



JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS D 1000 : 2009

(JSAE)

**Motorcycles—Engine test code—
Net power**

ICS 43.020; 43.140

Reference number : JIS D 1000 : 2009 (E)

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Date of Establishment: 1982-10-15

Date of Revision: 2009-12-21

Date of Public Notice in Official Gazette: 2009-12-21

Investigated by: Japanese Industrial Standards Committee
Standards Board

JIS D 1000:2009, First English edition published in 2010-10

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

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Printed in Japan

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Foreword

This translation has been made based on the original Japanese Industrial Standard revised by the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee as the result of proposal for revision of Japanese Industrial Standard submitted by Society of Automotive Engineers of Japan (JSAE) with the draft being attached, based on the provision of Article 12 Clause 1 of the Industrial Standardization Law applicable to the case of revision by the provision of Article 14.

Consequently **JIS D 1000:1998** is replaced with this Standard.

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Motorcycles—Engine test code— Net power

Introduction

This Japanese Industrial Standard has been prepared based on the third edition of **ISO 4106** published in 2004 with some modifications of the technical contents to improve the convenience of standard utilization.

Annex JA of this Standard is the matters not given in the corresponding International Standard. The portions given sidelines or dotted underlines are the matters in which the contents of the original International Standard have been modified. A list of modifications with the explanations is given in Annex JB.

1 Scope

This Standard specifies the test methods of net power for verifying the performance of engines designed for motorcycles as defined in **JIS D 0109**. The test results shall be presented by the characteristic curves of the corrected net torque, the corrected net power and the specific fuel consumption at full load as a function of engine speed.

This Standard is applicable to reciprocating internal combustion engines (spark-ignition or compression-ignition) excluding free-piston engines and rotary piston engines. Engines shall be either naturally aspirated, or pressure charged and equipped with either mechanical pressure-charger or turbocharger.

Test conditions and the like specific to the compression-ignition engine shall be specified in Annex JA.

NOTE : The International Standard corresponding to this Standard and the symbol of degree of correspondence are as follows.

ISO 4106:2004 *Motorcycles—Engine test code—Net power* (MOD)

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 21-1**.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. The most recent editions of the standards (including amendments) listed below shall be applied.

JIS B 0108-1 *Reciprocating internal combustion engines—Vocabulary—Part 1: Terms for engine design and operation*

NOTE : Corresponding International Standard: ISO 2710-1:2000 *Reciprocating internal combustion engines—Vocabulary—Part 1: Terms for engine design and operation* (IDT)

JIS B 8003 *Internal combustion engines—Determination and method for the measurement of engine power—General requirements*

NOTE : Corresponding International Standard: ISO 15550 *Internal combustion engines—Determination and method for the measurement of engine power—General requirements* (IDT)

JIS D 0109 *Motorcycles and mopeds—Vocabulary*

3 Terms and definitions

For the purposes of this Standard, the definitions given in **JIS B 0108-1** and **JIS B 8003**, and the following definitions shall apply.

3.1 net power

power obtained at the end of the crankshaft or its equivalent when the engine with the system and auxiliaries specified in **6.3.1** is operated on a test bed at a certain engine speed

3.2 corrected net power

net power corrected for standard atmospheric condition

3.3 net torque

torque obtained at the end of the crankshaft or its equivalent when the engine with the system and auxiliaries specified in **6.3.1** is operated on a test bed at a certain engine speed

3.4 corrected net torque

net torque corrected for standard atmospheric condition

3.5 specific fuel consumption

amount of fuel consumed by the engine per unit of power and time

NOTE : The lubricant for 2-stroke cycle engine is excluded.

3.6 auxiliaries

equipment and devices necessary to make the engine acceptable for service in the intended application

4 Symbols

For the purposes of this Standard, symbols shall be in accordance with table 1.

These symbols are also applicable to Annex JA.

