

“Toyolac”
Scratch Resistant Grade
(Impact Strength improved version)

910 X15 (Transparent)
(Trial product)

KK-S1 (Non-transparent)
(Trial product)

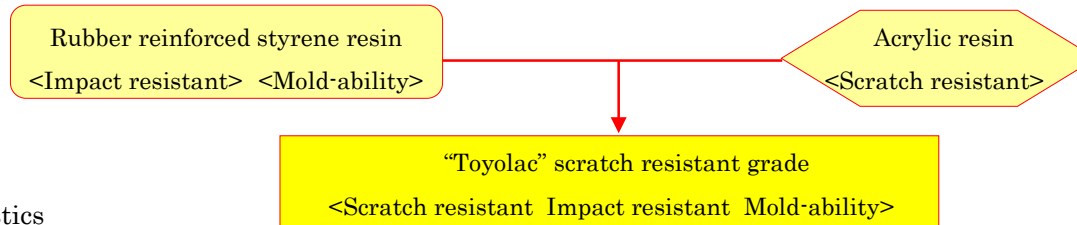
910 X01 (Standard) (Transparent)

I. Introduction “Toyolac” Scratch Resistant Grade (Impact Strength improved version)

◆Development Concept

MABS resin products used to face surface scratch problem during products handling or cloth wipe cleaning by consumers. In order to improve this aesthetic appearance, we have successfully developed “Toyolac” Scratch Resistant Grade. In comparison to other scratch resistant resins such as PMMA resin, “Toyolac” Scratch Resistant Grade shows improved impact strength and mold-ability. Thus, excellent improvement is expected in those exterior applications which require surface scratch resistant property.

“Toyolac” Scratch Resistant Grade possesses characteristics of both rubber reinforced styrene resin and acrylic resin.



◆Special Characteristics

910 X01 is standard of “Toyolac” Scratch Resistant Grades with excellent transparency. HT-15 and KK-S1 are new version improved mechanical properties.

【HT-15 (Transparent)】

This is a grade with excellent transparency, special mechanical properties and molding characteristics. In comparison to other resins such as MS resin with excellent scratch resistant property and PMMA resin, this grade possesses high impact strength. Moreover, due to its excellent transparency, design inclination is expected when painting is done at the back of molded part.

【KK-S1 (Non-transparent)】

This is a grade with excellent surface smoothness and high impact strength. Therefore, this grade shows special characteristic in which scratches are not easily happened caused by careless contact during product handling. This grade is suitable for coloring application as per common ABS resin.

Item	910-X-15	KK-S1	910 X01	920 555	Acrylic Resin/ABS alloy	General ABS
Scratch Resistant	Good	Best	Good	Fair	Poor ~ Good	Poor
Transparency	Best	Non-transparent	Best	Good	Non-transparent	Non-transparent
Surface Smoothness	Fair	Best	Fair	Fair	Fair	Fair
Impact Strength	Best	Best	Good	Best	Poor ~ Good	Best
Injection Mold-ability	Best	Best	Best	Good	Fair	Good

◆Examples of application

Button parts of Home appliances, Machine and Hand phone, Bezel parts of Plasma TV, PDP and CRT, Panel parts of Air-conditioner and etc.

II. Material Property “Toyolac” Scratch Resistant Grade (Impact Strength improved version)

Property	Test Method	Test Condition	Unit	“Toyolac” Scratch Resistant Grade			“Toyolac” General Transparent	Competitor Scratch Resistant	
				Transparent	Non- transparent	Transparent	Transparent	Non-transparent	
				910 X15	KK-S1	910 X01	920 555	Acrylic Resin/ ABS alloy	
General Properties	Tensile Strength	ISO 527	23°C / 50%RH	MPa	55	48	57	54	50 ~ 60
	Tensile Elongation	ISO 527	23°C / 50%RH	%	14	7	13	17	8 ~ 30
	Flexural Strength	ISO 178	23°C / 50%RH	MPa	80	70	85	77	78 ~ 95
	Flexural Modulus	ISO 178	23°C / 50%RH	MPa	2440	2320	2630	2260	2400 ~ 2900
	Charpy Impact Strength	ISO 179	23°C / 50%RH	kJ/m ²	8.5	16	5.9	9.4	3 ~ 14
	Temp. of Deflection Under Load	ISO 75	1.8MPa	°C	78	80	78	77	75 ~ 83
	Melt Flow Rate	ISO 1133	220°C / 98N	g/10min	26	42	28	25	9 ~ 20
Optical Properties (3mmt plate)	Light Transmission	ISO 13468	23°C / 50%RH	%	87	Non- transparent	87	88	-
	Haze	ISO 14782	23°C / 50%RH	%	2.4		2.6	2.3	-
Others	Density	ISO 1183	Underwater substitution method (23°C)	kg/m ³	1,100	1,050	1,100	1,090	1,080 ~ 1,150
	Pellet weight loss upon heating	Toray Method	230°C x 3 h	wt%	0.58	-	0.60	0.57	0.8 ~ 1.4

Note; These values are typical data for this product under specific test conditions and not intended for use as limiting specifications.

