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How To Aim Headlamps and Auxiliary Lamps

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Your headlamps will work as designed only if they are correctly aimed. Improperly aimed headlamps are dangerous, ineffective and illegal. The following procedures will assure correct aim of your headlamps for maximum seeing without unlawful and dangerous glare. Be sure to use the correct procedure for the specific headlamps and vehicle you are working with.

An optical beamsetter is a device that looks a bit like a TV camera. It is wheeled in front of each headlamp on your vehicle, adjusted to height, and the optics within the beamsetter permit highly precise visual aim checking and adjustment. This is definitely the most accurate way to aim lamps, but beamsetters are not yet as common in North America as they are elsewhere in the world. However, more and more optical beamsetters are placed in service all the time, so check around before deciding nobody near you has one. High-end body shops and auto dealer service departments are good bets.

If you cannot find someone who has a beamsetter and will use it correctly, you aren't necessarily out of luck. Fog lamps, driving lamps, and visually-aimable headlamps do not require a mechanical aimer or other machine in order to achieve at least passably-correct visual aim. All ECE (E-code) headlamps are visually aimable, and many newer US (DOT) headlamps can be accurately aimed visually. First, you must determine if your headlamps can accurately be aimed visually. If you have ECE (E-code, European-spec) headlamps, you can aim them visually. If your US DOT headlamp lenses are marked VOL, VO or VOR, they can be aimed visually. If your US DOT headlamps are NOT marked VOL, VO or VOR, they cannot officially be correctly aimed visually and are intended to be aimed using a mechanical aiming device. These mechanical aiming devices are all but extinct, and so you

will likely have to do the best you can using a visual method.

To prepare for aiming, the car should have at least 1/2 tank of fuel, weight in the trunk equal to the most frequently carried load (this may be a full trunk, or it may be an empty one, or anything in between), and weight in the driver's seat equivalent to the most frequent driver. All of the tires should be checked when cold to make sure they're at the correct inflation pressure. Jounce each corner of the car firmly (grasp the bumper and push down several times rhythmically) to ensure that the suspension is settled into a normal position.

Find a location that has a vertical wall and enough *level* ground for the length of the vehicle plus 25 feet (7.5 m). The wall will be used as an aiming screen. You'll need to make marks on the wall, so if it is a wall you're not allowed to deface, use tape. Measure a distance of 25 feet (7.5 m) straight back from the wall, and mark this position on the floor or ground. Align front of the vehicle with this floor mark, and then bring the vehicle straight forward, right up to the wall. Make a mark "V" on the wall directly in front of the center of the vehicle. Good references for the center point include such things as hood ornaments, grille badges and license plate brackets.

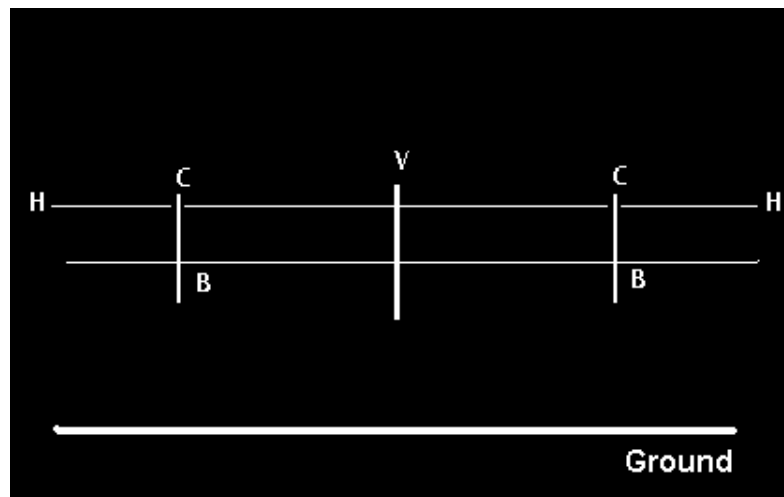
Next, make a mark "C" on the wall directly in front of the axis of each lamp. The "axis" is often marked with a dot, cross, bulb type designation or name brand, but if not, it is directly in front of the bulb. There is one axis for each lamp, so a vehicle with four lights will have four axes and a vehicle with two lights will have two, plus any auxiliary fog and/or driving lamps that may be present.

