



THE AUTOMOTIVE LIGHTING BENCHMARK

J583 Report summery

BAF011 4 Banger HXB Wide

BAF005 4 Banger NCS Wide

DD6489 SS3 Max SAE Fog (Failed)

DD6897 SS3 Max Backlit SAE Fog (Failed)

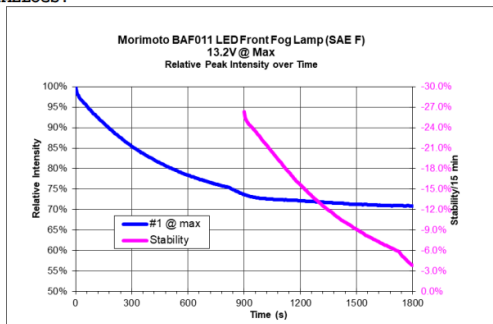
DD6130 SS3 Pro SAE Fog (Failed)

R504813 Rigid Industry D series SAE Fog

BD257805 Baja Design Squadron SAE Fog (Failed)

MEASURED POWER/RELATIVE INTENSITY DROP/STABILIZATION TIME

TIMELOGS:

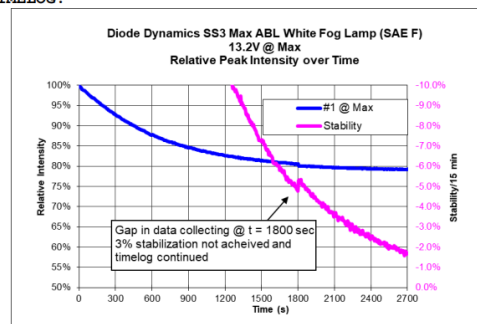


Sample required 30+ minute stabilization period (<3%/15 min).

4 Banger HXB Wide

38.8W
-29%
31min

TIMELOG:

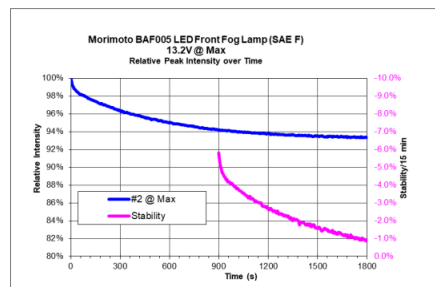


Sample required 30+ minute stabilization period (<3%/15 min).

SS3 Max ABL SAE Fog

39.2W
-20%
37min

TIMELOGS:

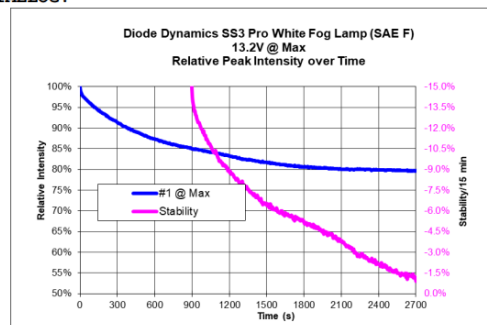


Sample required 20+ minute stabilization period (<3%/15 min).

4 Banger NCS Wide

15.6W
-7%
20min

TIMELOG:

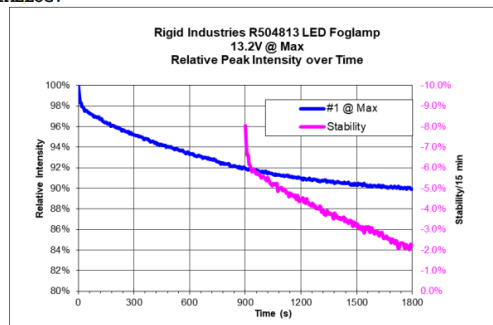


Sample required 30+ minute stabilization period (<3%/15 min).

SS3 Pro SAE Fog

33.5W
-20%
37min

TIMELOG:

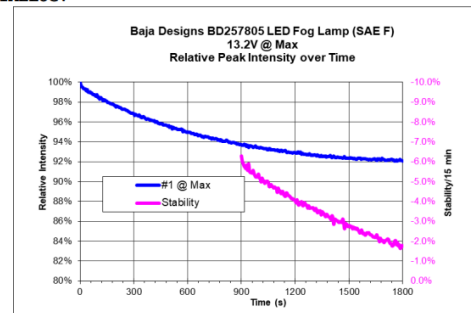


Sample required 25 minute stabilization period (<3%/15 min).

Rigid D-series SAE Fog

21.5W
-10%
25min

TIMELOG:



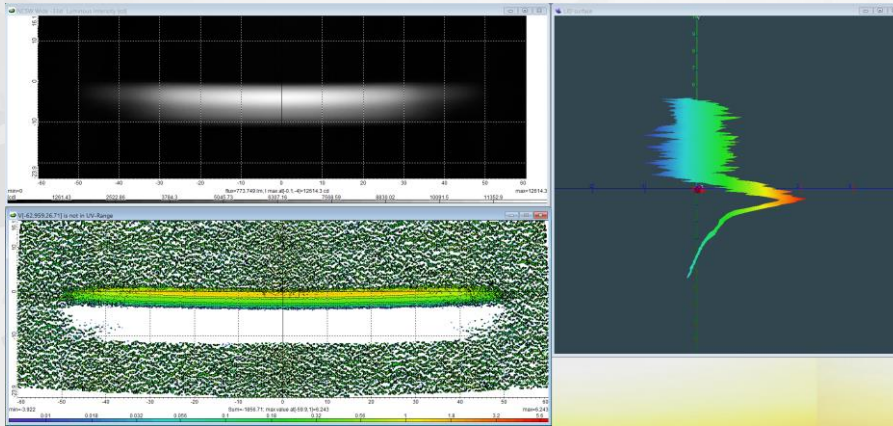
Sample required 25 minute stabilization period (<3%/15 min).

