

MAKER SPOILER IS CAR DAIHATSU USE FOR KIND POLYMER INGREDIEN ACRYLONITRIL BUTADIENA STYRENE

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ABSTRACT: *The spoiler is one of the accessories components in a four wheel vehicle four (car). The function of spoiler are making vehicle be seen sportier and as accessory addition, it can increase the cars selling. Because of that spoiler as one of the accessories will not influence the principal function of the vehicle. The selection of materials used and manufacture process will produce a product as the plan, besides production cost and production difficulty level is easier to overcome. Appropriate materials for the production spoiler kind plastic stuff as long. Acrylonitril Butadiena Styrene since it has soft and light characteristic so that the quality painting better, blow molding is one of the process choices profitable on low production cost than plasticity.*

Keywords: Acrylonitril Butadiena Styrene (ABS), Car, Spoiler, Polymer

I. INTRODUCTION

Planning, process and component are three important factors in the development of a product. Knowledge of component is a vital importance because relates to quality product and manufacturing process[1]. The appropriate materials and process can produce desirable quality and make possible to be done in the manufacturing process besides that production cost can be depressed. Development automotive is very fast one of the reasons in electing one of the automotive components as object spoiler one of the accessories components in a car. The function of spoiler are making vehicle be seen sportier and as accessory addition, it can increase the cars selling. So spoilers as accessories will not influence the principal function of the vehicle.

Based on the explanation above, consequently watchfulness to formulate per mass, where problem formulation that meaning among others: automotive component maker stage concept with ingredient polymer complete with picture scheme and layout with the current from the process, from begin planning to quality control with as which reference way of reading of the book and magazine or internet.

The aim of this study is to realizing and presenting the principle of making automotive component from polymer basic commodity and to detecting manufacturing process election used in making automotive component, on Daihatsu Xenia rear spoiler.

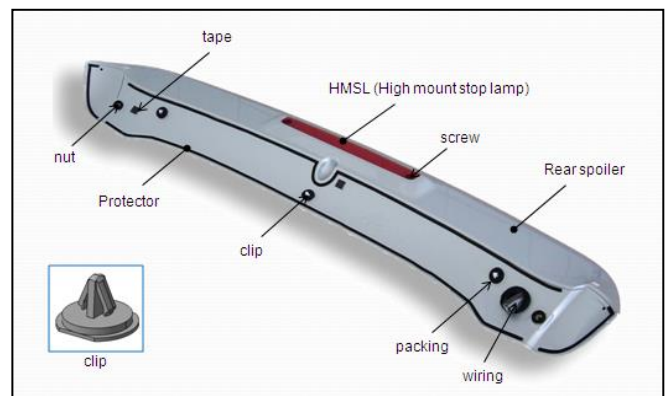
II. Literature Review

Description Rear Spoiler

The rear spoiler is one of the automotive components functioned as an accessory in a car. The existence of spoiler in a car can make the rear look sportier, more interesting.

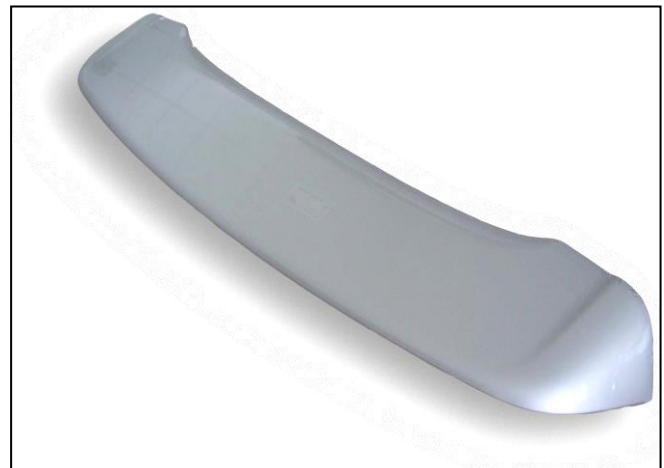
Plastical Stuff

Plastic is polymer; a material consisting of any range of this chain forms many molecule unit repeats, or monomer. The vast majority of these polymers are based on a chain of carbon atoms alone or with oxygen, sulfur, or nitrogen at the backbone.



