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AMERICAN NATIONAL STANDARD

American National Standard

ANSI C78.1386-1998

American National Standard

for electric lamps:

100-Watt, M91 Double-Ended Metal-Halide Lamps

NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
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American National Standard

Approved August 18, 1998 Secretariat: National Electrical Manufacturers Association

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Annex A: Informative References A-1

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Foreword (This Foreword is not part of ANSI C78.1386-1998.)

Suggestions for improvement of this standard should be submitted to the Secretariat C78, National Electrical Manufacturers Association, 1300 North 17th Street, Suite 1847, Rosslyn, VA 22209.

This standard was processed and approved by Accredited Standards Committee on Electric Lamps, C78, and its Sub-Committee, C78-4 for High-Intensity Discharge Lamps. Committee approval of the standard does not necessarily imply that all committee members voted for that approval. At the time this standard was published, the C78 Committee had the following members:

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for electric lamps—

100-watt, M91 double-ended metal-halide lamps

1 Lamp designation and description

Metal-halide lamp designations are assigned in accordance with ANSI C78.380.

Designation	Bulb	Base
M91TN-100	T6(T19)	R7s

CAUTION: For fused silica bulbs, protection against UV radiation is required.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this American National Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this American National Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below.

ANSI C78.260-1998, *ANS for electric lamps—Tubular Tungsten Halogen Lamps—Physical Characteristics*

ANSI C78.380-1997, *ANS for electric lamps—High-Intensity-Discharge Lamps—Method of Designation*

ANSI C78.387-1995, *ANS for electric lamps—Metal-Halide Lamps—Methods of Measurement*

ANSI C79.1-1994, *ANS for electric lamps—Nomenclature for Glass Bulbs and Molded Glass Flares Intended for Use with Electric Lamps*

ANSI C81.61-1990 (R1996), *ANS for electrical lamp bases*

ANSI C81.63-1991 (R1996), *ANS for gauges for electric lamp bases and lampholders*

ANSI C82.4-1992, *ANS for electric lamp ballasts—Ballasts for High-Intensity- Discharge and Low Pressure Sodium Lamps (Multiple Supply Type)*

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ANSI C82.5-1990 (R1995), *ANS for electric lamp ballasts—Reference Ballasts for High-Intensity-Discharge Lamps*

ANSI C82.6-1985 (R1996), *ANS for electric lamp ballasts—Ballasts for High-Intensity-Discharge Lamps—Method of Measurement*

ANSI/UL1029-1994, *Standard for High-Intensity-Discharge Lamp Ballasts*

ANSI/UL1572-1995, *Standard for Safety, High-Intensity-Discharge Lighting Fixtures*

3 Physical characteristics

3.1 Bulb designations

Bulb designations are defined in ANSI C79.1. Due to the long term use of the customary method of bulb designations, their use will continue herein with the equivalent metric bulb designations shown in parentheses (i.e. T8 (T25)) in contrast with the use of metric primary dimensions elsewhere in this standard.

3.2 Base specifications

R7s, type bases are specified in ANSI C81.61. Compliance shall be checked by the relevant gauges in ANSI C81.63.

3.3 General characteristics

With T6 (T19) bulb:

Dimensions (see Figure 1)

B. Max. base edge to contact length.....117.6 mm (4.63 in)
C. Contact to contact length .....114.2 mm ± 1.6 mm (4.50 in ± 0.06 in)
D. Axis to max. tip length .....15 mm (0.59 in)
T. Maximum major diameter length .....73 mm (2.87 in)

Effective arc length .....14 mm ± 3 mm (0.58 in ± 0.12 in)
Operating position limitation .....Horizontal ± 45°
Maximum permissible bulb temperature.....500°C (932°F)
Maximum permissible base temperature.....280°C (536°F)

NOTE—Use ANSI C78.260 and C81.61 as a guide when establishing the physical dimensions to assure compatibility with the lampholder system. (Pinch height and width dimensions are controlled by the base standard.)

