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

No. 533 HDT Tester

HDT / VICAT Tester

■Model 3M-2・6M-2 (Manual operation model)

■Model 3A-2・6A-2 (Fully automated operation model)

■APPLICATION

The **HDT Tester** evaluates thermal properties of plastics according to the following standards.

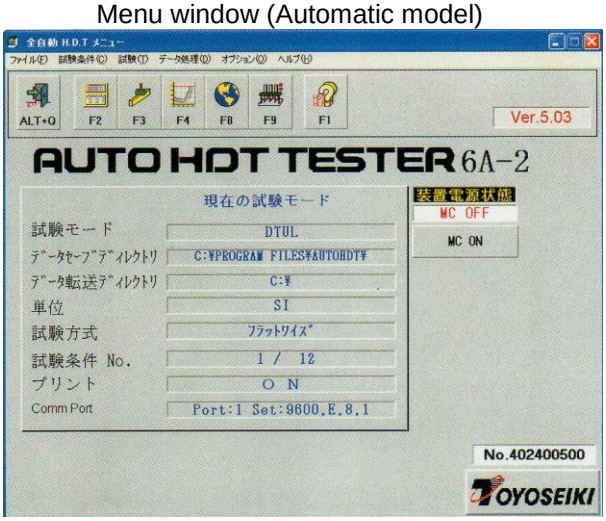
- **Deflection Temperature Under Load (DTUL or typically called HDT)…ISO 75 (JIS K 7191)**
- **VICAT Softening Temperature (VST)…ISO 306 (JIS K 7206)**
- **Ball Pressure Temperature…IEC 335-1**

In testing deflection temperature under load, a specified bending stress is applied by means of a presser to the sample immersed in oil tank and temperature of the heating medium (oil) is raised at constant rate and the temperature when the sample attains specified deflection is determined as the deflection temperature under load (DTUL). There are flatwise testing method and edgewise testing method according to the direction of bending of sample. After conducting test, the heating medium is safely cooled at fast rate by means of an externally installed heat exchanger and repeated tests are automatically continued. Moreover, this machine can also determine vicat softening temperature (VST) manually or automatically by changing the presser with a needle shaped presser and measuring the temperature at which the needle penetrates 1mm into the sample. In addition, by manual operation it can also conduct ball pressure test specified as heat resistance test for electric products by changing the presser, etc.

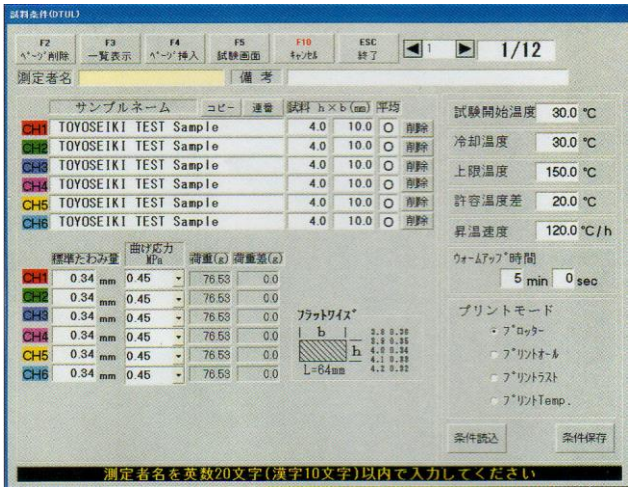
■TEST WINDOWS

Note: Displays shown are Japanese language version. English version is also available.

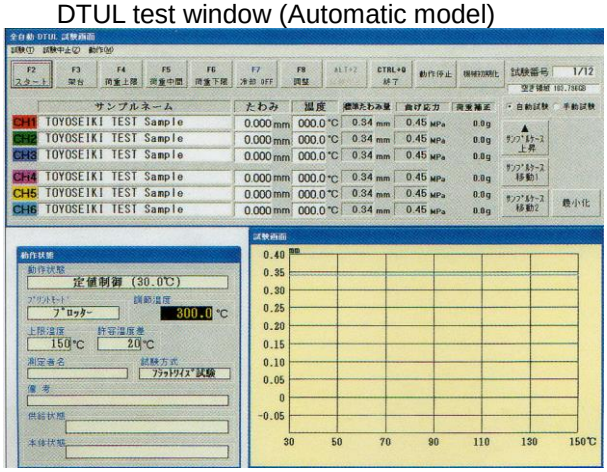
Menu window (Automatic model)