Picture 2.1 Rear Spoiler

Semiconductor and conductive polymers are conjugated polymers that shown the changing in single and multiple bonds between carbon atoms in the polymer main chain[2]. Multiple bonds got from carbon that has four valence electrons, but in the molecule conjugated has only three



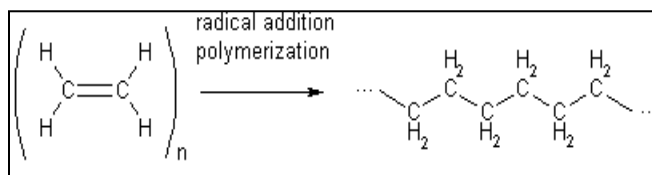
(sometimes two) atoms.

Picture 2.2. Component Rear Spoiler

Electron remained formed a π bond, delocalized electrons in entire molecules[3]. A substance can have a conductive polymer if has multiple bonds conjugated. Example of conjugated polymers is traditional plastic (polyethylene), while conductive polymers among are: polyacetylen, polypyrol, polytiopen, polyaniline and other[4].

Table 2.1 Component Specification Rear Spoiler

No.	Image			QTY
1				1
2				3
3				2
4				2
5				3
6				2
7				1
8				2
9				1
10	PROTECTOR C	EPDM	t 1,5 x 5 x 123	2
11	PROTECTOR D	EPDM	t 1,5 x 5 x 18	4
12	PROTECTOR E	EPDM	t 1,5 x 5 x 100	1
13	HMSL	-	-	1
14	SCREW	-	M5	2



Plasticity based on the physical character:

1. Thermoplastic, (1: 39)
A kind of plastic that can be recycled / printed again with reheat process. Example: polyethylene (peanut, polystyrene (PS), Acrylonitrile butadiene Styrene, polycarbonate (PC)
2. Thermostat, (1:3 9)
A kind of plastic cannot be recycled / printed again. Reheat will cause damaging molecules. Example: resin epoxy, bakelite, resin melamine, urea-formaldehyde.

Materials selection must be accustomed to function from a product that will be made. There are 3 kinds of materials commonly used which is:

1. ABS (Acrylonitrile Butadiene Styrene)[1, 3]
It is an organic polymer which has strength and relatively cheap. ABS used in many fields of technique, like for example for electronic and automotive need. It is because ABS has toughness and electrical insulation' than

polystyrene, so that appropriate for components that move. It used in hard component and brittle. The molding result is softer and stronger. Before printing process is begun, materials ABS must pass process heating. . This matter will be done to will prevent the happening of bubble in component that be made. This material melting point 210°C.

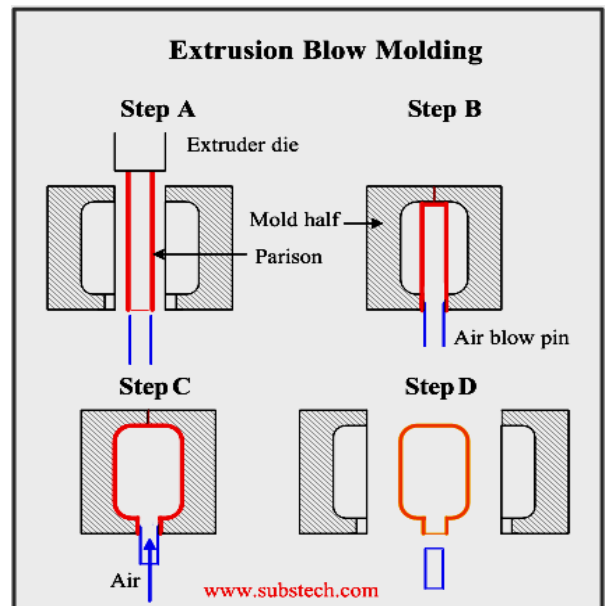
2. PP (Polypropylene)[5]

It is one kind of the plastic that very both for human body. This plastic has one surplus and one the example, deficit: can hold back chemistry, although heated in high temperature (range from 800°C to 999°C). It's the best record from all plastic. This kind of plastic can break, but it does not harm this plastic can break (for drink container in a plastic glass).

First of all ABS materials should be taught heating process, it considers preventing distend at the product will be made. This material melting point is 180°C.

