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**Energy consumption measurement methods for
medical electrical equipment**

医用电气设备能耗测量方法

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Energy consumption measurement methods for medical electrical equipment

1 Scope

This Standard specifies the energy consumption measurement and calculation methods for medical electrical equipment/system (hereinafter referred to as ME equipment/system).

This Standard applies to ME equipment/system which is powered by mains.

This Standard does not apply to ME equipment/system which is powered by internal electrical power source only.

2 Normative references

The following documents are indispensable for the application of this document. For dated references, only the dated version applies to this document. For undated references, the latest edition (including all amendments) applies to this document.

GB 9706.1-2020, Medical electrical equipment - Part 1: General requirements for basic safety and essential performance

3 Terms and definitions

Terms and definitions determined by GB 9706.1-2020 and the following ones are applicable to this document. For ease of use, some of the terms and definitions in GB 9706.1-2020 are repeated below.

3.1

Medical electrical equipment

Electrical equipment that has an applied part or transmits or obtains energy to the patient or detects the transmitted or obtained energy. Such electrical equipment:

- a) Has no more than one connection to a specified power supply mains; and
- b) Its manufacturer intends to use it for:
 - 1) Diagnosis, treatment or monitoring of patients; or

Off mode

The mode where the ME equipment/system is turned off according to the manufacturer's regulations, and the ME equipment/system is connected to the mains.

3.7**Standby mode**

The mode where the ME equipment/system is ready for operation according to the manufacturer's regulations, but the operating mode is not yet started.

3.8**Operating mode**

The mode where the ME equipment/system is connected to the mains to perform the functions that are specified by the manufacturer.

3.9**Low power consumption mode**

The mode where the energy consumption of the ME equipment/system is lower than the standby mode when it is set manually or when it has not been operated for a period of time according to the manufacturer's regulations.

3.10**Charging mode**

When the power of the internal electrical power source of the ME equipment/system drops to the point where it cannot operate normally, charge the internal electrical power source of the ME equipment/system according to the manufacturer's regulations until the internal electrical power source is fully charged.

Note: For the internal electrical power source that needs to be removed from the ME equipment/system for charging, do not count the energy consumption of the charging mode.

4 General requirements**4.1 Environmental requirements**

- c) Connect the test equipment to the mains input end of the ME equipment/system, to ensure that all energy consumption of the ME equipment/system is collected.
- d) Restore the unspecified setting parameters to the factory default values; any energy-saving measures that affect the normal operation of the ME equipment/system shall not be activated.

5 Test process

Test the power or power consumption of the ME equipment/system in each mode in the following order.

Note: Except for the operating mode, other modes are not necessary.

5.1 Off mode

Perform according to the following tests:

- a) Connect necessary accessories and loads as specified by the manufacturer.
- b) Connect to the mains; if the ME equipment/system has an internal electrical power source, make sure that the internal electrical power source is fully charged.
- c) Turn off the ME equipment/system power supply in off mode according to the requirements of the manufacturer's attached documents; keep the ME equipment/system connected to the mains.
- d) Start measuring the energy consumption of the ME equipment/system. If the power of the ME equipment/system changes cyclically in the current mode, test at least one cycle and not less than 15 minutes. Record the test time ($T_{\text{off mode test time}}$) and the electric energy that is consumed by the ME equipment/system during the test time ($E_{\text{off mode}}$) or the average power ($P_{\text{off mode AVG}}$).
- e) If there is no cyclic change, test for at least 15 minutes. Record the electric power that is consumed by the ME equipment/system during the test time ($E_{\text{off mode}}$) or the maximum power ($P_{\text{off mode MAX}}$).

