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Measuring methods of laser diode modules for optical fiber amplifier

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Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee in accordance with the Industrial Standardization Law.

This Standard has been made based on IEC 62007-2:1999 *Semiconductor optoelectronic devices for fibre optic system applications—Part 2 : Measuring methods* for the purpose of making it easier to compare this Standard with International Standard; to prepare Japanese Industrial Standard conforming with International Standard; and to propose a draft of an International Standard which is based on Japanese Industrial Standard.

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Measuring methods of laser diode modules for optical fiber amplifier

Introduction This Japanese Industrial Standard has been prepared based on the first edition of IEC 62007-2 *Semiconductor optoelectronic devices for fibre optic system applications—Part 2 : Measuring methods* published in 1999 with some modifications of the technical contents of the original International Standard.

The portions given dotted underlines are the matters in which the contents of the original International Standard have been modified.

A list of modifications with the explanation is given in annex (informative).

1 Scope This Standard specified the measuring methods of laser diode modules for optical fiber amplifier (hereinafter referred to as “laser diode modules”).

Remarks : The International Standard corresponding to this Standard is as follows.

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and JIS are IDT (identical), MOD (modified), and NEQ (not equivalent) according to ISO/IEC Guide 21.

IEC 62007-2 : 1999 *Semiconductor optoelectronic devices for fibre optic system applications—Part 2 : Measuring methods* (MOD)

2 Normative references The following standards contain provisions which, through reference in this text, constitutes provisions of this Standard. The most recent editions of the standard (including amendments) indicated below shall be applied.

JIS C 0617 : 1999 (All parts) *Graphical symbols for diagrams*

JIS C 1102-1 : 1997 *Direct acting indicating analogue electrical measuring instruments and their accessories—Part 1 : Definitions and general requirements common to all parts*

NOTE : IEC 60051-1 : 1984 [including amendment 1 (1994) and Amendment 2 (1995)] *Direct acting indicating analogue electrical measuring instruments and their accessories—Part 1 : Definitions and general requirements common to all part* is identical with the said standard.

JIS C 5946 : *General rules of laser diode modules for optical fiber amplifier*

3 Definitions For the purpose of this Standard, the definitions given in JIS C 5946 apply.

4 Measuring condition

4.1 Standard condition Unless otherwise specified, the measurement is carried out at the temperature of 15 °C to 35 °C, relative humidity of 25 % to 85 % and air pressure of 860 hPa to 1 060 hPa. If a doubt is thrown on the assessment of the measured value under this standard condition or if required in particular, the specification in 4.3 applies. In addition, when required to convert to the reference condition, the specification in 4.2 applies.

If the measurement under the standard condition is difficult, the measurement under other condition than the standard condition is allowed unless any doubt is thrown on the assessment.

4.2 Reference condition The reference condition is of 25 °C in temperature, 45 % in relative humidity and 860 hPa to 1 060 hPa in air pressure. The reference condition may, however be determined only by the temperature.

4.3 Assessment condition The assessment condition is of 25 °C $\pm$ 2 °C in temperature, 45 % to 55 % in relative humidity and 860 hPa to 1 060 hPa in air pressure.

5 Instruments and equipment for measurement and symbols

5.1 Power source for measurement DC power source of ripple content of not more than 3 % and AC power source of relative harmonic content of not more than 5 %. In case of commercial frequency, the relative harmonic content shall be not more than 10 %.

In addition, in particular is the test to measure AC output power, the ripple content of DC power source, relative harmonic content of AC power source and AC impedance of the DC power source circuit through which AC current passes shall be of so small value as not to give influence to the measurement. moreover, sufficient countermeasures shall be provided against the invasion of surge.

5.2 Meters and measuring instruments Unless otherwise specified, the meters shall be those of class 0.5 specified in JIS C 1102 and the measuring instruments be of equivalent or superior accuracy thereto. Their input impedance shall be negligible value in the influence to the measuring system.

Remarks : In case where there are no standard meters of at least class 0.5 nor class equivalent or superior accuracy thereto, the specification in 5.2 does not apply.

5.3 Optical power meter The optical power meter used in the measurement shall be calibrated with the relevant wavelength and be that the linearity is fully ensured within a range of the optical input power level being measured. In addition if the out-

put power of the laser diode module being measured is possible to exceed the upper limit of the measurement level range of the optical power meter, the measurement is carried out using an appropriate optical attenuator.

5.4 Optical spectrum analyzer The optical spectrum analyzer being used shall have, at the relevant wavelength, fully dynamic range (fully low stray light), accuracy of lateral (wavelength) axis and longitudinal (level) axis and sufficient resolution enough to separate the oscillation spectrum. In addition, if the output power of the laser diode module being measured is possible to exceed the upper limit of the measurement level range of the optical power meter, the measurement is carried out using an appropriate optical attenuation.

5.5 Graphical symbols The graphical symbols given in JIS C 0617 apply to this Standard.

6 Measurement procedures

6.1 Forward current (I_f)

6.1.1 Purpose The purpose is to measure the forward current of the laser diode modules under a specified conditions.

6.1.2 Measurement circuit The forward current of laser diode modules is measured in accordance with figure 1 and the procedure given in the following :

6.1.3 Measurement procedure Make the laser diode module generate the specified radiant power P_f and measure the forward current at that time.

6.1.4 Precautions to be observed In the case where considerable power is consumed in the laser diode module and, as a result, the rise of temperature at the joint part affects the measured value to a great extent, the measurement is carried out by any one of the following procedures and the procedure followed is recorded.

- a) Use DC current and measure after coming to stability of the temperature. If not coming to the stability of temperature, carry out the measurement in a specified time after beginning the application of a specified voltage.
- b) Apply pulse current or carry out the measurement in so short time that the rise of temperature at the joint part can be ignored.

