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Electric Lamps — Reference Ballasts for Fluorescent Lamps

National Electrical Manufacturers Association

ANSI C82.3-2016

American National Standard for Electric Lamps—
Reference Ballasts for Fluorescent Lamps

Secretariat:

National Electrical Manufacturers Association

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American National Standards Institute, Inc.

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Foreword (This foreword is not part of ANSI C82.3-2016)

Suggestions for improvement of this standard should be submitted to:

Secretariat C82
National Electrical Manufacturers Association
1300 North 17th Street
Suite 900
Rosslyn, VA 22209

This standard was processed and approved by Accredited Standards Committee (ASC) on Electric Lamps, C82, and its work group, C82-1. Committee approval of the standard does not necessarily imply that all committee members voted for that approval.

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1 Scope

This standard describes the essential design features and operating characteristics of reference ballasts for fluorescent lamps. The items specified are those that have been found necessary to ensure accurate and reproducible results when either lamps or ballasts are being tested. It includes requirements for both line frequency and high-frequency circuits. The specific values of rated input voltage and impedance for each size of lamp are listed in the applicable ANSI C78 lamp standard.

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 C78.81 *Double-Capped Fluorescent Lamps—Dimensional and Electrical Characteristics*

ANSI C78.375 *Fluorescent Lamps—Guide for Electrical Measurements*

ANSI C78.901 *Single Base Fluorescent Lamps—Dimensional and Electrical Characteristics*

ANSI C82.1 *Line Frequency Fluorescent Lamp Ballast*

ANSI C82.11 *High-Frequency Fluorescent Lamp Ballasts (Consolidated)*

ANSI C82.13 *Definitions—for Fluorescent Lamps and Ballasts*

IES LM-9 *IESNA Approved Method for the Electrical and Photometric Measurements of Fluorescent Lamps*

3 Definitions

See ANSI C82.13 for related definitions.

4 Marking

The reference ballast shall be provided with durable legible marking as follows:

Fixed-impedance type

a) the words “reference ballast” or “HF (high frequency) reference ballast” as applicable, in full;
b) manufacturer’s name and model number;
c) manufacturer’s serial number;
d) lamp type, wattage, and current;
e) rated supply voltage and frequency; and
f) impedance.

Adjustable-impedance type

a) the words “reference ballast” or “HF reference ballast” or “HF Power Supply” as applicable, in full;
b) manufacturer’s name and model number;
c) manufacturer’s serial number;
d) impedance range at rated frequency (or frequencies);
e) maximum voltage per element and maximum across unit;
f) maximum current;
g) frequency; and
h) connection diagram.

5 Design characteristics

5.1 General design for line frequency reference ballasts

A line frequency reference ballast is a self-inductive coil, with or without an additional series resistor for power factor adjustment, designed to give the operating characteristics of Clause 6.

It may be used either in a circuit employing a starter or, where applicable, in a circuit including separate power sources to heat the lamp cathodes. Further details of those circuits are given in ANSI C78.375.

5.2 General design for high-frequency reference ballasts at 25 kHz

A high-frequency reference ballast is a resistor or choke-coil designed to give the operating characteristics of Clause 7.

5.3 Permanence of impedance

5.3.1 Fixed-impedance type ballasts

Since this type of reference ballast is intended to serve as a permanent baseline of reference, it is vitally important that the ballast is constructed as to provide permanence of impedance under normal conditions of use and abuse.

A recheck of the impedance of the ballast shall give values within 0.1% of those previously determined.

5.3.2 Adjustable-impedance type ballasts.

This type of reference ballast, when adjusted to any given value of impedance, shall be capable of holding that adjustment through normal periods of use. For this purpose, suitable means shall be provided for mechanically locking the movable core (or other movable parts) in any desired position.

