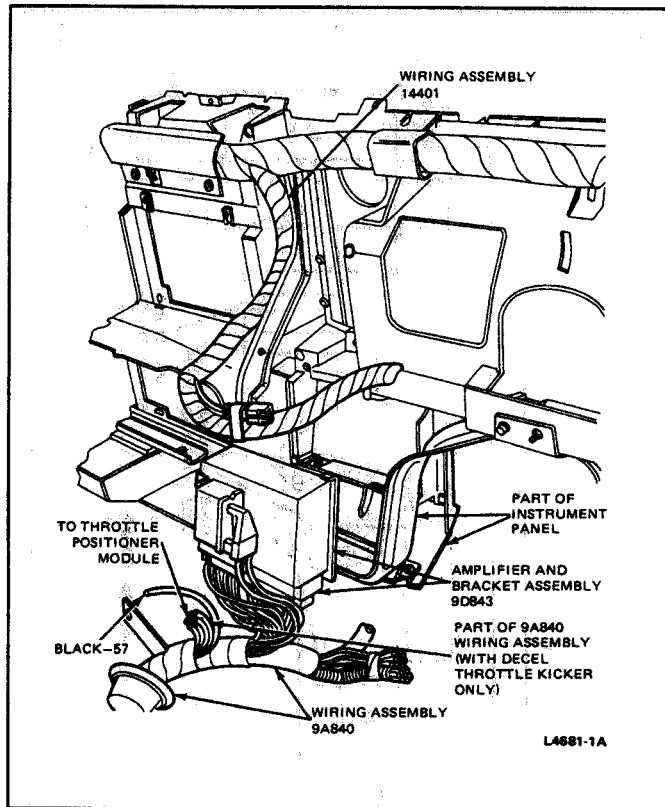


FIG. 5 Speed Control Amplifier and Wiring Installation—F-150—F-350 and Bronco—EEC IV

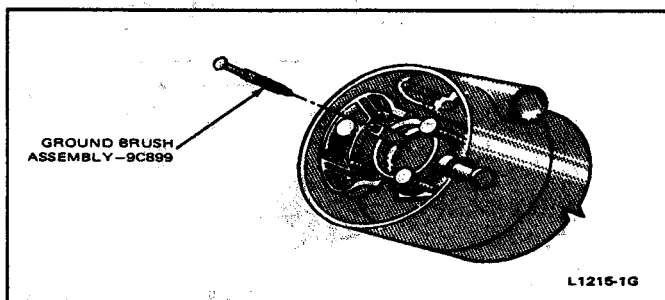


FIG. 6 Ground Brush Installation

hold the RESUME switch. A reading of 2200 ohms should be indicated on the ohmmeter.

Speed Sensor Test

Disconnect the 6-way connector (C-1006 on E-150—E-350 and C-717 on F-150—F-350, Bronco) at the amplifier assembly, (Figs. 6 and 7), and connect an ohmmeter between the wire connector terminals (Dark Green-614 and Black -57 on E-150—E-350 and Dark Green—White Stripe-150 and blank -57A on F-150 through F-350 and Bronco) at the speed sensor end. A reading of approximately 40 ohms should be obtained. A reading of Zero ohms indicates a shorted coil or wiring harness and a maximum reading indicates an open coil or wiring harness. Replace the sensor in either case.

If the ohmmeter records 40 ohms and the speedometer operates properly within needle waver, the speed sensor is probably good. A speed sensor of known good quality can also be substituted in place of the existing sensor to check for proper operation.

Servo Assembly Test

F-150—F-350 and Bronco

Disconnect the ball chain from the carburetor (if so equipped) (Figs. 15 and 16). Separate connector C-714 at the amplifier (Figs. 4 and 8). Connect an ohmmeter between the orange-yellow hash wire 144 and gray-black hash wire 145 at the 8-way connector. A resistance of approximately 40 to 125 ohms should be obtained. Connect the ohmmeter between the orange-yellow hash 144 and white-pink hash wire 146. A resistance of approximately 60 to 90 ohms should be obtained. Reconnect the ball chain (if so equipped) to the carburetor and properly adjust as described in Figs. 11 through 14.

Start the engine, and verify servo vacuum from engine exceeds 2.5 inches of Hg (1.22 psi). With the servo disconnected from the amplifier, connect the orange-yellow hash lead (wire 144) of the servo to the battery positive terminal. Connect the white-pink hash lead (wire 146) of the servo to ground, and momentarily touch the gray-black hash lead (wire 145) of the servo to ground. The servo throttle actuator should tighten the bead chain (or actuator cable) and open the throttle. The throttle should hold in that position or slowly release the tension. When the white-pink hash wire is removed from ground, the servo should release the bead chain (or actuator cable) tension immediately. Replace the servo if it fails any part of the preceding test.

CAUTION: If the orange-yellow hash lead is shorted to either the white pink hash or gray-black hash leads, it may be necessary to replace the amplifier.

E-150—E-350

Disconnect the ball chain from the carburetor (if so equipped) (Figs. 11 through 14). Separate connector C-1003 at the amplifier (Figs. 3 and 7). Connect an ohmmeter between the orange-yellow hash wire (734) and gray-black hash wire (825) at the 8-way connector. A resistance of approximately 40 to 125 ohms should be obtained. Connect the ohmmeter between the orange-yellow hash wire (734) and white-pink hash wire (826). A resistance of approximately 60 to 190 ohms should be obtained. Reconnect the ball chain (if so equipped) to the carburetor and properly adjust as described on Figs. 11 through 14.

Start the engine, and verify that the engine vacuum exceeds 2.5 in. Hg (1.22 psi). With the servo disconnected from the amplifier, connect the orange-yellow hash wire (734) of the servo to the battery positive terminal. Connect the white-pink hash wire (826) of the servo to ground, and momentarily touch the gray-black hash wire (825) of the servo to ground. The servo throttle actuator should tighten the bead chain (or actuator cable) and open the throttle. The throttle should hold in that position or slowly release the tension. When the white-pink hash wire is removed from ground, the servo should release the bead chain (or actuator cable) tension immediately. Replace the servo if it fails any part of the preceding test.

CAUTION: If the orange-yellow hash lead is shorted to either the white pink hash or gray-black hash leads, it may be necessary to replace the amplifier.

Amplifier Test

Do not use a test lamp to perform the following tests as excessive current draw will damage electronic

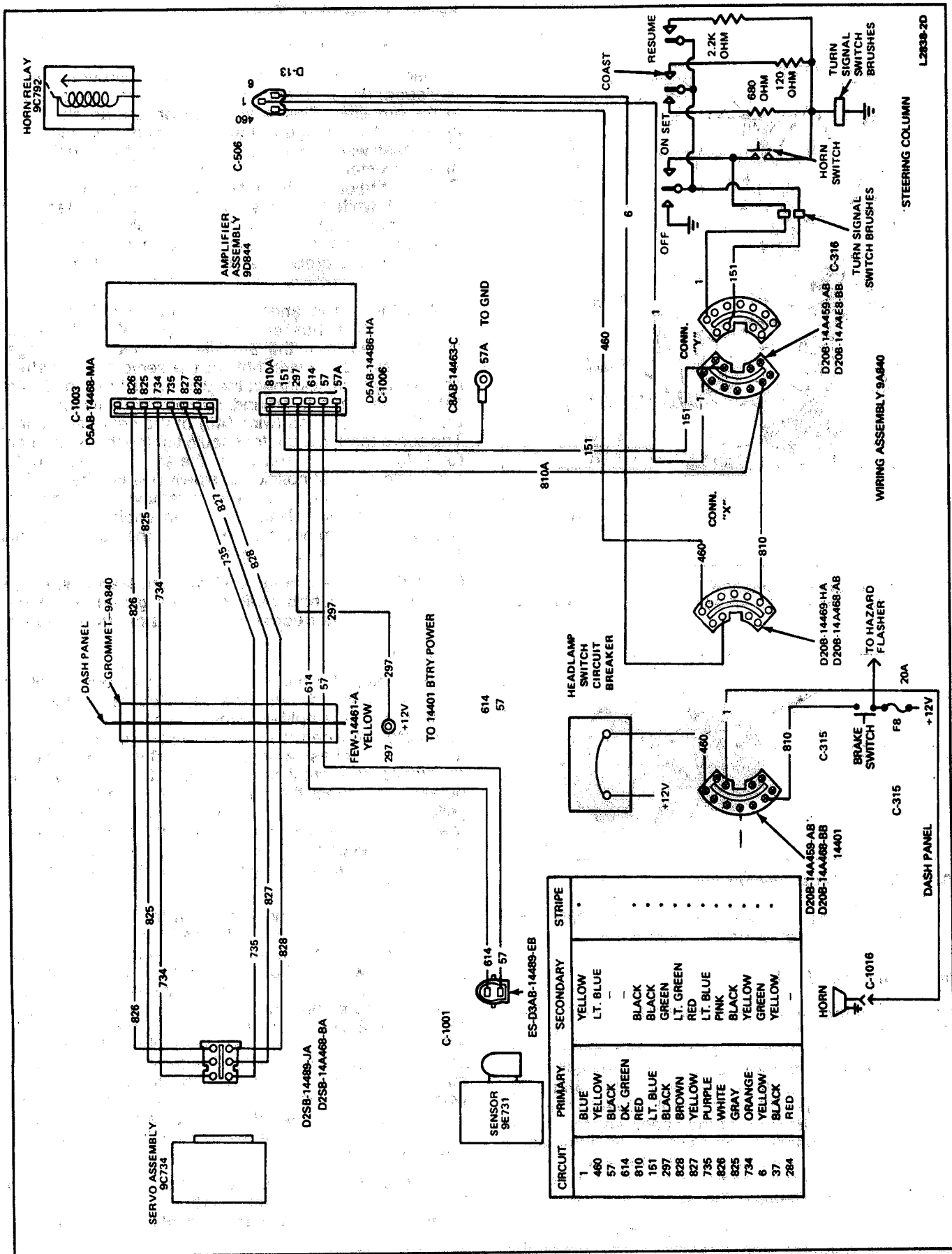


FIG. 7 Wiring Diagram—E-150—E-350

CIRCUIT NUMBER	CIRCUIT DESCRIPTION	GAGE	PRIMARY COLOR	SECONDARY COLOR	STRIPES	WASH	DOTS
1	HORN RELAY NEGATIVE	20	DARK BLUE	LIGHT BLUE			X
460	BATTERY TO HORN SW	16	YELLOW				
511	STOPLAMP SW TO TURN SIGNAL SW	18	LIGHT GREEN				
511A	BRAKE SW (LOAD SIDE) TO AMPLIFIER DSABLE	18	LIGHT GREEN				
57A	SENSOR GROUND	21	BLACK	WHITE	X		
150	SENSOR SIGNAL TO AMPLIFIER	20	DARK GREEN				
57	AMPLIFIER GROUND	18	BLACK				
151	AMPLIFIER CONTROL LINE	20	LIGHT BLUE	BLACK	X		
296	IGNITION/SW (ACCY) TO AMPLIFIER FEED	18	WHITE	PURPLE			
149	SERVO FEEDBACK POT + TO AMPLIFIER	20	BROWN	LIGHT GREEN			
148	SERVO FEEDBACK POT - TO AMPLIFIER	20	YELLOW	RED	X		
147	SERVO FEEDBACK POT -- TO AMPLIFIER	20	PURPLE	LIGHT GREEN	X		
146	SERVO VENT SOLENOID CONTROL	20	WHITE	LIGHT GREEN	X		
145	SERVO VACUUM SOLENOID CONTROL	20	GRAY	BLACK	X		
144	SERVO SOLENOID FEED	20	ORANGE	YELLOW	X		
6	HORN RELAY TO HORN	16	YELLOW	LT. GREEN	X		

