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**Paper and board—
Determination of roughness/
smoothness (air leak methods)—
Print-surf method**

ICS 85.060

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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 according to the proposal of establishing a Japanese Industrial Standard from Japan Technical Association of the Pulp and Paper Industry (JAPAN TAPPI)/Japanese Standards Association (JSA), with a draft of Industrial Standard based on the provision of Article 12 Clause 1 of the Industrial Standardization Law.

In order to conform to the International Standard, this Standard has been prepared based on **ISO 8791-4 : 1992** *Paper and board—Determination of roughness/smoothness (air leak methods)—Part 4 : Print-surf method*.

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In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

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Paper and board—Determination of roughness/smoothness (air leak methods)— Print-surf method

Introduction This Japanese Industrial Standard has been prepared based on the first edition of **ISO 8791-4** *Paper and board—Determination of roughness/smoothness (air leak methods)—Part 4 : Print-surf method* published in 1992 with some modifications of the technical contents.

Portions underlined with dots are the matters modified from the original International Standard. The list of modifications and their explanations is given in annex 1 (informative).

1 Scope This Standard specifies a method of determining the roughness of paper and board using the Print-surf apparatus.

NOTES 1 It is applicable to all printing papers and boards with which it is possible to form a substantially airtight seal against the guard lands of the measuring head.

2 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**.

ISO 8791-4 : 1992 *Paper and board—Determination of roughness/smoothness (air leak methods)—Part 4 : Print-surf method* (**MOD**)

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

JIS P 0001 *Paper, board and pulp—Vocabulary*

JIS P 8110 *Paper and board—Sampling to determine average quality*

NOTE : **ISO 186 : 1994** *Paper and board—Sampling to determine average quality* is equivalent to the said standard.

JIS P 8111 *Paper, board and pulps—Standard atmosphere for conditioning and testing*

NOTE : **ISO 187 : 1990** *Paper, board and pulps—Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples* is equivalent to the said standard.

JIS Z 8401 *Guide to the rounding of numbers*

3 Definitions For the purposes of this Standard, the definitions given in **JIS P 0001** and the following definition apply.

- a) **Print-surf roughness** The mean gap (μm) between a sheet of paper or board and a flat circular land pressed against it under specified conditions. The mean gap is expressed as the cube root mean cube gap calculated as prescribed in annex A.

4 Principle The test piece is placed between a circular flat metal sensing head and a resilient blanket, and inner and outer circular lands form a seal with the test piece. Under the influence of a pressure difference across the measuring land, air flows between the measuring land and the test piece. The rate of air flow is measured on a variable area flowmeter (Variable area flowmeter type) or the pressure difference across the measuring land is compared to the pressure difference across a known impedance (Impedance type). In both cases the reading is of air gap in micrometres.

- a) **Variable area flowmeter type Print-surf tester**, in which a standard pressure difference is created across the measuring land and the air flow rate is measured on a variable area flowmeter. The flow diagram for this type of instrument is shown in figure 1.
- b) **Impedance type Print-surf tester**, in which the air from the controlled pressure source passes first through a fluidic impedance and then through the sensing head, after which it discharges to atmosphere. The pressure differences across the fluidic impedance and across the land are each measured by a transducer. These pressure differences vary with roughness and the signals are converted to roughness in micrometres. The flow diagram for this type of instrument is shown in figure 2.

Procedures for maintaining these models in good working order are given in annex B.