BD Squadron SAE Fog

21.0W
-8%
25min



CUTOFF CRITERIA



J583 require beam to have well defined single peak gradient. Lamp will be aimed based on gradient peak to be $0.75D$
=Highest contrast border of lighted upper edge must be 0.75 degree down from horizontal line.

If no defined gradient, lamp cannot be aimed per J583

Gradient peak is measured at $2.5L$, V and $2.5R$

At each measurement horizontal angle points, gradient peak vertical angle variation must be within $-0.2 \sim +0.2$ degree

= $2.5L$ to $2.5R$ essentially must have flat cutoff line

Minimum required value of peak gradient is 0.08 (rounded off at 0.000)

** HXB barely made it by rounded up ($2.5L$ was 0.076)



Aim (SAE J583 MAY2020)

#1

Maximum Vertical Gradient

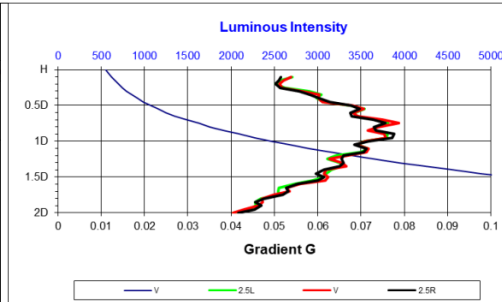
Location	Value	Required
0.75D/2.5L	0.076	≥ 0.08
0.75D/V	0.079	
0.90D/2.5R	0.078	

Maximum vertical gradient Glog is ≥ 0.08 when measured values rounded off

Plot of Glog demonstrates a well-defined single peak.

Horizontal width of cutoff is greater than $\pm 2.5^\circ$ centered at V-V.

Maximum inclination of cutoff is within $\pm 0.2^\circ$.



4 Banger HXB Wide

Aim (SAE J583 MAY2020)

#2

Maximum Vertical Gradient

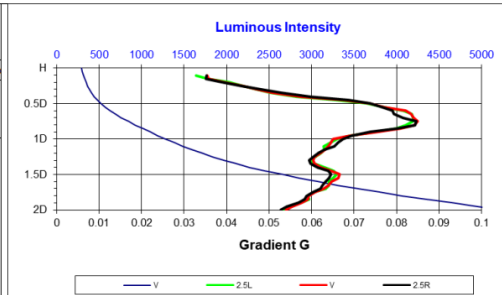
Location	Value	Required
0.70D/2.5L	0.084	≥ 0.08
0.75D/V	0.085	
0.75D/2.5R	0.085	

Maximum vertical gradient Glog is ≥ 0.08

Plot of Glog demonstrates a well-defined single peak.

Horizontal width of cutoff is greater than $\pm 2.5^\circ$ centered at V-V.

Maximum inclination of cutoff is within $\pm 0.2^\circ$.



4 Banger NCS Wide

Aim (SAE J583 MAY2020)

#1

Maximum Vertical Gradient

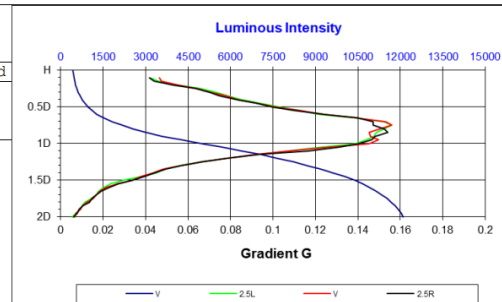
Location	Value	Required
0.75D/2.5L	0.156	≥ 0.08
0.75D/V	0.156	
0.85D/2.5R	0.154	

Maximum vertical gradient Glog is ≥ 0.08

Plot of Glog demonstrates a well-defined single peak.

Horizontal width of cutoff is greater than $\pm 2.5^\circ$ centered at V-V.

Maximum inclination of cutoff is within $\pm 0.2^\circ$.



Rigid D-series SAE Fog

Rigid had sharpest best cutoff

Aim (SAE J583 MAY2020)

#1

Maximum Vertical Gradient

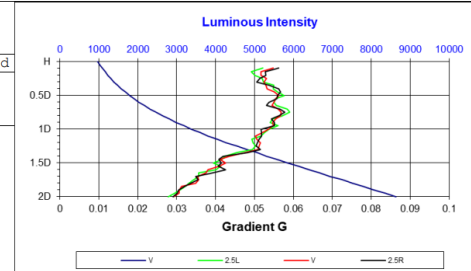
Location	Value	Required
0.75D/2.5L	0.059	≥ 0.08
0.75D/V	0.057	
0.75D/2.5R	0.058	

Maximum vertical gradient Glog is **not** ≥ 0.08

Plot of Glog **does not** demonstrate a well-defined single peak.

Unknown if horizontal width of cutoff is greater than $\pm 2.5^\circ$ centered at V-V because the Gmax is insufficient.

Maximum inclination of cutoff is within $\pm 0.2^\circ$.