3. PE (Polyethylene)[5]

Polyethylene is thermoplastic, widely used by consumer as a plastic bag. Around 60 million tons these plastic produce every year. Polyethylene is a polymer; consist of long chain monomer Etienne. In industrial polymers, polyethylene is written as PE, it also per annum abbreviation, treatment same that is done by polystyrene and polypropylene. Polyetilena formed to pass polymerization process from ethena. polyetilena can produced by a radical polymerization process, polymerize addition of anion, polymerize ion coordination, or polymerize addition of cation used in component with violence level between as long as the acrylonitril butadiena styrene and polyetylen. This material melting point is 130°C.

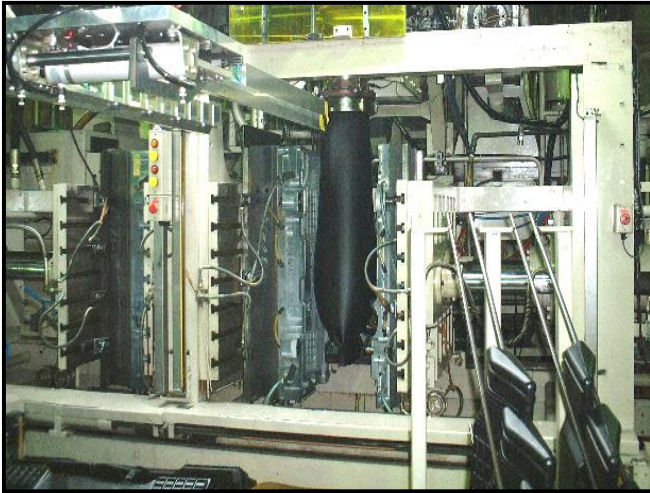


Picture 2.4 Plastic Ore

2.3. Blow Molding

Blow molding is a plastic manufacturing process by which hollow plastic is formed[6]. The parison that is produced from process extrusion developments in print by gas

pressure[7]. Basically blow molding development from a process extrusion pipe by adding printing and blowing mechanism.



Picture 2.5 Ekstrusi Blow Modling

Extrusion Process:

- Parison is extrusion from on downwards between printing hole (mold).
- Printing closes so that parison jam in by printing.
- Parison developed by high pressured gas so that impel to printing wall and formed as according to printing hole form.
- Refrigerant product and took from printing.

Remaining of blow molding:

- Make possible to make product form measures less up to king sized
 - Relative product maker cost cheaper as compared with plastic kind molding another
 - Possible to reuse and repeat
- Insufficiency of blow molding:
- Unstable product thickness
 - Difficult to get the angular shape with radius smaller
 - Product blow molding must be done continuously working

Picture 2.6 Blow Molding Machine

Process blow molding divided to be 3 process stages, that is:

1. Extrusion

In the course of this is the ingredient of raw thermoplastic processed in certain temperature and at extrusion to form the vertical cylinder or little tube to be used as parison in course of blow molding[8].

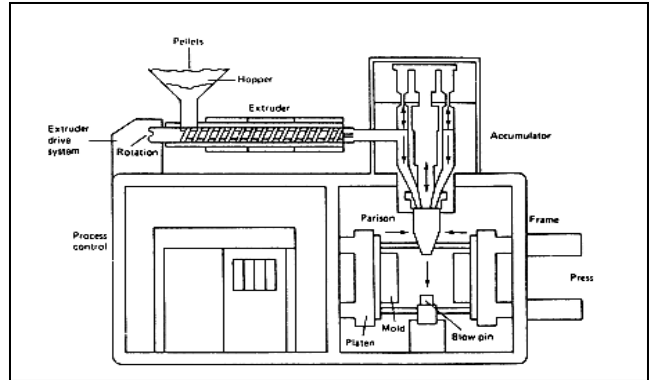
2. Inflation

In the course of this, parison closed by printing or molding to finish the deformation process shaped by blowing. Parison developing when tooted and stop to form the final appropriate product with printing.

3. Ejection

In the course of this is printing or mold open and release parison that have come to be a good product. Process blow molding is a low pressure process, but in the product maker process, an ingredient that used upon which to make printing in blow molding very have an in with total and

product capacity that be made. For the low product total or to make aluminum product as a sample serve is the purpose of the ingredient for the printing[8]. While in product maker with plethora and wanted tall speed so cast beryllium copper and machined tool steels serve the purpose of the ingredient to make prints[9].



