EURO SO BRIGHT

Further exploration of the E36 lighting solution leads to European housings—and a reasonably priced H1 bulb.

STORY AND IMAGES BY DON EILENBERGER

For many people, even the improved lighting possible using the stock E36 headlight housings (see *Roundel,* June issue) isn't enough; some prefer the pattern and looks of a European light housing. Continuing the quest for better lighting for the E36 3 Series, let's look at what options are available in European housings—along with some lighting sources that fit them.

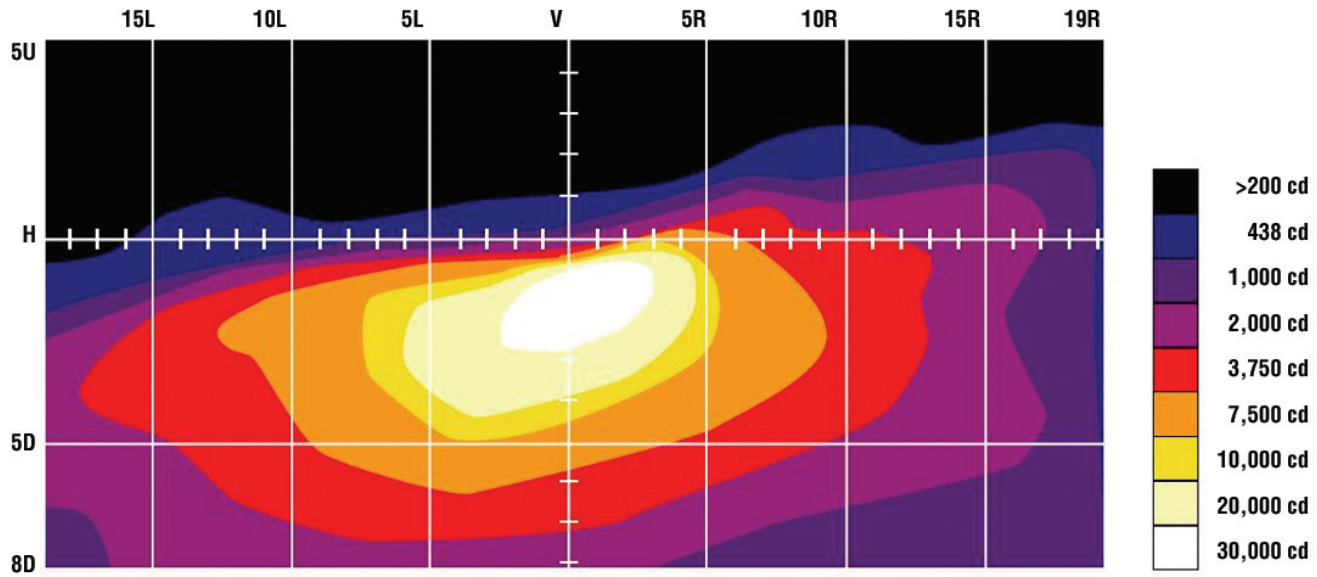
As we mentioned in June, the Euro E36 used three different headlight designs over the course of its life cycle; the most common was a design manufactured by ZKW and Bosch for BMW. This headlight assembly is widely available in the U.S. from various sources. There are also copies of this design—of varying quality—made by several Asian manufacturers. There is no real difference between the ZKW and Bosch housings—both were made to BMW's specifications—but very few of the Asian copies equal the quality of the ZKW and Bosch units.

Different housings: There are several differences between Euro housings and U.S.-spec housings, and there are several different Euro housings available for the

E36. The U.S. housing uses a polycarbonate front cover that deteriorates with time, causing loss of light and glare. The Euro housings use glass covers that are relatively resistant to time-caused deterioration, although they are subject to breakage (the Gravel Truck Syndrome).

