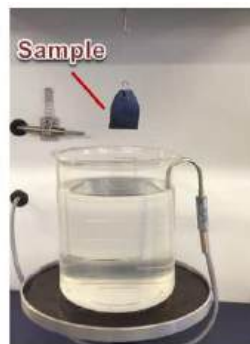




Toyo Seiki Seisaku-sho, Ltd. 5-15-4, Takinogawa, Kita-ku, Tokyo 114-8557, Japan

No.265 Automatic Densimeter Model **DSG-1**

Density Tester



➔
Automatic lifting



Measurement Principle

■ APPLICATION

The TOYOSEIKI **Automatic Densimeter** measures density of materials such as polymers or rubber in various forms. The weighing operation is automatic and the density of the sample is automatically calculated and displayed on the screen at the end of the test. By using the optional attachments, it can be used to determine density of liquids and rate of change of volume etc. An optional temperature sensor can also be added to allow direct measurement and input of air and liquid temperatures.

■ FEATURES

- The density of a wide range of materials from metals to foam bodies can be measured.
- Measurement can be performed in a short time (approximately 15 seconds per sample).
- Very simple operation-only mounting/dismounting the sample and pushing the Start button.
- In addition to distilled water, other liquids such as ethanol can also be used as the standard immersion liquid depending on sample.
- Beaker lifting speed & upper/lower stop position is adjustable. Allows you to reduce test cycles.
- Density tables (2 kinds each for liquid & air) are installed. Allows you to input immersion liquid density & air density by temperature.
- Automatic input of immersion liquid & air density is available. (Optional)
- Immersion liquid temperature can be controlled. (Optional)

■ CALCULATION FORMULAS

1. Density / Specific gravity of solid sample

$$W_2 = W_{\text{air}} - \Delta_w$$

W_1	Weight of a solid sample in air (kg)
W_2	Weight of a solid sample in a standard substance (kg)
W_{air}	Weight of a solid sample in a standard substance including the clamp correction value (kg)
Δ_w	Clamp correction value (kg)
ρ_s	Density of a standard substance at temperature t (kg/m ³)
ρ_{air}	Air density (kg/m ³)

Density

$$\rho_t = \frac{W_1}{W_1 - W_2} (\rho_s - \rho_{\text{air}}) + \rho_{\text{air}}$$

ρ_t	Density of a solid sample at temperature t (kg/m ³)
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Specific gravity

$$SG(t/t_0^{\circ}\text{C}) = \left(\frac{W_1}{W_1 - W_2} (\rho_s - \rho_{\text{air}}) + \rho_{\text{air}} \right) / \rho_s$$

SG(t/t 0°C)	Specific gravity of a standard substance when a water of temperature t0 is used
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Note: It is different when a standard substance use a solvent other than a water.

2. Volume (Option)

$$V = \frac{W_1 - W_2}{\rho_s - \rho_{\text{air}}}$$

V	Volume (m ³)
W1	Weight in air (kg)
W2	Weight in liquid (kg)
ρ_s	Liquid density (kg/m ³)
ρ_{air}	Air density (kg/m ³)

3. Volume change rate (Option)

$$\Delta V = \frac{V - VM}{VM} \times 100$$

ΔV	Volume change rate (%)
V	Volume after swelling (measured volume) (m ³)
VM	Sample's original volume (volume before change) (m ³)

4. Weight change rate (Option)

$$\Delta W = \frac{W - WM}{WM} \times 100$$

ΔW	Weight change rate (%)
W	Measured weight (kg)
WM	Sample's original weight (weight before change) (kg)

5. Forming rate (Option)

$$KS = \left(\frac{KD}{D} - 1 \right) \times 100$$

KS	Foaming rate (%)
KD	Calculated density (calculated specific gravity) (kg/m ³)
D	Measured density (measured specific gravity)

6. Density / Specific gravity of liquid sample (Option)

The density and specific gravity of a liquid can be measured by determining the weight of a standard material (solid) in pure water and the weight in the liquid to be measured.