SS3 Max ABL SAE Fog

Aim (SAE J583 MAY2020)

#1

Maximum Vertical Gradient

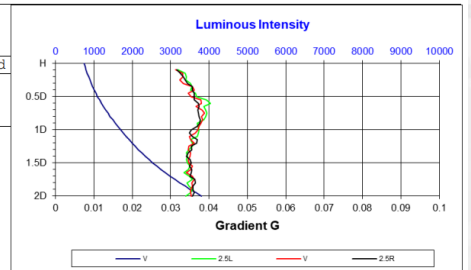
Location	Value	Required
0.60D/2.5L	0.040	≥ 0.08
0.75D/V	0.039	
0.85D/2.5R	0.038	

Maximum vertical gradient Glog is **not** ≥ 0.08

Plot of Glog **does not** demonstrate a well-defined single peak.

Unknown if horizontal width of cutoff is greater than $\pm 2.5^\circ$ centered at V-V because the Gmax is insufficient.

Maximum inclination of cutoff is within $\pm 0.2^\circ$.



SS3 Pro SAE Fog

Aim (SAE J583 MAY2020)

#1

Maximum Vertical Gradient

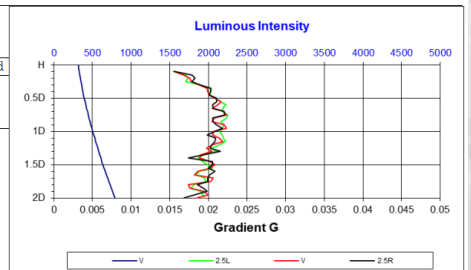
Location	Value	Required
0.75D/2.5L	0.022	≥ 0.08
0.75D/V	0.022	
0.75D/2.5R	0.022	

Maximum vertical gradient Glog is **not** ≥ 0.08

Plot of Glog **does not** demonstrate a well-defined single peak.

Unknown if horizontal width of cutoff is greater than $\pm 2.5^\circ$ centered at V-V because the Gmax is insufficient.

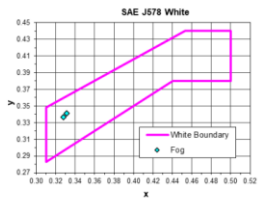
Maximum inclination of cutoff is within $\pm 0.2^\circ$.



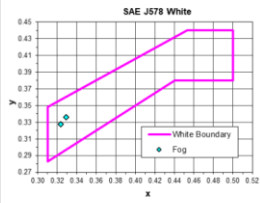
BD Squadron SAE Fog



COLOR SHIFT T=0, T=30

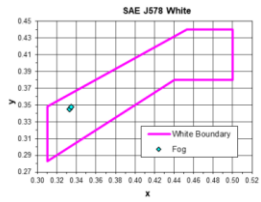
Measured (x,y)				Required & Chart	
Fog 13.2V 2.5°D/V	#2, t=0	0.3310	0.3410	5561K	$0.31 \leq x \leq 0.50$ $0.38 \leq y \leq 0.44$ $y \geq 0.75x + 0.05$ $y \leq 0.64x + 0.15$
	#2, t=30	0.3281	0.3367		
				5697K	

4 Banger HXB Wide

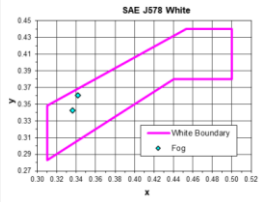
Measured (x,y)				Required & Chart	
Fog 13.2V 2.5°D/V	#1, t=0	0.3289	0.3361	5660K	$0.31 \leq x \leq 0.50$ $0.38 \leq y \leq 0.44$ $y \geq 0.75x + 0.05$ $y \leq 0.64x + 0.15$
	#1, t=30	0.3233	0.3277		
				5951K	

SS3 Max ABL SAE Fog

Larger color shift range is the indication of higher junction temp

Measured (x,y)				Required & Chart	
Fog 13.2V 2.5°D/V	#2, t=0	0.3327	0.3448	5487K	$0.31 \leq x \leq 0.50$ $0.38 \leq y \leq 0.44$ $y \geq 0.75x + 0.05$ $y \leq 0.64x + 0.15$
	#2, t=30	0.3344	0.3477		
				5416K	

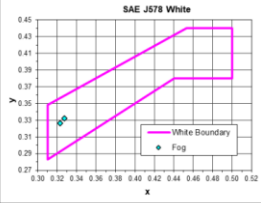
4 Banger NCS Wide

Measured (x,y)				Required & Chart	
Fog 13.2V 2.5°D/V	#1, t=0	0.3361	0.3427	5340K	$0.31 \leq x \leq 0.50$ $0.38 \leq y \leq 0.44$ $y \geq 0.75x + 0.05$ $y \leq 0.64x + 0.15$
	#1, t=30	0.3419	0.3603		
				5139K	

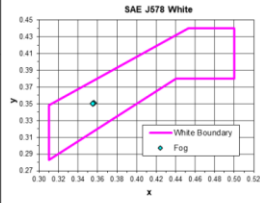
SS3 Pro SAE Fog

Color temp drops
Phosphor excitation RGB balance may cause this

Confirming with Mark

Measured (x,y)				Required & Chart	
Fog 13.2V 2.5°D/V	#1, t=0	0.3276	0.3320	5727K	$0.31 \leq x \leq 0.50$ $0.38 \leq y \leq 0.44$ $y \geq 0.75x + 0.05$ $y \leq 0.64x + 0.15$
	#1, t=30	0.3231	0.3263		
				5966K	

Rigid D-series SAE Fog

Measured (x,y)				Required & Chart	
Fog 13.2V 2.5°D/V	#1, t=0	0.3562	0.3506	4586K	$0.31 \leq x \leq 0.50$ $0.38 \leq y \leq 0.44$ $y \geq 0.75x + 0.05$ $y \leq 0.64x + 0.15$
	#1, t=30	0.3548	0.3505		
				4635K	