III. Scratch Resistant Property “Toyolac” Scratch Resistant Grade (Impact Strength improved version)

Property	Test Method	Test Condition	Unit	“Toyolac” Scratch Resistant Grade			“Toyolac” General Transparent	Competitor Scratch Resistant	General ABS	
				Transparent	Non-transparent	Transparent	Transparent	Non-transparent	Non-transparent	
				910 X15	KK-S1	910 X01	920 555	Acrylic Resin / ABS alloy	ABS	
Scratch Resistant Properties	Pencil Hardness	JIS K5400 ISO 15184	0.75 kgf	-	F ~ H	HB	H	HB	HB ~ H	B ~ HB
	Abrasion Resistance Test	Toray Method	(Refer below figure)	-	III	IV	III	II	I ~ IV	I
	Scratch Test (by finger nail)	Finger-nail mark (Visible level)		-	Fair	Good	Fair	Poor	Poor ~ Good	Poor
		Slipping character (Touch feeling)		-	Poor	Good	Poor	Poor	Poor ~ Good	Poor
Static / Dynamic Coefficient of friction (2.5mmt plate)	μs	Toray Method	μk speed : 0.1mm/s	-	0.33	0.24	0.33	0.33	-	-
	μk	Toray Method	μk speed : 0.1mm/s	-	0.30	0.22	0.31	0.29	-	-
			μk speed : 5.0mm/s	-	0.34	0.23	0.36	0.32	-	-

* The hardness of finger nail is equivalent to pencil hardness of H~4H.

Scratch Resistant Property (Abrasion Resistance Test)

The scratch resistant property judgment is based on observation done on surface condition (scratch) of black colored sample after abrasion resistance test. The 5 levels of judgment standard (number of scratch) is as below.

Number of scratch 0 ~ 3 : V 20 ~ 29 : II
 4 ~ 10 : IV >30 : I (surface glossiness disappears)
 11 ~ 19 : III

Test Method

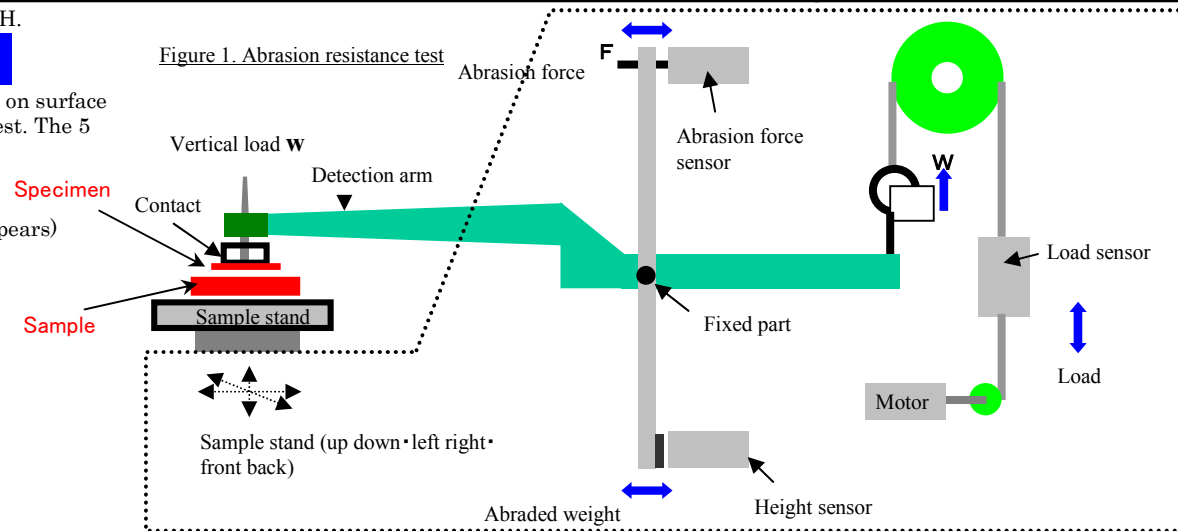
Testing machine : Kyowa Kaimen Chemical company