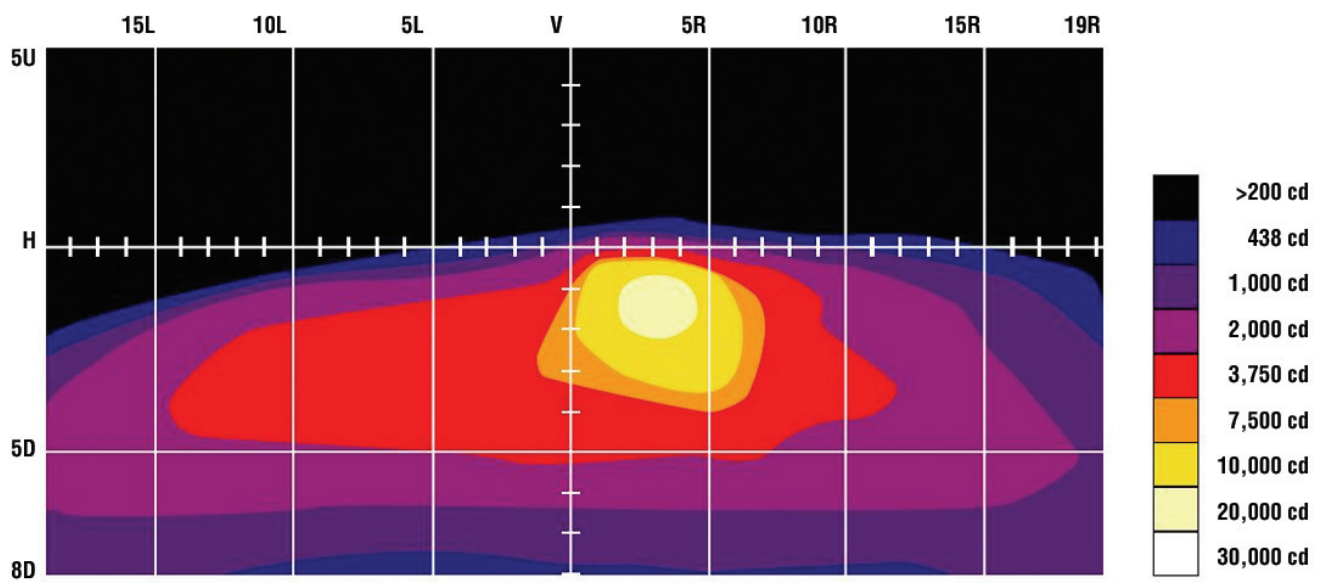
The U.S. housing uses a simple reflective low-beam housing with a prismatic beam-shaping lens. This rather crude optical assembly is the reason the beam is not very well defined. The Euro housing uses a complex reflective bulb housing with a "projector" lens, providing a very sharp and precise pattern. The U.S. lighting pattern is fairly diffuse, with a considerable amount of light above the horizon and slightly to the right of center; the Euro lighting pattern has a pronounced flat-topped pattern, with an upward ("kickup") component to the right of center (except for countries that drive on the left side of the road; their "kickup" goes to the left). The Euro upward component is very well defined.

Standard ECE (European) light pattern



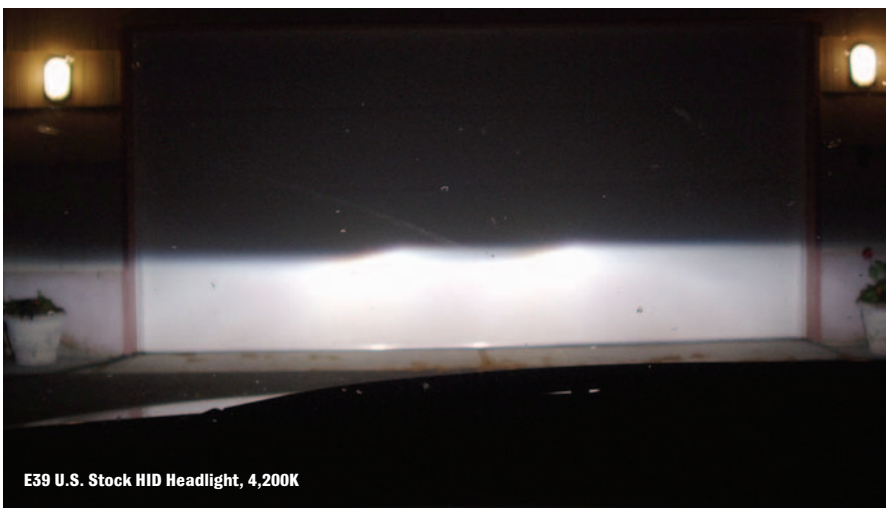
Low Beam ECE; MAX=28,808 cd (adapted from SAE 970913, p.211)

