SAE International

SURFACE VEHICLE RECOMMENDED PRACTICE

SAE J573 JUN2011

Issued 1918-03
Revised 2011-06

Superseding J573 JUN1998

(R) Signal & Marking Light Sources

RATIONALE

This standard was revised in two aspects. Specification for recent new signal and marking filament light sources have been included. The sections that were added/revised as part of the filament light source update are listed below. In addition to that the scope is extended to include solid state lighting.

Due to the development of more efficient and cost-effective solid-state lighting solutions using light emitting diodes (LEDs) over the last years, the use of solid-state lighting options for signaling and lighting function in vehicles has become more and more common. In many applications the installed light sources are sealed system solutions, where customized LED arrays and associated electronics are used. Another option for solid-state lighting is the use of replaceable LED light sources, which can be inserted into a system using traditional socket systems and can therefore be easily exchanged. This principle is similar to currently existing miniature filament bulbs. This proposal is intended to extend the scope of SAE J573 to include these replaceable LED light sources in a similar manner to filament light sources. Due to differences between LED light sources compared to filament light sources in terms of the optical, mechanical and electronic characteristics, the LED light sources are not intended as direct replacement of filament light sources.

The following revisions were made as part of the update to the filament light source sections in SAE J573:

a. Title change to Signal and Marking Light Sources

b. Terminology change, from bulb and/or lamp to light source

c. New filament light sources were added to the document:

   1. T-3 ¼ filament light sources included (W3W, W5W, WY5W)
   2. T-5 filament light source (W16W)
   3. B-6 (1003)
   4. S-8 bayonet base (1141, 1157A, 2057A, 2357NA)
   5. S-8 wedge (families of 3057, 3157, 3357, 3457, 3757, 4057, 4114, 4157)
   6. T6 ½ Light Sources were included (7400 series and WY21W)
   7. P-6 Light Sources (5200 series, 7000 series)
   8. ECE types H21W, H6W, HY21W, PSX26W

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b. In Table 2 light sources typically used only for Parts and Service are marked with a footnote, “listed for historical purpose”.

c. Table 3 was updated to include references to tables and figures with new light source specifications

d. Table 9 and Figure 11 were added to include T - 6½ light sources base configurations

e. In cases where light source dimensions are elsewhere documented, such as in ECE R37, and/or IEC (IEC-60809, IEC-60061-1) specifications and light source drawings were not duplicated to avoid showing discrepancies between the standards. Therefore this document contains no figures of ANSI 5000 series and 7000 series

Sections added/revised as part of the incorporation of LED light sources:

a. Scope

b. 2.1.1, added SAE J2357 to applicable SAE publications

c. 2.1.3, added IESNA LM-80 to applicable Other publications

d. Table 1

e. 3.xx (various)

f. Table 2B

g. 4.3, 4.4, 4.5

h. Figure 12, Figure 13, Table 9

1. SCOPE

Most signal and marking lighting devices have light sources (bulbs), which can be based on either filament or LED technology. To assure field replacement, it is important that light source types employed be readily available in normal service channels. This document defines the physical, electrical, and photometric characteristics necessary to achieve a proper replacement for popular types of signal and marking light sources.

Some of the design characteristics in this document are listed solely for the sake of standardization and are not intended to describe the performance of lighting devices (lamp assemblies) on the vehicle.

2. REFERENCES

2.1 Applicable Documents

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest issue of SAE publications shall apply.

2.1.1 SAE Publications

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J567 Light Source Retention System

SAE J578 Color Specification

SAE J1330 Photometry Laboratory Accuracy Guidelines

SAE J2357 Application Guidelines for Electronically Driven and/or Controlled Exterior Automotive Lighting Equipment

2.1.2 ANSI Publications

Available from American National Standards Institute, 25 West 43rd Street, New York, NY 10036-8002, Tel: 212-642-4900, www.ansi.org.

ANSI_ANSLG_C81.61 Electric Lamp Bases

ANSI_ANSLG_C81.62 Lamp Holders for Electric Lamps

ANSI_ANSLG_C81.63 Gauges for Electrical Lamp Bases and Lamp Holders

ANSI ANSLG Special Report SR25e - 2009 Assigned Miniature Lamp Codes

2.1.3 International Electrotechnical Commission (IEC) Publications

Available from International Electrotechnical Commission, 3, rue de Varembe, P.O. Box 131, CH-1211 Geneva 20, Switzerland, Tel: +41-22-919-02-11, www.iec.ch.

IEC Publication 60061-1	Lamp caps and holders together with gauges for the control of interchangeability and safety - Part 1: Lamp caps
IEC Publication 60809	Lamps for road vehicles - Dimensional, electrical and luminous requirements
IEC Publication 60810	Lamps for road vehicles - Performance requirements
IEC Technical Report 62471 Part 2	Photobiological safety of lamps and lamp systems - Part 2: Guidance on manufacturing requirements relating to non-laser optical radiation safety

2.2 Related Publications

The following publications are provided for information purposes only and are not a required part of this SAE Technical Report.

2.2.1 United Nations Publications

Available from United Nations Economic Commission for Europe, Palais des Nations, CH-1211, Geneva 10, Switzerland, Tel: +41-0-22-917-12-34, http://www.unece.org/trans/main/wp29/wp29regs.html.

2.2.2 CIE Publications

Available from Commission Internationale de L'eclairage, CIE Central Bureau, Kegelgasse 27, 1030 Wien Austria, see also: national organizations of CIE in the case of the USA: United States National Committee of the CIE, c/o Ronald B. Gibbons, Virginia Tech Transportation Institute, 3500 Transportation Research Place, Blacksburg, VA 24061, U.S.A., email: gibbons@vtti.vt.edu, http://www.cie-usnc.org

Publication No. 70 - 1987 The Measurement of Absolute Luminous Intensity Distributions

2.2.3 IES Publications

Available from Illuminating Engineering Society, 120 Wall Street, Floor 17, New York, NY, 10005-4001, Tel: 212-248-5000, www.iesna.org.

LM-45 Approved Method for Electrical and Photometric Measurements of General Service Incandescent Filament Lamps, IES Lighting Handbook, Reference Volume, Ill.NA

LM-80 - 2008 Measuring Lumen Maintenance of LED Light Source

2.3 Index of Tables and Figures

See Table 1.

TABLE 1 - INDEX OF TABLES AND FIGURES

Figure	Table	Description
1		Continuous Filament
2		Legged Filament
3		Typical Signal and Marking Filament Light Sources
	2A	Typical Signal and Marking Filament Light Sources for Motor Vehicles
	2B	Typical Signal and Marking LED Light Sources for Motor Vehicles
	3	Basic Filament Light Source Dimensions
4		Filament Shapes
5		Filament Location on Dual Function Light Sources
6	4	BA9s Base Dimensions to be Controlled on a Finished Filament Light Source (Old base designation: A1)
7a, 7b, 7c	5	BA15s, BA15d, and BAY15d Base Dimensions to be Controlled on a Finished Filament Light Source (Old base designation: B1, B2, and C2)
8	6	Base Type W2.1x4.9d (Old base designation: W-1 Wedge)
9	7	Base Type W2.1x9.2d (Old base designation: W-2 Wedge)
10	8	Base Type W2.5x16d Wedge and W2.5x16q Wedge (Old base designation: SC Wedge and DC Wedge)
11		LED Light Source - LR1
12		LED Light Emitting Area
13		Set Up to Measure LED Luminous Intensity Distribution
	9	Relative Intensity Values for Stop Function of Normal and Rated LED Light Source LR1

3. DEFINITIONS

3.1 TEST SAMPLE

Test samples are light sources fabricated from a normal production process.