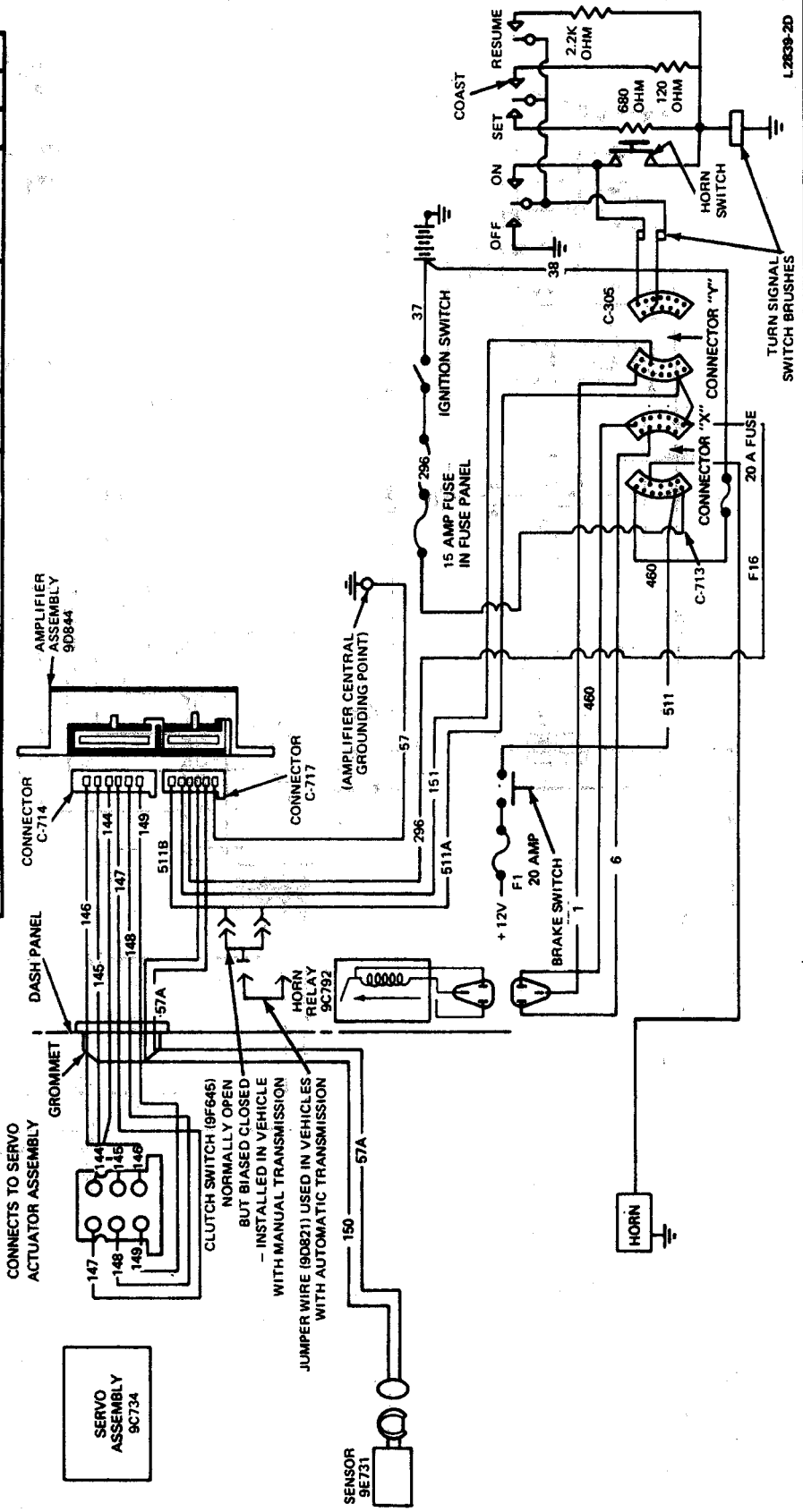
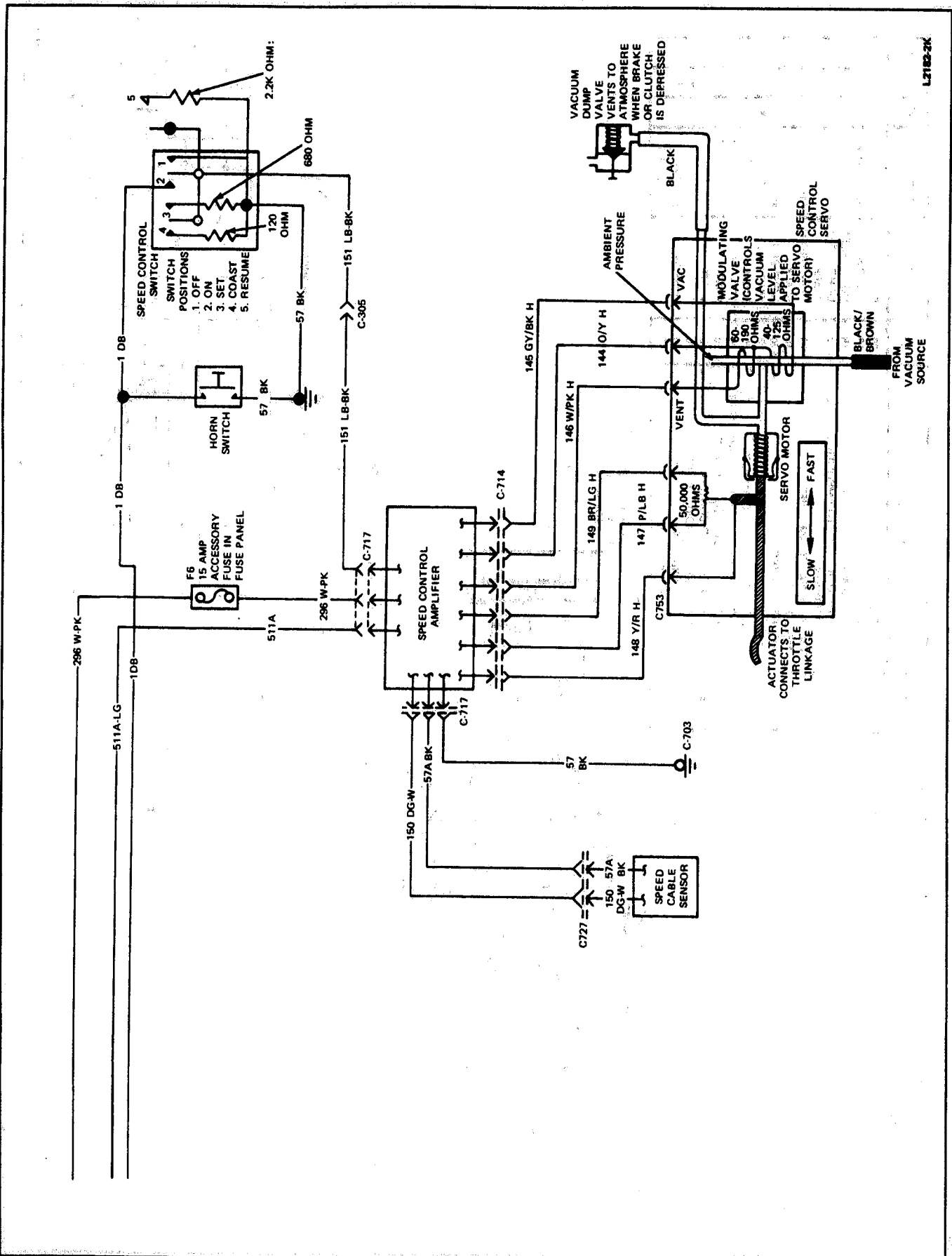
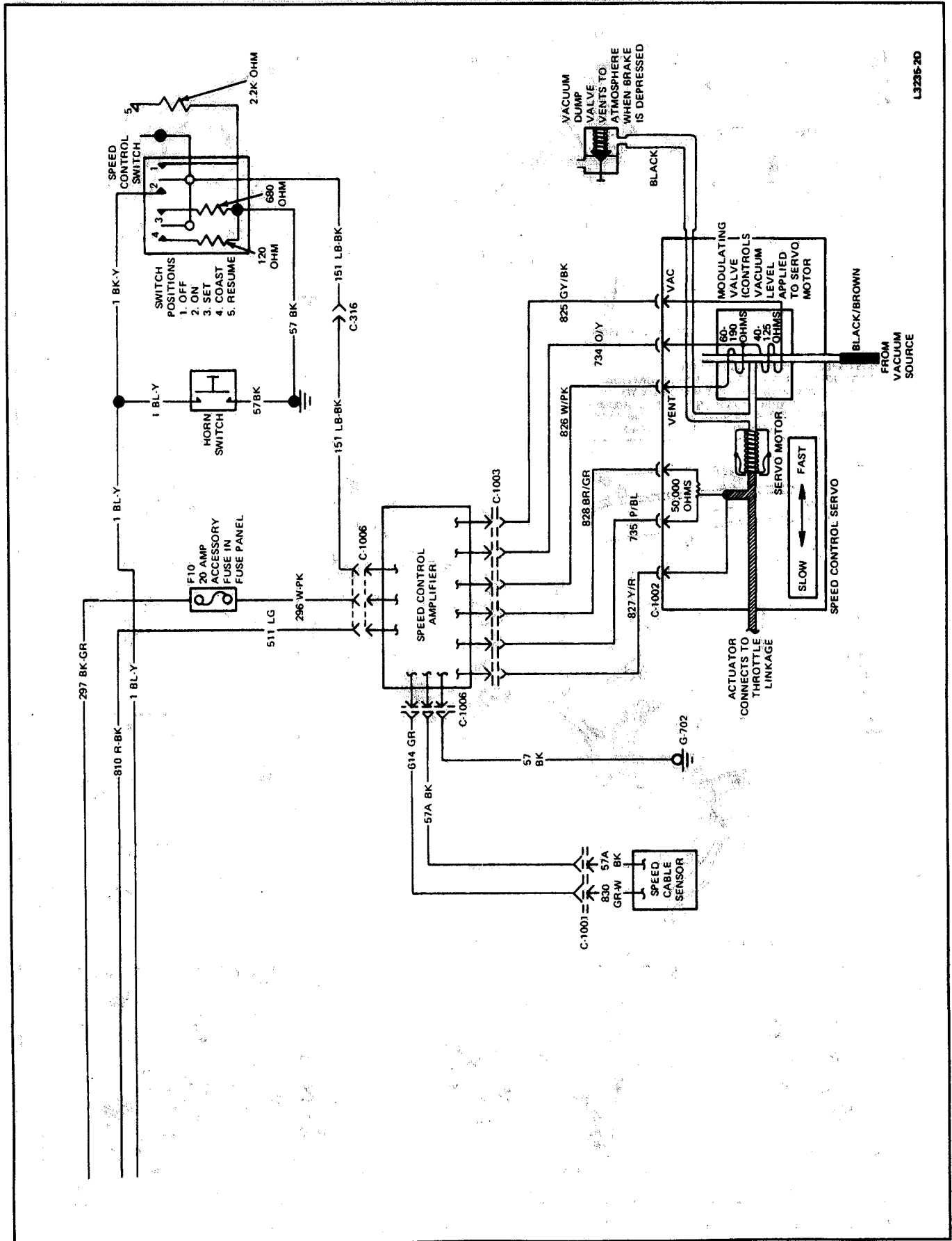