Standard U.S. DOT VOR light pattern



Low Beam U.S.; MAX=28,474 cd (adapted from SAE 970913, p.211)

As we mentioned in the June article, BMW and other European manufacturers have adopted a harmonized lighting pattern, a variant of the original European ECE pattern modified to meet the changes made to NHTSA Standard 108. The U.S. BMW HID headlight pattern is flat-topped with a wide spread below the horizon:



E39 U.S. Stock HID Headlight, 4,200K

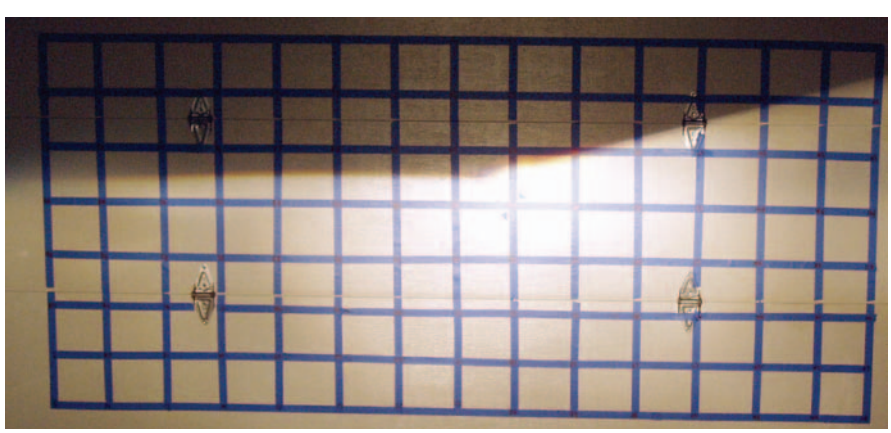
The ZKW Euro H1 housing with an HID light source shows a pronounced ECE "kickup" to the right, along with a narrower pattern below the horizon:

E36 Euro Headlight HID 6,000K

I tested various light sources for a European light housing in a standard ZKW housing, including H1 bulbs (available in the U.S. and Europe) and an HID conversion package. (The E36 never came with a factory HID lighting option, but there are numerous factories in Asia manufacturing kits to convert almost any bulb type to an HID system; this is a fairly popular conversion for E36 owners. There are also complete packages of an E36 projector-light housings with the HID light source preinstalled.)

