

Application Guide for Home Electric Appliances



Washing machine
Microwave Oven
Air-Conditioner
Refrigerator

Application Development CENTER
332-2, Kochun-dong Euiwang City
Kyunggi-do Korea
TEL: 82-31-428-3327
FAX: 82-31-458-6661

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- **Characteristics of the Resin for Air-conditioner**

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- **Characteristics of the Resin for Refrigerator**

1. Characteristics of Home Electrics Appliances

Resist Deformation to the in Everyday Use of Long Time

High Strength & Modulus

Resist Deformation Under Long Time Load.

Creep Resistance

Be Resistant To The Daily Life Chemicals.

Chemical Resistance

Withstand High Temperature.

Heat Resistance

Be Easily Released From Molds.

Mold Releasing Property

Withstand UV Resistance

UV Resistance

Have Tight Tolerance.

Dimensional Stability

Be Easy To Process.

Good Melt Flow

Be Cost-effective.

Cost-effectiveness

2. Application Guide for Items

1) Washing machine

● Automatic Type







Part name	Material	Grade	Characteristic
Top-Cover	ABS	HG-0760 SW	<ul style="list-style-type: none"> •Heat Temperature resistance •Good UV Resistance •Easy moulding
Lid - TC	SR-ABS	SR-0320	<ul style="list-style-type: none"> •High Heat Temperature resistance •Good UV Resistance •Easy moulding
Cover TC	T-ABS	CT-0510	<ul style="list-style-type: none"> •Excellent transparency •Good aesthetic •Good coloring property
Control Panel	T-ABS	CT-0510	<ul style="list-style-type: none"> •Excellent transparency •Good surface •Good coloring property
	FR-ABS	VH-0810	<ul style="list-style-type: none"> •Flame resistance •High thermal resistance •Easy moulding

1) Washing machine

● Drum Type



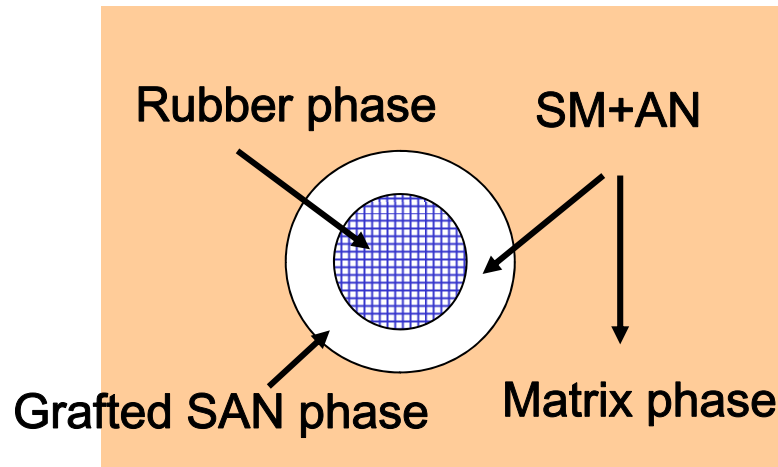
<i>Part name</i>	<i>material</i>	<i>Grade</i>	<i>Characteristic</i>
Top Cover 	<i>PC / ABS</i>	<i>HP-1001</i>	<ul style="list-style-type: none"> •<i>Good Chemical Resistance</i> •<i>good dimensional stability</i>
	<i>SR – ABS</i>	<i>SR-0320 K</i>	<ul style="list-style-type: none"> •<i>High Heat Temperature resistance</i> •<i>Good UV Resistance</i> •<i>Easy moulding</i>
Control panel 	<i>T – ABS</i>	<i>CT-0510</i>	<ul style="list-style-type: none"> •<i>Excellent transparency</i> •<i>Good surface</i> •<i>Free coloring</i>
	<i>ABS</i>	<i>HG-0760SW</i>	<ul style="list-style-type: none"> •<i>Heat Temperature resistance</i> •<i>Good UV Resistance</i> •<i>Easy moulding</i>
Door  Door cover 	<i>PC</i>	<i>PC-1025YL</i>	<ul style="list-style-type: none"> •<i>Middle viscosity PC</i>
	<i>Metal Plating ABS</i>	<i>MP-0160R</i>	<ul style="list-style-type: none"> •<i>High impact resistance</i> •<i>High impact strength</i>
	<i>ABS</i>	<i>HG-0760SW</i>	<ul style="list-style-type: none"> •<i>Heat Temperature resistance</i> •<i>Good UV Resistance</i> •<i>Easy moulding</i>

