CHAPTER

12

Electrical Systems and Auxiliary Components

Instructor Name: (Your Name)

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Objectives

Upon completion and review of this chapter, the student should be able to:

- Demonstrate safe working procedures around batteries.
- Explain the role of the battery in a truck's electrical system.
- Verify the condition of a battery using a voltmeter, hydrometer, refractometer, and carbon pile tester.
- Describe battery maintenance procedures.
- Describe and demonstrate the safe charging procedure for batteries.

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Objectives Continued

- Jump start a vehicle with a flat battery.
- Explain the role of the charging system.
- Verify the performance of an alternator.
- Explain what full fielding and an alternator will accomplish.
- Demonstrate how to test a starter to ensure it is in good condition.
- Explain the purpose of a liftgate.
- Describe maintenance procedures that must be performed on a liftgate.
- Troubleshoot for problems with a hydraulic liftgate.

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Battery Safety

- Keep flames or sparks away from batteries. No smoking around batteries.
- Always wear eye protection and rubber gloves to protect yourself from chemical burns when handling batteries.
- Never connect or disconnect live circuits. Always turn off the unit, battery charger, or tester when attaching or removing leads. (Sparks can be produced when making or breaking live circuits.)
- Batteries should always be installed in a vented battery box, as they emit hydrogen gas when charging.
- Work in a well-ventilated area when charging batteries.
- Always keep the battery top upright to prevent spilling of the electrolyte.
- Never work alone on batteries in case of accidents.

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CAUTION

Battery electrolyte contains sulphuric acid, which can cause severe personal injury (burns) and damage to clothing and equipment. If electrolyte is accidentally spilled or splashed on your body or clothing, immediately neutralize by washing with a solution of baking soda and water. The solution should be 0.25 pounds baking soda to 1 quart water (115 grams baking soda to 1 liter of water).

Electrolyte splashed into the eyes is extremely hazardous. Eyes should immediately be held open and flushed with cool clean water for about 5 minutes; then seek medical treatment at once.

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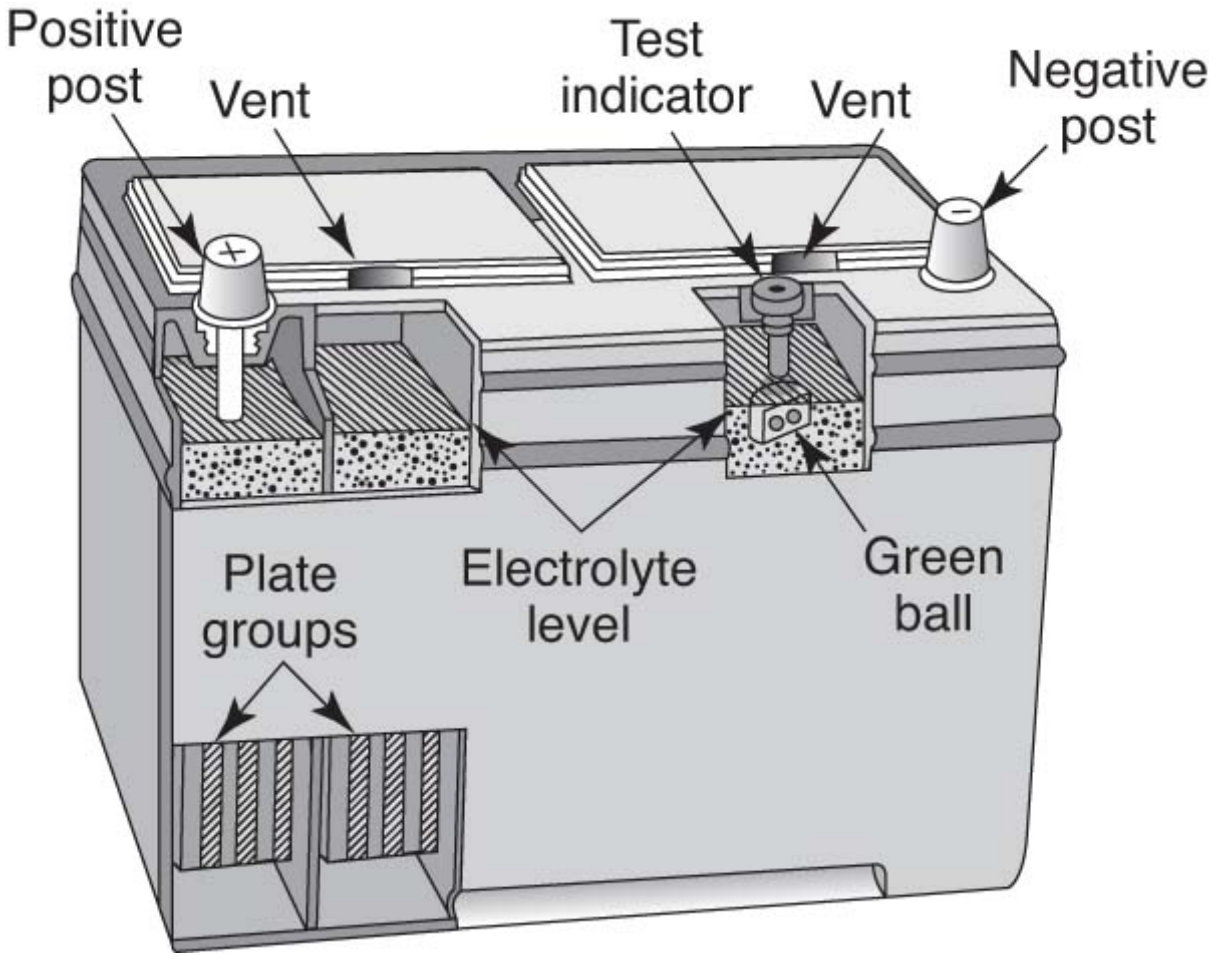
Correct Battery Fill Level