Now, move the vehicle **straight** back from the wall until the headlamps are aligned with the floor mark. Walk to the wall and make additional marks: Extend the "V" mark with a vertical line downward at least six inches. Next, connect all of the "C" marks with a horizontal line we'll call "H-H". Then, measure downward from each "C" mark that represents the axis of a lamp and place a mark "B" per the following tables.

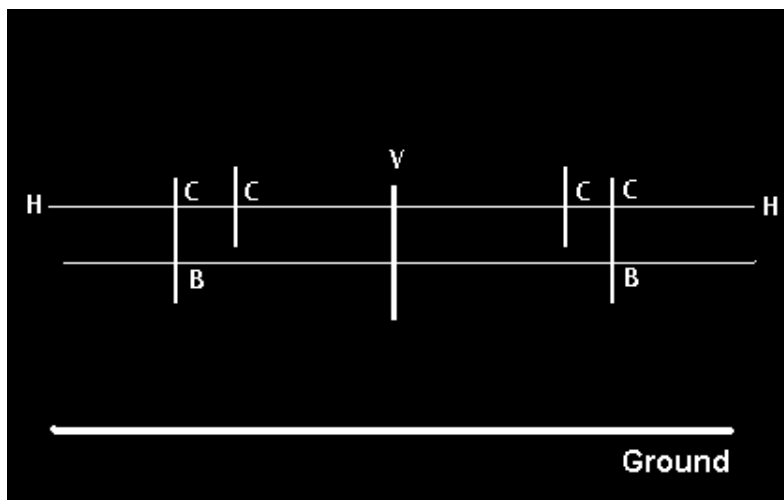
ECE (European E-code) headlamps	
Lamp axis height	Distance to measure downward
Up to 34.5" (80 cm)	3" (76 mm)
35" to 39" (89-99 cm)	4" (102 mm)

39.5" or higher (100 cm)	4.5" (114 mm)
US DOT headlamps marked VOL	
Up to 34.5" (80 cm)	2.1" (53 mm)
35" to 39" (89-99 cm)	3" (76 mm)
39.5" or higher (100 cm)	3.5" (89 mm)
US DOT headlamps marked VOR, and mechanical aim low or high/low beam lamps	
Up to 34.5" (80 cm)	N/A, do not measure downward
35" to 39" (89-99 cm)	2" (50 mm)
39.5" or higher (100 cm)	3" (76 mm)
US DOT headlamps marked VO, Mechanical-aim high-beam-only lamps, and <i>Driving</i> (auxiliary high beam) lamps	
Any mount height (80cm)	N/A, do not measure downward
Fog lamps	
Up to 18" (46 cm)	1.5" (38 mm)
18.5" to 28" (47-71 cm)	3" (76 mm)
28.5" or higher (72 cm)	4" (102 mm)

Connect these two newly-measured points with a horizontal line we'll call "B-B". After you've done all of this, your wall will be marked like this for a system of two high/low beam headlamps:



Or like this for a system of two low- or low/high beam plus two high-beam lamps:



NOTE The visual aim procedure for lamps listed above as "N/A, do not measure downward" does not require the lower B-B horizontal line. Simply connect your +C marks with a horizontal line.

Now draw a vertical line through through the center of each +C point. Do the same with the oV point. These lines make it easier to see the reference marks when you are standing 25 feet away, adjusting the aiming screws on the car. You now have an accurate plot on the wall of the height and separation of the headlamps (but ONLY if your car is level, the ground is level and the wall is vertical!). Note that the "B-B", "C" and "V" designations are for purposes of clarity in this descriptive article. It is not necessary to draw the letters on the wall-- just plot the points. Of course, you may use the letters in your aiming procedure if it will help you.