BD Squadron SAE Fog

Warmest white



PHOTOMETRIC TEST TABLE

Test Point	Location	Measured	Reaim	Minimum	Maximum
2.0U 15.0L TO 15.0R	1.2L	250.12		-	295
1.0U 15.0L TO 15.0R	1.5L	316.86		-	435
H 10.0L TO 10.0R	2.5R	564.20		-	585
H V		557.68		-	-
1.5D 9.0L		3860.70		1200	-
1.5D 3.0L		4145.47		2400	12000
1.5D 3.0R		4345.38		2400	12000
1.5D 9.0R		4217.47		1200	-
3.0D 15.0L		13007.59		1200	-
3.0D 15.0R		13271.83		1200	-
MX(10U-60U/15L-15R)	14.6U 0.7R	106.21		-	150
MAXIMUM	4.5D 0.5L	22615.38		-	-

Sample meets test requirements at all points @ t >30 minutes.

4 Banger HXB Wide

Test Point	Location	Measured	Reaim	Minimum	Maximum
2.0U 15.0L TO 15.0R	1.4R	150.94		-	295
1.0U 15.0L TO 15.0R	1.6R	186.94		-	435
H 10.0L TO 10.0R	1.8R	294.74		-	585
H V		291.57		-	-
1.5D 9.0L		2527.83		1200	-
1.5D 3.0L		2569.72		2400	12000
1.5D 3.0R		2627.42		2400	12000
1.5D 9.0R		2501.76		1200	-
3.0D 15.0L		9068.57		1200	-
3.0D 15.0R		8888.80		1200	-
MX(10U-60U/15L-15R)	17.3U 5.1L	80.95		-	150
MAXIMUM	4.0D 0.6L	14443.77		-	-

Sample meets test requirements at all points.

4 Banger NCS Wide

Test Point	Location	Measured	Reaim	Minimum	Maximum
2.0U 15.0L TO 15.0R	2.1L	164.40		-	295
1.0U 15.0L TO 15.0R	0.4L	236.04		-	435
H 10.0L TO 10.0R	0.9L	423.24		-	585
H V		421.37		-	-
1.5D 9.0L		9225.11		1200	-
1.5D 3.0L		10144.28		2400	12000
1.5D 3.0R		9838.57		2400	12000
1.5D 9.0R		8918.16		1200	-
3.0D 15.0L		8343.22		1200	-
3.0D 15.0R		8920.11		1200	-
MX(10U-60U/15L-15R)	10.0U 0.2L	53.44		-	150
MAXIMUM	2.6D 0.8L	12533.70		-	-

Sample meets test requirements at all points.

Rigid D-series SAE Fog

Best central intensity, x2+ of HXB Wide
= sharper cutoff allows higher intensity area closer to target point.

Test Point	Location	Measured	Reaim	Minimum	Maximum
2.0U 15.0L TO 15.0R	0.3L	252.33		-	295
1.0U 15.0L TO 15.0R	V	335.49		-	435
H 10.0L TO 10.0R	0.5L	670.51	546.02	-	585
H V		669.33		-	-
1.5D 9.0L		3410.72		1200	-
1.5D 3.0L		3655.18		2400	12000
1.5D 3.0R		3476.90		2400	12000
1.5D 9.0R		3412.24		1200	-
3.0D 15.0L		11561.99		1200	-
3.0D 15.0R		11138.15		1200	-
MX(10U-60U/15L-15R)	10.0U 5.7R	132.65		-	150
MAXIMUM	4.6D 0.2L	17624.16		-	-

Sample meets test requirements at all points.

SS3 Max ABL SAE Fog

Cutoff was not defined(Not aimable), re-aimed to -1 + additional 0.25D adjust to prevent glare limit exceeding. Met all requirement at lowered aim.

Test Point	Location	Measured	Reaim	Minimum	Maximum
2.0U 15.0L TO 15.0R	0.2R	265.96		-	295
1.0U 15.0L TO 15.0R	V	372.09		-	435
H 10.0L TO 10.0R	0.4L	632.20	545.79	-	585
H V		631.28		-	-
1.5D 9.0L		1848.43		1200	-
1.5D 3.0L		2027.32	2478.28	2400	12000
1.5D 3.0R		1878.45	2286.97*	2400	12000
1.5D 9.0R		1821.10		1200	-
3.0D 15.0L		6340.06		1200	-
3.0D 15.0R		6090.05		1200	-
MX(10U-60U/15L-15R)	10.0U 4.2R	145.38		-	150
MAXIMUM(S)	5.8D 0.7L	12802.21		-	-
	5.4D 24.4L	12800.49		-	-
	5.4D 24.2R	13954.69		-	-

* - Denotes Failure.

