A Methodology to Assess Cost Implications of Automotive Customization

by

Laëtitia Fournier

Ingénieur diplômé de l'Ecole Polytechnique, Palaiseau, France, 2005

Submitted to the Engineering Systems Division
in Partial Fulfillment of the Requirements for the Degree of

Master of Science in Technology and Policy

at the

Massachusetts Institute of Technology

June 2005

Signature of Author……………………………………………………………………………
Laëtitia Fournier
Technology and Policy Program, Engineering Systems Division
May 06, 2005

Certified by…………………………………………………………………………………
Richard Roth
Director, Materials Systems Laboratory
Thesis supervisor

Certified by…………………………………………………………………………………
Joel P. Clark
Professor, Materials Science and Engineering & Engineering Systems Division
Thesis supervisor

Accepted by………………………………………………………………………………...
Dava J. Newman
Professor of Aeronautics and Astronautics and Engineering Systems
Director, Technology and Policy Program

A Methodology to Assess Cost Implications of Automotive Customization

by

Laëtitia Fournier

Submitted to the Engineering Systems Division on May 6, 2005
in Partial Fulfillment of the Requirements for
the Degree of Master of Science in Technology and Policy

Abstract

This thesis focuses on determining the cost of customization for different components or groups of components of a car. It offers a methodology to estimate the manufacturing cost of a complex system such as a car. This methodology includes specific consideration of how costs change as customized variants of each component or grouping of parts are included. The central conclusion of the thesis is some recommendations for the automakers when they are facing customization decisions.

The automotive industry has reached a mature state, as is evidenced by its growth and by the nature of competition and industry consolidation. Consumers are no longer satisfied with the models that are not individualized and demand a greater variety and individuality. Consequently the automakers are moving towards custom-made cars by customizing the shape and style of components; and this at a certain price. While product variety enables the firm to charge higher prices, automotive customization means also producing at lower production volumes, thereby increasing manufacturing costs and eroding profits.

Understanding the cost of customization depends heavily on component cost structures. It is considered that this cost is equal to the difference between the price of a baseline and customized product. A methodology, called Systems Cost Modeling (SCM), is developed in the thesis to build cost structures when estimates for a large number of components have to be considered. After gathering detailed empirical data and considering the eventual changes in the processing conditions of all parts due to customization, the tooling and equipment investment as well as the labor and energy cost are estimated for both the standard and customized car. After determining the drivers of the customization cost, a sensitivity analysis is done to understand the variations of this cost under different operating conditions. Finally these results explain that the cost of customization is very sensitive to part and process characteristics.

Thesis supervisor: Richard Roth
Thesis Supervisor's Title: Director, Materials Systems Laboratory

Acknowledgments

First I would like to show my gratitude to my advisor Dr. Richard Roth who supported me throughout my research and taught me much of what follows in this thesis. He offered me both the freedom and the guidance I needed. I would like to thank him for his advice and his mentorship.

It was a great pleasure to work at the MIT Materials Systems Laboratory. I wish to thank the staff and the students for the excellent working atmosphere and motivating dynamics they create in the laboratory. I wish to thank very much Professor Randolph Kirchain for his invaluable support with Excel, and Dr. Jeremy Gregory who has been an enthusiastic supporter of my work, providing significant insights to my research and being so patient for going through the 3000 components of the car. I want also to thank Dr. Frank Field for the numerous comments and suggestions regarding this thesis and especially the PowerPoint presentations.

Many thanks to the numerous persons at General Motors, who, beside their busy schedule have helped me to access the data I needed to validate the theoretical work. Thank you to: Theresa Lee, Robert Ayres, Kenneth Mehrar, Bob Powell, C.S Wang, Janet Frahm, Joseph Hulway, Chris Oberlitner. I would also like to recognize the GM R&D and Planning, and especially Randall Urbance, who helped me to have a wonderful time in Detroit.

Finally my deepest appreciation goes to everyone I have had the opportunity to learn from in the Technology and Policy Program, and throughout MIT.

Table of Contents

List of Figures

List of Tables

1 Introduction

1.1 Background of the automotive industry

1.1.1 The state of the U.S automotive industry

The global automotive light vehicle assembly grew by 2% in 2004, to a total of 1,082,374 units [1] (1,061,735 units in 2003). However, this growth was anything but uniform across regions. Positive contributors included East Europe and Asia Pacific, which increased 4%. Negative contributors to growth included North America, off 2% and West Europe, down a slight 0.2%.

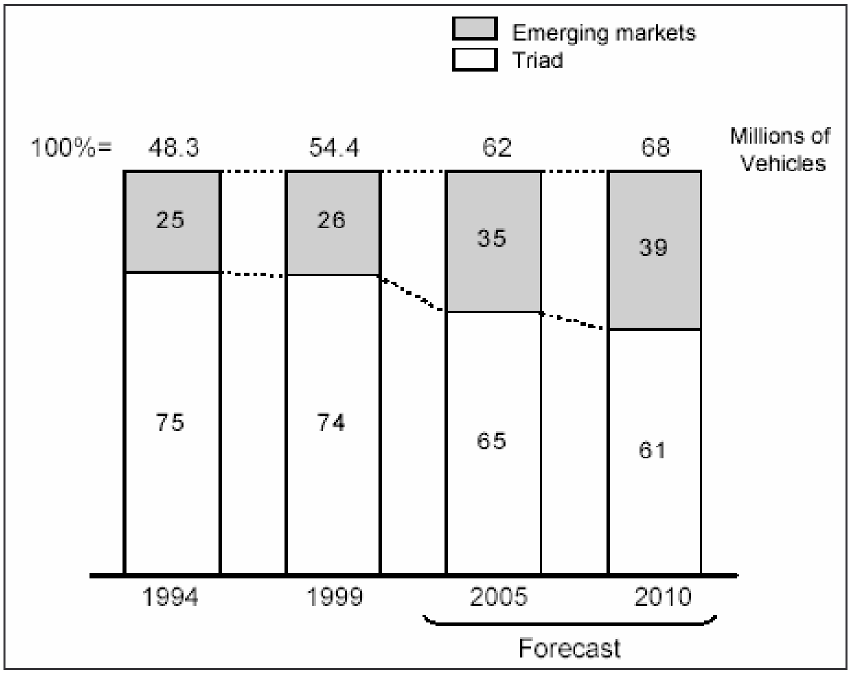


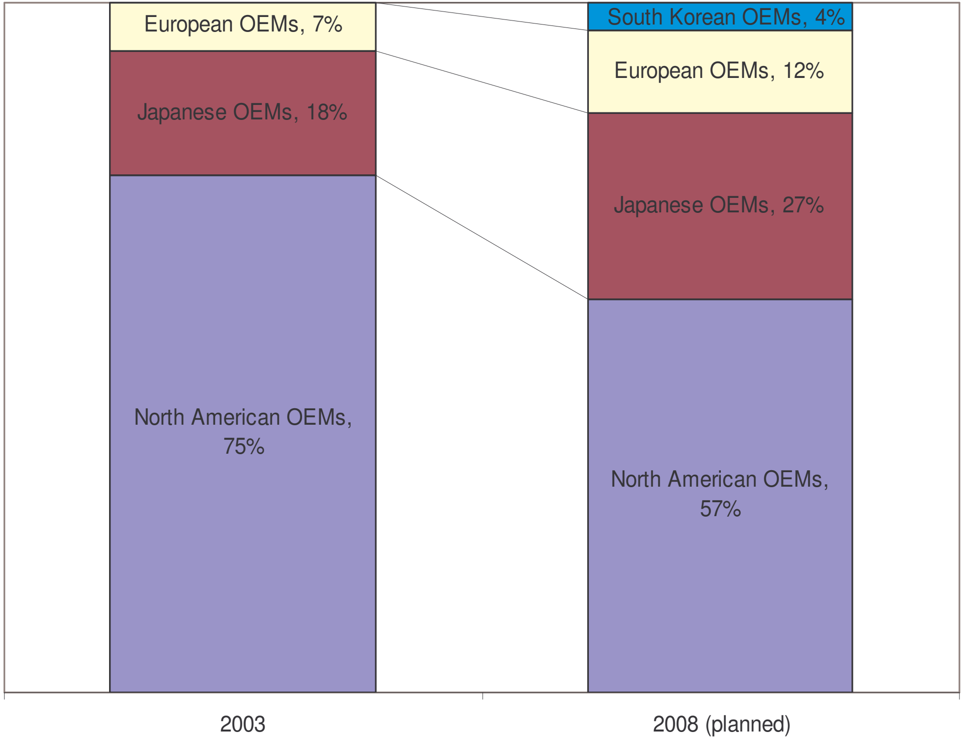
Figure 1-1 : New vehicle sales in triad versus the rest of the world
(Source: Automotive News McKinsey)

In any of the Triad regions (Western Europe, Japan and the US) Original Equipment Manufacturers (OEMs) have been facing a mature market for the past 10 years, with stagnant demand, product proliferation and stiff price competition. A flat demand is aggravated by increased competition in the product market. During the past two decades, most OEMs have invested heavily in plants outside their home base to better reach local consumers. As a result, market shares of incumbent players have become thinner. In the

US, domestic automakers have lost more 20% market share to Japanese and Korean automakers in the past two decades (see figure 1-2 for the trend). In 2003 North American carmakers accounted for 75 percent of the business of their North American suppliers, which now plan to reduce that level to less than 60 percent by 2008. European OEMs have experienced a similar trend, although ameliorated by the stricter regulations on the participation of Japanese OEMs that were in place until recently. Sales growth is now coming from developing regions, with South America, India, China and Eastern Europe leading this trend (see figure 1-1). To summarize, three factors are putting pressure on the OEMS:

- Increasing heterogeneity in the targeted market place
- Wider income distribution within the market
- Slower growth within the market.

Figure 1-2 : Distribution of customers (actual vs. planned) for North American auto suppliers, %



Faced with this changing face of competition in the automotive industry, the automakers have tried to reduce drastically development and manufacturing costs to remain competitive. Consequently they have for decades attempted to develop and produce "world cars" for the mass market that can be sold around the world with only minimal modifications. This strategy would result in tremendous economies of scale for the automotive industry. Despite the substantial benefits that could be gained from such products, past attempts at world cars have been failures. For example during the 1990's, three noticeable attempts were made at producing a world car. Honda made an attempt with its Accord model, Ford with its Mondeo/Contour models, and General Motors with its Cadillac Catera/Opel Omega models. All three of these models fell far short of their goals of achieving global success in the European, North American, and Asian markets for many reasons. The major theme in the failures of these world cars is the trade-offs in their development that were needed to satisfy the disparate preferences of the consumers in these different geographic markets. Here is a list of the failures:

- Different tastes:

Even in our increasingly globalized world, significant differences in tastes in automobiles still exist between the people in the different geographic markets. Among these differences in tastes are preferences in automobile size, design, and aesthetics. The most noticeable reason for failure of the world cars of the 1990's was the interior size of the cockpits of these automobiles. For example, the Ford Mondeo/Contour was well accepted in the European market, while the North American market found the interior of this automobile too cramped leading to its failure in this market. Another taste disparity between the North American and European markets exists in material preference for automobile construction. Both Europeans and Americans perceive an automobile construction of steel panels to be of superior construction to automobiles constructed of plastic panels. However Americans are more willing to accept plastic panels, while Europeans insist on steel. Consequently plastic construction is a growing trend in North America for cost and performance reasons. This taste discrepancy created issues for the GM subsidiary Saturn in its attempt to launch a world car during the late 1990's.

- Different infrastructures and economics:

The disparities in the infrastructures present in the different regions of the world create another challenge for the success of a world car. For example, a major hurdle in developing a world car that will satisfy the preferences of consumers in North America and Asia is created by the differences in the road infrastructures between these two regions. North Americans prefer large roomy cars as opposed to Asians who prefer a car small enough to squeeze through their crowded city streets. Honda designed its Accord model to meet the large car preference of the North American market, which led to its demise in Asia. Economics create another major challenge in developing a world car. For example, the disparities in the price of gasoline in the different regions of the world create another major hurdle. Europeans are obsessed with fuel economy in contrast to Americans who for the most part are more concerned about acceleration and performance.

- Different rules and regulations

Safety and emissions regulations vary significantly across national markets. In less developed countries such as those of Southeast Asia, regulations are more lax compared with the developed countries of Europe and North America. Even between Europe and North America, significant differences exist in safety and emissions regulations. As a consequence of these discrepancies, automotive OEMs have found tailoring their products to the specific requirements of these markets to be the most cost effective way to compete.

These failures show that today many influential factors affect decisions made in the automotive world. Consumer preferences determine the current styles, reliability, and performance standards of vehicles. Government trade, safety, and environmental regulations establish incentives and requirements for modernization and change in design or production.

1.1.2 The era of customization

As seen in the previous paragraph all automakers are under pressure to identify consumer preferences, national biases, and new market segments where they can sell vehicles and gain market share. As many markets become saturated, automakers tend to fracture the large mass automotive markets into smaller "niche" markets. They are trying to match their product to the particular customers' needs. To make customers feel special, they are moving towards custom-made cars by customizing the shape and style of components. This trend toward customization not only affects the automobile industry but also some other industries. For example, a mobile telephone manufacturer aware of the mass customization potential allows the customers to define their own shape of the telephone and the materials to be used for its production, adjust the shape and size of the keys, select the color of display illumination and choose optional telephone functionality, such as voice dialing. So just as consumers purchase such items as sandwiches, jeans, sofas and computers made-to-order, they expect to have the possibility to individually define a car to be purchased on the basis of a set of available engine types, transmission mechanism types, security device types, sunroofs of adjustable dimensions, seat types with a set of different seating surfaces materials in various colors, and others.

To a small extent, the customization effort is more and more intense in the auto industry. For every combination of make and model (e.g. Honda Accord, Toyota Camry), there is a variety of body type (e.g. convertible, coupe, hatchback, sport utility), doors (e.g. 2 door, 4 door, 4D Ext Cab), trim level (for Honda Accord, e.g. DX, EX, LX etc.), drive train type (e.g. 2WD, 4WD), transmission type (automatic, manual), cylinders (e.g. 4 Cyl, 6 Cyl), displacement (e.g. 3.0 liters,3.3 liters). In addition some companies like Mercedes, BMW and Porsche offer a variety of custom interior choices in European vehicles. Another example is the 2005 Audi A8, which will offer exclusive, luxury trim packages that feature more unique color choices and wood trims for roughly an extra $10,000 [2]. The options offered in a customized car concern not only the auto interior but sometimes also the engine. For example Perkins, a world-leader in the production of purpose-built diesel engines offers seven engines, each of which can be modified to fit customer requirements. The customer can modify oil filters and coolers, manifolds, alternators, flywheel housings, flywheels, oil pumps, fans and extensions, fan drives, exhaust outlets, starter motors, etc. [3]

Today, the Internet opens new channels for customization; indeed many automobile manufacturers have websites that allow users to “build your own” car. In addition to being able to simply view a particular model, a user could choose various packages and get updated information on pricing as options are selected. For example for the small car segment, the sites of Chevrolet, Honda, Nissan, and Toyota [4], contained customizable sections entitled “build your own” or “customize”. The customization process typically consists of the following steps:

- Select a model
- Select an exterior color
- Select an interior color
- Select packages and options.

All these examples of customization show that today consumers have compelled the automotive industry to ‘rethink’ its strategy on the production of automobiles. As shown in figure 1-3, the customization process starts from the customer preferences and then implies some production modifications.

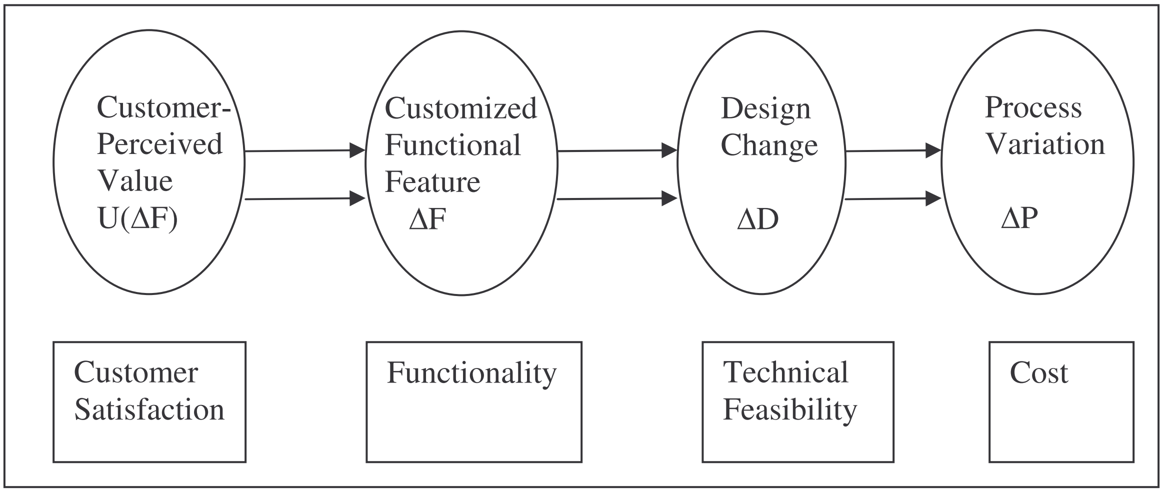


Figure 1-3 : The customization process- from the customer preferences to the manufacturing variations

A product is characterized by a set of design parameters (noted D), which suppose to meet certain customer needs characterized by a set of functional requirements (noted as F). The manufacturing process can be characterized by a set of process variables (noted as P). A customized product is the result of making changes to F, D and P. A customization requirement, ΔF is manifested by the customer's choice of customizable functional features. The customer-perceived value of each customization requirement indicated customer satisfaction in the customer domain and can be measured as a utility, U(ΔF). To deliver the expected ΔF, the product needs to be modified to a certain extent, resulting in some design changes, ΔD. Similarly the manufacturing process needs to be adjusted (e.g. different set-ups, tool modification) referred to as process variations, ΔP, representing the costs of fulfilling the customization. As a result, the customization decisions depend on the justification of cost-effectiveness around two pillars: the added value of customer satisfaction and the costs of customization.

1.2 Manufacturing costing in the automotive industry

1.2.1 The pressure for manufacturing costing in the automotive industry

Over the last couple of decades the increasing competition in most markets has increased the cost pressure for most firms. As a result costing approaches have been developed to reflect these changes and to support manufacturing managers to quickly make production decision making. First some "scientific management techniques" attempted to relate labor and operations' time measurement and work schedule controls to financial and cost controls. Then different costing approaches have emerged from rules of thumb or generally accepted accounting principles to process based cost models. These models estimate the cost of production by analyzing the various cost components of a production process. They aim at finding and specifying the relationship between product features, process characteristics, production conditions and cost. Managers, academia, and the trade press are all seeking new approaches which provide a more valid and accurate definition of manufacturing costs and a sound basis for product cost engineering and production estimating. Many articles [6] have been written which criticize past and present methods. While the initial methods were rather crude and served mainly to provide rough orders of magnitude, the recent ones become more and more accurate and thus can be largely used by managers for projecting the impacts of production decisions before critical financial resources are committed. The automotive industry is an example of market, where the automakers have to control their cost for surviving in the competitive environment. Customers will not accept higher prices, so price reductions within the automotive industry have become a norm and OEMs recognize the need to be low cost producers. Manufacturing an automobile is extremely complex, and decision makers have to evaluate design alternatives based on technical and non-technical performance. Projections of performance and cost can be highly uncertain, especially for technologies that are substantially different from current vehicle technologies and for those that are in a fairly early stage of development. Consequently these costing approaches are needed in the automotive industry to draw some preliminary conclusions, to identify the cost drivers, and to obtain a rough idea of what might be on the future automobile market.

1.2.2 The cost of customization

Although customization increases the customer satisfaction, it challenges the ability to maintain the cost of the product, thereby to offer a competitive product. Given the competitive environment of the auto industry, the OEMs should seriously evaluate the profitability of offering customized products and analyze the trade-offs between the benefits and the drawbacks of customization.

The benefits of the customization are easily perceived: customer satisfaction and market share increases. Some studies have identified customization as a means of improving customer satisfaction [7]. It is said that there is a growing demand for customized products and they are perceived as a status symbol [8]. Consumers are willing to pay a premium for customization to reflect the added value of customer satisfaction due to an individualized solution, i.e. the increment of utility customers gain from a product that better fits their needs than the best standard product attainable [9]. Thus sellers can price discriminatorily and charge a price premium since personalized product features better comply with buyers' tastes. As a result of this price discrimination, the company's profits should increase.

However, when a company starts customization, typically its variety of products increases, batch sizes and production volumes become smaller. Figure 1-4 illustrates the economics of production.

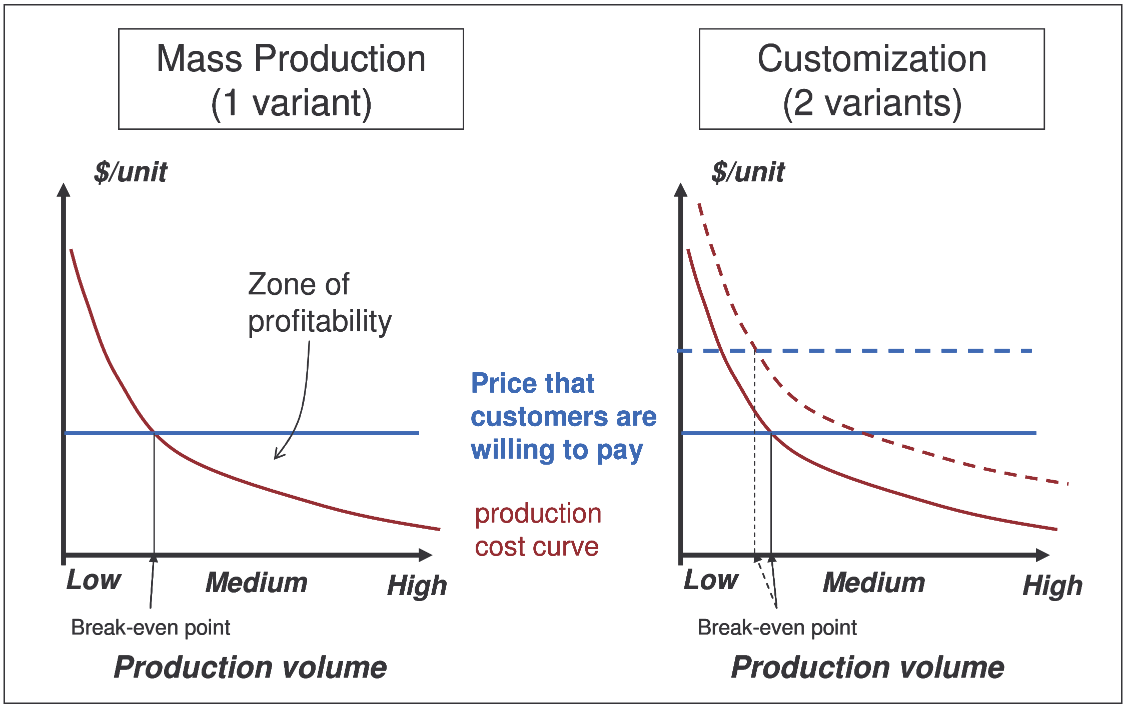


Figure 1-4 : Economics of production

The graph on the left of figure 1-4 highlights the break-even production volume. Beyond this specific volume, manufacturing a product is profitable because the potential revenues are superior to the production costs. The high production volume is sufficient to defray the costs of investment in equipment, tooling, engineering and others. By expanding their scale of production in the long run, the company can clearly exploit cost advantages. The effect of economies of scale[1] is to reduce the long run unit costs of production over a range of output. These lower costs represent an improvement in productive efficiency and can feed through to consumers in lower prices. On the other hand, in low to medium volume production where production quantity can not justify the investment, sellers can

---

[1] By definition economies of scale are the cost advantages due to the fact that the firm's long run average cost curve slopes downward as the scale of the operations expands.

no longer benefit from economies of scale and as such unit costs may significantly escalate. Moreover in low volume production batch sizes are smaller; manufacturing smaller batch sizes means typically more set-ups and changeovers. Ancillary costs are incurred every time a machine is set up or changed over. Some additional costs may also occur due to increased inventories or the use of specific equipments or tooling. Thus customizing a product adds some ancillary costs such as additional set-up expenses, new tools purchasing, etc., so the production curve shifts upward as it is shown on the graph on the right of figure 1-4. In addition the price that customers are willing to pay for the variants goes up because they grant a premium for variety. Consequently the new break-even production volume shifts (see figure 1-4). Since customization implies reducing the production volume, the manufacturers would expect that the break-even volume of the customized product is lower than the one for the standard product. However it is not always the case as it is shown in figure 1-5.

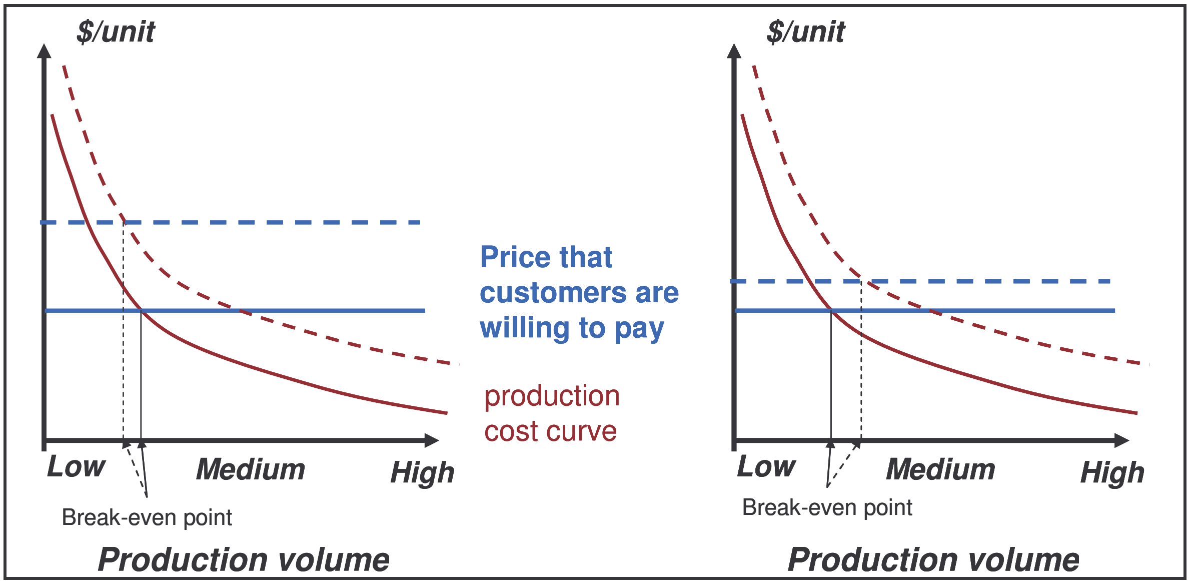


Figure 1-5 : Dilemma with customization - the added value of customer vs. the cost of customization

If the customers think that the variants don't match with their needs, they will not grant so much interest. In the case of the right graph, the premium is not high enough to compensate the increase of the manufacturing cost. The break-even production volume is higher than the one in the case of mass production. The customizable product is no longer profitable at low volume. Finally, these graphs show the importance of comparing customer behavior to the incremental cost of customization.

When managers have to make strategic variety decisions, which affect the number and scope of the variety offered to the customers, they should consider the trade-offs between the benefits and disadvantages of customization. Not all components are customizable, managers can offer variety only if the sales of the variants will increase the company's profits. That means that the managerial decisions should be based on an assessment of whether the additional revenues realized from the introduction of the new variety will be more than the increased cost of providing it. The thesis will focus on the investigation of direct and indirect costs of increased variety. A costing method as described in the previous paragraph can be useful to quickly estimate the costs of introducing or reducing variety. Such a tool will help focus the decision makers on where variety can be added profitably and where it should be avoided.

1.3 Problem statement

As automotive companies look for ways to stay competitive in the global market place, the concept of customization has appeared as a potential advantage. Consequently, a better understanding of the effects of customization decisions on the economics of car manufacturing has high leverage potential. What is needed is a method to help project leaders and engineers manage the incremental costs of providing variety to the market, which is mainly due to the loss of scale economy in design and production. This thesis focuses on issues concerning manufacturing costs of customized products. In particular this is done by developing methodologies to quantify the costs of providing variety and to select products that incur minimum variety costs.