Picture 2.7 General Description of Blow Bolding Machine

In the development process, process blow molding for plastic bottle maker with casquette material rounds into process stretch blow molding this plastic bottle maker process is two steps of molding process[10, 11]. Because of previous casquette ingredient is changed formerly to perform mechanically injection molding, new then processed again using engine stretch blow molding to change and perform plastic bottle. In the plastic bottle maker process stage mechanically stretch blow molding, much the same to stage exist process in engine process blow molding conventional.

Table 2.2 Recommendation Various Printing Materials for Plastic Maker Process

Process	Material	Steel grade	Recommended hardness, HRC (HB)
Injection molding	Thermoplastics	P20(a)	33 (-310)
		P6(b)	54-58
		S7	54-58
		H13	45-54
		420	50-54
Injection molding	Thermosets	Elmax(c)	58-60
		S7	54-58
		A2	58-60
		D2	58-60
		Elmax(c)	58-60
Compression/transfer molding	Thermosets	ASP 23(d)	60-64
		S7	54-58
		420	52-54
		Elmax(c)	58-60
		D2	58-60
Blow molding	General thermosets/thermoplastics	P20(a)	33 (-310)
		420	45-54
Extrusion	General thermosets/thermoplastics	420F	37 (-340)
		420	45-54
Holder material	General thermosets/thermoplastics	4130/4135(e)	33 (-310)
		Corrosion-resistant applications	420F

(a)Prehardened mold steel. (b)Carburized mold steel. (c)Elmax merupakan P/M stainless steel. (d)ASP 23 merupakan P/M high speed tool steel. (e)High-strength, prehardened. Sumber: Davis, J.R. Tool Materials, United State of America : ASM International, 1995, p. 277

Sanding

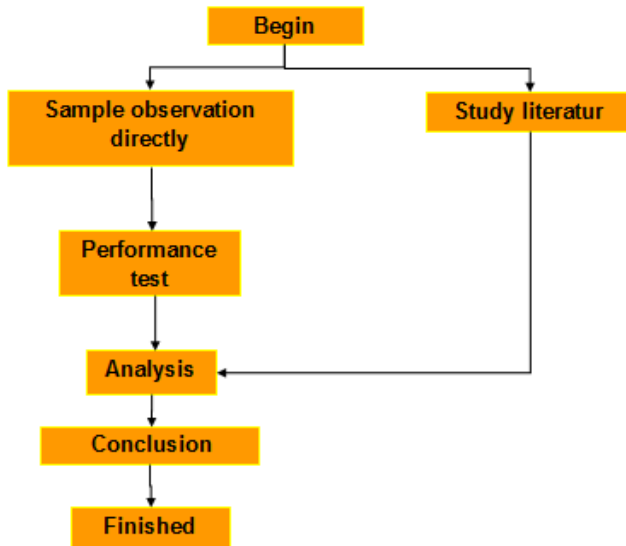
Sanding is continuation job from process blow molding (re-work). The purpose of sanding preparation process for continuous process is painting. This matter is done to produce good quality after process painting. Steps in the course of sanding are:

1. Baritori: cause the loss of flash sharp
2. Hole making: make hole wiring HMSL

3. Karatogi I : sandpapering with P 3204
4. Karatogi II : sandpapering with P 400
5. Suiken: sandpapering with P 600
6. Check product

III. Materials Selection And Manufacturing Process Real Spoiler

In general, materials selection working process and manufacturing process rear spoiler this visible from diagram emit a stream as shown in Picture 3.1.



Picture 3.1 Emits Working.

Marginally explainable that process to be done direct observation towards rear spoiler with added materials for literature study and the data from the internet. The process will be done in the performance test towards ingredient that be used. Furthermore, process is analyzed towards materials selection process and the manufacturing process. As ends stage made a conclusion from materials selection and manufacturing process in the rear spoiler car.