FIG. 8 Wiring Diagram—F-150—F-350 and Bronco



L7182-ZK

FIG. 9 Main Wiring Diagram—F-150—F-350 and Bronco



L3286-20

FIG. 10 Main Wiring Diagram—E-150—E-350

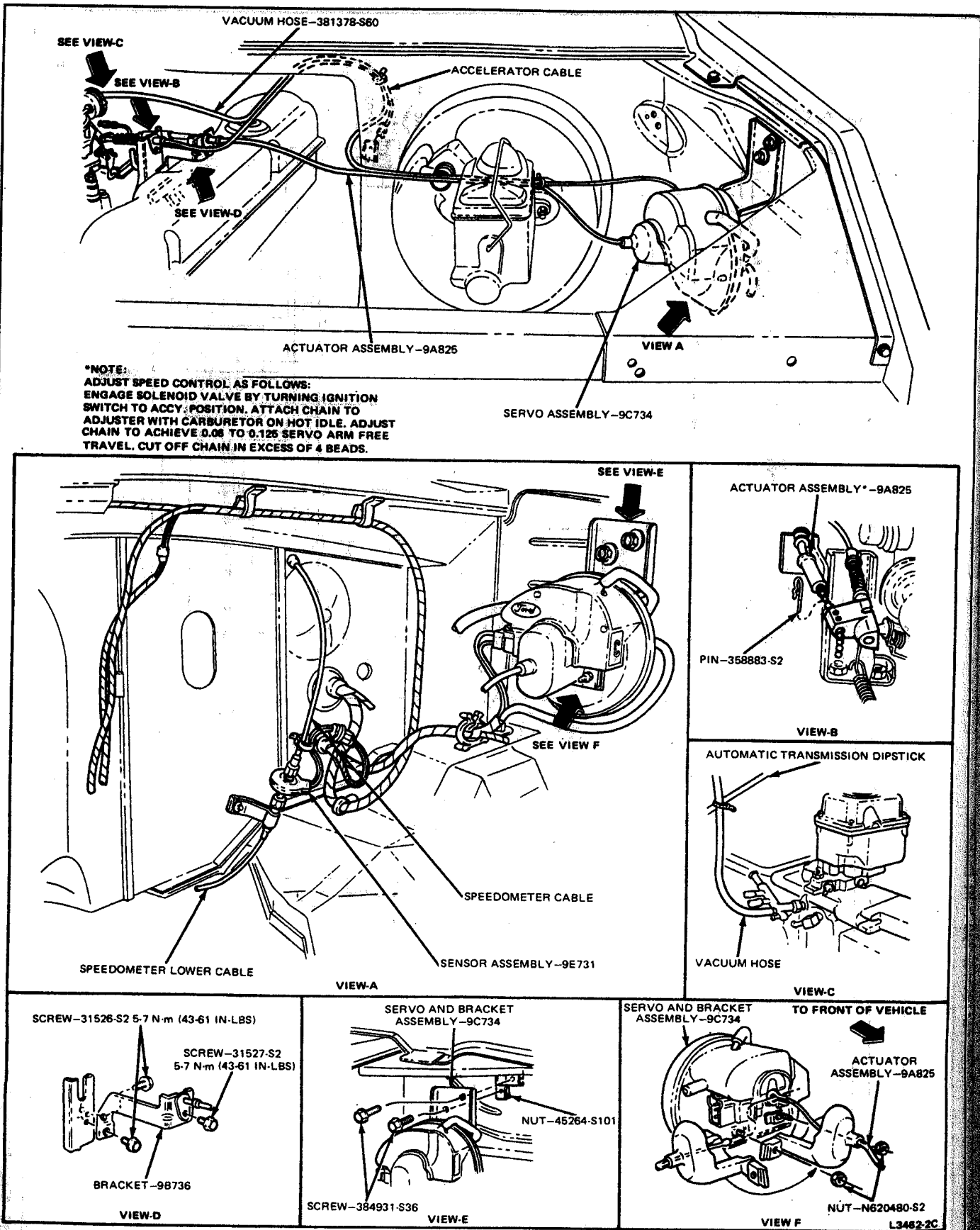


FIG. 11 Servo and Bracket Installation—E-150—E-350—4.9L (300 CID) w/o Dual Batteries

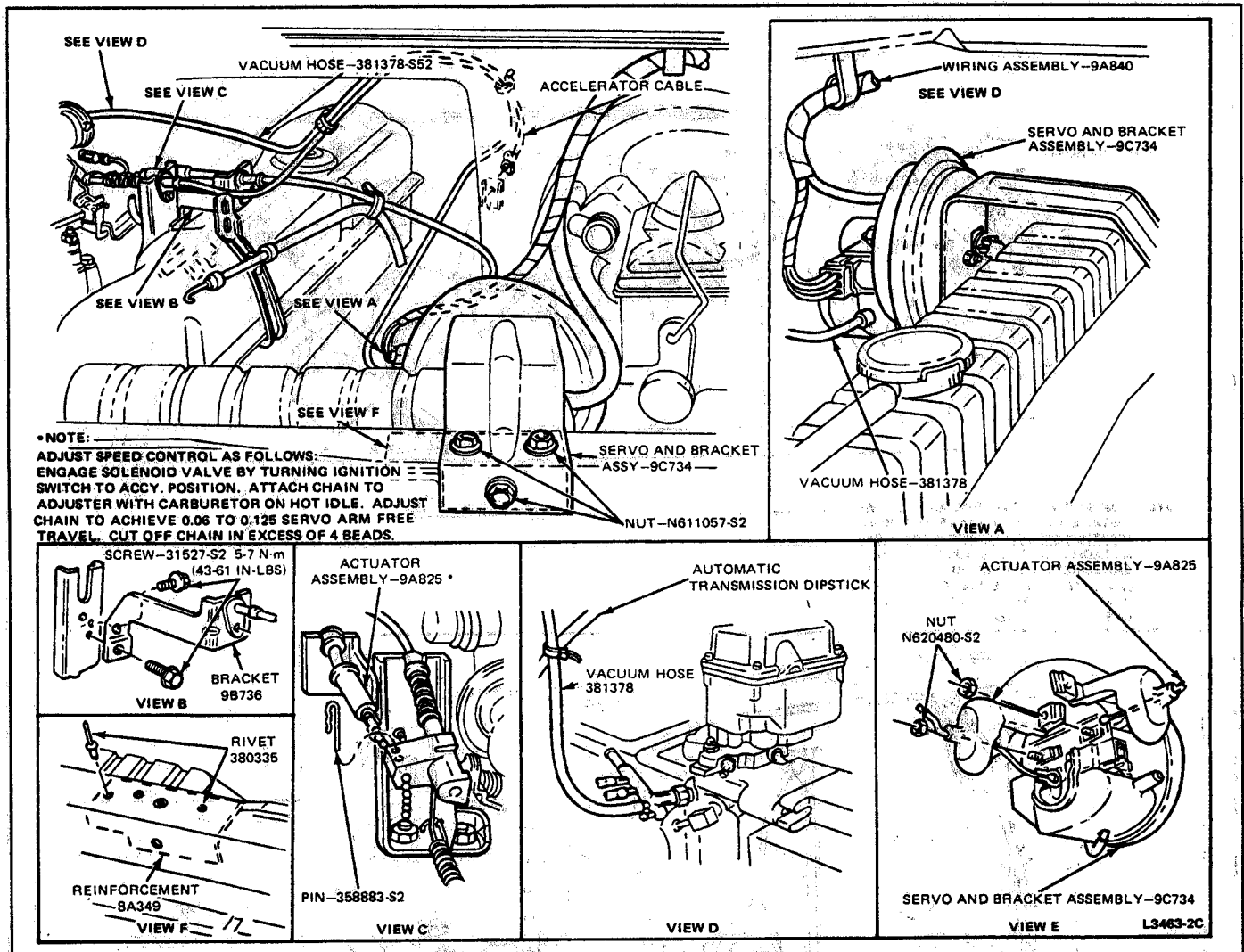


FIG. 12 Servo and Bracket Installation—E-150—E-350—4.9L (300 CID) w/Dual Batteries and All Chassis Cab Models with Speed Control

components inside the amplifier. Use only a voltmeter of 5,000 ohm/volt rating or higher.

Do not substitute a new amplifier for the old amplifier until the actuator coils have been tested. Refer to the Servo Assembly (Throttle Actuator Test).

ON Circuit Test

Turn On the ignition switch and connect a voltmeter between ground and the wire lead (151) (light blue-black hash) at the amplifier connector (C-717 on F-150—F-350, Bronco and C-1006 on E-150—E-350). The voltmeter should read 12 volts when the ON switch on the steering wheel is depressed and held. If voltage is not available check the horn relay circuit and control switch test. Release the ON button; the voltmeter should read approximately 7.8 volts, indicating the ON circuit is engaged. If the voltage does not remain, check for ground on the amplifier, fuse and/or circuit breaker and/or hang in a known good amplifier and re-check for a good ON circuit.

OFF Circuit Test

With the ignition On and the voltmeter connected between ground and the light blue-black hash wire (151), depress the OFF switch on the steering wheel. Voltage on the blue wire should drop to zero indicating the ON

circuit is de-energized. If the voltage does not drop to zero, perform the control switch test. If the switches check OK, hang in a known good amplifier and recheck the OFF circuit as above.

Set-Accelerate Circuit Test

With the ignition On and the voltmeter connected between ground and the light blue-black hash wire (151), depress the ON switch, then hold SET/ACCEL button on steering wheel. Voltmeter should indicate approximately 4.5 volts. Rotate the steering wheel back and forth and watch the voltmeter for fluctuations. If the voltage varies more than 0.5 volt, perform the control switch test.

Coast Circuit Test

With the ignition On and the voltmeter connected between ground and the light blue-black hash wire (151), depress the ON switch, then hold the COAST button on steering wheel. Voltmeter should indicate approximately 1.5 volts. If all the functions check OK, perform the servo check and sensor test and hang in a known good amplifier.