First, a deeper understanding of the level of customization is absolutely necessary. Customization can be carried out with regard to fit, style, and functionality. In the case of car customization, fit is mostly defined by the sizes and the shapes of some components. Style is the option to influence the aesthetic design of the car, i.e. interior and exterior appearance. A car's functionality can be defined by its performance and power. There are different approaches for delivering these types of customization. The simplest type of customization allows the customer to choose options of style (colors, fabrics) on standard products within constraints set by the manufacturer. A more advanced form of customization examines the need of each individual customer, to analyze his/her habits and to use this to make an individual car for each customer. This advanced form of customization can only be accomplished when an order is placed by a customer, for example through internet. Between these two extremes lie a variety of approaches all of which involve matching the choices of the individual to a library of existing options for the car. Until now customization in the auto industry has only been developed to a limited extent. Customers choose a type of car based on performance and power among a wide panel of cars. They then choose some packages to satisfy their style desire. The fit customization is growing fast in the auto industry, but the main issue for the automakers is to determine whether it is profitable or not. Indeed this type of customization will address much more the needs of a specific customer and, thus, there is a possibility to create additional value. However the required changes in the manufacturing process can be complex and costly. With more than 2000 individual components and as many as 300 sub-assemblies that perform integrated functions in the vehicle, the manager should select the number of possible configurations and determine the relevant level of the customization decision. The question of which costs are affected by the decision to customize requires much closer attention. Before making the customization decision the manager should determine based on the degree of customization whether the manufacturing process should be entirely modified to create the customized product, or if the production line can be adjusted to run the standard and customized products. For example a fit customization such as making a larger seat can require additional reinforcements on the seat structure. The customized seat may be manufactured differently; as a result its cost may more closely resemble that of a completely new lower volume component. On the other hand, the manufacturing process of a seat with a leather cover is very similar to the one of a seat with a fabric cover. However the cost analysis should go further, because substituting materials within an existing process can change yield, operating rates, tooling lives, and more. In addition it should be examined if the equipment and tooling can be reused or not. A replacement of the equipment or tooling adds some costs because it imposes additional set-up time on the production line, and because the cost of investment is defrayed on a smaller production volume. Since the variable and fixed costs of the customized product may change significantly, the manager should estimate the incremental cost and compare it to the benefit of customization before critical financial resources are committed.

To help managers, cost modeling approach can be used to estimate the manufacturing cost of a customized product and to analyze its key drivers. The thesis develops first a methodology based on a cost model framework to deal with the customization decisions. The model merges economic analysis and technical solutions used to assess cost in the auto components industry. In addition it takes into consideration the degree of customization and the level of variance by attributing additional or more expansive tools as well as time lost to increase setups. From this methodology numerous analyses can be done and several important questions will be addressed in this work. What is the cost difference between a standard product and one with multiple customized variants? What drives this cost difference? Which costs are affected the most? Is this difference dependent on the process, the geometry of the components or on other factors? The thesis will address these questions and provide insight by looking at different scenarios of customization. The scenarios are meant to represent the different conditions under which a manager has to make critical customization decisions in the auto industry.

1.4 Thesis outline

Chapter 2 of this thesis outlines the methods, which can estimate the cost of increased variety. Section 2.1 is an overview of the existing manufacturing cost methodologies, which determine the cost of a single product given product characteristics. Section 2.2 explains the limitations of the previous methods when estimates for a large number of components have to be considered and proposes the System Cost Modeling (SCM) as an alternative. Section 2.3 incorporates some major developments to the SCM to take into consideration the eventual changes in production when a component is customized.

Chapter 3 explains the framework of the case study, which considers the introduction of new variants in the auto industry. Section 3.1 details the baseline assumptions considered for this particular case. Section 3.2 examines which parts or groups of parts of the car can be considered as customizable and then defines different levels of customization that exist for this specific car. Section 3.3 introduces some customization parameters for every component. First the production volume of the customized component should be determined. Then a degree of tool modification is defined for every component of the customized product. An additional set-up time is also incorporated in the processing time of the customized part. Section 3.4 details the different relationships considered in the model to estimate the tooling and equipment investment of certain manufacturing processes such as stamping, die casting and injection molding.

Chapter 4 includes the results and analyses of the case study. Section 4.1 looks at the cost and cost drivers of the standard product; then compares the results of the standard and customized products; discusses the costs variation when the set of manufacturing assumptions is changing. Section 4.2 provides generalized results of the case study, discusses the problem of customization in the auto industry, and produces some recommendations for the automakers.

Chapter 5 lists the conclusions drawn from this work and details opportunities for extension of this work.

Supplemental data and figures referred to in the remainder of this thesis are found in the various appendices.

2 Model methodology

Understanding the customization decision depends heavily on component cost structures. The OEMs want to offer options to the customers if the premium that the customers are willing to pay is superior to the additional cost to customize. The problem is how to assemble cost information for all the relevant components. For an automobile this could mean thousands of components, for which price information for the standard and customized versions would have to be gathered. Since the customization decision is often taken before production begins, there is little data available about the customized product in a fairly early stage of development. The solution is to model the cost of the components. Indeed it establishes a cost structure for all the components that takes into consideration materials, size, required equipment and tooling, so it would allow changes in relevant variables such as volume or production time. Disciplines as diverse as engineering, operations management, or accounting have attacked this question from different angle. The next two sections present the current status of these costing techniques and analyze their advantages and disadvantages. The last section discusses a specific methodology to address questions of customization.

2.1 Manufacturing cost modeling

The issue of manufacturing cost estimation has long been a source of concern for managers and researchers. Several techniques have been proposed to estimate cost but a lot of them has been criticized [10, 11]. While the initial methods were rather crude and served mainly to provide rough orders of magnitude, the last ones are getting more and more precise in the cost estimation.

2.1.1 Rules of thumb

The best known techniques for evaluating the cost of manufacturing processes are simple rules of thumb. Designers or engineers with experience with the relevant technologies and processes usually develop rules of thumb [12]. They are often based on two of the core cost drivers of any manufacturing activity: materials cost and cycle time. Indeed experience in a particular industry enables experts to accurately predict the materials cost as a share of the total cost, suggests the development of rules that are easy to understand and provides results that are sometimes close to the actual cost of component. Processing time combined with a burden rate can also be used to estimate part costs. However, there are three major problems with the rule of thumb techniques. First, they rely heavily on historical data and previous experience. Therefore they have strong limitations in environments of rapid change in materials, technologies and customer requirements. Second, they assume linear relationships between factors driving cost. Third, these are black-box techniques that do not allow the manager to understand the interplay between the several factors that are driving cost. As a result, relying on rules of thumb to make important technical or managerial decisions can be extremely misleading and costly to the company. A similar method has been developed later, called parametric cost estimation. It provides one or few parameters with which cost estimates can be inter- or extrapolated from known product/cost relationships to estimate the cost of the 'unknown' product. It is simple rules adjusted by a fixed multiplier or other scaling factor ('mark-up'). The downside of this method is its crude level of accuracy; in addition only for items similar in kind costs can be meaningfully estimated.

2.1.2 Activity based costing methodology

Another technique for evaluating the cost of manufacturing processes is the use of current accounting data and practices in the plant. A particularly popular application is activity based costing (ABC). This method attributes direct and overhead costs to products and services on the basis of the underlying activities that generate the costs [13]. It calculates the cost of activities that serve as cost drivers and 'charge' products with the time with which they consume an activity times the use rate per time unit. However ABC has been of limited help to engineers and designers concerned with changing the manufacturing lines or choosing between alternative materials. The reason for this situation is that ABC is based on historical and descriptive information, and seldom incorporates any engineering control variables. Therefore it hampers the possibility to establish predictions for new manufacturing systems, materials or part characteristics.

2.1.3 Technical cost modeling methodology

The major problems with the previous techniques are that they offer very limited power for estimating the effects of departures from observed conditions in manufacturing cost. These limitations led to the development of the Technical Cost Modeling (TCM) methodology at the Massachusetts Institute of Technology [12, 14]. TCM is related to the activity based costing idea of accounting principles, but uses engineering, technical and economic characteristics associated with each manufacturing activity to evaluate its cost. The model serves as a mathematical transformation, mapping a description of a process and its processing conditions to measures of cost. The technical cost model is a representation of production processes. Its analysis starts with an identification of the relevant process steps required to manufacture a particular component, and then it is constructed through three steps: (i) identifying relevant cost elements, (ii) establishing contributing factors, and (iii) correlating process operations to cost of factor use [14].

The relevance of any particular cost element is a function of the process under consideration. The set of inputs can be broken into four main categories: exogenous, plant, part and process specific variables. The exogenous variables basically characterize the enterprise's interaction with its environment in a quantitative manner, such as financial data (e.g. the rate of return). Plant data relates to information that is not specific to any part or process but to the organization as a whole. Working hours, downtimes and workers per category are some examples of plant wide data. These two groups of variables are thus plant and part generic, that is, are independent of the product and process under analysis. The product variables define the characteristics of the part, namely, its geometry, weight, the raw materials and their cost. The remaining inputs, that are the process inputs, require a great understanding of the engineering and physical principles underlying the technologies, which when coupled with expertise in process implementation, permits an estimation of the number of workers, times, equipment characteristics and costs, lot sizes, space occupied, etc. Example of process inputs are reject rate, power requirement.

Once the inputs have been defined, the details of the manufacturing process can be mapped to their contributing factors [14]. For example for the die casting process, the molding tool and the molding cycle time can be identified as elements whose requirements would change with design parameters, and could be predicted based on the initial parameters describing the part. Cycle times affect the number of parallel streams necessary to achieve a specified production volume, and are related to part design and process operating conditions. This mapping to design parameters is achieved one of two ways; either based on existing empirical evidence or according to basic scientific and engineering principles. Then a predetermined functional form is assumed and the dependent variables are regressed on the relevant independent ones. Regressions can be linear or can use mathematical transformation to produce linearized forms of non-linear relationships. For example in the die casting process, the solidification time can be expressed by Chvorinov's rule: [15]

$$Solidification\ time = Cte \cdot \left(\frac{Volume}{Surface\ Area} \right)^2$$

where

Cte = constant based upon mold material properties, solidification temperature, and pouring temperature.

Volume = casting volume.

Surface Area = casting cooling surface area.

Since it is difficult to obtain accurately such data for every part of the complex system, this solidification time can be estimated by regression analysis. The experts can observe different times for several components; with this information they can then estimate a relationship between this time and part volume, part thickness, material density, thermal conductivity, and coefficient of thermal expansion. As we see in this example, it requires not only material property information, but also a reasonable description of the cast part's geometry.

The third step in creating a technical cost model is translating the process factors into costs. The total cost of each unit operation is broken down into separately calculated elements: the variable and fixed costs. The variable costs can be directly associated with the production of one unit of output, thus increasing roughly linearly with the production volume. On the contrary, fixed costs remain constant until production capacity is reached, whereupon more equipment is required. These categories are then subdivided into variable costs of material, direct labor, and energy; and the capital costs of main and auxiliary equipment, tooling, building, maintenance and overhead.

- Variable costs

The material cost category includes the primary or raw material required for a part as well as any process consumables. The type of material, the amount of scrap and the value of scrap are all important factors in determining material cost. Labor cost includes only the direct labor required for part fabrication. The fully burdened (including benefits) wage, amount of planned and unplanned downtime, and number of labors needed are some of the factors that affect labor costs. The indirect labor is captured in the overhead cost category. Energy costs include the cost of running machinery as well as any additional heating or other energy related input.

- Fixed costs

Main machine cost includes the cost of the primary machinery used for the fabrication of a part as well as the installation cost of the machinery; installation cost is usually estimated as a percentage of the machine cost. To calculate the machine cost, the investment required in main machines is first determined from the attributes needed to produce the component. Once the investment is determined a method is needed for allocating those costs among the numerous products that may be produced on this equipment over its lifetime. First the investment is amortized over its useful life in order to obtain an equivalent yearly cost, because it would not make sense to charge the entire investment to just the first year or years of production. Next, a decision has to be made about how to spread that yearly cost among the numerous products which could be made on that same equipment each year. In the case of dedicated manufacturing, the cost is then the cost of one year of machine use. For non-dedicated manufacturing, the cost is the percentage of yearly machine capacity used times the cost of one year of machine use. Whether or not a machine is dedicated, cycle time, part size, and manufacturing technology all contribute to the unit cost associated with the main machine. Tooling cost includes the cost of dedicated tools required for the manufacturing process. Tooling cost is usually amortized over the life of the product to arrive at an annualized tool cost. This can then be distributed among the part production volume to arrive at a unit tool cost. Product size, complexity, tool material, and any required tool action (such as release springs or pins) can affect tooling cost. Overhead costs include managerial labor as well as other support services. Overhead costs are often estimated as proportional to yearly machine, tooling and building costs. In some cases, the overhead labor costs can be estimated as a number of indirect workers needed to support the functions of the direct workers. Building cost is the cost of the fully built up factory space that the manufacturing operations occupy. The investment in building space is amortized over the life of a building resulting in an annual building cost equivalent. In the case of dedicated manufacturing the building cost is the yearly cost. For non-dedicated manufacturing, the cost is a percentage of the building space used times the yearly cost. Auxiliary equipment costs are the costs of equipment that is required to produce the part, but is often not part of the investment quoted for the main piece of equipment. These costs would include things like conveyance systems, lockout equipment, computers and controllers. Auxiliary costs are often estimated as proportional to main machine cost. Finally, maintenance cost is the cost of upkeep on machines, tools, and auxiliary equipment. Maintenance cost usually scales with the yearly cost of machines, tools, and equipment.

Most applications of TCM have been limited to comparisons involving limited number of parts in one or more competing individual processes to understand the economic implications of changes in process or in critical design parameters (e.g. material, production volume, factor condition). For example the United States council for automotive research (USCAR) developed a set of Technical Cost Models that are capable of assessing the manufacturing cost associated with the sand casting and die casting of various engine components in both aluminum and magnesium materials [16]. The importance of the model is not in producing an accurate manufacturing cost, but in examining how changes impact cost. Examples of changes that can be made are production volume, equipment type or material selection. A variety of gradual changes can be examined across many aspects of the production process.

2.2 Cost modeling of complex systems

2.2.1 The limitations of the Technical Cost Modeling methodology

The large majority of today's products are the result of a complex combination of parts that require numerous operations in their manufacturing as well as substantial assembly effort. The seat of an automobile, for example, may require 40 different individual parts and more than 10 different processes. If a manager wants to estimate the manufacturing cost of a seat using the TCM approach, he would need to use a combination of a significant number of different Technical Cost Models. For each of them, part and processing information has to be gathered and processed. Because of the high level of details associated with TCM, combining a large number of TCM will require large amounts of information. For the seat example, given that an average model requires the introduction of 25 descriptive variables, more than 10,000 variables would have to be accounted for. For a manufacturing firm, a high level of detail in cost estimation can be very important for rigorous competitive assessment, particularly at the manufacturing stage [10]. If this is the case, companies assemble large teams of engineers and can hire people devoted to estimating the cost of each individual part. However this operation is time consuming, and entering and manipulating large number of variables is very prone to errors. For the overall assessment of a system in early stages of development, or to investigate the generic impact of changes in factor conditions, such a level of detail is not desirable and sometimes even not possible to achieve. Therefore it is important to develop other less data intensive methods to estimate costs at the early design stage.

2.2.2 The system cost modeling

The TCM methodology is useful when comparing designs or materials solutions for individual or small groups of components. It becomes less practical and sometimes infeasible when trying to model several hundred components. To solve that problem a method has been developed which simplifies the traditional technical cost modeling techniques and uses a limited number of inputs [10]. This method, called the System Cost Model (SCM), "aims at establishing a systematic way to estimate cost functions for complex systems, such as the interior or the chassis of a car, where multiple processes and diverse components are present" [10]. The level of data is reduced but cost estimates are also less precise.

SCM is one modeling structure using different production data for a large number of processes and components. In a similar way as the TCM methodology, SCM breaks down the total manufacturing cost of each components of the system into fixed and variable costs; and then the cost estimations over individual components are aggregated. SCM estimates each of cost factors and process use time with limited information and using simple rules. To limit the number of inputs, the inputs chosen should be used as common inputs to all process models. These inputs might include one to represent the size, because the size is a major factor needed to determine the characteristics of the required processing equipment and tooling. There are many possible proxies for the size of the component: mass, volume or surface area. The choice of this proxy depends heavily of the characteristics of the process. For example in the die casting process the machine characteristics are mainly determined by the projected area, because the die casting press is chosen according to the range of clamping force that it could provide, and the clamping force requirement can be estimated as a function of the part projected area. However for all the joining processes such as adhesive bonding, the most relevant input is the length of the joints. The ideal alternative is to work off one variable that reflects the part size but that in some processes this is best represented by mass and in other processes by volume. Sometimes the surface area might be even more appropriate.

Another input might include one to represent part complexity. Since detailed information regarding shape, thickness, number of holes etc. might be essential to calculate the equipment or tooling characteristics, a complexity factor can be introduced to substitute this information. It would be estimated by judgment. The lowest level would correspond to simple components; higher levels of complexity would imply more details or additional features that require more complex (and therefore more expensive) equipment. Inputs to indicate which processes and which materials are used should be included. Indeed the material information is critical to estimate the material cost, which is often a significant portion of the total. These simplified inputs could be used directly to determine equipment cost, tooling cost, labor usage, cycle time and material needed for the relevant manufacturing of a component. Then following the TCM logic, the costs are derived from these core estimates.

Unlike TCM that uses detailed component characteristics together with engineering and statistical relationships to determine cost, SCM establishes a direct relationship between the inputs described in the previous paragraph and the cost drivers. In order to simplify the calculations, it is convenient to come up with a uniform modeling scheme that applies across products and processes, thus a similar relationship might be chosen for all the processes. For example for the equipment cost, several authors on the area of cost estimation [12, 17, 18] show that a logarithmic relationships between weight and equipment cost seems to hold in a number of other circumstances. Since this type of behavior is observed for diverse technologies, they suggest a generic choice:

$$Cost \quad = A \cdot (Weight)^{b} \cdot (Complexity)^{c}$$

where the relevant parameters A, b, c have to be estimated. The initial estimate of these coefficients is based on a three-point estimation [10], which is basically a regression from three specific points for every process. Once these three specific points are determined, the three parameters A, b and c are solved by a system of equations. The detailed calculations can be found in the appendix A.

Generally speaking, tool costs are difficult to estimate because they are designed as a unique item for each part. Statistical regression models have been shown to yield reasonably good estimates in some case [12, 17]. However, like many other aspects of previous TCMs the inputs to the regression equations varied widely by process. For SCM, regressions using a limited number of common inputs had to be developed for all processes. Since full regression models for each process would require a great deal of data, the first approach has been to apply the logarithmic relationship for all processes to estimate the equipment investment, tooling investment, cycle time and the number of workers. However, a comparison of the die investment of various stamped components estimated by the system cost model and the real investment occurred by General Motors to manufacture these components show that the percentage of errors can be significant for complex parts. Figure 2-1 indicates that the investment versus complexity relationship does not hold very well at complex level 3. Sometimes the error percentage can reach up to 70%. Since this model is used for managerial decisions, it is important to get more accuracy in the relationships and to decrease the percentage error, especially for the complex parts. The solution would be to develop mathematical models for every process and every intermediate variable (equipment investment, tooling investment, cycle time and the number of workers). As explained in the next section, some major developments have been considered on the current SCM to capture more details of the cost of the components.

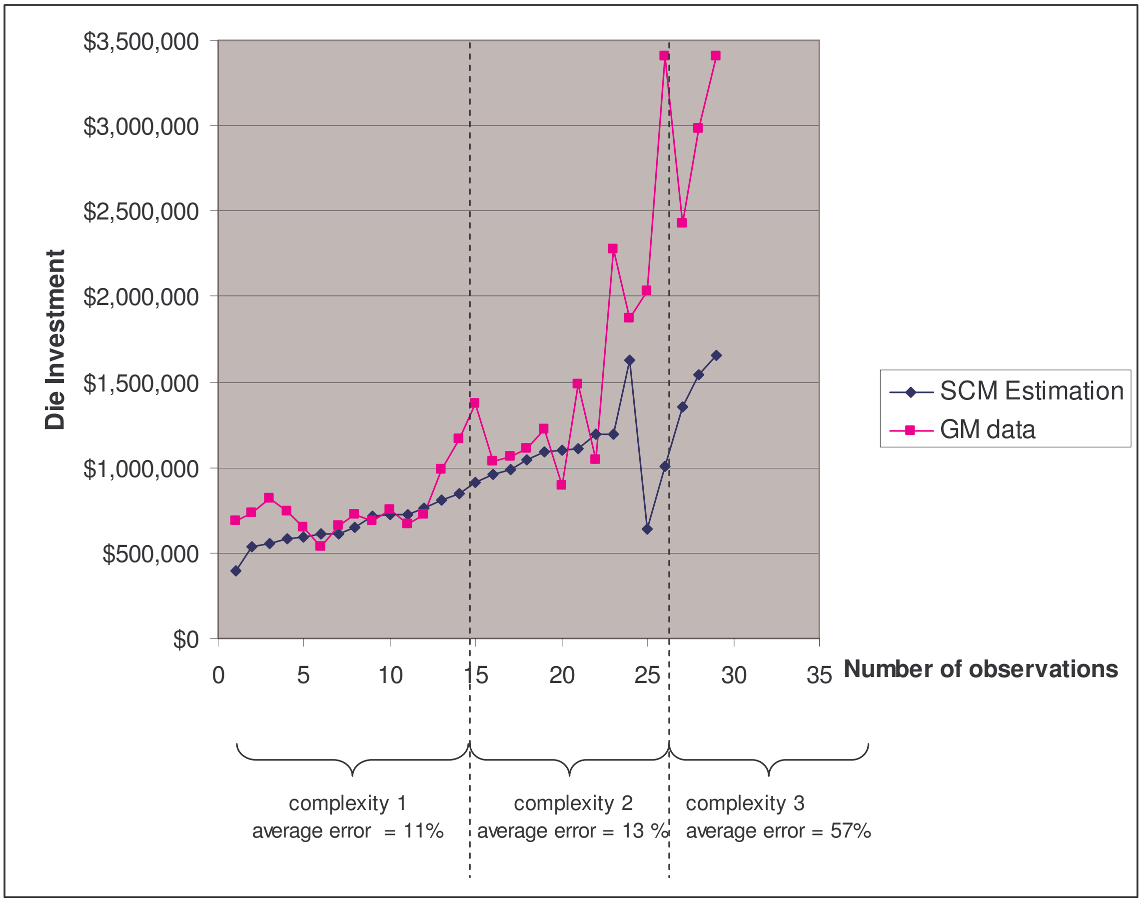


Figure 2-1 : Comparison between the die investment estimated by SCM and the real investment occurred by General Motors

2.3 Extension of the SCM for customization decisions

SCM is a methodology developed to evaluate the cost of complex systems with a large number of individual components and subsystems. This approach involves critical simplifications from traditional technical modeling techniques. Thus it provides only reliable calculations of the overall system costs. The goal of this thesis is to modify and apply this model to be able to make customization decisions, either on a large group of components such as a seat or at the component level such as the front brake or the accelerator pedal. Consequently, the model should be able to generate accurate cost estimates on the component level as well as on the subsystem level. To accomplish this, an extension of the SCM with a focus on getting more accurate individual component cost estimates was required. Furthermore, specific parameters to be able to address customization decisions had to be added.

The first section focuses on the modification of the relationships to get more accuracy in the intermediate variables. It reconsiders the way to estimate the reject rate, the trim scrap rate and the energy cost. The last section incorporates some additional parameters to be able to estimate the cost of increased variety.

2.3.1 Limitations of the SCM

The existing SCM needed further development to improve calculations related to the reject rate, the trim scrap rate and the energy costs. In the technical cost model approach, the reject rate and the trim scrap rate are considered as fixed. Each is provided as a single input with the same value applied to all processes. These rates are not only dependent on the process characteristics, but also on part characteristics. That means that to be realistic, a reject and trim scrap rate should be attributed to each component in the system cost model and thus the model would need thousands of additional inputs. The solution considered in the thesis was to set up a means for directly estimating trim scrap and reject rate based on part characteristics and the process. Building on the methods employed throughout the SCM, a three point logarithmic relationship was used. This avoided the need for extensive statistical data, while preserving a structure that could later incorporate statistical data to improve the accuracy once data becomes available. With this information, an estimation of the scrap rate can be done for every component of the complex systems manufactured by a specific process. The reject rate has been estimated by a similar method.

In the technical cost model approach, energy costs are calculated from different inputs, such as power requirement of the equipment, electricity price. While the electricity price can be a general input for the system cost model, attributing a power requirement for all the thousands of components is unrealistic since it would require a very large increase in the number of inputs. To overcome this difficulty while keeping the accuracy of the component manufacturing cost, energy requirements are calculated for each component based on its manufacturing process. To do this, energy cost calculations have been divided into three categories, corresponding to the possible energy sources characteristics: mechanical, electrical or thermal energy. The mechanical energy can be provided through relative motions, or pressure differences, or mass forces generated in the component. The electrical energy can be provided by a discharge between two electrodes, electromagnetic fields or simply by using electrical machine. And the thermal energy is related to the heat required for melting, evaporation, etc. Since a large amount of the energy may be lost during production, energy losses are also taken into account.

Each of these categories can then be estimated using physical relationships and engineering rules of thumb. Mechanical and electrical energy costs have been estimated as a percentage of the equipment cost. This simple approach provides reasonable cost estimates without the need for more complex model inputs. However, a more detailed approach based on the actual energy requirements of the part would yield additional refinements to the cost estimates. However, for the cost of thermal energy, this approach is rather inaccurate. Thermal energy requirements are more likely to scale with the type of material and its thermal properties rather than the equipment used. Therefore a more detailed treatment of the costs associated with thermal energy was required. First, the energy required to raise the temperature of the component from the ambient temperature to its processing temperature is determined. By definition the heat necessary to raise the temperature by ΔT is:

$$Heat \quad necessary = m \cdot C \cdot \Delta T = m \cdot C \cdot \left(T_{processing} - T_{ambient}\right)$$

Where m = mass of the component

C = specific heat (the amount of heat energy required to raise 1 g of a substance by 1° Celsius)

Then any heat losses through the tooling or equipment are calculated in order to determine the total thermal energy needed. This extra consideration was important to include because heat losses are often a significant portion of the total energy requirement. For example the heat losses in industrial heating processes are considered to be around

50% of the available energy [19]. Waste-gas heat losses are unavoidable in the operation of all fuel-fired furnaces, kilns, boilers, ovens, and dryers. Air and fuel are mixed and burned to generate heat, and a portion of this heat is transferred to the heating device and its load. These furnace losses include: (see Figure 2-2)

- Heat storage in the furnace structure.
- Losses from the furnace outside walls or structure.
- Heat transported out of the furnace by the load conveyors, fixtures, trays.
- Radiation losses from openings, hot exposed parts.
- Heat carried by the cold air infiltration into the furnace.
- Heat carried by the excess air used in the burners.

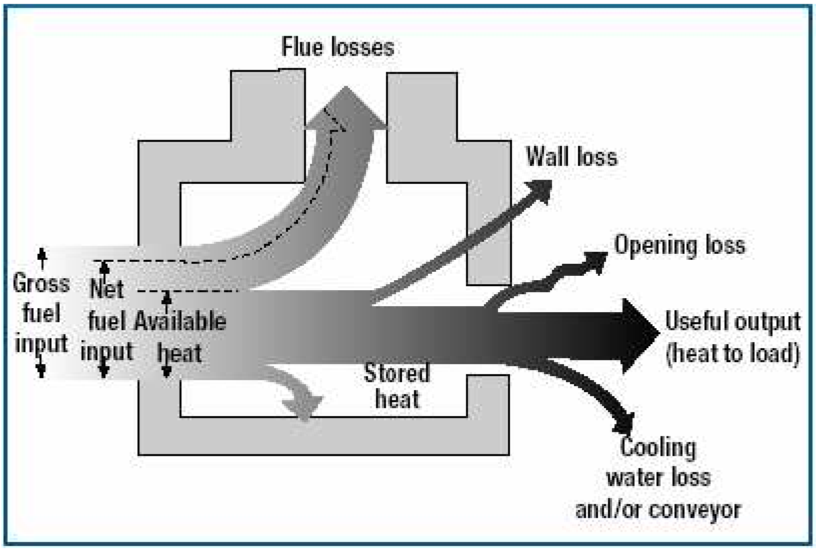


Figure 2-2 : Heat losses in industrial heating processes

The greatest source of heat loss in the process is the material handling losses and wall losses. However the material handling losses are not easy to estimate, because it is dependent of a large number of inputs such as the opening of the furnace, the time of load and transfer. It could be represented as a percentage of the heat loss. On the other hand, the wall losses are easy to estimate quantitatively:

$$Heat \quad losss \quad per \quad unit \quad area = k \cdot \frac{\Delta T}{\Delta x}$$

Where k = thermal conductivity of the structure.