Note: In place of pure water, a liquid of known density can be used for the measurement.

$$\rho_w = \frac{W_3 - W_1}{W_2 - W_1} (\rho_s - \rho_{air}) + \rho_{air}$$

ρ_w	Density of the liquid to be measured (kg/m ³)
W1	Weight of a standard material (solid) in air (kg)
W2	Weight in pure water (kg)
W3	Weight in the liquid to be measured (kg)
PS	Pure water density (kg/m ³)
Pair	Air density (kg/m ³)

When W₁ is 0.0000 g, liquid density can be determined by the following formula.

$$\rho_w = \frac{W_3}{W_2} (\rho_s - \rho_{air}) + \rho_{air}$$

The specific gravity of a liquid can be determined by the following formula.

$$SG(t/t_0^{\circ}C) = \left(\frac{W_3}{W_2} (\rho_s - \rho_{air}) + \rho_{air} \right) / \rho_s$$

SG (t/t ₀ °C)	Specific gravity when pure water at temperature t ₀ is used
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The Automatic Densimeter measures the weight in liquid W₂ in Liquid density measurement I and the weight in liquid W₃ in Liquid density measurement II, and then determines liquid density using the above formula.

■ TABLE OF WATER DENSITY

Condition: Density ρ_{SMOW} of water having the same isotopic composition as SMOW

Temperature (°C)	Density (g/cm ³)	Temperature (°C)	Density (g/cm ³)	Temperature (°C)	Density (g/cm ³)
0	0.999843	21	0.997995	42	0.991437
1	0.999902	22	0.997773	43	0.991036
2	0.999943	23	0.997541	44	0.990628
3	0.999967	24	0.997299	45	0.990213
4	0.999975	25	0.997047	46	0.989791
5	0.999967	26	0.996786	47	0.989362
6	0.999943	27	0.996515	48	0.988926
7	0.999904	28	0.996235	49	0.988484
8	0.999851	29	0.995946	50	0.988035
9	0.999784	30	0.995649	51	0.987579
10	0.999703	31	0.995342	52	0.987117
11	0.999608	32	0.995027	53	0.986649
12	0.999500	33	0.994704	54	0.986174
13	0.999380	34	0.994372	55	0.985693
14	0.999247	35	0.994033	56	0.985206
15	0.999103	36	0.993685	57	0.984712
16	0.998946	37	0.993329	58	0.984213
17	0.998778	38	0.992965	59	0.983707
18	0.998598	39	0.992594	60	0.983196
19	0.998408	40	0.992215	-	-
20	0.998207	41	0.991830	-	-

■ TABLE OF AIR DENSITY

Conditions: 101325 Pa, Relative humidity 50%, Carbon dioxide (CO₂) concentration 400 μ mol/mol

Temperature (°C)	Density (g/cm ³)	Temperature (°C)	Density (g/cm ³)	Temperature (°C)	Density (g/cm ³)
0	0.001292	21	0.001195	42	0.001103
1	0.001287	22	0.001190	43	0.001099
2	0.001282	23	0.001186	44	0.001094
3	0.001277	24	0.001182	45	0.001090
4	0.001272	25	0.001177	46	0.001085
5	0.001268	26	0.001173	47	0.001081
6	0.001263	27	0.001169	48	0.001076
7	0.001258	28	0.001164	49	0.001072
8	0.001254	29	0.001160	50	0.001067
9	0.001249	30	0.001156	51	0.001063
10	0.001244	31	0.001151	52	0.001058
11	0.001240	32	0.001147	53	0.001054
12	0.001235	33	0.001142	54	0.001049
13	0.001231	34	0.001138	55	0.001044
14	0.001226	35	0.001134	56	0.001040
15	0.001222	36	0.001129	57	0.001035
16	0.001217	37	0.001125	58	0.001030
17	0.001213	38	0.001121	59	0.001025
18	0.001208	39	0.001116	60	0.001020
19	0.001204	40	0.001112	-	-
20	0.001199	41	0.001108	-	-

■ DATA OUTPUT EXAMPLE (OPTION)

1. Mini printer, model PRT

DATE 2017.11. 1 DS
NAME Test
Ps : 0.998308 [g/cm³]
Pair : 0.001200 [g/cm³]
Clamp : -0.0259 [g]

No. 1
W1 : 2.3775 [g]
W2 : 1.4478 [g]
D : 2.551081 [g/cm³]

No. 2
W1 : 2.3775 [g]
W2 : 1.4473 [g]
D : 2.549710 [g/cm³]

No. 3
W1 : 2.3775 [g]
W2 : 1.4476 [g]
D : 2.550532 [g/cm³]

D(ave): 2.550441 [g/cm³]