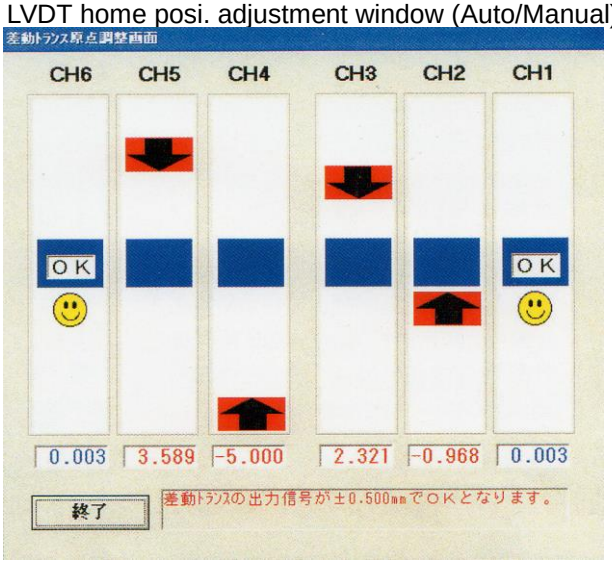
Test conditions input window (Automatic/Manual)



DTUL test window (Automatic model)

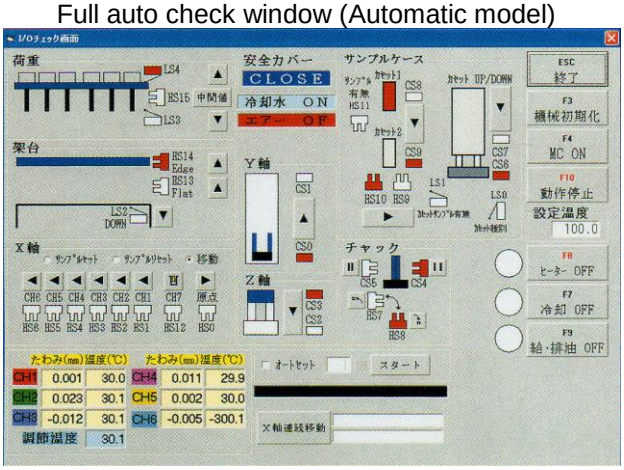


LVDT home posi. adjustment window (Auto/Manual)



I/O CHECK WINDOWS

Full auto check window (Automatic model)



TEST DATA

Print all mode

DEFLECTION TEMPERATURE DATA

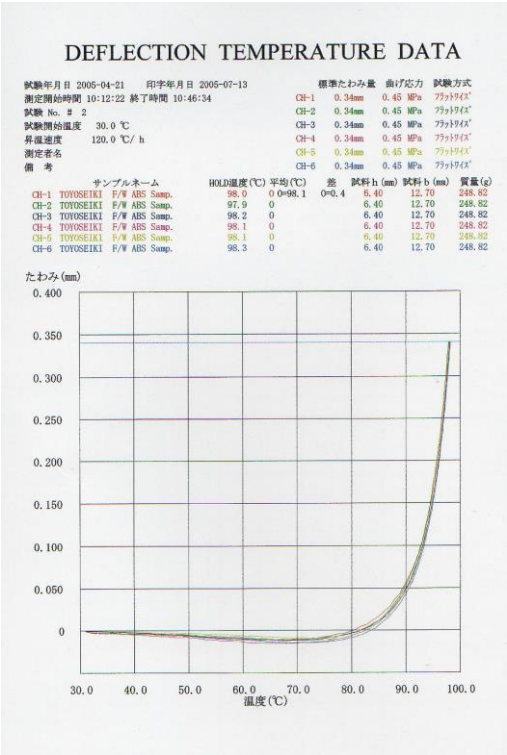
試験年月日 2005-04-21　印字年月日 2005-07-13
測定開始時間 10:12:22 終了時間 10:46:34
試験 No. # 2
試験開始温度 30.0 ℃
昇温速度 120.0 ℃/ h
測定者名
備 考