VERTICAL AIMING

The low beam pattern of a visually-aimable headlamp has a distinct horizontal cutoff. Below the cutoff is bright light. Above the cutoff is dark. The aim is determined by measuring and adjusting the height of this cutoff relative to the reference marks you plotted on the wall.

For European-spec ECE and US DOT VOL headlamps, the cutoff is at the top of the left half of the beam pattern, and it should be lined-up exactly with the B-B line.

For US DOT VOR headlamps, the cutoff is the squared-off top edge of the 'hot spot' (brightest region of the beam) on the right side of the beam pattern, and should be lined-up exactly with the applicable horizontal line per the table above.

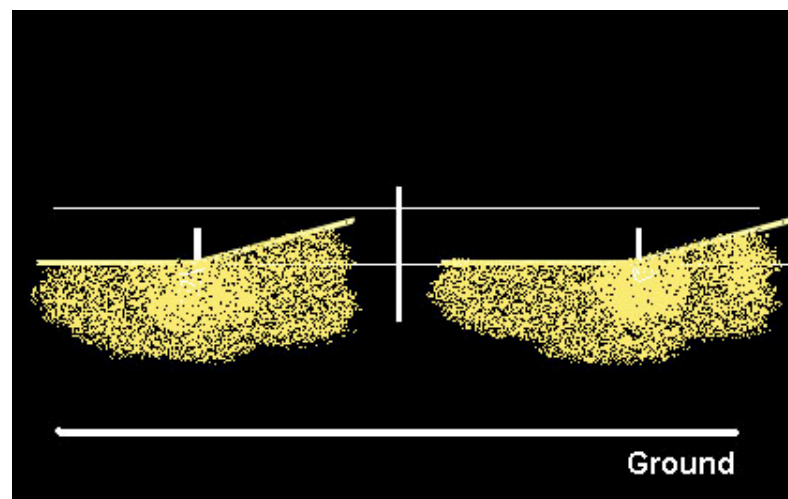
For mechanical-aim headlamps, you will have to do your best to place the top edge of the low beam 'hot spot' on the applicable horizontal line per the table above.

HORIZONTAL AIMING

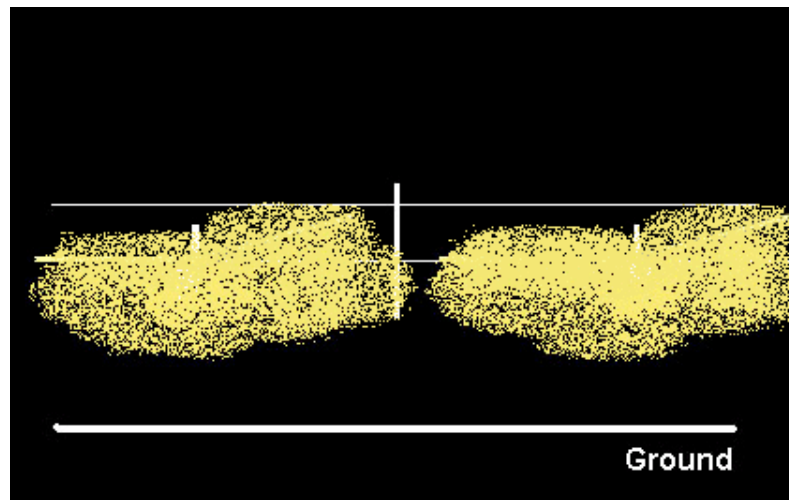
These instructions are applicable only to European ECE low beams, because US DOT VOL and VOR headlamps cannot be visually aimed horizontally, and in many cases, cannot be aimed horizontally by any means at all, because no provision for horizontal aim adjustment is provided. [This is because US regulators believe there is no way to define a visual cue, such as a kink in the cutoff, that would allow accurate left-to-right placement of a headlamp beam and that cars will not get in fender-benders that will knock the headlamps out of horizontal alignment. For what it's worth, the Europeans have been successfully aiming their headlamps vertically AND horizontally since 1955. -ed.]