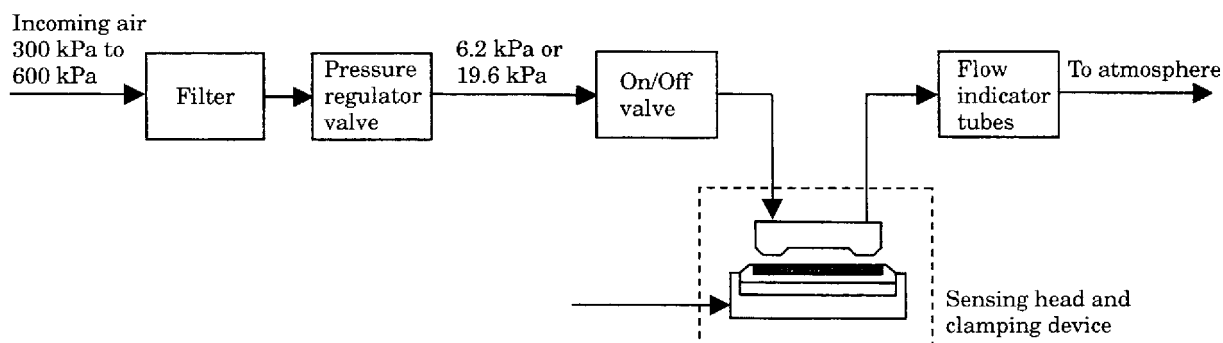


Figure 1 Flow diagram for variable area flowmeter type Print-surf tester

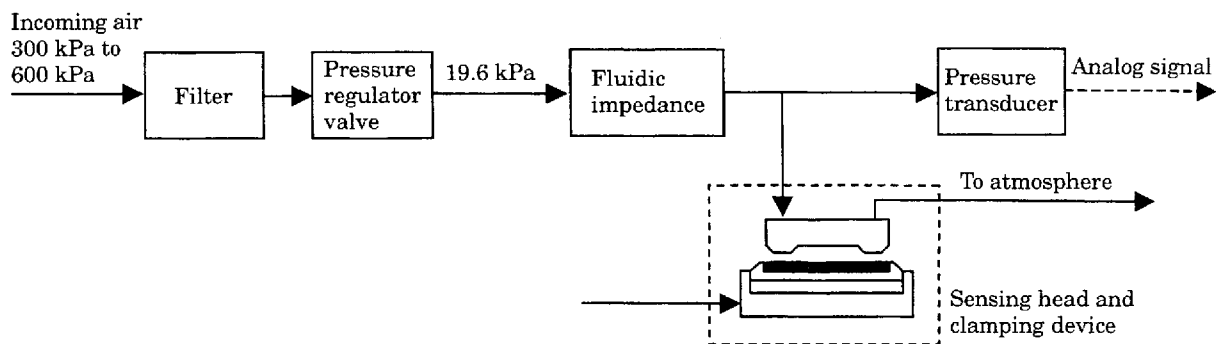


Figure 2 Flow diagram for impedance type Print-surf tester

5 Apparatus The principal components of the system are the following.

5.1 Air supply, supplying clean air, free of oil and water droplets, at a steady pressure within the range 300 kPa to 600 kPa.

5.2 Sensing head pressure regulator, allowing setting of the sensing head differential pressure on variable area flowmeter instruments to either $6.2 \text{ kPa} \pm 0.1 \text{ kPa}$ or $19.6 \text{ kPa} \pm 0.1 \text{ kPa}$.

5.3 Sensing head, annular (see figures 3 and 4), consisting of three stainless steel lands which have coplanar, polished surfaces. The centre or measuring land shall be $51.0 \mu\text{m} \pm 1.5 \mu\text{m}$ wide and have an effective length of $98.0 \text{ mm} \pm 0.5 \text{ mm}$. The two other guard lands shall each be at least $1\,000 \mu\text{m}$ wide at any point and the radial distance between them at any point shall be $152 \mu\text{m} \pm 10 \mu\text{m}$. The measuring land shall be centred between them to within $\pm 10 \mu\text{m}$.

NOTES 1 The lands shall be mounted in an airtight mounting, constructed so that air can be passed into the gap between the inner guard land and the measuring land and exhausted from the gap between the measuring land and the outer guard land. The back of the mounting shall be flat and form a ground mating surface with the flat surface of a manifold fitted with air inlet and outlet ports.

2 A spring loaded protective collar shall be fitted outside the guard lands. The force exerted by the loading spring (usually 9.8 N) shall be taken into account when setting the clamping pressure.

5.4 Backing holders, consisting of rigid metal discs of known mass, each recessed to accommodate a resilient backing at least 10 mm greater in diameter than the outside diameter of the guard land. The mass of both the resilient disc and the holder shall be allowed for in the initial adjustment of the clamping pressure.

5.5 Backings, of different types, which can be held in the recessed holders by means of double-sided adhesive tape.

a) **Soft backing**, resilient, consisting of an offset printing blanket composed of a layer of synthetic rubber, at least $600 \mu\text{m}$ thick, bonded to a fabric backing giving an overall thickness of $2\,000 \mu\text{m} \pm 200 \mu\text{m}$. The apparent hardness of the complete backing is $83 \text{ IRHD} \pm 6 \text{ IRHD}$ (International Rubber Hardness Degrees).

- b) **Hard backing**, resilient, usually made from a polyester film bonded at its periphery to cork, offset blanket or similar material. There is a small exhaust hole to prevent air being trapped between the film and the backing. The apparent hardness of the assembly is $95 \text{ IRHD} \pm 2 \text{ IRHD}$ (International Rubber Hardness Degrees).

5.6 Clamping mechanism, allowing clamping of the resilient disc at pressures of either $980 \text{ kPa} \pm 30 \text{ kPa}$ or $1\,960 \text{ kPa} \pm 30 \text{ kPa}$, the pressure being calculated from the total area of both measuring and guard lands. Note that the spring loading in the protective collar and the weight of the backing and its holder need to be taken into account. The rate of clamping shall be such that the pressure reaches 90 % of its final value in about 0.4 s and 99 % of its final value in about 0.8 s.

- NOTES 1 A third pressure of 490 kPa is available on most instruments but is not acceptable for use with this Standard because of a tendency for air to leak under the guard lands.
- 2 Variable area flowmeter models have a pressure gauge fitted to the instrument to indicate the clamping pressure, and the pressure can be adjusted by adjusting screws on the side of the instrument. Impedance models have integrated pneumatic and electronic circuitry which automatically controls the clamping pressure. In each case the actual pressure achieved must be verified as specified in **B.3**.

5.7 Measuring system Variable area flowmeter instruments shall be fitted with flowmeters which are graduated to read the “cube root mean cube gap” between the paper and the measuring land surface in micrometres (see annex A). The flowmeters shall be calibrated by the procedures outlined in either annex C or D. Impedance instruments measure air leakage by means of fluidic impedance, a pressure transducer and a function generator. They give a digital reading in micrometres, based on automatic measurement of pressure difference, over the range $0.6 \mu\text{m}$ to $6.0 \mu\text{m}$. The reading displayed shall be the reading calculated after 3 s to 5 s. This device shall be calibrated by the procedure described in annex D.