		標準たわみ量	曲げ応力	試験方式
CH-1		0.34mm	0.45 MPa	フラットワイズ
CH-2		0.34mm	0.45 MPa	フラットワイズ
CH-3		0.34mm	0.45 MPa	フラットワイズ
CH-4		0.34mm	0.45 MPa	フラットワイズ
CH-5		0.34mm	0.45 MPa	フラットワイズ
CH-6		0.34mm	0.45 MPa	フラットワイズ

サンプルネーム		HOLD温度(℃)	平均(℃)	差	試料h(mm)	試料b(mm)	質量(g)
CH-1	TOYOSEIKI F/W ABS Samp.	98.0	0 0=98.1	0=0.4	6.40	12.70	248.82
CH-2	TOYOSEIKI F/W ABS Samp.	97.9	0		6.40	12.70	248.82
CH-3	TOYOSEIKI F/W ABS Samp.	98.2	0		6.40	12.70	248.82
CH-4	TOYOSEIKI F/W ABS Samp.	98.1	0		6.40	12.70	248.82
CH-5	TOYOSEIKI F/W ABS Samp.	98.1	0		6.40	12.70	248.82
CH-6	TOYOSEIKI F/W ABS Samp.	98.3	0		6.40	12.70	248.82

[mm]	CH-1	CH-2	CH-3	CH-4	CH-5	CH-6
0.010	84.0	84.8	85.1	85.8	85.0	85.9
0.020	86.4	87.2	87.5	87.4	87.3	87.5
0.030	88.0	88.0	88.3	89.0	88.1	89.1
0.040	88.8	89.6	89.9	89.7	89.8	89.9
0.050	89.6	90.4	90.7	90.6	90.6	90.7
0.060	90.4	90.5	90.9	91.1	90.9	91.3
0.070	91.0	91.2	91.6	91.7	91.6	91.9
0.080	91.8	91.8	92.2	92.3	92.1	92.5
0.090	92.4	92.3	92.7	92.8	92.6	92.9
0.100	92.8	92.9	93.1	93.2	93.2	93.4
0.110	93.3	93.3	93.5	93.6	93.5	93.8
0.120	93.6	93.5	94.0	93.9	93.8	94.1
0.130	94.0	94.0	94.2	94.4	94.3	94.5
0.140	94.3	94.2	94.6	94.7	94.6	94.8
0.150	94.6	94.5	94.8	94.9	94.9	95.1
0.160	94.9	94.8	95.2	95.2	95.2	95.3
0.170	95.2	95.0	95.5	95.4	95.4	95.6
0.180	95.4	95.3	95.7	95.7	95.6	95.8
0.190	95.6	95.6	96.0	95.9	95.9	96.0
0.200	96.0	95.8	96.2	96.2	96.0	96.2
0.210	96.1	96.0	96.3	96.3	96.3	96.4
0.220	96.4	96.3	96.5	96.5	96.4	96.6
0.230	96.5	96.5	96.7	96.8	96.6	96.8
0.240	96.6	96.5	96.8	96.8	96.8	96.9
0.250	96.9	96.6	97.1	97.0	97.0	97.1
0.260	97.0	96.9	97.2	97.2	97.2	97.4
0.270	97.2	97.0	97.4	97.3	97.3	97.4
0.280	97.3	97.1	97.5	97.4	97.4	97.5
0.290	97.5	97.2	97.7	97.6	97.5	97.6
0.300	97.7	97.5	97.8	97.7	97.7	97.8
0.310	97.7	97.6	97.9	97.8	97.8	97.9
0.320	97.9	97.6	98.1	97.9	97.9	98.0
0.330	98.0	97.9	98.2	98.0	98.0	98.1
0.340	98.0	97.9	98.2	98.1	98.1	98.3

Plot mode (DTUL)



DEFLECTION TEMPERATURE DATA

試験年月日 2005-04-21　印字年月日 2005-07-13
測定開始時間 10:12:22 終了時間 10:46:34
試験 No. # 2
試験開始温度 30.0 ℃
昇温速度 120.0 ℃/ h
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CH-3		0.34mm	0.45 MPa	フラットワイズ
CH-4		0.34mm	0.45 MPa	フラットワイズ
CH-5		0.34mm	0.45 MPa	フラットワイズ
CH-6		0.34mm	0.45 MPa	フラットワイズ