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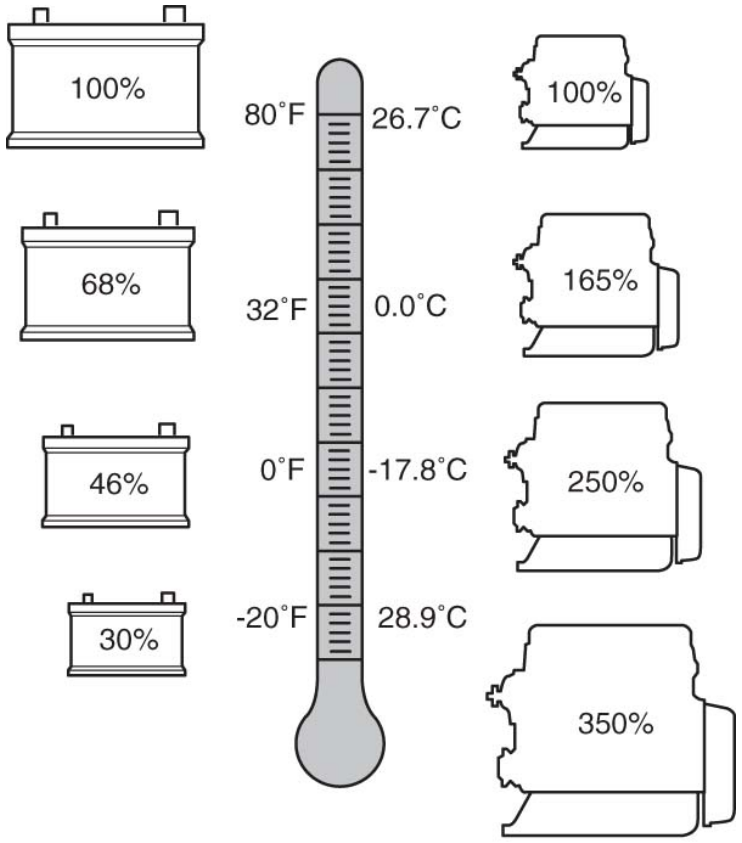
Cold Weather Effect on Battery Capacity