$\Delta T/\Delta x$ = gradient of temperature inside the wall of the structure.

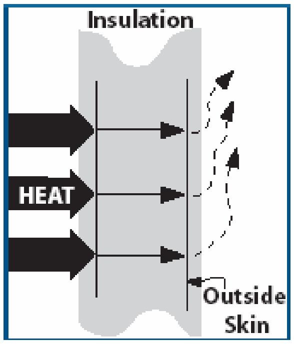


Figure 2-3 : Wall losses through a furnace

To conclude, the updated SCM develops certain relationships for the reject rate, trim scrap rate and energy cost. These relationships and the underlying assumptions remain a rough estimation and need further analysis.

2.3.2 Incorporation of customization parameters

Generally, when a product manager wants to determine if it is profitable to have more variety within the future or current product line, he looks at the direct costs of increased variety. Will it require more capital equipment or more space to have more product extensions? How many additional hours will it require to make the customized product? Will any tools have to be added? In order to answer these questions, some customization parameters needed to be incorporate in the updated system cost model.

First it is necessary to introduce a variable for the number of variants and their associated production volume. Incorporating customized product in a product line implies some modifications into the parameters of the product line. Because the construction of any production line is a large investment, the manufacturers prefer to reconfigure the current production lines to handle multiple variants of new product designs. But even if possible, a reconfigurable production line is not without costs. Additional equipment set ups are needed to switch between product variants. Furthermore changes are required to the equipment and tools resulting in modified (and usually increased) costs. The annual equipment is the same for any customized and standard product, but the relative time during which the capital is used for the relevant product is different for the two products.

The process time use is defined as the ratio between the line utilization time, which corresponds to the amount of time needed to manufacture the required volume of components and line available time that indicates the amount of time that the manufacturing equipment is available for the operation. Since the latter indicator is the result of company operating policies, including number of shifts, holidays, and planned line down time, it is the same value for the customized and standard products. However the line utilization time will be lower for the customized product than the standard product. Thus the model should consider separately the process time use, the cycle time, the equipment and tooling cost of the customized and standard product.

It is also important to take into consideration some variations in the initial inputs due to customization. Indeed the customized products may require different material requirements, different or modified equipment or tooling investment. For example, a change in the size of the stamped seat rack can imply a change in the tandem press, if the required tonnage to manufacture this new seat rack is higher. The first reason is that the calculation of the required tonnage is a function not only of the mechanical strength of the material, but also of the part forming area. The second reason is that each tandem press should be chosen according to a range of tonnage. Consequently, the equipment cost has to be determined both for the customized and standard product. While this is often the case, we have only considered limited changes in the customized product and therefore have not needed to consider possible use of alternate equipment in our case study described in chapter 3.

In a similar way, customized products may require additional tooling investment or modified tooling investment. For example, if the size of the customized product, manufactured by a die casting process, increases, the OEM should have a completely new mold. In general each customized part has to be analyzed individually to decide on the degree of tooling alteration required. While customized products may have substantially different costs, we have considered the variants to be very similar. As a result the only changes considered are the tool investment and the increased set-up times. The increased number of set-ups will lead to longer equipment and labor times thus affecting those cost elements as well.

To conclude, several costing approaches have been developed in this chapter from the first rules of thumb to the technical cost model. The development of these successive models has been pushed by being more and more accurate in the cost estimation. The system cost model relies on a more simplified engineering approach, implying less accuracy. The updated model developed in this thesis aims at being used for the customization decision, thus it seeks for a better accuracy in the component cost estimation through the identification of new parameters or modification of old ones. All these development are essential to further analyze the cost of customization associated to some components or groups of components of a car, as it is reported in the next chapter.

3 Case study definition: customization of an automotive

The usefulness of SCM can be more clearly show through its application of a case study. This case study would focus on the estimation of the manufacturing cost of a complex system and then the estimation of the customization cost. In this chapter the case study explores the model in the context of the automotive industry. With more than 2000 individual components and as many as 200 sub-assemblies, the car is a clear example of a product for which it becomes extremely complex to have detailed cost estimations for all the components. The car analyzed in the case study is a mid-size car manufactured by a major European manufacturer, Volkswagen, produced in 1999. The structure of this Volkswagen car is described in Table 3-1. The structure has been subdivided in different levels. Following a typical division found among OEMs, eight major groups are considered: powertrain, chassis, Heat Ventilation and Air Conditioning (HVAC), interior, body, exterior and electronics. They enable a good understanding of the relative importance of major areas of the car. The secondary level reflects typical sourcing decisions for automakers for supplying sub-assemblies. Table 3-1 describes how the total number of individual components is distributed over these two levels.

Groups	Number of sub-Assemblies	Number of components
Powertrain	40	434
Chassis	51	387
HVAC	14	173
Interior	39	433
Body	22	129
Exterior	31	109
Electronics and control	27	452
TOTAL	**224**	**2117**

Table 3-1: Example of car structure (Mid-size car, Volkswagen, 1999)

For each of the components, the weight (as a proxy of the part size), material, complexity and process information has been gathered. In some cases up to three manufacturing processes per component have been considered. For example, the alternator housing, which is made out of aluminum, needs first to be die cast and then machined. An important caveat is that the component breakdown used in the case study does not consider body-in-white (BIW) at the level of individual components. It also does not consider the cost of painting the BIW (although the cost of painting for non-body components is considered) nor the cost of engine dressing or the final or general assembly line by the automaker. It only includes the cost of producing the individual components and assembling them into modules or subassemblies. However it will be substituted by a fixed amount of $1,500 in the case study.

The first section of this chapter explains the baseline assumptions considered for the study of the customized car described above. The second section examines the different levels of customization existing for this car. Finally the last section describes the detailed relationships considered in the model for certain processes: stamping, die casting and injection molding.

3.1 Baseline assumptions

The calculation of the manufacturing costs associated with the components and sub-levels in the car rely on a set of baseline assumptions, described in Table 3-2. Production volume and number of years in production are instrumental in defining the type of vehicle and its useful life. These replicate what is typically found for high volume vehicles in Europe or US. The equipment life of 10 years corresponds to what equipment manufactures and parts suppliers usually report on average, although these can vary with process. For the remaining set of variables, values are based on operating conditions found in the automotive sector in the US and Europe. These values reflect direct information gathered from interviews with firms, or values in published resources. Most of the base information was obtained by Veloso, Henry et al. [20] to assess the competitiveness of the Portuguese auto parts industry. The number of days of operation per year is estimated at 240 days. It assumes no work on weekends and two weeks of line down for personnel holidays. Two shifts correspond to having 16 hours of operations per day. The remaining time is reserved for tasks such as maintenance and line problems. The line available time of 87.5% corresponds to having 2 hours of additional line downtime, both for planned activities and unplanned breakdowns, during the 16 hours of daily operations. Free capacity utilization indicates how the remaining available production time which is not needed for a specific component is used. A value of 100% indicates that all remaining time is used to produce other components, while a value of 0% indicates that the line sits completely idle the remainder of the time. The baseline assumption is that all free capacity is used.

Annual production volume	200,000 parts/year
Years of production	5 years
Life of equipment	10 years
Interest rate	12%
Wage ($/hour including benefits)	$56
Days per Year	240 days/year
Number of shifts	2
Line available time (Uptime)	87.5%
Free capacity utilization	100%

Table 3-2 : Baseline assumptions of the case study

As it has been mentioned in section 2-3-2, the energy is divided into three categories. The first one is the mechanical energy, which represents 3% of the equipment investment in the baseline assumption. The electrical energy represents 30% of the equipment investment. The thermal energy is considered for the case study as the energy required for melting the component in a typical furnace, whose dimensions are 4 feet by 4 feet by 6 feet, and whose thermal conductivity is the same as a refractory material.

Finally these are the baseline assumptions to manufacture a car in the US or Europe. The two other sections incorporate some additional inputs, which are related to the customization process.

3.2 The levels of customization

The word “customization” is becoming popular for several industries, particularly the automotive industry. However it is difficult to define the customization concept. One first visionary definition of customization can be the ability to provide your customers with anything they want, any time they want it, anywhere they want it, any way they want it and to do this while still remaining profitable. This is quite a goal, but in fact until now one which can rarely be achieved. A practical definition for the car manufacturer is the ability to efficiently deliver many variations of a standard product, each customized to the expressed preferences of the buyer. The products referred to in this second definition are not the “anything-at-any-time” promised by the visionary definition; rather, they are customized within a predetermined envelope of variety. The goal is to ascertain, from the customer’s perspective, the range within which a given product can be meaningfully customized for that customer, and then to facilitate the customer’s choice of options from within that range. In the car industry one problem of customization is to determine at which level the car manufacturer should offer the variety. Indeed if the manufacturer attempts to offer variety at the component level, the number of possible configurations increases dramatically. For example the front seat consists of six sub-assemblies: the buckle assembly, the cushions, the covers, the frames, the armrest and the headrest. In total that means about 30 components. If the manufacturer offers two versions (one standard and one customized version) for all the 30 components to the customers, that corresponds to 2^{30} possible seat types, that means more than one million of combinations. The number of combinations is higher if the manufacturer offers more versions for each component. This number becomes enormous if this method is applied to a large complex system such as a car composed with more than 2000 components. In reality the customers don’t ask for so many choices at the component level, but they have specific needs at a different level. For example if they seek the maximum comfort in their seat, they can ask for a specific seat width, depth, or angle, or a customized backrest, whose dimension are larger or taller than the standard seat, which only fits for an average individual profile. Since a change in a seat width, for example a larger seat, implies modifications in some dimensions of the seat rack, the seat back rack, the cover and also the cushion, it is clear that the level of individual components is not the relevant level of analysis for a customized seat. The customer will not ask to change the size of the cushion, but most probably the size of the frame; however there is a strong correlation between the cushion and the frame. That is why all the components of the seat belong to the same group of customization. On the other hand, customers may want variety at the component level such as for the fender liner or the brake pedal. The question of customization level is specific for each component or group of components. Thus, in the case study the individual components have been all analyzed and aggregated at a customization level. The criteria for the determination of the customization level were the following:

- Can the cost model be used to address the customization by a variation of the components inputs? For example, if the customized product requires a variation in the size, material or the complexity, it can be address in the updated SCM. However, customization that requires other types of variation such as a change in the motor oil are not addressed by the SCM and therefore cannot be included in this study.

- Is there an interest in customization? Neither customers nor designers have much interest in customized versions of all vehicle components.

Figure 3-1 shows an example of some components considered for customization of the chassis group (the levels of customization are highlighted in bold). A complete list of all components and their customization level can be found in Appendix B. In the case study the customization of the engine is not considered. While consumers might like to choose engine variants, it was beyond the scope of the SCM to consider the impact of these variants on production costs. The same is true for the air-conditioning system. On the other hand, in the chassis group, several sub-groups can be customized such as the front brake, the rear brake, the accelerator pedal, the clutch pedal, the rear suspension, the steering column and the fuel tank. Many components in the interior group are also easily customizable; all the sub-groups can be customized except the air bag system. In the exterior group we consider that the following groups are customizable: exterior rear view mirror, seal, front bumper, rear bumper, radiator grill, and spoiler. Table 3-3 described how the total number of customizable groups is distributed over the eight major groups of the car.

Groups	Number of sub-Assemblies	Number of customizable groups	Number of components
Powertrain	40	1	434
Chassis	51	14	387
HVAC[2]	14	3	173
Interior	39	35	433
Body	22	3	129
Exterior	31	7	109
Electronics and control	27	2	452
TOTAL	224	65	2117

Table 3-3 : Components, groups of customization and sub-assemblies groups for the Volkswagen car

---

[2] Heating Ventilation and Air Conditioning

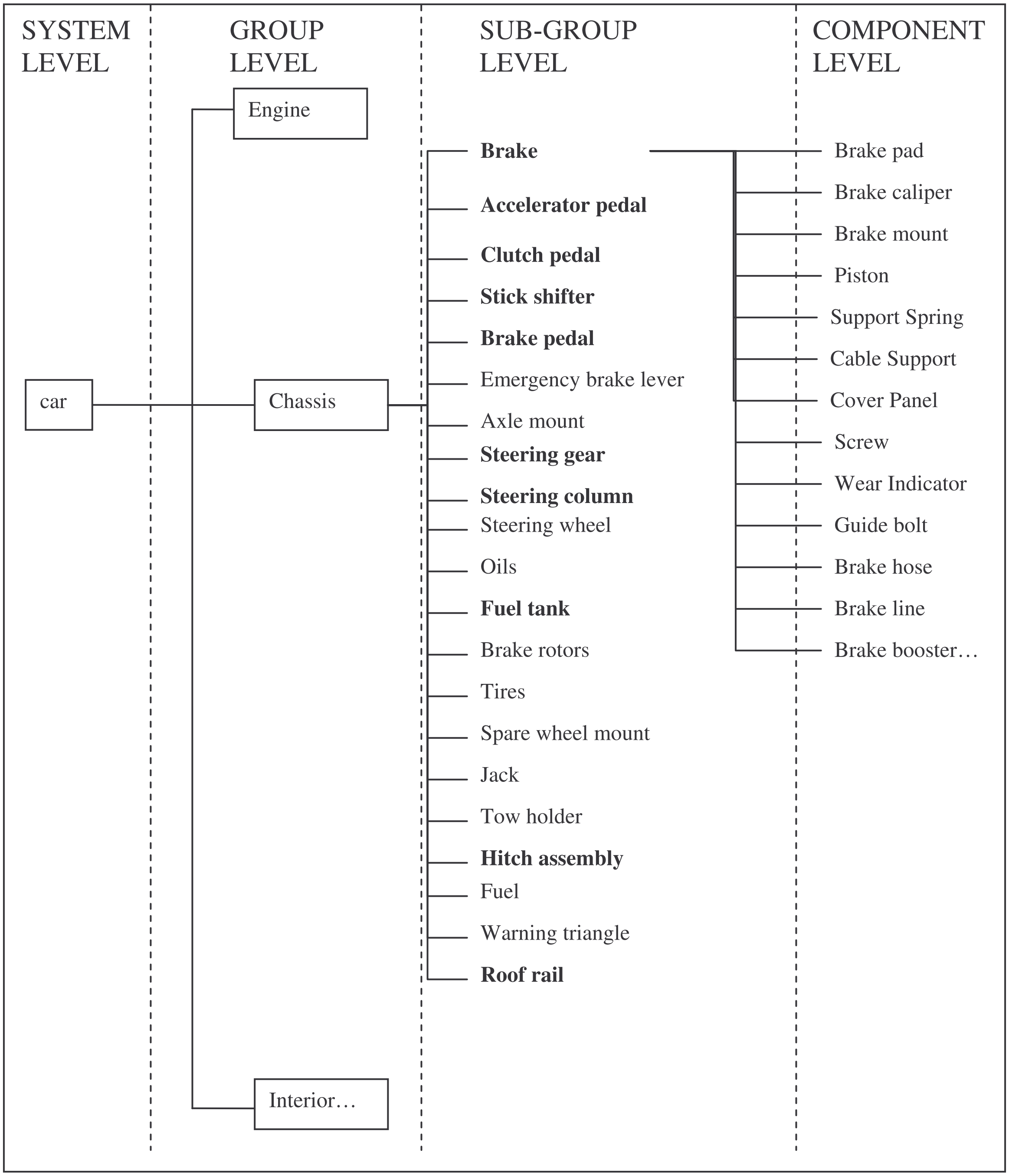


Figure 3-1 : Different levels of customization – Example with the chassis group

3.3 The other customization parameters

As it has been mentioned in chapter 2, there are several parameters which characterize the degree and the type of customization. The subject of the case study is a comparison of production for a single vehicle versus production of that same vehicle plus a customized variant (variants A and B). We assume for the study that the size and materials of the customized components are not changed; only the tooling, the equipment and the line utilization can be modified. The four simple metrics (weight, material, complexity and process) are the same for both the base vehicle and its variant. The total production volume in both cases is 200,000 vehicles per year. However, for the scenario involving a customized variant, the overall production volume of 200,000 is divided into 120,000 vehicles per year for one variant and 80,000 vehicles per year for the other.

As mentioned in the previous chapter, the set up time needed to be adjusted for the customized product. In the case study the production lot size is 5000 parts and thus one changeover is needed for every 5000 parts. For the customized products, two changeovers must be considered for each 5000 parts in order to take into account the need to set up the equipment twice (once for each variant) for each production lot. While the lot sizes were considered to be 5000 parts for all manufacturing processes, the set up time varied by process. Table 3-4 gives an example of the set up time considered for different processes.

Manufacturing processes	Set up time
Sand Casting	0 min
Die Casting	5 min
Forging	10 min
Extrusion	10 min
Stamping	10 min
Hydroforming	20 min
Bending	2 min
Machining	0 min
Molding	10 min
Welding	0 min

Table 3-4 : Set up times for different manufacturing processes

Finally, the case study needed to consider the effect of producing a customized variant on the tooling investment. The tooling investment can be separated into two categories: the design cost and the construction cost. The design cost is common for both the customized and the standard product, whereas the construction cost is specific depending mostly of the degree of tooling change. In the case study the baseline assumption considers that the design costs represents 10% of the total tooling investment. Since this number is estimated, a further sensitivity analysis will be done in the next chapter. While a continuum of tool modifications and their costs exists depending the specifics of the part and the degree of customized desire, only three options were considered in order to simplify the problem. First, the customized product may require no significant tooling changes. In this case the annualized construction tooling cost is exactly the same for standard and customized products. Second, a small modification to the tool is needed. In this case the tool investment was increased by 30%, called the modified tool rate. Finally the customized product requires a completely different tool. Some savings in terms of design cost may still be possible and thus the additional investment needed for the tool for the customized component was considered to be 90% of the cost of the initial tool. Table 3-5 describes the distribution of all the components over these three categories. It is important to notice that in our case study 65% of the cost is completely unaffected, 23% is greatly affected (radical tool change). So the cost of customization will come from only 27% of the total cost of the car.

Categories of components	Customization parameters	Number of components	Cost for the baseline product
No customized components (incl. BIW Manufacturing/Engine Assembly)		1,457	$6,559
Customized components	No tool change	360	$502
	Small tool change	78	$365
	Radical tool change	222	$2,360
TOTAL		2,117	$9,831

Table 3-5: The different categories of customization and tooling modifications

3.4 Modification of the SCM relationships

Improvements in the SCM focused on adjusting the estimated relationships between the simplified inputs and some of the intermediate variables such as the equipment, tooling investment, cycle time and the number of workers. The functional form used in the SCM is not realistic for all the processes. The ideal would be to gather more data from experts and OEM databases and to develop the mathematical models used for SCM cost elements with these new data. This has been done for the major component fabrication processes. The first step was to identify those processes which are most frequently used in component manufacturing. Tables 3-6 and 3-7 give the distribution of the different manufacturing processes for the entire vehicle for the Mid Size Volkswagen produced in 1999:

Table 3-6 : Distribution of the primary processes for the entire vehicle by number of parts

Manufacturing Processes	Percentage of parts
Stamping	37%
Plastic Molding	31%
Casting	4%
Forging	1%
Roll forming	1%
Extrusion	1%
Bending	2%
Other (less than 1%)	23%

Table 3-7 : Distribution of the primary processes for the entire vehicle by weight

Manufacturing Processes	Percentage of weight
Stamping	14%
Plastic Molding	10%
Casting	9%
Forging	40%
Roll forming	1%
Extrusion	2%
Bending	2%
Other (less than 1%)	22%

The tables show that the major manufacturing processes are stamping, plastic molding, die casting and forging. From interviews with General Motors experts [21], data collection from General Motors Laboratories and other resources and from some current TCMs used by General Motors, an analysis has been done to get better relationships for stamping, injection molding and die casting. However to capture more details in the relationships it was necessary to add a few additional inputs about the components, such as its thickness, projected area, or surface area. One idea was to categorize the components per process. The next sections analyze in details these categories and the relationships for the three major processes.

3.4.1 Stamping

Stamping is the process of impressing surface definition and three-dimensional designs onto materials with pressurized tools and dies. The main steps of the operations are blanking and stamping. Stamping can be associated with some major forming operations such as drawing, forming, and restrike. In a standard stamping press, there are four basic components:

- The machine itself, providing the power and the physical structure
- A pair of parallel surfaces that close and open again under power (the "bed", which stays still and the "ram" which moves down and back up)
- A two-part die-set, one part of which is fastened to the bed and the other part to the ram.
- The job-specific punches and dies.

When the ram closes, the punches and dies interact, cutting, bending, etc, and making the desired part. When the ram opens again, the part(s) are removed and new material is moved into place. Figure 3-2 shows a schematic of the typical stamping die.

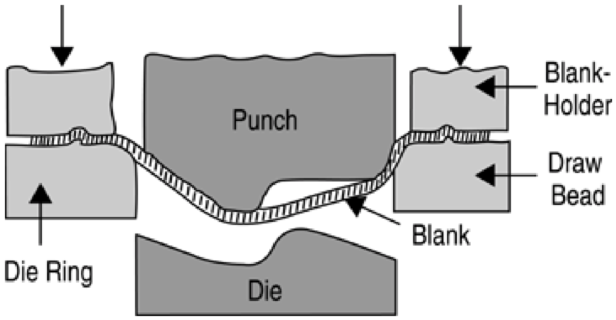


Figure 3-2: A schematic section of a typical stamping die.
The sheet contacts only the punch or the die at any point. Membrane stresses stretch the sheet over the tools.

In this sort of press, the motion supplied by the machine is all vertical. It makes flat parts easily. Stamping can be also used to make some very complex shapes using bends and draws; however this adds to die complexity and cost. The press section is used to make holes and certain other part features. The major factor determining the choice of the press is the tonnage. Every press has a range of tonnage. After gathering data about several stamped parts and their related tonnages, a regression analysis has given the following relationship between the tonnage, the complexity and the area of the part:

$$Estimated \quad tonnage = 27.041 \cdot Surface\ area \cdot \left[0.01 \cdot (complexity + 2)\right]^2$$

$$With \quad Surface\ area = \frac{Weight}{Density \cdot Thickness}$$

Since each new complex feature requires expensive cams, benders or other sub-machines to be built into the job-specific tooling, the tooling cost is heavily dependent of the complexity and surface area of the part. A regression analysis from GM data about stamped parts gave the following relationship:

$$Estimated\ Tooling\ Investment = \$11{,}950 + \$155{,}888 \cdot Complexity + \$612{,}322 \cdot Surface\ Area$$

These relationships are specific to the stamping process. A similar method of regression analysis has been done to find the detailed relationships for the die casting process.

3.4.2 Die casting

Die casting is a process for producing engineered metal parts by forcing molten metal under high pressure into reusable steel molds. These molds, called dies, can be designed to produce complex shapes with a high degree of accuracy and repeatability. The categories of components for the die casting process are described in Table 3-8. On average, the thickness of the parts in the die casting process is 4 millimeters. Some components are thinner, so their thickness is closer to 2 millimeters; the largest components have a thickness about 8 millimeters. The other variable is the ratio between the surface area and the projected area of the part. An average ratio is 3. If the part is more curved, the ratio is bigger and about 5; on the other hand the ratio can be lower and about 1.5.

Ratio = surface area/ projected area	Thickness of the part		
	2 mm	4 mm	8 mm
1.5	Bracket Assembly A/C compressor	Steering column support	Bracket A/C compressor Lower Front
3	Suspension arm	Support ASM	Transfer case
5	Motor cover	Instrument panel beam	Cylinder Mount Bracket

Table 3-8 : Typical components for the die casting process

In the die casting process, molten metal is injected, under pressure, into hardened steel dies, often water cooled. Dies are opened, and castings are ejected. The major factor of the equipment investment is the clamping force, which is dependent of the complexity and the part projected area. After gathering data about several GM parts, the regression gives the following relationship:

$$Estimated\ Equipment\ Investment = \$16{,}755 \cdot (Clamping\ Force)^{0.5615}$$

$$With \quad Estimated\ Clamping\ Force = 7{,}750.02 \cdot \Pr ojected\ Area \cdot (1.5)^{complexity}$$

$$Estimated\ \Pr ojected\ Area = \frac{Surface\ Area}{Ratio} = \frac{Volume}{Thickness \cdot Ratio}$$

The cost of the mold increases as the part geometry becomes more complex. Thus, the tooling investment is a function of complexity and surface area. The following relationship comes from the Technical Cost Model made by IBIS Associates [16]:

$$Estimated Tooling\ Investment = \$13{,}085 \cdot Complexity \cdot (Surface area \cdot Complexity)^{0.294} \cdot Adjust$$

$$With \quad Adjust = \begin{cases} 1 \quad if\ complexity = 1 \\ 1.6 \quad otherwise \end{cases}$$

The last process, where detailed relationships have been estimated is the injection molding process.

3.4.3 Injection molding

Injection molding is a polymer processing method similar to the die casting method for metals. A granular polymer material is fed from a hopper into a screw chamber, where it is heated and melted and then injected under high pressure into the mold or die and allowed to solidify. Examples of the applications of this process include the bumper and head lamp. We can distinguish different categories of components manufactured by the injection molding process, which are summarized in Table 3-9. The average thickness is 2 millimeters, the thinner parts have a thickness around 1millimeter, and whereas the largest molded parts have a thickness around 3 millimeters. The ratio has a range from 1 for the flat parts to 5 for the curved parts.

Ratio = surface area/ projected area	Thickness of the part		
	1 mm	2 mm	3 mm
1	Duct ASM-Air Distribution	Panel ASM-Quarter Upper Trail	Panel ASM-D/Seat Back Cushion Outer FIN
3	Liner ASM-Rear-Wheelhouse Panel	Module ASM HTR& A/C EVPR&BLO	Fascia ASM Front Bumper
5		Pocket Body Side- T-Panel	

Table 3-9 : Typical components for injection molding process

The molding machines are mainly characterized by their clamping force (up to 30 MN). In the updated SCM, the relationships for the equipment and tooling investment come from the ones used in the Technical Cost Model developed at MIT Materials Systems Laboratory [22].

$$Estimated\ Equipment\ Investment = 14{,}829 + 41 \cdot Clamping\ Force$$

$$With \quad Clamping\ Force = \Pr ojected\ Area \cdot \left(1 + \frac{Complexity}{10}\right) \cdot \left(\frac{224}{\sqrt{Thickness}} + 172\right)$$

The mold is the part of the machine that receives the plastic and shapes it appropriately. Its cost is dependent of the projected area, complexity and weight of the part. The formula used in the updated SCM is the one estimated in the TCM used at MIT Materials Systems Laboratory [22].

$$Estimated\ Tooling\ Investment = 220 \cdot Weight \cdot \left(1 + Complexity / 10\right) + 423 \cdot \Pr ojected\ Area + 53{,}800 \cdot Actions + 33{,}900$$

$$We\ assumed\ that \quad Actions = \begin{cases} 1 & if\ complexity = 3 \\ 0 & otherwise \end{cases}$$

These relationships for the injection molding process are similar to the ones for the die casting process.

To conclude, the model has been largely developed for the three major processes used in the car manufacturing: stamping, die casting and injection molding. These developments allowed the cost models to capture some additional details in the calculation of the manufacturing cost to get closer to the real data and the real physical formulas by requiring just a few more inputs for parts. Beyond the four simple metrics used in the SCM (weight, material, process and complexity), an additional input has been added, which is the ratio between the projected and the surface area. Since it is time-consuming to gather this input for thousands of parts, we established different categories of parts, characterized by their thickness and their ratio. Thus, from a quick look of the part, we can estimate in which category the part belong to. This categorization idea has helped to produce more accurate cost estimates. These inputs and the estimated relationships will be used in the next chapter to estimate the cost of customization of the mid-size car from Volkswagen, manufactured in 1999. Then some manufacturing scenarios and analysis will be also done in the next chapter.

4 Results and analysis

This chapter examines first the results of the case study. Then it identifies how the methods and results presented in the thesis can affect the customization decisions in the auto industry.

4.1 Specific results for the case

4.1.1 The cost analysis of the standard product

Given the set of assumptions described in the previous chapter, the cost model is used to estimate the car manufacturing cost for each of the 2117 individual components. These results are then used to generate the total manufacturing costs for the 224 subassemblies, the 61 customizable groups and the 8 vehicle subsystems. The overall results by major subsystems for the baseline product are presented in figure 4-1.

