Dual-filament (double-contact) bulbs contain both a low-intensity filament for taillights or parking lights and a high-intensity filament for brake lights and turn signals. Bulbs come in a variety of shapes and sizes. The numbers shown are the trade numbers.

<table>
<thead>
<tr>
<th>Bulb Type</th>
<th>Trade Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dual-Contact</td>
<td>75590/5000/8000</td>
</tr>
<tr>
<td>Single-Contact</td>
<td>11001000</td>
</tr>
</tbody>
</table>

**Chart 32.1**

This chart is for typical applications. Check the owner’s manual or service information, or view manufacturer’s applications chart for exact bulb to use.
<table>
<thead>
<tr>
<th>Chart 32.1</th>
<th>Lighting And Signaling Circuits</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Column 1</strong></td>
<td><strong>Column 2</strong></td>
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<tr>
<td>Data 1</td>
<td>Data 2</td>
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<td>Data 4</td>
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<td>Data 19</td>
<td>Data 20</td>
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<td>Data 22</td>
<td>Data 23</td>
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</tbody>
</table>
Bulbs that have the same trade number have the same operating voltage and wattage. The NA means that the bulb uses a natural amber glass envelope with clear turn signal lenses.

FIGURE 32.2 Shows a 2057 dual-filament double-contact bulb that failed. Notice that the top filament broke from its mounting and melted onto the bottom filament. This bulb caused the dash lights to come on whenever the brakes were applied.

Corrosion caused the two terminals of this dual-filament bulb to be electrically connected.
FIGURE 32.5 Often the best diagnosis is a thorough visual inspection. This bulb was found to be filled with water, which caused welding problems.

FIGURE 32.6 This single-filament bulb is being tested with a digital multimeter set to read resistance in ohms. The reading of 1.1 ohms is the resistance of the bulb when cold. As soon as current flows through the filament, the resistance increases about 10 times. It is the initial surge of current flowing through the filament when the bulb is cool that causes many bulbs to fail in cold weather as a result of the reduced resistance. As the temperature increases, the resistance increases.

FIGURE 32.7 Typical brake light and taillight circuit showing the brake switch and all of the related circuit components.
FIGURE 32.8 A replacement LED taillight bulb is constructed of many small, individual light-emitting diodes.

FIGURE 32.9 The typical turn signal switch includes various springs and cams to control the switch and to cause the switch to collapse after a turn has been completed.

FIGURE 32.10 When the stop lamps and turn signals share a common bulb filament, stop light current flows through the turn signal switch.
When a right turn is signaled, the turn signal switch contacts send flasher current to the right-hand filament and brake switch current to the left-hand filament.

A hazard warning flasher uses a parallel resistor across the contacts to provide a constant flashing rate regardless of the number of bulbs used in the circuit.
FIGURE 32.14 The side-marker light goes out whenever there is voltage at both points A and B. These opposing voltage stop current flow through the side-marker light. The left turn light and left park light are actually the same bulb (usually 2057) and are shown separately to help explain how the side-marker light works on many vehicles.

FIGURE 32.15 Typical headlight circuit diagram. Note that the headlight switch is represented by a dotted outline indicating that other circuits (such as dash lights) also operate from the switch.

FIGURE 32.16 A typical four-headlight system using sealed-beam headlights.
A typical composite headlamp assembly. The lens, housing, and bulb sockets are usually included as a complete assembly.

Handle a halogen bulb by the base to prevent the skin’s oil from getting on the glass.

The igniter contains the ballast and transformer needed to provide high-voltage pulses to the arc tube bulb.
FIGURE 32.20 HID (xenon) headlights emit a whiter light than halogen headlights and usually look blue compared to halogen bulbs.

FIGURE 32.21 LED headlights usually require multiple units to provide the needed light, as seen on this Lexus LS600H.

FIGURE 32.22 Typical headlight aiming diagram as found in service literature.
FIGURE 32.23 Many composite headlights have a built-in bubble level to make aiming easy and accurate.