Table 1 Symbols

Symbol	Definition	Unit
b_e	Specific fuel consumption	g/kW · h
p_d	Ambient dry barometric pressure during test	kPa
p_r	Standard reference total barometric pressure	kPa
p_{sr}	Standard reference saturated water vapour pressure	kPa
p_{sy}	Saturated water vapour pressure of ambient atmosphere during test	kPa
p_y	Ambient barometric pressure during test	kPa
P	Power measured	kW
P_o	Corrected net power	kW
P_y	Net power	kW
T	Torque measured	Nm
T_o	Corrected net torque	Nm
T_y	Net torque	Nm
t_r	Standard reference ambient atmospheric temperature	°C
t_y	Air temperature inhaled during test	°C
α_a	Power correction factor according to atmospheric condition	—
α_m	Power correction factor for transmit efficiency of transmission	—
η_i	Transmit efficiency of transmission for each element constituting transmission	—
η_t	Transmit efficiency of transmission located between crankshaft and measurement point	—
ϕ_r	Standard reference relative humidity	%
ϕ_y	Ambient relative humidity during test	%

5 Standard reference conditions

When determining the power and the specific fuel consumption of the engine, the following standard reference conditions shall be used.

Standard reference total barometric pressure: $p_r = 100$ kPa

Standard reference ambient atmospheric temperature: $t_r = 25$ °C

Ambient relative humidity: $\phi_r = 30$ %

NOTE : The relative humidity of 30 % at an atmospheric temperature of 25 °C corresponds to a water pressure of 1 kPa. According to this, the dry air pressure in the atmosphere becomes 99 kPa.

6 Test method

6.1 General

This test method is used for verifying the net power of the engine. In this test method, the engine performance at full-load conditions shall be presented by generating the curve of the corrected net torque, the corrected net power and the specific fuel consumption as a function of engine speed.

6.2 Accuracy of measuring apparatus

6.2.1 Torque

The torque measuring apparatus shall have an accuracy within $\pm 1\%$ in the range of measurement values required for the test. However, the accuracy may be within $\pm 2\%$ for the measurement made at a power less than 50 % of the maximum power. The torque measuring apparatus shall be calibrated by taking into account the friction losses.

6.2.2 Engine speed

The engine speed measuring apparatus shall have an accuracy within $\pm 0.5\%$.

6.2.3 Fuel flow

The fuel flow measuring apparatus shall have an accuracy within $\pm 1\%$.

6.2.4 Fuel temperature

The fuel temperature measuring apparatus shall have an accuracy within $\pm 1\text{ }^{\circ}\text{C}$.

6.2.5 Engine inlet air temperature

The engine inlet air temperature measuring apparatus shall have an accuracy within $\pm 1\text{ }^{\circ}\text{C}$.

6.2.6 Barometric pressure

The barometer shall have an accuracy within $\pm 70\text{ Pa}$.

6.2.7 Back pressure in exhaust system

The back pressure (differential pressure) measuring apparatus in exhaust system shall have an accuracy within $\pm 25\text{ Pa}$.

6.2.8 Test room humidity

The test room humidity measuring apparatus shall have an accuracy of $\pm 2\%$ in relative humidity.

6.3 Setting and test conditions

6.3.1 Equipment and auxiliaries

During the test, when the equipment and auxiliaries shown in table 2 are those of the standard production equipment, they shall be installed on the test bench in the same position and conditions as in the intended application as far as possible.

The equipment and auxiliaries used in the power test of the compression-ignition engine shall be in accordance with Annex JA.

Table 2 Equipment and auxiliaries installed for measurement of engine power

No.	Equipment and auxiliaries
1	Inlet system Inlet manifold Crankcase emission control device Dual induction controller Electronic controller Air flowmeter Inlet ductwork ^{a)} Air filter ^{a)} Inlet silencer ^{a)} Speed-limiting device ^{a)}
2	Heating device for inlet manifold
3	Exhaust system Exhaust purifier Exhaust manifold Pressure-charger Connecting pipes ^{b)} Silencer ^{b)} Tail pipe ^{b)} Exhaust brake ^{c)} Electronic controller
4	Fuel supply system Fuel supply pump ^{d)} Carburettor Electronic controller Gas fuel pressure reducer Gas fuel evaporator Gas fuel mixer
5	Fuel injection system Prefilter Filter Fuel injection pump High-pressure pipe Injector Inlet valve Electronic controller
6	Liquid-cooling system Radiator ^{e)} Cooling fan ^{e), f)} Cooling fan cowl ^{e)} Circulating pump ^{e)} Thermostat ^{e), g)}

Table 2 (continued)