1) Washing machine

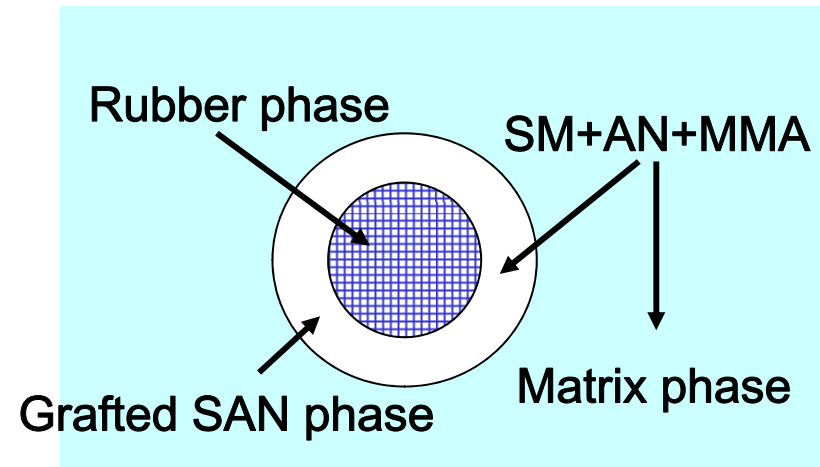
- *Transparent - ABS*

- ▶ **Basic concept of Transparent ABS**

General type of ABS



Transparent ABS



▶ **Characteristics of Transparent ABS**

Excellent Mechanical Properties

**High Impact Strength
as General ABS**

Transparency

Transparency near the SAN,GPPS

Good Chemical Resistance

**Good Chemical Properties
Similar to General ABS**

► Processability of Transparent ABS

Predrying

Dehumidified dryer condition
Temperature : 75 ~80 °C
Time : 2~3 hrs

Convection oven dryer condition
Temperature : 75~80 °C
Time : 3 ~4 hrs

Molding Conditions

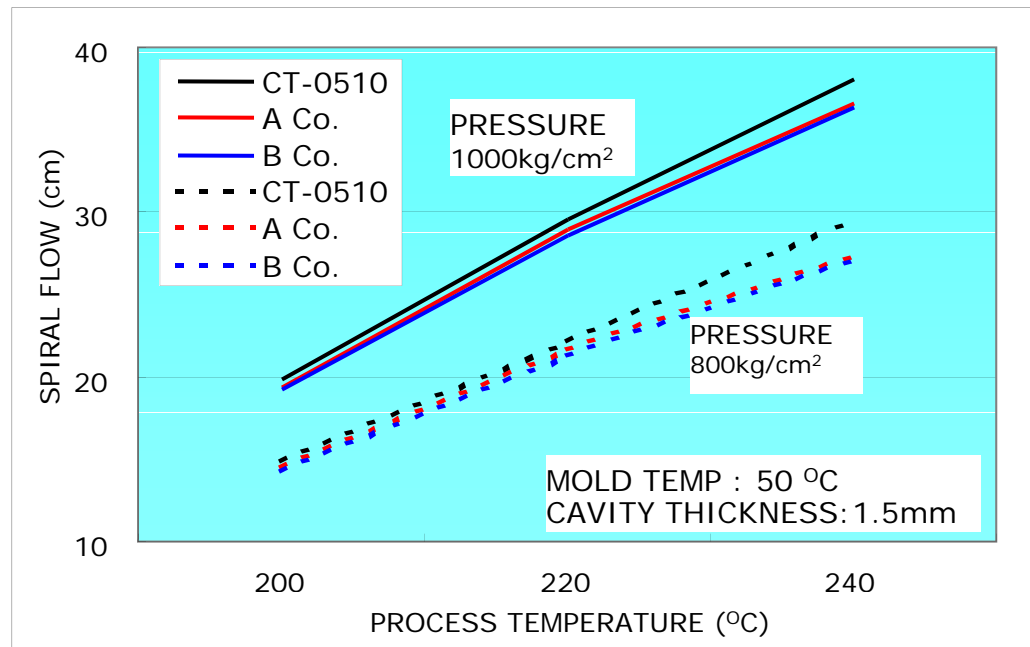
Item	Condition
Possible processing temperature	190°C ~ 230°C
Mold temperature	40°C ~ 80°C
Screw RPM	60 ~ 90
Injection pressure	700 ~ 1100 kgf/cm ²
Back pressure	10 ~ 20 kgf/cm ²

► Processability of Transparent ABS

Processability

Starex Transparent ABS has similar processability to general ABS

Comparison of Spiral Flow



▶ **Processability of Transparent ABS**

Recycle

- ✓ Starex Transparent ABS is recycle available less than 20 wt.%.
- ✓ Attention must be paid to contamination as recycling transparent ABS
- ✓ Do not mix with the other company's transparent ABS because of a falling-off in transparency.