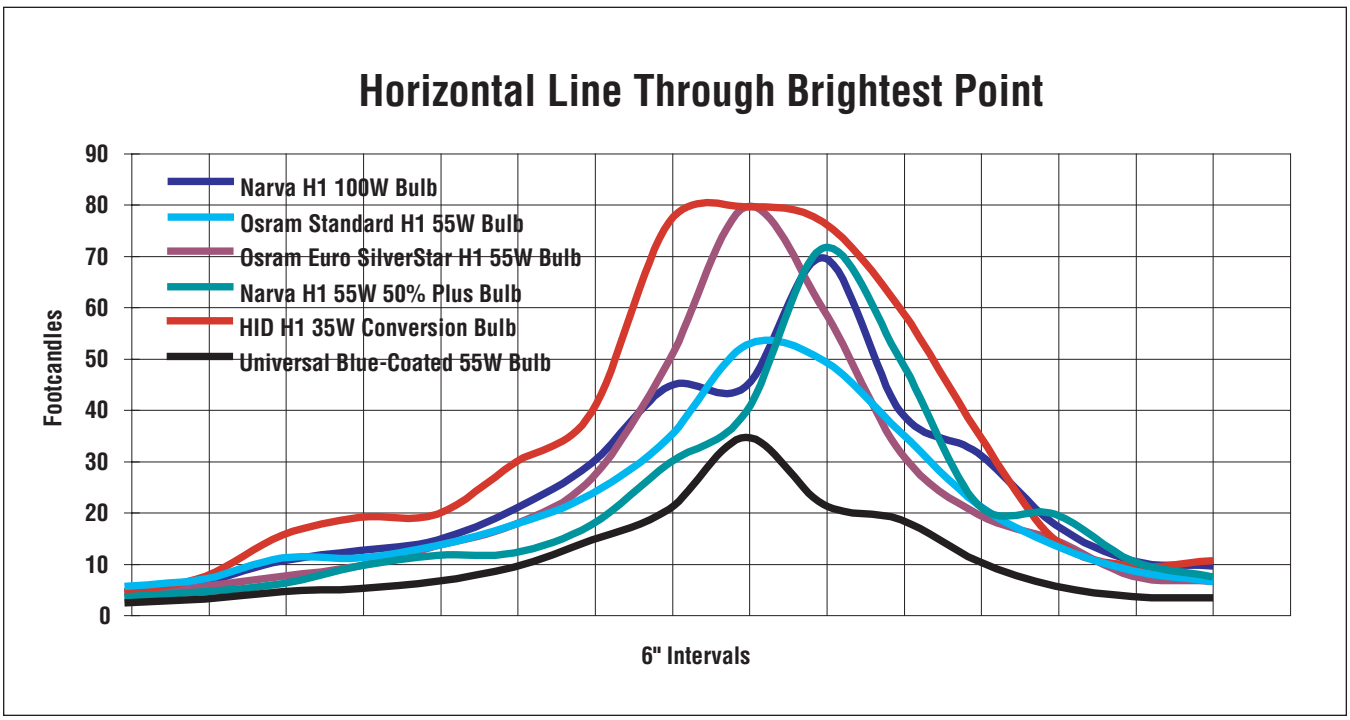
The intensity plots of the European housing are a bit more difficult to understand than the U.S. housing patterns. Due to the very sharp cutoff of the top edge of the pattern, and the six-inch intervals of our test grid, the top edge doesn't accurately reflect the true pattern of light intensity. The photo below shows what is seen on the test grid, and the plots show how the light pattern looks when plotted as an intensity plot:

BMW and other European manufacturers have adopted a harmonized lighting pattern, a variant of the original European ECE pattern modified to meet the changes made to NHTSA Standard 108.



Euro E36 H1 Housing Pattern—Standard H1 55W bulb.

Plotting the brightness of each bulb—installed in the European housing—on a horizontal line that passes through the brightest point in the plot provided the most useful information. This bright point was typically just below the point where the top line starts heading upward to the right.



Euro headlight housings: A new Hella housing appears to be a modern projector design; it can be found at the Hella web site (www.hella.com/production). There are also several German sources selling these on eBay; search the Parts and Accessory section for "BMW E36 Hella Angel." One source sells it with an HID light source; another uses halogen H7 lamps. Costs range from just over $500 with shipping to over $1,000 with the HID option. This housing has "Cellis" light rings from the manufacturer.

Hella, Bosch, and ZKW were all original-equipment manufacturers for the most common series of European light housings that can be found in the U.S. There are various Asian companies that produce copies of this design—with varying levels of quality. The OE housings are all made using BMW designs and specifications, and are functionally equivalent.

There was also one final BMW light design used in Europe, a housing made for the last of the E36s by Hella and Bosch. It uses a fully reflective housing (not a projector design) and H7 bulbs. Photos I've seen of the output pattern indicate a well-defined European pattern with a wider pattern below the horizon. This may be the best of the headlight housings made for the E36; unfortunately, it isn't available from any U.S. sources that I know of.

Some vendors also add options to the European housings they sell in the U.S. A form of the Cellis "light rings" first used


ZKW OE Headlight Housing

on the E39 5 Series is a common add-on. These "angel eyes" are mimicked using various ring designs, with light provided by everything from common bulb, to LEDs and even florescent lighting (called "Angel Eyes" or "Demon Eyes" by vendors). Vendors may also supply the European housings with an HID light source preinstalled—along with the necessary HID high-voltage ballasts with an adaptor wiring harness to connect to the stock wiring:


ZKW with Angel Eyes

Fitting Euro lights on the E36: Prices on the common European light housings range from $100 a pair (eBay) for Asian copies to $900 a pair for European-manufactured housings with all the bells and whistles (Cellis and HID additions). Installing the European light housings on an E36 isn't a difficult job. You'll need a few common tools.