5.4 Enclosure

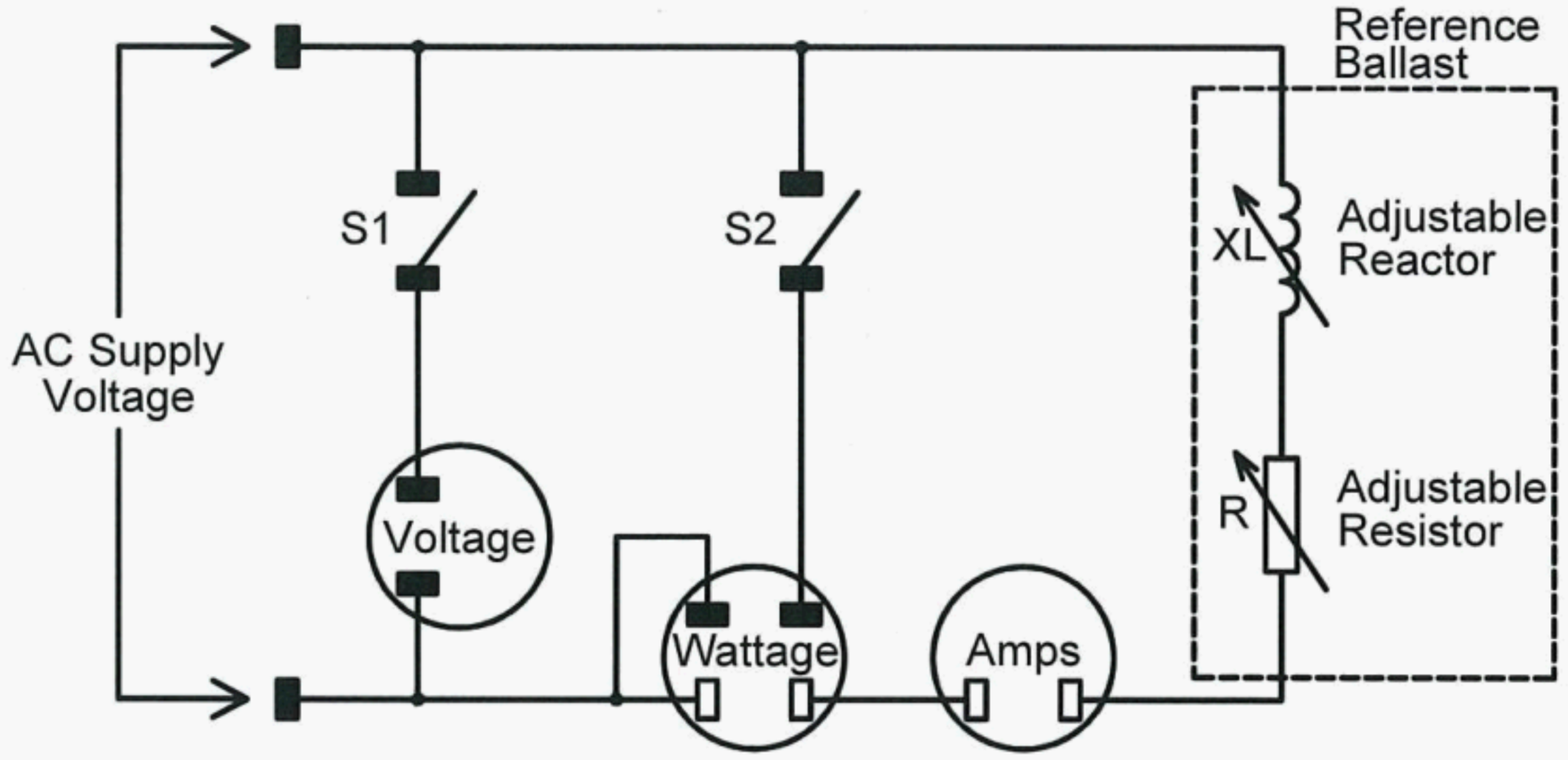
A reference ballast shall be enclosed for mechanical protection. In the case of the adjustable-impedance-type ballast, the series resistor need not be in the same enclosure with the reactor. Care should be taken for proper conduction of the dissipated wattage losses.

5.5 Magnetic shielding (for 60 Hz reference ballast)

A reference ballast should be protected against magnetic influence in such a way that its impedance at reference current shall not be changed by more than 0.2% when a half-inch (13-mm) plate of magnetic steel is placed within 1 inch (25 mm) of any face of the ballast enclosure. The steel plate shall have dimensions at least 2 inches (51 mm) greater than the maximum dimension of the ballast enclosure and shall be placed in geometric symmetry to each surface as tested. In the event that a reference ballast is not magnetically shielded, precautions shall be taken to keep magnetic objects far enough removed from the leakage field so that the impedance of the ballast will not be altered by more than the 0.2% mentioned above.

5.6 Inclusion of instrument current coils

When an adjustable-impedance type reference ballast is being used, a choice may be made as to whether the impedances of the instrument current coils (the ammeter and wattmeter) will or will not be included as part of the impedance of the reference ballast. Either procedure is satisfactory, however if the coils are included in the original calibration they must be left in the circuit at all times during subsequent use. Figure 1 shows the current coils included.



Current terminals of instruments are shown as:▯
Potential terminals of instruments are shown as:▮

Figure 1 Circuit for impedance and power factor measurement

6 Operating characteristics for 60 Hz

6.1 Rated supply voltage and frequency

The rated supply voltage and frequency of a reference ballast shall be in accordance with the value given on the relevant lamp data sheet in either ANSI C78.81 or ASI C78.901.