When using a pulse current, the pulse width and duty cycle are clearly described.

6.1.5 Items to be specified in individual specification

- a) operating temperature T_{op} ;
- b) radiant power P_f .

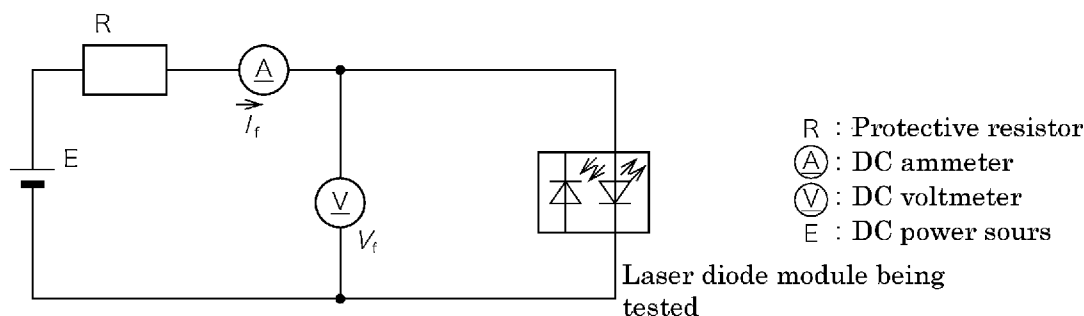


Figure 1 Measurement of forward current and forward voltage

6.2 Forward voltage (V_f)

6.2.1 Purpose The purpose is to measure the forward voltage of the laser diode module under a specified conditions.

6.2.2 Measurement circuit The forward voltage of the laser diode modules is measured in accordance with figure 1 and the procedure given in the following :

6.2.3 Measurement procedure Flow a specified forward current I_f between the terminals of laser elements of the laser diode module and measure the forward voltage V_f at that time.

6.2.4 Precautions to be observed In the case where considerable power is consumed in the laser diode module and, as a result, the rise of temperature at the joint part affects the measured value to a great extent, the measurement is carried out by any one of the following procedures and the procedure followed is recorded.

- Use DC current and measure after coming to stability of the temperature. If not coming to the stability of temperature, carry out the measurement in a specified time after beginning the flow of a specified current.
- Apply pulse current or carry out the measurement in so short time that the rise of temperature at the joint part can be ignored.

When using pulse current, the pulse width and duty cycle are clearly described.

6.2.5 Items to be specified in individual specification

- operating temperature T_{op} or $T_{op (sub)}$;
- forward current I_f or radiant power P_f

6.3 Reverse voltage (V_r)

6.3.1 Purpose The purpose is to measure the reverse voltage of the laser diode module under a specified condition.

6.3.2 Measurement circuit The reverse voltage of the laser diode modules is measured in accordance with figure 2 and the procedure given in 6.3.3.

6.3.3 Measurement procedure Flow a specified reverse current I_r between the terminals of laser elements of the laser diode module and measure the reverse voltage V_r .

at that time.

6.3.4 Precautions to be observed In the case where considerable power is consumed in the laser diode module and, as a result, the rise of temperature at the joint part affects the measured value to a great extent, the measurement is carried out by any one of the following procedures and the procedure followed is recorded.

- Use DC current and measure after coming to stability of the temperature. If not coming to the stability of temperature, carry out the measurement in a specified time after beginning the flow of a specified current.
- Apply pulse current or carry out the measurement in so short time that the rise of temperature at the joint part can be ignored.

When using pulse current, the pulse width and duty cycle are clearly described.

6.3.5 Items to be specified is individual specification

- operating temperature T_{op} :
- reverse current I_r

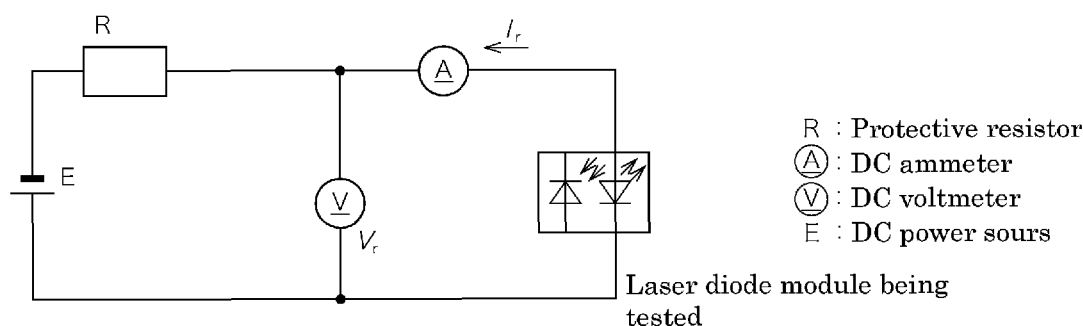


Figure 2 Measurement of reverse voltage

6.4 Radiant power (P)

6.4.1 Purpose The purpose is to measure the radiant power of the laser diode modules under a specified condition.

6.4.2 Measurement circuit The radiant power of the laser diode modules is measured in accordance with figure 3 and the procedure in 6.4.3.

6.4.3 Measurement procedure Flow a specified forward current I_f into the laser diode module and measure the optical output power P .

6.4.4 Precautions to be observed The light receiving surface of the optical power meter shall be sufficiently large enough to fully receive the total quantity of light emitted from the end of the optical fiber. In addition, the quantity of light returning from the light receiving surface of optical power meter to the laser diode module is required to be restrained so as to be sufficiently small.

If the optical output power exceeds the maximum optical input level of the optical power meter, the input level of the optical power meter is set in an appropriate range using an appropriate optical attenuator. In this case, the alternation of the alternator