Resume Circuit Test

With the ignition On and the voltmeter connected between the light blue-black hash mark wire in the six-

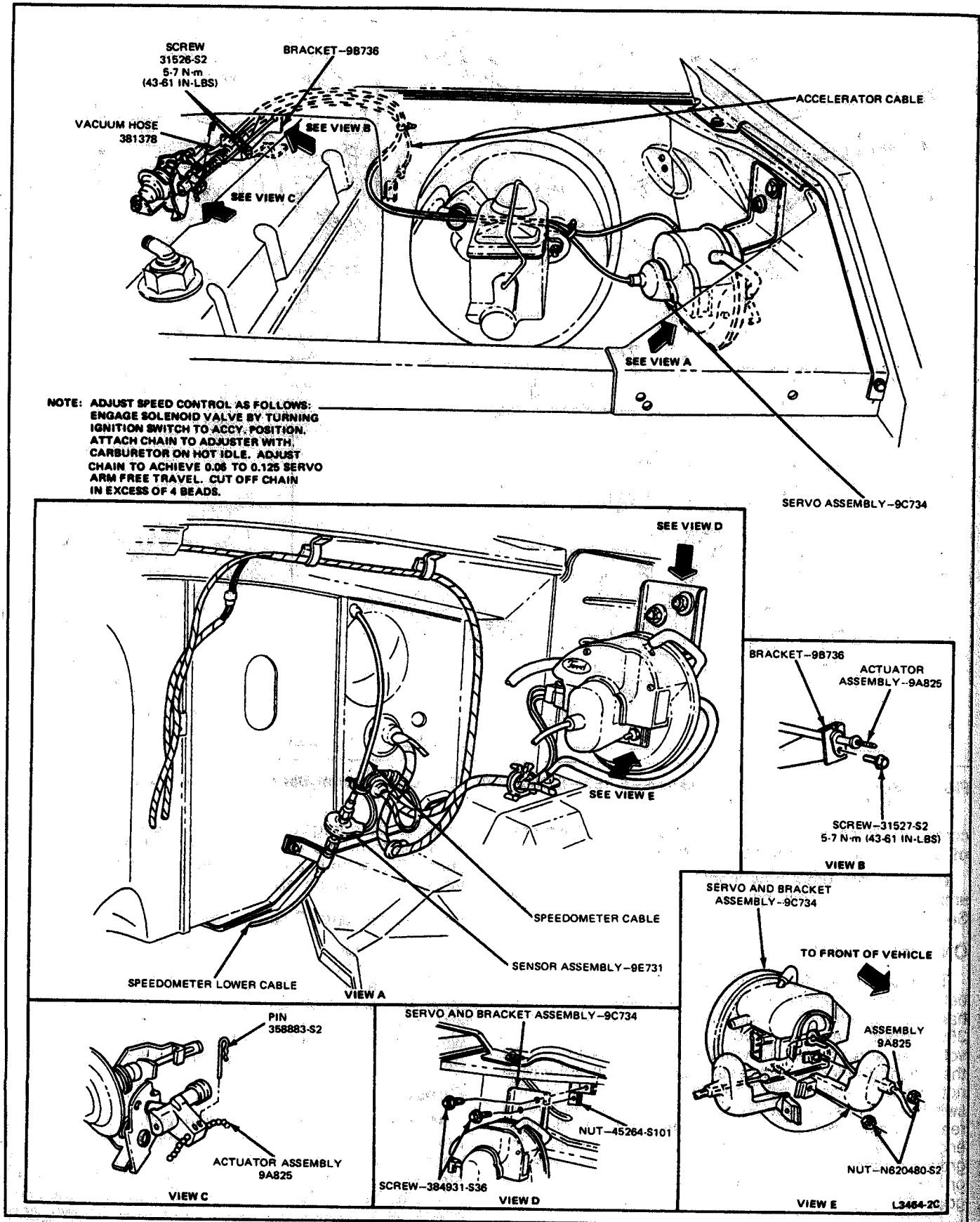


FIG. 13 Servo and Bracket Installation—E-150—E-350—V-8 Gasoline Engines w/o Dual Batteries

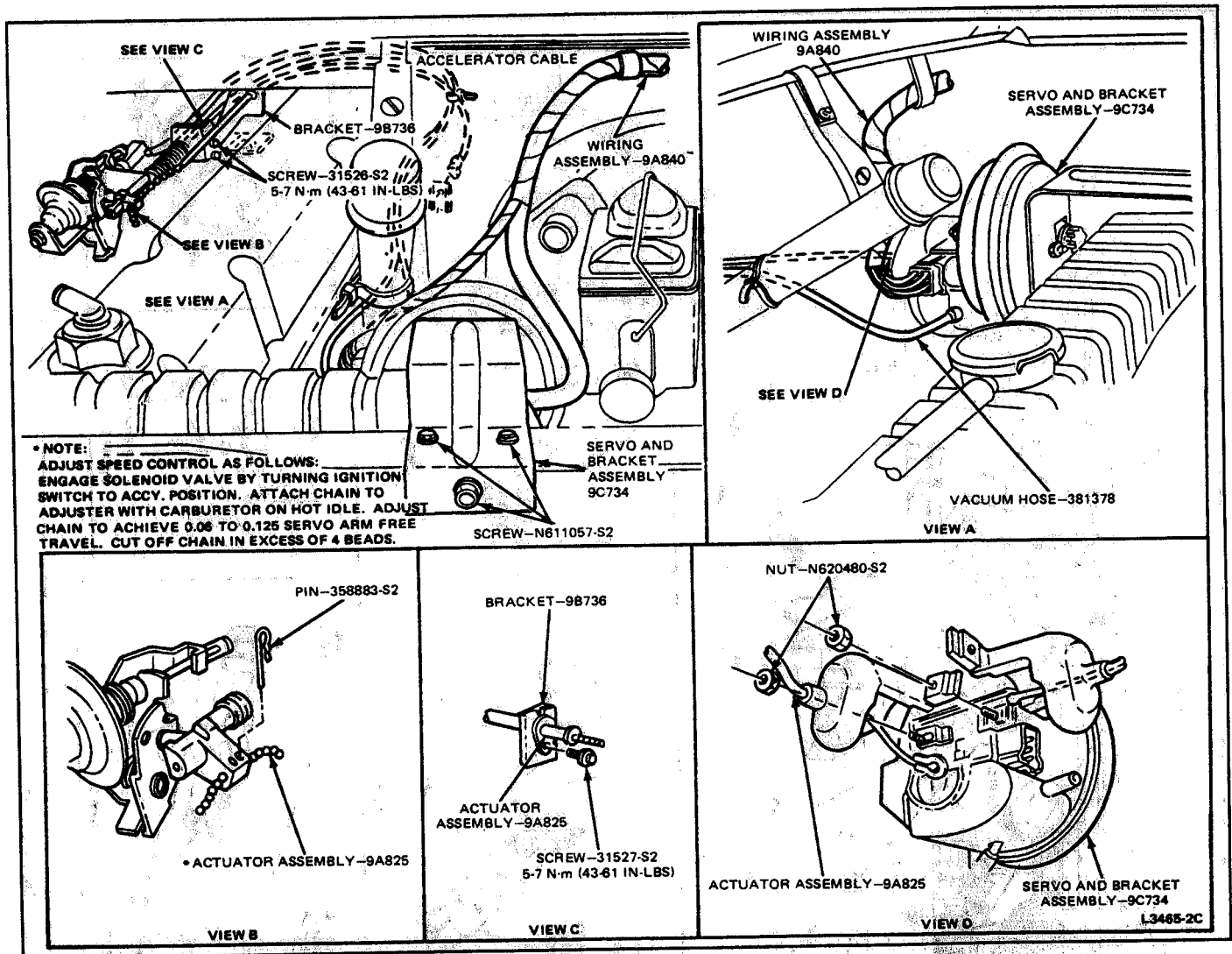


FIG. 14 Servo and Bracket Installation—E-150—E-350—V-8 Gasoline Engines w/Dual Batteries and All Chassis Cab Models with Speed Control

way connector and ground, depress and hold the RESUME button on the steering wheel. The voltmeter should read approximately 6.5 volts.

If all the circuits check OK, perform the servo assembly test and hang in a known good amplifier.

Simulated Road Test

CAUTION: When performing this simulated road test, the rear wheels of the vehicle must be raised clear of the floor. Block the front wheels securely and use only a suitable lifting device (such as a garage-type hoist) and support the rear axle with one jack stand on each side. Never attempt to use the vehicle bumper jack for tests of this type.

1. Start the engine.
2. Shift the transmission to drive.
3. Turn on the speed control.

CAUTION: If any time during the following steps the system should appear to go out of control and overspeed, be prepared to turn the system off at once with the OFF switch or the ignition switch.

4. Accelerate and hold at 56 Km/h (35 mph).

5. Press and release the SET speed button. Hold foot pressure very lightly on accelerator pedal. Normally the speed will continue at 56 Km/h (35 mph) for a short period of time and then gradually start surging because the engine is not loaded.
6. Press the OFF button. The engine should drop back to idle. Stop the rear wheels with the brake.
7. Press ON button, accelerate and hold the speed at 56 Km/h (35 mph).
8. Press and hold the SET/ACCEL button. Slowly remove the foot from the accelerator. The engine speed should gradually increase.
9. When the speed reaches 80 Km/h (50 mph), release the SET/ACCEL button. The vehicle should maintain 80 Km/h (50 mph) for a short time before the surging begins.
10. Press the COAST button and hold. The engine should idle. Slow the rear wheels to 56 Km/h (35 mph).
11. Release the COAST button, speed should set in. Surging should soon start.
12. Press the brake pedal. The system should shut off, the engine should slow to idle and the wheels should stop.