6.2 Impedance

The ratio of voltage to current of a reference ballast shall have the value given on the relevant lamp data sheet in either ANSI C78.81 or ANSI C78.901, subject to the following tolerances:

a) ±0.5% at the calibration current value;
b) ±3% at any other value of current from 50% to 115% of the calibration current.

See figure 1.

6.3 Ballast power factor

The effective power factor of the reference ballast (ratio of wattage loss to the product of ballast voltage and current) when the ballast is carrying reference current shall be 0.075 ±0.005 unless specified otherwise on the individual lamp data sheet. See Figure 1.

6.4 Temperature rise

When the reference ballast is operated in an ambient air temperature of 25°C and at calibration current and rated frequency, and after thermal stabilization, the temperature rise of the ballast winding shall not exceed 25°K, when measured by the change in resistance method.

7 Operating characteristics for 25 kHz

7.1 Rated supply voltage and frequency

The rated supply voltage and frequency of a reference ballast shall be in accordance with the values given on the relevant lamp data sheets in either ANSI C78.81 or ANSI C78.901.

7.2 Impedance

The following specifications apply to measurements made at rated input voltage and rated frequency of the HF reference ballast and with a room temperature of 25°C ±5°C and with stabilized temperature of the reference ballast.

The impedance of an HF reference ballast shall have the value given on the relevant lamp data sheet in either ANSI C78.81 or ANSI C78.901, subject to the following tolerances:

a) ±0.5% at the reference current value

The series inductance of a reference resistor shall be less than 0.1 mH and its parallel capacitance shall be less than 1 nF (nano farads).

7.3 Power supply

The HF voltage supply used for the adjustment of or test with the HF reference ballast shall be such that a full load the rms summation of the harmonic contents shall not exceed 3% of the fundamental component.

This supply shall be a steady and free from sudden changes as possible. For best results, the voltage should be regulated to within 1.0%.

7.4 Instruments

All instruments used in HF reference ballast measurements should be suitable for high-frequency operation.

For details refer to ANSI C82.11.

7.5 Wiring

Connecting cables should be a short and straight as possible to avoid parasitic capacitance.

The parasitic capacitance parallel to the lamp shall be less than 1 nF.