3.2 FILAMENT LIGHT SOURCE

Device in which light is produced by means of one or more filaments heated to incandescence by the passage of an electric current.

3.3 LED LIGHT SOURCE

A light source where the visible radiation is emitted from one or more LEDs. An LED light source may or may not require an additional electronic control unit (gear) and may or may not require additional provisions for thermal management.

3.4 SEASONED LIGHT SOURCE

3.4.1 Filament Type

A filament light source which is energized, at design voltage, for 1% of its rated life or 10 h; whichever is shorter. See Table 2A for design voltage and life rating (for light sources not listed see manufacturer's data).

3.4.2 LED Type

LED light sources operated at their design voltage for at least 48 h. Operation shall be at the highest design power function (mode). If multiple functions are present with separate LED sources each function (mode) shall be seasoned individually. See Table 2B for design voltage and life rating (for light sources not listed see manufacturer's data).

3.5 STANDARD FILAMENT LIGHT SOURCE (BULB, LAMP)

A light source which meets reduced (tighter) tolerances for both filament position and photometry. Light Sources are seasoned to attain photometric stability.

3.6 ACCURATE RATED LIGHT SOURCE

A seasoned light source unit operated at design mean spherical luminous intensity and having its light source(s) positioned within strict tolerances as specified in the applicable standard.

Accurate rated light sources are necessary to certify that lighting devices (lamps) meet legal illumination requirements. This normally applies to light sources used for tail, stop, park, turn, or combination functions in addition to forward lighting devices.

3.6.1 Filament Type

A properly seasoned filament light source operated at design mean spherical candela (mscd), and having its filament(s) within ±0.25 mm of nominal design position (X, Y, Z axes). It is necessary to rate each filament separately in a double filament bulb and may require calibrating two separate bulbs to achieve an Accurate Rated Bulb qualification for each filament.

3.6.2 LED Type

A properly seasoned LED light source operated in steady-state condition at design mean spherical candela (mscd) and with the light center length and light emitting area within ±0.10 mm of nominal design position (X, Y, Z axes). It is necessary to rate each function separately in multi-function LED light sources and may require calibrating two separate LED light sources to achieve an accurate rated source qualification for each function.

3.7 ABBREVIATIONS (for filament light sources)

L - Maximum Exposed Length
LCL - Light Center Length
WAA - Wide Axial Alignment
NAA - Narrow Axial Alignment

TABLE 2A - TYPICAL SIGNAL AND MARKING LIGHT SOURCES FOR MOTOR VEHICLES

ANSI No.	ECE/IEC Designation	Mean Spherical Candela	MScd Tol. ± %	Design Voltage	Design Amps	Amp Tol. ± %	Rated Average Lab Life Hours[1]	Filament Shape or Type[2]	LCL mm	LCL Tol. ± mm	Axial Align. ± mm	Light Source Type[3]	Base Type[4]
37		0.5	30	14.0	0.09	15	1500	C-2F	10.2	1.0	1.0	T-1 ¾	W2.1x4.9d
73		0.3	30	14.0	0.08	15	15000	C-2F	10.2	1.0	1.0	T-1 ¾	W2.1x4.9d
74		0.7	30	14.0	0.10	15	500	C-2F	10.2	1.0	1.0	T-1 ¾	W2.1x4.9d
57[7]		2	20	14.0	0.24	10	500	C-2V	14.2	2.3	2.3	G-4 ½	BA9s
1895[7]		2	20	14.0	0.27	10	1500	C-2F	14.2	2.3	2.3	G-4 ½	BA9s
67[7]		4	15	13.5	0.59	8	5000	C-2R	20.6	2.3	2.3	G-6	BA15s
89[7]		6	15	13.0	0.58	8	750	C-2R	19.0	2.3	2.3	G-6	BA15s
97[7]		4	15	13.5	0.69	8	5000	C-2V	20.6	2.3	2.3	G-6	BA15s
161[7]		1	20	14.0	0.19	10	1500	C-2F	14.2	2.3	2.0	T-3 ¼	W2.1x9.2d
168		3	20	14.0	0.35	10	1500	C-2F	14.2	2.3	2.0	T-3 ¼	W2.1x9.2d
194		2	20	14.0	0.27	10	1500	C-2F	14.2	2.3	2.0	T-3 ¼	W2.1x9.2d
	W3W[10]	1.75	30	13.5	0.255	Max	T_c=4000	C-2R	12.7	1.5	1.5	T-3 ¼	W2.1x9.5d
	W5W[10]	4	20	13.5	0.407	Max	T_c=1000	C-2R C-2V	12.7	1.5	1.5	T-3 ¼	W2.1x9.5d
	WY5W[10]	2.4	30	13.5	0.407	Max	T_c=1000	C-2R	12.7	1.5	1.5	T-3 ¼	W2.1x9.5d
PC175		5	20	14.0	0.58	10	1000	C-2F	14.2	2.3	2.0	T-3 ¼	PC
PC194		2	20	14.0	0.27	10	1500	C-2F	14.2	2.3	2.0	T-3 ¼	PC
906		6	15	13.0	0.69	10	1000	C-2F	20.6	2.3	2.3	T-5	W2.1x9.2d
912		12	15	12.8	1.00	10	1000	C-2R	20.6	2.3	2.3	T-5	W2.1x9.2d
921		21	20	12.8	1.40	10	1000	C-2R	20.6	2.3	2.3	T-5	W2.1x9.2d
	W16W[10]	24.66	20	13.5	1.58	Max	500	C-2R	20.6	2.3	1.0	T-5	W2.1x9.5d
1003[7]		15		12.8	0.94		200	C-6	26.9			B-6	BA15s
1141[7]		21		12.8	1.44		1000	C-6	31.75	1.5	1.5	S-8	BA15s
1156[7]		32	10	12.8	2.10	5	600	C-6	31.75	1.5	1.5	S-8	BA15s
1157[7]		32	10	12.8	2.10	5	600	C-6	31.75	1.5	1.5	S-8	BAY15d
		3	12	14.0	0.59	8	5000	C-6	[6]				
1157A / 1157NA[7]		24	30	12.8	2.10	5	600	C-6	31.75	1.5	1.5	S-8	BAY15d
		2.2	30	14.0	0.59	8	5000	C-6	[6]				
2057[7]		32	10	12.8	2.10	5	1200	C-6	31.75	1.5	1.5	S-8	BAY15d
		2	12	14.0	0.48	8	5000	C-6	[6]				
2057A / 2057NA[7]		24	30	12.8	2.10	5	1200	C-6	31.75	1.5	1.5	S-8	BAY15d
		1.5	30	14.0	0.48	8	5000	C-6	[6]				
2357[7]		40	10	12.8	2.23	5	400	C-6	31.75	1.5	1.5	S-8	BAY15d
		3	12	14	0.59	8	5000	C-6	[6]				