Coloring

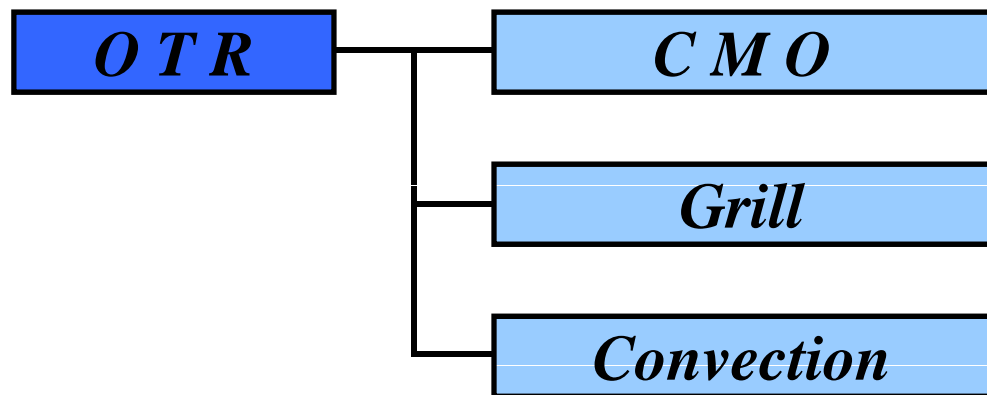
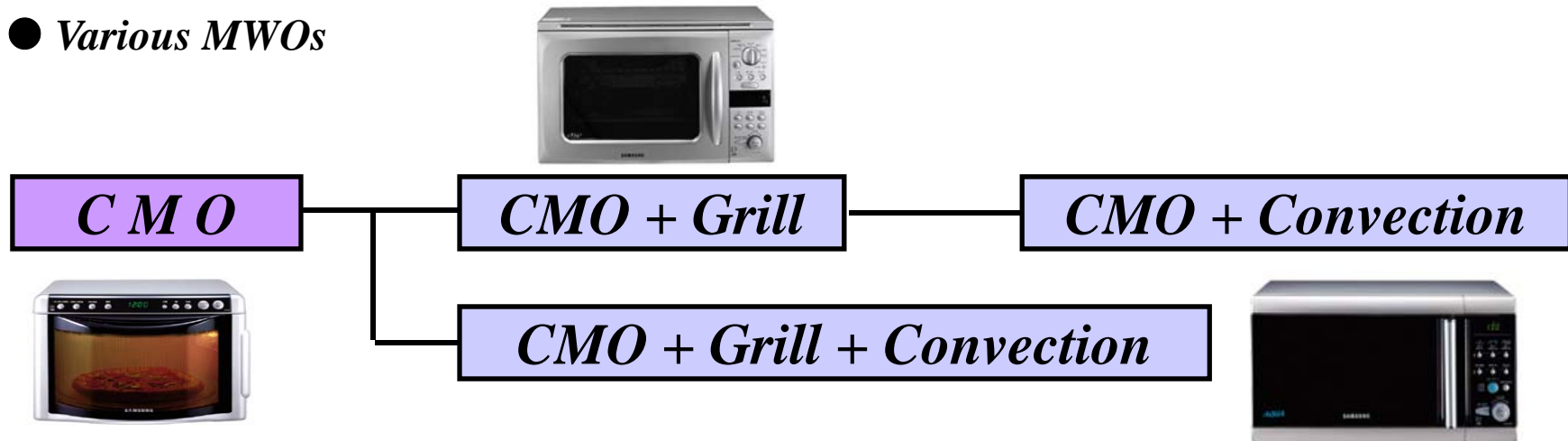
- ✓ Starex Transparent ABS can be matched to assorted colors.
- ✓ Asking for Coloring , please refer the standard color specimen.

Secondary Process

- ✓ Starex Transparent ABS can be processed after molding such as hot Stamping silk print, adhesion, painting, plating and so on.

2) Microwave Oven

● Various MWOs



● *CMO and Grill Type*



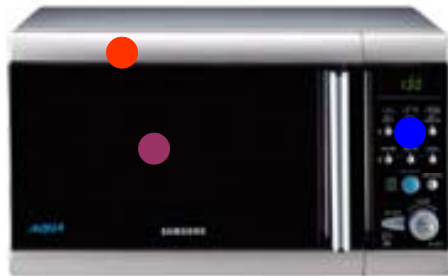
◆ *CMO*



◆ *Grill*

<i>Part name</i>	<i>material</i>	<i>Grade</i>	<i>Characteristic</i>
<i>Door – A</i> ●	<i>ABS</i>	<i>HG-0760SR</i>	<ul style="list-style-type: none"> •<i>High gloss surface</i> •<i>excellent chemical resistance</i> •<i>Heat Resistance (HDT : 90 °)</i>
<i>Control Panel</i> ●	<i>ABS</i>	<i>HG-0760SR</i>	<ul style="list-style-type: none"> •<i>High gloss surface</i> •<i>excellent chemical resistance</i> •<i>Heat Resistance (HDT : 90 °)</i>
	<i>FR-ABS</i>	<i>VE-0812 (1.5 V-0)</i>	<ul style="list-style-type: none"> •<i>Excellent heat resistance</i> •<i>Good weatherability</i>
		<i>VH-0800 (1.5 V-0)</i>	<ul style="list-style-type: none"> •<i>Excellent flow</i>
<i>Door-Screen</i> ●	<i>SAN</i>	<i>CR-5381</i>	<ul style="list-style-type: none"> •<i>High rigidity</i> •<i>Heat resistance</i> •<i>Chemical resistance</i>

● *OTR and Convection Type*



◆ *Convection*



◆ *OTR*

<i>Part name</i>	<i>material</i>	<i>Grade</i>	<i>Characteristic</i>
<i>Door - A</i> ●	<i>PC</i>	<i>PC-1023</i>	<ul style="list-style-type: none"> •<i>Low Viscosity</i> •<i>High Impact</i> •<i>High Flow</i> •<i>Molding For Thin Wall</i> •<i>HDT : 131 ° C</i>
<i>Control Panel</i> ●	<i>PC</i>	<i>PC-1023</i>	<ul style="list-style-type: none"> •<i>Low Viscosity</i> •<i>High Impact</i> •<i>High Flow</i> •<i>Molding For Thin Wall</i> •<i>HDT : 131 °</i>
<i>Door-Screen</i> ●	<i>SAN</i>	<i>CR-5381</i>	<ul style="list-style-type: none"> •<i>High rigidity</i> •<i>Heat resistance</i> •<i>Chemical resistance</i>