Automatic friction and abrasion tester DFPM-SS

Test load : 500g

Specimen : PureLeaf M-120

Frequency : 20 times



IV. Mold Shrinkage Rate “Toyolac” Scratch Resistant Grade (Impact Strength improved version)

Molding Temperature	Injection Pressure	Measuring Position	Grade Name	“Toyolac” Scratch Resistant Grade			“Toyolac” General Transparent
				910 X15	KK-S1	910 X01	920 555
230°C	Min. hold pressure + 3%	Mold Flow Direction	A-A	0.59%	0.60%	0.57%	0.61%
		Transverse Direction	B-B	0.51%	0.53%	0.50%	0.53%
			C-C	0.60%	0.61%	0.58%	0.63%
	Min. hold pressure + 6%	Mold Flow Direction	A-A	0.55%	0.54%	0.54%	0.56%
		Transverse Direction	B-B	0.48%	0.48%	0.48%	0.48%
			C-C	0.56%	0.54%	0.55%	0.57%

<Molding Condition>

Molding Machine : NISSEI PS60E-12A

Molding Temperature : 230°C

Mold Temperature : 60°C

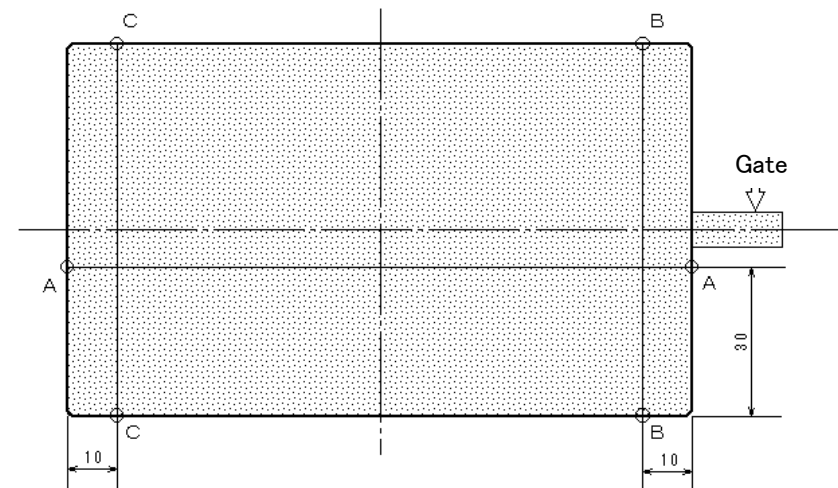
Injection Pressure : Resin filling minimum pressure, +3% and +6%.