サンプルネーム		HOLD温度(℃)	平均(℃)	差	試料h(mm)	試料b(mm)	質量(g)
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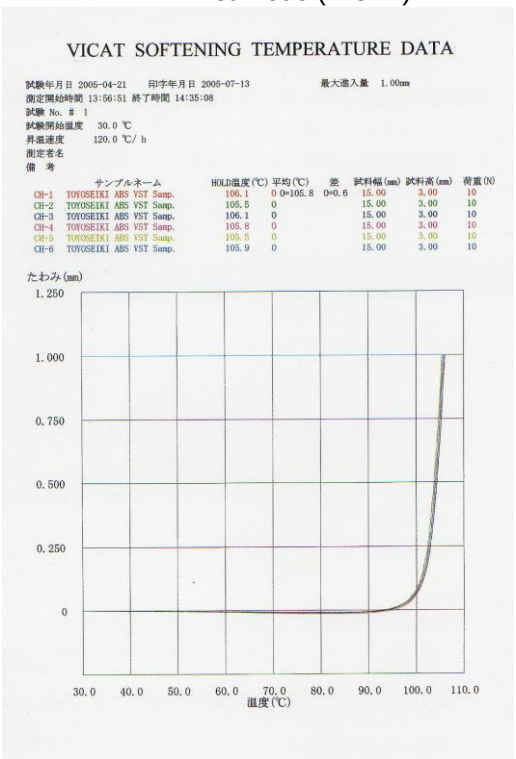
CH-2	TOYOSEIKI F/W ABS Samp.	97.9	0		6.40	12.70	248.82
CH-3	TOYOSEIKI F/W ABS Samp.	98.2	0		6.40	12.70	248.82
CH-4	TOYOSEIKI F/W ABS Samp.	98.1	0		6.40	12.70	248.82
CH-5	TOYOSEIKI F/W ABS Samp.	98.1	0		6.40	12.70	248.82
CH-6	TOYOSEIKI F/W ABS Samp.	98.3	0		6.40	12.70	248.82

Deformation process curve

Plot mode (VICAT)



VICAT SOFTENING TEMPERATURE DATA

試験年月日 2005-04-21　印字年月日 2005-07-13　最大進入量 1.00mm
測定開始時間 13:56:51 終了時間 14:35:08
試験 No. # 1
試験開始温度 30.0 ℃
昇温速度 120.0 ℃/ h
測定者名
備 考

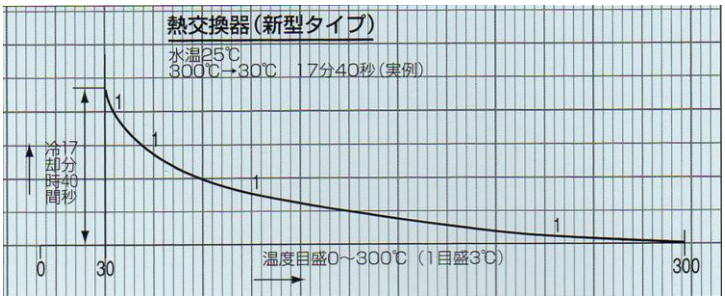
サンプルネーム		HOLD温度(℃)	平均(℃)	差	試料幅(mm)	試料高(mm)	荷重(N)
CH-1	TOYOSEIKI ABS VST Samp.	106.1	0 0=105.8	0=0.6	15.00	3.00	10
CH-2	TOYOSEIKI ABS VST Samp.	105.5	0		15.00	3.00	10
CH-3	TOYOSEIKI ABS VST Samp.	106.1	0		15.00	3.00	10
CH-4	TOYOSEIKI ABS VST Samp.	105.8	0		15.00	3.00	10
CH-5	TOYOSEIKI ABS VST Samp.	105.5	0		15.00	3.00	10
CH-6	TOYOSEIKI ABS VST Samp.	105.9	0		15.00	3.00	10