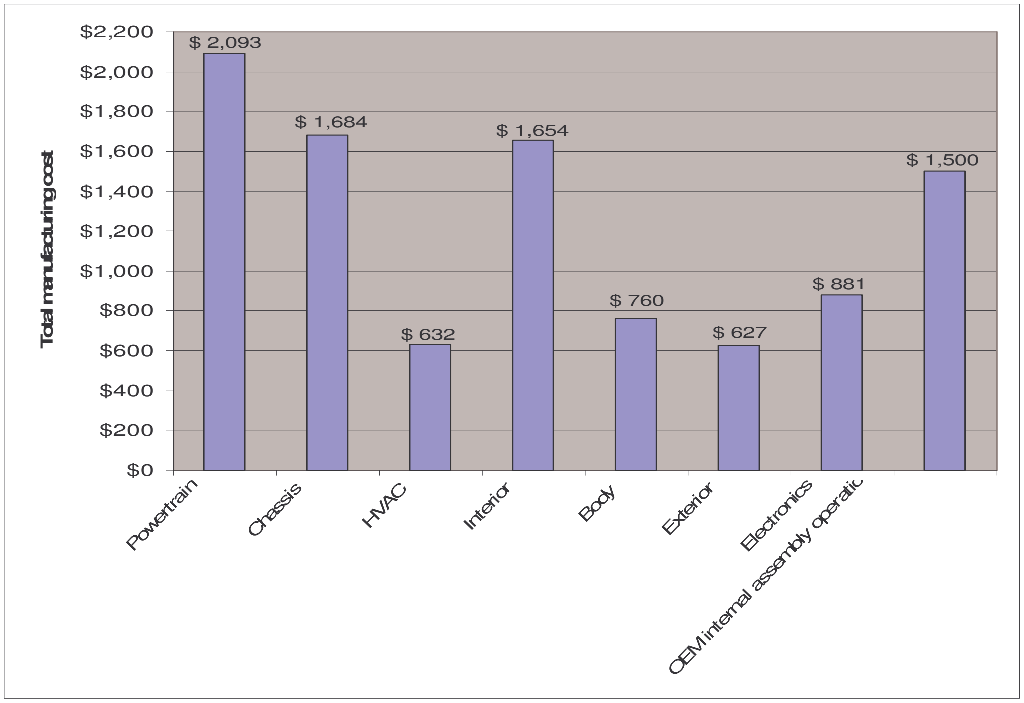


Figure 4-1 : Car manufacturing cost breakdown [3]

---

[3] The cost of OEM internal assembly operations includes the body assembly, paint, engine dressing and final or general assembly lines.

Figures 4-1 and 4-2 show the cost and the distribution (in percentage) of the major subsystems of a car. From these results we see that the powertrain group is the most expensive system of a vehicle, followed by the interior and the chassis. Powertrain represents 22% of the total cost or a total of $2,093 per vehicle. The exterior, HVAC system (Heating Ventilation and Air conditioning) are less expansive, representing 6% of the total cost. The figures also present an estimate of the engine and body assembly work to show the relative importance of OEM manufacturing responsibility against purchased parts, but this category is not modeled in the updated SCM. Instead an industry estimate of $1,500 per vehicle is used for all analyses.

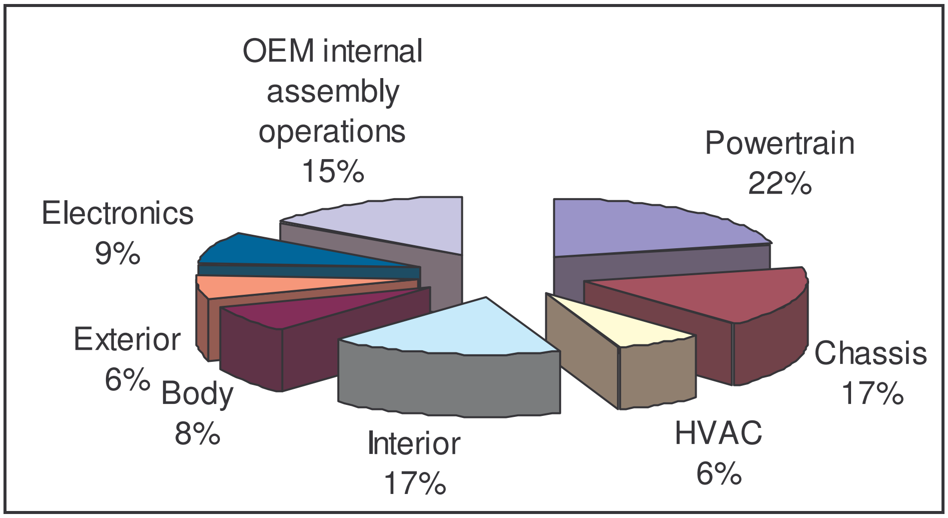


Figure 4-2 : Car manufacturing cost breakdown in percentage

When a manager has to make some decisions about new manufacturing systems, alternative materials or parts characteristics, it is important to understand the interplay between the several factors that are driving cost. The manager should have a tool to understand direct costs closely related to manufacturing process and variations of it affect these costs. Given that the model analyzes each cost driver and adds them up, it is possible to establish predictions about the cost of the system and its variations. This is important especially for customization decisions, because the manager can assess the impact of design, materials or other manufacturing changes on the total cost of the system. Secondly using what-if analyses it is possible to assess the impact of changed input factors on the overall part costs. Figure 4-3 presents the sum of all costs for the baseline product. Tooling costs are the major cost driver with 34% of the total, followed by material costs at 19%. The equipment costs and the labor costs represent 12% and 15% respectively. Tooling is the main cost driver but also the area that is most affected by the decision to customize. Therefore this breakdown shows that customization will likely have a significant effect on cost. In the model, the costs for both the electronic components and the internal OEM assembly operations are included as separate line items. No cost breakdown for these items is possible since they are not modeled. Electronics components are considered as a purchased component and their manufacturing cost is only equal to the material costs. Indeed there is no pre-determined relationship for the tooling or equipment investment of electronics; however it is something which needs definitively further developments. On the other hand the OEM internal assembly operations are also not modeled and counts for $ 1,500. The other cost drivers are all modeled but do not reflect the cost breakdowns for either electronic components or OEM assembly activities.

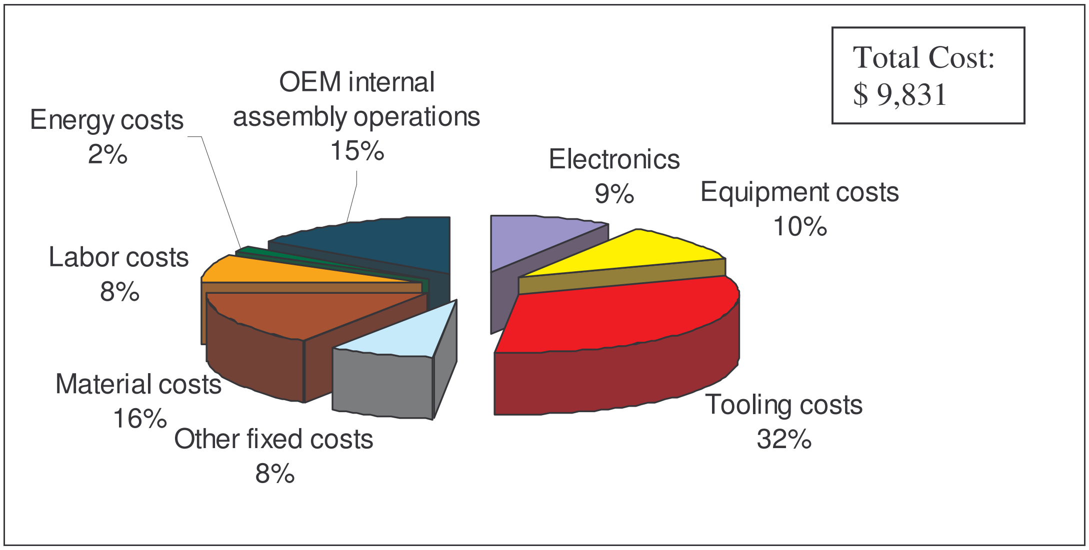


Figure 4-3 : Major cost drivers of the car manufacturing

Tooling costs are the major cost driver with 34% of the total, followed by material costs at 19%. The equipment costs and the labor costs represent 12% and 15% respectively.

As important as these is the share of the cost that is associated with purchased electronics, which corresponds to 9% of the total cost.

4.1.2 Cost model validation

To ensure that conclusions and cost comparisons can be done from the analysis, the cost estimation process for the car system must be sufficiently accurate. For the purposes of validating the results, some quotes provided by an OEM for equivalent components in similar cars (although not exactly the same car) have been found. That validation is shown in figure 4-4. This figure also includes the results from using the SCM prior to the modeling modifications. The range of differences at the subsystem level between the updated model and the external quotes provides a good indication of the validity of the modeling method. The accuracy of the cost estimates by subsystem with the closest match for the HVAC group and the largest cost difference for the powertrain group. One of the main reasons is that there are not enough details in the breakdown of components for the powertrain group. For example the crankcase is considered as a simple component, whose weight is around 34kg and whose processes are sand casting and machining. More details about the components and the manufacturing processes of the powertrain would have added more accuracy in the estimation of the manufacturing cost. For example it is not taken into account the installation of the four crankcase pins which holds the crankcase together. Another step not taken into account is the installation of the bolts that will hold the two halves of the crankcase. All these simplifications lead to a rough estimation of the powertrain. Although there are some outliers where the cost difference is large, the total manufacturing cost of the car falls within a 10% difference, which is better than the SCM prior to the modifications (18% difference). This improvement is due to the detailed relationships which were added to the SCM in order to capture much more precision in the manufacturing cost.

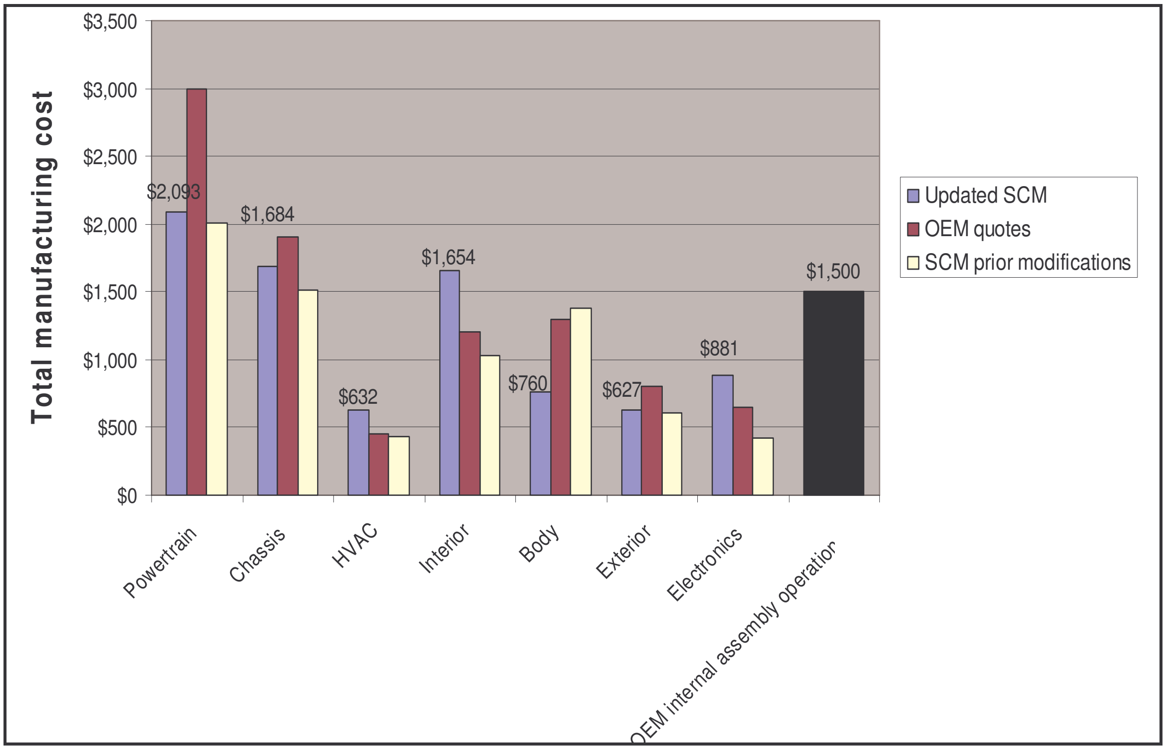


Figure 4-4 : Cost differences between OEM quotes[4], SCM and updated SCM estimations

The errors in estimation include both values where the OEM quote is above and below the value estimated through the updated SCM. The powertrain and chassis groups are both underestimated by 30% for the first one and by 11% for the second; while the interior group is overestimated by 38%. It can be tempting to correlate the errors with the manufacturing processes required to manufacture the groups of components. Table 4-1 shows the major manufacturing processes for the different subsystems of the car. The powertrain and chassis group are both groups where around 50% of the components are stamped, and only 20% are molded plastics, while the components of the interior group are in majority molded plastics (injection molding, RIM/ Foam molding and compression molding are required for 52% of the components). Since the cost estimations of the updated model for the powertrain and chassis groups are closer to the OEM quotes than they were with the previous SCM, this could mean that the relationships for the stamping process have improved the results by adding more accuracy. On the other hand the relationships for the injection molding process may slightly overestimate the real

---

[4] Quote is for similar car, but not exactly the same one.

investments of the manufacturers, because in the updated model, the cost estimation is above the OEM quotes.

Groups	Major manufacturing processes	Number of parts manufactured per process	Percentage of components per process
Powertrain	Stamping	243	56%
	Injection Molding	72	17%
	Forging	50	12%
	Die casting	23	5%
Chassis	Stamping	184	47%
	Injection molding	92	23%
	Forging	46	12%
	Roll forming	18	5%
HVAC	Stamping	80	46%
	Injection molding	58	34%
	Electrics	16	9%
Interior	Injection molding	170	39%
	Stamping	157	36%
	RIM/Foam molding	28	7%
	Compression molding	23	5%
Body	Stamping	80	62%
	Injection molding	31	24%
	Forging	6	5%
Exterior	Stamping	20	18%
	Injection Molding	67	61%
	Extrusion (plastic)	8	7%

Table 4-1 : Distribution of the processes over the subsystems of a car

It is important to keep in mind that the actual price that an OEM pays for a particular component, or sub-assembly depends on a larger number of aspects, that ranges from the particular location of the plant and the supplier of the component, the exact volume of production and whether there are wider purchasing agreements. Since the OEM quotes come from a similar car, but not exactly the same, there will remain always a difference between our estimation and these quotes.

4.1.3 Comparison between standard and customized products

The main goal of the thesis is to understand the customization decisions of the OEMs, and more precisely to understand what drives the cost difference between a standard and a customized product. The main assumptions made for the production of the customized product have been described in the chapter 3. Briefly, it has been assumed that the size, materials and the process of the standard and customized versions are identical. The major changes in production between the two variants were the tool modification and the additional set-up time. The initial analysis of the standard product described in the previous paragraph has shown that the cost structure is mainly dependent upon the tooling costs. This is an important aspect for the customization decisions, because the cost of customization could be heavily affected when there is a major tool change. Figure 4-5 shows a comparison between the manufacturing cost of the baseline and the customized product for the eight major groups of the car. The total manufacturing cost for the baseline product is estimated at $9,831; whereas the estimation for the customized product is $11,242. This is an increase of 14% of the total cost over the baseline version. Consequently the premium that the customer is willing to pay for "customization" should be at least equal to $1,411 in order for the manufacturer to cover his expenses.

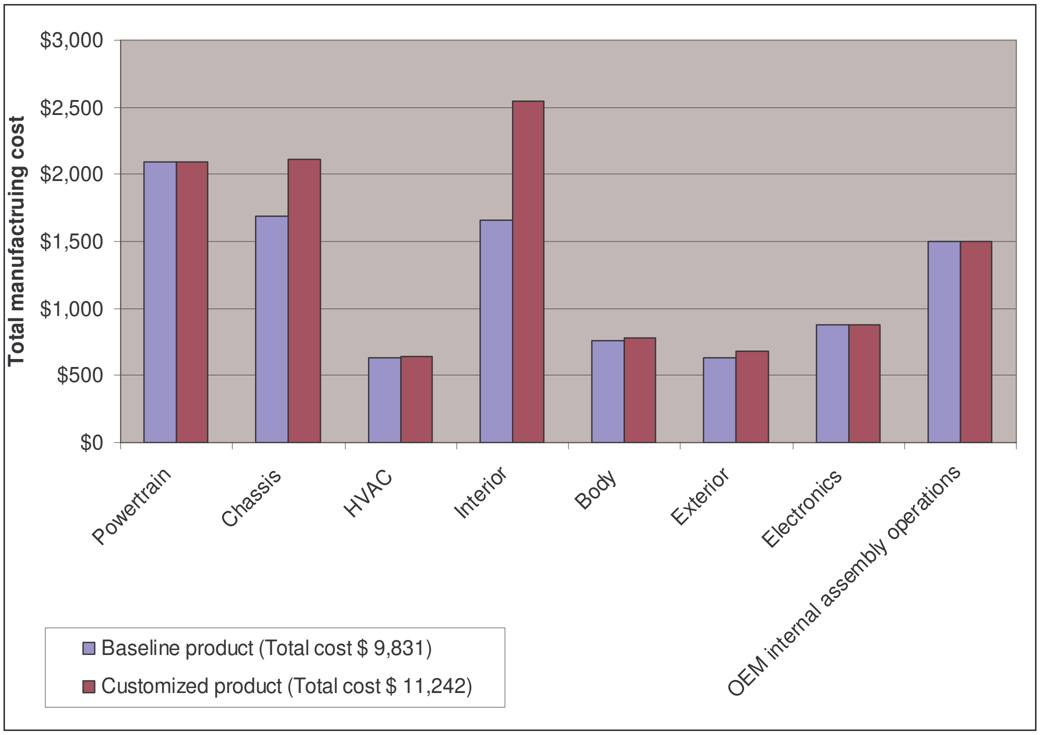


Figure 4-5 : Cost breakdown for the standard and customized products

It is important to remember that the total cost of $11,242 for the customized product represents the maximum cost of the customized version, because it counts for all the possible customized components. However the manufacturer may want to offer variety for the seat group but not for the suspension group, which will mean that the cost increase for the customized product will only include a portion of the $1411 cost increase. Consequently it is more interesting for customization decisions to look at the absolute difference of the different customizable groups. The absolute difference for all the customizable groups is shown in the appendix C. Table 4-2 provides a sample of some of the results for individual customized groups.

Groups of customization	Baseline Product	Customized product	Absolute difference	Percentage Difference
Side trim	$131	$134	$3	3%
Storage Tray Trunk	$16	$26	$10	64%
Steering column	$55	$92	$37	68%
Trim instrument panel	$181	$250	$69	38%
Seat rack front	$203	$351	$148	73%

Table 4-2 : Example of baseline vs. customized costs for different customizable groups

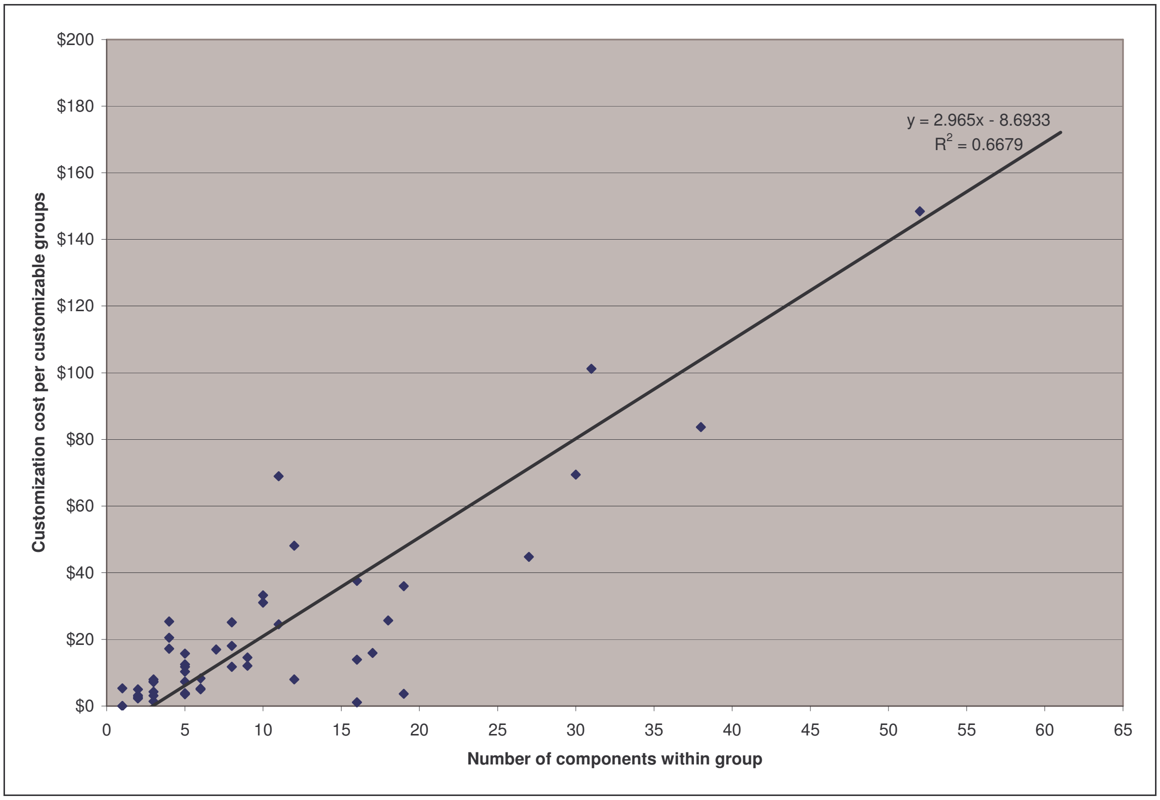
The absolute difference is the main criteria for the customization decision. We can see from table 4-2 that this difference can vary from $3 to more than $100. To be able to give guidelines for what to customize, the ideal would be to compare the absolute difference to the premium that customers are willing to pay for the variety. The example of the side trim shows that the absolute difference is very small ($3.65), so the automakers will likely be willing to do this customization since it does not cost very much; in addition the absolute difference is insignificant in comparison to the baseline product (3% of difference). Concerning the storage tray trunk, the absolute difference is also small ($10.31), and even if it represents a large amount of the cost of the baseline product (64%), the automakers will choose to customize provided that they can recover this small cost through increased price or market acceptance. For certain components such as the trim instrument panel, the OEM may offer a customized version, because this is an area that is very visible to the customer and may be worth the extra cost of $69.45. On the other hand, the steering column and the seat rack front are components that are not likely to be customized since the additional cost of customization is high, representing around 70% of the baseline cost and the consumer is not likely to pay such a high premium.

4.1.4 Sources of customization cost premiums

Several factors may explain the large differences in customization cost premium for different groups. Groups have different number of components, made with different production processes and each sub-component may require different levels of redesign for the customized product. The following section explores the impact of each of these factors on the customization cost premium. First, the number of components within the customizable group may be an explanation for a larger cost difference. Table 4-3 gives some examples of some customizable groups, their cost of customization and their number of components.

Groups considered as customizable	Manufacturing cost of the baseline product ($)	Manufacturing cost of the customized product ($)	Absolute difference	Number of parts within the group
Damping hood	$4	$7	$3	2
Storage Tray Trunk	$16	$26	$10	5
Steering column	$55	$92	$37	16
Trim instrument panel	$181	$250	$69	30
Seat rack front	$203	$351	$148	52

Table 4-3 : Example of customizable groups, their customization costs and their number of parts



Regression Statistics	
Multiple R	0.81728
R Square	0.667947
Adjusted R Square	0.661682
Standard Error	26.72588
Observations	55

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	76150.85	76150.85	106.6131	2.7135E-14
Residual	53	37856.45	714.2726		
Total	54	114007.3			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-8.693304	4.854576	-1.790744	0.079046	-18.43034979	1.043741	-18.43035	1.043741
X Variable 1	2.965006	0.287157	10.32536	2.71E-14	2.38904081	3.540971	2.389041	3.540971

Figure 4-6 : Variation of the customization cost with the number of components within the group

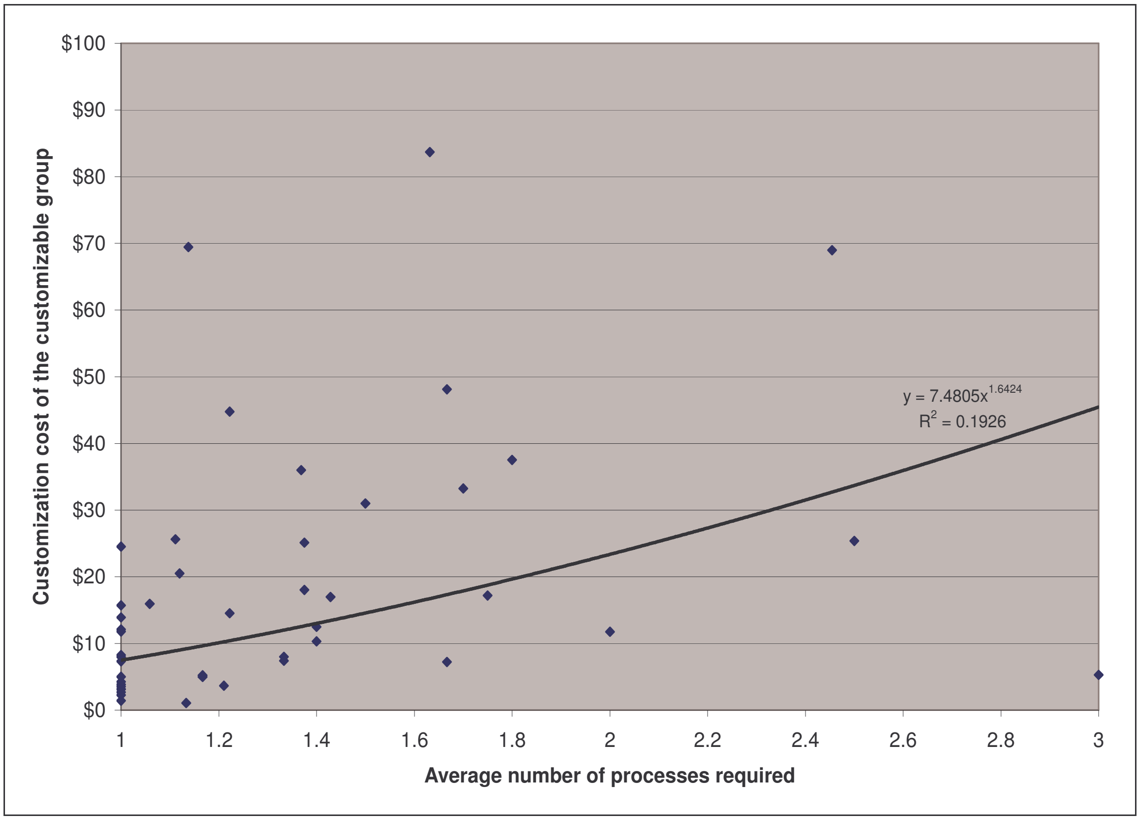
A statistical relationships between the customization cost premium and the number of components has been done for all the 65 customizable groups. The graph and the regression results are shown in figure 4-6. The more components within the group, the more changes or adjustments in the production need to be done and therefore more additional set-up time is needed. This would add more cost for customizing this group.

The regression statistics give the overall goodness-of-fit measures: the R-squared is high (0.667947), the correlation between y and x is significant (0.81728), the "significance F" number and the p-value f the variable are inferior to 0.05, which means that the number of components is a significant predictor of the customization cost (An explanation of all the regression results is explained in details in Appendix D). For example the storage tray trunk, which contains only 5 components, requires an additional cost of $10 for customization, whereas the seat rack front, which is composed of about 50 components, reaches a cost of customization in the order of $150, which means fifteen times the customization cost of the storage compartment door.

Second, the processes used to manufacture the components of the customizable group are important for determining the cost of customization. Generally, the components which require at least two or three manufacturing processes have a larger cost of customization. Indeed two parallel manufacturing processes may increase the customization cost, because again there might be additional set-up time for every process considered, and additional cost for the tooling changes. Table 4-4 gives examples of customizable groups associated with the number of processes required for manufacturing the components within the group. The manufacturing of the damping hood requires only one process for each component and thus its cost of customization is minimized. However the seat rack front contains 52 components out of which 5 require three processes to be manufactured. These components are expensive to customize since additional tooling investments are needed for all three processes. Consequently, the customization cost may be higher for this group. Figure 4-7 shows the trend across all most customizable groups. The curve does not fit as well as the curve in figure 4-6, which means that this criterion has less influence, and it may be considered as a secondary criterion. Indeed the statistical relationship is less significant and the explanatory variables explain the variation in cost less well (lower R-square).