No.	Equipment and auxiliaries
7	Air-cooling system Cowl ^{e)} Cooling fan or blower ^{e), f)} Temperature controller
8	Electrical system Generator ^{h)} Battery ^{h)} Spark distributor Coil Wiring Spark plug Electronic controller for spark ⁱ⁾
9	Pressure-charging system Compressor driven by engine and/or by exhaust gas Pressure-charging controller ^{j)} Charge air cooler ^{e), f), k)} Coolant pump or fan (engine-driven)
10	Air pollution control device ^{l)}
11	Lubricant pump
12	Oil cooler
Notes	^{a)} An equivalent may be used. In this case, a check that the inlet depression does not differ by more than 100 Pa from the limit specified by the manufacturer for a clean air filter shall be made. ^{b)} If it is impracticable to fit the standard exhaust system, a system permitting the normal engine running characteristics in accordance with the manufacturer's specification may be fitted for the test. In this case, the back pressure of the exhaust system at the position where the test bench exhaust system is connected shall not create a pressure differing from the barometric pressure by more than ± 740 Pa. When the manufacturer has designated the difference in pressure of ± 740 Pa or under, it shall be used. ^{c)} If an exhaust brake is incorporated in the engine, the throttle valve shall be fixed in the fully open position. ^{d)} If necessary, the fuel feed pressure may be adjusted to reproduce the fuel pressures existing in the particular engine application (particularly, for example, when a fuel return system to tank or filter is used). ^{e)} The radiator, cooling fan, cooling fan cowl, circulating pump, thermostat and cowl shall be located on the test bed in the same relative positions that they are to occupy on the vehicle. The coolant circulation shall only be operated by the engine pump. Cooling of the coolant may be made either by the engine radiator or by an external device, provided that the pressure loss of this path and the pressure at the pump inlet remains substantially the same as those of the engine cooling system. The radiator shutter, if incorporated, shall be set in the open position. Where the cooling fan, radiator and cowl system cannot conveniently be fitted to the engine, the power consumed by the cooling fan when separately mounted in its correct position in relation to the radiator and the cooling fan cowl (if used) shall be determined

Table 2 (concluded)

	at the speed corresponding to the engine speed used for measurement of the engine power either by calculation from standard characteristics or by practical tests. This power shall be corrected to the standard reference conditions defined in clause 5, and deducted from the corrected power.
f)	Where a fan or blower capable of switching on-and-off or running at maximum slip is incorporated, the test shall be made with the fan or blower off or running at maximum slip.
g)	The thermostat may be fixed in the fully open position.
h)	The electrical power of the generator shall be the minimum and limited to that necessary for operation of accessories which are indispensable for engine operation. If the connection of a battery is necessary, a fully charged battery in good condition shall be used.
i)	The spark advance shall be the representative value established with the minimum octane-number fuel as recommended by the manufacturer.
j)	For engines equipped with variable pressure-charging controller corresponding to the charge or inlet air temperature, octane number and/or engine speed, the pressure charging shall be the representative value established with the minimum octane-number fuel as recommended by the manufacturer.
k)	Charge-air-cooled engines shall be tested with the charge air cooler operated, whether it is liquid-cooled or air-cooled. If the manufacturer prefers, the charge air cooler of a test bed system may be used for an air-cooled charge air cooler. In either case, the measurement of power at each engine speed shall be made with the pressure drop and temperature drop of the engine air across the charge air cooler in the test bed system the same as those specified by the manufacturer for the system on the complete vehicle or machine.
l)	These may include, for example, Exhaust Gas Recirculation (EGR), catalytic converter, secondary air-supply and fuel evaporation preventive systems and crankcase emission control device.

6.3.2 Test conditions

The test conditions shall be as follows.

Test conditions specific to the compression-ignition engine shall be in accordance with Annex JA.

- The power test shall be made under the full-load operating conditions where the equipment and auxiliaries specified in 6.3.1 are equipped.
- The engine speed during power measurement shall not deviate from the selected speed within ± 1 %.
- When measuring the power data, the stabilized operating conditions shall be maintained with an adequate fresh-air supply to the engine in accordance with the manufacture's specifications. Before the measurement, the engine shall have been run-in in accordance with the manufacturer's recommendations.

The test conditions such as an air temperature inhaled shall be set to be as near to the standard reference conditions (see clause 5) as possible in order to minimize the magnitude of the correction factor.