***** Hei-Cast 8160 *****

1.Description

Hei-Cast 8160 is a polyurethane resin with well-balanced overall physical properties specifically developed for vacuum casting application that offers the following characteristics.

(1) Compared with the vacuum casting materials so far available, Hei-Cast 8160 yields an improved elongation and is more difficult to break. Hei-Cast 8160 therefore approaches closer to the physical properties of ABS.
(2) Hei-Cast 8160 has been improved in its hardening property at low temperatures.It can therefore be demolded with the slightest fear of cracks or deformation.
(3) Tough resin layers with excellent heat and impact resistance can be obtained.
(4) Hei-Cast 8160 offers less damage against silicone mold and yields resin layers of even color.

2.Basic Properties

Item		Value	Remarks
Appearance	A Comp.	Not colored / Black / Beige	Polyols
	B Comp.	clear, pale yellow	Isocyanates
Color of Article		Milky white / Black / Beige	
Viscosity (mPa･s, 25°C)	A Comp.	800	Viscometer Type BM
	B Comp.	200	
Specific Gravity (25°C)	A Comp.	1.12	Standard Hydrometer
	B Comp.	1.20	
Mixing Ratio	A : B	100 : 200	Parts by weight
Pot Life	25°C	5 minutes and 30 seconds	Resin 100g
		5 minutes and 30 seconds	Resin 300g
	35°C	3 minutes and 40 seconds	Resin 100g
S. G. of Finished Article		1.23	JIS K-7112

3. Basic Physical Properties

Item		Value	Remarks
Hardness	Type D	83	JIS K-7215
Tensile Strength	MPa	67	JIS K-7113
Yield strength	MPa	67	
Tensile modulus	MPa	1850	
Elongation at break	%	15	
Elongation at yield	%	3	
Bending strength	MPa	80	JIS K-7171
Young's modulus in flexure	MPa	1800	
Impact strength	kJ/m^2	20	JIS K-7110 Izod V Notch
Shrinkage	%	0.3	Inhouse specification
Deflection temp.under load	°C	95	JIS K-7191(1.80 MPa)
		100	JIS K-7191(0.45 MPa)
Glass transition temperature	°C	115	TMA Method
Coefficient of thermal expansion	/°C	9×10^{-5}	JIS K-6911
Thermal conductivity	W/m･K	0.233	probe technique
Demold Time	Minute	25～60	Mold temp. : over 60 °C

Remarks: Curing condition : Mold temperature:60°C 60°C×60min.＋25°C×24hours.Physical properties listed above are typical values measured in our laboratory and not the values for specification. When using our product, it must be noted that physical properties of final product may differ depending on the shape of article and the molding condition.

4. Endurance test

※ Color difference (ΔE) is data for uncolored products

(1)Heat Resistance [Allow to stand in a thermostatic oven with 80℃ hot air circulation]

Item	UNIT	Blank	100 hrs		200 hrs		500 hrs	
			Value	Rate of change(%)	Value	Rate of change(%)	Value	Rate of change(%)
Hardness	Type D	83	84	＋1.2	83	0	83	0
Tensile Strength	MPa	67	70	＋4.5	69	＋3.0	72	＋7.5
Elongation at break	%	15	27	＋80	40	＋167	35	＋133
Bending strength	MPa	80	81	＋1.3	79	-1.3	86	＋7.5
Young's modulus in flexure	MPa	1800	1710	-5.0	1690	-6.1	1770	-1.7
Impact strength	kJ/m^2	20	22	＋10	20	0	19	-5.0
Deflection temp.under load (1.80MPa)	℃	95	109	＋15	109	＋15	115	＋21
Color difference	(ΔE)	-	1.8		3.9		9.7	

(2)Heat Resistance [Allow to stand in a thermostatic oven with 120℃ hot air circulation]

