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JAPANESE INDUSTRIAL STANDARD

Testing Method for Melt Flow Rate of Thermoplastics

JIS K 7210 —1976

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Testing Method for Melt Flow Rate of Thermoplastics K 7210-1976
(Reaffirmed: 1979)1. Scope

This Japanese Industrial Standard specifies the testing method for the flow rate of thermoplastics for general application.

- Remarks 1. This method measures the rate of extrusion when molten thermoplastics are extruded through a die of specified length and diameter under specified temperature and pressure conditions.
2. This testing method includes Method A and Method B, Method A being a manual cutting-off method applicable to materials whose melt flow rates⁽¹⁾ are 0.1 to 25 g per 10 minutes and Method B being an automatic time measuring method applicable to materials whose melt flow rates⁽¹⁾ are 0.50 to 300 g per 10 minutes (refer to Remark of Table 3).

Note ⁽¹⁾ This means the same as the melt flow index shown in JIS K 6900 and is expressed by the symbol MFR.

3. The melt flow properties of high polymers depend on the rate of shear. The rates of shear in this test are extremely lower than the rate of shear used in usual forming work, and therefore, precautions shall be taken because for many thermoplastics the data obtained by this method do not always correlate with the flow behavior in actual use of such plastics. However, this method is useful for quality control.
4. The units and numerical values shown in { } in this standard are based on the International System of Units (SI) and are appended for reference.

2. Definitions

The main terms used in this standard shall be in accordance with JIS K 6900.

3. Apparatus and Appliances

3.1 Apparatus The apparatus used shall basically be an extrusion type plastometer which operates at a constant temperature and its general construction and dimensions are shown in Fig. 1. The sample is placed in a metal cylinder supported vertically and is extruded through a die by a weighted piston. The apparatus shall consist of the following main components:

Applicable Standards:

JIS K 6900-Glossary of Terms used in Plastic Industry

JIS Z 8401-Rules for Rounding off of Numerical Values

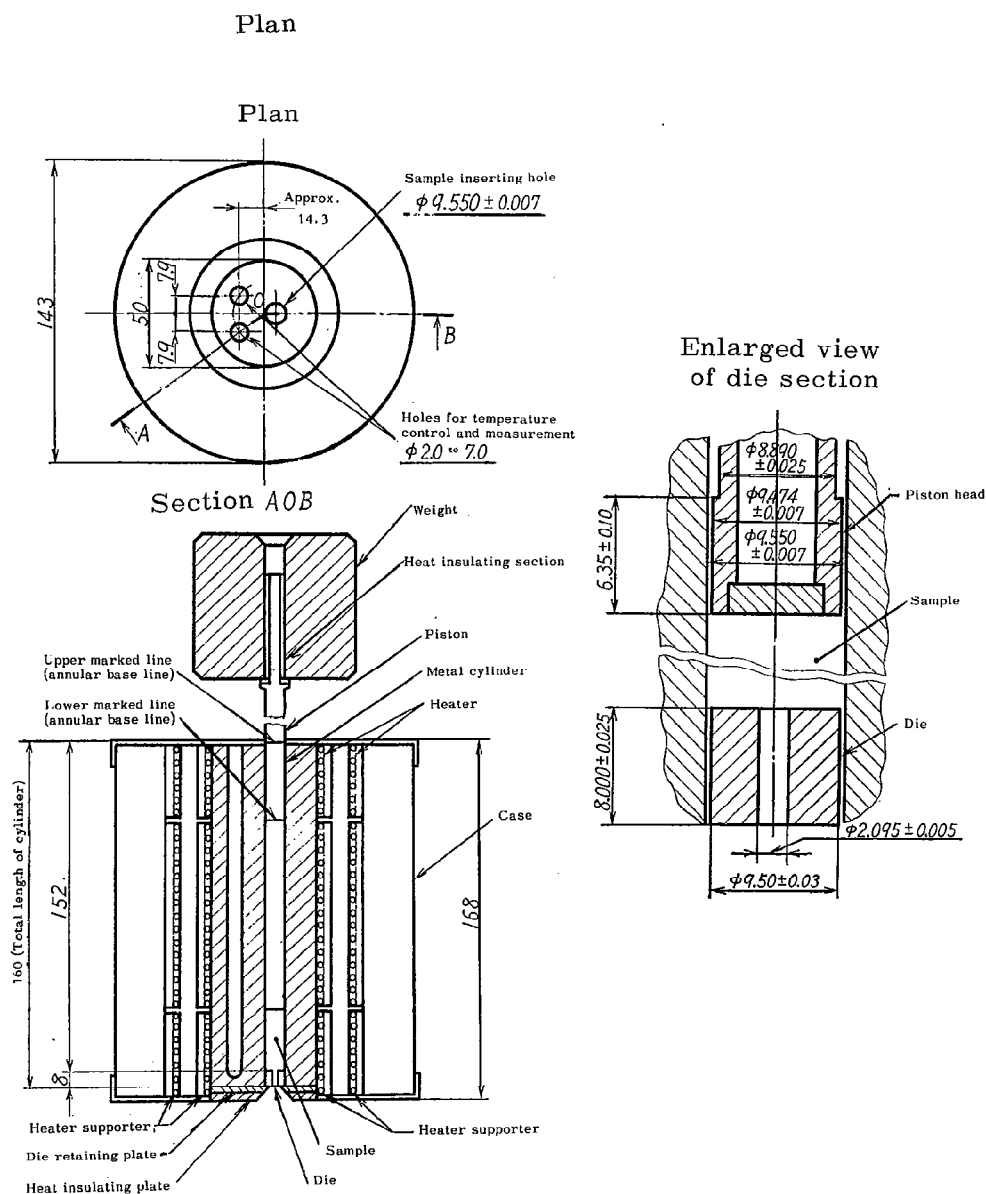
Reference Standard:

JIS Z 8203-SI Units and Recommendations for the Use of their Multiples and of Certain Other Units

2
K 7210-1976

Fig. 1. Test Apparatus

Unit: mm



3.1.1 Cylinder The cylinder shall be a vertically fixed metal cylinder and thermally insulated so as to allow operation at temperatures up to 300 °C. The cylinder shall be about 160 mm in length and have a sample inserting hole of 9.550 ± 0.007 mm in diameter and holes for inserting a thermometer and temperature adjusting device. The cylinder base shall be covered with a heat insulating plate⁽²⁾ so that the area of exposed metal portions is 4 cm² or less.

Note (2) It is recommended that the heat insulating plate be made of a material to which the extrudate does not stick, for example, a plate of polytetrafluoroethylene (approx. 3 mm in thickness).

3.1.2 Piston The piston⁽³⁾ shall be made of metal, have a construction to allow a weight to be inserted in the upper portion, and have a heat insulating section to reduce the heat conduction from the piston to the weight. The piston head shall be 9.474 ± 0.007 mm in diameter and 6.35 ± 0.10 mm in length and the diameter of the portion of the piston above the piston head shall be decreased to approx. 9 mm. An upper marked line⁽⁴⁾ shall be scribed shallowly on the piston axis at such a position that it agrees with the upper surface of the cylinder when the distance between the lower end of the piston head and the upper surface of the die is 20 mm, and in addition, a lower marked line at a position 30 mm below the upper marked line.

Notes (3) The piston and the cylinder shall be made of materials of different hardnesses. In this case, it is more convenient for maintenance, replacement, and the like to select the material of the cylinder to be harder than that of the piston.

Pistons for lighter loads shall preferably be hollow-structured. A suitable guide of little friction may also be provided to keep the piston vertical during measurement.

(4) Because the two marked lines show the limits for the working length of the cylinder, the cutting off of the sample shall be performed within these limits.

3.1.3 Heating and Temperature Adjusting Devices The heating and temperature adjusting devices used shall be capable of adjusting the temperature of the sample in the cylinder to within $\pm 0.5^\circ\text{C}$ of the specified test temperature. The variation in temperature during the test shall be capable of being maintained within $\pm 0.2^\circ\text{C}$.

3.1.4 Thermometer for Apparatus The thermometer for apparatus, used for reading the temperature of the portion of the cylinder close to the die, shall be a mercury thermometer or a temperature detector which has been preliminarily calibrated so as to be capable of measuring temperatures with a precision of $\pm 0.1^\circ\text{C}$. A suitable low-melting alloy or silicone oil shall preferably be provided between the thermometer and the cylinder wall.

3.1.5 Die The die shall be made of steel and 8.000 ± 0.025 mm in length and 9.50 ± 0.03 mm in outer diameter. The inner diameter shall be 2.095 ± 0.005 mm and the dimension shall be uniform lengthwise with a tolerance of ± 0.005 mm⁽⁵⁾.

Note (5) The surfaces of the die coming in contact with the sample during the test shall all be finished by lapping.

3.1.6 Weight The weight shall be used for being placed on the upper part of the piston to obtain the test load shown in Table 1. However, the test load referred to here shall include the mass of the piston, and its value shall be within a tolerance of $\pm 0.5\%$.

4
K 7210-1976

3.2 Appliances

3.2.1 Tool for Filling Sample in the Cylinder

3.2.2 Tool for Cutting Extruded Sample

3.2.3 Appliance for Cleaning

3.2.4 Stopwatch ± 0.1 s precision.

3.2.5 Balance ± 0.5 mg precision.

3.2.6 Calibration Thermometer Capable of measuring temperatures correctly to 0.1°C .

4. Sample

4.1 Form of Sample The sample used shall, as a rule, be in the form of pellets. However, it may also be in the form of powder, granules, aggregates or film, if the material can be packed in the cylinder bore. In the case of sample in the form of powder or the like, care shall be taken because air bubbles may be entrained in the extruded sample if the sample is preliminarily not be compressed.

4.2 Conditioning of Sample The sample shall be conditioned prior to the test according to the applicable material standards. If necessary, a stabilizer shall also be added. Materials containing volatile matter or hygroscopic materials shall be thoroughly dried preliminarily.

5. Test Conditions

5.1 As a rule, conditions suitable for the material shall be selected from the general test conditions⁽⁶⁾ shown in Table 1. Test conditions generally used for respective resins are shown in Table 2 for reference.

Note ⁽⁶⁾ Where the application of the conditions shown in Table 1 are not suitable, other conditions may be used on agreement between the parties concerned.