

## LED Headlight Bulbs for the BMW R1200RS

By Michael Spratley, 7-Dec-2019

During a group ride after I had installed Clearwater Darla LED driving lights on my 2016 BMW R1200RS, several people suggested there was something wrong with my headlight because... "it looks really yellow". I believe this perception was due to the contrast between the yellowish standard halogen headlight bulb and the ultra-white LED Darlas. When the low beam later failed, I ordered four Sylvania H7 Silver Star Ultra bulbs from eBay for \$46.00, \$11.50 each. At the beginning of July 2018, I replaced both high and low beam bulbs with the Sylvania's, being careful to not touch the bulb glass. Although to me the color didn't appear much whiter, I didn't get any more comments about yellow headlights. Since then I've had to replace the low beam twice, most recently during a trip to Minneapolis in October 2019, and so I've depleted my supply of spare Sylvania's. Clearly, they don't last very long, and indeed according to the packaging their rated lifespan is 340 hours.



Figure 1: H7 Halogen

It was about this time I saw a [FortNine YouTube video](#) comparing different types of headlight bulbs. The video recommends LED bulbs by ODX of California for use in motorcycle headlights. I enjoy the careful and scientific approach of the FortNine dude in the product reviews and comparisons he does, so I did some more research on LED headlight bulbs in general, and decided to try the ODX bulbs, which ODX claims on their website [ODX.ca](#) will last 32,000 hours and "install without any modifications". The latter claim is to some extent true for the R1200RS, but as we will see later, not without a corollary. I ordered two different ODX bulbs. For the low beam I ordered the H7 V3 3000 LUMENS LED, and for the high beam the H7 S6 SERIES 6000 LUMENS. I made this decision after reviewing the characteristics of each of the two models.