FIGURE 32.24 Adaptive front lighting systems rotate the low-beam headlight in the direction of travel.

FIGURE 32.25 A typical adaptive front lighting system uses two motors, one for the up-and-down movement and the other for rotating the low-beam headlight in the up-and-down direction.
FIGURE 32.26 Typical dash-mounted switch that allows the driver to disable the front lighting system.

FIGURE 32.27 Typical daytime running light (DRL) circuit. Follow the arrows from the DRL module through both headlights. Notice that the left and right headlights are connected in series, resulting in increased resistance, less current flow, and dimmer than normal lighting. When the normal headlights are turned on, both headlights receive full battery voltage, with the left headlight grounding through the DRL module.

FIGURE 32.28 Most vehicles use positive switching of the high- and low-beam headlights. Notice that both filaments share the same ground connection. Some vehicles use negative switching and place the dimmer switch between the filaments and the ground.
FIGURE 32.29 A typical courtesy light doorjamb switch. Newer vehicles use the door switch as an input for the vehicle computer, allowing the computer to turn the interior lights on or off. By placing the lights under the control of the computer, the vehicle engineers have the opportunity to delay the lights after the door is closed and to shut them off after a period of time to avoid draining the battery.

FIGURE 32.30 An automatic dimming mirror compares the amount of light toward the front of the vehicle to the rear of the vehicle and adjusts the voltage to cause the gel to darken the mirror.

UNFIGURE 32.1 The driver noticed that the taillight fault indicator on the dash was on any time the front lights were on.
UNFIGURE 32.2 A visual inspection at the rear of the vehicle indicated that the right rear taillight bulb did not light. Removing a few screws from the plastic cover revealed the taillight assembly.

UNFIGURE 32.3 The bulb socket is removed from the taillight assembly by gently twisting the base of the bulb counterclockwise.

UNFIGURE 32.4 The bulb is removed from the socket by gently grasping the bulb and pulling the bulb straight out of the socket. Many bulbs required that you rotate the bulb 90° (1/4 turn) to release the retaining clips.
UNFIGURE 32.5 The new 7443 replacement bulb is being checked with an ohmmeter to be sure that it is okay before it is installed in the vehicle.

UNFIGURE 32.6 The replacement bulb is inserted into the taillight socket and the lights are turned on to verify proper operation before putting the components back together.

UNFIGURE 32.7 Before checking the vehicle for headlight aim, be sure that all tires are at the correct inflation pressure, and that the suspension is in good working condition.
UNFIGURE 32.8 The headlight aim equipment will have to be adjusted to the slope of the floor in the service bay. Start the process by turning on the laser light generator on the side of the aimer body.

UNFIGURE 32.9 Place a yardstick or measuring tape vertically in front of the center of the front wheel, noting the height of the laser beam.

UNFIGURE 32.10 Move the yardstick to the center of the rear wheel and measure the height of the laser beam at this point. The height at the front and rear wheels should be the same.
If the laser beam height measurements are not the same, the floor slope of the aiming equipment must be adjusted. Turn the floor slope knob until the measurements are equal.

Place the aimer in front of the headlight to be checked, at a distance of 10 to 14 inches (25 to 35 cm). Use the aiming pointer to adjust the height of the aimer to the middle of the headlight.

Align the aimer horizontally, using the pointer to place the aimer at the center of the headlight.
Lateral alignment (aligning the body of the aimer with the body of the vehicle) is done by looking through the upper visor. The line in the upper visor is aligned with symmetrical points on the vehicle body.

Turn on the vehicle headlights, being sure to select the correct beam position for the headlight to be aimed.

View the light beam through the aimer window. The position of the light pattern will be different for high and low beams.
If the first headlight is aimed adequately, move the aiming tool to the second headlight on the opposite side of the vehicle. Follow the previous steps to position the aiming tool accurately.

If adjustment is required, move the headlight adjusting screws using a special tool or a 1/4 inch drive ratchet/socket combination. Watch the light beam through the aiming tool window to verify the adjustment.