● Processing Guide

Predrying

Dehumidified dryer condition
Temperature : 120 °C
Time : 4~5 hrs

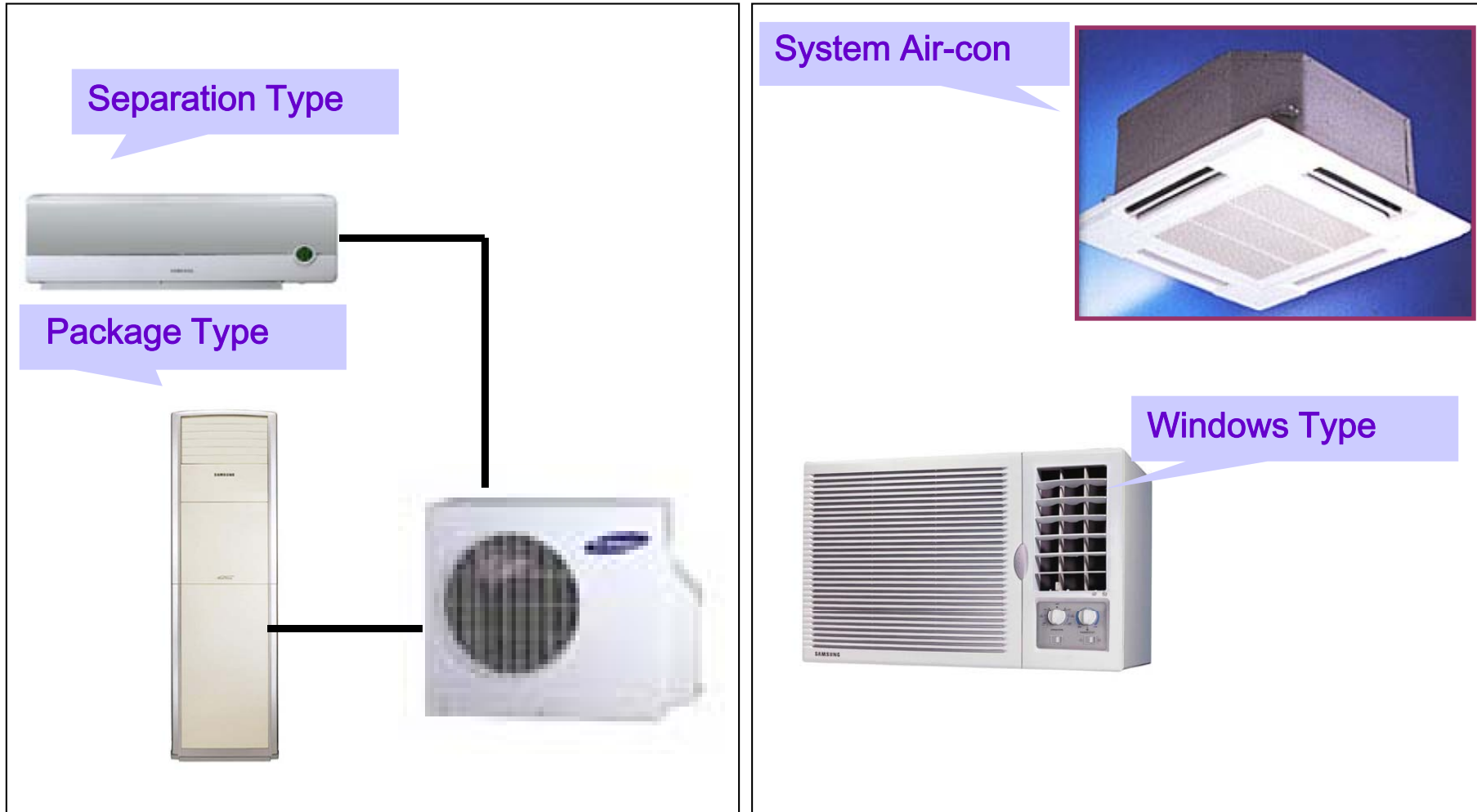
Convection oven dryer condition
Temperature : 120 °C
Time : 4~5 hrs

Molding Conditions

<i>ITEM</i>	<i>VALUE</i>
<i>Cylinder Temp.</i>	<i>250 ~ 280 ° C</i>
<i>Nozzle Temp.</i>	<i>285 ~ 305 ° C</i>
<i>Resin Melt Temp.</i>	<i>285 ~ 310 ° C</i>
<i>Mold Temp.</i>	<i>90 ~ 130 ° C</i>
<i>Injection Pressure</i>	<i>600~1,100 kg/ cm²</i>
<i>Back Pressure</i>	<i>0~30 kg/ cm²</i>
<i>Injection Velocity</i>	<i>40~80 %</i>