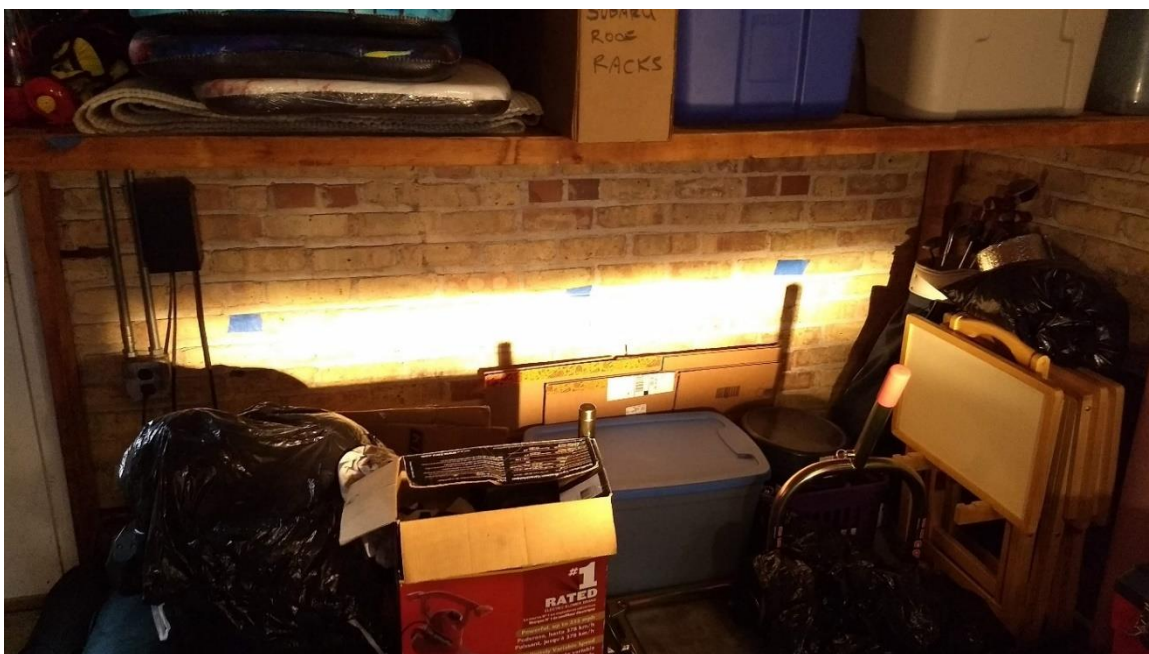


Figure 2: R1200RS standard halogen low beam with distinct horizontal cutoff

In order to not blind oncoming drivers, low beam headlight reflectors create a light pattern with a distinct horizontal cutoff. Figure 2 above shows the R1200RS low beam with a Sylvania H7 Halogen bulb installed, reflected against the end wall of my small and cluttered garage ('scuze the mess). I've marked the cutoff with three pieces of blue tape for later comparison with the LEDs. Notice that there is no light above the cutoff line marked by the 3 pieces of tape.

A modern headlight reflector acts like a lens in reverse. A lens takes incoming rays of light and focuses them to a focal point. A headlight reflector takes light rays from a point light source and reflects them to the desired pattern. What is critical in order to obtain the correct low beam light dispersion pattern, with the distinct horizontal cutoff, is the precise size, shape, and positioning of the light source within the 3-dimensional space of the low beam headlight reflector. Figure 3 shows the V3 3000 bulb compared to the original 55 watt H7 halogen bulb I removed from R1200RS. The light source of the H7 halogen is a curled metal filament, which I have colored orange in the image, that is about 3/32" wide and 3/8" long. The light source of the V3 3000 LED bulb is the three small square yellow LED (light emitting diode) chips, which are lined up and positioned to closely mimic the H7 halogen's filament. The V3 has two sets of the chips, three on each side of the bulb, mounted back-to-back on a thin metal sheet.

The halogen and the V3 bulbs, which both conform to the H7 standard, share an identical round metal mounting skirt with a rectangular tab protruding from one side. Figure 1 on page 1 better shows the skirt of the halogen bulb, with the tab on the left in that image. The bulb is inserted into the R1200RS headlight reflector with the tab pointing up. The skirt mates snugly with the rear of the headlight housing to ensure the light source (filament or LED chips) is positioned precisely within the 3-dimensional interior space of the reflector. Although the V3 3000's design permits the entire body of the bulb to be rotated within the mounting ring, when the bulb is correctly installed, the LED chips face horizontally to each side within the headlight housing/reflector.

LED bulbs produce a substantial amount of heat. Apparently, it is not the LED chips that get hot, but rather the electronic circuitry that drives the chips. That heat must be dissipated, or the circuitry will fail. The LED chips might last 32,000 hours, but unless kept cool the circuitry will not. The V3 bulb uses a large heat sink to dissipate the heat. Figure 4 shows the heat sink viewed from the bottom end of the V3. There is an array of cooling fins but no cooling fan, and the connector cable exits from the bottom center of the heat sink.



Figure 3: H7 Halogen vs ODX V3 3000



Figure 4: ODX V3 3000 heatsink



Figure 5: ODX S6 6000 Lumen LED

In contrast, the S6 6000 shown in Figure 5, which I bought as the high beam, has a smaller body that houses a cooling fan, and the connector cable exits from the side. The S6 doubles the V3's light output by doubling the number of LED chips. However, this wider 3 x 2 array of LED chips no longer closely mimics the size and shape of the H7 halogen's filament.

It is difficult to determine via Google the light output of a 55w halogen bulb. Some sources claim about 700 lumens and some claim up to 1,600 lumens. The first reason I chose the V3 for the low beam, rather than the more powerful S6, is that 6000 lumens seems too much for low beam. The second reason is that I did not expect the S6's wider LED array to produce the distinct horizontal low-beam cutoff needed to avoid blinding oncoming drivers, whereas I had high hopes that the V3 would have a good cutoff.

