

**2002  
STANDARD for**

**AIR-CONDITIONING  
AND  
REFRIGERATING  
EQUIPMENT  
NAMEPLATE  
VOLTAGES**



**AIR-CONDITIONING &  
REFRIGERATION  
INSTITUTE**

**Standard 110**

## **IMPORTANT**

### ***SAFETY RECOMMENDATIONS***

It is strongly recommended that the product be designed, constructed, assembled and installed in accordance with nationally recognized safety requirements appropriate for products covered by this standard.

ARI, as a manufacturers' trade association, uses its best efforts to develop standards employing state-of-the-art and accepted industry practices. However, ARI does not certify or guarantee safety of any products, components or systems designed, tested, rated, installed or operated in accordance with these standards or that any tests conducted under its standards will be non-hazardous or free from risk.

Note:

This standard supersedes ARI Standard 110-97.

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# AIR-CONDITIONING AND REFRIGERATING EQUIPMENT NAMEPLATE VOLTAGES

## Section 1. Purpose

**1.1 Purpose.** The purpose of this standard is to establish, for air-conditioning and refrigerating equipment: definitions; voltage rating requirements; equipment performance requirements; and conformance conditions.

**1.1.1 Intent.** This standard is intended for the guidance of the industry, including manufacturers, engineers, installers, contractors, and users.

**1.1.2 Review and Amendment.** This standard is subject to review and amendment as technology advances.

**1.2** The provisions herein are recommendations intended for implementation only through reference by other authoritative documents.

## Section 2. Scope

**2.1 Scope.** This standard applies to 60 Hz electrical voltage ratings and operating limits as applied to air-conditioning and refrigerating equipment, heat pumps, and electric furnaces.

**2.1.1 Exclusions.** This standard does not apply to 50 Hz electrical voltage ratings

## Section 3. Definitions

All terms in this document shall follow the standard industry definitions in the current edition of *ASHRAE Terminology of Heating, Ventilation, Air Conditioning and Refrigeration* unless otherwise defined in this section.

**3.1 "Shall" or "Should."** "Shall" or "should" shall be interpreted as follows:

**3.1.1 Shall.** Where "shall" or "shall not" is used for a provision specified, that provision is mandatory if compliance with the standard is claimed.

**3.1.2 Should.** "Should" is used to indicate provisions which are not mandatory but which are desirable as good practice.

## 3.2 Voltages.

**3.2.1 Equipment Nameplate Voltage Rating.** The nominal Utilization Voltage marked on the equipment nameplate by the manufacturer (Table 1).

**3.2.2 Nominal System Voltage.** A nominal value assigned to the electric power supply system for the purpose of conveniently designating its voltage class.

**3.2.3 Service Voltage.** The voltage at the point where the electric systems of the supplier and the user are connected.

**3.2.4 Utilization Voltage.** The voltage at the line terminals of the utilization equipment.

## Section 4. Voltage Rating Requirements

**4.1 Standard System Voltage Relationships.** Table 1 presents the basic relationships between standard Nominal System Voltages and Utilization Voltages for air-conditioning and refrigeration equipment and components. (Data derived from ANSI C84.1).

**4.2 Application of Voltage Ranges.** (See ANSI C84.1).

**4.2.1 Range A-Service Voltage.** Electric supply systems are to be so designed and operated that most Service Voltages are within the limits specified for this range. The occurrence of Service Voltages outside of these limits should be infrequent.

**4.2.2 Range A-Utilization Voltage.** User systems are to be so designed and operated that, with Service Voltages within Range A limits, most Utilization Voltages are within the limits specified for this range.

Utilization equipment shall be designed and rated to give fully satisfactory performance throughout this range.

**4.2.3 Range B-Service and Utilization Voltages.** This range includes voltages above and below Range A limits that necessarily result from practical design and operating conditions on supply or user systems or both. Although such conditions are a part of practical operations, they shall be limited in extent, frequency and duration. When they occur, corrective measures shall be undertaken within a reasonable time to improve voltages to meet Range A requirements.