Item	UNIT	Blank	100 hrs		200 hrs		500 hrs	
			Value	Rate of change(%)	Value	Rate of change(%)	Value	Rate of change(%)
Hardness	Type D	83	83	0	83	0	84	＋1.2
Tensile Strength	MPa	67	67	0	66	-1.5	69	＋3.0
Elongation at break	%	15	57	＋280	55	＋267	67	＋347
Bending strength	MPa	80	71	-11	74	-7.5	79	-1.3
Young's modulus in flexure	MPa	1800	1570	-13	1700	-5.6	1760	-2.2
Impact strength	kJ/m^2	20	18	-10	18	-10	18	-10
Deflection temp.under load (1.80MPa)	℃	95	109	＋15	108	＋14	111	＋17
Color difference	(ΔE)	-	19.0		27.3		42.6	

(3) Heat-resistant water [80 ° C tap water immersion]

Item	UNIT	Blank	100 hrs		200 hrs		500 hrs	
			Value	Rate of change(%)	Value	Rate of change(%)	Value	Rate of change(%)
Hardness	Type D	83	83	0	83	0	83	0
Tensile Strength	MPa	67	51	-24	53	-21	50	-25
Elongation at break	%	15	51	＋240	33	＋120	60	＋300
Bending strength	MPa	80	56	-30	61	-24	63	-21
Young's modulus in flexure	MPa	1800	1400	-22	1480	-18	1640	-8.9

Impact strength	kJ/m^2	20	19	-5.0	18	-10	20	0
Deflection temp.under load (1.80MPa)	℃	95	78	-18	74	-22	74	-22
Color difference	(ΔE)	-	1.5		2.4		4.8	

(4)Oil resistance [80 ℃ engine oil immersion]

Item	UNIT	Blank	100 hrs		200 hrs		500 hrs	
			Value	Rate of change(%)	Value	Rate of change(%)	Value	Rate of change(%)
Hardness	Type D	83	85	＋2.4	85	＋2.4	85	＋2.4
Tensile Strength	MPa	67	75	＋12	75	＋12	76	＋13
Elongation at break	%	15	16	＋6.7	20	＋33	12	-20
Bending strength	MPa	80	80	0	85	＋6.3	83	＋3.8
Young's modulus in flexure	MPa	1800	1580	-12	1680	-6.7	1650	-8.3
Impact strength	kJ/m^2	20	20	0	20	0	21	＋5.0
Deflection temp.under load (1.80MPa)	℃	95	113	＋19	114	＋20	115	＋21
Color difference	(ΔE)	-	1.6		2.7		5.4	

(5)Weather resistance [xenon lamp type weather meter]

Item	Unit	Blank	500hrs		1000hrs	
			Value	Rate of change(%)	Value	Rate of change(%)
Hardness	Type D	83	85	+2.4	85	+2.4
Tensile Strength	MPa	67	71	+6.0	74	+10
Elongation at break	%	15	11	-27	10	-33
Bending strength	MPa	80	79	-1.3	78	-2.5
Young's modulus in flexure	MPa	1800	1700	-5.6	1630	-9.4
Impact strength	kJ/m^2	20	11	-45	10	-50
Deflection temp.under load (1.80MPa)	℃	95	94	-1.1	90	-5.3

NOTE) Testing machine:ATLAS Ci4000 Weatherometer
Test conditions: No water spray Irradiance: 42.00 w/㎡
Black Standards Temperature：63.0 ℃ Relative humidity ：50.0％

(6)Heat and humidity resistance [70℃ 95% RH constant humidity and constant temp. oven left]

Item	Unit	Blank	1 week later		2 weeks later		5 weeks later	
			Value	Rate of change(%)	Value	Rate of change(%)	Value	Rate of change(%)
Hardness	Type D	83	82	-1.2	83	0	82	-1.2
Tensile Strength	MPa	67	54	-19	55	-18	55	-18
Elongation at break	%	15	73	387	52	247	84	460
Bending strength	MPa	80	61	-24	63	-21	60	-25
Young's modulus in flexure	MPa	1800	1490	-17	1580	-12	1510	-16
Impact strength	kJ/m^2	20	19	-5.0	17	-15	20	0
Deflection temp.under load (1.80MPa)	℃	95	83	-13	83	-13	81	-15
Color difference	(ΔE)	-	2.6		3.6		6.7	