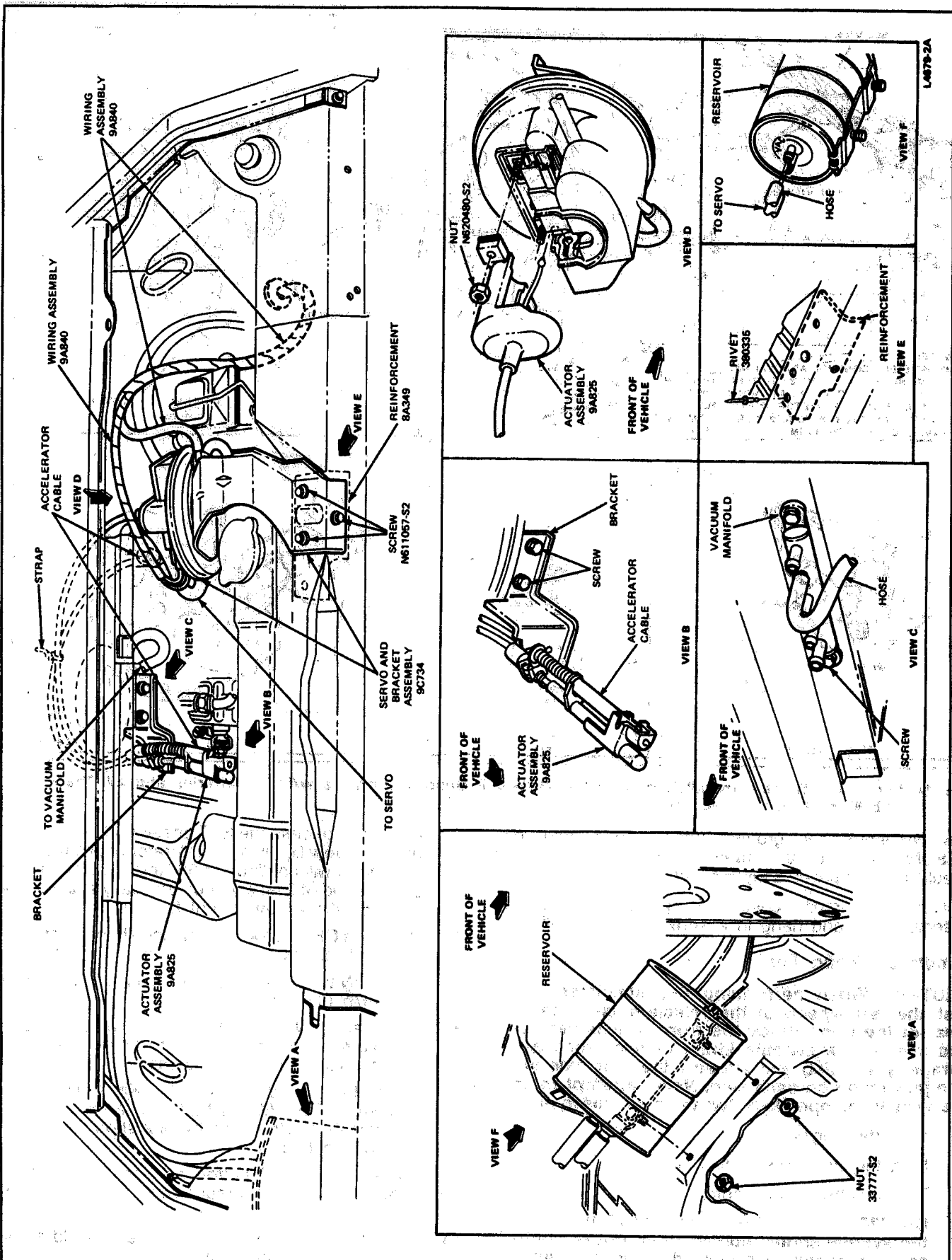


FIG. 15 Servo and Bracket Installation—E-250—E-350 with 6.9L Diesel Engine

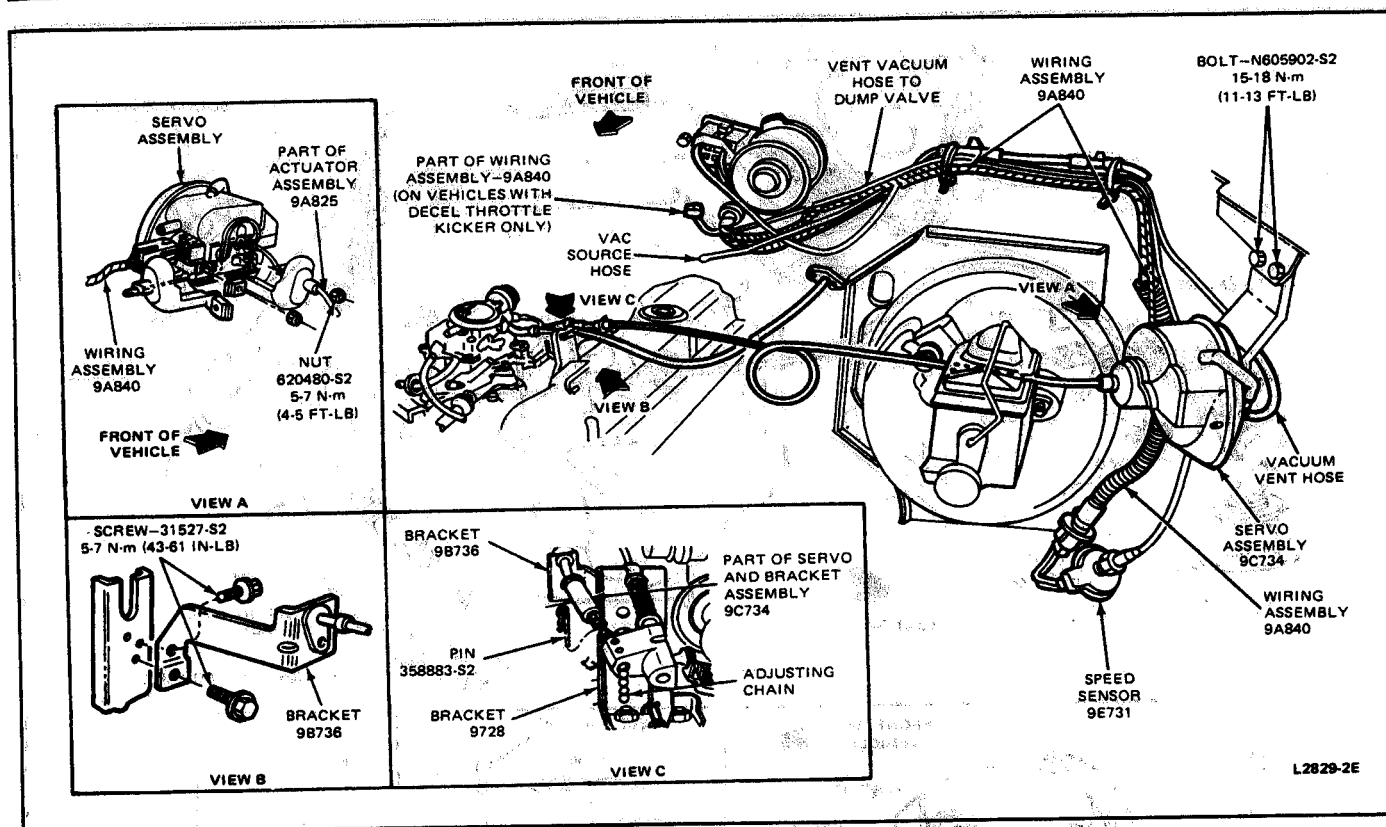


FIG. 16 Servo and Bracket Installation—F-150—F-350 and Bronco 4.9L (300 CID) Engine

- Set the speed at 80 Km/h (50 mph). Brake to 56 Km/h (35 mph) and maintain 56 Km/h (35 mph) with the accelerator. Depress and release the RESUME button. The speed should return to 80 Km/h (50 mph).

When performing these tests keep the vehicle speeds within reasonably low limits. If the system does not perform as normally expected, make note of the malfunction.

Road Test

- Start the engine. Perform speed control system road test in high gear with manual transmission or Drive with automatic transmission vehicles.
- Turn ON the speed control.
NOTE: If any time during the following steps the system should appear to go out of control and overspeed, be prepared to shift the transmission into Neutral and turn the system off at once with the OFF switch or the ignition switch.
- Accelerate and hold at 56 Km/h (35 mph).
- Press and release the set-speed button. Hold foot pressure very lightly on accelerator pedal. Normally the speed will continue at 56 Km/h (35 mph).
- Press the OFF button (Figs. 1 and 2). The engine should decelerate.
- Press ON button, accelerate and hold the speed at 56 Km/h (35 mph).
- Press and hold the SET/ACCEL button. Slowly remove foot from the accelerator. The engine speed should gradually increase.
- When the speed reaches 80 Km/h (50 mph), release the set-speed button.

- Press the COAST button and hold. The engine should decelerate and slow to 56 Km/h (35 mph).
- Release the COAST button. Speed should set in.
- Press the brake pedal. The system should shut off causing the engine to idle.
- Set the speed at 80 Km/h (50 mph). Brake to 56 Km/h (35 mph) and maintain 56 Km/h (35 mph) with the accelerator; depress and release the RESUME button. The speed should return to 80 Km/h (50 mph).

When performing these tests, keep the vehicle speeds within reasonably low limits. If the system does not perform as normally expected, make note of the malfunction.

Supply Circuit

Blow the horn. This test will determine that there is power in the horn circuit to the steering wheel.

Brake Stoplight Switch and Circuit Test

To be performed when brake application will not disconnect the speed control. On manual transmission vehicles, verify that clutch switch is correct before performing the following. See clutch switch test section.

- Check for stop lamp operation with a maximum brake pedal effort of 26.7N (6 lbs.). If more than 26.7N (6 lbs.) effort is required, check the brake pedal actuation and stop lamp switch. Repair or replace as required.
- If stop lamps work properly, check the battery voltage on the black-green stripe hash lead 297 at the amplifier connector C-1006 (E-150—E-350) white—purple stripe lead (296 at connector) or C-717 (F-150—F-350 and Bronco) (Figs. 7 and 8). Depress the brake pedal until the stop-lamps are lit.

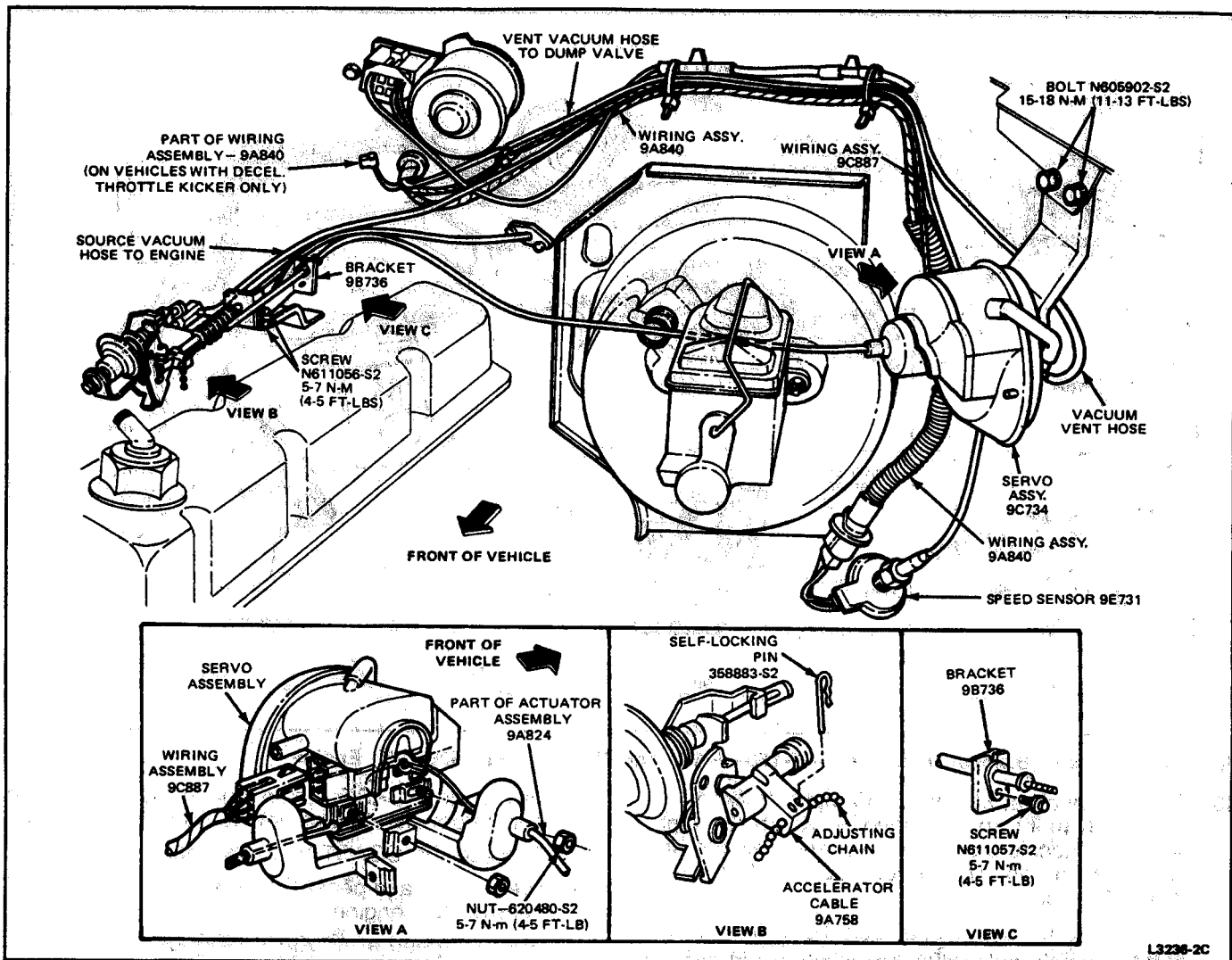


FIG. 17 Servo and Bracket Installation—F-150—F-350 and Bronco—All V-8 Gasoline Engines

