Addendum k to
ASHRAE Guideline 13-2000

ASHRAE GUIDELINE

Specifying Direct Digital Control Systems

Approved by the ASHRAE Standards Committee on January 21, 2006, and by the ASHRAE Board of Directors on January 26, 2006.

This guideline is under continuous maintenance by a Standing Guideline Project Committee (SGPC) for which the Standards Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the guideline. The change submittal form, instructions, and deadlines may be obtained in electronic form from the ASHRAE Web site, http://www.ashrae.org, or in paper form from the Manager of Standards. The latest edition of an ASHRAE Guideline may be purchased from ASHRAE Customer Service, 1791 Tullie Circle, NE, Atlanta, GA 30329-2305. E-mail: orders@ashrae.org. Fax: 404-321-5478. Telephone: 404-636-8400 (worldwide), or toll free 1-800-527-4723 (for orders in US and Canada).

ISSN 1049-894X

American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.
1791 Tullie Circle NE, Atlanta, GA 30329
www.ashrae.org

SPECIAL NOTE

This American National Standard (ANS) is a national voluntary consensus standard developed under the auspices of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). Consensus is defined by the American National Standards Institute (ANSI), of which ASHRAE is a member and which has approved this standard as an ANS, as "substantial agreement reached by directly and materially affected interest categories. This signifies the concurrence of more than a simple majority, but not necessarily unanimity. Consensus requires that all views and objections be considered, and that an effort be made toward their resolution." Compliance with this standard is voluntary until and unless a legal jurisdiction makes compliance mandatory through legislation.

ASHRAE obtains consensus through participation of its national and international members, associated societies, and public review.

ASHRAE Standards are prepared by a Project Committee appointed specifically for the purpose of writing the Standard. The Project Committee Chair and Vice-Chair must be members of ASHRAE; while other committee members may or may not be ASHRAE members, all must be technically qualified in the subject area of the Standard. Every effort is made to balance the concerned interests on all Project Committees.

The Manager of Standards of ASHRAE should be contacted for:

a. interpretation of the contents of this Standard,
b. participation in the next review of the Standard,
c. offering constructive criticism for improving the Standard,
d. permission to reprint portions of the Standard.

Addendum k

(This foreword is not a part of this guideline. It is merely informative and does not contain requirements necessary for conformance to the guideline.)

FOREWORD

This addendum modifies Section 8.10.9.3 of Guideline 13 to improve the description of power meter considerations and to update sample specification Section 2.10-O accordingly. Section 8.10.9.4 and sample specification Section 2.10-P are added to address thermal energy meters.

Note: In this addendum, changes to the current guideline are indicated in the text by underlinined blue type (for additions) and ~~strikethrough~~ (for deletions) unless the instructions specifically mention some other means of indicating the changes.

Change text as indicated.

8.10.9.3 Power Sensing

~~Wattmeters measure both the current and voltage of a device and provide an output signal (current or voltage) that can be read directly by a controller, which is proportional to the power consumed. Generally, current and voltage transformers are used to provide input to the wattmeters.~~

~~Power measurement (for multi phase circuits) can be approximated by measuring the current and voltage of only one leg—assuming that all phases are equal. This saves both equipment and installation cost. If higher accuracy is necessary, it is important that all phases be measured.~~

~~Power factor meters measure the ratio of active power to apparent power. Their operation and connection are similar to wattmeters.~~

~~The following characteristics should also be considered when specifying power monitoring devices:~~

- ~~Three phase (wye or delta) or single phase systems~~
- ~~Voltage (120-600 V)~~
- ~~UL listing, CSA approval~~
- ~~Linearity~~
- ~~Pulse kWh with selectable pulse rate~~
- ~~Window kW~~
- ~~Instantaneous kW~~
- ~~Power factor (PF)~~
- ~~kVA~~
- ~~VARs~~

Wattmeters measure both current and voltage to determine the consumption (kWh) and demand (kW) of electrical loads (e.g., equipment, building service, electric panels). Wattmeters may be either a stand-alone device or a "virtual" device created by a custom application controller that takes a signal (pulse, voltage, or current) and then calculates the total energy and peak demand. Stand-alone wattmeters come in several different versions depending upon the features desired; for example, some units read only kWh and kW while others provide expanded point information such as kWh, kW, PF, V, A, and kVA.

Wattmeters come in two types:

1. Integrated into the current transducer (CT): this type supports applications with a voltage range from 100 to 480 V and current range from 0 to 2400 amps
2. Panel mounted: this type supports applications with a voltage range of 100 to 600 V and a current range from 0 to 5000 amps.

The advantage of the integrated CT wattmeter is lower installation cost as the wattmeter is integrated into the CT and no power or signal wiring needs to be run.