Groups considered as customizable	Manufacturing cost of the baseline product ($)	Manufacturing cost of the customized product ($)	Absolute difference	Number of parts which requires 1 process	Number of parts which requires 2 processes	Number of parts which requires 3 processes
Damping hood	$4	$7	$3	2	0	0
Storage Tray Trunk	$16	$26	$10	4	0	1
Steering column	$55	$92	$37	8	4	4
Trim instrument panel	$181	$250	$69	28	0	2
Seat rack front	$203	$351	$148	47	0	5

Table 4-4 : Example of customizable groups, their customization cost and their number of processes required



Regression Statistics	
Multiple R	0.31383925
R Square	0.1926
Adjusted R Square	0.07800633
Standard Error	1.00756859
Observations	46

ANOVA

	df	SS	MS	F	Significance F
Regression	1	4.88032	4.88032	4.807276	0.033672605
Residual	44	44.66856	1.015194		
Total	45	49.54888			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	1.37156783	0.206886	6.629582	4E-08	0.954616438	1.788519	0.954616	1.788519
X Variable 1	7.4805	0.007883	2.19255	0.033673	0.001396801	0.033173	0.001397	0.033173

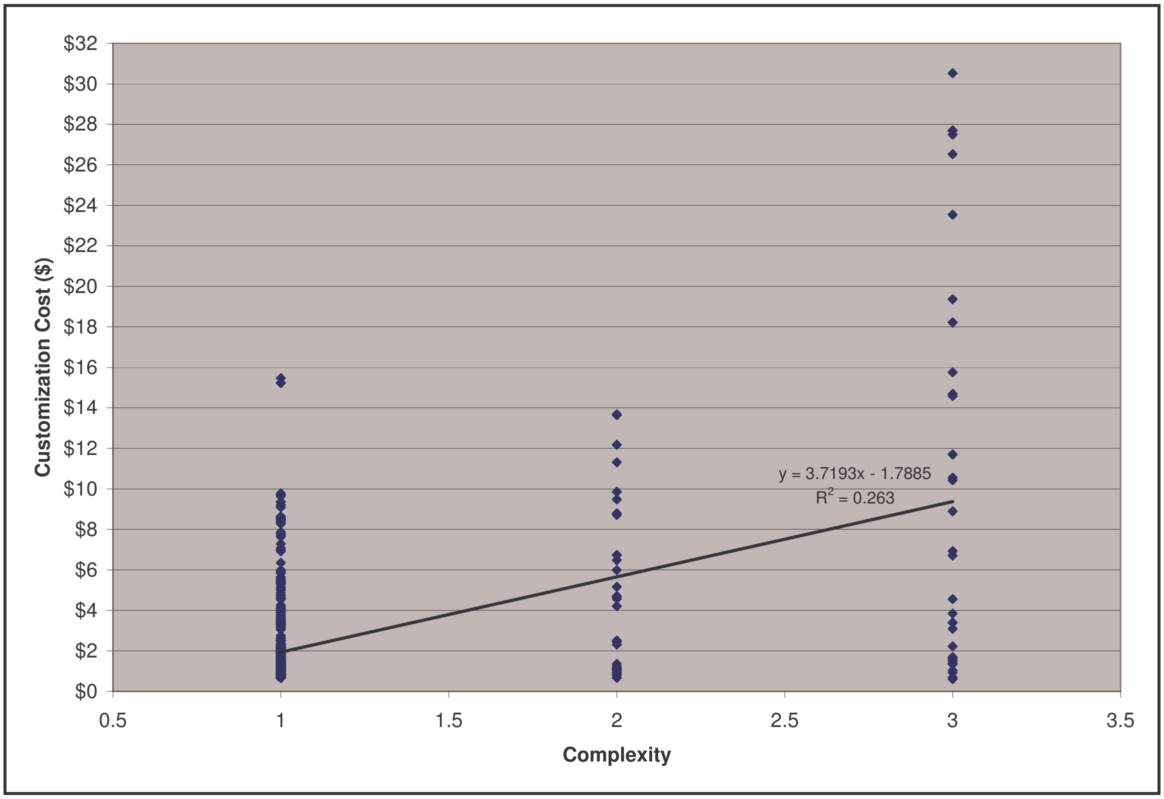
Figure 4-7: Cost of customization as a function of the average number of processes required within the customizable groups

Another factor, which could explain the variation of customization costs of the different customizable groups, is the complexity of the part. The higher the complexity of the part, the more expensive the tool investment may be and the longer the cycle time may be. In addition it is likely that the complex parts have completely dedicated tooling. As such, the production of a customized version of these parts may require a completely new and expensive tool, rather than just a modification of the existing tool. Table 4-5 shows some examples of how the complexity of the components affects the cost of customization. The low absolute cost difference for the damping hood can be explained by the fact that all its components are simple, and therefore, presumably have relatively low tooling investments and short cycle times.

Groups considered as customizable	Absolute difference	Number of parts w/ complexity 1 (% of the cost difference)	Number of parts w/ complexity 2 (% of the cost difference)	Number of parts w/ complexity 3 (% of the cost difference)
Damping hood	$3	2 (100%)	0	0
Storage Tray Trunk	$10	5 (100%)	0	0
Steering column	$37	11 (80%)	2 (15%)	2 (4%)
Trim instrument panel	$69	25 (85%)	1 (2%)	3 (13%)
Seat rack front	$148	46 (36%)	1 (1%)	5 (63%)

Table 4-5: The customizable groups, their customization costs and their number of complex parts

The seat rack front group has five complex components. Since the cost increase comes primarily from the five complex parts, we can conclude that the driving force around the cost customization for the seat rack front is the complexity and not the number of parts. This could explain why the seat rack front is so expensive to customize. However, this is not the case for the trim instrument panel and the steering column, where most of their parts are not complex. The cost of customization is much more driven by the number of parts. Figure 4-8 shows the trend of the variation between the customization cost and the complexity for all the customized parts of the car. We can see that the complex parts imply a higher cost customization. The customization cost for these parts can reach $30; while parts with a lower complexity level have a maximum customization cost around $15. The regression statistics give the following measures: while the R-squared is a little low (0.2581), the correlation between y and x is significant (0.507989), the “significance F” number and the p-value f the variable are inferior to 0.05, which means that the complexity is a significant predictor of the customization cost.



Regression Statistics	
Multiple R	0.512879
R Square	0.263045
Adjusted R Square	0.261819
Standard Error	3.257589
Observations	603

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	2276.439	2276.439	214.5178	9.25409E-42
Residual	601	6377.742	10.61188		
Total	602	8654.181			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	-1.788471	0.328645	-5.441958	7.68E-08	-2.433902473	-1.143039	-2.433902	-1.143039
X Variable 1	3.719259	0.253936	14.64643	9.25E-42	3.220548428	4.217969	3.220548	4.217969

Figure 4-8 : Variation of the customization cost with the complexity of the part

The last major factor, which may cause a large variation of customization cost for different groups, is the degree of tool change. If a complete new tool is required for the customized product, the tool investment increases by up to 90% of the initial tool investment made for the standard product. There are some savings in the design cost but other than the entire tooling investment needs to be made twice, once for each of the part. For components where a tool modification is sufficient the incremental investment may only be around 30%. Additional tools aren't necessary only modifications to the original tool are needed and thus there is the potential for substantial cost savings. So it is reasonable that a group (e.g. the seat rack front), in which most of components require a new tool for their customized version, will have a higher customization cost than a group (e.g. damping hood) whose components require no tool change (see Table 4-6).

Groups considered as customizable	**Absolute difference**	**Number of parts w/ no tool change**	**Number of parts w/ adjusted tool**	**Number of parts w/ new tool**
Damping hood	$3	1	1	0
Storage Tray Trunk	$10	4	0	1
Steering column	$37	8	1	7
Trim instrument panel	$69	12	0	18
Seat rack front	$148	32	0	29

Table 4-6 : Example of customizable groups, their customization cost and the tool modification of the parts

Figure 4-9 shows the trend of the variation between the customization cost and the tool change. The main assumption in the model is that number 0 has been attributed to the non-customized components, number 1 to the customized components with no tool change, number 2 to the customized parts with a small tool change, and number 3 to the customized parts with a radical tool change. We can see on this figure that the customization cost tends to be higher when a radical tool change is needed for the customized product; while customization costs are on average less expensive for small tool change.

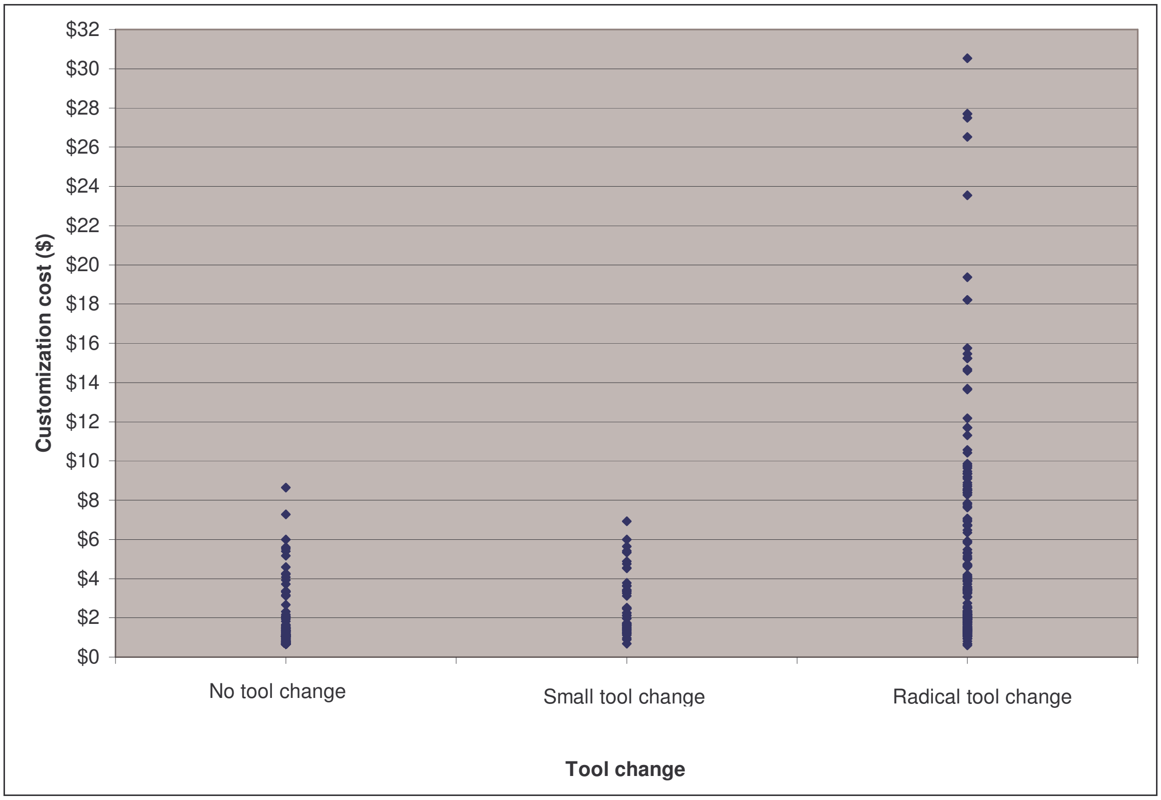


Figure 4-9 : variation of the customization versus the tool change

To conclude, the main criteria, which influence the cost of customization, are:

- The number of parts: groups with more parts have higher customization costs.
- The degree of tool change: groups with components that need substantial changes for the customized version and therefore a completely new tool have higher customization costs.

- The tooling investment of the manufacturing process: groups with components made by processing methods that require large investments in tools will have higher customization costs.

The other criteria have less impact on the cost of customization

- The complexity of the parts: groups with more complex parts have higher customization costs.
- The number of process steps: groups with parts that require more steps have higher customization costs.

4.1.5 Sensitivity analysis

Two important strategic variables for a development project are the production volume and product life. It could be interesting to understand how changes in the set of assumptions, especially changes in production volume and product life, may alter the costs discussed above. As it has been previously mentioned, production volume affects how fixed costs are spread over each unit of production. Thus the higher the production volume, the less expensive the unit manufacturing cost of the car. Figure 4-10 shows the impact of production volume on both the standard and the customized product. As it has been mentioned in the chapter 3, the sensitivity analysis has been done, given the assumption that the four simple metrics (weight, material, complexity and process) are the same for both the base vehicle and its variant, but the total production volume in both cases is equal. However, for all the scenarios involving a customized variant, the overall production volume is divided into 60% of the total production volume for one variant and 40% for the other. Table 4-7 summarizes the distribution of the production volume for the two variants; the total production volume varies from 20,000 to 200,000 vehicles per year.

	Production Volume (vehicles per year)				
Baseline product	20,000	50,000	100,000	150,000	200,000
Product A	12,000	30,000	60,000	90,000	120,000
Product B	8,000	20,000	40,000	60,000	80,000

Table 4-7 : Production volume for the two variants of the car.

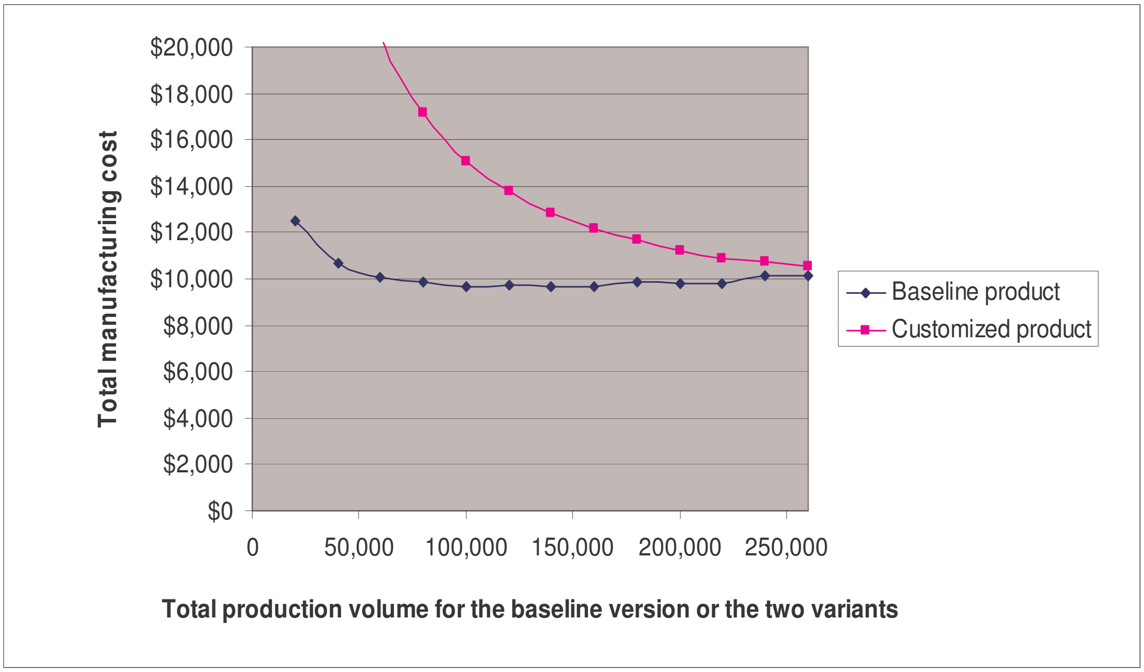


Figure 4-10 : Sensitivity analysis with the production volume for the total car system

A reduction of the production volume can have a substantial impact on the cost of the customized product. Indeed the cost difference with a high production volume such as 250,000 parts per year is estimated around $600, whereas at lower production volumes such as 100,000 parts per year, the cost difference can be as high as $5,000. Often at low volumes the additional tools that are needed for customized products are poorly utilized, while at high volumes additional tools might be needed anyway, so the cost penalty for an additional customized tool is low in those cases. However this cost difference means that all 65 groups are customized, which of course is unlikely. Figure 4-11 shows the same sensitivity analysis but for one customizable group, the trim instrument panel. As expected, as production volume decreases the additional customization cost increases. At production volumes as high as 250,000 vehicles per year, the cost difference between the standard and the customized trim instrument panel is around $25, whereas in the very low production volume range (around 10,000 vehicles per year) the cost difference can be as high as $300, which corresponds to two thirds of the price of the baseline product. Therefore, it is quite expensive for the automakers to customize the trim instrument panel at very low production volumes.

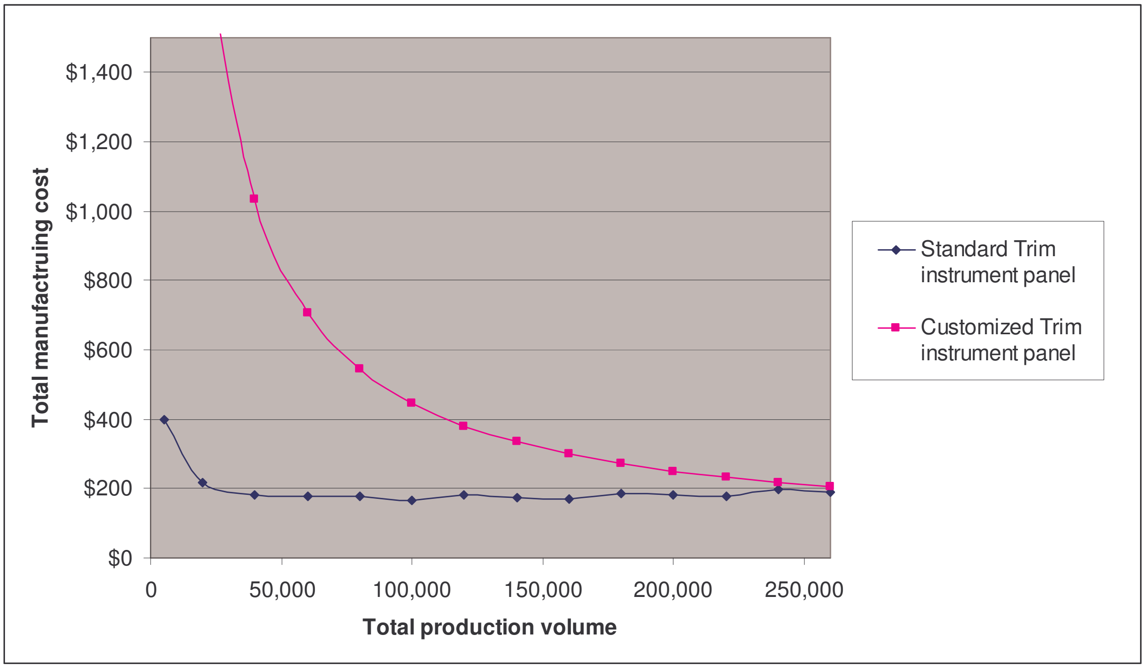


Figure 4-11 : Sensitivity analysis with the production volume for the trim instrument panel group

Product life is the number of years a product is expected to be produced; it is also the number of years over which tooling costs are amortized. Shorter product lifetimes result in higher yearly costs for tooling. If the automaker could offer a more customized product with lots of variants, it may be able to extend the product life. Figure 4-12 shows the impact of variations of the product life on the total manufacturing cost of a car. The variations between the cost of the standard and customized products vary from $1,200 (when the product life equals 3 years) to $1,411 (when the product life equals 5 years). Product life has a small effect on the customization cost because many parts can be spread on the tooling investments across. Figure 4-12 shows changes in the product life only from three to eight. The impact would have been more important if the variation in the production life were larger, which is not likely to happen.

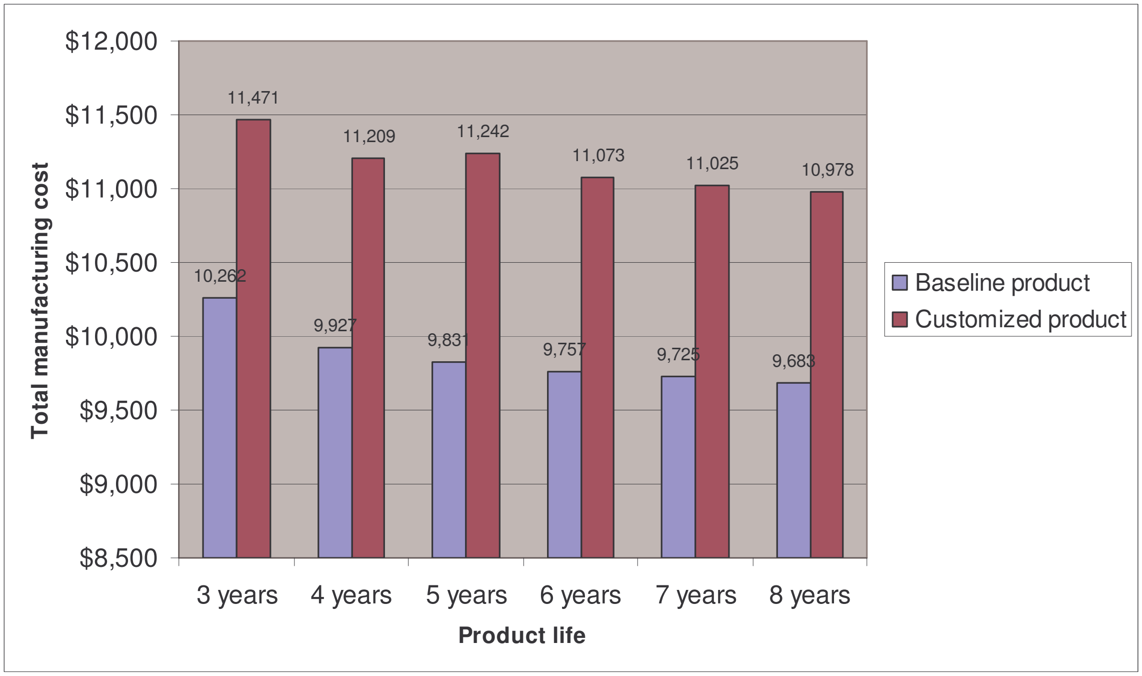


Figure 4-12 : Sensitivity analysis with the product life for the complex car system

Figure 4-13 shows variations of the customization with the production volume for several customizable groups. As expected, whatever the customizable groups, as production volume increases, the cost difference decreases. At production volume less than 80,000 vehicles per year, the cost of customization is very high, because the large fixed investment in machine and tools can not be spread enough on the total production volume. From this graph, we can see also different sensitivities to the production volume. For a given product life (5 years), the cost differences of the brake fall in a range between $501 (at a production volume of 100,000 vehicles per year) and $289 at high production volume (260,000 vehicles per year). This corresponds to a difference of $212. The cost differences for the trim instrument panel are generally not as and range from $443 at low volume and to $204 at high volume. This corresponds to a higher difference ($239). Consequently the trim instrument panel is more sensitive to the production volume than the brake.

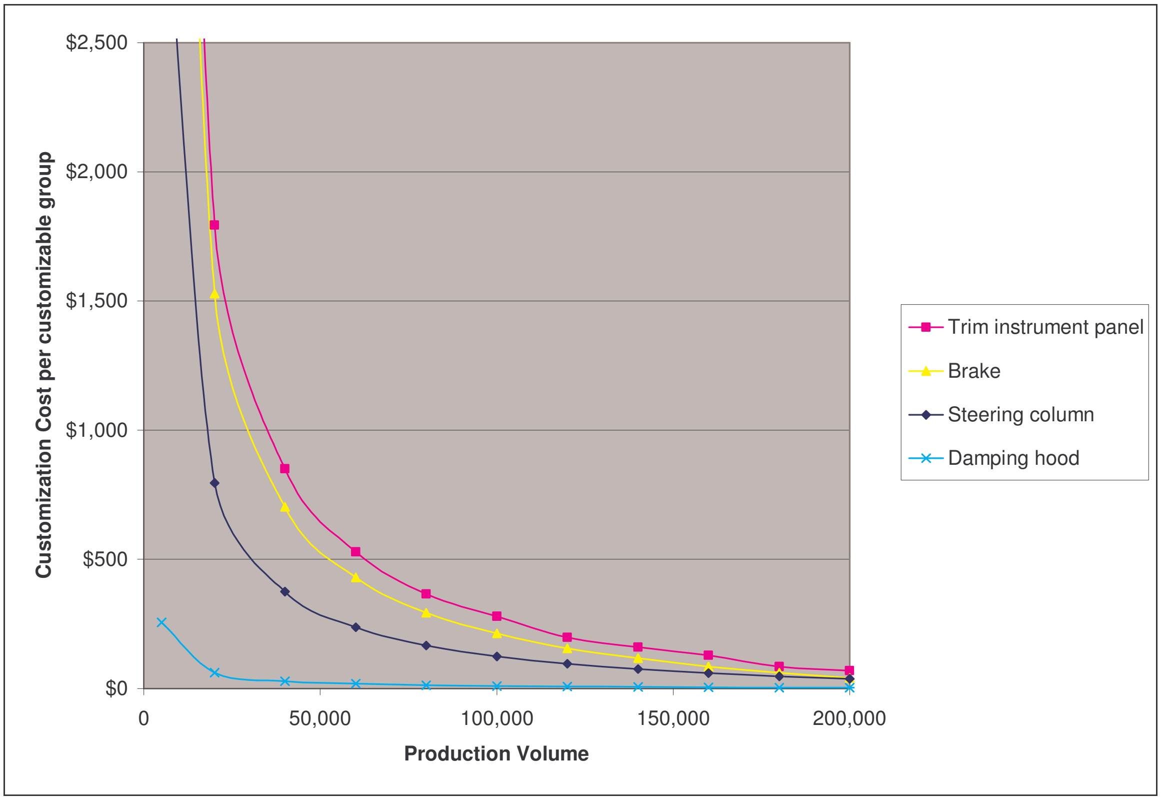


Figure 4-13 : Variations of the customization cost with the production volume for several customizable groups

All these results show that production volume and product life are two variables, which can impact the customization cost of the different customizable groups.

4.2 Implications for the problem of customization

4.2.1 General discussion from the case

To help the manager make better customization decisions, it is important to determine the different elements which influence the cost of customization. As we mentioned in the paragraph 4.1.2, one of these elements is the characteristics of the manufacturing process required and its major cost drivers, in particular the balance between investments in non-dedicated equipment and dedicated tooling as well as the relationship between cycle time and set up time. Since the only changes in the production of the customized product considered in this work concern the tool modifications and the addition of some set up time, it is important to assess how theses effects play out together in order to draw some conclusions about customization.

According to figure 4-3, the main cost drivers of the vehicle manufacturing are the tooling costs (32%), the material costs (16%), the OEM assembly activities (16%) and the equipment costs (10%). The other cost drivers are less significant and represent less than 10% of the total car manufacturing. Since the size and the complexity of the customized product are the same as in the baseline version, there is no additional material cost for customization. For the same reason the equipment investment and the number of workers are unchanged when standard and customized products are compared. Consequently the major modification is the tooling costs. When the share of tooling cost of one manufacturing process is important, the large influence of the tooling costs creates a large gap between the manufacturing cost of the standard and the customized product. On the other hand, if the share of tooling cost is less expansive, the effect of the tool modification may be less important, except if another factor predominates. Figure 4-14 shows the trend of the customization cost with the percentage of the unit tooling cost over the total manufacturing unit cost of the baseline product for several manufacturing processes. For every customized part, we only consider the primary manufacturing process of the part. Then we calculate the percentage of the unit tooling cost over the total unit cost of the part and plot it on the graph with its corresponding customization cost. As expected, as the percentage of tooling cost increases the customization cost increases. Given the sharp slope of the curves for most of the manufacturing processes on the graph, we can conclude that a small variation in the tooling cost implies an important increase in the customization cost.

The second factor which has to be taken into consideration in the discussion, is the relative importance of the set up time compared with the production cycle time. Indeed as mentioned above, introducing a customized version in the production increases the number of set ups, thus increasing the total production time. If the set up time is negligible compared to the total cycle time, the addition of one or more additional set up does not really affect the cycle time, consequently the line utilization of the standard and customized products may be very similar. On the other hand, if the setup time is large percentage of the total production time, then additional setups required for the customized product will significantly affect the amount of equipment time charged to the part. Furthermore, other costs that scale with the equipment utilization, such as the labor or energy costs, will also increase, resulting in an even great cost increase for the customized product. Figure 4-15 shows the trend of the customization with the percentage of the annual time for setups for a given production volume of 100,000 vehicles per year over the annual time attributed to total cycle time for several manufacturing processes. For every customized part, we only consider the primary manufacturing process of the part. Then we calculate the percentage of the annual time for setups over the total production time of the part and plot it on the graph with its corresponding customization cost. As expected, as the percentage increases the customization cost increases. The slope of the curves for all the manufacturing processes on the graph are sharp, which means that the setup time is an important factor of the customization cost.