3) Air-Conditioner

● Type of Air-conditioner

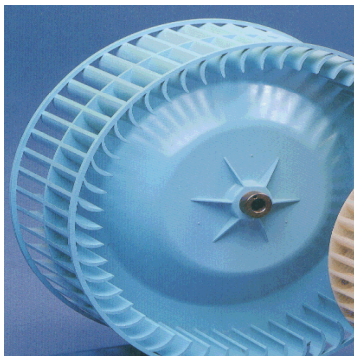


● Separation Type (Indoor Unit)



<i>Part name</i>	<i>Material</i>	<i>Grade</i>	<i>Characteristics</i>
<i>Guide filter</i> ●	<i>ABS</i>	<i>HF-0660I</i>	<ul style="list-style-type: none"> • <i>High Melt Flow Index (3.8 at 200 °C/5Kg)</i> • <i>High Impact Strength (19 at 1/4" 23 °C)</i> • <i>Filter Insert Moulding</i>
<i>Front panel</i> ●	<i>ABS</i>	<i>HF-0660I</i>	• <i>Same as above</i>
	<i>HIPS</i>	<i>HG-1760SF</i>	<ul style="list-style-type: none"> • <i>High Gloss(Good Appearance) (Gloss 96)</i> • <i>Good Processability</i>
<i>Control panel</i> ●	<i>FR-ABS</i>	<i>VH-0815(V0)</i>	<ul style="list-style-type: none"> • <i>Flame Retardant (UL 94 V-0)</i> • <i>High Thermal Resistance</i>
<i>Cross Fan</i> ●	<i>SAN/GF</i>	<i>GR-5020F</i>	<ul style="list-style-type: none"> • <i>Excellent Creep Resistance</i> • <i>Superior Heat Deflection Tem. With Good Melt Flow</i> • <i>Easy moulding</i>
<i>Back panel</i>	<i>HIPS</i>	<i>HR-1360</i>	<ul style="list-style-type: none"> • <i>Heat Resistance</i> • <i>High Impact Strength</i>

● **Package Type (Indoor Unit)**



<i>Part name</i>	<i>Material</i>	<i>Grade</i>	<i>Characteristic</i>
<i>Inlet Grill Front</i>	<i>ABS</i>	<i>HF-0660I</i>	• <i>Same as Above</i>
		<i>HG-0760</i>	• <i>High Gloss (Good Appearance)</i> • <i>Excellent UV Stability (ΔE<2)</i>
<i>Panel Outlet</i>	<i>HIPS</i>	<i>HG-1760SF</i>	• <i>High Gloss(Good Appearance)</i> (Gloss 96)
<i>Blade H, V</i>			• <i>Good Processability</i>
<i>COVER-TOP</i>	<i>HIPS</i>	<i>HR-1360</i>	• <i>Heat Resistance</i> • <i>High Impact Strength</i>
<i>Control Panel</i>	<i>FR-ABS</i>	<i>VH-0815</i>	• <i>Flame Retardant (UL 94 V-0)</i> • <i>High Thermal Resistance</i>
<i>Blower Fan</i>	<i>SAN/GF</i>	<i>GR-5020F</i>	• <i>Same as above</i>
	<i>ABS/GF</i>	<i>GR-4020</i>	• <i>G/F 20%, high impact</i> • <i>high strength</i>

● **Window Type (Indoor Unit)**



<i>Part name</i>	<i>Material</i>	<i>Grade</i>	<i>Characteristic</i>
<i>Guide filter</i>	<i>ABS</i>	<i>HF-0660I</i>	<ul style="list-style-type: none"> • <i>High Melt Flow Index</i> • <i>High Impact Strength</i>
<i>Front panel</i>	<i>ABS</i>	<i>HF-0660I</i>	• <i>Same as above</i>
<i>Blade</i>	<i>HIPS</i>	<i>HG-1760SF</i>	<ul style="list-style-type: none"> • <i>High Gloss(Good Appearance) (Gloss 96)</i> • <i>Good Processability</i>
<i>Control panel</i>	<i>FR-ABS</i>	<i>VH-0815(V0)</i>	<ul style="list-style-type: none"> • <i>Flame Retardant (UL 94 V-0)</i> • <i>High Thermal Resistance</i>
<i>Blower Fan</i>	<i>SAN/GF</i> <i>ABS/GF</i>	<i>GR-5020F</i> <i>GR-4020</i>	<ul style="list-style-type: none"> • <i>Excellent Creep Resistance</i> • <i>Superior Heat Deflection Tem. With Good Melt Flow</i> • <i>Easy moulding</i>
<i>Propeller Fan</i>	<i>ABS/GF</i>	<i>GR-4020</i>	<ul style="list-style-type: none"> • <i>G/F 20%, high impact</i> • <i>high strength</i>

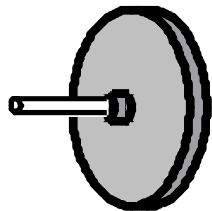
● *Outdoor unit (Package/Separation type)*



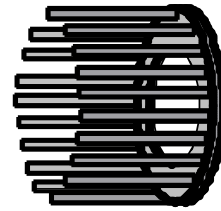
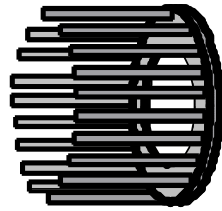
<i>Part name</i>	<i>Material</i>	<i>Grade</i>	<i>Characteristic</i>
<i>Propeller Fan</i>	<i>ABS/GF</i>	<i>GR-4020</i>	<ul style="list-style-type: none">• <i>Excellent Creep Resistance</i>• <i>Superior Heat Deflection Temperature With Good M/F</i>• <i>Easy moulding</i>• <i>Good ultrasonic adhesive property</i>

