

# **PATIO® SERIES**

## **«Substance»**

**Polypropylene + Inorganic filler**

## **«Grade»**

**Patio T-20 ..... Filler 20 % contained**

**Patio T-30 ..... Filler 30 % contained**

**Patio T-40 ..... Filler 40% contained**

## **«Feature»**

**Patio thermoforming sheet produces the following features as a food package after thermoformed**

### **1) Excellent heat resistance**

**The heat resistance of Patio sheet is drastically improved as compared to PP solid, and Patio is optimum case or tray for microwave oven.**

### **2) Excellent safety**

**Patio sheet passed The Health, Labor and Welfare Ministry Notice article No. 370 and No. 20. Patio sheet can be used safely**

### **3) Excellent flammability**

**Patio sheet is that calorific value is low at time of burning and as compared to general plastic case, it is easy to burn.**

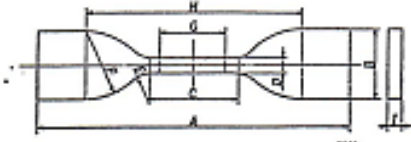
**(1) Sheet physical property**

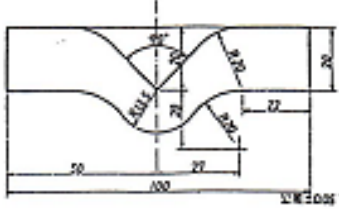
**1. Physical property**

Item		Unit	PP solid	Patio T-20	Patio T-30	Patio T-40
M F R		g/10min.	0.50	0.70	0.75	0.80
Density		g/cm <sup>3</sup>	0.91	1.05	1.15	1/25
Tensile strength	MD	kg/cm <sup>2</sup>	300	310	310	310
	TD		270	280	280	280
Tensile elongation at rupture	MD	%	800	600	500	450
	TD		600	400	150	70
Tensile elastic modulus	MD	kg/cm <sup>2</sup>	15000	25000	32000	40000
	TD		13000	20000	26000	36000
Tearing strength	MD	g	7500	7200	6800	6500
	TD		8500	8000	7800	7500
Du Pont impact strength	+23℃	Kg-cm	85	35	30	20
	±0℃		50	19	15	10
	- 20℃		30	10	7	5
Water vapor permeability		g/m <sup>2</sup> 24h	0.74	0.45	0.44	0.40

※ Above is a representative value of 0.5 mm thick sheet but is not a guaranteed one.