Figure 4-14 : Variations of the customization cost with the percentage of tooling unit cost over the total unit cost

At least it is relevant to notify the order in which the manufacturing processes appear on the graph. The stamping process has a high percentage of setup time, which corresponds to a small cycle time in comparison to the setup time. On the other hand, the injection molding has a small percentage of setup time, which means that the setup time is considered small in comparison to the total production time.

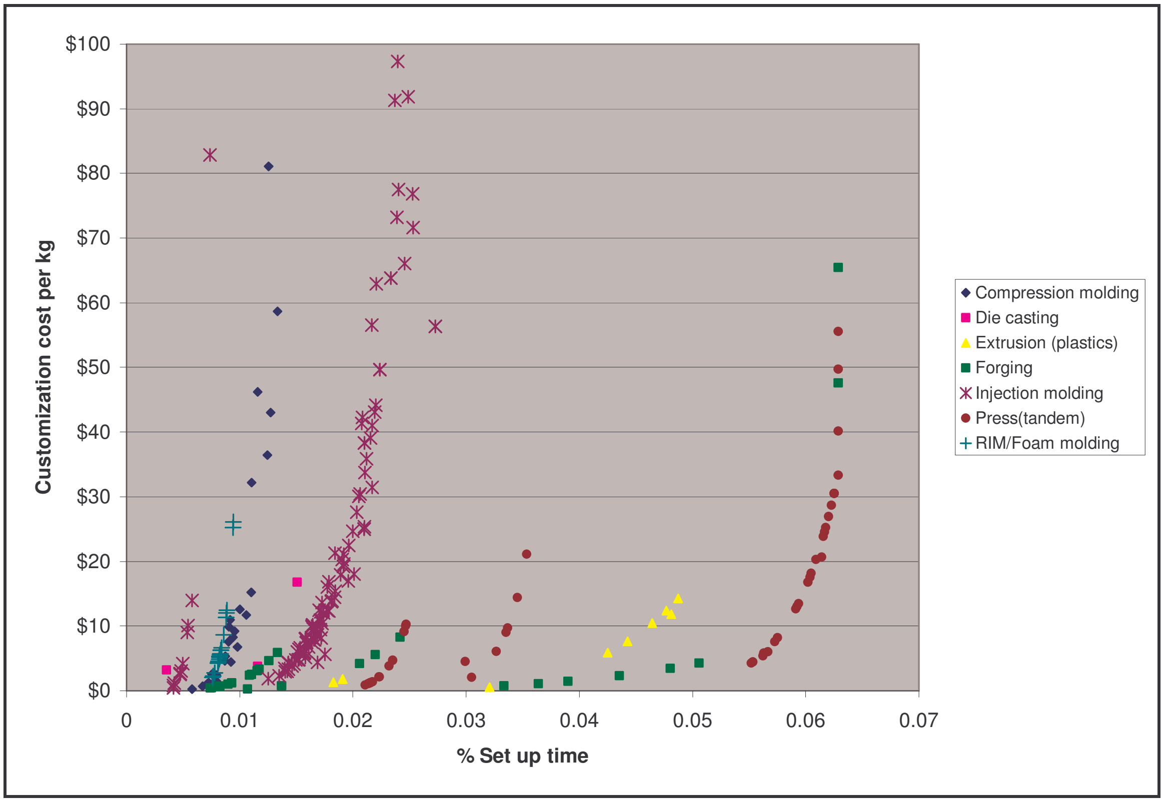


Figure 4-15 : Variations of the customization cost with the percentage of set up time over the total cycle time

To conclude, some process characteristics such as tooling investment and set up time are important to be considered when customization decisions have to be made.

4.2.2 Recommendations

The previous chapters offered a method to estimate the cost of customization. After analysis of the customization process we considered only some changes in the production characteristics in our case study: a variation in the tool investment and in the cycle time. From the analyses of the previous section we can also already draw some guidelines concerning the best way to minimize the customization cost. The guidelines can be categorized into three types: the production volume, the group and part characteristics, the process characteristics.

- High Production Volume

From the sensitivity analysis it is clear that the customization should be done at a large scale of the production volume (200,000 vehicles per year); otherwise it is too expensive to offer variety, because the customization cost increases exponentially with the production volume. Since the production volume reflects the market conditions; it is not always easy to choose it. However it may be interesting to produce one high volume vehicle that has multiple customized variants versus multiple low volume vehicles. Indeed at a production volume of 200,000 vehicles per year the cost of a vehicle with two variants is $11,242; while the cost of two standard vehicles at a production volume of 100,000 vehicles per year each is $9,674 x 2 = $19,348. Consequently customization cost for a variety of parts or groups kept to a minimum when done for high volume cars and this may be a more cost effective approach to offering variety than producing multiple low volume vehicles.

- Group and parts characteristics : small group of simple parts

It is recommended to customize when the customizable group consists of a few simple parts, which require at maximum one or two manufacturing processes to minimize the customization cost. These two criteria are independent of each other; however the number of parts within a customizable group seems to have more impact on the customization cost than the number of manufacturing processes required for every part of this group.

- Process characteristics : low tooling investment and small set up time

Customizing a product implies several changes in the process characteristics such as the tooling and the processing time. One of the criteria of the customization decision is the tooling investment of the process. If the percentage of unit tooling cost over the total manufacturing cost is high, there will be a large impact on the customization cost. Furthermore if the customized product requires a substantially different or even a completely new tool, the cost of the customized product could be as much as twice the cost of the standard product. The influence of the annual time lost to set up compared to the total annual production time also a substantial criterion, because it modifies the line utilization and consequently increases the manufacturing cost.

5 Conclusions and future work

5.1 Conclusions

The goal of this work was to address the question of customization for the automotive industry. Initial chapters proposed a general methodology to understand the cost structure of a complex system. The later chapters offer an analysis of different manufacturing scenarios applicable in the automotive industry. First, the manufacturing cost of a standard product and a product with multiple variants are compared; then an analysis to understand the variations of the customization cost under different operating conditions is done. The customization cost of several groups of components is studied in detail to draw some conclusions for further recommendations to the automakers.

Several conclusions have been drawn from the analysis of the case study:

- The major cost driver of the car manufacturing is the tooling cost, followed by the assembly operations and the equipment cost.
- The customization cost for a group of components can be as low as \$3, but can also reach high cost around \$150. This large difference highlights the importance of estimating the manufacturing cost before critical financial resources are committed.

Some considerations concerning the selection of groups of components to be customized seem generalizable in the automotive industry:

- Is the production volume large enough?
- How large is the group of components to be customized?
- How complex are the components within the group?
- How many processes are required to manufacture the components?
- What is the cost structure of the manufacturing processes?
- What is the influence of the tooling investment on the total manufacturing cost?
- What is the influence of the set-up time on the total production time?
- How easy it is to adjust or re-use the tools?

5.2 Future work

A number of additional developments can be done in future work in order to answer the problem of customization

- The development of the methodology

The methodology has generated some results of manufacturing costs which fall within a range of +/-20% of values typically experienced by the automotive OEMs for these subsystems. While this level of accuracy was considered to be sufficient for the customization analysis, further refinements could improve the accuracy of the cost estimation and thus allow the user to make more informed customization decisions. Model refinements will entail gathering component and processing conditions data for each process to enable more accurate estimates if the functional relationships.

While energy costs may often represent a low percentage of the total car manufacturing cost; some model improvements are needed in this area. Presently, mechanical and electrical energy costs are estimated as a percentage of the equipment investment. Further research would be in developing a method to characterize the actual mechanical or electrical requirements of the process. Then, by determining the losses or other inefficiencies, it would be possible to calculate the cost of supplying the energy needs. In addition the models lack a systematic view of energy. Further work should begin with an appropriate energy balance and then a discussion of the energy requirements of each type (thermal, mechanical, etc). The user should also be able to specify the energy sources and the model would have a method to address energy conversion and other types of losses. A similar idea could be developed for materials costs. The model lacks a systematic material balance, which would describe accurately all the material losses. First products with multiple materials are now handled poorly. Losses in the model are a function of each process and were applied to all materials. But in reality each material would often correspond to just a subset of the processes used to make a multi-material part. And thus the inputs should have assigned materials to the appropriate process and then only that scrap rate applied to the material. Also, little if any consideration is given to process materials in the current model.

The methodology needs some further development to be more accurate in the manufacturing cost. One major development could be to take into consideration the logistic and supply chain costs. Some factors would be particularly instructive to incorporate in the model: the incorporation of inventory and transportation costs. First these costs have to be considered in the total manufacturing cost of a car. In addition they may be higher for a product with multiple variants than for a single vehicle, so it may be relevant for customization decisions.

- The customization considerations

First it would be instructive to gather some data about the customer preferences and utility. Thus it would be interesting to compare the obtained results for the customization cost of different groups of component with the added value considered by the customer. Some research [23] has begun to explore the customer perceived value of customization, by constructing some utility functions from quantitative measures and statistical analyses about customer's subjective preferences. This could make a large framework around customization decisions that would balance that with issues of value of customization.

Another important development would be to consider that the components in a car are not totally independent each other. For example the dimensions of the seat frame should be related to the dimensions of the seat cover; or the two parts of the seat frame should have the same length. Thus when the model estimates the customization of a group of components, it would calculate the cost of only the components, which are connected together. Basically what is needed is a way to rigorously discuss the interdependence of the part design. An idea would be to develop a method which would allow the user the make changes to any part or groups of parts and the model would automatically determine all the changes that would be needed throughout the vehicle.

6 Appendices

Appendix A: The three point estimation – Determination of the parameters A, b, c

The system cost model establishes a direct relationship between the inputs and the cost drivers. When this relationship has the following functional form:

$$Cost = A \cdot (Weight)^{b} \cdot (Complexity)^{c} \qquad \text{(Equation 1)}$$

the relevant parameters A, b, c have to be estimated. The approach is to have an initial estimate of the three coefficients in the proposed relationship based on a three-point estimation [10].

While any three points can be used, the particular evaluation that was selected follows the procedure described below, given the example of the determination of the parameters for the equipment cost:

1. Identification of extreme points. The choices for two of the points were the extremes. For a range of components for which equipment cost is to be estimated, the extreme points are such that the component with minimum weight (*Min_Weight*) and complexity equal to one is associated with the minimum equipment cost (*Min_Cost*), and the component with maximum weight (*Max_Weight*) and complexity level equal to three corresponds to the highest equipment cost (*Max_Cost*). This uses the weight and complexity information for the set of parts manufactured with the relevant technology. Equipment costs for the extreme parts are gathered either from published sources or directly from equipment suppliers. For example an observation of several stamped parts reveals that weights range from a few grams to 15 kg. Eliminating the parts below 10g whose cost is mostly material driven, stamped parts will have a weight from 0.1 kg (*Min_Weight*) to 15 kg (*Max_Weight*) and complexities from 1 to 3. Literature on stamping establishes that a line of tandem presses required to handle components

weighting 0.1 kg and with minimal complexity costs approximately $200,000 (*Min_Cost*). The cost of a press line to stamp a 15 kg part of high complexity was estimated to be $6,000,000 (*Max_Cost*). These values establish the extreme points.

2. Mid point estimation. An additional point is required to complete the estimation. The strategy was to choose a point that would define the relative importance of complexity and weight in establishing equipment cost. The mid point chosen corresponds to a simple part (complexity equal to one) with maximum weight defines the share of the maximum equipment cost that is defined by the weight as opposed to complexity. If the equipment cost for this part is close to the maximum cost, then most of the cost is defined by weight; if it is closer to the minimum cost, then complexity is the determining factor. To have this tradeoff explicit, equipment cost for this point is presented as a share of the difference between the values gathered for the extreme points defined before, instead of an absolute value. This share value is labeled as a weight *Factor*. For example for the stamping process, it was assumed 80% of the cost difference is determined by weight (this is equivalent to having Factor = 80%), while only 20% is determined by part complexity. In other words a part weighting 15 kg with a complexity level of 1 requires a press line that costs approximately $4.84 Million (80% of the way from $200,000 to $6M).

Given this methodology, the three points are the used to determine the coefficient A, b, c. This is done by writing an equation for each of the points and then solving for the unknown coefficients. That solution is given by the equations below:

$$\begin{cases} Max\_Cost = A \cdot (Max\_Weight)^{b} \cdot (3)^{c} \\ Min\_Cost = A \cdot (Min\_Weight)^{b} \cdot (1)^{c} \\ Min\_Cost + (Max\_Cost - Min\_Cost) \cdot Factor = A \cdot (Max\_Weight)^{b} \cdot (1)^{c} \end{cases}$$

Where Factor is the share of the cost difference explained by the complexity level.

Solving these equations results in:

$$A = \frac{Min\_Cost}{(Min\_Weight)^b}$$

$$b = \frac{\log\left(\dfrac{Max\_Weight}{Min\_Weight}\right)}{\log\left(1 + \left(\dfrac{Max\_Cost}{Min\_Cost} - 1\right) \cdot Factor\right)}$$

$$c = (\log 3)^{-1} \cdot \log\left(\frac{Max\_Cost}{A \cdot (Max\_Weight)^b}\right)$$

Appendix B: List of the components and their level of customization

GROUP			PART NAME		PART CHARACTERISTICS					PROCESS DEFINITIONS			CUSTOMIZATION			
SubAssembly ID	Group ID	Group of customization	Sub Assembly Name	Part Name	Total Part Mass (g)	Material ID	Mixed with	Share of Mass	Complexity	Process 1 Name	Process 2 Name	Process 3 Name	Customized?	Tool change	Production volume Customized part A	Production volume Customized part B
74	1	1	clutch pressure plate w/ friction disk	flywheel	7,935	STEEL	STEEL	90%	3	Forging	Machining Center	Heat Treatment	no	0	120,000	80,000
74	1	1	clutch pressure plate w/ friction disk	flywheel - Cover	3,401	STEEL	-	100%	3	Press (Tandem)	Machining Center	Other - Not relevant	no	0	120,000	80,000
74	1	1	clutch pressure plate w/ friction disk	screw	20	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
74	1	1	clutch pressure plate w/ friction disk	clutch disk	1,144	STEEL	STEEL	90%	3	Forging	Machining Center	Heat Treatment	no	0	120,000	80,000
74	1	1	clutch pressure plate w/ friction disk	clutch pressure pla	3,101	STEEL	STEEL	90%	3	Forging	Machining Center	Heat Treatment	no	0	120,000	80,000
74	1	1	clutch pressure plate w/ friction disk	clutch pressure pla	775	STEEL	-	100%	1	Press (Tandem)	Machining Center	Other - Not relevant	no	0	120,000	80,000
74	1	1	clutch pressure plate w/ friction disk	screw	11	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
75	1	1	clutch controls at the transmission	release bearing	406	STEEL	AL	70%	3	Forging	Precision Mechanics	Other - Not relevant	no	0	120,000	80,000
75	1	1	clutch controls at the transmission	screw	9	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
76	1	1	oil tank, oil filler plugs, oil drain plugs	oil drain plug	51	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
76	1	1	oil tank, oil filler plugs, oil drain plugs	radial seal	1	AL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
76	1	1	oil tank, oil filler plugs, oil drain plugs	magnet	25	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
77	1	1	transmission housing, transmission co	transmission case	5,452	AL	-	100%	3	Die Casting	Machining Center	Other - Not relevant	no	0	120,000	80,000
77	1	1	transmission housing, transmission co	clutch casing	7,940	AL	-	100%	3	Die Casting	Machining Center	Other - Not relevant	no	0	120,000	80,000
77	1	1	transmission housing, transmission co	cover panel	304	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
77	1	1	transmission housing, transmission co	plug	10	CR	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
77	1	1	transmission housing, transmission co	screw	34	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
77	1	1	transmission housing, transmission co	screw	29	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
78	1	1	gears w/ clutch bodies	transmission gear	1,323	STEEL	STEEL	90%	3	Forging	Milling	Heat Treatment	no	0	120,000	80,000
78	1	1	gears w/ clutch bodies	transmission gear	1,203	STEEL	STEEL	90%	3	Forging	Milling	Heat Treatment	no	0	120,000	80,000
78	1	1	gears w/ clutch bodies	transmission gear	1,002	GRAPHITE	GRAPHITE	90%	3	Forging	Milling	Heat Treatment	no	0	120,000	80,000
78	1	1	gears w/ clutch bodies	transmission gear	831	GRAPHITE	GRAPHITE	90%	3	Forging	Milling	Heat Treatment	no	0	120,000	80,000
78	1	1	gears w/ clutch bodies	transmission gear	938	GRAPHITE	GRAPHITE	90%	3	Forging	Milling	Heat Treatment	no	0	120,000	80,000
78	1	1	gears w/ clutch bodies	transmission gear	583	GRAPHITE	GRAPHITE	90%	3	Forging	Milling	Heat Treatment	no	0	120,000	80,000
78	1	1	gears w/ clutch bodies	gear	971	STEEL	-	90%	3	Forging	Milling	Heat Treatment	no	0	120,000	80,000
78	1	1	gears w/ clutch bodies	gear	447	STEEL	STEEL	90%	3	Forging	Milling	Heat Treatment	no	0	120,000	80,000
78	1	1	gears w/ clutch bodies	transmission gear	737	GRAPHITE	GRAPHITE	90%	3	Forging	Milling	Heat Treatment	no	0	120,000	80,000
78	1	1	gears w/ clutch bodies	reverse gear shaft	1,600	STEEL	STEEL	90%	3	Forging	Milling	Heat Treatment	no	0	120,000	80,000
78	1	1	gears w/ clutch bodies	rotational seal	9	ACM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
78	1	1	gears w/ clutch bodies	drive shaft	1,771	STEEL	STEEL	90%	3	Forging	Milling	Heat Treatment	no	0	120,000	80,000
78	1	1	gears w/ clutch bodies	driven shaft	2,174	STEEL	STEEL	90%	3	Forging	Milling	Heat Treatment	no	0	120,000	80,000
78	1	1	gears w/ clutch bodies	driven shaft	2,299	STEEL	STEEL	90%	3	Forging	Machining Center	Heat Treatment	no	0	120,000	80,000
79	1	1	bearing for G 17 A	Z tapered roller bea	176	STEEL	-	100%	1	Forging	Precision Mechanics	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	screw	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	lock plate	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	Z tapered roller bea	242	STEEL	-	100%	1	Forging	Precision Mechanics	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	washer disk	9	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	retainer ring	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	oil slinger disk	27	STEEL	-	100%	1	Forging	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	Z tapered roller bea	468	STEEL	-	100%	1	Forging	Precision Mechanics	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	Z tapered roller bea	242	STEEL	-	100%	1	Forging	Precision Mechanics	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	thrust washer	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	retainer ring	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	Z tapered roller bea	245	STEEL	-	100%	1	Forging	Precision Mechanics	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	thrust washer	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	Z tapered roller bea	243	STEEL	-	100%	1	Forging	Precision Mechanics	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	thrust washer	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	retainer ring	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	Z needle bushing	52	STEEL	-	100%	1	Forging	Precision Mechanics	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	thrust washer	29	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	linear needle beari	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	support disk	19	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	needle cage	36	STEEL	PA66-GF	90%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	Z pressure disk	47	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	needle cage	33	STEEL	PA66-GF	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	needle cage	36	STEEL	PA66-GF	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	needle cage	38	STEEL	PA66-GF	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	needle cage	36	STEEL	PA66-GF	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	spacer bushing	116	STEEL	-	100%	1	Roll forming	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	retainer ring	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
79	1	1	bearing for G 17 A	needle cage	65	STEEL	PA66-GF	50%	1	Forming & Shaping	Other - Not relevant	Molding	no	0	120,000	80,000
80	1	1	synchromesh	synchronizing ring	76	MS	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
80	1	1	synchromesh	spacer	37	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
80	1	1	synchromesh	synchronizing ring	45	MS	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
80	1	1	synchromesh	syncrodog	373	STEEL	STEEL	90%	2	Powder Metalurgy	Milling	Heat Treatment	no	0	120,000	80,000
80	1	1	synchromesh	thrust block	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
80	1	1	synchromesh	spring	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
80	1	1	synchromesh	retainer ring	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
80	1	1	synchromesh	sliding collar	301	STEEL	STEEL	70%	2	Forging	Milling	Heat Treatment	no	0	120,000	80,000
80	1	1	synchromesh	synchronizing ring	74	MS	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
80	1	1	synchromesh	spacer	34	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
80	1	1	synchromesh	synchronizing ring	40	MS	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
80	1	1	synchromesh	syncrodog	328	STEEL	STEEL	70%	2	Powder Metalurgy	Heat Treatment	Milling	no	0	120,000	80,000
80	1	1	synchromesh	thrust block	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
80	1	1	synchromesh	spring	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
80	1	1	synchromesh	retainer ring	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
80	1	1	synchromesh	sliding collar	238	STEEL	STEEL	70%	2	Forging	Milling	Heat Treatment	no	0	120,000	80,000
80	1	1	synchromesh	synchronizing ring	80	MS	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
80	1	1	synchromesh	shim	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
80	1	1	synchromesh	synchronizing ring	64	MS	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
80	1	1	synchromesh	syncrodog	318	STEEL	STEEL	70%	3	Powder Metalurgy	Milling	Heat Treatment	no	0	120,000	80,000
80	1	1	synchromesh	thrust block	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
80	1	1	synchromesh	spring	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
80	1	1	synchromesh	retainer ring	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
80	1	1	synchromesh	sliding collar	208	STEEL	STEEL	70%	2	Forging	Heat Treatment	Milling	no	0	120,000	80,000
80	1	1	synchromesh	Z shift sleeve	368	STEEL	MS	50%	2	Forging	Heat Treatment	Milling	no	0	120,000	80,000
80	1	1	synchromesh	syncrodog	317	STEEL	STEEL	70%	2	Powder Metalurgy	Milling	Heat Treatment	no	0	120,000	80,000
80	1	1	synchromesh	retainer ring	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
81	1	1	differential gearbox	Z differential housi	8,608	CAST IRON	STEEL	90%	3	Sand Casting	Machining Center	Heat Treatment	no	0	120,000	80,000
81	1	1	differential gearbox	thrust washer comp	15	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
81	1	1	differential gearbox	bevel pinion	474	STEEL	STEEL	70%	2	Powder Metalurgy	Heat Treatment	Milling	no	0	120,000	80,000
81	1	1	differential gearbox	bevel pinion	207	STEEL	STEEL	70%	2	Powder Metalurgy	Heat Treatment	Milling	no	0	120,000	80,000
81	1	1	differential gearbox	differential pinion s	254	STEEL	STEEL	70%	2	Forging	Milling	Heat Treatment	no	0	120,000	80,000
81	1	1	differential gearbox	collet	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
81	1	1	differential gearbox	Z tapered roller bea	1,252	STEEL	-	100%	3	Forging	Precision Mechanics	Other - Not relevant	no	0	120,000	80,000
81	1	1	differential gearbox	thrust washer	16	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
81	1	1	differential gearbox	Z tapered roller bea	362	STEEL	-	100%	2	Forging	Precision Mechanics	Other - Not relevant	no	0	120,000	80,000
81	1	1	differential gearbox	washer	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000