* Filling is done with controlled pressure

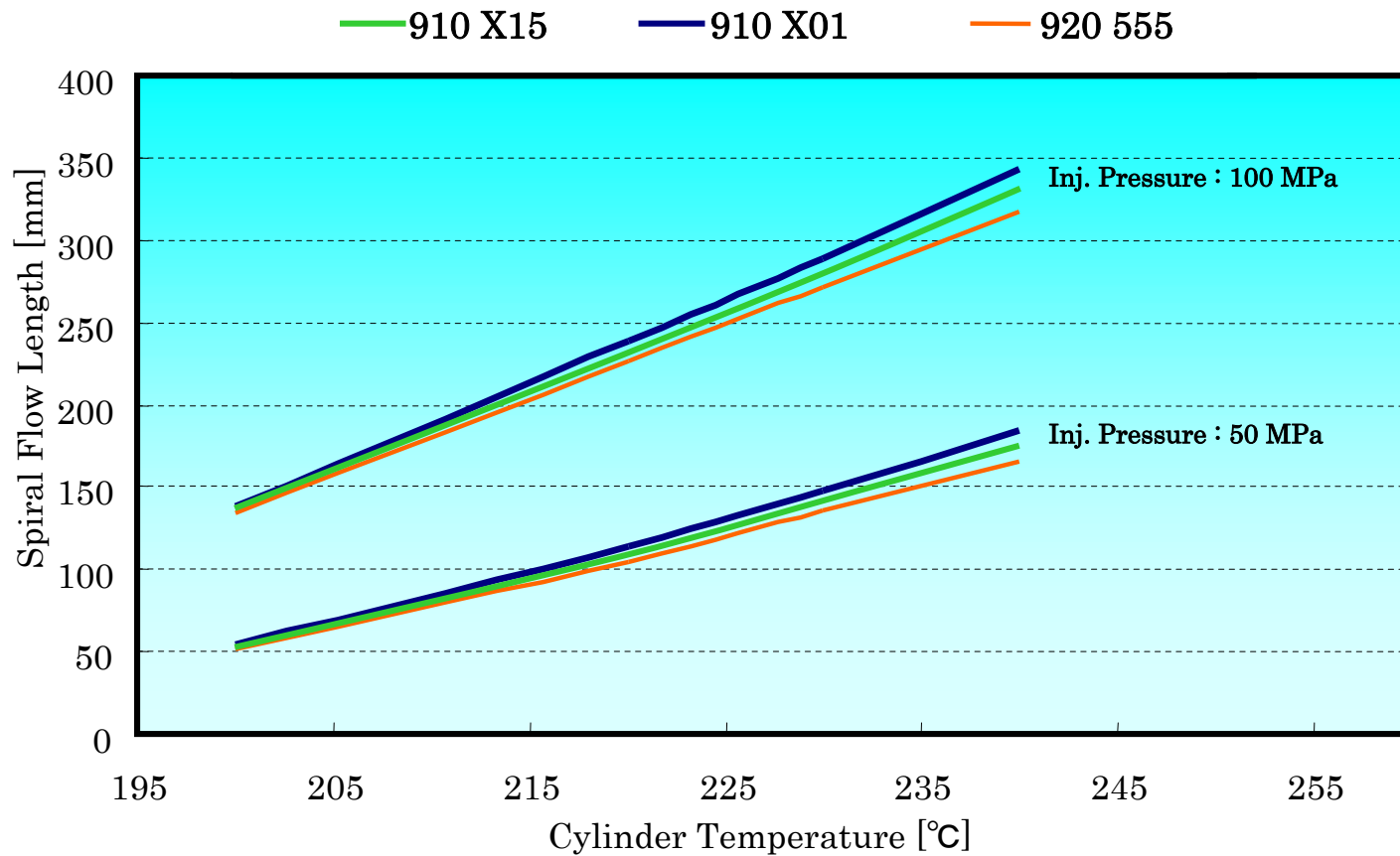
Mold Dimension : 127 x 76 x 3 mmt

<Dimension Measurement>

Dimension is measured after 24 hours conditioned at 23°C、50%RH.



V. Spiral Flow Length “Toyolac” Scratch Resistant Grade (Impact Strength improved version)



Spiral Flow Length of “Toyolac” Scratch Resistant Transparent Grade

<Molding Condition>

Injection Molding Machine : NISSEI PS60E - 12A

Mold Temperature : 60°C

Injection Pressure : Filling is carried out with controlled pressure at 50MPa, 100MPa.

Mold Dimension : 10w x 2mmt Spiral

VI. Molding Condition “Toyolac” Scratch Resistant Grade (Impact Strength improved version)

<Setting>	<Item>		<Condition>
Material Pre-drying *1	Temperature / Duration (Hot air ventilated oven)		80°C / 3 ~ 5 hr
			90°C / 2 ~ 3 hr
Molding Temperature *2	Cylinder Temperature	Rear	195~235°C
		Center ~ Front	200 ~ 260°C
	Nozzle Temperature	Cold Runner	195 ~ 260°C
		Hot Runner	230 ~ 260°C
Mold Temperature *3	General Injection Molding	Core / Cavity	40 ~ 80°C
	Runnerless Molding	Manifold Temperature	230 ~ 260°C
		Band Heater Temperature	230 ~ 260°C
		Hot Runner Nozzle Temperature	230 ~ 260°C
		Core / Cavity	40 ~ 80°C

*1 Depending on the molded part shape, pellet pre-drying might be also necessary even with vented type injection molding machine.

*2 Molded part becomes yellowish when molding at high temperature, long molding cycle and etc. as a result of material retention inside the cylinder.

*3 The influence to molded part appearance is significant, thus precaution is necessary when aesthetic appearance is desired.

Molded part appearance is improved by applying higher mold temperature, but too high mold temperature will cause long cycle time and possible to induce sink mark defect.

VII. Attention

We accept no responsibility for results obtained by the application of this information or the safety or suitability of our products, either alone or in combination with other products.

Users are advised to make their own tests to determine the safety and suitability of each such product or product combination for their own purpose.

Caution!!

Do not use in medical applications involving permanent implantation in the human body.

Refer to the Material Safety Data Sheet for this product before use.

We believe this information to be reliable and the best currently available on the subject.

Revisions will be made as additional information and experience are obtained.

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