## 2. Test method

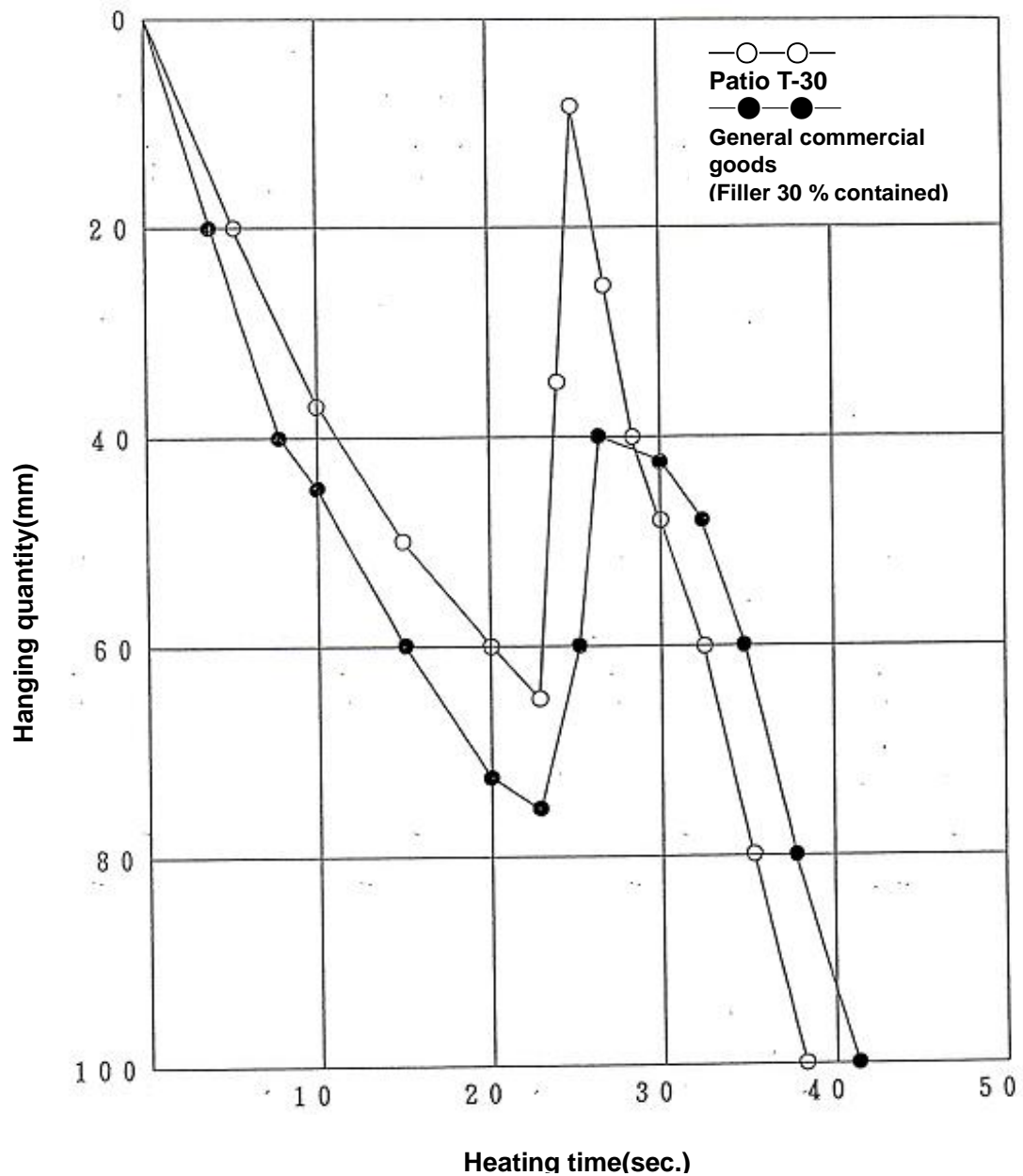
Item	Standard	Test method
MFR	JIS K 7210	<p>A method(Manual cutting off method)  Condition: Test Temp. 230℃, Test load weight: 2160g  Inner diameter x length: <math>\phi</math> 2095mmx8mm  Residual heat time: 6 min.  Calculation: <math>600(\text{second for 10 min.}) \times M / T</math>  M: Cutoff test material massy (g)  T : Mass measure test specimen collection time (T)</p>
Density	JIS K 7112	<p>A method (water replacement method)  Condition: About 35 mm x 35 mm  Immersion fluid : Water  Calculation: <math>\text{Density} = A / (A+B-C)</math>  A: Mass of test specimen in the air (g)  B: Mass of metallic line in immersion fluid (g)  C: Mass of metallic line and test specimen in immersion fluid (g)</p>
Tensile strength Tensile elongation at rupture	JIS K 7113	<p>Type No. 2 test specimen used</p>  <p style="text-align: right;">Unit: mm</p> <p> A: Total length: 115                      F: Max radius <math>25 \pm 2</math>  B: Width of both edge: <math>25 \pm 1</math>      G: marked line dis. <math>25 \pm 1</math>  C: Length of parallel area: <math>33 \pm 2</math>  D: Width of parallel area: <math>6 \pm 0.4</math>  E: Minimum radius: <math>14 \pm 1</math>      H: Grab distance: <math>80 \pm 5</math>  I: Thickness: 1~3 </p> <p> Condition: Tensile speed: 50 mm/min.  Marked line distance: 25 mm  Calculation Tensile strength : <math>F / A</math>  F: Load at time of yielding or breaking (kg)  A: Original specimen minimum section area (<math>\text{cm}^2</math>)  Tensile elongation at rupture=<math>\{(L-L_0) / L_0\} \times 100</math>  <math>L_0</math>: Original marked line distance (mm) </p>
Tensile elastic modulus	Our method	<p> Condition: Test specimen dim. 20 mm x 200 mm  Tensile speed: 10 mm/min.  Distance between chuck: 100 mm  Calculation: Tensile elastic modulus: <math>(F \times L) / (A \times D)</math>  F: Stress (kg)  L: Distance between chuck (mm)  A: Original specimen minimum section area(<math>\text{cm}^2</math>)  D: Elongation to stress (mm) </p>