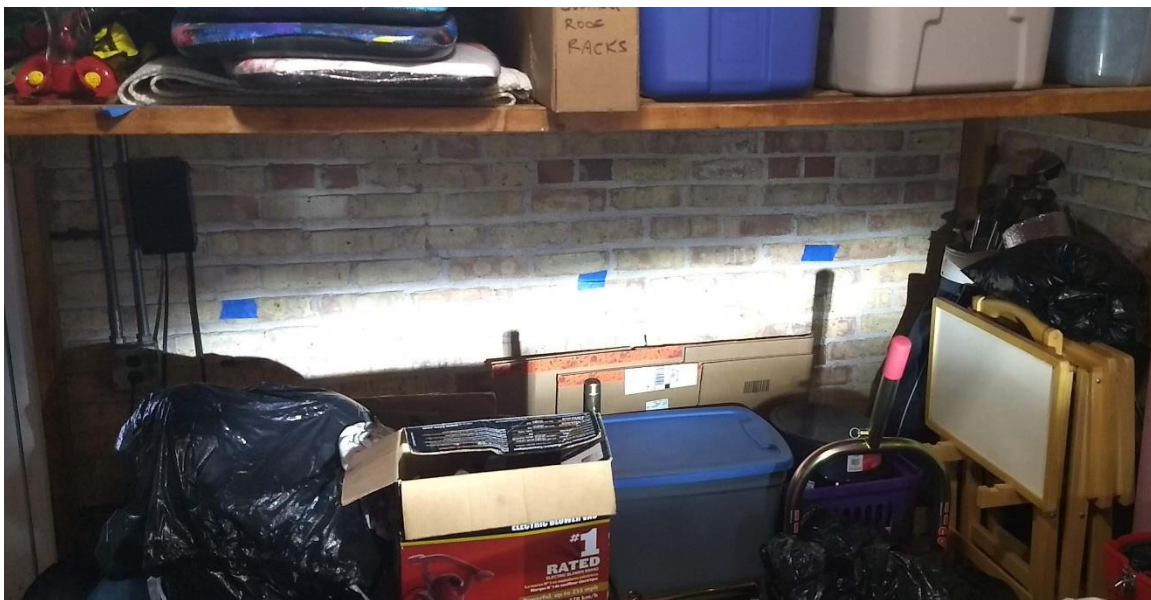
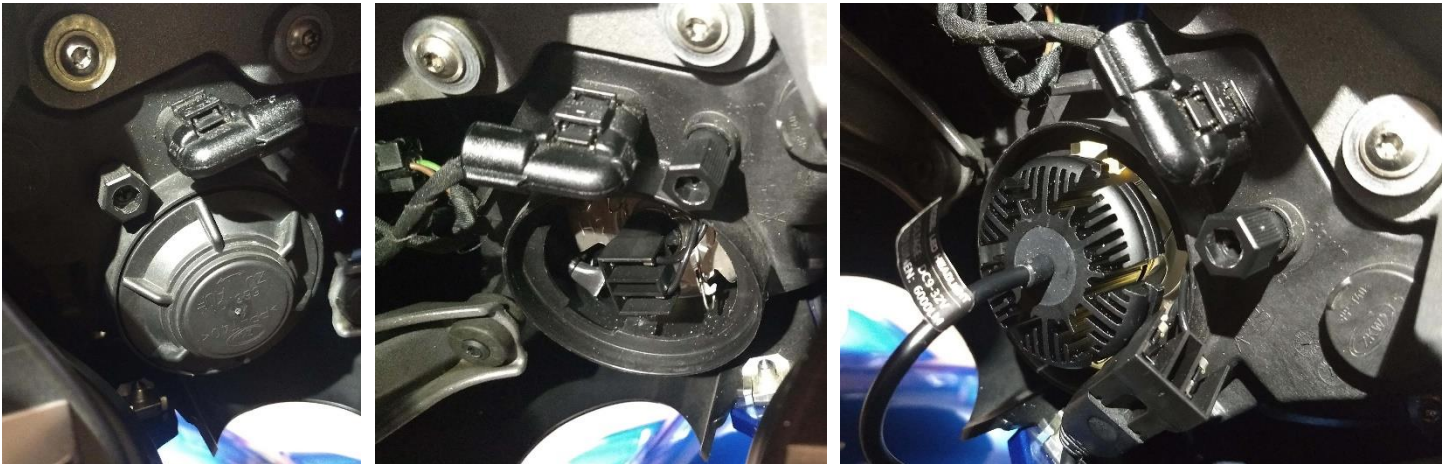


Figure 6: ODX V3 3000 showing good cutoff

I was able to install the V3 3000 into the low-beam housing, although I did have to make a jig from a paper clip and a rubber band to hold the locking clip out of the way while I installed the bulb. Figure 6 shows the light pattern with the

ODX V3 3000 LED installed as low beam. The color is very white, and the cutoff is just as distinct as the halogen, although before I took this shot, I did have to adjust the beam downwards quite a bit to bring it down level with the blue tape.