TABLE 2A - TYPICAL SIGNAL AND MARKING LIGHT SOURCES FOR MOTOR VEHICLES (CONTINUED)

ANSI No.	ECE/IEC Designation	Mean Spherical Candela	MScd Tol. ± %	Design Voltage	Design Amps	Amp Tol. ± %	Rated Average Lab Life Hours[1]	Filament Shape or Type[2]	LCL mm	LCL Tol. ± mm	Axial Align. ± mm	Light Source Type[3]	Base Type[4]
3047		21	12	12.8	1.6	5	2300	C-6	27.9	1.0	1.0	S-8/GT-8	W2.5x16q
		2	12	14.0	0.48	8	10000	C-6	[6]				
3057		32	10	12.8	2.10	5	1200	C-6	27.9	1.0	1.0	S-8/GT-8	W2.5x16q
		2	12	14.0	0.48	8	5000	C-6	[6]				
3057A / 3057NA		24	30	12.8	2.10	5	1200	C-6	27.9	1.0	1.0	S-8/GT-8	W2.5x16q
		1.5	30	14.0	0.48	8	5000	C-6	[6]				
3155		21	10	12.8	1.60	8	1500	C-6	27.9	1.0	1.0	S-8/GT-8	W2.5x16d
3156	P27W	32	10	12.8	2.10	5	1200	C-6	27.9	1.0	1.0	S-8/GT-8	W2.5x16d
3157	P27/7W	32	10	12.8	2.10	5	1200	C-6	27.9	1.0	1.0	S-8/GT-8	W2.5x16q
		3	12	14.0	0.59	8	5000	C-6	[6]				
3157A / 3157NA		24	30	12.8	2.10	5	1200	C-6	27.9	1.0	1.0	S-8/GT-8	W2.5x16q
		2.2	30	14.0	0.59	8	5000	C-6	[6]				
3357		40	10	12.8	2.23	5	400	C-6	27.9	1.0	1.0	S-8/GT-8	W2.5x16q
		3.0	12	14.0	0.59	8	5000	C-6	[6]				
3357A / 3357NA / 3457A / 3457NA		30	30	12.8	2.23	5	400	C-6	27.9	1.0	1.0	S-8/GT-8	W2.5x16q
		2.2	30	14.0	0.59	8	5000	C-6	[6]				
3757A / 3757NA	PY27/7W	22.28	15	13.5	2.38	Max	600	C-6	27.9	1.0	1.0	S-8/GT-8	WX2.5x16q
		1.67	15	13.5	0.63	Max	5000	C-6	[6]				
4057		32	10	12.8	2.23	5	4000	C-6	27.9	1.0	1.0	S-8/GT-8	W2.5x16q
		2	12	14.0	0.48	8	10000	C-6	[6]				
4114		32	10	14.0	2.23	5	4000	C-6	27.9	1.0	1.0	S-8/GT-8	W2.5x16q
		3	12	14.0	0.59	8	10000	C-6	[6]				
4157		32	10	12.8	2.23	5	4000	C-6	27.9	1.0	1.0	S-8/GT-8	W2.5x16q
		3	12	14.0	0.59	8	10000	C-6	[6]				
4157NAK		24	30	12.8	2.23	5	4000	C-6	27.9	1.0	1.0	S-8/GT-8	W2.5x16q
		2.2	30	14.0	0.59	8	10000	C-6	[6]				
5200	PY24W[10]	23.9	+15 -25	13.5	1.78	4.1	1900 Blinking	C-8Z	24	0.5	0.5	P-6	PGU20-4
5201	PS19W[10]	27.9	15	13.5	1.41	5.2	1900	C-8Z	24	0.5	0.5	P-6	PG20-1
5202	PS24W[10]	39.8	+10 -20	13.5	1.78	4.1	1400	C-8Z	24	0.5	0.5	P-6	PG20-3
7010[11]	PC16W[10]	23.9	10	13.5	1.19	6	2800	C-8Z	18.5	0.5	0.5	G-5-¼	PU20d-1
7011[12]	PCY16W[10]	14.3	15	13.5	1.19	6	2300 Blinking	C-8Z	18.5	0.5	0.5	G5-¼	PU20d-2
7012[13]		27.9	15	13.5	1.41	5.2	1900	C-8Z	19.5	0.5	0.5	P-6	PU20d-3

TABLE 2A - TYPICAL SIGNAL AND MARKING LIGHT SOURCES FOR MOTOR VEHICLES (CONTINUED)

ANSI No.	ECE/IEC Designation	Mean Spherical Candela	MScd Tol. ± %	Design Voltage	Design Amps	Amp Tol. ± %	Rated Average Lab Life Hours[1]	Filament Shape or Type[2]	LCL mm	LCL Tol. ± mm	Axial Align. ± mm	Light Source Type[3]	Base Type[4]
7013[14]		39.8	+10 -20	13.5	1.78	4.1	1400	C-8Z	19.5	0.5	0.5	P-6	PU20d-5
7014[15]		23.9	+15 -25	13.5	1.78	4.1	2300 Blinking	C-8Z	19.5	0.5	0.5	P-6	PU20d-6
	H21W[10]	48	12	13,5	1.85	5	300	C6	20.0	0.5	0.75	H21W	BAY9s
	H6W[10]	10	12	13.5	0.52	5	750	C6	15.0	0.75	0.75	H6W	BAX9s
	HY21W[10]	8	17	13,5	1.85	5	300	C6	20.0	0.5	0.75	12V 21W amber	BAW9s
	PSX26W[10]		10	13.5	1.78	4.1	1500	C-8Z	24	0.3	0.3	P-6	PG18.5d-3
	PSX24W[10]	39.8	+10 -15	13.5	1.78	4.1	1500	C-8Z	24	0.35	0.35	P-6	PG20-7
	P13W[10]	39.8	10	13.5	1.25	11	8000	C-8Z	25	0.3	0.3	P-6	PG18.5d-1
	PSY19W[10]	17.1	20	13.5	1.41	4.1	2400	C-8Z	24	0.5	0.5	P-6	PG20-2
	PSY24W[10]	23.9	+15 -25	13.5	1.78	4.1	2400	C-8Z	24	0.5	0.5	P-6	PG20-4
	PR21W[10]	8.75	20	13.5	1.85	6	600	C6	31.8	0.1	0.1	S-8	BAW15s
	PR21/5W[10]	8.36 0.64	20 25	13.5 13.5	1.85 0.44	6 10	1000 2000	C6 C6	31.8	1.75	1.75	S-8	BAW15d
	WR5W[10]	0.95	25	13.5	0.37	10	1000	C2-R	12.7	1.5	1.5	T3-1/4	W2,1X9,5d
7440	W21W[10]	36.6	15	13.5	1.85	6	300	C-6	1.142	Note (8)	Note (8)	T-6-1/2[9]	W3x16d
7443	W21/5W[10]	35 2.8	15	13.5 13.5	1.85 0.44	6 10	500 1000	C-6 C-6	0.984	Note (8)	Note (8)	T-6-1/2[9]	W3x16q
—	WY21W[10]	22.3	20	13.5	1.85	6	300	C-6	1.142	Note (8)	Note (8)	T-6-1/2[9]	WX3x16d