Item	Standard	Test method
Tensile strength	JIS K 6781	<p>Test specimen dimension</p>  <p>Condition: Tensile speed: 500 mm/min Indication: Maximum load up to breaking</p>
Du Pont Impact strength	Our method	<p>Test specimen dimension: About 130 mm x any length Condition: Impact shaft radius 1/2 inch Plumb bob: 1 kg, 0.5 kg, 0.3 kg Calculation: 50% destruction height x plumb bob 50% destruction height is calculated in conformity to JIS 7211</p>
Water vapor Permeability	JIS Z 0208	<p>Each sheet is made to boundary surface at 40°C. One side air is made to relative humidity is 90% and other side air is kept to arid condition by Calcium Chloride. The value which the mass ( g ) of water vapor passing on the boundary surface for 24 hours is converted per 1M<sup>2</sup>. Calculation: <math>(240 \times m) / (t \times s)</math> m: The total of mass augmentation of final weighing interval after test performed (mg) t: The total time of final weighing interval after test performed (t) s: vapor transmission area (28.26cm<sup>2</sup>)</p>

## [2] Drawdown characteristic at time of heating

### DRAWDOWN CHARACTERISTIC

(Sheet handing return at time of heating)



Sheet thickness : 0.5 mm

Heating condition: Sheet apparatus tool: 1 m x 1 m (Inner dimension)

Far-infrared ray heater 350°C (heater surface temperature)

### [3] Formed tray physical property

#### 1. Physical property

Item		Unit	PP solid	Patio T-20	Patio T-30	Patio T-40
Forming Shrinkage	MD	1/1000	15	11	11	10
	TD	1/1000	16	14	14	13
Heat resistant temperature		℃	110	130	140	150
Cold resistant temperature		℃	-30	-30	-30	-30
Durability			○	○	○	○
Impact resistant property	A method		○	○	○	○
	B method	100cmH	○	○	○	○
		150cmH	○	○	○	○

#### 2. Measurement method

Items	Standard	Test method
Forming shrinkage	Our method	Forming condition: Mold temp. 70℃ Cooling time: 4.5 sec. Sheet temp. at time of forming: 190℃ Measurement: Dimension of prescribed position is measured to MD·TD direction Calculation: Forming shrinkage: $\{(S_1 - S_0)/S_1\} \times 1000$ S <sub>1</sub> : Dimension of mold described position S <sub>0</sub> : Dimension of formed (case) products prescribed position
Heat resistant temperature	Our method	Salad oil is put into case and put its case into microwave oven and go up its temperature at which case does not deform . Microwave high frequency output: 600W Salad oil temperature heating time 3 min. : 100℃ 4 min.: 125℃ 5 min.: 150℃
Cold resistant temperature	※	Water is put into case and cool the case for one hour at the described temperature at which case does not deform.
Durability	※	Salad oil is put into the half of full case and heat its case to the indicative heat resistant temperature in the microwave and cool its case to indicative heat resistant temperature in the low temperature tank. After this operation is repeated five times, below mentioned test method A is performed and check its damage level.
Impact resistant	※	A method : 19.5 kgs steel ball is dropped than 30 cm height from case bottom and check its damage.  B method: Rice is put into case and cool its case at -20℃ for 24 hours and its case is dropped from the height of 100 cm and 150 cm and check its damage.