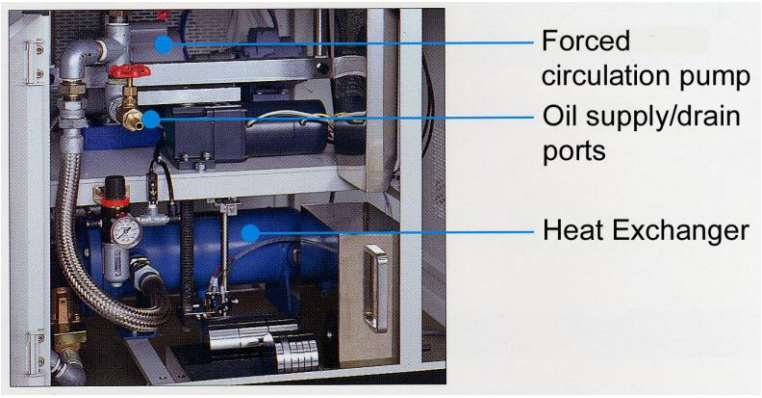
Softening process curve

■PERFORMANCE

(1) Oil Cooling System

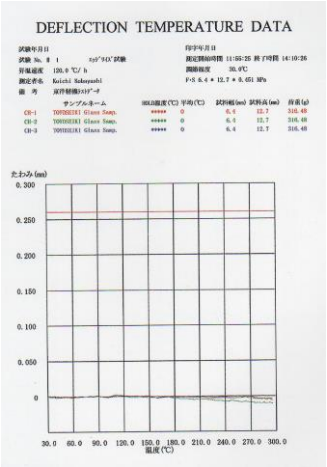
- To ensure safety the cooling system employs a water-cooled type heat exchanger installed outside the oil tank and the oil is cooled by forced-circulating by means of pump. (In conventional cooling system using a cooling coil placed inside the oil tank, there is danger of water leakage inside the tank, causing damage)
- Oil is easily supplied by using forced circulation pump.
- Since heat exchanger is used for cooling, cooling speed is faster compared to conventional cooling system of placing cooling coil inside the oil tank, thus considerably shortening the cooling cycle.
  (Example)
  300°C→30°C cooling (Water temp. 25°C)
  Cooling coil-in-tank system…Approx. 55 min.
  Heat exchanger cooling sytem…Approx. 18 min.





(2) Distortion of measuring unit due to heating is automatically corrected by the computer and the measured value is directly read.

Zero point shift after measuring unit's distortion correction



■LOAD SYSTEM

■SAFETY DEVICES

Temperature	■ When the temperature of oil tank reaches the upper limit on computer screen, the heater shuts off and oil cooling starts. (Arbitrary setting) ■ When the oil tank temperature reaches the limit set by the sample overheat protector, the heater circuit and machine operation circuit shut off. (Arbitrary setting) ■ Machine overheat protector: Same as above (Fixed approximately 10ºC higher than the maximum specified temperature of the machine.)
Mechanical	■ An optical sensor and a microswitch are used at each normal operation stop position. The microswitch is equipped for safety to directly shut off each motor circuit in case the sensor becomes abnormal. ■ Each motor is equipped with a circuit-protector or circuit-breaker circuit to shut off the motor when an overcurrent flows. A circuit to shut off the drive current when operating longer than the set time is also equipped.
Cooling water	Equipped with a circuit to stop the oil circulation pump motor when cooling water does not flow.
Other	An I/O check window is provide to easily check the above-mentioned sensors, which facilitates quick recovery by quickly detecting and replacing faulty sensor.

■SPECIFICATIONS

Manual operation model

Model	3M-2V・3M-2W	6M-2V・6M-2W・6M-2KW
Number of stations	3	6
Temperature range	Room temperature to 300°C	
Test bath (Oil bath)	Approx. 16L	Approx. 28L
Heating rate	120°C/h, 50°C/h (Arbitrary setting is possible)	
Temperature distribution	±0.5°C (In the vicinity of specimens) Temperature sensors are installed in the vicinity of each specimens	
Temperature control system	PID control, SSR drive system	
Temperature sensor	Platinum resistance thermometer (Pt 100)	
Number of temperature sensors	4 (Including sensor for temp. control)	7 (Including sensor for temp. control)
Displacement measurement	LVDT (1/1000mm indication, 0 to ±2mm measurement)	
Stirrer	Parallel circulation system by propeller type stirrer	
Cooling system	U tube type heat exchanger (Forced oil circulation system 200W motor) installed outside oil bath	
Specimen support	■ DTUL (HDT), Flatwise, Span 64mm ■ DTUL (HDT), Edgewise, Span 100mm	
Bending stress	■ DTUL (HDT), Flatwise: 1.80MPa (Standard) Note: In case of 0.45MPa, since the weight is same 76.5g which is the total of the weights of weight pan, load rod, presser and LVDT core, it gives specified load without adding a weight. ■ DTUL (HDT), Edgewise: 0.45MPa & 1.80MPa (Option) ■ VST (VICAT): 10N, 50N (Option) ■ Ball pressure test: 20N (Option)	
Data processing unit (Provided as standard)	Software, Personal computer, LCD monitor, Ink-jet printer	
Power requirements	**3M-2V** Single-phase, AC200V, 50Hz or 60Hz, 2.7kVA **3M-2W** Single-phase, AC220/230V, 50Hz or 60Hz, 2.7kVA	**6M-2V** Single-phase, AC200V, 50Hz or 60Hz, 4.5kVA **6M-2W・6M-2KW** Single-phase, AC220/230V, 50Hz or 60Hz, 4.5kVA
Water requirements	Pressure: 0.1 to 0.7MPa Flow rate: 5L/min. or more Water drain: Required	
Dimensions	W720 x D630 x H1350mm	W1010 x D630 x H1380mm
Weight	Approx. 150kg	Approx. 180kg
Related standards	■ DTUL (HDT): ISO75 (JIS K 7191), ASTM D 648 ■ VST (VICAT): ISO306 (JIS K 7206), ASTM D 1525 ■ Ball pressure test: IEC 335-1	