SS3 Pro SAE Fog

Cutoff was not defined(not aimable), re-aimed to -1 + additional 0.25D adjust to prevent glare limit exceeding. Which caused brighter beam center to be so low, required minimum beam central intensity fell below minimum requirement. Peak is NOT at center, it was at 24R

Test Point	Location	Measured	Reaim	Minimum	Maximum
2.0U 15.0L TO 15.0R	1.4R	252.12		-	295
1.0U 15.0L TO 15.0R	1.5R	274.02		-	435
H 10.0L TO 10.0R	0.7L	314.41		-	585
H V		313.50		-	-
1.5D 9.0L		628.75		1200	-
1.5D 3.0L		626.75	706.42*	2400	12000
1.5D 3.0R		619.36	699.98*	2400	12000
1.5D 9.0R		599.70	696.29*	1200	-
			674.32*		
3.0D 15.0L		1250.06		1200	-
3.0D 15.0R		1186.44	1301.55	1200	-
MX(10U-60U/15L-15R)	10.0U 10.8L	91.44		-	150
MAXIMUM(S)	8.5D 9.5L	3343.08		-	-
	8.7D 14.9R	3159.15		-	-

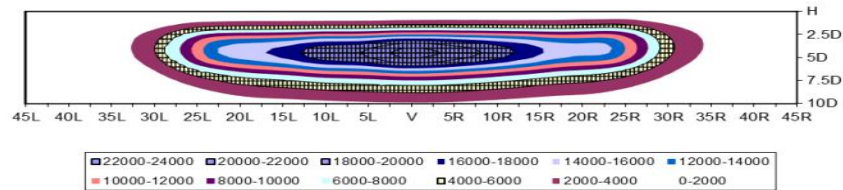
* - Denotes Failure.

BD Squadron SAE Fog

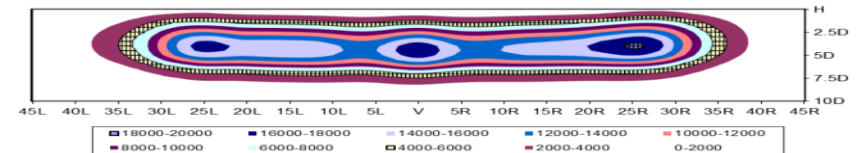
No cutoff(Not aimable), weak beam, failed on all required central intensity minimum



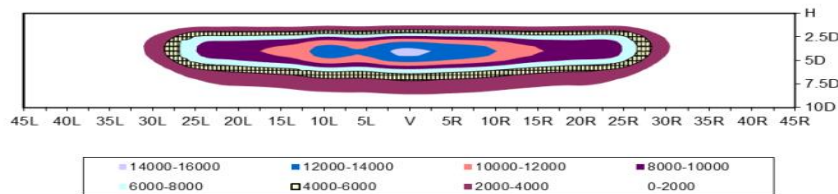
Morimoto BAF011 LED Front Fog Lamp (SAE F)
Sample #1 / 13.2V / 0.75° Aim
Luminous Intensity (Candela)



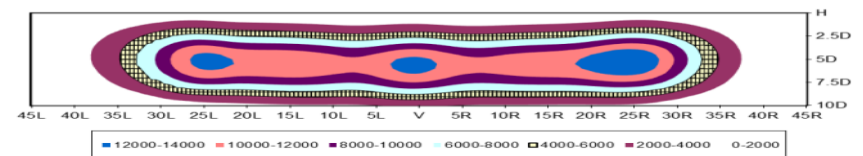
Diode Dynamics SS3 Max ABL White Fog Lamp (SAE F)
Sample #1 / 13.2V / 0.75° Aim
Luminous Intensity (Candela)



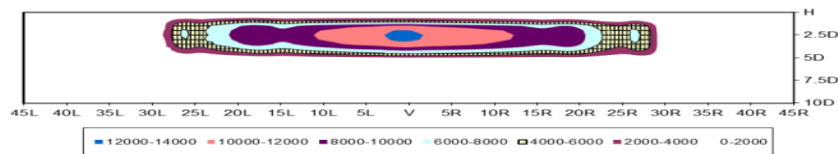
Morimoto BAF005 LED Front Fog Lamp (SAE F)
Sample #2 / 13.2V / 0.75° Aim
Luminous Intensity (Candela)



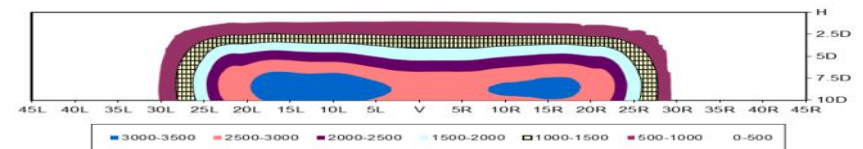
Diode Dynamics "Worklight SS3 Pro White Fog" Lamp (SAE F)
Sample #1 / 13.2V / 0.75° Aim
Luminous Intensity (Candela)



Rigid Industries R504813 LED Foglamp
Sample #1 / 13.2V / 0.75° Aim
Luminous Intensity (Candela)



Baja Designs BD257805 LED Fog Lamp (SAE F)
Sample #1 / 13.2V / 0.75° Aim
Luminous Intensity (Candela)