3.1 Technique factor deliberation rear spoiler

3.1.1. Ingredient election rear spoiler

Appropriate materials selection with thing function that will produce to determine also thing performance that will produce[12]. Must be accustomed to function from a product that be made, 3 plastic stuff kinds commonly use that is:

1. The acrylonitril Butadiena Styrene used in hard component and brittle. The molding result is softer and

stronger materials. Before printing process is begun, material ABS acrylonitril butadiena siren must pass process heating. . This matter will be done to will prevent the happening of bubble in component made. This material is melting point 210°C.

2. The polypropilen used in bent component. The molding result is harsher materials. This material is melting point 180°C

3. The polyetylen is used in component with violence level between as long as the acrylonitril butadiena siren and polypropylen. This material melting point 130 °c based on plastic stuff on we can detect several ingredient physical characters that serve the purpose of materials to rear spoiler. Seen from the plasticly kind third function on, can be estimated that ingredient that chosen ABS because hardest the component and brittle and in the application can hold back when can car can walk. And in basic rear spoiler want plastic result molding hard and brittle.

Table 3.1 Performance Test Report Acrylonitril Butadiena Styrene

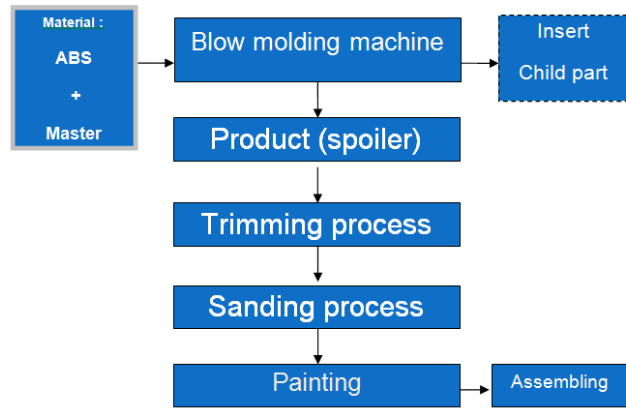
In general requirement materials for making rear spoiler are:

1. Hold back towards the environment temperature condition.
2. Light.
3. Hold back towards vibration.
4. Can be done process painting.
5. Result good painting

In product development stage usually done trial or effort product that produced in stage trial be done performance test. A performance test is purpose to detect product quality. Method that used in performance test based on in engineering standards that appointed by vehicle manufacturer. Such as on vehicle manufacturer Daihatsu Japanese origin has engineering standards by the name (Daihatsu technical standards). Product that done performance test spoiler, as explains in Table3, six items test that's done:

1. **Heat Test**, at one particular room with surface condition on spoiler given temperature test that done that is product testing with given tall temperature 90°C during 3 clocks. Testing done as much as four times. Afterwards bumpy surface or transformation so testing heat test has done re-checking according to visual. Otherwise found deformation, crack, and assumed success.

2. **Cold-Hot Repeating Test**, test done with temperature condition those changes extremely from cold aim hot. In low temperature condition, spoiler given temperature -30°C during 7, 5 hours, then continued in temperature 80°C during 15.5 hours. Testing is done as much as four times. The same as with first testing, checking is done according to visual. Otherwise found deformation, crack, bumpy surface or transformation, hence cold-hot repeating test assumed success.
3. **Ball-Dropped Impact Test**, testing is done with the spoiler condition that given by the temperature -30°C then dropped with weighing metal ball pressure 500g aim surface spoiler. On the table is mentioned material strength condition minimum 0.74 Nm up to ingredient broken. Testing result shows 4.9 Nm up to ingredient broken. Declared success to ball-dropped impact test.
4. **Liquid Resistance Test**, testing is done to detect strength spoiler towards resistance of water. Testing is declared to escape otherwise happen color change, deformation etc.
5. **Limited Heated Test**, testing principle much the same to with first testing. Temperature condition 100°C during 3 hours.
6. **Destructive Strength of Fitted Parts Insert Nut**, testing is done to detect strength torsi from insert nut. A method that's done with twist and interesting nut until broken by using tools. Testing a condition from testing the

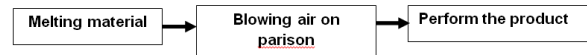


Picture.3.2. Diagram of manufacturing process, making real spoiler

The process is begun in mixing materials (ABS, master batch and anti UV) with a composition that determined then at process in engine blow molding. After product formed and out of printing then the continuous process is process trimming (separate flash with product). From process trimming then be continued with the sanding process (this process be done if the product is going to molding process). The last process is assembling component. ABS materials described on in spoiler maker. Masterbatch functioned as a dye. Anti UV is used in component exterior as patron from ultraviolet light.