COLD WEATHER AFFECTS THE BATTERY AND ENGINE WHEN STARTING

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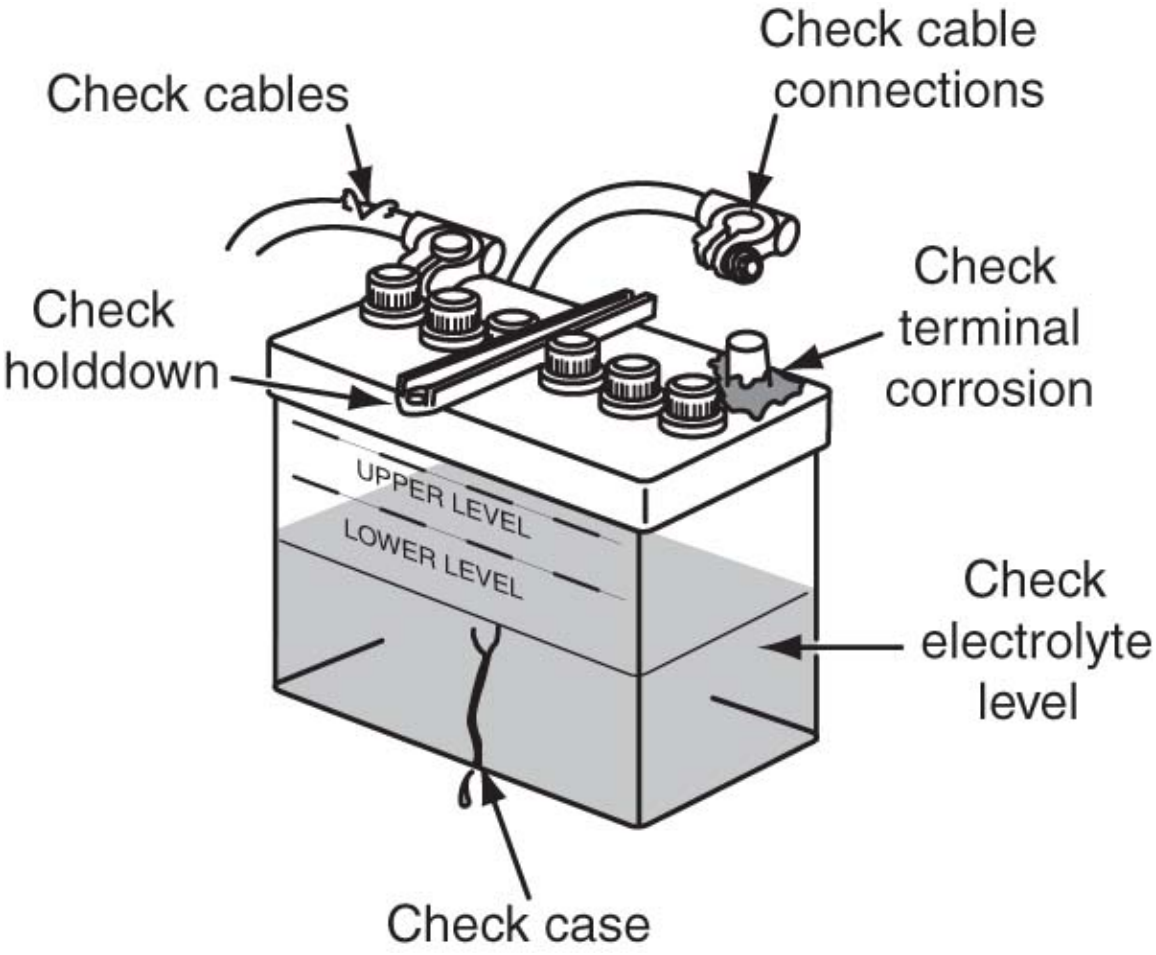
Battery Inspection Areas



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Note:

Even maintenance-free batteries should be checked monthly, especially if the battery is in severe service conditions such as extreme heat.

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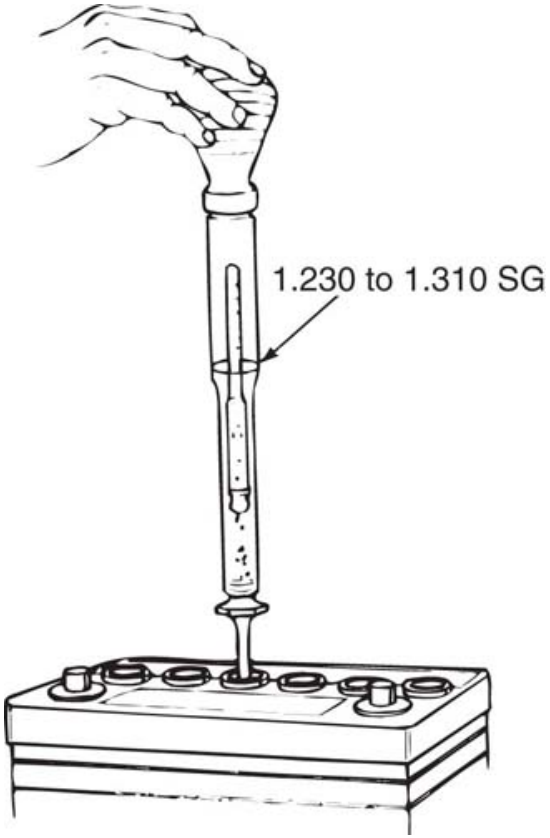
Testing Specific Gravity

Hydrometer



Refractometer

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Electrolyte Specific Gravity

Percent Charge

Meter Reading	Battery Condition
12.66 volts	100% charged
12.48 volts	75% charged
12.30 volts	50% charged
11.76 volts	0% charge

Freeze Point

Electrolyte Specific Gravity	Freeze Point
1.260	–71.3°F (–57.3°C)
1.250	–62°F (–52.3°C)
1.230	–16°F (–26.6°C)
1.200	0°F (–17.8°C)
1.100	19°F (–7.3°C)

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Testing Truck Batteries

P10-1 Dip the refractometer probe into the battery cell, wetting just the tip of the probe. Throughout this procedure, remember that battery electrolyte is corrosive.