[1] ANSI Rating
[2] Filament types - see Figure 4
[3] Light Source Types - see Figure 3
[4] Base Types - see Figures 6, 7A, 7B, 7C, 8, 9, and 10
[5] See Figure 5 for filament spacing and light center length
[6] Plane of pins with respect to filament is 90 degrees ± 15 degrees
[7] Light-source listed for historical purpose. Typically used only for Parts and Service.
[8] Refer Box system shown in Figure 5B
[9] Refer Figure 3
[10] See 5.5.3
[11] Alternate non-ANSI, non-ECE designation HPC16W
[12] Alternate non-ANSI, non-ECE designation HPC16WY
[13] Alternate non-ANSI, non-ECE designation HPC19W
[14] Alternate non-ANSI, non-ECE designation HPC24W
[15] Alternate non-ANSI, non-ECE designation HPC24WY

TABLE 2B - TYPICAL LED SIGNAL AND MARKING LIGHT SOURCES FOR MOTOR VEHICLES

SAE Desig-nation	ECE Desig-nation	Luminous Flux Lm	Flux Tol. ± %	Design Voltage	Operating Voltage Range	Wattage (Max)	Rated Average Lab Life Hours[1]	Color (J578)	Symmetry	LCL mm	LCL Tol. ± mm	Base Type[2]	Connector Type	Status Function	Typical Application
LR1	LR1	47	20	12.8	10-16	3.5	5000	Red	rotational	24.0	0.2	PGJ21t-1	USCAR 064-S004-1-A02	Yes	Stop/Turn
		3.5	20	12.8	10-16	0.75	10000	Red	rotational	24.0	0.2			No	Tail

[1] Laboratory life is defined as steady operation of 23.5 h "on" followed by 0.5 h "off" at 23 °C ± 2.5 °C
[2] Per IEC Publication 60061 (sheet 7004-165-1)

3.8 FILAMENT

A tungsten wire wound into a coiled body which is heated to incandescence when voltage is applied. Continuous and legged filaments are the two most common styles used in automotive applications. Figure 1 shows a typical example of a continuous filament and Figure 2 shows a typical example of a legged filament.

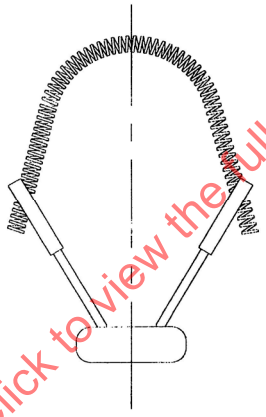

FIGURE 1 - CONTINUOUS FILAMENT
(WAA VIEWS, C-2R FILAMENT SHAPE)

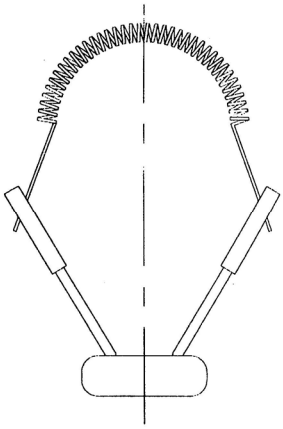

FIGURE 2 - LEGGED FILAMENT
(WAA VIEW, C-2R FILAMENT SHAPE)

In dual function bulbs, filaments are typically designated as follows:

Major Filament - The filament that has the higher light output.
Minor Filament - The filament that has the lower light output.

TABLE 3 - BASIC FILAMENT LIGHT SOURCE DIMENSIONS (SEE FIGURE 3)

Light Source Type	Base Type	Maximum Light Source Diameter mm	Maximum Light Source Diameter in	Maximum Exposed Length (L) mm	Maximum Exposed Length (L) in	Typical Application	ANSI Numbers
B - 6	BA15s	19.7	0.775	37.3	1.469	Deck Lid, Engine Compartment	1003, 1004
G - 4 ½	BA9s	15.0	0.590	21.4	0.843	Instrument Cluster, License	57, 1895
G - 5 ½	P(G)(U)20(d)-n	(1)	(1)	(1)	(1)	Exterior Signal Lighting	7010-7011
G - 6	BA15s	19.0	0.748	30.2	1.189	Deck Lid, Engine Compartment	67, 89, 97
GT - 8	W2.5x16	26.5	1.043	44.0	1.732	Exterior Signal Lighting	3057, 3156, 3157
P - 6	P(G)(U)20(d)-n	(1)	(1)	(1)	(1)	Exterior Signal Lighting	5200, 5201, 5202, 7012-7014
S - 8	BA15s	26.5	1.043	45.0	1.772	Exterior Signal Lighting	1073, 1141, 1156
S - 8	BAY15d	26.5	1.043	45.0	1.772	Exterior Signal Lighting	1157, 2057, 2357
S - 8	W2.5x16	26.5	1.043	44.0	1.732	Exterior Signal Lighting	3057, 3156, 3157
T - 1 ¾	W2.1x4.9d	5.8	0.230	15.2	0.598	Indicator, Radio	37, 73, 74
T - 3	RIGID LOOP	10.16	0.400	43.7	1.720	Interior application	561, 562, 563, 564, 567
T - 3 ¼	BA9s	11.0	0.433	23.9	0.941	Instrument Cluster, License	1889, 1893
T - 3 ¼	W2.1x9.2d	10.3	0.405	20.7	0.815	Instrument Cluster, License	161, 168, 194
T - 5	W2.1x9.2d	15.7	0.620	32.0	1.500	Interior application, CHMSL	906, 912, 921
T - 6 ½	W3x16d		0.807		1.693	Turn signal, Stop	7440
T - 6 ½	W3x16q		0.807		1.535	Stop, Tail	7443
T - 6 ½	WX3x16d		0.807		1.693	Turn Signal	