2. Data transfer software for spreadsheet, model EX


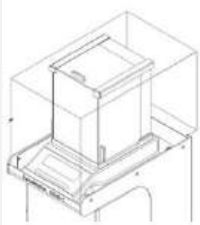




DS	20171101 Test	0.998308	0.0012	-0.0259
	1	2.3775	1.4478	2.551081
	2	2.3775	1.4473	2.54971
	3	2.3775	1.4476	2.550532
AVE	2.550441			






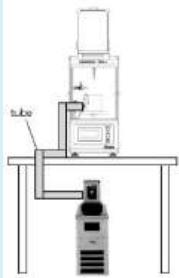
■ SPECIFICATIONS






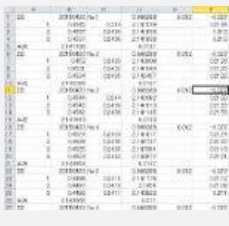
Model	DSG-1
Balance unit capacity	100g
Balance unit resolution	0.0001g (0.1mg)
Balance unit repeatability	0.1mg (Standard) 0.07mg (Optional high repeatability balance unit)
Balance unit setting time	2s (Standard) 1.5s (Optional high repeatability balance unit)
Operating panel	4 inch LCD touch screen
Measurement item (Standard)	<ul style="list-style-type: none"> ■ Density / Specific gravity of solid sample
Measurement items (Option)	<ul style="list-style-type: none"> ■ Volume (Solid sample) ■ Volume change rate (Solid sample) ■ Weight change rate (Solid sample) ■ Foaming rate (Solid sample) ■ Density / Specific gravity of liquid sample (Optional glass ball clamp is required)
Density range (Specific gravity range)	0.100000 to 20.000000g/cm ³ (0.100000 to 20.000000)
Density display resolution	0.000001g/cm ³
Density measurement units	<ul style="list-style-type: none"> ■ g/cm³ ■ kg/m³
Volume measurement units (Option)	<ul style="list-style-type: none"> ■ cm³ ■ m³
Beaker lifting mechanism	Motorized direct-drive actuator <ul style="list-style-type: none"> ■ Lifting speed: 10, 20, 30mm/sec (Selectable) ■ Beaker stop position: Lower side: 0, 10, 20mm (Selectable) Upper side: 80, 90, 100mm (Selectable)
Data storage	200 lots, 1000 sets of data (up to 100 sets of data per lot can be saved)
Immersion liquid	Water, ethanol, acetone (to be used in the range of 10 to 30°C)
Immersion liquid temperature control (Option)	Possible to control immersion liquid temperature with optional refrigerated circulator and double-wall beaker
Immersion time range	1 to 999 seconds
Air density input	You can input air temperature then air density is automatically set using stored air density table. (Direct input of air density is also possible). <i>Automatic input using temperature sensor is available as option.</i>
Immersion liquid density input	You can input immersion liquid temperature then liquid density is automatically set using stored liquid density table. (Direct input of liquid density is also possible). <i>Automatic input using temperature sensor is available as option.</i>
Table of air & immersion liquid density	<ul style="list-style-type: none"> ■ Table of air & water density is installed as standard (See page 5) ■ Possible to save up to 2 kinds of table.
Interface	RS-232 x 1
Power requirement	Single-phase, AC100 to 240V, 50/60Hz, 0.1kVA
Dimensions	W290 x D443 x H890mm
Weight	Approx. 35kg
Related standards	ISO 1183-1, ISO 2781 ASTM D792 JIS Z 8807, JIS K 6268, JIS K 7112

■ STANDARD FUNCTIONS / ACCESSORIES & OPTIONS

● Standard ○ Option

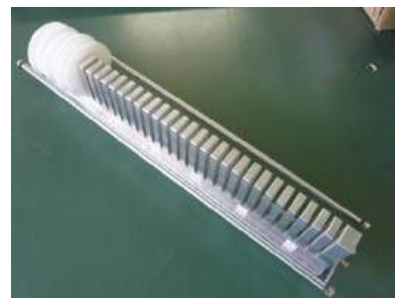
	Name	Model (Part No.)	Photo	DSG-1
1	Standard balance unit <ul style="list-style-type: none"> ■ Repeatability: 0.1mg ■ Setting time: 2s 	----		●(x1)
2	High repeatability balance unit option <ul style="list-style-type: none"> ■ Repeatability: 0.07mg ■ Setting time: 1.5s 	STAB-1		○
3	Acrylic windshield for balance	SC		○
4	Balance hook	----		●(x1)
5	Pierce clamp	1-d (2130002)		●(x1)
6	Pierce clamp (Heavier weight than 1-d)	1-e		○
7	Ohm clamp, without weight	2-a (2130006)		●(x3)