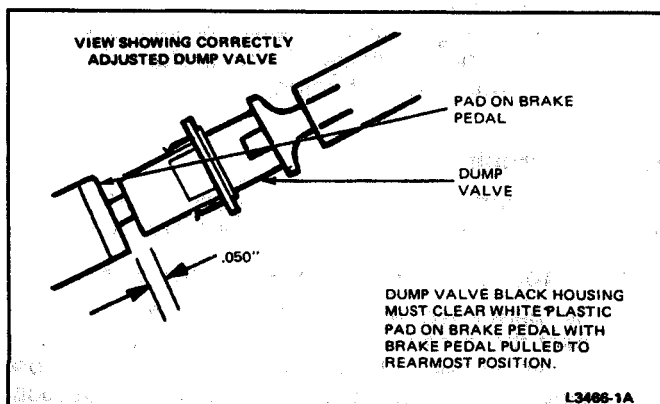


FIG. 18 Dump Valve Adjustment

Check voltage on the red-black stripe hash lead 810 (E-150—E-350) or on the light green wire (511A) (F-150—F-350 and Bronco) at the same connector. The difference between the two voltage readings must not exceed 1.5 volts. The high resistance must be found and corrected in the stop lamp circuit.

3. If the stop lamps do not work, the stop lamp switch, supply circuit, fuses or bulbs must be checked.

Vacuum Dump Valve Test

The vacuum dump valve releases the vacuum in the servo assembly whenever the brake pedal is depressed. It should be checked whenever brake application does not disconnect the speed control. The dump valve should be pushed sufficiently forward in the retainer clip so that no more than 3.2mm (1/8 inch) of the white plunger is showing when the brake pedal is in the released position (Fig. 18).

Disconnect the vacuum hose from the dump valve to the servo at the servo. Connect a hand vacuum pump to the hose, and pump up a vacuum. If a vacuum cannot be obtained, the hose or the dump valve leaks and should be replaced or adjusted. Step on the brake pedal. The vacuum should be released. If it is not, adjust as described below:

1. Move the valve forward in the retaining clip (Fig. 3, View B) with the valve plunger contacting the brake pedal adapter and the pedal in the released position until 3.2mm (1/8 inch) or less of the white plunger shows.
2. Make certain brake pedal is against the stop in the release position after adjustment.

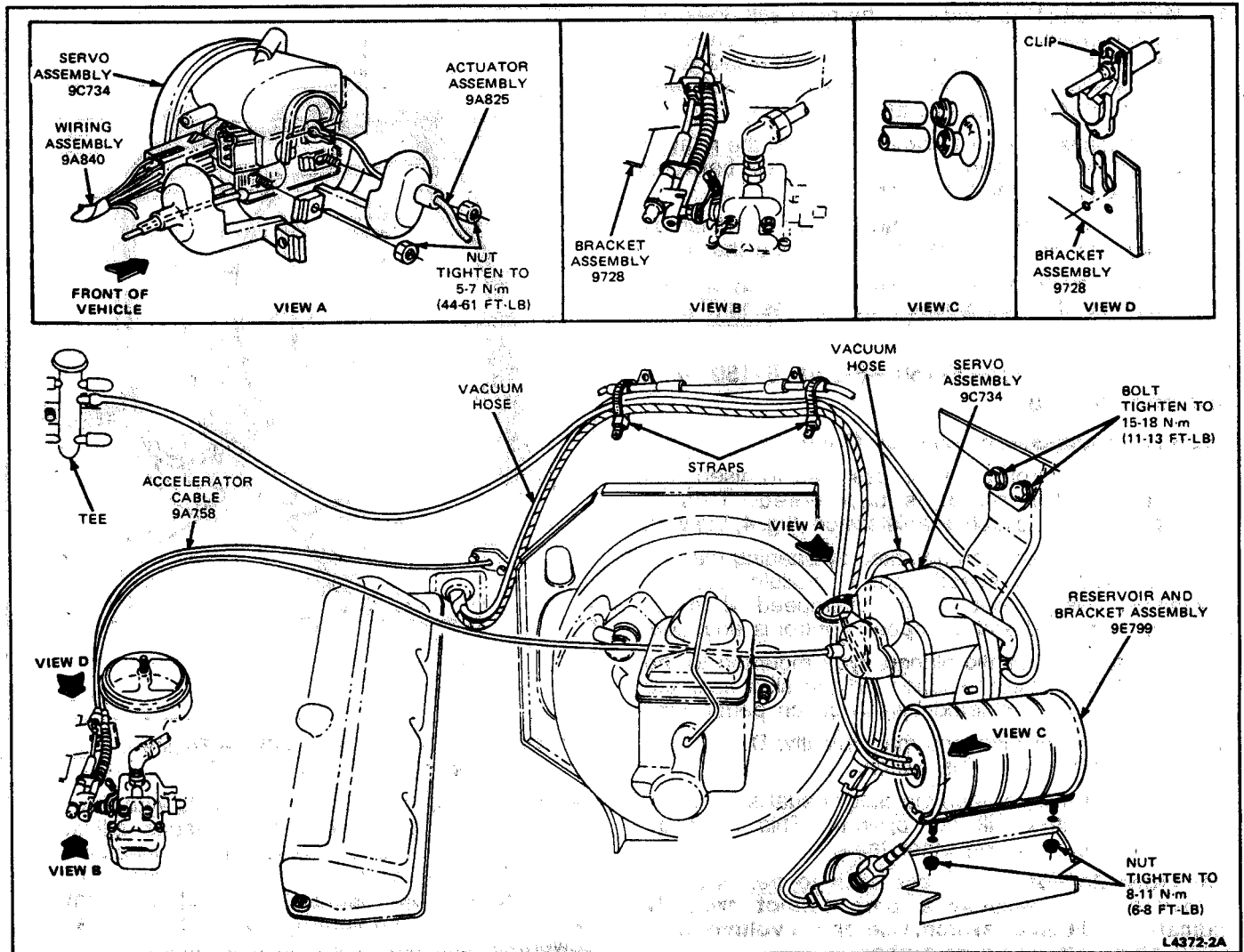


FIG. 19 Servo and Bracket Installation—F-250—F-350 w/6.9L Diesel Engine

If vacuum still does not release, replace vacuum dump valve.

Vacuum Reservoir Test

To test the vacuum reservoir and check valve for vacuum leakage, proceed as follows:

1. Locate vacuum reservoir on left hand apron, refer to Fig. 19. Disconnect vacuum hose at the servo and connect hose to a vacuum gauge with a minimum range of 0-85 kPa (0-25 inches of mercury).
2. Start the engine and observe that the vacuum level exceeds 67.4 kPa (20 in. Hg) [(77.5 kPa (23 in. Hg) is nominal]. If not, check for leaky vacuum source hose or damaged vacuum pump.
3. Turn off the engine after the vacuum level has stabilized above 67.4 kPa (20 in. Hg). The vacuum level should remain essentially constant and after 24 hours should still exceed 50.5 kPa (15 in. Hg).
4. If the vacuum level can not be maintained, the reservoir should be replaced.

Horn Relay Circuit Test—E-150—E-350, F-150—F-350 and Bronco

1. Locate horn relay wire connector marked "X" and "Y" on the wiring diagram (Figs. 7 and 8).

NOTE—Connectors remain connected for the following tests.

2. Using connector "X" located Yellow wire (460) (E-150—E-350) or yellow-light blue dot wire (460) (F-150—F-350 and Bronco) (Figs. 7 and 8).
3. Using voltmeter, measure for battery voltage (approximately +12V) on the pin side of the connector to ground.
4. Using connector "Y", locate blue-yellow stripe wire (1) (E-150—E-350) or dark blue (1) (F-150—F-350 and Bronco) (Figs. 7 and 8).
5. Using voltmeter, measure for battery voltage (approximately +12V) on socket side of connector.
6. With voltmeter still connected to socket lead in step 5, depress horn switch. Voltmeter should read zero. Horn should sound.
7. If voltmeter reading remains at +12V when horn switch is depressed, horn switch or steering column wiring has an open circuit.
8. Before continuing, prove out horn relay by momentarily grounding circuit (1) (step 4 above) to body electrical ground or body sheet metal and the horn should sound. This test by-passes horn switch.

9. With circuit (1) grounded, if the horn still does not sound, check for approximately $\frac{1}{2}$ V at connector "X" yellow-green stripe wire (6) (E-150—E-350) or yellow—light green wire (6) (F-150—F-350 and Bronco) when relay operates.
 10. If voltage is present at circuit (6) when the relay is operated, an open circuit is present between connector "X" and the horn.
 11. If the relay does not operate with +12V on circuit (460) and circuit (1) grounded, replace the relay.
- NOTE- The horn and/or speed control may operate intermittently if the ground brush is missing (Figs. 2 and 6).

Clutch Switch Test—F-150—F-350, E-150—E-350 and Bronco

(Manual Transmission Vehicles Only)

The speed control system is designed to disengage when the clutch pedal is depressed. This is accomplished via a clutch disable switch (Fig. 4, View E).

The disengage function operates by opening the 511 circuit between the speed control module and the stoplamps. This prevents engine overspeed when the clutch is depressed and the speed control is engaged.

The switch is a plastic plunger type mounted to the brake and clutch pedal support on the side near the driver's door. It is actuated by the clutch pedal arm.

NOTE: The switch functions magnetically. Do not use magnetized tools near this switch.

If the switch is open when the clutch pedal is released, the speed control will not operate. This must be corrected before making other tests.

CAUTION: Do not use a test lamp to perform the following tests because a lamp cannot properly indicate condition of switch. Use only a voltmeter of 5,000 ohm/volt rating or higher.

To check the switch, disconnect the switch pigtail connector from the speed control harness connector and connect an ohmmeter to the two switch connector terminals. With the clutch pedal in the full up (released) position the resistance should be less than 5 ohms. With the clutch pedal depressed (switch plunger extended) the circuit should be open.

Automatic Transmission

Vehicles equipped with automatic transmissions use a shorting plug instead of a clutch switch.

Diagnosis Guides

The speed control system diagnosis guides in this Section can be used to determine and isolate speed control problems.