Item	Unit	10 weeks later		15 weeks later		20 weeks later	
		Value	Rate of change(%)	Value	Rate of change(%)	Value	Rate of change(%)
Hardness	Type D	83	0	82	-1.2	82	-1.2
Tensile Strength	MPa	53	-21	53	-21	53	-21
Elongation at break	%	58	287	71	373	92	513
Bending strength	MPa	60	-25	60	-25	60	-25
Young's modulus in flexure	MPa	1510	-16	1610	-11	1590	-12
Impact strength	kJ/m^2	19	-5.0	18	-10	19	-5.0
Deflection temp.under load (1.80MPa)	℃	74	-22	69	-27	71	-25
Color difference	(ΔE)	12.6		13.1		24.8	

5.Chemical resistance

Chemicals	Weight change (%)	Loss of gloss	Discolo-ration	Crack	Warpage	Swelling	Degradation	Dissolution
Distilled water	0.14	○	○	○	○	○	○	○
10%Sulfuric acid	0.13	○	○	○	○	○	○	○
10%Hydrochloric Acid	0.11	○	○	○	○	○	○	○
10%Sodium Hydroxide	0.12	○	○	○	○	○	○	○
10%Ammonia Water	0.19	○	○	○	○	○	○	○
Acetone	15	○	○	○	○	△	○	○
Toluene	0.02	○	○	○	○	○	○	○
Methylene chloride*1	10	○	○	○	○	△	○	○
Trichloroethane	0	○	○	○	○	○	○	○

Ethyl acetate	6.7	○	○	○	○	△	○	○
Ethanol	0.09	○	○	○	○	○	○	○
Gasoline	0.02	○	○	○	○	○	○	○
Benzine	0.01	○	○	○	○	○	○	○

Tested according to JIS K-6911. Changes after 24 hrs. immersion in each chemicals were observed. Those marked with *1 mark were immersed for 60 min..
○:Good, △:Slightly No good, ×: Bad

6. Physical properties vs. Temperature

Temperature (℃)	Bending strength (MPa)	Young's modulus in flexure (MPa)	Impact strength (kJ/m^2)
−20	98	1940	21
0	82	1850	21
20	80	1810	20
40	60	1700	21
60	42	1510	22
80	16	910	24

※For the impact strength, the specimens were adjusted to each temperature in a thermostatic bath and tested immediately after removal.

7. electrical properties

Item	Unit or Terms		Value
Surface resistivity	Ω Applied voltage 500V		4.4×10^{16}
Volume resistivity	Ω・cm Applied voltage 500V		2.2×10^{16}
Breakdown voltage	KV/mm		23
Permittivity ε	25℃	60Hz	4.1
		1MHz	3.7
	80℃	60Hz	4.5
		1MHz	4.0
dielectric loss tangent tanδ	25℃	60Hz	0.013
		1MHz	0.035
	80℃	60Hz	0.034
		1MHz	0.032

8. Softer formulation through addition of 8400 C to 8160

It is possible to provide some flexibility to HC 8160 cast material through incorporation of HC 8400 C to 8160. Following table is a guide to select suitable mixing ratio for your desired hardness, Young's modulus in flexure, etc.

Ite m		Value					
Mixing ratio	A:C:B	100:0:200	100:10:200	100:20:200	100:30:200	100:40:200	100:50:200
Hardness	Type D	83	82	80	79	77	75
Tensile strength	MPa	67	60	52	46	41	36
Elongation at break	%	15	21	29	34	55	62
Bending strength	MPa	80	72	66	60	53	49

Young's modulus in flexure	MPa	1800	1700	1550	1450	1300	1150
Izod Impact strength	kJ/m^2	20	16	14	14	13	11
Deflection temp.under load	°C	95	91	90	90	90	90

Remarks) Curing condition: Mold temperature, 60^{0}C 60^{0}C x 60 min. + 25^{0}C x 24 hrs.
Physical properties listed above are typical values measured in our laboratory and not the values for specification. When using our product, it must be noted that physical properties of final product may differ depending on the contour of article and the molding condition.

How to add HC 8400C

(1) Add necessary amount of 8400 C to A-component of 8160 and mix to make first a polyol mixture. In this case, please note that 8160 A-component and 8400 C will separate from each other if mixture is left for some time. Such separated mixture won't give prescribed physical properties even if it has been reacted with B-component.