8	Ohm clamp, with weight	2-d (2130008)		<input type="radio"/>
9	Clip type clamp	3-a (2130005)		<input type="radio"/>
10	Glass ball clamp for liquid density measurement	----		<input type="radio"/>
11	Calculation software (Optional program) <ul style="list-style-type: none"> ■ Volume (Solid sample) ■ Volume change rate (Solid sample) ■ Weight change rate (Solid sample) ■ Forming rate (Solid sample) ■ Density / Specific gravity of liquid sample (Optional glass ball clamp & small beaker is required) 	----	----	<input type="radio"/>
12	Automatic input of air density (Temperature sensor for air)	AT-A1	----	<input type="radio"/>
13	Automatic input of water density, for standard beaker (Temperature sensor for water)	AT-L1	----	<input type="radio"/>
14	Automatic input of water density, for double-wall beaker (Temperature sensor for water)	AT-L2		<input type="radio"/>
15	Standard beaker (Ø90 x H120mm, Material:PMP resin)	----		●(x1)
16	Refrigerated circulator (Immersion liquid temp. control) <ul style="list-style-type: none"> ■ Closed-loop chiller ■ Temperature range: -20 to 150°C (Meas. range should be 10 to 30°C) ■ Power supply: Single-phase, AC230V, 50Hz 	T3		<input type="radio"/>
17	Refrigerated circulator (Immersion liquid temp. control) <ul style="list-style-type: none"> ■ Closed-loop chiller ■ Temperature range: -20 to 150°C (Meas. range should be 10 to 30°C) ■ Power supply: Single-phase, AC115V, 60Hz 	T5		<input type="radio"/>

18	Double-wall beaker, Open type (For open-loop chiller)	B2OP1		○
19	Double-wall beaker, Closed type (For closed-loop chiller)	B2OP2		○
20	Main unit windshield modification to connect with refrigerated circulator			○
21	Small beaker for liquid density measurement	----		○
22	Mini thermal printer	PRT		○
23	Thermal paper for mini printer	P-58-30	----	○
24	Data exporting software for spreadsheet	EX		○
25	RS-232C cable	RS-1	----	○
26	RS-232C cable with USB conversion adapter	RS-2	----	○
27	Power cord, Type B (For Japan)	----	----	● (x1)
28	Power cord, Type B (For USA etc.)	AC-U	----	○
29	Power cord, Type F (CEE7/4, For Germany etc.)	AC-C	----	○
30	Power cord, Type F (For South Korea)	AC-K	----	○
31	Power cord, Type G (BS1363, (For UK etc.)	AC-B	----	○
32	Power cord, Type I (For China)	AC-G	----	○

No.265 Automatic Densimeter Model **DSG-A**

Density Tester with Automatic Sample Feeder



Sample cassette tray

■ APPLICATION

This device measures the density of rubber, plastic and ceramic, etc. in a fully automated operation.

■ SPECIFICATIONS

		Model	DSG-A
Measurement unit	Max. capacity		100g
	Minimum readout		0.0001g (0.1mg)
	Operation panel		4 inch LCD touch screen
	Measurement item	■	Solid density
	Measurement units	■	g/cm ³ ■ kg/m ³ (Selectable)
	Density display resolution		0.000001g/cm ³
	Beaker lifting mechanism		Motorized direct-drive actuator
	Data saving capacity		200 lot (100data/lot; provided max. 1000 data can be saved)
	Interface		RS-232 x 1
	Power supply		Single-phase, AC100 to 240V, 50/60Hz, 0.1kVA
	Dimensions		W290 x D443 x H915mm
	Net weight		Approx. 35kg
Sample feeder	Sample dimensions		40 x 40 x 2mm or Ø40 x 2mm (On request basis. Need confirmation for other dimensions)
	Number of samples		Max. 64 (Vary depending on sample dimensions)
	Measurement time		Approx. 2 minutes / test (Depends on sample)
	Sample feeding		Pick-up hand, Feeding arm (Pneumatic cylinder, Motorized actuator)
	Operation panel		4 inch LCD touch screen
	Power requirement		Single-phase, AC100 to 240V, 50/60Hz, 2kVA
	Compressed air requirement		0.3MPa
	Dimensions		W300 x D600 x H850mm
	Weight		Approx. 40kg

Specifications are subject to change without notice.



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