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3.4 Lamp enclosure (for lamps requiring UV protection)

These lamps are not intended for operation in free air, and shall be operated in suitably designed enclosed luminaires. The luminaires shall also provide protection against UV radiation. See requirements contained in ANSI/UL 1572. The lamp operating and warm-up characteristics given in Sections 5 and 6 apply to lamps operating in a luminaire simulator. Details of suitable simulators which may or may not provide UV protection must be obtained from the lamp manufacturer.

4 Typical lamp outline drawing

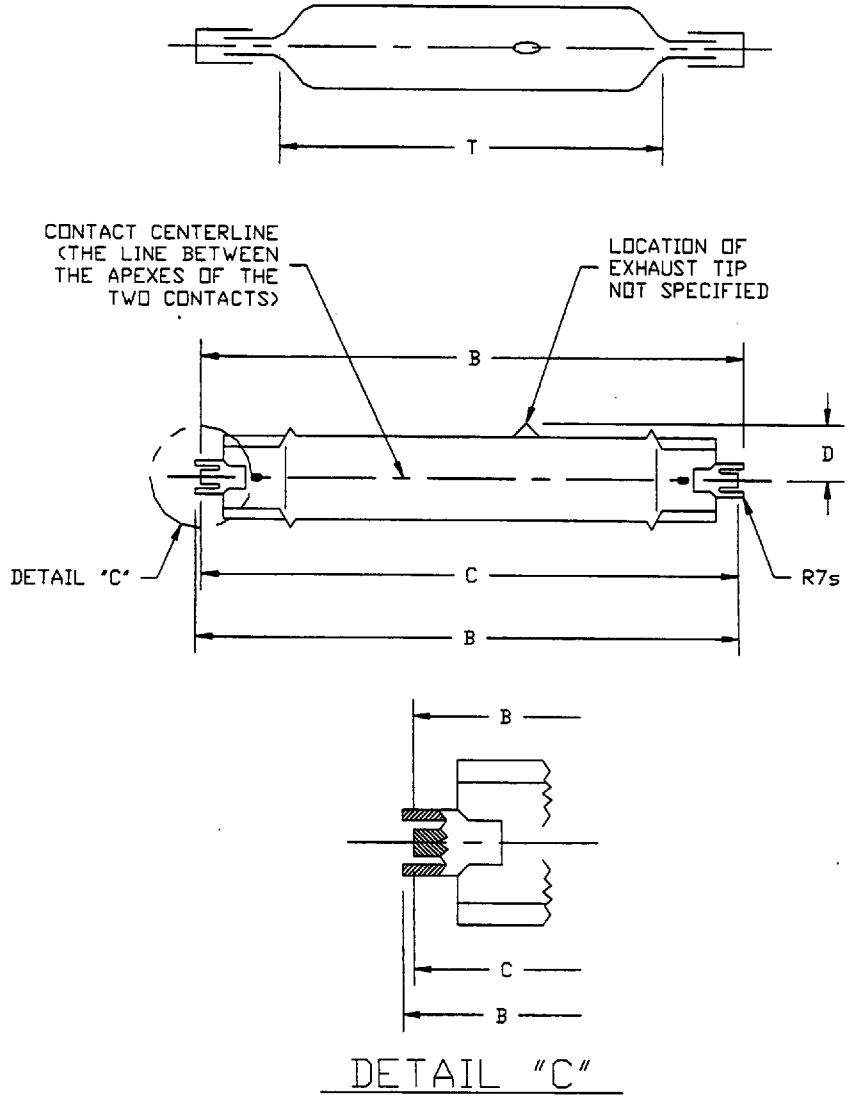

Figure 1
Typical Lamp Outline Drawing

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5 Electrical characteristics

See ANSI C78.387 for measurement procedures.

Lamps shall be measured in the horizontal position with the internal arc tube fill tip pointing vertically upwards unless otherwise designated by the lamp manufacturer.

5.1 Lamp operating characteristics at 100 hours burning

	Horizontal*		
	Min	Nom	Max
Voltage at lamp terminals (volts, rms)	90	100	110
Lamp current (amperes, rms)	-	1.1	-
Lamp wattage (Watts)	-	100	-

*Unless otherwise designated by the lamp manufacturer.