81	1	1	differential gearbox	flanged shaft	1,182	STAINLESS	STAINLESS	70%	2	Forging	Milling	Heat Treatment	no	0	120,000	80,000
81	1	1	differential gearbox	rotational seal	21	RUBBER	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
81	1	1	differential gearbox	compression spring	43	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
81	1	1	differential gearbox	thrust washer	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
81	1	1	differential gearbox	bevel ring	13	AL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
81	1	1	differential gearbox	retainer ring	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
81	1	1	differential gearbox	Z push on shaft	1,004	STEEL	STEEL	70%	3	Forging	Heat Treatment	Milling	no	0	120,000	80,000
81	1	1	differential gearbox	screw	29	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
81	1	1	differential gearbox	nut for flanged sha	44	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
81	1	1	differential gearbox	radial seal	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
81	1	1	differential gearbox	bearing case	868	AL	-	100%	1	Die Casting	Drilling	Other - Not relevant	no	0	120,000	80,000
81	1	1	differential gearbox	support	309	AL	-	100%	1	Die Casting	Drilling	Other - Not relevant	no	0	120,000	80,000
81	1	1	differential gearbox	screw	46	STEEL	AL	75%	1	Forming & Shaping	Other - Not relevant	Forming & Shaping	no	0	120,000	80,000
81	1	1	differential gearbox	screw	55	STEEL	AL	75%	1	Forming & Shaping	Other - Not relevant	Forming & Shaping	no	0	120,000	80,000
81	1	1	differential gearbox	flanged shaft	2,155	STEEL	STEEL	90%	2	Forging	Milling	Heat Treatment	no	0	120,000	80,000
81	1	1	differential gearbox	Z tapered roller bea	270	STEEL	RUBBER	90%	2	Forging	Assembly	Injection Molding	no	0	120,000	80,000
81	1	1	differential gearbox	retainer ring	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
81	1	1	differential gearbox	cover panel	36	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
81	1	1	differential gearbox	screw	16	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
82	1	1	manual transmission		8	RUBBER	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
82	1	1	manual transmission		3	-	-	100%	1	Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
82	1	1	manual transmission		195	AL	-	100%	1	Die Casting	Drilling	Other - Not relevant	no	0	120,000	80,000
82	1	1	manual transmission		1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
82	1	1	manual transmission		1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
82	1	1	manual transmission		92	AL	-	100%	1	Die Casting	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
82	1	1	manual transmission		1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
82	1	1	manual transmission		17	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
82	1	1	manual transmission		850	STEEL	-	100%	1	Forging	Milling	Other - Not relevant	no	0	120,000	80,000
82	1	1	manual transmission		1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
82	1	1	manual transmission		14	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
82	1	1	manual transmission	Z arrestor bolt	7	PA6-GF	STEEL	80%	1	Molding	Other - Not relevant	Forming & Shaping	no	0	120,000	80,000
82	1	1	manual transmission	Z shifting rod	447	STEEL	AL	50%	1	Investment Casting	GMAW/FCAW-MIG	Investment Casting	no	0	120,000	80,000
82	1	1	manual transmission	Z shifting rod	432	STEEL	AL	50%	1	Investment Casting	GMAW/FCAW-MIG	Investment Casting	no	0	120,000	80,000
82	1	1	manual transmission	Z shifting rod	560	STEEL	AL	50%	1	Investment Casting	GMAW/FCAW-MIG	Investment Casting	no	0	120,000	80,000
82	1	1	manual transmission	Z shift fork	344	STEEL	AL	50%	1	Investment Casting	GMAW/FCAW-MIG	Investment Casting	no	0	120,000	80,000
82	1	1	manual transmission	bearing sleeve	26	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
83	1	1	transmission oil	transmission oil	893	-	-	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
111	1	1	crankcase	crankcase	34,930	CAST IRON	CAST IRON	90%	3	Sand Casting	Machining Center	Other - Not relevant	no	0	120,000	80,000
111	1	1	crankcase	bearing cover	385	CAST IRON	-	100%	1	Sand Casting	Drilling	Other - Not relevant	no	0	120,000	80,000
111	1	1	crankcase	bearing cover	445	CAST IRON	-	100%	1	Sand Casting	Drilling	Other - Not relevant	no	0	120,000	80,000
111	1	1	crankcase	screw	55	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
111	1	1	crankcase	oil jet	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
111	1	1	crankcase	hollow bolt	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
111	1	1	crankcase	oil pan	2,045	AL	-	100%	3	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
111	1	1	crankcase	splash plate	206	PA6-GF	-	100%	3	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
111	1	1	crankcase	screw	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
111	1	1	crankcase	screw	18	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
111	1	1	crankcase	screw	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
111	1	1	crankcase	oil drain plug	37	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
111	1	1	crankcase	radial seal	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
111	1	1	crankcase	gasket	561	AL	AL	50%	2	Die Casting	Drilling	Milling	no	0	120,000	80,000
111	1	1	crankcase	gasket	144	MS	PPS	100%	1	Forging	Drilling	Other - Not relevant	no	0	120,000	80,000
111	1	1	crankcase	Timing belt cover	235	PA66-GF	STEEL	95%	1	Injection Molding	Other - Not relevant	Forming & Shaping	no	0	120,000	80,000
111	1	1	crankcase	cover	62	STEEL	-	100%	2	Press (Tandem)	Painting	Other - Not relevant	no	0	120,000	80,000
111	1	1	crankcase	Timing belt cover	144	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
111	1	1	crankcase	Timing belt cover	126	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
111	1	1	crankcase	screw	9	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
111	1	1	crankcase	screw	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
112	1	1	cylinder head	cylinder head gask	206	RUBBER	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
112	1	1	cylinder head	Z cylinder head	8,820	AL	STEEL	90%	3	Die Casting	Machining Center	Milling	no	0	120,000	80,000
112	1	1	cylinder head	bearing cover	45	AL	-	100%	1	Die Casting	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
112	1	1	cylinder head	bearing cover	57	AL	-	100%	1	Die Casting	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
112	1	1	cylinder head	assembly aid	117	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
112	1	1	cylinder head	screw	15	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
112	1	1	cylinder head	screw	79	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
112	1	1	cylinder head	nut	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
112	1	1	cylinder head	gasket	48	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
112	1	1	cylinder head	cap	44	PA-GF	EPDM	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
112	1	1	cylinder head	nut	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
112	1	1	cylinder head	splash plate	211	PA6-GF	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
112	1	1	cylinder head	Cam cover	888	AL	-	100%	1	Die Casting	Milling	Other - Not relevant	no	0	120,000	80,000
113	1	1	crankshaft, bearing, rotational seals	crankshaft	14,668	STAINLESS	-	100%	3	Forging	Machining Center	Other - Not relevant	no	0	120,000	80,000
113	1	1	crankshaft, bearing, rotational seals	belt pulley	1,748	STEEL	EPDM	75%	2	Press (Tandem)	Other - Not relevant	Injection Molding	no	0	120,000	80,000
113	1	1	crankshaft, bearing, rotational seals	screw	12	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
113	1	1	crankshaft, bearing, rotational seals	rotational seal	13	STEEL	EPDM	80%	1	Forming & Shaping	Other - Not relevant	Molding	no	0	120,000	80,000
113	1	1	crankshaft, bearing, rotational seals	thrust washer	9	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
113	1	1	crankshaft, bearing, rotational seals	thrust washer	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
113	1	1	crankshaft, bearing, rotational seals	bearing liner	29	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
113	1	1	crankshaft, bearing, rotational seals	bearing liner	23	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
114	1	1	connecting rod and cap w/ bearings	connecting rod	314	STAINLESS	-	100%	1	Forging	Milling	Other - Not relevant	no	0	120,000	80,000
114	1	1	connecting rod and cap w/ bearings	connecting rod bea	139	STAINLESS	-	100%	1	Forging	Milling	Other - Not relevant	no	0	120,000	80,000
114	1	1	connecting rod and cap w/ bearings	bearing liner	16	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
114	1	1	connecting rod and cap w/ bearings	bearing liner	17	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
114	1	1	connecting rod and cap w/ bearings	screw	21	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
115	1	1	piston, piston rings, piston pin	piston	269	AL	-	100%	2	Die Casting	Milling	Other - Not relevant	no	0	120,000	80,000
115	1	1	piston, piston rings, piston pin	piston ring	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
115	1	1	piston, piston rings, piston pin	piston ring	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
115	1	1	piston, piston rings, piston pin	oil scraper ring	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
115	1	1	piston, piston rings, piston pin	piston pin	61	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
115	1	1	piston, piston rings, piston pin	retainer ring	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
116	1	1	cam shaft	cam shaft	2,078	STAINLESS	-	100%	3	Forging	Milling	Other - Not relevant	no	0	120,000	80,000
116	1	1	cam shaft	rotational seal	14	STEEL	EPDM	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
117	1	1	cam pulleys	Timing belt	117	RUBBER	PA66-GF	50%	1	Vulcanization	Other - Not relevant	Compression Molding	no	0	120,000	80,000
117	1	1	cam pulleys	Z cam shaft pulley	638	STEEL	-	100%	2	Forging	Milling	Other - Not relevant	no	0	120,000	80,000
117	1	1	cam pulleys	crankshaft sprocke	275	STEEL	-	100%	1	Forging	Milling	Other - Not relevant	no	0	120,000	80,000
117	1	1	cam pulleys	idler pulley	454	STEEL	STEEL	50%	2	Press (Tandem)	GMAW/FCAW-MIG	Press (Tandem)	no	0	120,000	80,000
117	1	1	cam pulleys	screw	48	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
117	1	1	cam pulleys	screw	119	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
117	1	1	cam pulleys	nut	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
117	1	1	cam pulleys	washer	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
118	1	1	lifter with adjuster plate	hydraulic lifter	55	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
119	1	1	intake and exhaust valve	intake valve	60	STEEL	-	100%	1	Forging	Milling	Other - Not relevant	no	0	120,000	80,000
119	1	1	intake and exhaust valve	valve shaft seal	1	STEEL	EPDM	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
119	1	1	intake and exhaust valve	valve guide	20	MS	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
119	1	1	intake and exhaust valve	cone	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
119	1	1	intake and exhaust valve	spring seat	12	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
119	1	1	intake and exhaust valve	valve spring	44	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
119	1	1	intake and exhaust valve	exhaust valve	59	STEEL	-	100%	1	Forging	Milling	Other - Not relevant	no	0	120,000	80,000
120	1	1	oil pump w/ drive	oil pump housing	400	AL	-	100%	2	Die Casting	Milling	Other - Not relevant	no	0	120,000	80,000
120	1	1	oil pump w/ drive	lid	100	AL	-	100%	1	Die Casting	Milling	Other - Not relevant	no	0	120,000	80,000
120	1	1	oil pump w/ drive	external rotor	165	STEEL	-	100%	1	Forging	Milling	Other - Not relevant	no	0	120,000	80,000
120	1	1	oil pump w/ drive	interior light	200	STEEL	-	100%	1	Forging	Milling	Other - Not relevant	no	0	120,000	80,000
120	1	1	oil pump w/ drive	drive pulley	135	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
120	1	1	oil pump w/ drive	drive chain	164	STEEL	-	100%	2	Press (Tandem)	Assembly	Other - Not relevant	no	0	120,000	80,000
120	1	1	oil pump w/ drive	tensioner	57	PA-66	STEEL	100%	1	Molding	Other - Not relevant	Forming & Shaping	no	0	120,000	80,000
120	1	1	oil pump w/ drive	radial seal	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
120	1	1	oil pump w/ drive	intake runner	166	STEEL	STEEL	60%	1	Bending	Press (Tandem)	GMAW/FCAW-MIG	no	0	120,000	80,000
120	1	1	oil pump w/ drive	screw	12	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
120	1	1	oil pump w/ drive	screw	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
120	1	1	oil pump w/ drive	screw	17	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000

120	1	1	oil pump w/ drive	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
121	1	1	oil filter and oil cooler	flange gasket	926	AL	STEEL	100%	1	Die Casting	Milling	Other - Not relevant	no	0	120,000	80,000
121	1	1	oil filter and oil cooler	threaded nipple	90	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
121	1	1	oil filter and oil cooler	screw	17	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
121	1	1	oil filter and oil cooler	radial seal	5	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
121	1	1	oil filter and oil cooler	oil cooler	440	AL	AL	50%	2	Press (Tandem)	Press (Tandem)	GMAW/FCAW-MIG	no	0	120,000	80,000
121	1	1	oil filter and oil cooler	nut	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
121	1	1	oil filter and oil cooler	radial seal	6	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
121	1	1	oil filter and oil cooler	oil filter	630	STEEL	PUR	50%	3	Press (Tandem)	Other - Not relevant	Nonwoven	no	0	120,000	80,000
121	1	1	oil filter and oil cooler	gasket	20	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
121	1	1	oil filter and oil cooler	hose	98	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
121	1	1	oil filter and oil cooler	hose	80	EPDM	PE	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
121	1	1	oil filter and oil cooler	hose clamp	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
122	1	1	oil level dipstick, sleeve bushing	oil level dipstick	42	STEEL	PBT	70%	1	Forming & Shaping	Other - Not relevant	Molding	no	0	120,000	80,000
122	1	1	oil level dipstick, sleeve bushing	sleeve tube	34	PBT	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
122	1	1	oil level dipstick, sleeve bushing	sleeve tube	101	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
122	1	1	oil level dipstick, sleeve bushing	support	17	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
122	1	1	oil level dipstick, sleeve bushing	screw	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
123	1	1	oil level sensor (WIV) , sensor	oil level sensor	103	AL	EPDM	100%	1	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
123	1	1	oil level sensor (WIV) , sensor	screw	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
128	1	1	shield panels and skids preventing dar	engine shielding	4,222	UP-GF	-	100%	2	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
128	1	1	shield panels and skids preventing dar	rubber bearing	17	STEEL	RUBBER	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
128	1	1	shield panels and skids preventing dar	nut	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
128	1	1	shield panels and skids preventing dar	screw	11	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
129	1	1	design cover	design cover	951	PA6-GF	-	100%	2	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
129	1	1	design cover	support bracket	330	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
129	1	1	design cover	bolt	19	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
129	1	1	design cover	grommet	11	RUBBER	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
129	1	1	design cover	washer	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
129	1	1	design cover	nut	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
129	1	1	design cover	ball joint head	8	PPA-GF	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	engine control mod	411	Electronics	-	100%	3	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	support	221	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	bracket	9	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	bracket	6	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	screw	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	throttle body contro	987	AL	PBT-GF	80%	1	Die Casting	Milling	Electronics	no	0	120,000	80,000
130	1	1	injection system	gasket	2	PAPER	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	screw	12	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	air flow meter	225	PBT-GF	-	100%	2	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	radial seal	5	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	screw	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	pedal position sens	243	PP-GF	STEEL	100%	1	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	screw	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	oxygen sensor	134	Electronics	-	100%	1	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	oxygen sensor	133	Electronics	-	100%	1	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	fuel line compound	162	PLASTIC	-	100%	1	Extrusion (plastic)	Compression Molding	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	vacuum hose	51	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	hose clamp	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	support	20	STEEL	PA66-GF	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	screw	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	hose	51	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	clamp	2	AL	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	fuel distributor	173	PA66-GF	STEEL	100%	1	Injection Molding	Other - Not relevant	Casting	no	0	120,000	80,000
130	1	1	injection system	pressure regulator	48	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	bracket	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	hose	6	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	injector	48	AL	-	100%	2	Electro-Mechanical	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	radial seal	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	radial seal	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	bracket	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	screw	9	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	air line	52	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	hose clamp	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	hose	105	EPDM	PLASTIC	35%	1	Molding	Molding	Molding	no	0	120,000	80,000
130	1	1	injection system	support	2	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	hose clamp	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	fuel tank breather v	120	PA66-GF	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	support	13	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	vacuum line	8	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	Z fuel pump	868	POM	POM	35%	2	Injection Molding	Injection Molding	Electric	no	0	120,000	80,000
130	1	1	injection system	retainer	298	POM	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	radial seal	48	RUBBER	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	cap nut	82	PE	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	lid	233	PLASTIC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	bracket	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
130	1	1	injection system	switch	21	PA-6	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
131	1	1	intake line and manifold	intake runner	3,394	AL	-	100%	2	Die Casting	Milling	Other - Not relevant	no	0	120,000	80,000
131	1	1	intake line and manifold	intake manifold	1,088	AL	-	100%	1	Die Casting	Milling	Other - Not relevant	no	0	120,000	80,000
131	1	1	intake line and manifold	gasket	16	RUBBER	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
131	1	1	intake line and manifold	gasket	22	RUBBER	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
131	1	1	intake line and manifold	screw	38	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
131	1	1	intake line and manifold	screw	15	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
131	1	1	intake line and manifold	screw	15	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
131	1	1	intake line and manifold	nut	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
131	1	1	intake line and manifold	support	170	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
131	1	1	intake line and manifold	screw	15	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
132	1	1	air filter	air filter housing	808	PLASTIC	-	100%	3	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
132	1	1	air filter	filter element	300	EPDM	EPDM	50%	1	Injection Molding	RIM/Foam Molding	Other - Not relevant	no	0	120,000	80,000
132	1	1	air filter	air filter housing	694	PLASTIC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
132	1	1	air filter	intake runner	115	PP	EPDM	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
132	1	1	air filter	intake runner	140	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
132	1	1	air filter	connecting pipe	238	TEEE	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
132	1	1	air filter	splashguard	247	PLASTIC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
132	1	1	air filter	clamp	27	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
132	1	1	air filter	hose clamp	39	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
132	1	1	air filter	gasket	41	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
132	1	1	air filter	retainer	12	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
132	1	1	air filter	retainer	4	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
132	1	1	air filter	sleeve	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
132	1	1	air filter	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
132	1	1	air filter	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
132	1	1	air filter	screw	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
133	1	1	crankcase ventilation	hose	220	AL	-	100%	1	Extrusion	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
133	1	1	crankcase ventilation	hose clamp	15	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
133	1	1	crankcase ventilation	hose clamp	11	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
133	1	1	crankcase ventilation	hose support	4	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
134	1	1	exhaust manifold	exhaust manifold	5,403	-	-	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
134	1	1	exhaust manifold		1,500	STEEL	STEEL	50%	1	Press (Tandem)	GMAW/FCAW-MIG	Press (Tandem)	no	0	120,000	80,000
134	1	1	exhaust manifold		1,000	STEEL	-	100%	1	Press (Tandem)	GMAW/FCAW-MIG	Other - Not relevant	no	0	120,000	80,000
134	1	1	exhaust manifold		400	STEEL	-	100%	1	Press (Tandem)	GMAW/FCAW-MIG	Other - Not relevant	no	0	120,000	80,000
134	1	1	exhaust manifold	exhaust manifold	1,500	CAST IRON	CAST IRON	70%	1	Sand Casting	GMAW/FCAW-MIG	Other - Not relevant	no	0	120,000	80,000
134	1	1	exhaust manifold	exhaust manifold	1,000	CAST IRON	CAST IRON	70%	1	Sand Casting	GMAW/FCAW-MIG	Other - Not relevant	no	0	120,000	80,000
134	1	1	exhaust manifold	gasket	27	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
134	1	1	exhaust manifold	nut	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
134	1	1	exhaust manifold	support	294	STEEL	-	100%	2	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
134	1	1	exhaust manifold	screw	20	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
134	1	1	exhaust manifold	washer	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000

134	1	1	exhaust manifold	nut	13	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
135	1	1	exhaust gas recirculation (EGR), EGR	EGR valve	608	STEEL	AL	40%	3	Press (Tandem)	Precision Mechanics	Die Casting	no	0	120,000	80,000
135	1	1	exhaust gas recirculation (EGR), EGR	gasket	2	AL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
135	1	1	exhaust gas recirculation (EGR), EGR	screw	21	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
135	1	1	exhaust gas recirculation (EGR), EGR	hose	21	RUBBER	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
135	1	1	exhaust gas recirculation (EGR), EGR	clamp	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
135	1	1	exhaust gas recirculation (EGR), EGR	pipe clamp	188	AL	-	100%	1	Coiling	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
136	1	1	secondary air system	secondary air pum	1,317	PA6-GF	STEEL	100%	2	Precision Mechanics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
136	1	1	secondary air system	nut	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
136	1	1	secondary air system	support	464	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
136	1	1	secondary air system	screw	13	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
136	1	1	secondary air system	valve	194	AL	-	100%	3	Die Casting	Milling	Other - Not relevant	no	0	120,000	80,000
136	1	1	secondary air system	gasket	1	PAPER	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
136	1	1	secondary air system	screw	9	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
136	1	1	secondary air system	adapter	107	STEEL	AL	100%	2	Die Casting	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
136	1	1	secondary air system	screw	15	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
136	1	1	secondary air system	screw	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
136	1	1	secondary air system	connecting pipe	49	PA6-GF	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
136	1	1	secondary air system	connecting tube	173	AL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
136	1	1	secondary air system	support	3	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
136	1	1	secondary air system	support	6	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
136	1	1	secondary air system	clamp	13	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
136	1	1	secondary air system	screw	13	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
136	1	1	secondary air system	clamp	12	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
136	1	1	secondary air system	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
136	1	1	secondary air system	hose	106	PA6-GF	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
137	1	1	mufflers	exhaust pipe	4,295	AL	STEEL	40%	1	Sand Casting	Bending	GMAW/FCAW-MIG	no	0	120,000	80,000
137	1	1	mufflers	catalytic converter	3,866	STEEL	-	100%	3	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
137	1	1	mufflers	connecting tube	693	STEEL	AL	70%	2	Bending	GMAW/FCAW-MIG	Bending	no	0	120,000	80,000
137	1	1	mufflers	connecting tube	1,146	STEEL	STEEL	80%	2	Bending	Press (Tandem)	GMAW/FCAW-MIG	no	0	120,000	80,000
137	1	1	mufflers	resonator	6,338	STEEL	-	100%	2	Bending	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
137	1	1	mufflers	connecting tube	1,898	STEEL	-	100%	1	Bending	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
137	1	1	mufflers	connecting tube	176	STEEL	-	100%	1	Roll forming	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
137	1	1	mufflers	muffler	5,738	STEEL	STEEL	70%	3	Roll forming	GMAW/FCAW-MIG	Roll forming	no	0	120,000	80,000
137	1	1	mufflers	tailpipe	777	STEEL	-	100%	2	Roll forming	Bending	Other - Not relevant	no	0	120,000	80,000
137	1	1	mufflers	gasket	26	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
137	1	1	mufflers	nut	11	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
137	1	1	mufflers	gasket	20	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
137	1	1	mufflers	screw	17	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
137	1	1	mufflers	nut	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
137	1	1	mufflers	heat shield panel	530	STEEL	-	100%	2	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
137	1	1	mufflers	screw	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
137	1	1	mufflers	push nut	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
137	1	1	mufflers	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
137	1	1	mufflers	pipe clamp	161	STEEL	-	100%	1	Forging	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
137	1	1	mufflers	screw	39	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
137	1	1	mufflers	nut	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
137	1	1	mufflers	exhaust rubber har	75	EPDM	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
138	1	1	heat shield panels	heat shield panel	825	AL	-	100%	3	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
138	1	1	heat shield panels	heat shield panel	648	AL	-	100%	3	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
138	1	1	heat shield panels	heat shield panel	804	AL	-	100%	2	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
138	1	1	heat shield panels	heat shield panel	348	AL	-	100%	3	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
138	1	1	heat shield panels	heat shield panel	453	AL	-	100%	2	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
138	1	1	heat shield panels	nut	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
138	1	1	heat shield panels	heat shield panel	120	AL	-	100%	2	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
138	1	1	heat shield panels	heat shield panel	81	AL	-	100%	2	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
138	1	1	heat shield panels	heat shield panel	78	AL	-	100%	2	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
138	1	1	heat shield panels	heat shield panel	134	STEEL	AL	100%	2	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
138	1	1	heat shield panels	shield	38	AL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
138	1	1	heat shield panels	shield	25	AL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
138	1	1	heat shield panels	shield	23	AL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
138	1	1	heat shield panels	bracket	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
138	1	1	heat shield panels	screw	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
138	1	1	heat shield panels	nut	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
139	1	1	motor oil	motor oil	883	-	-	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
140	1	1	coolant	coolant	1,055	-	-	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
156	1	1	engine fastening elements	bearing block	912	STEEL	-	100%	2	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
156	1	1	engine fastening elements	screw	19	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
156	1	1	engine fastening elements	angle support	465	AL	-	100%	2	Die Casting	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
156	1	1	engine fastening elements	screw	31	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
156	1	1	engine fastening elements	screw	35	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
156	1	1	engine fastening elements	support bearing	6,505	CAST IRON	-	100%	2	Sand Casting	Milling	Other - Not relevant	no	0	120,000	80,000
156	1	1	engine fastening elements	screw	72	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
157	1	1	engine damping elements	Z damping elemen	1,005	STEEL	RUBBER	70%	3	Press (Tandem)	Assembly	Injection Molding	no	0	120,000	80,000
157	1	1	engine damping elements	Z damping elemen	302	RUBBER	STEEL	70%	2	Injection Molding	Assembly	Forming & Shaping	no	0	120,000	80,000
157	1	1	engine damping elements	nut	18	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
157	1	1	engine damping elements	nut	13	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
158	1	1	transmission fastening elements	support bearing	1,215	AL	-	100%	2	Die Casting	Milling	Other - Not relevant	no	0	120,000	80,000
158	1	1	transmission fastening elements	screw	90	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
158	1	1	transmission fastening elements	support	118	AL	-	100%	1	Forging	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
158	1	1	transmission fastening elements	screw	93	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
158	1	1	transmission fastening elements	screw	65	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
158	1	1	transmission fastening elements	screw	80	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
158	1	1	transmission fastening elements	screw	47	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
158	1	1	transmission fastening elements	screw	74	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
158	1	1	transmission fastening elements	screw	70	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
158	1	1	transmission fastening elements	screw	72	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
159	1	1	transmission damping elements	transmission bearin	1,910	AL	RUBBER	70%	3	Press (Tandem)	Assembly	Injection Molding	no	0	120,000	80,000
159	1	1	transmission damping elements	screw	45	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
159	1	1	transmission damping elements	screw	45	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
159	1	1	transmission damping elements	screw	89	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
159	1	1	transmission damping elements	nut	18	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
159	1	1	transmission damping elements	washer	54	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
159	1	1	transmission damping elements	hinged column	1,295	AL	RUBBER	70%	3	Die Casting	Assembly	Injection Molding	no	0	120,000	80,000
159	1	1	transmission damping elements	screw	100	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
159	1	1	transmission damping elements	nut	18	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
16	2	21	front brake	brake mount	1,742	STAINLESS	STAINLESS	90%	3	Sand Casting	Milling	Heat Treatment	yes	3	120,000	80,000
16	2	21	front brake	brake caliper	2,896	STAINLESS	EPDM	90%	3	Sand Casting	Machining Center	Heat Treatment	yes	3	120,000	80,000
16	2	21	front brake	piston	483	STEEL	STEEL	90%	1	Forging	Milling	Heat Treatment	yes	2	120,000	80,000
16	2	21	front brake	gasket	7	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
16	2	21	front brake	brake pad	563	STEEL	STEEL	90%	3	Forging	Impregnation	Heat Treatment	yes	2	120,000	80,000
16	2	21	front brake	brake pad	555	STEEL	STEEL	80%	3	Forging	Impregnation	Heat Treatment	yes	2	120,000	80,000
16	2	21	front brake	brake pad	513	STEEL	STEEL	80%	3	Forging	Impregnation	Heat Treatment	yes	2	120,000	80,000
16	2	21	front brake	cable support	30	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
16	2	21	front brake	screw	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
16	2	21	front brake	support spring	11	STEEL	-	100%	1	Bending	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
16	2	21	front brake	bleeder valve	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
16	2	21	front brake	dust cap	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
16	2	21	front brake	dust cap	1	PP	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
16	2	21	front brake	guide bolt	38	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
16	2	21	front brake	screw	77	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
16	2	21	front brake	cover panel	77	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
16	2	21	front brake	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
17	2	21	rear brake	brake mount	767	STAINLESS	STAINLESS	90%	1	Investment Casting	Milling	Heat Treatment	yes	3	120,000	80,000
17	2	21	rear brake	brake caliper	1,851	CAST IRON	CAST IRON	90%	3	Investment Casting	Milling	Heat Treatment	yes	3	120,000	80,000
17	2	21	rear brake	piston	261	STEEL	STEEL	90%	2	Forging	Milling	Heat Treatment	yes	2	120,000	80,000
17	2	21	rear brake	gasket	6	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
17	2	21	rear brake	brake pad	234	STEEL	STEEL	90%	3	Forging	Impregnation	Heat Treatment	yes	2	120,000	80,000
17	2	21	rear brake	wear indicator	14	Electronics	-	100%	1	Electronics	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
17	2	21	rear brake	cable tray	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000

17	2	21	rear brake	cable support	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
17	2	21	rear brake	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
17	2	21	rear brake	bleeder valve	13	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
17	2	21	rear brake	dust cap	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
17	2	21	rear brake	guide bolt	40	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
17	2	21	rear brake	protective cover	2	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
17	2	21	rear brake	screw	12	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
17	2	21	rear brake	screw	56	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
17	2	21	rear brake	cover panel	653	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	brake hose	124	STEEL	EPDM	50%	1	Forging	Other - Not relevant	Vulcanization	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	brake hose	105	STEEL	EPDM	50%	1	Forging	Other - Not relevant	Vulcanization	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	brake hose	67	STEEL	EPDM	50%	1	Forging	Other - Not relevant	Vulcanization	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	brake line	55	STEEL	-	100%	1	Roll forming	Welding and Cutting	Other - Not relevant	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	brake line	56	STEEL	-	100%	1	Roll forming	Welding and Cutting	Other - Not relevant	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	support bracket	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	support spring	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	support spring	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	support	3	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	support	3	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	support	2	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	support	2	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	support	5	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	brake line	231	STEEL	-	100%	1	Roll forming	Welding and Cutting	Other - Not relevant	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	brake line	229	STEEL	-	100%	1	Roll forming	Welding and Cutting	Other - Not relevant	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	brake line	138	STEEL	-	100%	1	Roll forming	Welding and Cutting	Other - Not relevant	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	brake line	109	STEEL	-	100%	1	Roll forming	Welding and Cutting	Other - Not relevant	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	brake line	83	STEEL	-	100%	1	Roll forming	Welding and Cutting	Other - Not relevant	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	brake line	89	STEEL	-	100%	1	Roll forming	Welding and Cutting	Other - Not relevant	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	brake line	69	STEEL	-	100%	1	Roll forming	Welding and Cutting	Other - Not relevant	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	brake line	69	STEEL	-	100%	1	Roll forming	Welding and Cutting	Other - Not relevant	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	support	40	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
18	2	21	brake pressure lines, hoses, fluid tank	screw	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	power brake booste	3,951	-	-	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	HOUSING LOW	901	STEEL	-	100%	2	Investment Casting	Milling	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	HOUSING LOW	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	BRACKET	416	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	BRACKET	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	RETAINER	67	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	RETAINER	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	GASKET	46	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	GASKET	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	GASKET	14	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	DIAPHRAGM	96	EPDM	-	100%	3	Extrusion (plastic)	Vulcanization	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	PISTON	101	PET	-	100%	2	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	SPRING	76	STEEL	-	100%	2	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	PISTON	296	STEEL	-	100%	2	Investment Casting	Milling	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	SEAL	14	STEEL	-	100%	2	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	SHAFT	200	STEEL	-	100%	1	Forging	Milling	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	BOOT	18	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	ISOLATOR	1	PUR	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	PLUNGER	47	STEEL	-	100%	2	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	PLUNGER	8	STEEL	-	100%	2	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	HOUSING UPP	984	STEEL	-	100%	2	Investment Casting	Milling	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	RETAINER	3	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	TUBE	6	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	COVER	4	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	CONNECTOR	4	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	VALVE	11	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	master cylinder	502	AL	AL	70%	3	Investment Casting	Assembly	Investment Casting	no	0	120,000	80,000
19	2	21	brake booster	cap	17	PP/EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	plug	3	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	nut	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	brake fluid containe	109	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	gasket	5	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	gasket	3	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
19	2	21	brake booster	vacuum line	59	TEEE-EPDM	PLASTIC	95%	1	Extrusion (plastic)	Other - Not relevant	Bending	no	0	120,000	80,000
20	2	21	brake pressure control system	hydraulic unit	3,604	AL	-	100%	2	Electro-Mechanical	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
20	2	21	brake pressure control system	support	323	STEEL	STEEL	80%	1	Press (Tandem)	Welding and Cutting	Press (Tandem)	no	0	120,000	80,000
20	2	21	brake pressure control system	rubber bearing	11	-	-	100%	1	Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
20	2	21	brake pressure control system	shoulder bolt	21	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
20	2	21	brake pressure control system	screw	23	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
20	2	21	brake pressure control system	nut	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
21	2	21	brake fluid	brake fluid	1,062	-	-	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
68	2	22	accelerator with controls	accelerator pedal	336	STEEL	EPDM	85%	1	Press (Tandem)	Other - Not relevant	Vulcanization	yes	3	120,000	80,000
68	2	22	accelerator with controls	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
68	2	22	accelerator with controls	stop	27	PA6.6-GF-PA	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
69	2	23	clutch pedal w/ controls	clutch pedal	234	PA6.6-GF	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
69	2	23	clutch pedal w/ controls	bushing	1	STEEL	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
69	2	23	clutch pedal w/ controls	stop	17	PA66-GF	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
69	2	23	clutch pedal w/ controls	Clutch master cylin	157	PAA-GF	STEEL	70%	1	Injection Molding	Press (Tandem)	Precision Mechanics	yes	3	120,000	80,000
69	2	23	clutch pedal w/ controls	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
69	2	23	clutch pedal w/ controls	guide	3	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
69	2	23	clutch pedal w/ controls	compression spring	31	STEEL	PLASTIC	30%	1	Coiling	Injection Molding	Other - Not relevant	yes	1	120,000	80,000
69	2	23	clutch pedal w/ controls	cover	48	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
69	2	23	clutch pedal w/ controls	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
69	2	23	clutch pedal w/ controls	bleeder	43	PA66-GF	STEEL	70%	1	Injection Molding	Press (Tandem)	Precision Mechanics	yes	1	120,000	80,000
69	2	23	clutch pedal w/ controls	Z pressure line	326	STEEL	EPDM	80%	1	Forming & Shaping	Bending	Precision Mechanics	yes	1	120,000	80,000
69	2	23	clutch pedal w/ controls	bracket	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
69	2	23	clutch pedal w/ controls	bracket	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
69	2	23	clutch pedal w/ controls	support	30	STEEL	-	100%	2	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
69	2	23	clutch pedal w/ controls	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
69	2	23	clutch pedal w/ controls	feed hose	21	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
69	2	23	clutch pedal w/ controls	hose clamp	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
69	2	23	clutch pedal w/ controls	support	24	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
69	2	23	clutch pedal w/ controls	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	Z shifter knob	144	LEATHER	PLASTIC	30%	1	Extrusion (plastic)	Injection Molding	Other - Not relevant	yes	3	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	hose clamp	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	shift housing	1,032	-	-	100%	3	Other - Not relevant	Precision Mechanics	Other - Not relevant	yes	1	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	shift housing	600	MG/AL9/ZN1	-	100%	2	Die Casting	Milling	Other - Not relevant	yes	3	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	Stick	150	STEEL	-	100%	1	Roll forming	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	Bracket	100	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	Spring	50	STEEL	STEEL	50%	1	Forming & Shaping	Forming & Shaping	Other - Not relevant	yes	1	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	Mechanism	132	-	-	100%		Precision Mechanics	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	cover panel	267	PUR	STEEL	70%	2	Injection Molding	Other - Not relevant	Press (Tandem)	yes	3	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	set screw	13	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	nut	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	Z selector cable	470	PLASTIC	STEEL-AL	60%	1	Precision Mechanics	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	Z shifting cable	519	PLASTIC	STEEL-AL	60%	1	Precision Mechanics	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	bracket	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	bracket	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	cuff seal	20	TPE	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	support	217	STEEL	-	100%	2	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	retainer bumper	10	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	guide bushing	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	screw	27	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	Z shifter	670	GRAPHITE	-	100%	1	Die Casting	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	nut	11	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	Z bell crank	163	STEEL	POM-PTPE	80%	1	Press (Tandem)	Roll forming	Injection Molding	yes	2	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	bracket	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	bushing	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000