(1) See ECE Regulation 37

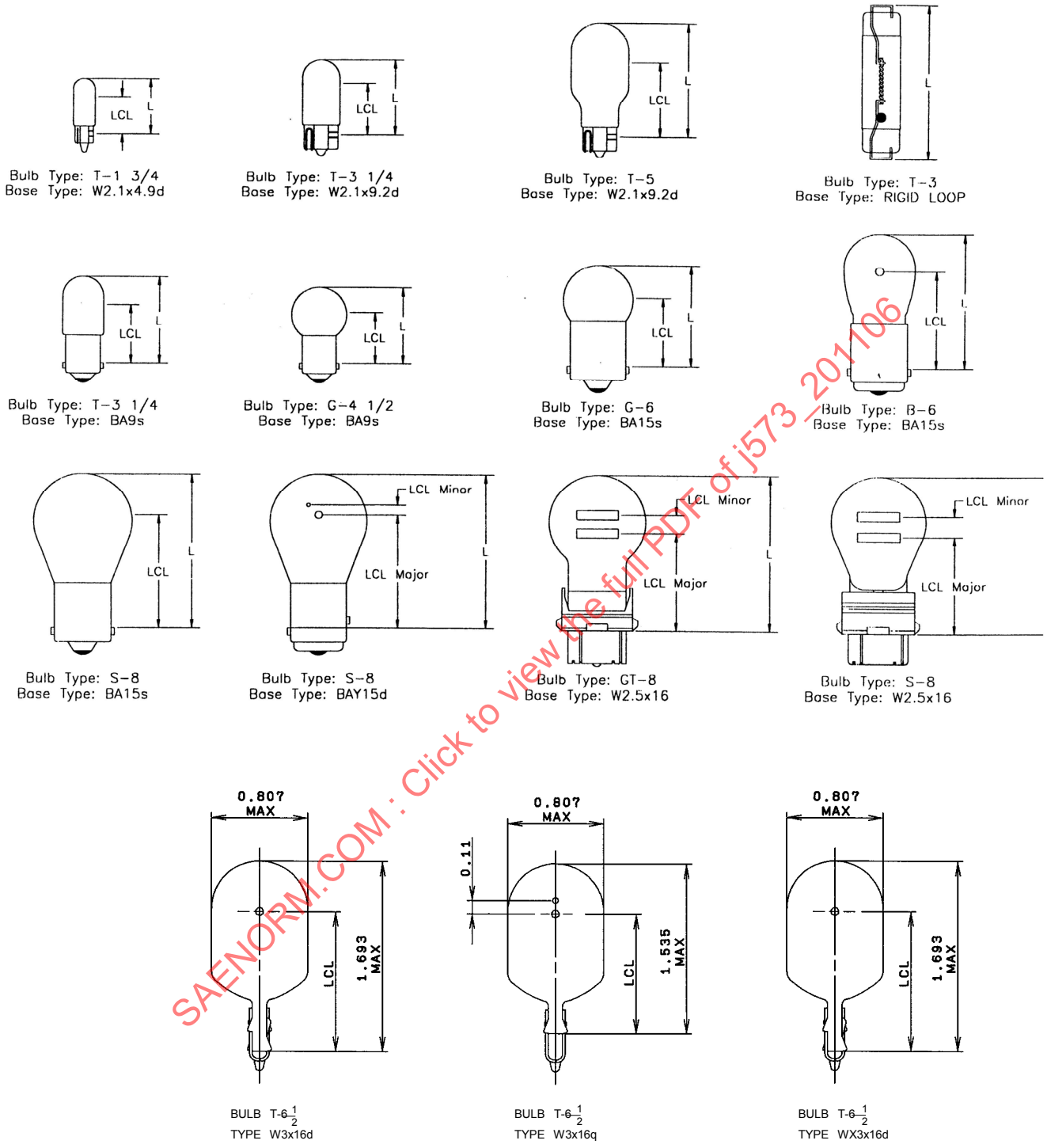

FIGURE 3 - TYPICAL SIGNAL AND MARKING FILAMENT LIGHT SOURCES

3.9 FILAMENT SHAPE

See Figure 4.

C-6 - straight transverse mounted (horizontal)
C-8 - straight axial mounted (vertical)
C-2R - non support (arched)
C-2V - single support (v-eed)
C-2F - dual support

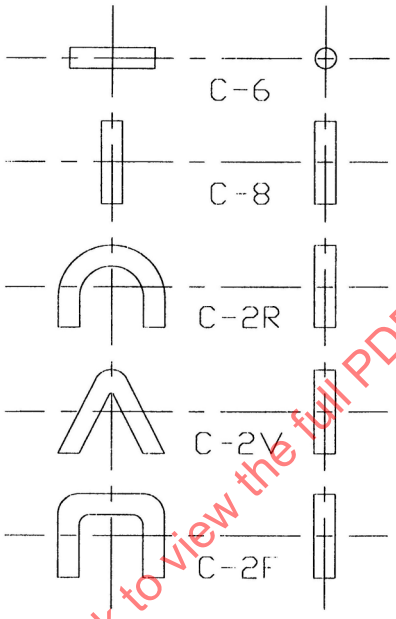

FIGURE 4 - FILAMENT SHAPES

3.10 FILAMENT CENTER

The LCL is to be located at approximately center-of-light mass and examples of possible LCL determinations are as shown in Figure 5.

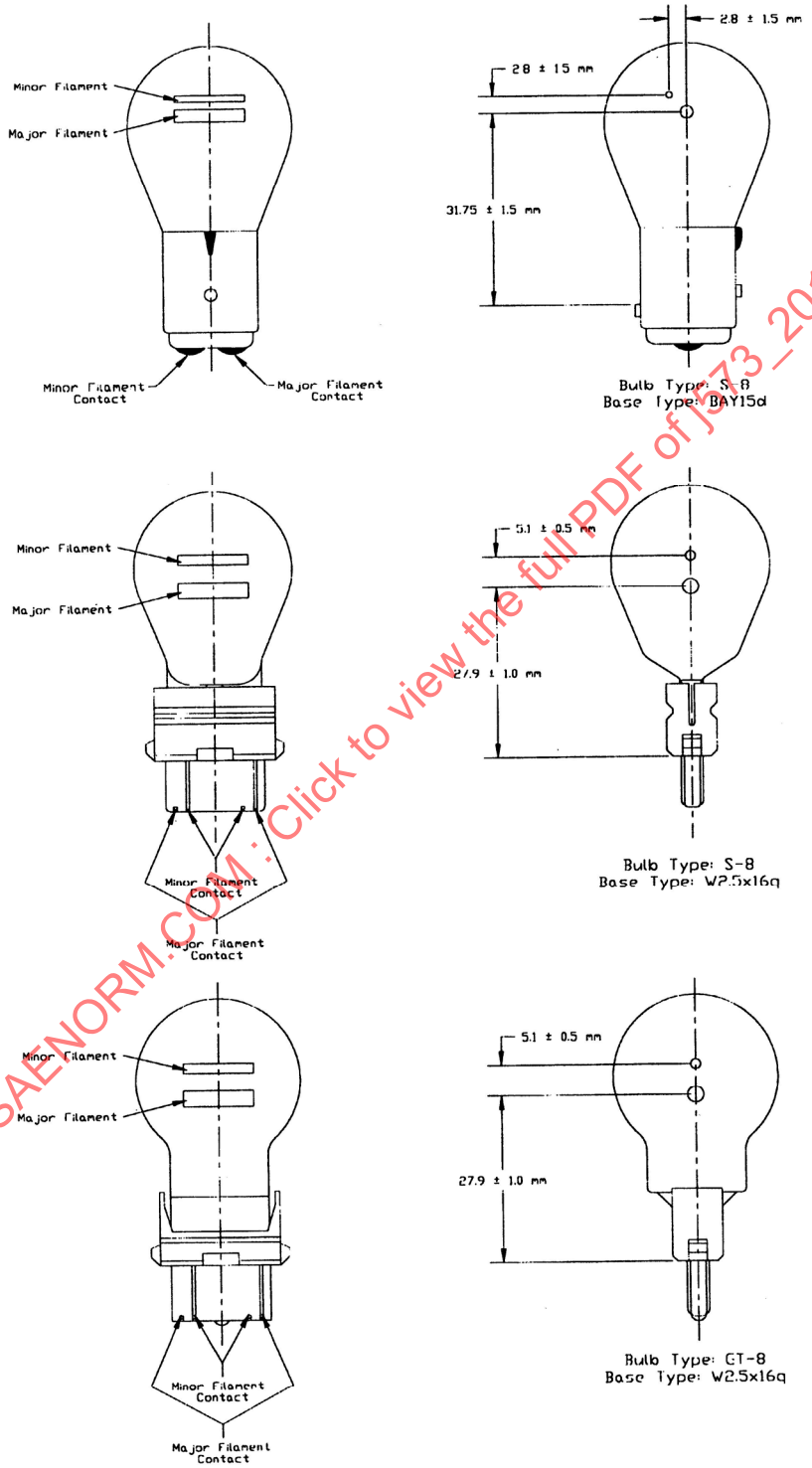

FIGURE 5 - FILAMENT LOCATION ON DUAL FUNCTION FILAMENT LIGHT SOURCES

a. Continuous Coil:

1. For LCL - Half the distance between the clamped filament and the most upward bound part of the filament.
2. For WAA - Half the distance between the lead wire clamps.
3. For NAA - Half the distance between the lead wire clamps and the most outward bound part of the filament.

b. Legged Coil:

1. For LCL - Half the distance between the first turn of the coil and the most upward bound part of the filament.
2. For WAA - Half the distance between the first turn on each end of the coil.
3. For NAA - Half the distance between the lead wire clamps and the most outward bound part of the filament.

3.11 LIGHT CENTER

A position on the reference axis at a defined distance from the reference plane.

3.12 LIGHT CENTER LENGTH (LCL)

The distance between the reference plane and the light center.

3.13 LED LIGHT EMITTING AREA (LEA)

An area that contains the source of radiation when observed under a certain viewing axis. This area is defined in a plane that contains the light center and that is perpendicular to the corresponding viewing axis

3.14 LED APPARENT LIGHT EMITTING AREA

An area that contains the apparent source of radiation when observed under a certain viewing axis. This area is defined in a plane that contains the light center and that is perpendicular to the corresponding viewing axis.

3.15 NORMALIZED LUMINOUS INTENSITY DISTRIBUTION

Distribution of luminous intensity divided by the luminous flux of a light source in order to characterize the angular radiation pattern of a light source.

3.16 VIEWING AXIS (OF A LIGHT SOURCE)

An axis through the light center at defined polar and azimuthal angle used to characterize photometrical properties of the LED light source.

3.17 REFERENCE AXIS

An axis defined with reference to the base and to which certain dimensions of the light sources are referred.

3.18 REFERENCE PLANE

A plane defined with reference to the base perpendicular to the reference axis and to which certain dimensions of the light sources are referred.

4. TESTS

4.1 Samples

Samples shall be selected in accordance with 3.1 and then seasoned according to 3.4. Any associated electronics shall be also used in order to meet the requirements of samples as defined by 3.1.

4.2 Mean Spherical Candela/Luminous Flux

The mean spherical candela or luminous flux shall be measured per LM-45 (Incandescent) and LM-79 (LED) and tabulated per characteristics as outlined in Table 2A and 2B.

4.3 Optical Characteristics of LED Light Sources

For all optical measurements thermal management of the light source system is essential. Performance will depend on temperature. These considerations may include active (i.e., fan) or passive (i.e., heat sink) components. Also, a minimum free air space for convection may be required. To verify the performance of the thermal management, the following procedure shall be applied: A luminous flux measurement shall be made after 1 min and after 30 min of operation. The luminous flux values, as measured after 1 min and after 30 min, shall comply with the minimum and maximum requirements.

4.3.1 Luminous Flux

A seasoned LED light source shall be measured per 4.1. The ambient temperature shall be 23 °C ± 2 °C.

4.3.2 LED Light Emitting Area

Figure 12 defines the light emitting area of an LED light source to determine whether the light emitting area is correctly positioned relative to the reference axis and reference plane in order to check compliance with the requirements.

The position of the light emitting area is checked in two planes containing the reference axis for C=0 degree and C=90 degrees (C is defined in Figure 13). The light source is viewed perpendicular to the reference axis.

4.3.3 Normalized Luminous Intensity Distribution

The set up for measuring the luminous intensity distribution is shown in Figure 13 and refers to the C-γ system according to CIE publication No. 70 -1987, "The Measurement of Absolute Luminous Intensity Distributions".

The measurements shall be performed in three C-planes containing the reference axis and at several γ-angles with reference to the light center.

4.4 Ultraviolet (UV) Radiation of LED Light Sources

4.4.1 The UV radiation of the LED light source shall be measured in accordance with IEC/TR 62471-2. The measured value shall meet the following:

$$k_{UV} = \frac{\int_{\lambda=250\,nm}^{400\,nm} E_e(\lambda)\, S(\lambda)\, d\lambda}{k_m \int_{\lambda=380\,nm}^{780\,nm} E_e(\lambda)\, V(\lambda)\, d\lambda} \le 10^{-5}\, W/lm \qquad \text{(Eq. 1)}$$

where:

$E_e(\lambda)$ [W/nm]	is the spectral distribution of radiant flux
$V(\lambda)$	is the spectral luminous efficiency
λ [nm]	is the wave length
$S(\lambda)$	is the spectral weighting function
k_m = 683 [lm/W]	is the maximum value of the luminous efficacy of radiation

This value shall be calculated using intervals of 1 nm. The UV-radiation shall be weighted according to the values as indicated in the table below:

λ	S(λ)	λ	S(λ)	λ	S(λ)
250	0.430	305	0.060	355	0.000 16
255	0.520	310	0.015	360	0.000 13
260	0.650	315	0.003	365	0.000 11
265	0.810	320	0.001	370	0.000 09
270	1.000	325	0.000 50	375	0.000 077
275	0.960	330	0.000 41	380	0.000 064
280	0.880	335	0.000 34	385	0.000 530
285	0.770	340	0.000 28	390	0.000 044
290	0.640	345	0.000 24	395	0.000 036
295	0.540	350	0.000 20	400	0.000 030
300	0.300				

NOTE: Values according to "IRPA/INIRC Guidelines on limits of exposure to ultraviolet radiation". Wavelengths (in nanometers) chosen are representative; other values should be interpolated.

4.5 Electronics (Associated Electronics)

If a light source contains or has associated electronics that control or drive the light source it shall be tested per SAE J2357.

5. REQUIREMENTS

5.1 Test samples shall comply with the following requirements.

5.2 Mean Spherical Candela/Luminous Flux

After seasoning, test samples shall be measured at design voltage in a properly calibrated integrating sphere (Reference SAE J1330) or in accordance with other accepted integrating photometric procedures. See Table 2A and Table 2B for luminous flux values. For light sources not listed, refer to the manufacturer's published data.

5.3 Physical Dimensions of Filament Light Sources

5.3.1 Table 3 lists the basic filament light source dimensions for maximum light source diameter, maximum exposed length, typical application, and ANSI numbers.

5.3.2 Table 2A lists the design value and tolerances for the electrical, photometrical, and physical location of the filament(s)

5.3.3 For ECE type light sources indicated by footnote (10) in Table 2A, Regulation 37, and IEC 60061 base data sheets define the dimensions necessary for interchangeability. For other light sources Tables 4, 5, 6, 7, and 8 list the dimensions necessary to insure interchangeability.