The preceding lamp operating characteristics are based on operation within a luminaire simulator and in an ambient temperature of 25°C ± 5°C (77°F ± 9°F) on a reference ballast as shown in Section 7.

5.2 Lamp reignition voltage spike

The reignition voltage spike during warm-up for any lamp shall not exceed 200 volts peak when operated on a linear reactor ballast having the following characteristics:

Supply voltage ..... 300 volts
Ballast short circuit current..... 1.5 amperes
Impedance ..... 200 ohms
Power factor..... 0.075 ± 0.005
Linearity ..... Requirements identical to reference ballasts (See ANSI C82.5)

5.3 Lamp reignition voltage (Vr)

Maximum level through life as measured on a reference ballast in section 7: TBD volts, peak

6 Lamp starting voltage and warm-up requirements

See ANSI C78.387 for measurement procedures.

Lamps shall be measured in the horizontal position with the internal arc tube fill tip pointing upwards, unless otherwise designated by the lamp manufacturer.

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6.1 Lamp starting voltage requirements

Lamps shall start within the time specified at the ambient temperature indicated under the following test conditions:

(1) A reference ballast as specified in Section 7 except using a 235 volt sine-wave power supply of 60 Hz.

(2) A starting pulse with open circuit characteristics at the minimum pulse characteristics of 8.1. The starting pulse shall be applied to either base contact with the wiring between ballast and lampholder (or its equivalent capacitance) connected. See the manufacturer's literature for the correct value of equivalent capacitance.

Temperature	Time
10°C ± 1°C (50°F ± 2°F)	30 Secs.
-30°C ± 1°C (-22°F ± 2°F)	120 Secs.

6.2 Lamp warm-up requirements

Preparation of lamps for warm-up tests shall be in accordance with ANSI C78.387.

Bare lamps operating within a luminaire simulator at an ambient temperature of 25°C ± 5°C (77°F ± 9°F) shall reach a minimum of 80 volts in not more than 5 minutes. The lamps shall be operating in a horizontal position with the internal arc tube fill tip upwards on a reference ballast as specified in Section 7 using a 220-volt sine-wave power supply of 60 Hz.

7 Reference ballast characteristics

See ANSI C82.5 for the general specifications for reference ballasts.

Various lamp test procedures are based on operation on a reference ballast having the following characteristics:

Supply voltage ..... 220 volts*
Reference current ..... 1.1 amperes
Impedance ..... 157 ohms
Power factor ..... 0.075 ± 0.005
Frequency ..... 60 Hz

* An auxiliary starter is required.

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8 Data for ballast and starter design

The ballast requirements shall be met throughout the full range of ballast rated supply voltages. They apply to ballasts integral to the luminaire as well as remotely connected ballasts and HID starters (that is, ignitors). Capacitive loading across the lampholder terminals may be necessary to simulate characteristics of a remotely connected ballast. For additional limits on ballast performance, see ANSI C82.4.

8.1 Starting voltage

Ballasts shall meet the following minimum open-circuit voltage specifications in order to reliably start lamps and sustain the arc discharge at ambient temperatures of -30°C (-22°F) or above:

(1) Open-circuit voltage

	For Starting		For Operation	
	Vrms	Vpeak	Vrms	Vpeak
(a) Minimum voltage, 60 Hz (lag circuit ballasts)	235	332	235	332
(b) Minimum voltage, 60 Hz (lead circuit ballasts)	Reserved for future consideration			

(2) Starter requirements

The starting pulse shall be applied to either base contact with the wiring between ballast and lampholder (or its equivalent capacitance) connected. See the manufacturer's literature for the appropriate value of equivalent capacitance. The pulse, measured at the lampholder terminals across a simulated lamp load of 20pF, shall have the following characteristics:

(a) Min pulse height, kV 4.0
(b) Max pulse height, kV 6.0
(c) Min pulse width, µs @ kV ..... 2 @ 3.6
(d) Min pulse repetition rate per 1/2 cycle 1
(e) Pulse position for
lag circuit ballasts ..... 60° to 90°
..... 240° to 270°
lead circuit ballasts ..... Reserved for future consideration
(g) Minimum starter current, milliamps, peak ..... TBD
(h) Starter cut-off voltage 180
(j) Instantaneous open circuit recovery voltage, minimum 280

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8.2 Starting current requirements

Amperes, rms	Lag Ballasts
Minimum	1.1
Maximum	1.5

Starting current is measured 5 to 15 seconds after the lamp has started.