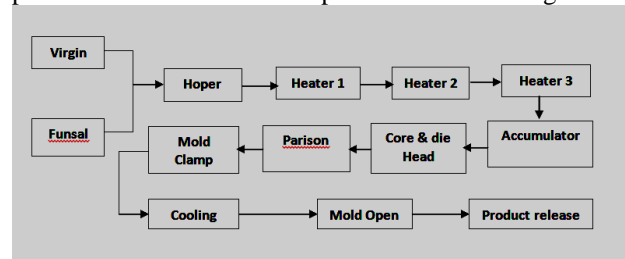
1. **Blow molding**

In general the production process by blow molding is:



Picture 3.3 Diagram Flow of Blow Molding Process

The material is thawed, then channelled to pass manage core. Then secretory material from the core or be called with parison at pincers by printing. Afterwards process of blowing air to depress wall parison form profile of mold [11]. After forming process product furthermore is taking product from mold. In detail process blow molding:



Picture. 3.4. Diagram emits process blow molding in detail

Explanation:

Virgin: pure material

Funsai: cycle ingredient repeats (recycle), composition between ingredient virgin and funsai in hopper 90: 10

The mixture between virgin and funsai is comparison 10: 90. Total funsai (cycle ingredient repeat) are much more aim to maximize material used. Material mixture with a composition that determined to then enter to into hopper and be heated in heater will be easier in mixing and channelled by the accumulator. After out of the die core core mixture

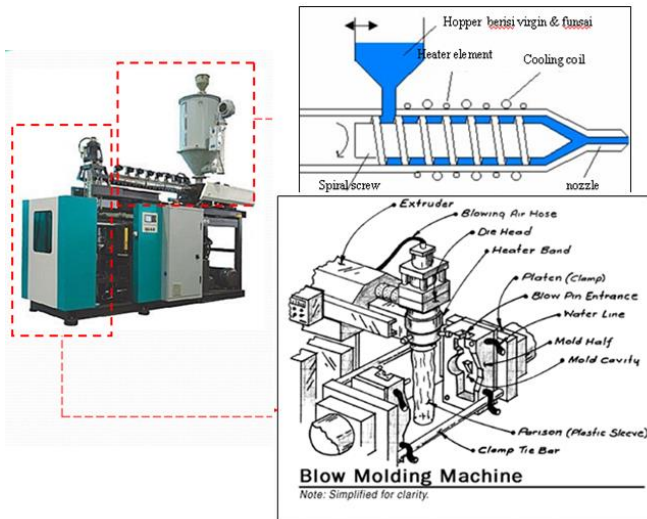
PERFORMANCE TEST REPORT				
Product No. : T&T6-VZC01		KYOBAKU CORP. RESEARCH DEPT.		PAGE 1/1
Product name : SPOILER BODY REAR				
Material : ABS 0547				
Specification No. :				
Test Item	Test Conditions	Specifications	Results	Judgement
HEAT TEST	The test was performed with 4 cycles of before cycling. T&T6-VZC01 (B method) ① Upper surface WTC x 3 for 10min (plus WTC) ② room temperature x 0.5 hr	The seriously deformation, warp, bending, crack, falling, etc during and after the test	The seriously deformation, war deformation.	OK
COLD-HOT REPEATING TEST	The test was performed with 4 cycles of before cycling. T&T6-VZC01 (B method) ① -30°C x 7.5 hr ② room temperature x 0.5 hr ③ 80°C x 15.5 hr ④ room temperature x 0.5 hr	The seriously deformation, discoloration, bending, crack, etc during and after the test	The seriously deformation, war deformation.	OK
BALL-DROPPED IMPACT RESISTANCE	T&T6-VZC01 (B method) 100 g of steel ball was dropped on -30°C for 10 min (max 10 kgf)	Minimum destructive strength must be over 75 kgf	Min. destructive strength 4.9 Nm	OK
LIQUID RESISTANCE	T&T6-VZC01 (B method) Was immer 97.7 Washable weather liquid liquid was	No fading, discoloration, seriously deformation, shrinkage, etc.	The abnormalities in each subject	OK
LIMITED HEAT TEST	T&T6-VZC01 (B method) Atmosphere WTC Surface temperature 100°C x 3 hr Surface temperature were raised per 10°C	The occurrence of deformation must be higher than conditions of heat test WTC	Qty item of spurious center deformation Top 0.1mm max 100°C ±0.5 140°C ±0.5	OK
DESTRUCTIVE STRENGTH OF FITTED PARTS INSERT NUT	Relation torque strength and pull strength of insert nut	Minimum destructive strength must be over 75 kgf	Relation torque 80 - 90 kgf Pull strength 130 - 140 kgf	OK