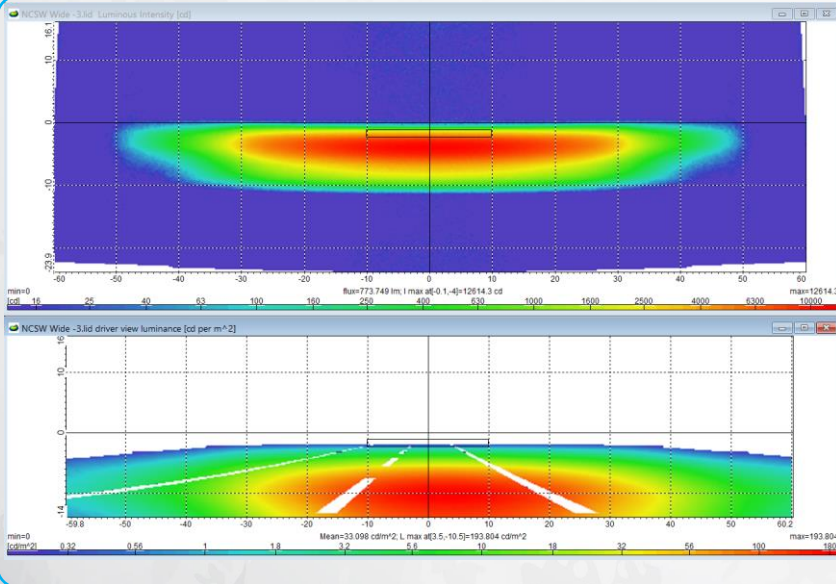


ROAD PROJECTION INTERPRETATION

Test Point	Location	Measured	Reaim	Minimum	Maximum
2.0U 15.0L TO 15.0R	1.2L	250.12	-	-	295
1.0U 15.0L TO 15.0R	1.5L	316.86	-	-	435
H 10.0L TO 10.0R	2.5R	564.20	-	-	585
H V	-	557.68	-	-	-
1.5D 9.0L	-	3860.70	-	1200	-
1.5D 3.0L	-	4145.47	-	2400	12000
1.5D 3.0R	-	4345.38	-	2400	12000
1.5D 9.0R	-	4217.47	-	1200	-
3.0D 15.0L	-	13007.59	-	1200	-
3.0D 15.0R	-	13271.83	-	1200	-
MX(10U-60U/15L-15R)	14.6U 0.7R	106.21	-	-	150
MAXIMUM	4.5D 0.5L	22615.38	-	-	-

Sample meets test requirements at all points @ t >30 minutes.

4 Banger HXB Wide

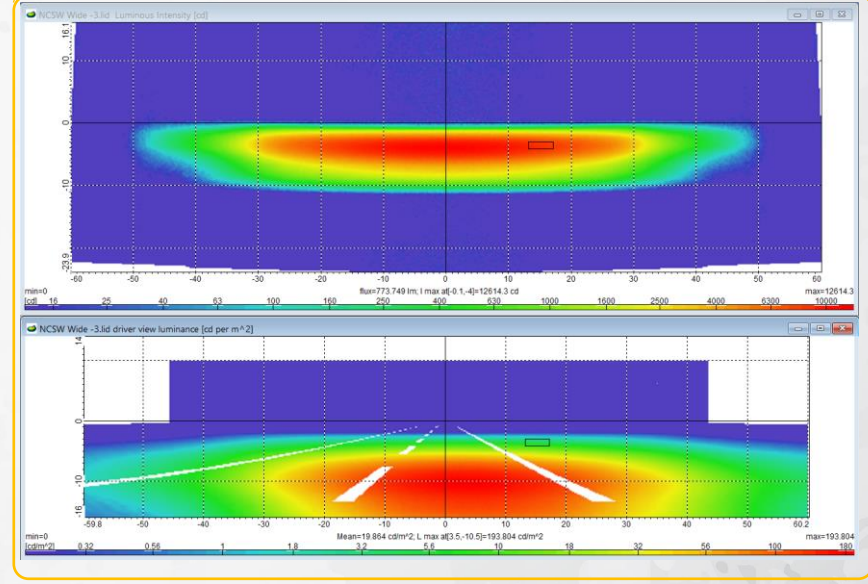


Central intensity zone are corresponded to lower area of low beam's down road illuminance zone. Higher central intensity can supplement mid distance illuminance support.

Test Point	Location	Measured	Reaim	Minimum	Maximum
2.0U 15.0L TO 15.0R	2.1L	164.40	-	-	295
1.0U 15.0L TO 15.0R	0.4L	236.04	-	-	435
H 10.0L TO 10.0R	0.9L	423.24	-	-	585
H V	-	421.37	-	-	-
1.5D 9.0L	-	9225.11	-	1200	-
1.5D 3.0L	-	10144.28	-	2400	12000
1.5D 3.0R	-	9838.57	-	2400	12000
1.5D 9.0R	-	8918.16	-	1200	-
3.0D 15.0L	-	8343.22	-	1200	-
3.0D 15.0R	-	8920.11	-	1200	-
MX(10U-60U/15L-15R)	10.0U 0.2L	53.44	-	-	150
MAXIMUM	2.6D 0.8L	12533.70	-	-	-

Sample meets test requirements at all points.

Rigid D-series SAE Fog



3D 15R 15L are corresponded to road edge illuminance zone.



EXPECTED ROAD PROJECTION VIEW (J583 AIM)

With Main Low beam = new xB Bi-LED dual low beam



4 Banger HXB Wide



SS3 Max ABL SAE Fog



4 Banger NCS Wide



SS3 Pro SAE Fog



Rigid D-series SAE Fog



BD Squadron SAE Fog



A-PILLAR MOUNT OFF-ROAD APPLICATION 3D AIM 1.2M HIGH



4 Banger HXB Wide Full volume road illuminance. Strong coverage of mid-distance to foreground, road-edge in balance.



4 Banger NCS Wide Scaled down illuminance impression of HXB Wide. Blends with low beam at neutral illuminance balance.



Rigid D-series SAE Fog Coverage is small. Narrow and skinny. Moderate mid-distance selective illuminance



SS3 Max ABL SAE Fog Strongest far road-edge illuminance, lack of foreground and mid-distance filling capability, peaky band shaped illuminance.