5.3.3.1 Figure 3 shows typical signal and marking filament light sources

5.3.3.2 Figure 4 shows the determination of filament center for different filament configurations.

5.3.3.3 Figure 5 indicates filament location for dual function filament light sources.

5.3.4 Table 4 lists the base dimensions considered important for Miniature Bayonet Base (Base Type BA9s) light sources to ensure that filament light sources will perform satisfactorily in a light source -retaining device (socket) made in accordance with SAE J567 and ANSI C81.62 standard sheet 2-10-x and its related documents.

TABLE 4 - BA9s BASE DIMENSIONS TO BE CONTROLLED ON A FINISHED LIGHT SOURCE (SEE FIGURE 6)

Dimension	(millimeters) Min.	(millimeters) Max.
D1	4.57	6.48
N	4.50	—
U	—	10.41

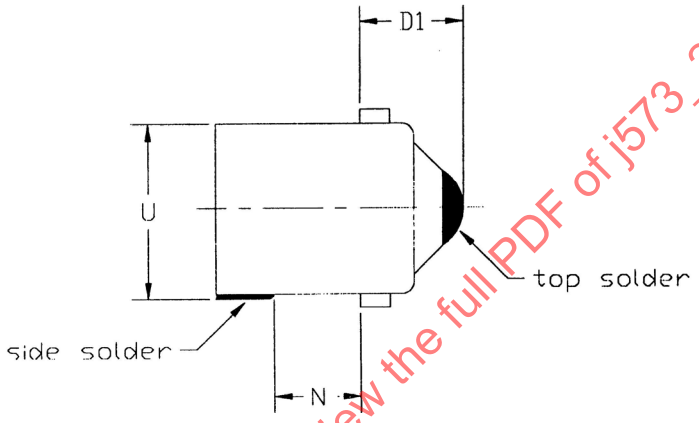

FIGURE 6 - BA9s BASE DIMENSIONS TO BE CONTROLLED ON A FINISHED LIGHT SOURCE

5.3.5 Table 5 lists the base dimensions considered important for Candelabra Bayonet Bases (Base Type BA15s, BA15d, BAY15d) light sources to ensure that light source will perform satisfactorily in a light source -retaining device (socket) made in accordance with SAE J567 and ANSI C81.62 standard sheet 2-20-x, 2-22-x, and its related documents.

TABLE 5 - BA15s, BA15d, BAY15d BASE DIMENSIONS TO BE CONTROLLED ON A FINISHED LIGHT SOURCE (SEE FIGURES 7A, 7B, AND 7C)

Dimension	(millimeters) Min.	(millimeters) Max.
D1	6.32	8.03[1]
N	8.90	—
U	—	16.26

[1] This dimension is used by North American Light Source Manufacturers and is different than the European Light Source Manufacturers.

For full base detail see ANSI standard C81.61 sheet 1-20-x and 1-22-x

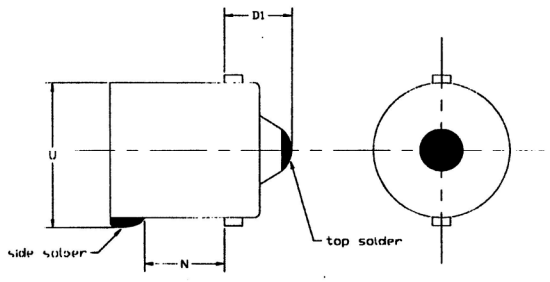

FIGURE 7A - BA15s DIMENSIONS TO BE CONTROLLED ON A FINISHED LIGHT SOURCE

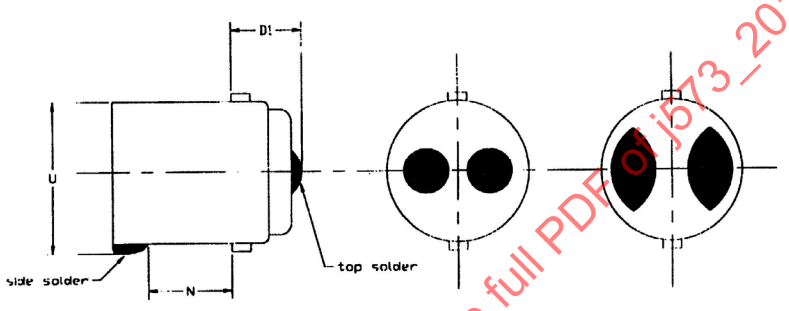

FIGURE 7B - BA15d DIMENSIONS TO BE CONTROLLED ON A FINISHED LIGHT SOURCE

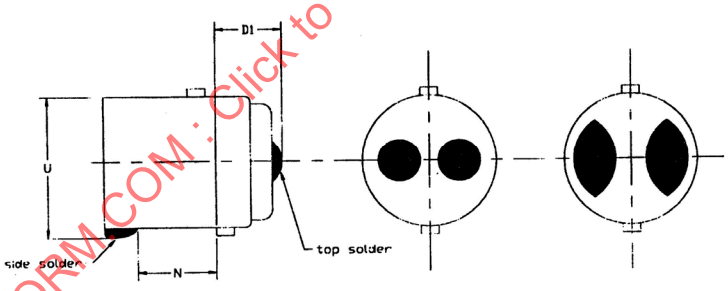

FIGURE 7C - BAY15d DIMENSIONS TO BE CONTROLLED ON A FINISHED LIGHT SOURCE

5.3.6 Table 6 lists the base dimensions considered important for subminiature wedge base (Base Type W2.1x4.9d) light sources to ensure that light sources will perform satisfactorily in a light source retaining device (socket) made in accordance with SAEJ567 and ANSI C81.62 standard sheet 2-900-x and its related documents.

TABLE 6 - WEDGE BASE DIMENSIONS
(SEE FIGURE 8)
BASE TYPE W2.1 x 4.9d

Dimension	(millimeters) Min.	(millimeters) Max.
A (Note 1)	2.03	3.04
B	3.04	5.08
C	—	5.08
E	4.70	5.08
G (Note 2)	—	3.10
H	3.30 NOM	3.30 NOM
L (Note 3)	—	5.84
M	1.52 NOM	1.52 NOM
N	1.65	—
P (Note 4)	1.78	2.28
Q	0.51 NOM	0.51 NOM
α	10 degrees	18 degrees