**Table 1. Standard System Voltage Relationships for Power Circuits<sup>1</sup>**

Nominal System Voltage	Equipment Nameplate Voltage Rating <sup>2, 3</sup>	Voltage Range A			Voltage Range B		
		Minimum		Maximum	Minimum		Maximum
		Utilization Voltage <sup>1</sup>	Service Voltage	Utilization and Service Voltage	Utilization Voltage <sup>1</sup>	Service Voltage	Utilization and Service Voltage
Single- Phase							
120	115	108	114	126	104	110	127
208	208(200)* or 208/230(200/230)*	187	197	218	180	191	220
240	230 or 208/230(200/230)*	216	228	252	208	220	254
277	265	249	263	291	240	254	293
Three-Phase							
208	208(200)* or 208/230(200/230)*	187	197	218	180	191	220
240	230 or 208/230(200/230)*	216	228	252	208	220	254
480	460	432	456	504	416	440	508
600	575	540	570	630	520	550	635

\*Alternate values.

Notes: 1. Minimum Utilization Voltages for 120 thru 600 volt combination lighting and power circuits serving cord-and plug-connected equipment are:

Nominal System Voltage	Range A	Range B
120	110	106
208	191	184
240	220	212
277	254	245
480	440	424
600	550	530

- It is recognized that there are in existence, power systems whose operating characteristics deviate from the voltage range limits of this Table. It shall not be construed that nameplate voltage rated equipment, suitable for application to such systems and deviating from the values appearing in this table, may not be produced.
- Equipment having more than one marked rated voltage, which is permitted to be connected to these voltages without individual adjustment, should have the voltages separated by a hyphen.

Example: 208-230V; The equipment may be operated at these utilization voltages or at voltages between these values without individually adjusting for the difference between them.

Equipment having more than one marked rated voltage, which requires rewiring or other adjustments made by the installer to the equipment to permit connection to these voltages, should have the voltages separated by an oblique stroke.

Example: 208/230V; The equipment may be operated at these utilization voltages only if the installer makes the proper wiring or adjustment to the equipment for each voltage as specified by the manufacturer.

Insofar as practicable, utilization equipment shall be designed to give acceptable performance in the extremes of this range of Utilization Voltage, although not necessarily as good performance as in Range A.

*Exception.* For 208 V systems only, motor driven equipment shall be designed to start and operate satisfactorily under rated load conditions at the extremes of Range B, but not necessarily under maximum load conditions. For rated and maximum load conditions, see the industry standards for the product concerned.

It must be recognized that, because of conditions beyond the control of the supplier or user, or both, there will be infrequent and limited periods when sustained voltages outside of Range B limits will occur. Utilization equipment may not operate satisfactorily under these conditions, and protective devices may operate to protect the equipment. When voltages occur outside the limits of Range B, prompt corrective action is recommended. The urgency for such action will depend upon many factors, such as the location and nature of load or circuits involved, and the magnitude and duration of the deviation beyond Range B limits.

## **Section 5. Equipment Performance Requirements**

**5.1** *Equipment Standard Rating Requirements.* Equipment standard rating tests, in accordance with equipment rating standards, shall be conducted at the Equipment Nameplate Voltage Rating.

## **Section 6. Conformance Conditions**

**6.1** *Conformance.* While conformance with this standard is voluntary, conformance shall not be claimed or implied for products or equipment within its *Purpose* (Section 1) and *Scope* (Section 2) unless such claims meet all of the requirements of the standard.

## APPENDIX A. REFERENCES - NORMATIVE

**A1** Listed here are all standards, handbooks and other publications essential to the formation and implementation of the standards. All references in this appendix are considered as part of the standard.

**A1.1** ANSI C84.1-1995, *Electrical Power Systems and Equipment - Voltage Ratings (60 Hz)*, 1995, American National Standards Institute, 25 West 43<sup>rd</sup> Street, 4<sup>th</sup> Floor, New York, NY 10036, U.S.A.

**A1.2** *ASHRAE Terminology of Heating, Ventilation, Air Conditioning & Refrigeration*, Second Edition, 1991, American Society of Heating, Refrigerating, and Air-Conditioning Engineers, Inc., 1791 Tullie Circle N.E., Atlanta, GA 30329, U.S.A.

## APPENDIX B. REFERENCES - INFORMATIVE

**B1** Listed here are all standards, handbooks, and other publications which may provide useful information and background but are not considered essential. References in this appendix are not considered part of the standard.

**B1.1** IEC Standard Publication 60038, *IEC Standard Voltages*, 1983, International Electrotechnical Commission, 3 rue de Varembe, P.O. Box 131, 1211 Geneva 20, Switzerland.