The following characteristics should be considered when specifying power-monitoring devices:

- Required accuracy (nonrevenue or revenue grade). For most submetering applications an acceptable accuracy is ±1%.
- Three-phase (wye or delta) or single-phase system
- Voltage (120-600 V)
- Current transformers (100-5000 amps), high accuracy, split-core
- UL listing, CSA approval
- Memory: Nonvolatile EEPROM memory retains last known values in the event of power loss
- Programming: Factory programmed or not
- Manual readout: None or LED display
- Communication protocols supported
- Outputs:
  - Pulse signal for kWh (optional)
  - Analog signal (0-10 V or 4-20 mA) for demand kW
  - Sub-LAN output points
    - Total energy (kWh)
    - Energy rate (kW)
    - Reactive power (kVAR)
    - Apparent power (kVA)
    - Power factor
    - Voltage: line–line, line–neutral, A–B, B–C, A–C, A–N, B–N, C–N
    - Current total: A, B, C

O. Power monitors.

~~1. Power monitors shall be the three phase type furnished with three phase disconnect/shorting switch assembly, UL Listed voltage transformers, and UL Listed split core current transformers.~~

~~2. They shall provide a selectable rate pulse output for kWh reading and a 4 to 20 mA output for kW reading. They shall operate with 5 A current inputs with a maximum error of ±2% at 1.0 power factor or ±2.5% at 0.5 power factor.~~

1. Selectable rate pulse output for kWh reading, 4–20 mA output for kW reading, N.O. alarm contact, and ability to operate with 5.0 amp current inputs or 0–0.33 volt inputs.
2. 1.0% full-scale true RMS power accuracy, + 0.5 Hz, voltage input range 120–600 V, and auto range select.
3. Under voltage/phase monitor circuitry.
4. NEMA 1 enclosure.

5. Current transformers having a 0.5% FS accuracy, 600 VAC isolation voltage with 0–0.33 V output. If 0–5 A current transformers are provided, a three-phase disconnect/shorting switch assembly is required.

8.10.9.4 Thermal Energy (BTU) Meter

Thermal energy meters (often called Btu meters when the output is measured in British thermal units) measure flow, supply temperature, and return temperature to determine the thermal energy consumption (Btu or kWh) and demand (Btu/h or kW) of thermal energy loads (e.g., hot water, chilled water, and steam). Btu meters may be either a stand-alone device or a "virtual" device created by a custom application controller that takes flow and temperature signals and then calculates the total consumption and peak demand.

The advantage of the stand-alone Btu wattmeter is lower installation cost because a Btu meter is factory programmed, tested, and calibrated, making start-up and commissioning of the Btu meter less time consuming.

The accuracy of the Btu meter is directly related to the accuracy of the temperature sensors. A ±1.0°F error and a 5°F temperature differential can cause an error of 20% in the energy calculation in addition to any error introduced by the flow meter.

The following characteristics should be considered when specifying power-monitoring devices:

- Required accuracy
- Accuracy of temperature sensors: ±0.25%, matched or calibrated with respect to one another, RTD sensors or thermistors
- Accuracy of flow meter: ±1.0%
- UL listing, CSA approval
- Factory calibration: traceable to NIST with certification
- Memory: nonvolatile EEPROM memory retains values in the event of power loss
- Programming: factory programmed or user-programmed
- Communication protocols
- Display units: English or SI or the capability to select either units
- Compensation: built-in tables for density and pressure
- Calculation modes: heat, cool, heat and cool, charge/discharge
- Panel display: none or LED display
- Security for LED display models: password protection
- Inputs:
  - Flow
  - Entering temperature
  - Leaving temperature
  - Pressure (for steam applications)
- Outputs:
  - Pulse signal for energy (optional)
  - 4–20 mA signal for power (optional)
  - Sub-LAN output points
    - Total energy
    - Power
    - Flow
    - Density
    - Delta temperature
    - Energy consumption: hour, day, month, year (optional)

P. Thermal Energy Meters

1. Matched RTD or thermistor temperature sensors with a differential temperature accuracy of ±0.15°F.
2. Flow meter that is accurate within ±1% at calibrated typical flow rate and does not exceed ±2% of actual reading over an extended 50:1 turndown range.
3. Unit accuracy of ±1% factory calibrated, traceable to NIST with certification.
4. NEMA 1 enclosure.
5. Panel mounted display.
6. UL listed.
7. Isolated 4–20 ma signals for energy rate and supply and return temperatures and flow.

POLICY STATEMENT DEFINING ASHRAE'S CONCERN FOR THE ENVIRONMENTAL IMPACT OF ITS ACTIVITIES

ASHRAE is concerned with the impact of its members' activities on both the indoor and outdoor environment. ASHRAE's members will strive to minimize any possible deleterious effect on the indoor and outdoor environment of the systems and components in their responsibility while maximizing the beneficial effects these systems provide, consistent with accepted standards and the practical state of the art.

ASHRAE's short-range goal is to ensure that the systems and components within its scope do not impact the indoor and outdoor environment to a greater extent than specified by the standards and guidelines as established by itself and other responsible bodies.

As an ongoing goal, ASHRAE will, through its Standards Committee and extensive technical committee structure, continue to generate up-to-date standards and guidelines where appropriate and adopt, recommend, and promote those new and revised standards developed by other responsible organizations.

Through its *Handbook*, appropriate chapters will contain up-to-date standards and design considerations as the material is systematically revised.

ASHRAE will take the lead with respect to dissemination of environmental information of its primary interest and will seek out and disseminate information from other responsible organizations that is pertinent, as guides to updating standards and guidelines.

The effects of the design and selection of equipment and systems will be considered within the scope of the system's intended use and expected misuse. The disposal of hazardous materials, if any, will also be considered.

ASHRAE's primary concern for environmental impact will be at the site where equipment within ASHRAE's scope operates. However, energy source selection and the possible environmental impact due to the energy source and energy transportation will be considered where possible. Recommendations concerning energy source selection should be made by its members.