P10-2 Deposit a drop of electrolyte onto the refractometer read-lens as shown. Close the refractive lid.

P10-3 Raise the refractometer view scope to your eye and point the refractive window toward a light source, preferably natural. The shaded area in the view finder correlates to a specific gravity reading.

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Testing Truck Batteries

P10-4 Connect a digital AVR to test a battery by connecting the polarized clamps as shown. Then connect amp pick-up lead with its arrow pointing in the direction of current flow.

P10-5 A digital AVR with inductive pick-up connected to a battery bank ready for a load test.

P10-6 Turn the load test knob CW as shown to load the battery. Typically, you will load to $^1/_2$ CCA for 15 seconds and observe the voltmeter reading, which should not drop below 9.6 volts.

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Temperature Compensation for Load Test of Battery

Battery Temperature	Minimum Test Voltage
70°F (21°C)	9.6 V
60° (15.5°C)	9.5 V
50° (10°C)	9.4 V
40° (4.4°C)	9.3 V
30° (–1.1°C)	9.1 V
20° (–6.6°C)	8.9 V
10° (–12.2°C)	8.7 V
0° (–17.7°C)	9.5 V

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CAUTION

Always follow safety practices when recharging batteries. Connect the cable from the battery charger to the battery first, before plugging in and turning the charger on. Keep sparks and flames away from the battery and never smoke around a battery. Before using a battery charger, always read the manufacturer's instructions before using the equipment.

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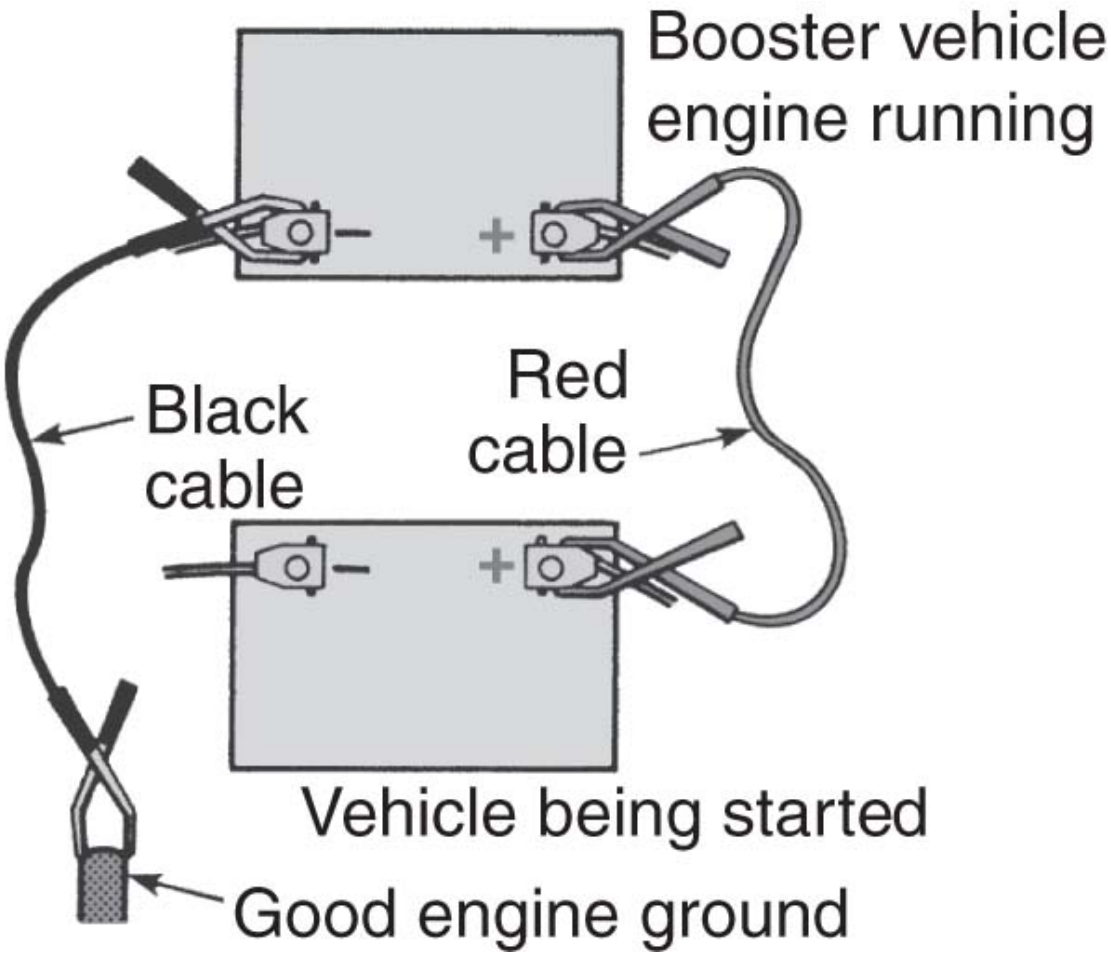
Jump Starting a Vehicle