The factory lights are held in place with five screws, the European ones with four. Three of the screws (at the top of each light) can be seen with the hood open; there are two more screws a bit more difficult to find. The turn signal/parking light hides one of them; this light is removed by depressing a clip that holds it to the headlight housing. The clip is easily found by looking straight down at the turn-signal light. Press the clip toward the turn-signal light and wiggle the light out.

This is the fourth screw; the fifth screw is found where the headlight housing is nearest the radiator. To see this screw you'll have to remove the protective cover between your grille and radiator, removing four Philips-head screws and two of the infamous BMW plastic push rivets. Once the cover is removed, look for openings just to the side of the headlight housing.

All of the screws go into plastic adjusters that go into the body. It is very helpful if you keep the adjusters in their original position with an open-end wrench. It isn't difficult.

Once you remove the old lights, connect the adaptor wiring harness to the new lights; then, as they say, installation is the reverse of removal—except the European lights don't use the middle top mounting position. When mounted, all edges of the glass covers should be evenly spaced from the surrounding body,

and the bottom of the glass should sit flush with the body below. If any of the gaps are uneven, loosen the screws holding the housing and adjust the plastic adjusters going into the body panels.

Alignment: European headlights are aligned differently than the U.S. units. I would strongly suggest looking at www.danielsternlighting.com/tech/aim/aim.html for complete instructions along with easy-to-understand illustrations. The fine adjustments are made with the two 8-mm Allen adjusters on the rear of the headlight housings.

Legality: None of the European housings I have seen meet the requirements and specifications of NHTSA FMVSS-108 (see "Let There Be More E36 Light" in the June issue for more information on the Federal Motor Vehicle standards regarding lighting). None of them have Department of Transportation (DOT) markings. Many vendors advertise "DOT Approved" lights; this is bogus, since the DOT does not test or "approve" any light housing (or other products). The DOT provides a specification for the output of the light (color, pattern, and intensity) from the housing; the vendor must certify that the lights conform to these specs in order to have a DOT symbol on the headlight cover.

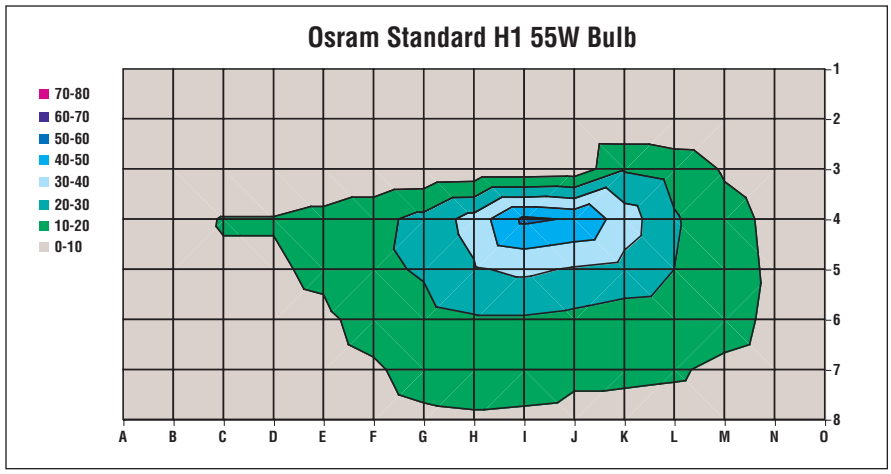
The commonly imported European housings do not meet the DOT standard due to the "kickup" to the right on the beam pattern. Which is rather odd, as this same pattern is entirely legal on a motorcycle.

Will this be a problem for you? If you live in a state where your vehicle inspection is rigorous, it may. In some states the motor-vehicle agencies have adopted NHTSA Standard-108 as part of the motor-vehicle code; in these states, use of these lights is not legal, and it is quite likely that during vehicle inspection you will be failed for having an illegal headlight assembly. Use of any of these housings is your responsibility and at your own risk.