Success! I can use the V3 3000 for low beam of the R1200RS, right?



*Figure 7: Rear views of R1200RS headlight housing*

Not so fast! Figure 7 above shows three shots of the rear of the R1200RS headlight housing. The left shot shows the dust cover in place. The center shot shows the dust cover removed, with the R1200RS's rectangular connector, still attached to the halogen bulb, in the center of the circular rim. The final shot shows the ODX V3 3000 LED bulb installed in the housing. It is not easy to see from this shot, but the V3's heat sink protrudes a good 5/8" beyond the circular rim of the housing, and yet the dust cover mounts pretty much flush with the circular rim. Even ignoring the connector, the dust cover won't come close to fitting over the heat sink. Furthermore, when the plug on the connector cable (see Figure 5) is plugged into the R1200RS's square plastic connector (shown in the center shot in Figure 7 above) the two pieces together make a chunk of plastic about 3/4" by 1/2" by 1 1/4". Where is that going to go?

Although the S6 6000's fan housing is smaller in diameter than the V3's heat sink, it protrudes about the same amount, making the dust cover equally impossible to install. As predicted, when installed as the low beam the S6's cutoff is much less distinct than the standard halogen bulb's or the V3's, making the S6 unsuitable for low beam use. Unfortunately, I neglected to take a photo of the light pattern of the S6 installed as low beam.

So, ODX's claim that these LED bulbs will "install without any modifications" comes with the unspoken corollary "provided you discard the dust covers". I thought about it... for about 10 seconds. Then I remembered all the times I've ridden for hundreds of miles in pouring rain, and I imagined dirty water getting inside the headlight reflectors, turning them into non-reflectors. I shipped both the V3 and the S6 back for a refund.

I neglected to mention earlier that I paid \$64.00 for the V3 and \$71.00 for the S6, with free shipping. The return shipping cost me about \$15.00 with insurance.

## Plan B

...and then, because I'm a sucker for punishment, I ordered two of the ODX H7 Spark Series bulbs (see Figure 8) for \$36.00 each, plus \$8.00 for shipping. They are no bigger than a standard H7 halogen, and their six LED chips, three each side, appear to be correctly sized and positioned to match the filament positioning of a halogen bulb. A video on ODX's website makes the following claim regarding the Spark LED:

"With 1250 lumens each, you have two times more power than regular halogen bulbs, while having a bright white light..."

I had high hopes.

I installed one of the Spark LEDs into the low beam housing and turned on the ignition and the lights. Two problems were immediately evident:

1. The high beam came on too, and the dash was displaying a warning light for a failed headlight bulb. When the BMW CanBus detects that the low beam bulb has failed, it turns on the high beam. The Spark LED apparently does not draw enough current, and the bike thinks the bulb has failed.
2. The Spark LED produces significantly less light than a standard 55w halogen bulb.

Figure 9 below shows the light pattern of the Spark LED installed as low beam. I disconnected the high beam bulb for this shot. Not only is the cutoff line indistinct, but if you compare this to Figure 2 you will see that is significantly less bright than even a 55 watt halogen. Photography buffs will appreciate that for the light-pattern shots in this article I set my camera to manual mode, using the same aperture, shutter speed, ISO, and white balance (sunlight) for all the shots. This makes them comparable in terms of both light color and intensity.