● *Material for Fans in Air-conditionel*

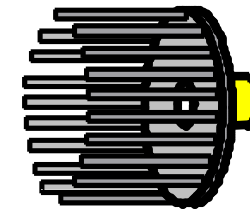
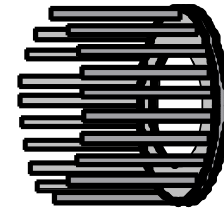
▶ *Cross Fan*



FAN - C part

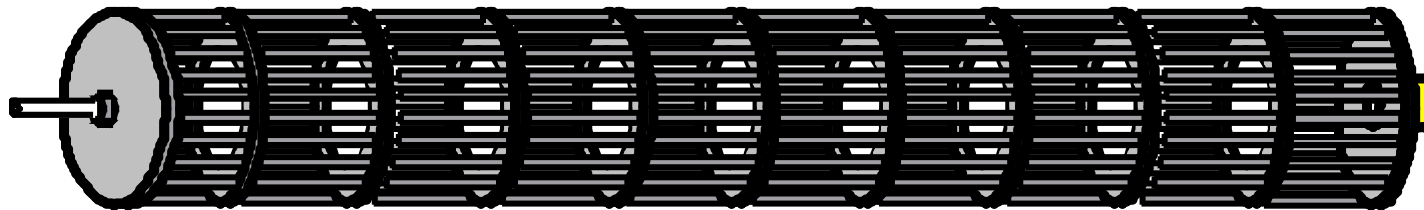


FAN - B part



FAN - A part

After Ultra Sonic welding

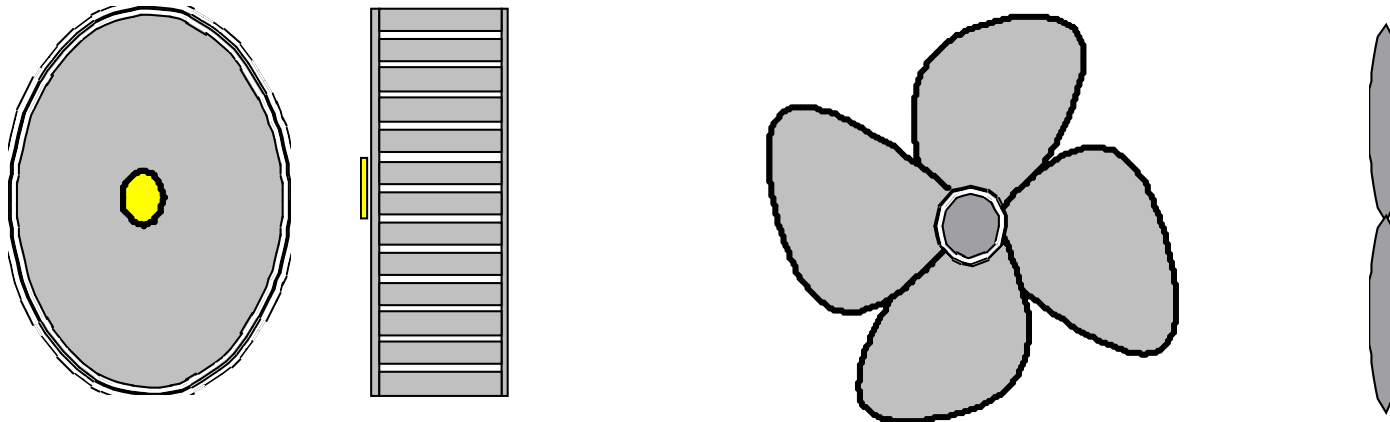


SEC : 10 unit under/80°C X 10 hr , 12 unit/90°C X 18 hr : Diameter type - Ø88, Ø91, Ø100
CARRIER : 10 unit under/90°C X 12hr, 12 unit/ 90°C X 24hr : Diameter type - Ø80, Ø90, Ø100
DAEWOO : 10 unit / 75°C X 12hr : Diameter type - Ø100

▶ *Cross Fan*

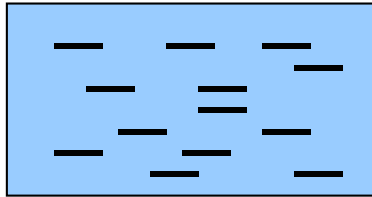
© *USING of BLOWER FAN : Windows Type Airconditioner
Package Type Air-conditione*