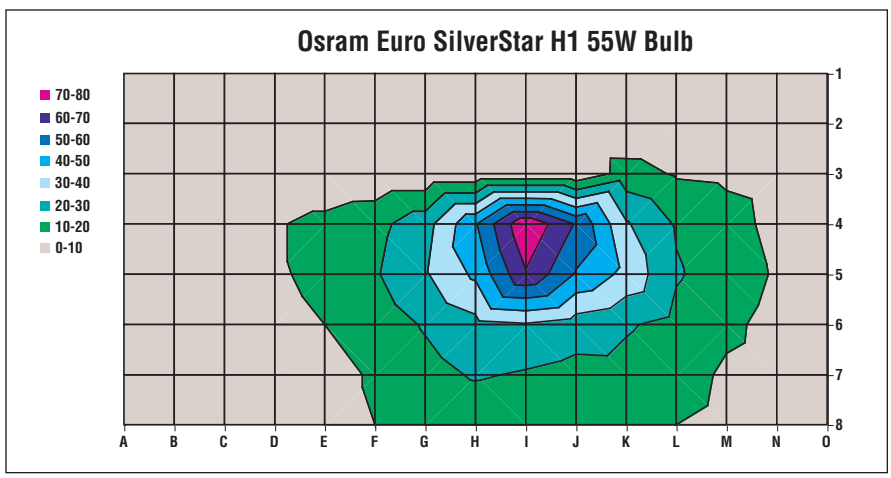
TESTING THE LIGHT SOURCE

I tested the following light sources: Standard Osram Halogen 55W H1 bulb; Osram Euro (this bulb is not available over the counter in the U.S., but it can be found on eBay Autos by searching for seller "pdburg," or it can be ordered from the UK from www.powerbulbs.co.uk/); SilverStar H1 55W H1 +50% bulb (claiming 50% more light output); Narva H1 100W (marked "Not for use in Europe"); Narva 55W H1 +50% bulb; HID H1 35W light source; and finally a "Universal Blue-Coated" 55W Asian bulb. These were all tested using ZKW European housings.

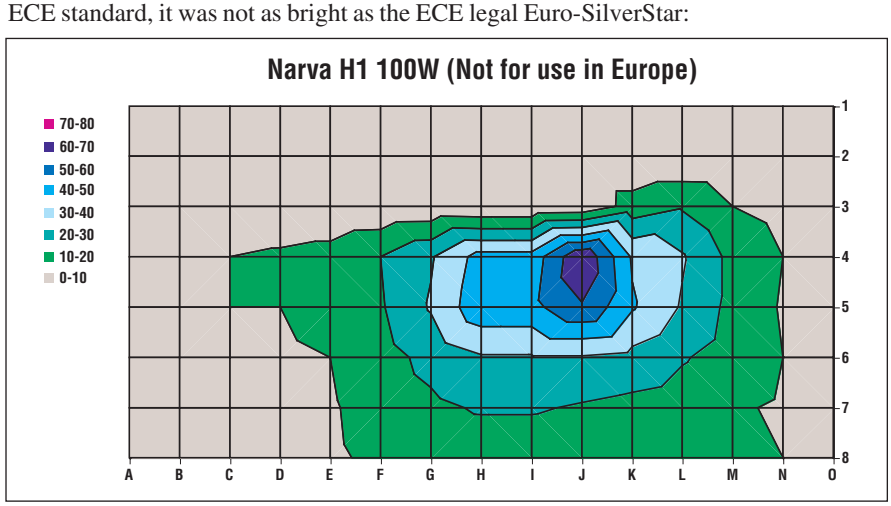
Osram Standard Halogen H1 55W: This is a standard H1 bulb, and any "standard" H1 bulb should match this bulb in performance. The brightest point from this bulb was 53 foot-candles. The bulb consumes 55.4W at 12.6V. The pattern from this bulb is below:



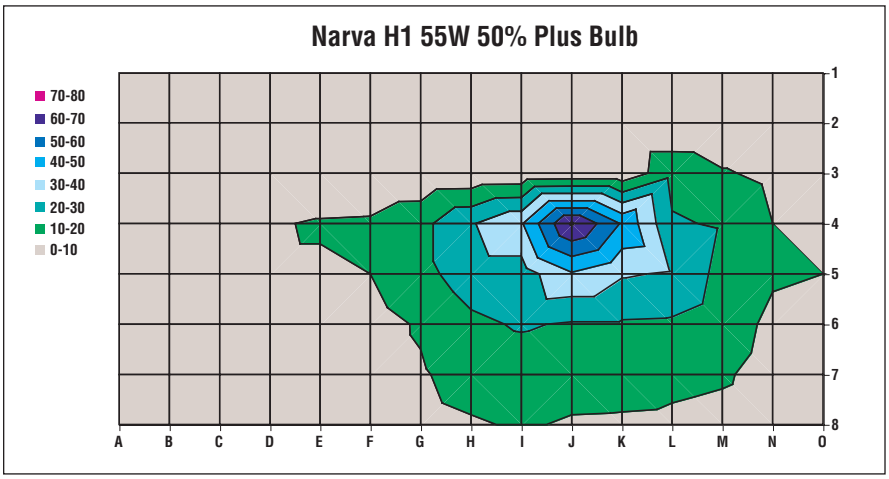
Osram Euro SilverStar H1 55W H1 bulb: This bulb is advertised as providing 50% more light. The brightest point I measured with this light was 79 foot-candles, which is 49% more light than the standard Osram 55W H1 bulb. What can be seen in the intensity plot is that the center of the beam pattern has more light in it—but the outer portions appears similar to the standard Osram 55W bulb, with more light below the horizon. This bulb consumes 56.7W at 12.6V:



Narva H1 100W: This bulb is labeled "Not for use in Europe"—which implies that it will not conform to the ECE intensity requirements. Although it was labeled as a 100W bulb, in reality it consumes 87W. The brightest spot on the pattern from this bulb was 69 foot-candles. Even though it was labeled representing it as being too bright to meet the Euro ECE standard, it was not as bright as the ECE legal Euro-SilverStar:



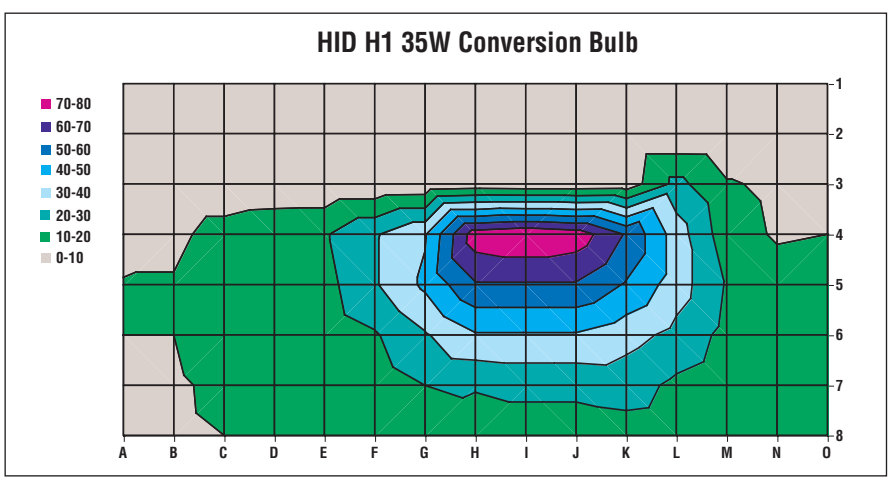
Narva H1 55W +50: Marketed as a +50% light output bulb, it doesn't quite achieve this goal, putting out 71 foot-candles at its brightest point (about 34% brighter). The pattern is tighter than a standard H1 bulb, likely due to the change in the filament to achieve the brighter central spot. (It's worth noting that both Narva bulbs moved the bright spot about six inches to the right on the test grid. This isn't too significant a problem as the Euro housing has an adjustment for centering the horizontal pattern.)