Figure 8: ODX H7 Spark Series

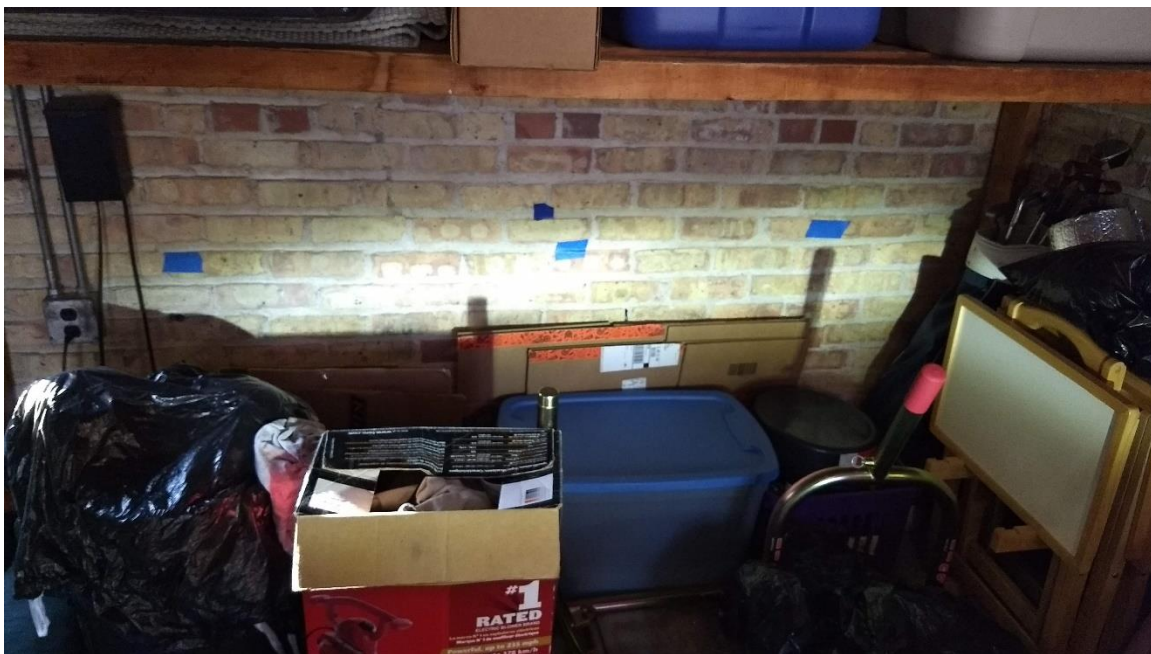


Figure 9: ODX H7 Spark Series light pattern



I returned both H7 Spark LEDs for a refund. Return shipping with insurance cost me about \$12.00.

## Conclusions

Perhaps there are ways I could have made this work.

If I had a 3D printer and some computer-aided design skills I could have designed and printed new dust covers that would have worked with the V3 and S6 LEDs. Such covers would need enough room to contain the heat sink or cooling fan of the LED, plus the bulky connector plug/socket combination. Such dust covers might clear the fork legs as the steering is turned, but I'm not certain of that; it would be close.

Perhaps the bulkiness of the plug/socket combination could be avoided if the plug and socket were both cut off and the wiring soldered and then insulated with some heat-shrink insulation or electrical tape. Personally, I would be reluctant to take that approach.

If water-tight dust covers could be made that would fit over the LEDs and clear the fork legs, there is still the worry in my mind about how the substantial heat generated by the V3 and S6 LEDs would be dissipated. The heat sink or cooling fan would be operating within a very small enclosed space with nowhere for the heat to go but out through the walls of the plastic headlight enclosure. Would it melt?

I could have ordered special resistors from ODX to be installed (in parallel I guess) with the Spark LEDs to draw more current and eliminate the BMW CanBus "failed bulb" error. But I see little point in doing so given the low level of light from the Spark LED.

For the time being I have resigned myself to 55-watt halogen bulbs, and to always carrying a spare bulb. I might stick with the Sylvania Silver Star Ultras, if I can get anything like the price (\$12 each) I got for the first four I bought on eBay. Most sellers seem to sell them for about twice that. Alternatively, I could try the PIAA Extreme White Plus halogen discussed in the FortNine YouTube video, which is rated for 1,000 hours, three times the Sylvania's rated life, but also cost quite a bit more. I still have two working Sylvania bulbs, plus the original H7 halogen I took out of the high beam as a spare, so I have a bit of time to decide. However, I'm clearly back where I started.