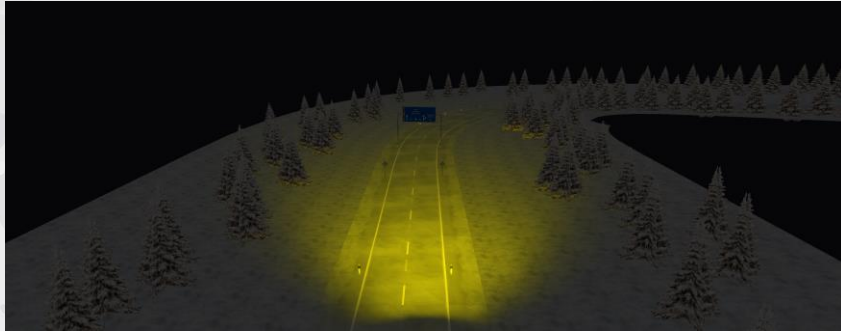
SS3 Pro SAE Fog Larger upper illuminance gives highest gentle comfort and wide illuminance impression. Fills both foreground and upper distance



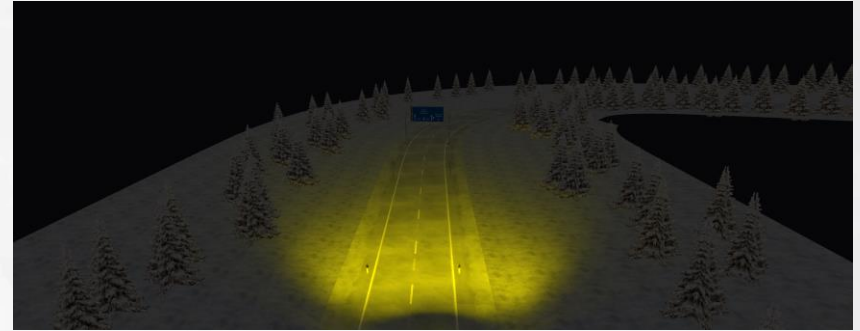
BD Squadron SAE Fog Poor performance as wide beam



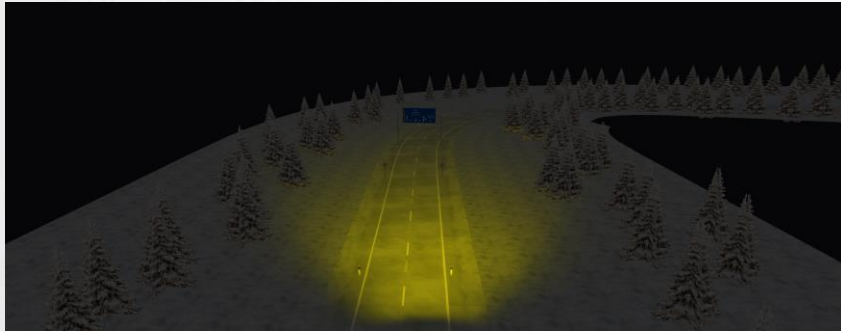
A-PILLAR MOUNT OFF-ROAD APPLICATION 3D AIM 1.2M HIGH