European ECE headlamps have a "kink" or "elbow" at the top of the center of the beam pattern, where the cutoff bends upwards. Adjust each headlamp so that the kink lines up (left-to-right) with the +C mark for whichever headlamp you're working on. The tolerance here is +/- 2 inches of point (c). Slight leftward aim (-1") increases seeing distance down the road, but excessive leftward aim increases glare to oncoming traffic.

Here is what a correctly aimed set of European ECE or US DOT VOL headlamps looks like on low beam:



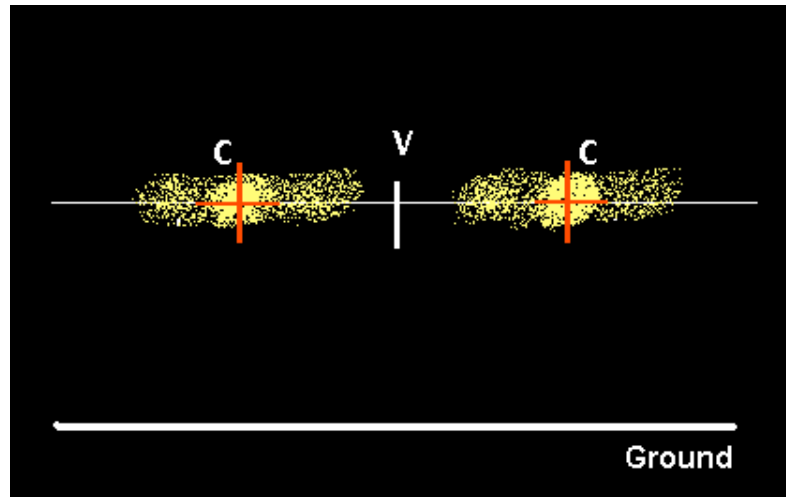
And here is what a correctly aimed set of US DOT VOR or mechanical-aim headlamps looks like on low beam:



After adjusting a high/low beam headlamp in the low beam mode, do not attempt to readjust it in high beam mode. All high/low beam headlamps are meant to be adjusted on the low beam setting only-- the high beam adjustment is correct when the low beam adjustment is correct. If you are experiencing a problem where setting the low beams correctly places the high beams too high, but setting the high beams correctly places the low beams too low, you are dealing with a poorly-designed headlamp.

DRIVING LAMPS & HIGH-BEAM-ONLY LAMPS IN 4-LAMP SYSTEMS

These instructions apply to ECE high beam headlamps, US DOT high beam headlamps marked "VO", and all driving lamps. These must be adjusted so that the bright, center "hot spot" of the beam is straight ahead of the lamp in both the vertical and horizontal planes. Use the intersection of the horizontal and vertical lines at point +C for each headlamp as "cross-hair sights" to center the high beam hot spot, like this:



Make sure to work on one lamp at a time. It is best to disconnect the power to the headlamp you are not working on, so light from the other lamp's beam pattern doesn't mislead your eyes. Also be sure to disconnect or cover the adjacent high/low beam lamp when you are aiming its high-beam-only neighbour.

FOG LAMPS

Fog lamps are aimed using a procedure very similar to that used for low-beam headlamps. The cutoff extends clear across the top of the beam pattern. Simply align the fog lamp so that the cutoff at the top of the beam falls on the appropriate B-B line for the lamp mounting height, as listed in the table above.

Fog lamps produce a wide, bar-shaped beam of light. Horizontal aim is much less critical than it is with headlamps. The fog lamps should be pointed straight ahead, not leftward or rightward.

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