8 Circuits

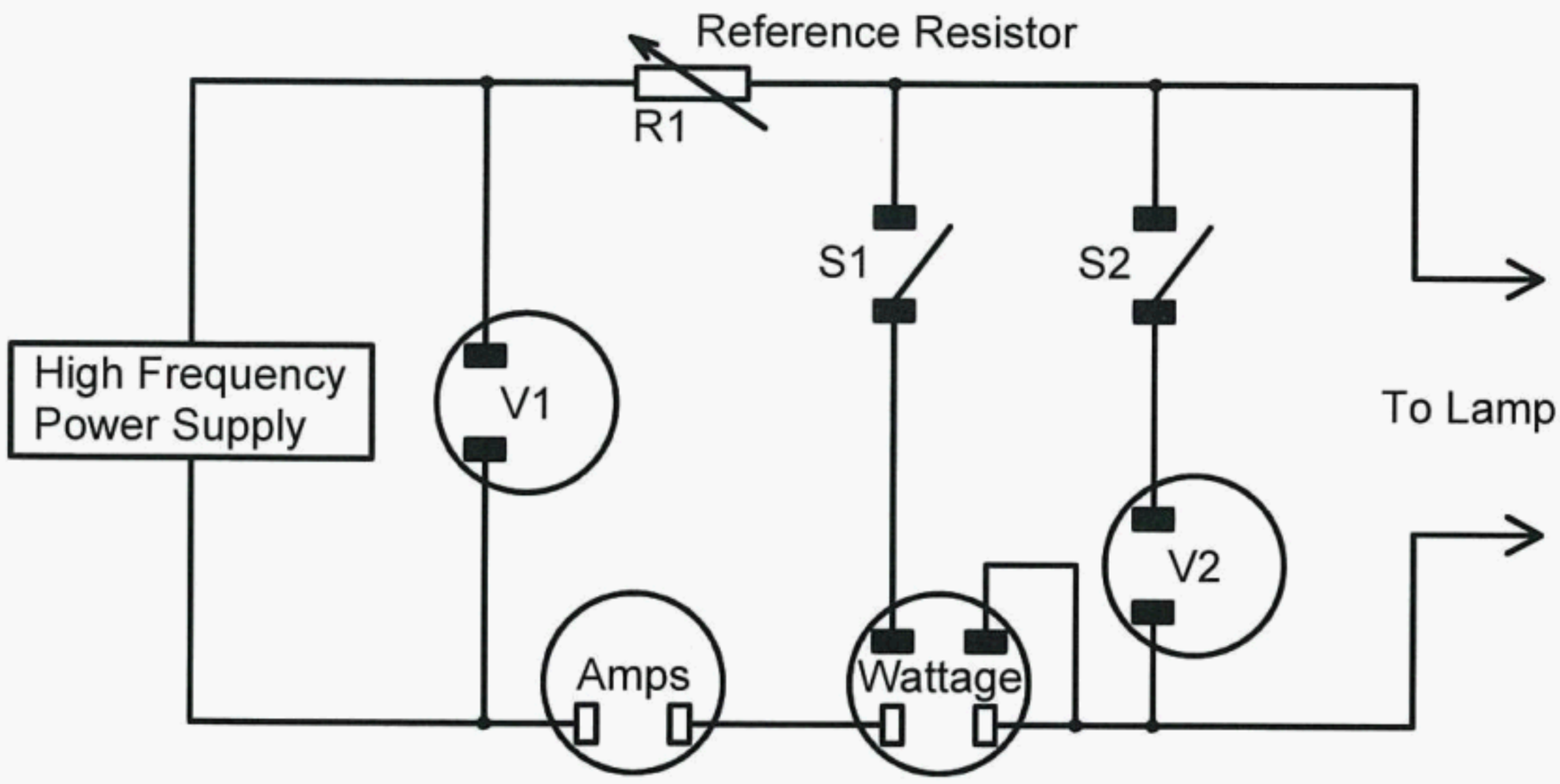
8.1 Line frequency

Reference ballasts may be used with any of the three basic types of fluorescent lamps. In each case certain details of the circuit are dictated by the characteristics of the lamp type. Details for rapid start, preheat start, and instant start circuits are given in ANSI C78.375.

8.2 High frequency

See Figure 2.

HF reference ballasts may be used in a circuit employing separate power sources to heat the lamp cathodes for proper starting of the lamp. These power sources shall be disconnected when measuring a lamp.



Current terminals of instruments are shown as ▯
Potential terminals of instruments are shown as ▮

Figure 2 High-frequency reference circuit

ANNEX I
(Informative)

Guide for measurement and adjustment of the impedance and power factor characteristics of a line frequency reference ballast

Although the specifications to which a reference ballast must conform have been fully stated in the standard, it may also be helpful to outline in a more detailed manner the calculations and measurements that would be needed to set up a reference ballast in compliance with these specifications.

In the following example, it is assumed that the reference ballast consists of an adjustable reactor with a variable resistor connected in series and that the current coil is included in the reference ballast. It is also assumed that digital meters with high impedance potential circuits are used which require no correction. If necessary, guidance on corrections to compensate for the presence of test instruments in the lamp circuit can be found in IES LM-9.

The required value of impedance and the corresponding reference current at which it is to be measured should be obtained from the applicable ANSI C78 lamp standard. This example uses those values that are shown for the 40 watt T12 rapid start lamp. The values are:

Impedance:	439 ohms
Reference current:	0.430 ampere
Power factor:	0.075 +/- 0.005

Example:

Step 1. Calculate the voltage (Vz) that is to be impressed on the test circuit:

V_z = IR x ZRB

Vz = 0.430 x 439 = 188.8 volts

Step 2. With R at a moderate value, XL at its maximum value, and an impressed voltage of 188.8 volts, reduce XL until the reference current (0.430 ampere) is obtained.

Step 3. Calculate the required power loss for power factors of 0.07 and 0.08.

W = VZ x IR x pf

W0.07 = 188.8 x 0.430 x 0.07 = 5.7 watts

W0.08 = 188.8 x 0.430 x 0.08 = 6.5 watts

Step 4. With the applied voltage remaining at 188.8 volts, read the wattmeter. If the reading is less than 5.7 watts, R should be increased to bring it into the range of 5.7 to 6.5 watts. If the wattmeter reading exceeds 6.5 watts, R should be reduced until the reading is within the calculated range.

Step 5. Readjust XL as in step 2 to provide a current of 0.430 ampere with 188.8 volts applied.

Step 6. Recheck the wattmeter reading. If the deflection is within the previously mentioned 5.7 to 6.5 watts range, no further adjustment of R is required. If necessary, however, repeat steps 2 and 4 alternately until neither XL nor R requires further adjustment.

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NATIONAL ELECTRICAL MANUFACTURERS ASSOCIATION
1300 NORTH 17TH STREET, SUITE 900 • ROSSLYN. VA 22209
www.NEMA.org

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