minimum destructive strength exceed 75 kgf.

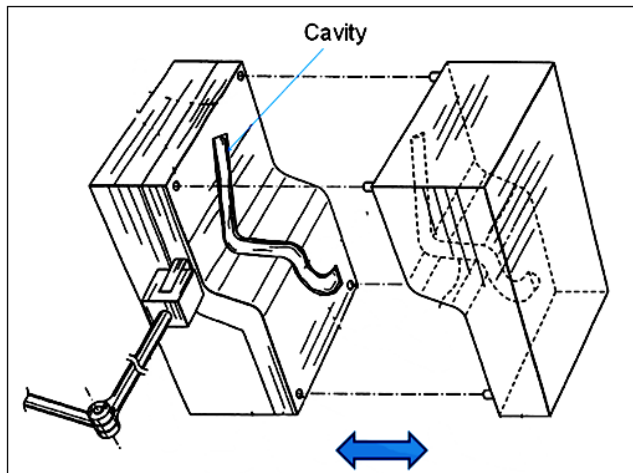
Manufacturing Process Rear Spoiler

Manufacturing process rear spoiler consists of several stages. It can be seen at below diagram:

(parison) is formed in printing. Parison insides printing will load pressurized air to will form printing profile. A product with high temperature in the moldy refrigerator for a short time to will speed up product formation[13]. After mold opened, then is continued product, expenditure process from mold.



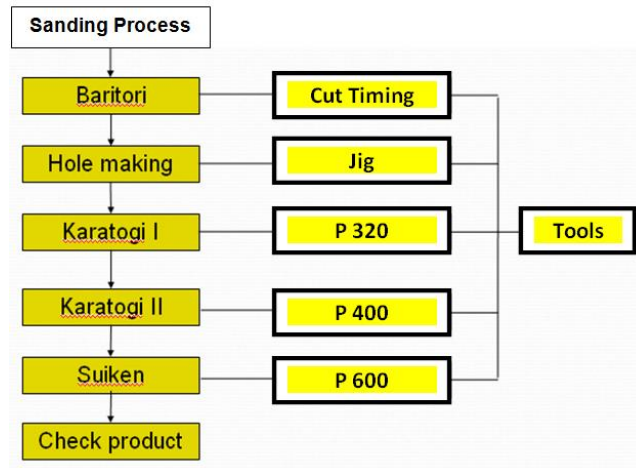
Picture 3.5. Scheme of Blow Molding Machine



Picture 3.6 Rear Spoiler Printing

Printing in blow molding has a cavity and doesn't have core differ from printing in process injection mold. Printing movements is can open and close to sink in arrow direction. Printing usually made of aluminium and stainless steel. In printing found water full duct as refrigerators. In printing profile at give vacuum (little hole) that functioned as sucker to produce product formation better. Usually vacuum laid in little radius part

2. Sanding



Picture 3.7 Sanding Process

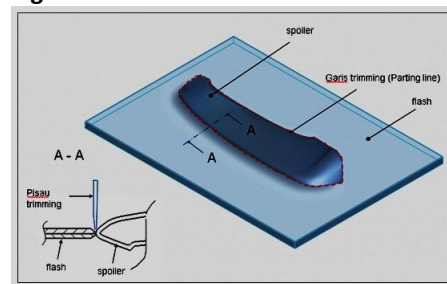


Picture 3.8. Working Process Sanding

Step - step in a course of sit side by side:

1. Baritori: causes the loss of flash sharp.
2. Hole making: make hole wiring HMSL.
3. Karatogi I: sandpapering with P 3204.
4. Karatogi II: sandpapering with P 4005.
5. Suiken: sandpapering with P 6006.
6. Check product.