Case which was used in this measurement : Food tray 140W x 210L x 40H(mm)

※ Measurement method in conformity to the guide line of heat resistant plastic (microwave)

#### [4] Reference test by case

##### 1. Burning characteristic

- 1) Test method: Measurement by calorie mater
- 2) Test result

Item	PP solid	Patio T-20	Patio T-30	Patio T-40
Burning calorie(kcal/kg)	11000	8800	7700	6600
Black smoke, poisonous gas generation	No detection	No detection	No detection	No detection

##### 2. Scentlessness

- 1) Test method: Pour a 500 cc heated water into case. Place an Aluminum foil on it as a lid. After left it for 3 min. check whether or not odor is generated from case . A total of 10 persons checked it and made a judgment.
- 2) Test result

Rank		PP Solid	Patio T-20	Patio T-30	Patio T-40
No ↑ Smell ↓ Yes	1	10	10	10	10
	2	0	0	0	0
	3	0	0	0	0
	4	0	0	0	0
	5	0	0	0	0

Judgment standard: 5-grade evaluation

##### 3. Food resistant property

- 1) Test method: In conformity to JIS K 7114  
Test specimen was immersed in the test liquid at 23℃ for 7 days and then, measured its weight and change of appearance.
- 2) Test Result

Test liquid	PP solid		Patio T-20		Patio T-30		Patio T-40	
	Weight	Apper.*	Weight	Apper.	Weight	Apper.	Weight	Apper.
Soy Sauce	+ 0.1	○	+ 0.1	○	+ 0.1	○	+ 0.1	○
Sauce	0	○	0	○	0	○	0	○
Vinegar	+ 0.1	○	+ 0.1	○	+ 0.1	○	+ 0.1	○
Mayonnaise	0	○	0	○	0	○	0	○
Salad oil	+ 0.2	○	+ 0.2	○	+ 0.2	○	+ 0.2	○

\* Apper. (= appearance)

1) Unit of weight change shows wt%

2) ○ shows no change

## **PATIO SHEET POLLUTION DOCUMENTS**

### **1) Heat resistance**

<b>Patio T- 20</b>	<b>130℃</b>
<b>Patio T- 30</b>	<b>140℃</b>
<b>Patio T- 40</b>	<b>150℃</b>
<b>Patio T- 50</b>	<b>130℃</b>
<b>P/S/P</b>	<b>130℃</b>
<b>PS</b>	<b>130℃</b>

### **2) Combustion calorific value**

<b>Patio T- 20</b>	<b>8,800</b>
<b>Patio T- 30</b>	<b>7,700</b>
<b>Patio T-40</b>	<b>6,600</b>
<b>Patio T-50</b>	<b>5,500</b>
<b>P/S/P</b>	<b>9,800</b>
<b>PS</b>	<b>9.600</b>
<b>Wood</b>	<b>4,400</b>

### **3) Burning gas**

	<b>T-30</b>	<b>PS</b>	<b>PVC</b>	<b>PP</b>	<b>Wood</b>	<b>Paper</b>
<b>Carbon dioxide</b>	<b>170</b>	<b>315</b>	<b>66</b>	<b>285</b>	<b>241</b>	<b>175</b>
<b>Carbon monoxide</b>	<b>2</b>	<b>5</b>	<b>18</b>	<b>5</b>	<b>15</b>	<b>7</b>
<b>Ethane, Methane</b>	<b>6</b>	<b>2</b>	<b>1</b>	<b>10</b>	—	—
<b>Styrene</b>	—	<b>35</b>	—	—	—	—
<b>Hydrogen chloride</b>	—	—	<b>29</b>	—	—	—
<b>TTL</b>	<b>178</b>	<b>357</b>	<b>114</b>	<b>300</b>	<b>256</b>	<b>182</b>

### **4) Max light extinction coefficient, Minimum transmission(JIS D 1201) (Smoke quantity)**

	<b>Max. light extinction coefficient</b>	<b>Minimum transmission</b>
<b>Patio T-50</b>	<b>0.10 ~ 0.50</b>	<b>75 ~ 95 %</b>
<b>PP</b>	<b>1.30</b>	<b>55%</b>
<b>HIPS</b>	<b>1.51</b>	<b>45%</b>
<b>P/S/P</b>	<b>1.60</b>	<b>45%</b>