Automatic operation model

Model	3A-2V・3A-2W	6A-2V・6A-2W
Number of stations	3	6
Temperature range	Room temperature to 300°C	
Test bath (Oil bath)	Approx. 16L	Approx. 28L
Heating rate	120°C/h, 50°C/h (Arbitrary setting is possible)	
Temperature distribution	±0.5°C (In the vicinity of specimens) Temperature sensors are installed in the vicinity of each specimens	
Temperature control system	PID control, SSR drive system	
Temperature sensor	Platinum resistance thermometer (Pt 100)	
Number of temperature sensors	4 (Including sensor for temp. control)	7 (Including sensor for temp. control)
Displacement measurement	LVDT (1/1000mm indication, 0 to ±2mm measurement)	
Stirrer	Parallel circulation system by propeller type stirrer	
Cooling system	U tube type heat exchanger (Forced oil circulation system 200W motor) installed outside oil tank	
Automatic / Manual operation	■ DTUL (HDT), Flatwise: Automatic (Standard) ■ DTUL (HDT), Edgewise: Automatic (Option) ■ VST (VICAT): Manual (Option) ■ Ball pressure test: Manual (Option)	
Specimen feeder	Max. 120 specimens (when ISO flatwise specimen)	Max. 240 specimens (when ISO flatwise specimen)
Specimen support	■ DTUL (HDT), Flatwise, Span 64mm ■ DTUL (HDT), Edgewise, Span 100mm	
Bending stress	■ DTUL (HDT), Flatwise: 1.80MPa (Standard) Note: In case of 0.45MPa, since the weight is same 76.5g which is the total of the weights of weight pan, load rod, presser and LVDT core, it gives specified load without adding a weight. ■ DTUL (HDT), Edgewise: 0.45MPa & 1.80MPa (Option) ■ VST (VICAT): 10N, 50N (Option) ■ Ball pressure test: 20N (Option)	
Data processing unit (Provided as standard)	Software, Personal computer, LCD monitor, Ink-jet printer	
Power requirements	**3A-2V** Single-phase, AC200V, 50Hz or 60Hz, 2.7kVA **3A-2W** Single-phase, AC220/230V, 50Hz or 60Hz, 2.7kVA	**6A-2V** Single-phase, AC200V, 50Hz or 60Hz, 4.5kVA **6A-2W** Single-phase, AC220/230V, 50Hz or 60Hz, 4.5kVA
Compressed air requirement	Pressure: 0.3MPa or more, Flow rate: 5L/min. or more	
Water requirements	Pressure: 0.1 to 0.7MPa, Flow rate: 5L/min. or more Drain: Required	
Dimensions	W780 x D760 x H1540mm	W1080 x D760 x H1590mm
Weight	Approx. 180kg	Approx. 210kg
Related standards	■ DTUL (HDT): ISO75 (JIS K 7191), ASTM D648 ■ VST (VICAT): ISO306 (JIS K 7206), ASTM D1525 ■ Ball pressure test: IEC 335-1	