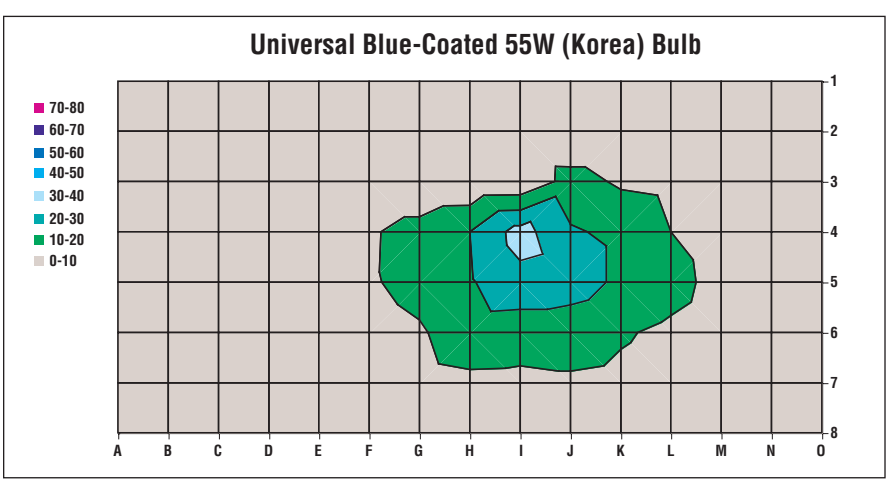
HID H1 35W light source: This light source was provided as part of a ZKW headlight assembly from a U.S. vendor (Umnitza); the complete package of headlight and HID source are sold as a manufactured unit. The HID source was rated as a 6,000 Kelvin (K) bulb. This rating refers to a measurement of light color; as the Kelvin number increases, the light color moves towards the blue end of the spectrum. A normal halogen light source is roughly 3,800-4,200 Kelvin.

Many advertisements imply that a higher Kelvin number is better, or that it provides more light. This is actually wrong; higher Kelvin numbers on an HID light source typically result in *less* available light from the source; more important, there's less *useable* light, since as the color temperature moves toward blue internal scattering in the human eye increases.

However, the output pattern of this source does reveal a wider distribution of the light compared to a halogen source, and an overall increase in light output. The brightest point measured was 79 foot-candles, about 50% more light than a standard H1 halogen source, equal to the ECE legal Osram Euro SilverStar.



Universal "Blue Coated" 55W Bulb (made in Korea): This bulb is rather typical of the blue bulbs available in almost any auto-parts store, and quite popular with people trying to emulate the color of an HID light. But the light output of this bulb is almost embarrassing; it is only ~65% of the output of a standard H1 bulb, and less than 45% of the light output of our best halogen 55W bulb—the Osram Euro SilverStar.



Conclusions: If you're looking for an improved light pattern over the standard U.S. pattern, projector-type "Euro" housings may be a good choice. These are available from a variety of manufacturers: ZKW and Bosch were the manufacturers for BMW, and their housings are of the highest quality. There are other housings available from Asia which may be of lesser quality. There are also entirely different types of housings available on eBay from various Asian sources—housings which don't resemble anything BMW ever used. There are also new housings available from Hella that appear of good quality, but I was unable to obtain one for testing.

Many of the vendors of the "Euro housings" will combine the housing with an HID light source, and add "angel eye" rings—the new Hella housings have integral angel eyes. The only restriction on your choices appears to be your Visa card credit limit. If you can't afford the HID option, you can obtain nearly the same light intensity by buying the European Osram Silverstar +50% bulb (which is NOT the same as the Sylvania Silverstar sold in U.S. auto-parts stores.) This bulb is available from various European vendors and on eBay for a reasonable price. This bulb does meet ECE standards and is a good match with European headlight housings. ◆

Once again, thanks to Daniel Stern for guidance through the regulatory maze in the U.S. and Europe; to Matt Grintsaig at Umnitza for use of the ZKW/HID lights; to Rob Levinson at UUC MotorWerks for use of the ZKW/halogen lights; and to Bill Fox (http://hirheadlights.com/index.htm), who provided me with a very extensive and widely varied group of bulbs to test—and finally, thanks to all those people who provided encouragement in pursuing these articles; they wouldn't have been written without you!