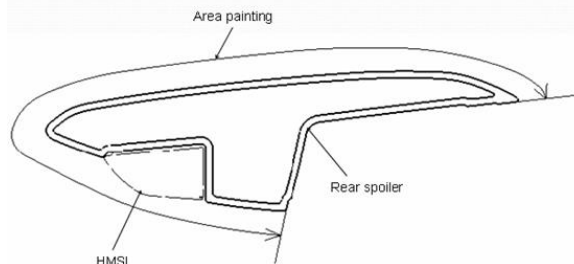
3. Trimming



Picture 3.9 Trimming Rear Spoiler

Process trimming one of [the] continuation process from blow molding that aim to separate flash with product. Flash at will use to return in process blow molding by crush beforehand mechanical crusher. After flash measure little (item) or called by funsai then mixed with ingredient virgin aim hopper. A tool that used in process trimming that is knife trimming.

4. Area painting



Picture 3.10 Area Painting

Process painting has been done after process sits. Color painting must equal to the base color from the vehicle that be installed spoiler. Manner that used to check for result painting to see according to be sunshine and compare with sample master color. The painting sample area in spoiler can be seen in picture 3.9. Method that used in process painting that is with at where is the product will be laid at one particular room with temperature that set so that entire product surfaces that at painting will produce thickness painting same[14].

IV. CONCLUSION

1. The use of ingredient and suitable manufacturing process will produce an appropriate product with a plan besides production cost and easier production difficulty level is overcome.
2. The suitable ingredient for product spoiler kind plastic stuff as long as the boss is happy caused by has soft character and light so that quality painting better.
3. Blow molding one of the process choice that has profited in a low production cost compared to other plastic stuff.

V. REFERENCE

1. Groover, M.P., *Fundamentals of modern manufacturing: materials processes, and systems*2007: John Wiley & Sons.
2. Kalpakjian, S., S.R. Schmid, and C.-W. Kok, *Manufacturing processes for engineering materials*2008: Pearson-Prentice Hall.
3. Gao, D.M., et al., *Modeling of industrial polymer processes: injection molding and blow molding*. Advanced Performance Materials, 1998. **5**(1-2): p. 43-64.
4. Edelman, R., F.M. Berardinelli, and K.F. Wissbrun, *Blow molding, containers, polymer modified with chain branching agent and chain terminating agent*, 1980, Google Patents.
5. Braun, D., et al., *Peroxy-initiated chain degradation, crosslinking, and grafting in PP-PE blends*. Journal of applied polymer science, 1998. **68**(12): p. 2019-2028.
6. Subramanian, P. and V. Mehra, *Laminar morphology in polymer blends: Structure and properties*. Polymer Engineering & Science, 1987. **27**(9): p. 663-668.
7. Chidambaram, P., et al., *Fundamentals of silicon material properties for successful exploitation of strain engineering in modern CMOS manufacturing*. Electron

Devices, IEEE Transactions on, 2006. **53**(5): p. 944-964.

8. Callister, W.D. and D.G. Rethwisch, *Materials science and engineering: an introduction*. Vol. 7. 2007: Wiley New York.
9. Davim, J.P., *Machining: fundamentals and recent advances*2008: Springer Science & Business Media.
10. Sodeik, M., K. Täffner, and F. Weber, *Fundamentals of modern can making and materials development for three-piece can manufacturing*. Transactions of the Iron and Steel Institute of Japan, 1988. **28**(8): p. 663-671.
11. Marcus, P., *Injection blow molding method*, 1973, Google Patents.
12. Morris, J.C., J.R. Bradley, and K.S. Seo, *Blow-molding polyesters from terephthalic acid, 2, 2, 4, 4-tetramethyl-1, 3-cyclobutanediol, and ethylene glycol*, 1999, Google Patents.
13. Hermawan, Y. and I. Astika, *Cycle Time Optimization of Chamomile Package 120 MI Product at Blow Molding Process*. Jurnal Energi Dan Manufaktur, 2009. **3**(1).
14. Taguchi, G., *Introduction to quality engineering: designing quality into products and processes*1986.