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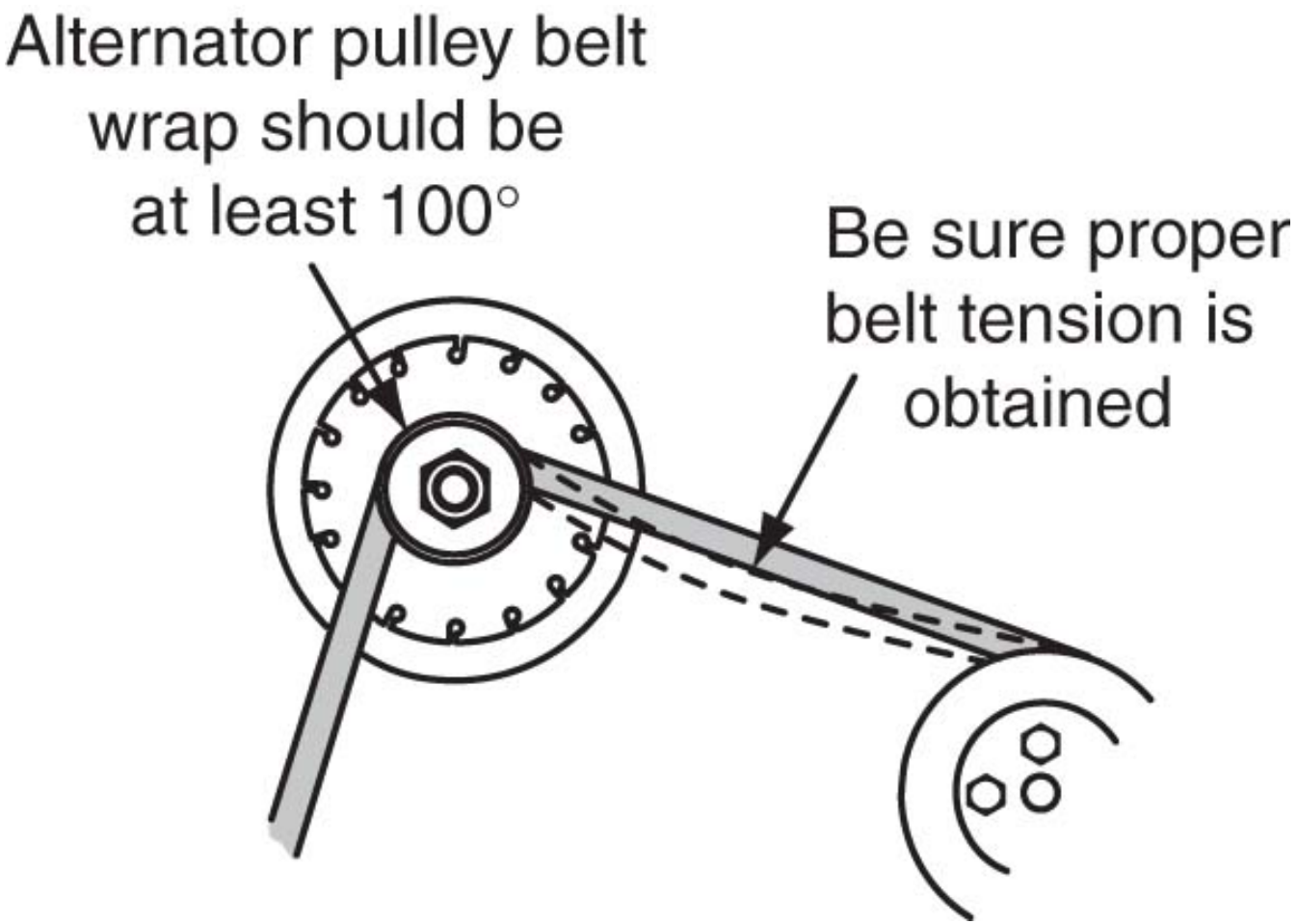
Proper Alternator Belt Contact