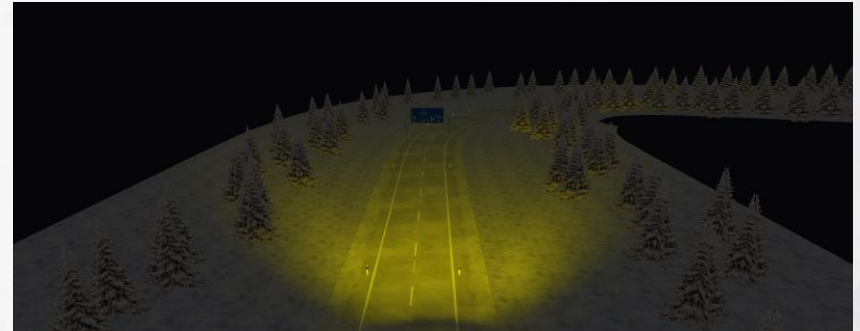
4 Banger HXB Wide



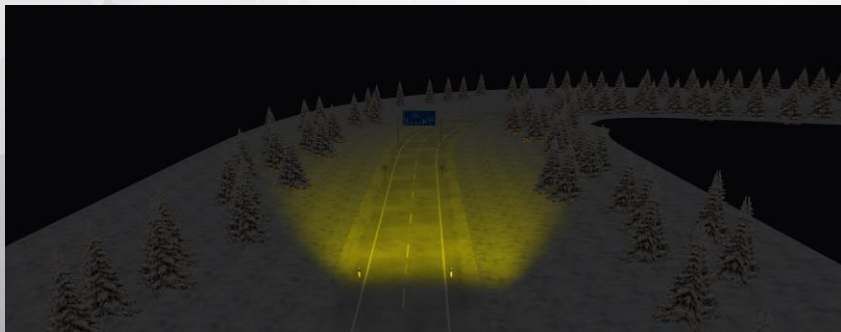
SS3 Max ABL SAE Fog



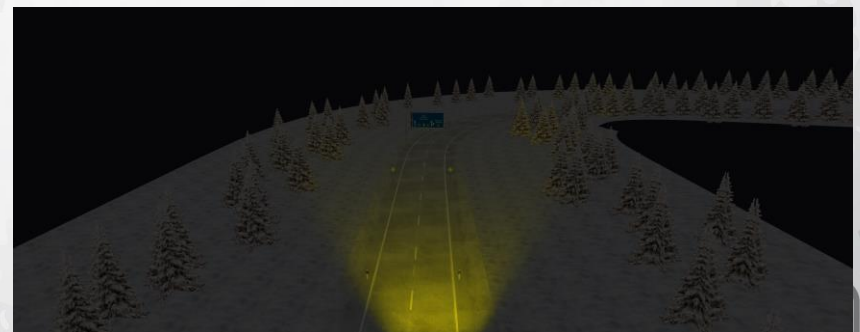
4 Banger NCS Wide



SS3 Pro SAE Fog



Rigid D-series SAE Fog

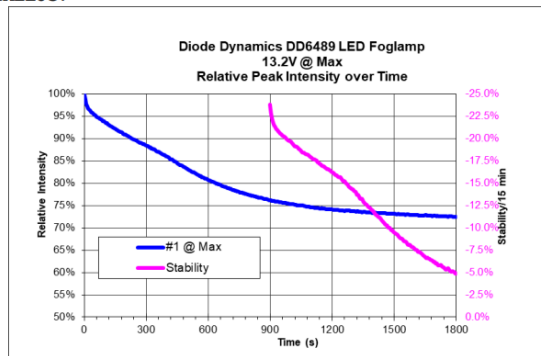


BD Squadron SAE Fog



SS3 MAX VS SS3 MAX BL

TIMELOG:

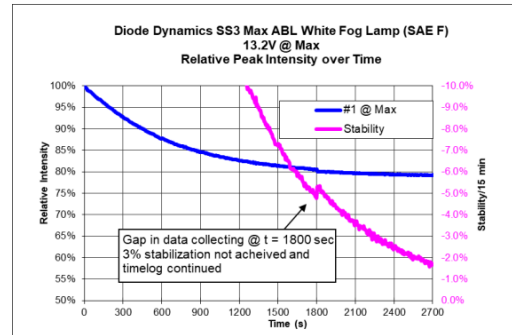


Sample required 30+ minute stabilization period (<3%/15 min).

SS3 Max SAE Fog

32.6W
-27%
37min

TIMELOG:



Sample required 30+ minute stabilization period (<3%/15 min).

SS3 Max ABL SAE Fog

39.2W
-20%
37min

Test Point	Location	Measured	Reaim	Minimum	Maximum
2.0U 15.0L TO 15.0R	1.0R	249.68	-	295	-
1.0U 15.0L TO 15.0R	0.7R	300.34	-	435	-
H 10.0L TO 10.0R	0.5R	494.42	-	585	-
H V		494.43	-	-	-
1.5D 9.0L		2586.40		1200	-
1.5D 3.0L		2650.14		2400	12000
1.5D 3.0R		2606.42		2400	12000
1.5D 9.0R		2607.06		1200	-
3.0D 15.0L		11325.93		1200	-
3.0D 15.0R		11221.14		1200	-
MX(10U-60U/15L-15R)	10.0U 6.1L	114.80		-	150
MAXIMUM	4.5D 0.6L	17236.71		-	-

Sample meets test requirements at all points.

Test Point	Location	Measured	Reaim	Minimum	Maximum
2.0U 15.0L TO 15.0R	0.3L	252.33	-	295	-
1.0U 15.0L TO 15.0R	V	335.49	-	435	-
H 10.0L TO 10.0R	0.5L	670.51	546.02	-	585
H V		669.33	-	-	-
1.5D 9.0L		3410.72		1200	-
1.5D 3.0L		3655.18		2400	12000
1.5D 3.0R		3476.90		2400	12000
1.5D 9.0R		3412.24		1200	-
3.0D 15.0L		11561.99		1200	-
3.0D 15.0R		11138.15		1200	-
MX(10U-60U/15L-15R)	10.0U 5.7R	132.65		-	150
MAXIMUM	4.6D 0.2L	17624.16		-	-

Sample meets test requirements at all points.

Despite 20% of additional power consumption, peak intensity only increased by 2%

T=0 to T=30 intensity stability is greatly improved by 7%

This change made lamp only needed to be aimed even lower, more power consumption with practically 0 peak intensity increase.

Higher central beam intensity measurement of Max ABL maybe due to sample level variation.

Heatsink capacity is not strong enough to handle additional 20% power, made it pointless improvement in my opinion.



CONCLUSION

All of SS3 series did NOT prove SAE J583 compliance.

SS3 max has tighter beam, but this still did not demonstrate sharp enough cutoff gradient criteria

SS3 max uses HXB which has 1.25mm emission area height

SS3 Sport uses Z ES which has 1.25mm emission area height

= while it is not verified, SS3 Sport also will also likely result in same gradient criteria issue.

SS3 Pro gradient issue was beyond salvageable. It is NOT safe to use on the road at all regardless of aim.

Therefore, SS3 in general, are NOT SAE compliant fog lamp because they cannot be “aimed” using gradient criteria.

They are very wide off-road wide lamp. Widest far road-edge illuminance capability.

Rigid D-series had very clean controlled cutoff. Strong intensity in balance, lack of width but as on road fog lamp, it had most proper intensity and control balance as SAE F fog -3 degree aim is required to use as SAE Fog

NCS wide has second best beam control as SAE Fog, with extended off-road wide beam capability. Must be aimed -3.5 degree at least (almost all the way lowest aim of bracket allows)

HXB wide has strongest off-road wide beam coverage, but as SAE fog, it is at the borderline cutoff quality and simply too bright. To use as SAE F fog, must be aimed as much as -4 degree (lowest aim of bracket allows)

BD Squadron Very unfortunate product. This is more like a narrow ? range flood beam. No cutoff, no intensity, no width. Beam is extremely tall and regular mount will not allow to aim lamp low enough to prevent glare. Not safe to use on the road at all.