(2) Add necessary amount of 8160 B-component and prepare article by vacuum casting.

9. Softer formulation through addition of 8434 C to 8160

It is possible to provide some flexibility to HC 8160 cast material through incorporation of HC 8434 C to 8160. Following table is a guide to select suitable mixing ratio for your desired hardness, Young's modulus in flexure, etc.

Item		Value					
Mixing ratio	A:C:B	100:0:200	100:10:200	100:20:200	100:30:200	100:40:200	100:50:200
Hardness	Type D	83	82	80	79	77	76
Tensile strength	MPa	67	61	52	47	43	38
Elongation at break	%	15	16	25	48	52	60
Bending strength	MPa	80	70	68	61	57	50
Young's modulus in flexure	MPa	1800	1700	1600	1450	1350	1200
Izod Impact strength	kJ/m^2	20	16	15	14	13	13
Deflection temp. under load	°C	95	92	92	91	91	90

Remarks) Curing condition: Mold temperature, 60^{0}C 60^{0}C x 60 min. + 25^{0}C x 24 hrs.
Physical properties listed above are typical values measured in our laboratory and not the values for specification. When using our product, it must be noted that physical properties of final product may differ depending on the contour of article and the molding condition.

10. Processing guide for vacuum casting

(1) Shaking

Before using,warm up A component to 40～50°C and shake well 20～30 times..

(2) Pre-degassing

Degas both A and B component in a degassing chamber for about 5 minutes. Degas material as much as you need. We recommend to degas the material which has been pre-heated to temperature of 40～50°C.

(3) Temperature of resin

Keep temperature of 40～45°C for both A and B component during casting. The higher liquid temperature goes up, the shorter the pot life becomes. Conversely, the pot life gets longer in case of lower liquid temperature. It may cause insufficient mixing and poor curing in case of extremely low temperatures.