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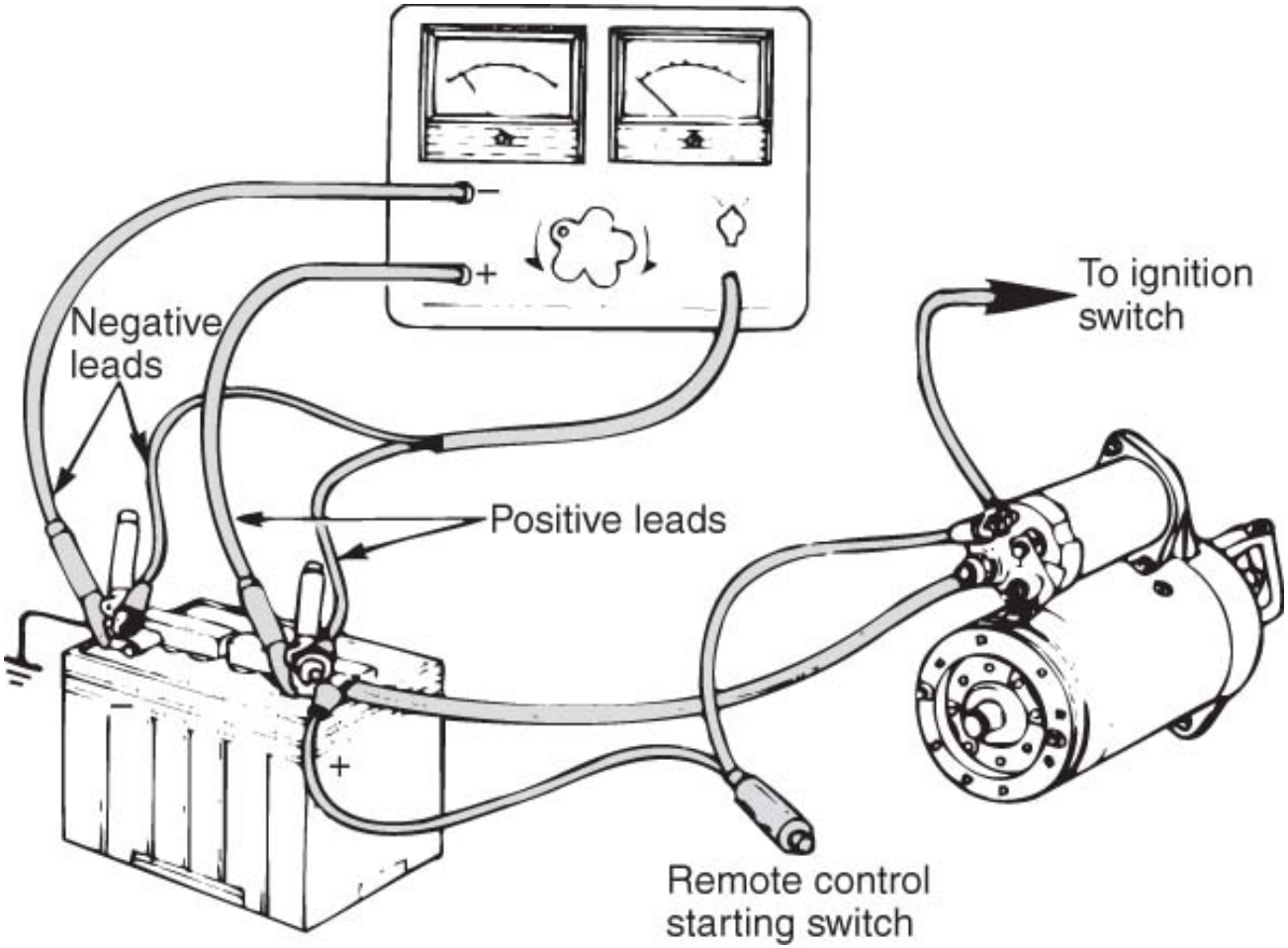
Current Draw Test of Starter



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Tech Tip:

Digital multimeters can be used with an amp clamp to make this same measurement. The amp clamp is installed on the battery ground cable so that the amperage can be read off the meter as the engine is cranking.