For full base detail see ANSI standard C81.61 sheet 1-900-x

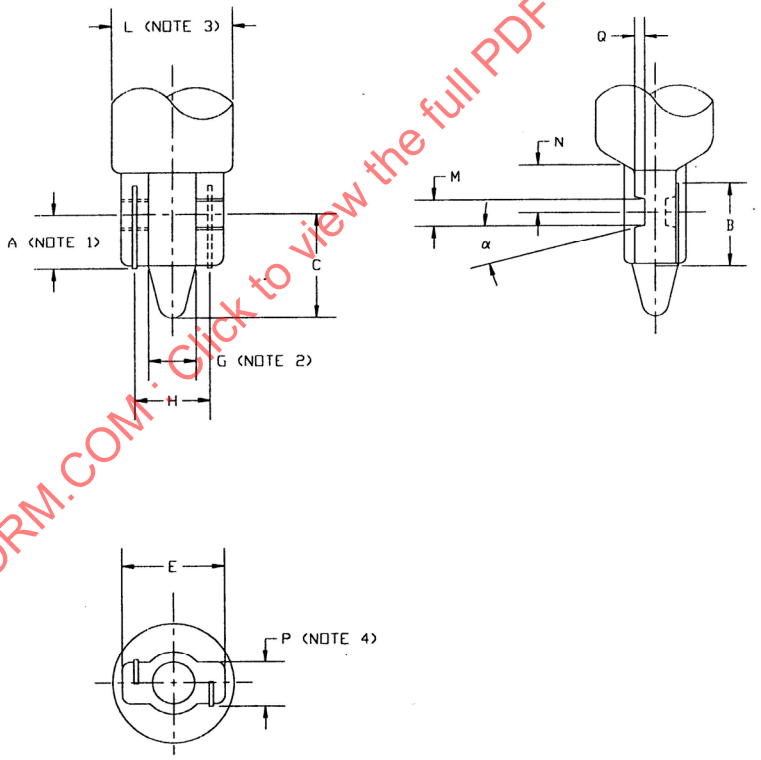

FIGURE 8 - BASE TYPE W2.1x4.9d

NOTE 1: Dimension A to be measured on the longest side only, with the wire in intimate contact with the bottom of the glass.

NOTE 2: Dimension G applies to the cylindrical section, and for exhaust tip clearance.

NOTE 3: Dimension L applies to lamps designed to fit P8.25d bases. See ANSI C81.61-19xx Standard Sheet 1-530-x.

NOTE 4: Dimension P to be measured over the lead wire.

5.3.7 Table 7 lists the base dimensions considered important for wedge base (Base Type W2.1x9.2d) light sources to ensure that the light sources will perform satisfactorily in a light source-retaining device (socket) made in accordance with SAE J567 and ANSI C81.62 standard sheet 2-920-x and its related documents.

TABLE 7 - WEDGE BASE DIMENSIONS
(SEE FIGURE 9)
BASE TYPE W2.1x9.2d

Dimension	(millimeters) Min.	(millimeters) Max.
A (Note 1)	3.43	4.45
B (Note 2)	4.83	—
C	—	6.35
D	1.5 NOM	1.5 NOM
E	8.89	9.50
F (Note 3)	—	3.04
G (Note 4)	—	4.06
H (Note 5)	5.58 NOM	5.58 NOM
J	0.76 NOM	0.76 NOM
J1	1.20 NOM	1.20 NOM
L	—	10.30
M	1.25 NOM	1.25 NOM
N	1.65	—
P	1.91	2.41
Q	0.53	0.67
R	0.76 NOM	0.76 NOM
T (Note 8)	4.90	7.50
α	10 degrees	18 degrees

For full base detail see ANSI standard C81.61 sheet 1-920-x

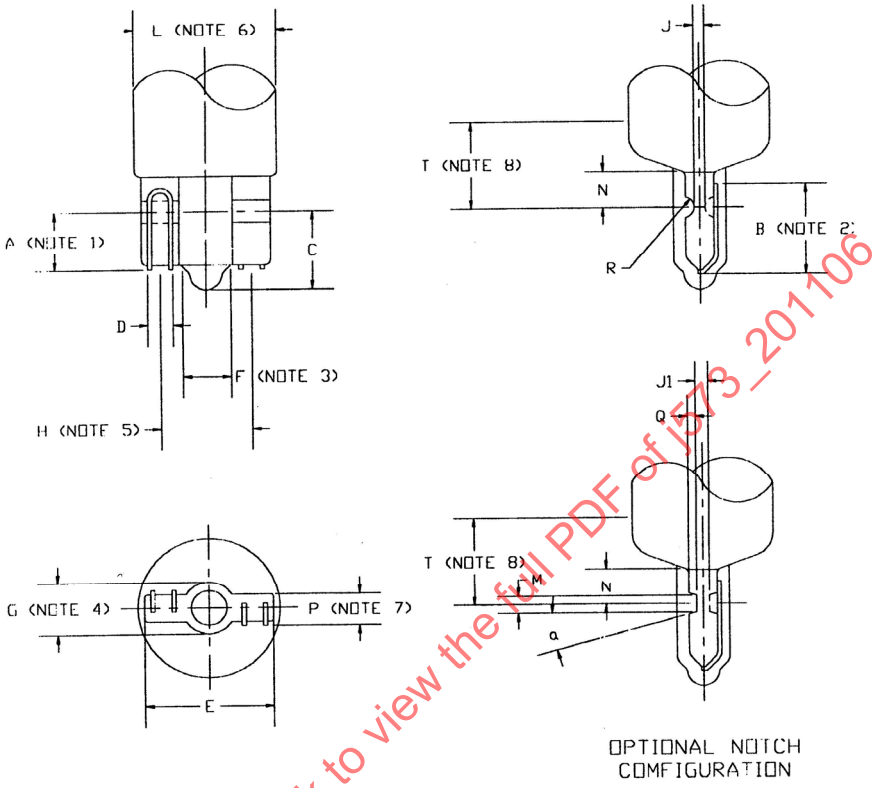

FIGURE 9 - BASE TYPE W2.1x9.2d

NOTE 1: Dimension A to be measured on the longest side only, with the wire in intimate contact with the bottom of the glass.

NOTE 2: Inside of the lead loop to extend past the detent and remain on the flat portion of the base.

NOTE 3: Dimension F is for exhaust tip clearance.

NOTE 4: Dimension G applies to the cylindrical section.

NOTE 5: Dimension H to be maintained over the entire length as specified by Dimension B.

NOTE 6: Dimension L applies to lamps designed to fit P12.4d bases, and is applicable for 7.1 mm minimum from notch centerline. See ANSI C81.61-19xx Standard Sheet 1-550-x.

NOTE 7: Dimension P to be measured over the lead wire.

NOTE 8: Dimension T applies from the notch centerline to the full diameter of the light source .

5.3.8 Table 8 lists the base dimensions considered important for wedge base (Base Type W2.5x16d and W2.5x16q) light sources to ensure that light sources will perform satisfactorily in a light source-retaining device (socket) made in accordance with SAE J567 and ANSI C81.62 standard sheet 7005-104-x and its related documents.

TABLE 8 - WEDGE BASE DIMENSIONS
(SEE FIGURE 10)
BASE TYPE W2.5x16d AND W2.5x16q

Dimension	(millimeters) Min.	(millimeters) Max.
A	19.4	19.6
B	8.0	8.2
C (3) (4)	11.9	12.1
D	5.9	6.3
F	8.4	9.4
F1 (1)	—	10.5
G	2.49	2.79
G1	3.45	4.30
H	4.3	4.6
H1	6.3	6.6
J	15.75	16.25
K (4) (7)	1.0 NOM.	1.0 NOM.
L	1.8	2.2
M (5)	3.65	3.85
N (5)	5.7	—
P (W2.5x16d)	5.4	5.6
P (W2.5x16q)	2.9	3.1
R (6)	2.75	2.95
T (6)	22.1	22.3
U	9.65	9.85
V	5.6	6.0
W	11.0	11.2
α	44 degrees	46 degrees
β	24 degrees	26 degrees
γ (6)	44 degrees	46 degrees
θ (5)	44 degrees	46 degrees
μ (4)	40 degrees	—