© *USING of PROPELLER FAN : Out door of Any Type Airconditioner*



► Characteristics of GF

GATE

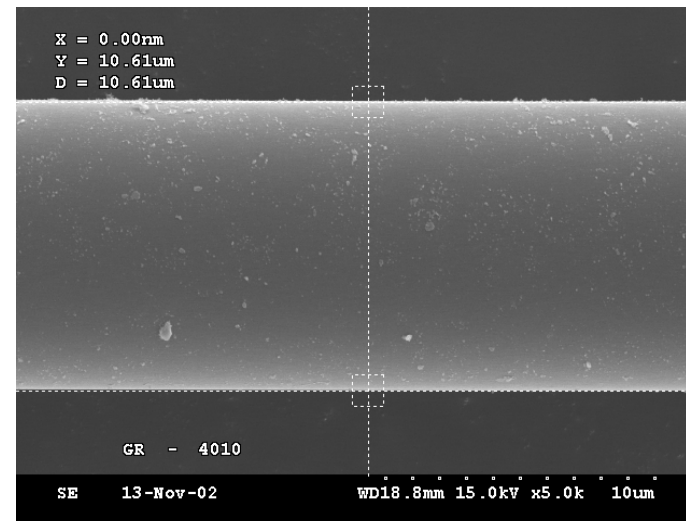
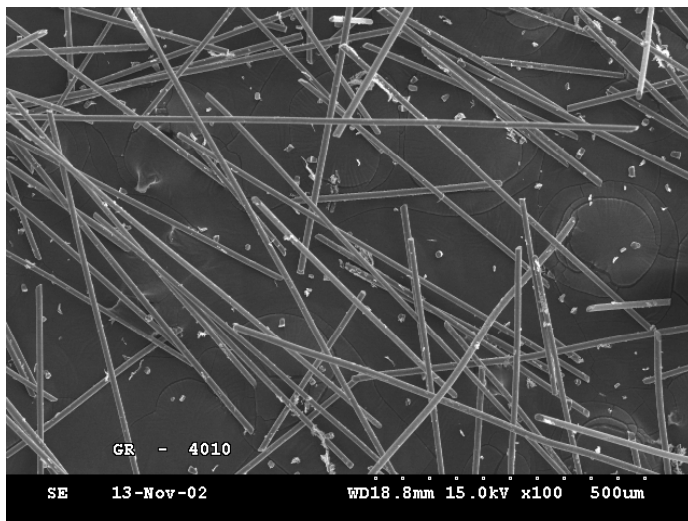
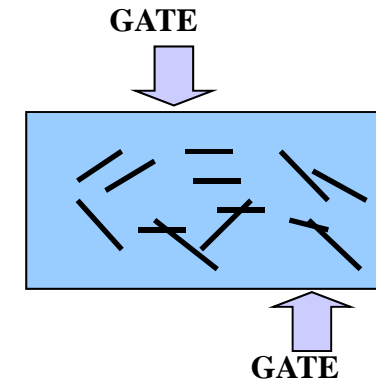


MERIT

- Excellent Creep Resistance
- high strength
- High heat resistance

DEMERIT

- Deformation of contraction
- Bad surface



Cross section of GF Image

► *Plastics in Air conditioner*

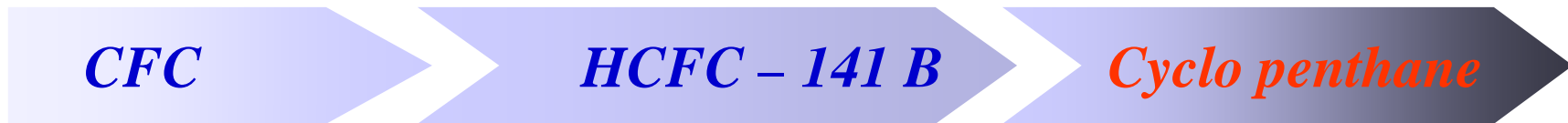
<i>Parts</i>	<i>Material</i>	<i>Grades</i>	<i>Characteristics</i>
<i>Cross Fan</i>	<i>SANGF</i>	<i>GR-5020FX GR-5030FX GR-5020F GR-5021</i>	<i>「FX」 Excellent Creep Resistance Superior Heat Deflection Temperature With Good Melt Flow Easy Demoulding</i>
<i>Propeller Fan</i>	<i>ABS/GF</i>	<i>GR-4020</i>	<i>High Modulus, Heat Resistance</i>
	<i>SANGF</i>	<i>GR-5020FX GR-5020F GR-5021</i>	<i>「FX」 Excellent Creep Resistance Superior Heat Deflection Temperature With Good Melt Flow Easy Demoulding Good ultrasonic adhesive property</i>
<i>Blower(Fan)</i>	<i>ABS/GF</i>	<i>GR-4020</i>	<i>High Modulus, Heat Resistance Easy Demoulding</i>

4) Characteristics for Refrigerator

- *Characteristics for forming Agent*



	<i>HCFC-141 B</i>	<i>Cyclo Penthane</i>
<i>STATE</i>	<i>Unstable</i>	<i>Stable</i>
<i>Chemical Attack</i>	<i>Strong</i>	<i>Mild</i>
<i>Injection ABS</i>	<i>EG-0763</i>	<i>HG-0760 H</i>
<i>Extrusion ABS</i>	<i>ES-0163</i>	<i>SV Series</i>