Speed Decreases—On Steep Grades Or Under Heavy Loads

Verify that a complaint regarding a decrease in speed up steep grades or under heavy-load conditions is not caused by a powertrain limitation. To verify, conduct a road test. Set the speed at about 88.5 Km/h (55 mph) and proceed up a steep grade. When the speed decreases 6.4 to 9.7 Km/h (4 to 6 mph), manually accelerate the vehicle. Verify that the vehicle can maintain the SET speed **without** causing transmission kickdown (a transmission down-shift is acceptable with the overdrive transmissions). If SET speed can be

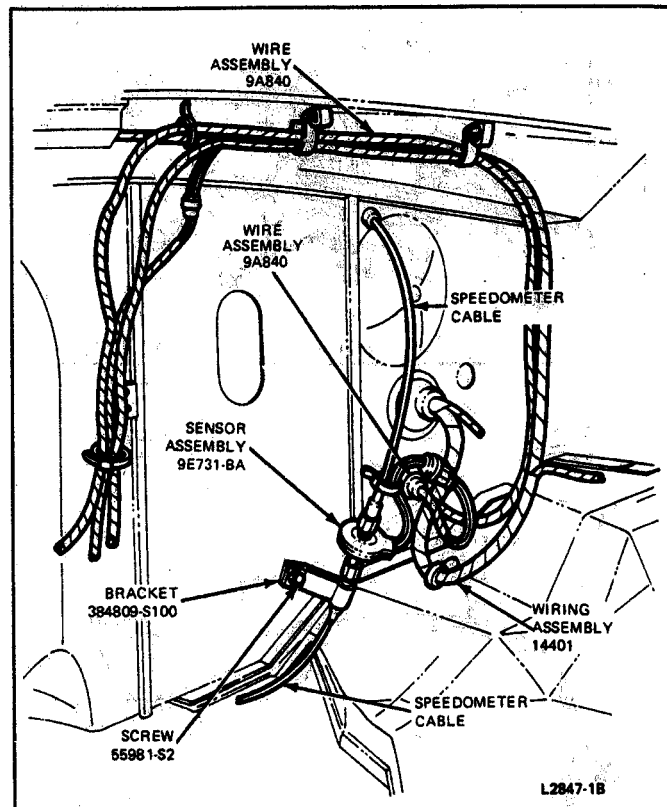


FIG. 20 Speed Sensor Installation—Engine Compartment—E-150—E-350

maintained manually, a problem exists with the speed control system (e.g., bead chain needs adjustment, vacuum leak or vacuum source not connected to the 5/16 inch port, a damaged servo or amplifier, etc). If SET speed cannot be maintained without a transmission kickdown, the speed control system is normal and the powertrain capacity is the limiting factor.

NOTE: When the vehicle speed decreases about 16.1 Km/h (10 mph) below the SET speed, the speed control system will, by design, cancel control (similar to the cancellation that occurs when the stop lamps are activated).

ADJUSTMENTS

Linkage Adjustment—Bead Chain (All Except 6.9L Engine)

Adjust the bead chain to obtain 1.53-3.17mm (0.060-.125 inch) actuator arm free travel when the engine is at hot idle (Figs. 11, 12, 13, 14, 16, 17 and 18). The adjustment should be made to take as much slack out of the bead chain as possible **without restricting the carburetor lever from returning to idle**. The tighter the bead chain the better performance of the speed control system. Cut off chain in excess of four beads. On vehicles equipped with a solenoid anti-diesel valve, perform this adjustment with the ignition switch in the Off position.

Linkage Adjustment—Actuator Cable (6.9L Engine)

Refer to Figs. 15 and 19.

1. Snap the molded speed control actuator cable retainer over the accelerator cable end fitting attached to the throttle ball stud.

SPEED CONTROL DOES NOT WORK

TEST STEP		RESULT	ACTION TO TAKE
A0	VERIFY THE CONDITION		GO to A1.
A1	CHECK CONNECTIONS		
	<ul style="list-style-type: none"> Check all electrical and vacuum connections. 	<input checked="" type="radio"/> OK ► <input type="radio"/> OK ►	GO to A2. SERVICE or REPLACE as required.
A2	CHECK BRAKE LAMP		
	<ul style="list-style-type: none"> Press brake pedal. Check to see that brake lamp is operating. 	<input checked="" type="radio"/> OK ► <input type="radio"/> OK ►	GO to A3 if manual transmission. If automatic transmission GO to A4. SERVICE brake lamp circuit.
A3	CHECK CLUTCH SWITCH (MANUAL TRANSMISSION)		
	<ul style="list-style-type: none"> Check clutch switch for proper operation. 	<input checked="" type="radio"/> OK ► <input type="radio"/> OK ►	GO to A4. SERVICE as required.
A4	CHECK THROTTLE LINKAGE		
	<ul style="list-style-type: none"> Check throttle linkage bead chain (or cable). 	<input checked="" type="radio"/> OK ► <input type="radio"/> OK ►	GO to A5. SERVICE as required.
A5	CHECK LINKAGE OPERATION		
	<ul style="list-style-type: none"> Check the throttle linkage for proper operation. 	<input checked="" type="radio"/> OK ► <input type="radio"/> OK ►	GO to A6. SERVICE as required.
A6	CHECK VACUUM		
	<ul style="list-style-type: none"> Check vacuum at servo. NOTE: 2.5 inches of Hg (1.22 psi) is minimum vacuum for normal servo operation. The vacuum source hose is attached to the 5/16 inch, vacuum fitting port or the vacuum reservoir "VAC" port with the 6.9L diesel engine. The servo vacuum source hose is connected to the unmarked vacuum reservoir port.	<input checked="" type="radio"/> OK ► <input type="radio"/> OK ►	GO to A8. GO to A7.
A7	CHECK DUMP VALVE		
	<ul style="list-style-type: none"> Check vacuum dump valve. 	<input checked="" type="radio"/> OK ► <input type="radio"/> OK ►	SERVICE or REPLACE vacuum hose as required. SERVICE or ADJUST as required.

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SPEED CONTROL DOES NOT WORK (Continued)

TEST STEP		RESULT	ACTION TO TAKE
A8	PERFORM CONTROL SWITCHES AND CIRCUIT TESTS		
	<ul style="list-style-type: none"> Perform control switches and circuit tests as described in this Section. 	<p>(OK) →</p> <p>(X) →</p>	<p>GO to A9.</p> <p>SERVICE circuit or REPLACE horn pad assembly as required.</p>
A9	PERFORM SERVO TESTS		
	Perform servo tests as described in this Section.	<p>(OK) →</p> <p>(X) →</p>	<p>GO to A10.</p> <p>REPLACE actuator.</p>
A10	PERFORM SENSOR TEST		
	<ul style="list-style-type: none"> Perform speed sensor test as described in this Section. 	<p>(OK) →</p> <p>(X) →</p>	<p>GO to A11.</p> <p>REPLACE speed sensor.</p>
A11	PERFORM AMPLIFIER TEST		
	<ul style="list-style-type: none"> Perform amplifier test as described in this Section (Substitution). 	<p>Problem corrected →</p> <p>Problem not corrected →</p>	<p>INSTALL a new amplifier.</p> <p>EXAMINE all connectors carefully for proper contact. SERVICE as required. REMOVE substitute amplifier.</p>

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- Remove the adjuster retainer clip, if installed, from the adjuster mounting tab.
- Insert the speed control actuator cable adjuster mounting tab in the slot provided in the accelerator cable support bracket.
- Pull cable through adjuster until a slight tension is felt **without** opening the throttle plate or increasing idle rpm.
- Insert adjuster retainer clip slowly until engagement is felt and then push downward until it locks in position.

Vacuum Dump Valve Adjustment

Refer to Vacuum Dump Valve Test in this Section.

REMOVAL AND INSTALLATION**Control Switches****Removal**

- Remove the two retaining screws holding the horn pad assembly to the steering wheel (Fig. 1).
- Lift up the pad assembly to expose the horn and speed control wire terminals. Disconnect and remove the horn pad assembly.

Installation

Attach the wires to the steering wheel hub and the horn pad assembly to the steering wheel with the two retaining screws (Fig. 2).

NOTE: Do not replace individual switch of horn pad assembly.

Speed Sensor**Removal**

- Separate the electrical two way connector leading to the amplifier assembly.
- Disconnect the upper and lower speedometer cables at the speed sensor (Figs. 16, 17 and 20).
- Remove the speed sensor.

Installation

- Install the speed sensor.
- Install O-ring seals on sensor.
- Connect the upper and lower speedometer cables.

NOTE: Torque limits are 3.9-4.5 N·m (30-40 in-lbs). Excessive torque may cause binding or sensor damage.

- Connect the electrical connector leading to the amplifier assembly.

SPEED CONTROL OPERATION IS INTERMITTENT

TEST STEP		RESULT	ACTION TO TAKE
B0	VERIFY THE CONDITION		
	<ul style="list-style-type: none"> Note carefully when intermittent action occurs. 		GO to B1.
B1	INSPECT VISUALLY		
	<ul style="list-style-type: none"> Perform visual inspection test. 	If intermittent action occurs while cruising → If intermittent action occurs while using control buttons or turning steering wheel →	GO to B2. GO to B4.
B2	CHECK VACUUM TO SERVO		
	<ul style="list-style-type: none"> Check vacuum supply to servo. <p>NOTE: 2.5 inches of Hg (1.22 psi) is minimum vacuum for normal servo operation. The vacuum source hose is attached to the 5/16 inch engine vacuum-fitting port or the vacuum reservoir "VAC" port with the 6.9L diesel engine.</p>	(OK) → (X) →	GO to B3. SERVICE vacuum supply.
B3	PERFORM SERVO ASSEMBLY TEST		
	<ul style="list-style-type: none"> Perform servo assembly test. Lightly tap servo body while making test. 	(OK) → (X) →	SUBSTITUTE known good amplifier if OK — properly INSTALL amplifier. REPLACE servo assembly.
B4	PERFORM CONTROL SWITCHES AND CIRCUIT TESTS		
	<ul style="list-style-type: none"> Perform control switches and circuit tests as described in this Section. 	(OK) → (X) →	SUBSTITUTE known good amplifier if OK — properly INSTALL amplifier. REPAIR circuits, REPLACE horn pad assembly. CLEAN or SERVICE three copper brushes and steering wheel ring.

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Amplifier Assembly**Removal**

- Disconnect the connectors at the amplifier (Fig. 3).
- Remove the attaching screws or nuts that fasten the amplifier bracket to the vehicle.
- Remove the amplifier assembly and mounting bracket from the vehicle.
- Remove the amplifier assembly from the mounting bracket.

Installation

- Install the amplifier on the mounting bracket.

- Connect the connectors to the amplifier (Fig. 3 and 4).
- Attach the amplifier assembly and mounting bracket to the vehicle with the attaching screws or nuts.
- Road test and check the system for proper operation.

Servo Assembly (Throttle Actuator)**Removal**

- Disconnect the wiring harness connectors under the hood at the servo assembly (Figs. 11 through 19).