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Typical Liftgate

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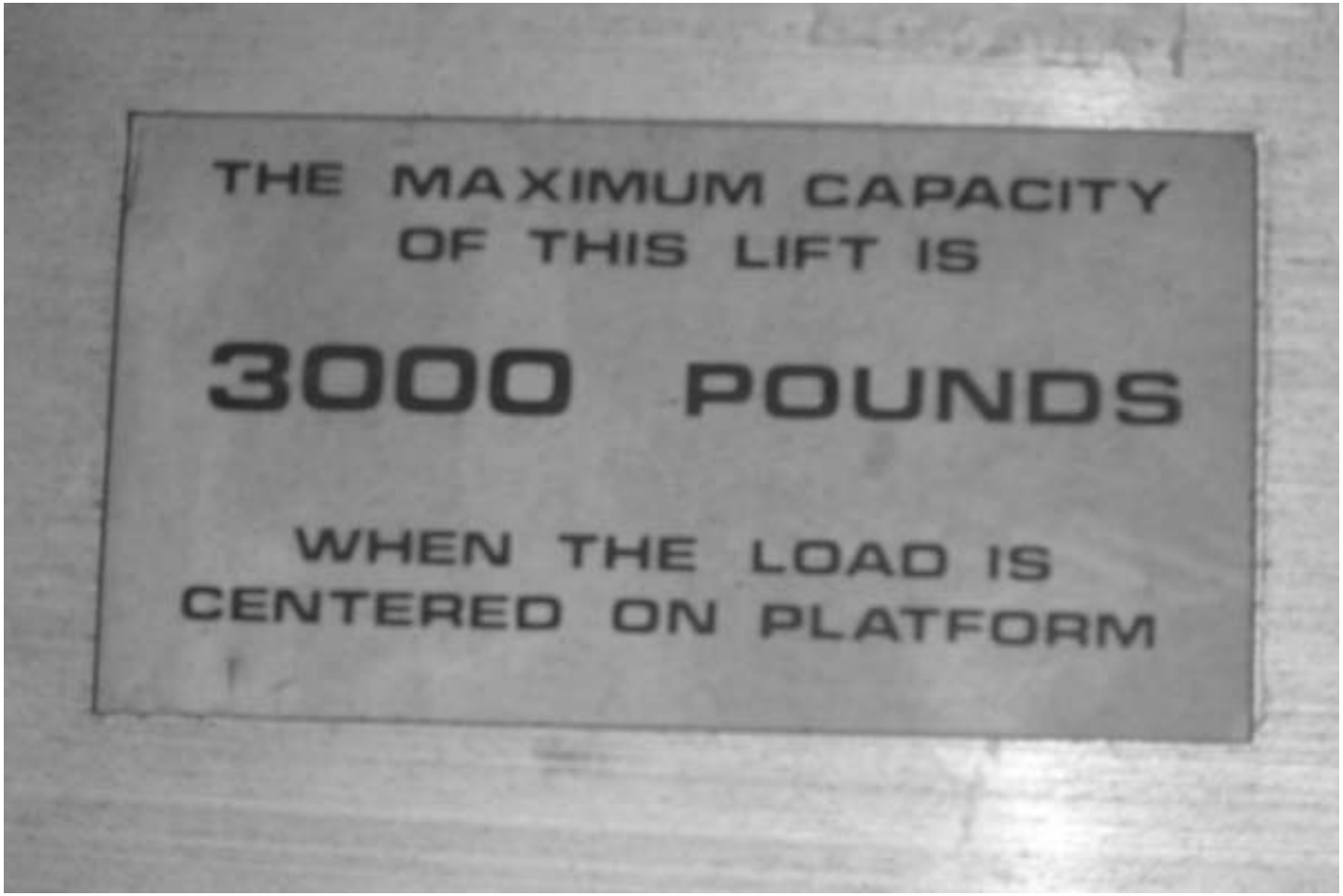
Liftgate Capacity Decal



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CAUTION

When hydraulic fluid is under pressure, it has the ability to penetrate the skin, causing serious personal injury, blindness, or death. If hydraulic fluid is injected beneath the skin, it must be surgically removed by a qualified doctor familiar with the treatment of this type of injury. Failure to adhere to this warning may result in serous Injury or death.