To protect lamps during initial warm-up, maximum peak rectification current for lag ballasts shall be TBD amperes, peak. The peak value shall be measured with a suitable load substituted for the lamp. Refer to lamp manufacturer for details.

8.3 Current waveshape characteristics (for lead circuit ballasts)

Reserved for future consideration

8.4 Current crest factor

The lamp current crest factor, at any rated supply voltage, during warm-up and operation of a reference lamp shall not exceed 1.8.

8.5 Maximum peak voltage (across lamp terminals)

The maximum peak voltage across lamp terminals shall be 6.0 kilovolts.

NOTE—Instant hot lamp restart requires the use of suitable lampholder and luminaire construction.

8.6 Lamp operating wattage

The operating wattage of a lamp in a luminaire simulator is measured in its designated operating position on a ballast throughout its range of rated supply voltages in a still air ambient of 25°C ± 5°C (77°F ± 9°F). The following wattage limits apply.

	Minimum (Watts)	Maximum (Watts)
Wattage limits, 100hr lamps	80	120*
Wattage limits, through life (At all rated input voltages)	TBD	TBD*

Lamps shall operate within these limits throughout the full range of lamp voltage tolerance. When measured on a reference ballast, the range of lamp voltage through life is 90 to TBD volts.

To meet these limits, a ballast at 100% rated input voltage shall operate a reference lamp within ± 5% of the wattage delivered to the same lamp in the same position by a

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reference ballast. Also a ballast, throughout the input voltage range, shall operate a reference lamp within ± 15% of the wattage delivered to that reference lamp by a reference ballast at its rated voltage.

The design center of a ballast intended for this lamp shall be 100 watts.

* **CAUTION:** Specific wattage limits are based on normal tolerance distributions of lamp voltage, ballast adjustment, and line voltage. If these tolerances are extreme and in the same direction, the specified wattage limits could be exceeded.

8.7 Minimum lamp operating wattage

Operation of metal halide lamps below the limits of this standard will lower lamp efficacy and may result in color shift, arc instability, flicker and reduced lamp life. The lamp manufacturer shall be consulted before operating metal halide lamps at reduced wattage or in dimming circuits.

For additional limits of ballast performance, see ANSI C82.4.

9 Information for luminaire design

CAUTION: To insure correct thermal operation, UV protection and non-passive failure protection, the luminaire shall be designed in accordance with lamp manufacturers' recommendations for use and application.

Also see ANSI/UL 1572 for requirements on the construction of luminaires.

9.1 Voltage rise, luminaire effect limit

The lamp voltage of reference lamps, operating on a sinusoidal power supply of 60 Hz with the specified reference ballast at its rated input voltage, shall not change more than 5 volts when going from stabilized operation in a luminaire simulator to stabilized operation in a luminaire.

9.2 Lamp failure mechanism

Double-ended metal-halide lamps are constructed of a quartz arc tube with or without an outer jacket. These arc tubes operate under high pressure (typically 5 atmospheres) and temperature (900°C). The arc tube may unexpectedly rupture due to internal causes or external factors. When this occurs, particles of extremely hot quartz may be discharged into the luminaire enclosure. Therefore, these lamps must be used in suitably enclosed luminaires.

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Annex A
(informative)

A.1 Related standards

ANSI C81.62-1991 (R1996), *ANS for electric lampholders*

ANSI C82.9-1996, *ANS for lamp ballasts—Definitions for High-Intensity-Discharge and Low Pressure Sodium Lamps, Ballasts, and Transformers*

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