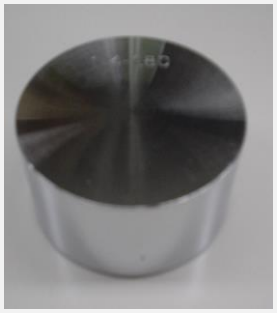
■STANDARD FUNCTIONS / ACCESSORIES & OPTIONS

●Standard ○Option

	Name	Model	Part No.	HDT Tester
1	Data processing unit (HDT Software, PC, LCD Monitor, Printer)	-----	-----	●
2	HDT mix software *(For simultaneous measurement of DTUL & VICAT)*	HVC	-----	○
3	LVDT	-----	-----	●
4	Temperature sensor, PT100Ω	-----	1300119	●
5	Specimen support (Span 64mm / 100mm)	-----	-----	●
6	Load for DTUL, Flatwise (ISO), 0.45MPa (0.45MPa=Total weight of weight pan, load rod, presser and LVDT core.	-----	-----	●
7	Weight for DTUL, Flatwise (ISO), 1.80MPa	F41018	-----	●
8	Weight for DTUL, Edgewise (ASTM), 1/2” - 0.45MPa	12-045	-----	○
9	Weight for DTUL, Edgewise (ASTM), 1/2” - 1.80MPa	12-180	-----	○
10	Weight for DTUL, Edgewise (ASTM), 1/4” - 0.45MPa	14-045	-----	○
11	Weight for DTUL, Edgewise (ASTM), 1/4” – 1.80MPa	14-180		○
12	Weight for DTUL, Edgewise (ASTM), 1/8” - 0.45MPa	18-045	-----	○
13	Weight for DTUL, Edgewise (ASTM), 1/8” - 1.80MPa	18-180	-----	○
14	Weight for VICAT, 10N	W-1	-----	○
15	Weight for VICAT, 50N	W-5	-----	○
16	VICAT test needle	-----	2100490	○
17	Weight for ball pressure test, 20N	B-2	-----	○
18	Ball type presser for ball pressure test	-----	-----	○
19	Support for ball for ball pressure test	-----	-----	○
20	Dummy resistor for temperature calibration,(0°C, 300°C)	-----	-----	○
21	Micrometer for LVDT displacement calibration	-----	-----	○
22	Secondary cooling system (External chiller) Standard type, Including solenoid valve box, For 200V	3-C2	-----	○
23	Secondary cooling system (External chiller) Standard type, Including solenoid valve box, For 220V to 230V	3-C3	-----	○
24	Secondary cooling system (External chiller) Standard type, Without solenoid valve box, For 200V	6-C2	-----	○
25	Secondary cooling system (External chiller) Standard type, Without solenoid valve box, For 220V to 230V	6-C3	-----	○
26	Secondary cooling system (External chiller) Rapid cooling type, Including solenoid valve box, For 200V	3-HC2	-----	○
27	Secondary cooling system (External chiller) Rapid cooling type, Including solenoid valve box, For 220V to 230V	3-HC3	-----	○
28	Secondary cooling system (External chiller) Rapid cooling type, Without solenoid valve box, For 200V	6-HC2	-----	○
29	Secondary cooling system (External chiller) Rapid cooling type, Without solenoid valve box, For 220V to 230V	6-HC3	-----	○

30	Silicone fluid, Shin-Etsu (16kg/can)	KF-965	-----	○
31	Silicone fluid, Toray (18kg/can)	SRX-310	-----	○
32	Silicone fluid, Momentive (15kg/can)	YF-33	-----	○

			
3. LVDT	5. Specimen support	7. Weight for DTUL, Flatwise (ISO), 1.80MPa (F41018)	8. Weight for DTUL, Edgewise (ASTM), 1/2”-0.45MPa (12-045)

			
9. Weight for DTUL, Edgewise (ASTM), 1/2”-1.80MPa (12-180)	10. Weight for DTUL, Edgewise (ASTM), 1/4”-0.45MPa (14-045)	11. Weight for DTUL, Edgewise (ASTM), 1/4”-1.80MPa (14-180)	12. Weight for DTUL, Edgewise (ASTM), 1/8”-0.45MPa (18-045)

			
13. Weight for DTUL, Edgewise (ASTM), 1/8”-1.80MPa (18-180)	16. VICAT test needle		

Note:

Specifications are subject to change without notice.

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