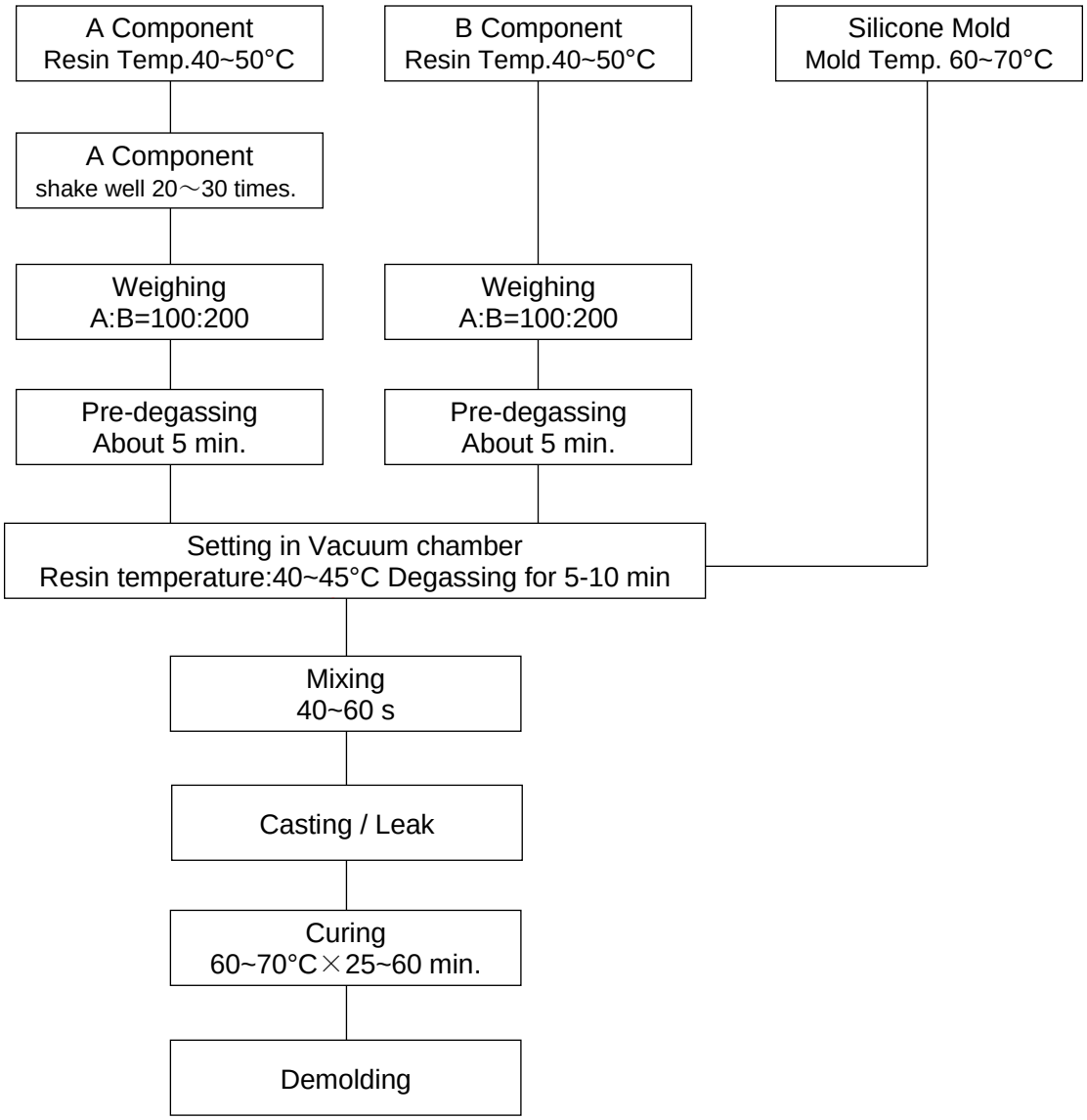
(4) Mold temperature

Keep the temperature of silicone mold at 60~70°C. It may cause poor curing and deterioration of the physical properties in case of lower mold temperature. Mold temperature should be controlled precisely as it affects the dimensional accuracy of the finished article.

(5) Casting
Containers should be set in such a way that A component is added into B component. Apply vacuum in the chamber and degas B component for 5~10 minutes while it is stirred from time to time. Add A component into B component and stir for 40~60 seconds and then cast the mixture into the silicone mold immediately.

(6) Curing condition
Place the filled mold in thermostatic oven of 60~70°C for 25 to 60 minutes and demold the article. Conduct post curing at 70~80°C for 2-3 hours depending on the requirements.

11. Flow chart of vacuum casting



12. Precautions in Handling

(1) As both A and B components are sensitive to water, avoid not only the mixture of water but also the prolonged contact with moisture. Close containers tightly after use.

(2) The mixture of water into A component may lead to generation of much air bubbles in the cured product. If this is the case, it is recommended to heat A component to 100°C and degas it under vacuum for about 30 minutes.

(3) B component may react with moisture to become turbid or to cure into a solid material. Do

not use the material when it has lost the transparency or it has shown any hardening so as not to cause deterioration of physical properties.

(4) B component in part or in whole may freeze when it is stored for longer period of time at temperatures below 5°C. Frozen material can be used after melting. Warm up the container to 60 ~70°C for 1~2 hours and use the material after stirring it well.

(5) B component is prone to deteriorate by the prolonged heating at temperatures over 50°C and the container can be inflated by the inner pressure increase.

(6) When B component is stored in frozen state, it deteriorates more quickly on the life of material than liquid material. It is recommended to melt completely and store at 20~25°C.

13. Precautions in Safety and Hygiene

(1) B component includes more than 1% of 4,4'-Diphenylmethane diisocyanate. Install local exhaust ventilation system in a workplace to secure good ventilation of the air.

(2) Take care that hands or skin are not coming in direct contact with raw materials. In case of contact, wash with soap and water immediately. It may irritate hands or skin if they are left in contact with raw materials for longer period of time.

(3) If raw materials get into eyes, rinse with flowing water for 15 minutes and see a doctor.

(4) Install ducts for vacuum pump to ensure that air is exhausted to the outside of the workplace.

14. Dangerous Materials Classification according to the Fire Services Act

A Component: Fourth Petroleum Group, Dangerous Materials Fourth Group.

B Component: Fourth Petroleum Group, Dangerous Materials Fourth Group.

15. Packaging

A Component: 1 kg in bottle.

B Component: 1 kg in bottle.

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