**SPEED CONTROL OPERATES BUT DOES NOT
ACCELERATE OR COAST DOWN PROPERLY**

TEST STEP		RESULT	ACTION TO TAKE
C0	PERFORM VISUAL INSPECTION TEST		
	<ul style="list-style-type: none"> • Visually inspect system. 	<p align="center">⊙ OK ▶</p> <p align="center">⊗ OK ▶</p>	<p align="center">GO to C1.</p> <p align="center">SERVICE or REPLACE affected circuit.</p>
C1	PERFORM CONTROL SWITCHES AND CIRCUIT TESTS		
	<ul style="list-style-type: none"> • Perform control switches and circuit tests as described in this Section. 	<p align="center">⊙ OK ▶</p> <p align="center">⊗ OK ▶</p>	<p align="center">GO to C2.</p> <p align="center">SERVICE circuits or REPLACE horn pad assembly.</p>
C2	PERFORM SERVO ASSEMBLY TEST		
	<ul style="list-style-type: none"> • Perform servo assembly test as described in this Section. 	<p align="center">⊙ OK ▶</p> <p align="center">⊗ OK ▶</p>	<p align="center">SUBSTITUTE known good amplifier if OK, REPLACE amplifier.</p> <p align="center">REPLACE servo assembly.</p>

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2. Disconnect the adjuster from accelerator cable and disconnect the vacuum hose at the servo Y.
3. Remove the screw attaching the actuator cable to the retaining bracket.
4. Remove the pins and nuts retaining the servo assembly to the mounting bracket and remove the servo assembly.

Installation

1. Position the servo assembly to the bracket and install the retaining nuts. Connect the vacuum hose.
2. Attach the actuating cable to the retaining bracket.
3. Connect the adjuster to the accelerator cable.
4. Connect the wiring harness connectors under the hood at the servo assembly.

Actuator Cable

Follow the same procedure as used for removal and installation of the servo Assembly in this Section. Remove the actuator cable from the servo assembly (Figs. 11 through 19). Reverse the procedure for installation.

Vacuum Dump Valve

Removal

1. Remove the vacuum hose from the valve and remove the bracket mounting screw (Fig. 3, View B). On F-Series or Bronco vehicles the dump valve can be replaced without removing the bracket (Fig. 4, Views B and C).
2. Remove the valve and bracket assembly.
3. Remove the valve from the bracket.

Installation

1. Install the valve to the bracket.
2. Install the bracket mounting screw.
3. Connect the vacuum hose.
4. Adjust dump valve.

Vacuum Reservoir

Refer to Figs. 15 and 19.

Removal

1. Disconnect both vacuum hoses from the two ports located on the reservoir.
2. Remove the two nuts retaining the reservoir from the underside of the left hand apron and remove the reservoir.

Installation

1. Position the reservoir to the left hand apron and secure with two nuts and tighten.
2. Connect the two vacuum hoses to the reservoir.

NOTE: Be certain when connecting the vacuum hoses that hoses are connected to the proper vacuum outlet at the reservoir.

Ground Brush

Removal

1. Remove the steering wheel for access. Refer to Section 13-06.
2. Snap the brush assembly out of the turn signal switch (Fig. 5).

SPEED CONTINUOUSLY CHANGES UP AND DOWN

TEST STEP		RESULT	ACTION TO TAKE
D0	VERIFY CONDITION		GO to D1.
D1	CHECK THROTTLE LINKAGE		
	<ul style="list-style-type: none"> Check throttle linkage for proper operation and adjustment. 	<input checked="" type="radio"/> OK ► <input type="radio"/> OK ►	GO to D2. SERVICE or ADJUST as required.
D2	CONTINUITY CHECK		
	<ul style="list-style-type: none"> Check continuity of circuits 147, 148 and 149 on F-150 — F-350 and Bronco. Check continuity of circuits 735, 827 and 828 on E-150 — E-350. 	<input checked="" type="radio"/> OK ► <input type="radio"/> OK ►	GO to D3. REPAIR or REPLACE wiring as necessary.
D3	TEST SERVO		
	<ul style="list-style-type: none"> Perform servo test as described in this Section. 	<input checked="" type="radio"/> OK ► <input type="radio"/> OK ►	GO to D4. REPLACE as required.
D4	CHECK SPEEDOMETER CABLES		
	<ul style="list-style-type: none"> Check speedometer cables for proper routing, no sharp bends or binding. 	<input checked="" type="radio"/> OK ► <input type="radio"/> OK ►	GO to D5. SERVICE as required.
D5	CHECK SENSOR		
	<ul style="list-style-type: none"> Check sensor for free operation. 	<input checked="" type="radio"/> OK ► <input type="radio"/> OK ►	GO to D6. REPLACE sensor.
D6	TEST SENSOR		
	<ul style="list-style-type: none"> Perform sensor test as described in this Section. 	<input checked="" type="radio"/> OK ► <input type="radio"/> OK ►	GO to D7. REPLACE speed sensor.
D7	CHECK DUMP VALVE		
	<ul style="list-style-type: none"> Check vacuum dump valve. 	<input checked="" type="radio"/> OK ► <input type="radio"/> OK ►	GO to D8. SERVICE or ADJUST as required.
D8	TEST AMPLIFIER		
	<ul style="list-style-type: none"> Perform amplifier test as described in this Section. 	Corrects problem ► Does not correct problem ►	REPLACE amplifier. CHECK circuit connections for good contacts. SERVICE as required.

**SPEED CONTROL DOES NOT DISENGAGE
WHEN BRAKES ARE APPLIED**

TEST STEP		RESULT	ACTION TO TAKE
E0	VERIFY THE CONDITION		GO to E1.
E1	CHECK STOPLAMPS		
	<ul style="list-style-type: none"> Apply brakes and observe stop lamps. 	(OK) ► (X) ►	GO to E2. SERVICE stoplamp circuit as required. VERIFY fuses are not open. GO to E2.
E2	CHECK DUMP VALVE		
	<ul style="list-style-type: none"> Check vacuum dump valve. 	(OK) ► (X) ►	GO to E3. ADJUST or SERVICE as required.
E3	CHECK SERVO		
	<ul style="list-style-type: none"> Check servo operation and throttle linkage. 	(OK) ► (X) ►	GO to E4. REPLACE servo.
E4	TEST AMPLIFIER		
	<ul style="list-style-type: none"> Perfrom amplifier test as described in this Section. 	Corrects problem ► Does not correct problem ►	REPLACE amplifier. CHECK contacts of green connector. SERVICE as required.

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Installation

1. Install the ground brush in the turn signal switch. (If the turn signal switch was lifted off the column when removing the ground brush, install the turn signal switch.)
2. Install the steering wheel horn pad assembly and the steering wheel (Fig. 2). Refer to Section 13-06 for steering wheel installation.



Clutch Deactivator Switch (Manual Transmission Only)

1. Remove nut and bolt attaching switch to bracket (Fig. 4, View E).
2. Disconnect switch connector.
3. Reverse steps 1 and 2 for installation.

SPEED WILL NOT SET IN SYSTEM







TEST STEP		RESULT	ACTION TO TAKE
F0	VERIFY THE CONDITION		GO to F1:
F1	CHECK THROTTLE LINKAGE		
	<ul style="list-style-type: none"> • Check throttle linkage for proper operation and adjustment 	<input checked="" type="radio"/> OK → <input type="radio"/> OK →	GO to F2. ADJUST or SERVICE as required.
F2	CHECK CONNECTIONS		
	<ul style="list-style-type: none"> • Check system circuit connections. 	<input checked="" type="radio"/> OK → <input type="radio"/> OK →	GO to F3. SERVICE as required.
F3	CHECK CONTROL SWITCH		
	<ul style="list-style-type: none"> • Check control switch circuit. 	<input checked="" type="radio"/> OK → <input type="radio"/> OK →	GO to F4. SERVICE switch circuit as required.
F4	CHECK DUMP VALVE		
	<ul style="list-style-type: none"> • Check vacuum dump valve. 	<input checked="" type="radio"/> OK → <input type="radio"/> OK →	GO to F5 for manual transmission, F6 for automatic transmission. ADJUST or SERVICE as required.
F5	CHECK CLUTCH SWITCH		
	<ul style="list-style-type: none"> • Check clutch switch. 	<input checked="" type="radio"/> OK → <input type="radio"/> OK →	GO to F6. SERVICE switch as required.
F6	CHECK STOPLAMPS		
	<ul style="list-style-type: none"> • Check stoplamps, switch and circuit. 	<input checked="" type="radio"/> OK → <input type="radio"/> OK →	GO to F7. SERVICE lamps and circuit as required.
F7	CHECK SERVO		
	<ul style="list-style-type: none"> • Check servo for proper operation. 	<input checked="" type="radio"/> OK → <input type="radio"/> OK →	GO to F8. REPLACE servo.
F8	CHECK SENSOR		
	<ul style="list-style-type: none"> • Check speed control sensor. 	<input checked="" type="radio"/> OK → <input type="radio"/> OK →	CHECK amplifier, REPLACE as required. REPLACE sensor.

**SPEED CONTROL SYSTEM DOES NOT DISENGAGE WHEN CLUTCH PEDAL IS DEPRESSED
(MANUAL TRANSMISSION ONLY)**

TEST STEP		RESULT	ACTION TO TAKE
G0	VERIFY		
	<ul style="list-style-type: none"> • Verify system disengages when stoplamp switch is activated. • Check clutch switch operation. 	<p align="center"> <input type="radio"/> OK  <input checked="" type="radio"/> OK  </p>	<p> <input type="radio"/> SERVICE or REPLACE wire assembly 9A840 as required. <input checked="" type="radio"/> SERVICE or REPLACE as required. </p>

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SPEED GRADUALLY INCREASES OR DECREASES AFTER SPEED IS SET

TEST STEP		RESULT	ACTION TO TAKE
H0	VERIFY*		
	<ul style="list-style-type: none"> • Verify that engine is properly tuned. • Check accelerator action and bead chain (or actuator cable) adjustment. 	<p align="center"> <input type="radio"/> OK  <input checked="" type="radio"/> OK  </p>	<p> <input type="radio"/> GO to H1. <input checked="" type="radio"/> ADJUST or CORRECT as required. </p>
H1	CHECK DUMP VALVE		
	<ul style="list-style-type: none"> • Check vacuum dump valve. 	<p align="center"> <input type="radio"/> OK  <input checked="" type="radio"/> OK  </p>	<p> <input type="radio"/> GO to H2. <input checked="" type="radio"/> ADJUST or SERVICE as required. </p>
H2	TEST SERVO		
	<ul style="list-style-type: none"> • Perform servo test. 	<p align="center"> <input type="radio"/> OK  <input checked="" type="radio"/> OK  </p>	<p> <input type="radio"/> PERFORM amplifier test. REPLACE if required. <input checked="" type="radio"/> REPLACE servo. </p>

*Perform "Speed Decreases — On Steep Grades or Under Heavy Loads" test in this Section.

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SPEED CONTROL OPERATES BUT DOES NOT RESUME ACCELERATE OR COAST DOWN PROPERLY

TEST STEP		RESULT	ACTION TO TAKE
J0	VERIFY THE CONDITION		GO to J1.
J1	CHECK FOLLOWING SWITCHES AND CIRCUITS		
	<ul style="list-style-type: none"> Check the SET-ACCEL switch, Coast switch, RESUME switch and slip ring circuits and brush contacts. 	(OK) ► (X) ►	GO to J2. SERVICE the circuit as required.
J2	TEST SERVO		
	<ul style="list-style-type: none"> Perform servo test. 	(OK) ► (X) ►	GO to J3. REPLACE servo.
J3	TEST AMPLIFIER		
	<ul style="list-style-type: none"> Perform amplifier test as described in this Section. 	Corrects problem. ► Does not correct problem. ►	REPLACE amplifier. CHECK circuit connections for proper contact. SERVICE as required.

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ROTUNDA EQUIPMENT

Model	Description
007-00013	Speed Control Tester

CL4691-1A