● *Characteristics for Refrigerator*

Part Name	Material	Grade	Characteristics
Sheet	ABS	SV-series	· High ESCR Property for CP
	ABS	ST-series	· High ESCR Property for CP · 10 - 20 % Downgauging
	ABS	ES-0163	· High ESCR Property for HCFC-141b
	ABS	ES-0173	· High ESCR Property for HCFC-141b · 10 - 20 % Downgauging
Handle Cap-Sash Dispenser	ABS	HG-0760H	· High Gloss, High Melt Flow (CP)
	ABS	EG-0763	· High Gloss, Good Weatherability (HCFC)
SHELF	ABS	SD-0160	- High Impact Strength
	GPPS	HF-2660 S	· High Clear of Transparency · High Melt Flow
	SAN	HC-5920	· High Clear of Transparency With Impact Strength · High Melt Flow
Guard	ABS	HF-0680	- High Melt Flow
	GPPS	HF-2660S	· High Clear of Transparency · High Melt Flow
Vegetables Box	GPPS	HF-2660S	· High Clear of Transparency · High Melt Flow
	SAN	HF-5661HC	· High Clear of Transparency With Impact Strength · High Melt Flow

● *Characteristics for Extrusion ABS*

Type	Test Condition	Unit	ABS				
			SV-0157	SV-0156 T	ST-0181	ES-0163	ES-0173
Physical Properties							
Specific Gravity	Natural Color	-	1.03	1.04	1.04	1.03	1.04
Melt Index	200°C/5KG	g/10min	-	-	-	-	-
	220°C/10kg	g/10min	5.7	4.0	3.4	6.3	3.0
Mold Shrinkage	-	%	0.3~ 0.6	0.3~ 0.6	0.3~ 0.6	0.3~ 0.6	0.3~ 0.6
Water Absorption	24hrs, in water	%	0.3	0.3	0.3	0.3	0.3
Mechanical Properties							
Tensile Strength	5mm/min	kgf/cm ²	430	470	490	440	410
Elongation at Break	5mm/min	%	-	-	-	-	-
Flexural Strength	2.8mm/min	kgf/cm ²	630	690	780	660	610
Flexural Modulus	2.8mm/min	kgf/cm ²	24,000	25,000	25,500	21,000	19000
Izod Impact Strength	1/4"	kgf-cm/cm	25	27	25	27	33
	1/8"	kgf-cm/cm	-	-	-	-	-
Rockwell Hardness	R-scale	-	105	107	108	99	96
Thermal Properties							
Heat Deflection Temp.	1/4", 18.56kgf/cm ²	°C	89	90	92	87	91
Vicat Softening Temp.	5kgf/cm ² , 50°C/hr	°C	99	100	102	99	99
Flammability	-	-	HB	HB	HB	HB	HB

● *Characteristics for Injection ABS*

Type	Test Condition	Unit	ABS			
			HG-0760 H	EG-0763	SD-0160	HF-0680
Physical Properties						
Specific Gravity	Natural Color	-	1.03	1.03	1.04	1.04
Melt Index	200°C/5KG	g/10min	3.1	-	1.3	5.8
	220°C/10kg	g/10min	-	15	-	-
Mold Shrinkage	-	%	0.3~ 0.6	0.3~ 0.6	0.3~ 0.6	0.3~ 0.6
Water Absorption	24hrs, in water	%	0.3	0.3	0.3	0.3
Mechanical Properties						
Tensile Strength	5mm/min	kgf/cm ²	460	460	400	410
Elongation at Break	5mm/min	%	-	-	-	-
Flexural Strength	2.8mm/min	kgf/cm ²	650	670	600	560
Flexural Modulus	2.8mm/min	kgf/cm ²	24,000	25,000	20,000	20,500
Izod Impact Strength	1/4"	kgf-cm/cm	20	22	32	20
	1/8"	kgf-cm/cm	-	-	-	-
Rockwell Hardness	R-scale	-	106	102	98	104
Thermal Properties						
Heat Deflection Temp.	1/4", 18.56kgf/cm ²	°C	83	86	82	82
Vicat Softening Temp.	5kgf/cm ² , 50°C/hr	°C	95	96	96	96
Flammability	-	-	HB	HB	HB	HB

● **Characteristics for GPPS & SAN**

Type	Test Condition	Unit	GPPS	SAN	
Properties at 23°C			HF-2660 S	HC-5920	HF-5661HC
Physical Properties					
Specific Gravity	Natural Color	-	1.05	1.07	1.08
Melt Index	200°C/5KG	g/10min	7.3	4.5	1.5
	220°C/10kg	g/10min	-	-	-
Mold Shrinkage	-	%	0.3~ 0.6	0.2~ 0.4	0.2~ 0.4
Water Absorption	24hrs, in water	%	0.3	0.3	0.3
Mechanical Properties					
Tensile Strength	5mm/min	kgf/cm ²	450	630	770
Elongation at Break	5mm/min	%	-	-	-
Flexural Strength	2.8mm/min	kgf/cm ²	580	900	1190
Flexural Modulus	2.8mm/min	kgf/cm ²	28,200	32,500	31,000
Izod Impact Strength	1/4"	kgf-cm/cm	-	2.1	2.7
	1/8"	kgf-cm/cm	-	-	-
Rockwell Hardness	R-scale	-	120	75	76
Thermal Properties					
Heat Deflection Temp.	1/4", 18.56kgf/cm ²	°C	81	92	95
Vicat Softening Temp.	5kgf/cm ² , 50°C/hr	°C	92	108	106
Flammability	-	-	HB	HB	HB