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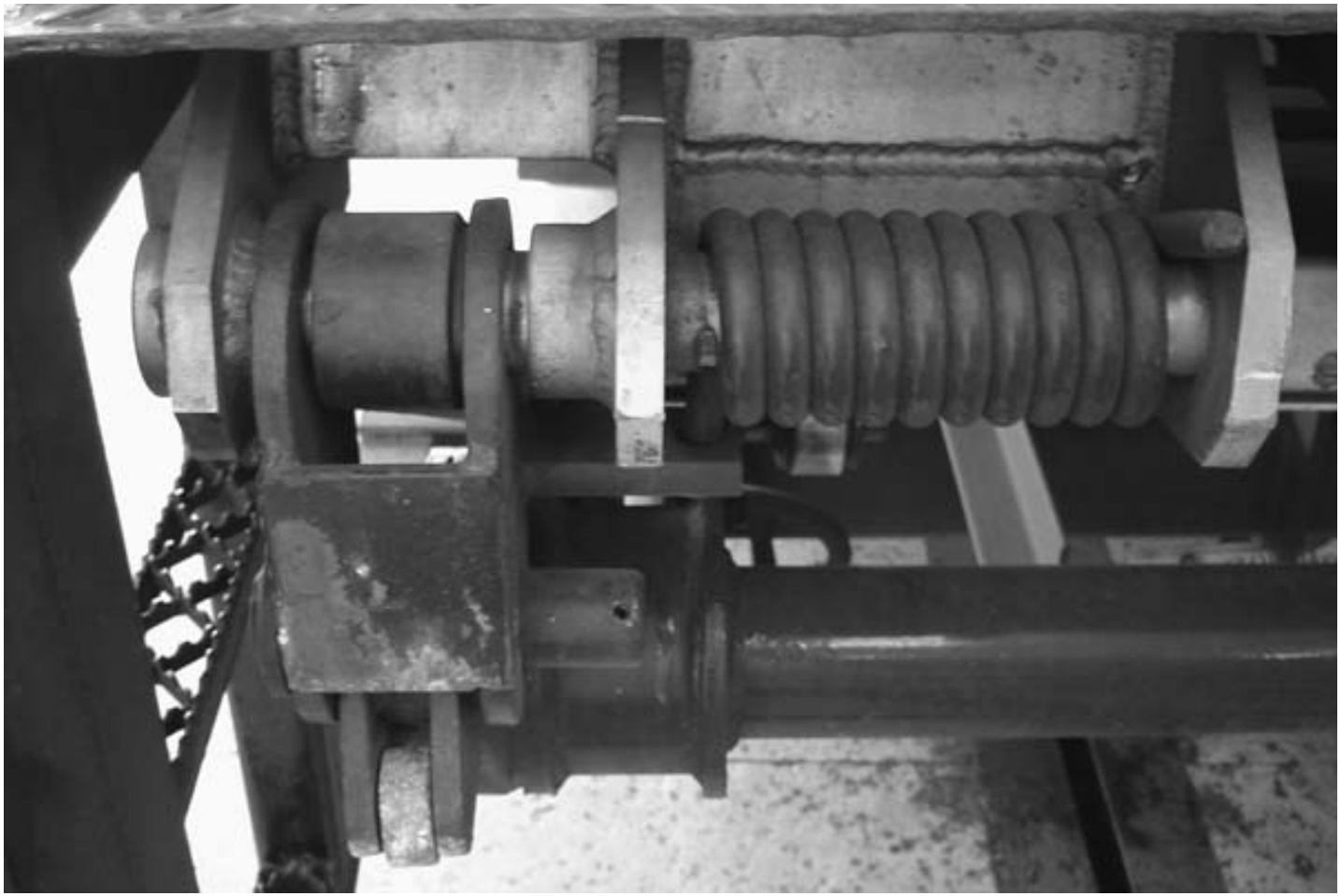
Liftgate Pivot Points



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Summary

- Battery electrolyte contains sulphuric acid, which can cause severe personal injury (burns) and damage to clothing and equipment.
- Storage batteries are the energy source for the vehicle's electrical system.
- Each of the six cell elements in a 12-volt battery produces approximately 2.1 volts.
- Batteries can be classified as conventional, low maintenance, and maintenance free.
- Use only distilled water when adding water to the battery.
- Maintenance-free batteries are designed to not require electrolyte replenishment.

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Summary Continued

- Storage batteries can be selected for their application by four different ratings. They are ampere-hour rating, cold cranking amps rating, reserve capacity rating, and the BCI (Battery Council International) dimensional group number.
- All batteries should be stored in a clean, cool, and dry environment and tested at regular intervals.
- For testing a batteries state of charge and its ability to perform, the most common methods are the open circuit voltage test and the hydrometer test for state of charge, and the load test for the batteries performance rating.
- Batteries can be charged at one of two different rates: fast charging or slow charging.

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Summary Continued

- It may be necessary to get the vehicle started when there is insufficient charge in the battery. This is referred to as jump starting or boosting a vehicle.
- The charging system converts mechanical energy to electrical energy when the engine is running.
- The voltage regulator controls the alternator output by monitoring the charge condition of the battery.
- An alternator output test checks an alternator's ability to deliver its rated output of voltage and current.

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Summary Continued

- A full field test will allow the technician to determine whether the problem with the charging system is the fault of the alternator or of the voltage regulator.
- Getting the vehicle started is possibly the most important function of the electrical system. The starter changes electrical energy from the battery into mechanical energy in the starter motor.
- A starter amp draw test is a common way of ensuring a starter is in good condition.
- A liftgate is designed to move cargo from the vehicle's floor height to ground level or vice versa.

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Summary Continued

- Before attempting to operate a truck/trailer liftgate, you must be fully trained.
- Hydraulic fluid under pressure has the ability to penetrate the skin, causing serious personal injury, blindness, or death.
- Never use your bare hand to check for fluid leaks.
- When checking the hydraulic fluid level, keep dirt, water, and other contaminants from entering the hydraulic system.

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