5.2 Standby mode

Perform according to the following tests:

- a) Connect necessary accessories and loads as specified by the manufacturer.

operating period and record the test time ($T_{\text{operating mode test time}}$) and the electric power that is consumed by the ME equipment/system during the test time ($E_{\text{operating mode}}$) or the average power ($P_{\text{operating mode AVG}}$); if the power does not change cyclically in the current mode, test the power during the entire operating period and record the electric power that is consumed by the ME equipment/system during the test time ($E_{\text{operating mode}}$) or the maximum power ($P_{\text{operating mode MAX}}$).

5.4 Low power consumption mode

Perform according to the following tests:

- a) Connect necessary accessories and loads as specified by the manufacturer.
- b) Connect to the mains; if the ME equipment/system has an internal electrical power source, make sure that the internal electrical power source is fully charged.
- c) Connect the ME equipment/system power supply according to the manufacturer's attached documents and set the relevant parameters; then, choose the low power consumption mode, or wait for the ME equipment/system to automatically enter the low power consumption mode; keep the ME equipment/system connected to the mains.
- d) Start measuring the energy consumption of the ME equipment/system. If the power of the ME equipment/system changes cyclically in the current mode, test at least one cycle and not less than 15 minutes. Record the test time ($T_{\text{low power consumption mode test time}}$) and the electric energy that is consumed by the ME equipment/system during the test time ($E_{\text{low power consumption mode}}$) or the average power ($P_{\text{low power consumption mode AVG}}$).
- e) If there is no cyclic change, test for at least 15 minutes. Record the electric power that is consumed by the ME equipment/system during the test time ($E_{\text{low power consumption mode}}$) or the maximum power ($P_{\text{low power consumption mode MAX}}$).

5.5 Charging mode

Perform according to the following tests:

- a) Disconnect the ME equipment/system from the mains; use the internal electrical power source of the ME equipment/system to run, until the ME equipment/system cannot operate normally.

Appendix B

(Informative)

Energy consumption calculation example

B.1 Examples of calculation formula for energy consumption test

B.1.1 Power consumption in off mode

The power consumption in off mode is shown in Formula (B.1):

$E_{\text{total off mode}} = E_{\text{off mode}} \times T_{\text{off mode specified time}} \div T_{\text{off mode test time}}, \text{ OR}$

$E_{\text{total off mode}} = P_{\text{off mode MAX (or } P_{\text{off mode AVG)}} \times T_{\text{off mode specified time}} \dots \dots \dots (B.1)$

B.1.2 Power consumption in standby mode

The power consumption in standby mode is shown in Formula (B.2):

$E_{\text{total standby mode}} = E_{\text{standby mode}} \times T_{\text{standby mode specified time}} \div T_{\text{standby mode test time}}, \text{ OR}$

$E_{\text{total standby mode}} = P_{\text{standby mode MAX (or } P_{\text{standby mode AVG)}} \times T_{\text{standby mode specified time}} \dots \dots \dots (B.2)$

B.1.3 Energy consumption in operating mode

The power consumption in operating mode is shown in Formula (B.3):

$E_{\text{total operating mode}} = E_{\text{operating mode}} \times T_{\text{operating mode specified time}} \div T_{\text{operating mode test time}}, \text{ OR}$

$E_{\text{total operating mode}} = P_{\text{operating mode MAX (or } P_{\text{operating mode AVG)}} \times T_{\text{operating mode specified time}} \dots \dots \dots (B.3)$

B.1.4 Energy consumption in low power consumption mode

The energy consumption in low power consumption mode is shown in Formula (B.4):

$E_{\text{total low power consumption mode}} = E_{\text{low power consumption mode}} \times T_{\text{low power consumption mode specified time}} \div T_{\text{low power consumption mode test time}}, \text{ OR}$

$E_{\text{total low power consumption mode}} = P_{\text{low power consumption mode MAX (or } P_{\text{low power consumption mode AVG)}} \times T_{\text{low power consumption mode specified time}} \dots \dots \dots (B.4)$

B.1.5 Energy consumption in charging mode

The energy consumption in charging mode is shown in Formula (B.5):

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