70	2	24	stick shifter w/ transmission controls,	guide plate	60	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
70	2	24	stick shifter w/ transmission controls,	nut	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
71	2	25	brake pedal with master cylinder contr	brake pedal	860	STEEL	STEEL	85%	1	Forging	Press (Tandem)	Welding and Cutting	yes	3	120,000	80,000
71	2	25	brake pedal with master cylinder contr	bearing pin	204	STEEL	-	100%	1	Roll forming	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
71	2	25	brake pedal with master cylinder contr	retainer washer	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
71	2	25	brake pedal with master cylinder contr	retainer washer	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
71	2	25	brake pedal with master cylinder contr	bushing	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
72	2	2	assembly plate, bearing block	bearing block	3,040	STEEL	-	100%	3	Precision Mechanics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
72	2	2	assembly plate, bearing block	bearing block	800	STEEL	-	100%	2	Press (Tandem)	Other - Not relevant	Painting	no	0	120,000	80,000
72	2	2	assembly plate, bearing block	bearing block	400	STEEL	STEEL	100%	2	Press (Tandem)	Welding and Cutting	Painting	no	0	120,000	80,000
72	2	2	assembly plate, bearing block	bearing block	300	STEEL	STEEL	70%	1	Press (Tandem)	Welding and Cutting	Painting	no	0	120,000	80,000
72	2	2	assembly plate, bearing block	bearing block	200	STEEL	STEEL	100%	1	Press (Tandem)	Welding and Cutting	Painting	no	0	120,000	80,000
72	2	2	assembly plate, bearing block	bearing block	550	STEEL	STEEL	100%	2	Press (Tandem)	Welding and Cutting	Painting	no	0	120,000	80,000
72	2	2	assembly plate, bearing block	bearing block	600	STEEL	STEEL	100%	2	Press (Tandem)	Welding and Cutting	Painting	no	0	120,000	80,000
72	2	2	assembly plate, bearing block	bearing block	100	STEEL	STEEL	100%	1	Press (Tandem)	Welding and Cutting	Painting	no	0	120,000	80,000
72	2	2	assembly plate, bearing block	bearing block	90	STEEL	STEEL	100%	1	Press (Tandem)	Welding and Cutting	Painting	no	0	120,000	80,000
72	2	2	assembly plate, bearing block	screw	18	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
72	2	2	assembly plate, bearing block	screw	34	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
72	2	2	assembly plate, bearing block	nut	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
73	2	26	emergency brake lever	emergency lever b	896	STEEL	LEATHER	90%	1	Press (Tandem)	Press (Tandem)	Injection Molding	no	0	120,000	80,000
73	2	26	emergency brake lever	cover	88	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
73	2	26	emergency brake lever	trim	92	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
73	2	26	emergency brake lever	screw	18	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
73	2	26	emergency brake lever	washer	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
73	2	26	emergency brake lever	Z pull cable	83	STEEL-CR	POM	70%	1	Forming & Shaping	Molding	Other - Not relevant	no	0	120,000	80,000
73	2	26	emergency brake lever	pin	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
73	2	26	emergency brake lever	cotter pin	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
73	2	26	emergency brake lever	Z pull cable	84	STEEL	PLASTIC	70%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
73	2	26	emergency brake lever	Z compensation le	59	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
73	2	26	emergency brake lever	nut	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
73	2	26	emergency brake lever	spring retainer	2	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
73	2	26	emergency brake lever	tension spring	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
73	2	26	emergency brake lever	support	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
73	2	26	emergency brake lever	brake cable	445	STEEL	PVC	70%	1	Forming & Shaping	Other - Not relevant	Molding	no	0	120,000	80,000
73	2	26	emergency brake lever	bracket	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
84	2	27	axle mount	rear axle mount	22,954	STEEL	RUBBER	95%	3	Hydroforming	GMAW/FCAW-MIG	Other - Not relevant	yes	3	120,000	80,000
84	2	27	axle mount	screw	336	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
84	2	27	axle mount	rear axle bearing	1,128	STEEL	AL	75%	2	Press (Tandem)	Other - Not relevant	Press (Tandem)	yes	3	120,000	80,000
84	2	27	axle mount	strut	722	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
84	2	27	axle mount	screw	173	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
84	2	27	axle mount	screw	47	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
84	2	27	axle mount	screw	36	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
85	2	27	control arm	control arm	14,860	STAINLESS	STAINLESS	80%	2	Hydroforming	GMAW/FCAW-MIG	Other - Not relevant	yes	3	120,000	80,000
85	2	27	control arm	screw	112	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
85	2	27	control arm	nut	22	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
86	2	27	wheel bearing, bearings, gaskets	wheel bearing	733	STEEL	EPDM	80%	3	Forging	Milling	Injection Molding	yes	3	120,000	80,000
86	2	27	wheel bearing, bearings, gaskets	retainer ring	22	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
87	2	27	springs, coil springs	Z spring base	357	STEEL	RUBBER	90%	1	Forging	Milling	Vulcanization	yes	2	120,000	80,000
87	2	27	springs, coil springs	coil spring	3,312	STEEL	-	100%	2	Coiling	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
87	2	27	springs, coil springs	bedding layer	18	PUR	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
87	2	27	springs, coil springs	cushion bumper	145	STEEL	RUBBER	75%	1	Press (Tandem)	Assembly	Vulcanization	yes	1	120,000	80,000
88	2	27	stabilizer bar	stabilizer bar	3,958	STEEL	-	100%	1	Heat Treatment	Bending	Other - Not relevant	yes	2	120,000	80,000
88	2	27	stabilizer bar	clamp	82	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
88	2	27	stabilizer bar	bearing	18	RUBBER	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
88	2	27	stabilizer bar	clamp	91	STEEL	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
88	2	27	stabilizer bar	bearing	26	RUBBER	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
88	2	27	stabilizer bar	screw	17	STEEL	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
89	2	27	shock absorber	shock absorber	1,980	STEEL	STEEL	70%	3	Forging	Milling	Press (Tandem)	yes	3	120,000	80,000
89	2	27	shock absorber	shock absorber -	495	STEEL	STEEL	80%	3	Roll forming	Forging	GMAW/FCAW-MIG	yes	2	120,000	80,000
89	2	27	shock absorber	shock absorber -	990	STEEL	STEEL	80%	3	Roll forming	Press (Tandem)	Precision Mechanics	yes	2	120,000	80,000
89	2	27	shock absorber	screw	80	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
89	2	27	shock absorber	screw	178	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
89	2	27	shock absorber	nut	33	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
90	2	27	wheel hubs	wheel hub	2,442	STEEL	STEEL	90%	3	Forging	Milling	Heat Treatment	yes	3	120,000	80,000
91	2	27	brake disks, brake drums	brake rotor	4,076	STEEL	STEEL	70%	3	Forging	Heat Treatment	Milling	yes	3	120,000	80,000
91	2	27	brake disks, brake drums	screw	15	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
105	2	2	steering gear	steering gear	2,751	AL	STEEL	60%	3	Die Casting	Roll forming	Heat Treatment	no	0	120,000	80,000
105	2	2	steering gear	steering gear - inte	4,126	STEEL	STEEL	75%	3	Forging	Forging	Precision Mechanics	no	0	120,000	80,000
105	2	2	steering gear	cuff seal	138	EPDM	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
105	2	2	steering gear	rubber bearing	61	RUBBER	-	100%	1	Vulcanization	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
105	2	2	steering gear	clamp	245	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
105	2	2	steering gear	nut	16	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
105	2	2	steering gear	screw	36	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
105	2	2	steering gear	protective cover	169	CR	-	100%	1	Blow Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
105	2	2	steering gear	clamp	5	AL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
105	2	2	steering gear	clamp	7	AL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
106	2	2	track rods	track rod ball	779	STEEL	CR	70%	1	Forging	Heat Treatment	Milling	no	0	120,000	80,000
106	2	2	track rods	steering tie rod	434	STEEL	STEEL	70%	1	Forging	Heat Treatment	Milling	no	0	120,000	80,000
106	2	2	track rods	track rod ball	792	STEEL	CR	70%	1	Forging	Heat Treatment	Milling	no	0	120,000	80,000
106	2	2	track rods	nut	15	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
106	2	2	track rods	nut	16	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
107	2	2	steering power assist	vane pump	1,267	AL	STEEL	35%	1	Die Casting	Die Casting	Precision Mechanics	no	0	120,000	80,000
107	2	2	steering power assist	screw	24	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
107	2	2	steering power assist	port	47	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
107	2	2	steering power assist	radial seal	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
107	2	2	steering power assist	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
107	2	2	steering power assist	clamp	15	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
107	2	2	steering power assist	clamp	13	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
107	2	2	steering power assist	hollow bolt	33	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
107	2	2	steering power assist	radial seal	2	AL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
107	2	2	steering power assist	vee belt pulley	413	STEEL	STEEL	70%	1	Forging	Milling	Heat Treatment	no	0	120,000	80,000
107	2	2	steering power assist	screw	11	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
107	2	2	steering power assist	cap	26	PA66-GF	EPDM	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
107	2	2	steering power assist	oil tank	223	PA66-GF	STEEL	60%	1	Injection Molding	Injection Molding	Adhesive Bonding	no	0	120,000	80,000
107	2	2	steering power assist	support	42	STEEL	EPDM	100%	1	Forming & Shaping	Other - Not relevant	Molding	no	0	120,000	80,000
107	2	2	steering power assist	nut	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
107	2	2	steering power assist	screw	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
107	2	2	steering power assist	screw	14	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
107	2	2	steering power assist	return hose	220	RUBBER	STEEL	70%	1	Extrusion (plastic)	Other - Not relevant	Forming & Shaping	no	0	120,000	80,000
107	2	2	steering power assist	suction hose	215	EPDM	RUBBER	50%	1	Extrusion (plastic)	Other - Not relevant	Compression Molding	no	0	120,000	80,000
107	2	2	steering power assist	suction hose	135	RUBBER	RUBBER	50%	1	Extrusion (plastic)	Other - Not relevant	Compression Molding	no	0	120,000	80,000
107	2	2	steering power assist	coolant tube	450	STEEL	STEEL	70%	1	Roll forming	Bending	GMAW/FCAW-MIG	no	0	120,000	80,000
107	2	2	steering power assist	expansion hose	1,227	STEEL	STEEL	80%	3	Roll forming	Bending	Adhesive Bonding	no	0	120,000	80,000
108	2	28	steering column, steering wheel tilt	steering column	4,936	-	-	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
108	2	28	steering column, steering wheel tilt	steering column - L	2,000	STEEL	STEEL	70%	3	Forging	Milling	Heat Treatment	yes	3	120,000	80,000
108	2	28	steering column, steering wheel tilt	steering column -	800	STEEL	STEEL	60%	3	Forging	Heat Treatment	Milling	yes	3	120,000	80,000
108	2	28	steering column, steering wheel tilt	steering column -	150	STEEL	STEEL	50%	2	Forging	Forging	GMAW/FCAW-MIG	yes	3	120,000	80,000
108	2	28	steering column, steering wheel tilt	steering column -	987	STEEL	STEEL	70%	2	Roll forming	Milling	Precision Mechanics	yes	2	120,000	80,000
108	2	28	steering column, steering wheel tilt	steering column -	150	STEEL	STEEL	75%	1	Press (Tandem)	GMAW/FCAW-MIG	Other - Not relevant	yes	3	120,000	80,000
108	2	28	steering column, steering wheel tilt	steering column -	350	STEEL	STEEL	50%	1	Press (Tandem)	GMAW/FCAW-MIG	Other - Not relevant	yes	3	120,000	80,000
108	2	28	steering column, steering wheel tilt	steering column -	250	STEEL	STEEL	50%	1	Press (Tandem)	GMAW/FCAW-MIG	Other - Not relevant	yes	3	120,000	80,000
108	2	28	steering column, steering wheel tilt	steering column -	250	STEEL	-	100%	1	Press (Tandem)	GMAW/FCAW-MIG	Other - Not relevant	yes	3	120,000	80,000
108	2	28	steering column, steering wheel tilt	torque to break bol	12	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
108	2	28	steering column, steering wheel tilt	bushing	21	PUR	STEEL	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
108	2	28	steering column, steering wheel tilt	screw	11	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
108	2	28	steering column, steering wheel tilt	eccentric bolt	27	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
108	2	28	steering column, steering wheel tilt	nut	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
108	2	28	steering column, steering wheel tilt	cover	28	ABS	PC	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
108	2	28	steering column, steering wheel tilt	clip	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
109	2	2	steering wheel	steering wheel	1,171	MG	PUR	75%	3	Die Casting	Other - Not relevant	Injection Molding	no	0	120,000	80,000

109	2	2	steering wheel	screw	46	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
110	2	2	oils	power steering fluid	873	-	-	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
181	2	29	fuel tank, assembly filler neck	fuel tank	7,805	PE	-	100%	2	Blow Molding	Assembly	Other - Not relevant	yes	3	120,000	80,000
181	2	29	fuel tank, assembly filler neck	tensioning strap	903	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
181	2	29	fuel tank, assembly filler neck	tensioning strap	1,051	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
181	2	29	fuel tank, assembly filler neck	screw	15	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
182	2	2	filler neck	fuel filler door	251	STEEL	-	100%	1	Press (Tandem)	GMAW/FCAW-MIG	Other - Not relevant	no	0	120,000	80,000
182	2	2	filler neck	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
182	2	2	filler neck	Z drip pan	80	PVC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
182	2	2	filler neck	ring	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
182	2	2	filler neck	tank cap	91	PA66-GF	POM	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
182	2	2	filler neck	Z pot	95	STEEL	-	100%	2	Forging	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
182	2	2	filler neck	Z funnel	45	STEEL	PLASTIC	80%	1	Roll forming	Other - Not relevant	Molding	no	0	120,000	80,000
182	2	2	filler neck	radial seal	4	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
182	2	2	filler neck	filler neck	1,044	PE	-	100%	2	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
182	2	2	filler neck	cuff seal	12	EPDM	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
182	2	2	filler neck	screw	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
183	2	2	fuel lines	fuel filter	317	AL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
183	2	2	fuel lines	Z support	104	PP-GF	-	100%	2	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
183	2	2	fuel lines	bracket	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
183	2	2	fuel lines	hose clamp	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
183	2	2	fuel lines	support	7	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
183	2	2	fuel lines	support	3	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
183	2	2	fuel lines	Z fuel feed line	42	PA-6	STEEL	20%	1	Molding	Other - Not relevant	Forming & Shaping	no	0	120,000	80,000
183	2	2	fuel lines	Z fuel feed line	57	PA-6	STEEL	20%	1	Molding	Other - Not relevant	Forming & Shaping	no	0	120,000	80,000
183	2	2	fuel lines	Z fuel return line	45	PA-6	STEEL	20%	1	Molding	Other - Not relevant	Forming & Shaping	no	0	120,000	80,000
183	2	2	fuel lines	Z fuel return line	40	PA-6	STEEL	20%	1	Molding	Other - Not relevant	Forming & Shaping	no	0	120,000	80,000
183	2	2	fuel lines	Z check valve	10	PE	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
183	2	2	fuel lines	Z tube	37	PA-6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
183	2	2	fuel lines	hose clamp	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
183	2	2	fuel lines	Z tube	47	PA-6	STEEL	20%	1	Molding	Other - Not relevant	Forming & Shaping	no	0	120,000	80,000
183	2	2	fuel lines	Z tube	57	PA-6	STEEL	20%	1	Molding	Other - Not relevant	Forming & Shaping	no	0	120,000	80,000
183	2	2	fuel lines	Z tube	40	PA-6	STEEL	20%	1	Molding	Other - Not relevant	Forming & Shaping	no	0	120,000	80,000
183	2	2	fuel lines	hose clamp	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
183	2	2	fuel lines	bleeder valve	11	POM	-	100%	2	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
184	2	2	carbon filter and controls	carbon filter contai	1,030	PA-66	-	100%	1	Blow Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
184	2	2	carbon filter and controls	support	402	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
184	2	2	carbon filter and controls	screw	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
184	2	2	carbon filter and controls	nut	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
184	2	2	carbon filter and controls	Z gravity valve	44	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
184	2	2	carbon filter and controls	radial seal	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
184	2	2	carbon filter and controls	Z bleeder piece	27	POM	EPDM	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
184	2	2	carbon filter and controls	breather tube	5	PA-6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
184	2	2	carbon filter and controls	Z breather tube	30	PA-6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
184	2	2	carbon filter and controls	Z breather tube	22	PA-6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
184	2	2	carbon filter and controls	Z breather tube	35	PA-6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
184	2	2	carbon filter and controls	Z breather tube	35	PA-6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
184	2	2	carbon filter and controls	Z breather tube	23	PA-6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
185	2	210	axle mount	control arm	12,527	STEEL	-	100%	3	Press (Tandem)	GMAW/FCAW-MIG	Other - Not relevant	yes	3	120,000	80,000
185	2	210	axle mount	screw	147	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
185	2	210	axle mount	screw	136	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
185	2	210	axle mount	acorn nut	71	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
186	2	210	control arm	control arm	4,090	STAINLESS	RUBBER	80%	2	Forging	Assembly	Injection Molding	yes	3	120,000	80,000
186	2	210	control arm	screw	135	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
186	2	210	control arm	control arm	4,031	STAINLESS	RUBBER	80%	2	Forging	Assembly	Injection Molding	yes	3	120,000	80,000
187	2	210	joints	guide joint	384	STEEL	RUBBER	80%	2	Forging	Assembly	Injection Molding	yes	3	120,000	80,000
187	2	210	joints	nut ss	20	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
187	2	210	joints	screw	20	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
188	2	210	hinge bearing, steering knuckle	hinge bearing	4,874	STAINLESS	-	100%	3	Forging	Machining Center	Other - Not relevant	yes	3	120,000	80,000
188	2	210	hinge bearing, steering knuckle	screw	60	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
189	2	210	wheel bearing assembly	wheel bearing	732	STEEL	EPDM	80%	3	Forging	Milling	Injection Molding	yes	3	120,000	80,000
189	2	210	wheel bearing assembly	retainer ring	22	STEEL	-	100%	1	Forging	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
189	2	210	wheel bearing assembly	screw	255	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
190	2	210	springs, coil springs	coil spring	2,730	STEEL	-	100%	3	Bending	Heat Treatment	Other - Not relevant	yes	2	120,000	80,000
190	2	210	springs, coil springs	spring seat	194	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
191	2	210	stabilizer bar	stabilizer bar	2,924	STEEL	-	100%	1	Bending	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
191	2	210	stabilizer bar	coupling rod	300	STEEL	RUBBER	100%	1	Forming & Shaping	Assembly	Other - Not relevant	yes	1	120,000	80,000
191	2	210	stabilizer bar	nut	14	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
191	2	210	stabilizer bar	nut	25	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
191	2	210	stabilizer bar	rubber bearing	40	RUBBER	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
191	2	210	stabilizer bar	clamp	60	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
191	2	210	stabilizer bar	screw	19	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
191	2	210	stabilizer bar	nut	9	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
192	2	210	shock absorber	McPherson strut	3,936	STEEL	STEEL	70%	3	Forging	Milling	Forging	yes	3	120,000	80,000
192	2	210	shock absorber	bellows	81	EPDM	PP	50%	1	Injection Molding	Other - Not relevant	Molding	yes	1	120,000	80,000
192	2	210	shock absorber	cushion bumper	49	PUR	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
192	2	210	shock absorber	cap	42	PLASTIC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
192	2	210	shock absorber	nut	24	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
192	2	210	shock absorber	suspension suppor	140	STEEL	RUBBER	80%	1	Forming & Shaping	Other - Not relevant	Molding	yes	1	120,000	80,000
192	2	210	shock absorber	strut bearing	324	STEEL	RUBBER	80%	3	Forging	Milling	Molding	yes	3	120,000	80,000
192	2	210	shock absorber	nut	19	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
192	2	210	shock absorber	linear ball baring	61	PA66-GF	STEEL	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
193	2	210	wheel drive, joint shafts	universal joint	6,900	STEEL	RUBBER	80%	3	Forging	Assembly	Injection Molding	yes	3	120,000	80,000
193	2	210	wheel drive, joint shafts	universal joint	7,610	STEEL	RUBBER	90%	3	Forging	Assembly	Injection Molding	yes	3	120,000	80,000
193	2	210	wheel drive, joint shafts	screw	21	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
194	2	210	wheel hubs	wheel hub	2,460	STEEL	STEEL	90%	1	Forging	Milling	Heat Treatment	yes	3	120,000	80,000
195	2	21	brake rotors, brake drums	brake rotor	7,424	STAINLESS	STAINLESS	90%	3	Forging	Machining Center	Heat Treatment	yes	0	120,000	80,000
195	2	21	brake rotors, brake drums	screw	15	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	0	120,000	80,000
206	2	211	rims, wheel lugs, nuts	wheel rim	10,805	AL	-	100%	2	Sand Casting	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
206	2	211	rims, wheel lugs, nuts	wheel lug nut	103	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
206	2	211	rims, wheel lugs, nuts	wheel lug nut	109	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
207	2	2	tires, valves, balancing weights	tire	9,842	RUBBER	STEEL	80%	3	Compression Molding	Vulcanization	Assembly	no	0	120,000	80,000
207	2	2	tires, valves, balancing weights	valve	12	EPDM	STEEL	100%	1	Molding	Assembly	Forming & Shaping	no	0	120,000	80,000
208	2	2	spare wheel mount	spare wheel fixture	2,191	STEEL	-	100%	2	Forging	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
208	2	2	spare wheel mount	screw	16	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
208	2	2	spare wheel mount	cover	444	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
208	2	2	spare wheel mount	latch	13	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
209	2	2	jack	jack	2,461	STEEL	STEEL	50%	3	Forging	GMAW/FCAW-MIG	Forging	no	0	120,000	80,000
209	2	2	jack	retainer	138	PP	-	100%	2	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
209	2	2	jack	screw	39	STEEL	PLASTIC	100%	1	Assembly	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
210	2	2	tools, bag	lug nut wrench	348	STEEL	-	100%	1	Forging	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
210	2	2	tools, bag	open end wrench	37	STEEL	-	100%	1	Forging	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
210	2	2	tools, bag	puller hook	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
211	2	2	tow holder front and rear	tie-down grommet	111	STEEL	-	100%	1	Forging	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
211	2	2	tow holder front and rear	screw	31	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
212	2	212	hitch assembly	Z ball neck	4,047	STAINLESS	-	100%	1	Forging	Painting	Other - Not relevant	yes	3	120,000	80,000
212	2	212	hitch assembly	protective cover	17	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
212	2	212	hitch assembly	key	5	PA	STEEL	50%	1	Molding	Other - Not relevant	Forming & Shaping	yes	1	120,000	80,000
212	2	212	hitch assembly	retainer	1,642	STEEL	-	100%	1	Forging	Milling	Other - Not relevant	yes	3	120,000	80,000
212	2	212	hitch assembly	clamping plate	83	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
212	2	212	hitch assembly	screw	17	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
212	2	212	hitch assembly	screw	24	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
212	2	212	hitch assembly	screw	8	STEEL	-	100%	1	Forging	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
212	2	212	hitch assembly	mounting	18,513	STEEL	STEEL	33%	2	Forging	GMAW/FCAW-MIG	Bending	yes	3	120,000	80,000
212	2	212	hitch assembly	screw	46	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
213	2	2	fuel	fuel	752	-	-	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
214	2	2	warning triangle with holder and warnir	support	259	STEEL	EPDM	100%	2	Press (Tandem)	Assembly	Other - Not relevant	no	0	120,000	80,000
214	2	2	warning triangle with holder and warnir	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
215	2	213	roof rail	roof rail	2,525	AL	-	100%	2	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
215	2	213	roof rail	rubber seal	24	EPDM	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000

215	2	213	roof rail	rubber seal	21	EPDM	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
215	2	213	roof rail	rubber seal	3	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
215	2	213	roof rail	nut	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
124	3	3	radiator and expansion tank, hoses	coolant radiator	3,658	-	-	100%	1	Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	tube	1,000	AL	-	100%	1	Bending	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	strips	1,250	AL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	sides metal	300	AL	AL	50%	1	Press (Tandem)	GMAW/FCAW-MIG	Press (Tandem)	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	sides plastic	1,108	PA66-GF	PA66-GF	50%	1	Injection Molding	Other - Not relevant	Injection Molding	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	retainer	5	EPDM	PLASTIC	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	retainer	34	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	screw	35	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	push nut	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	screw	19	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	support	71	AL	EPDM	60%	1	Forming & Shaping	Other - Not relevant	Molding	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	cap	73	PA-GF	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	expansion tank	544	PP	PE	50%	1	Injection Molding	Adhesive Bonding	Injection Molding	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	coolant hose	21	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	tee piece	7	PA66-GF	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	hose compound	231	EPDM	-	100%	1	Extrusion (plastic)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	coolant hose	39	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	hose clamp	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	support	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	support	3	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	neck	54	STEEL	PA66-GF	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	coolant hose	107	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	branch	44	PA66-GF	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	coolant hose	95	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	hose clamp	17	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	coolant flange	137	PA66-GF	EPDM	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	screw	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	coolant hose	33	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	tee piece	21	PA66-GF	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	coolant hose	29	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	coolant hose	47	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	hose clamp	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	coolant tube	485	EPDM	EPDM	75%	1	Extrusion (plastic)	Press (Tandem)	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	coolant hose	434	EPDM	-	100%	1	Extrusion (plastic)	Compression Molding	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	flange gasket	53	PA66-GF	STEEL	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
124	3	3	radiator and expansion tank, hoses	hose clamp	17	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
125	3	3	water pump w/ drive	coolant pump	683	AL	STEEL	100%	1	Precision Mechanics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
125	3	3	water pump w/ drive	gasket	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
125	3	3	water pump w/ drive	screw	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
125	3	3	water pump w/ drive	auxiliary coolant pu	401	STEEL	PA66-GF	100%	1	Precision Mechanics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
125	3	3	water pump w/ drive	retainer	26	RUBBER	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
125	3	3	water pump w/ drive	retainer	33	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
125	3	3	water pump w/ drive	support	115	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
125	3	3	water pump w/ drive	nut	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
126	3	3	fan w/ drive	radiator scoop	774	PA66-GF	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
126	3	3	fan w/ drive	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
126	3	3	fan w/ drive	seal	5	EPDM	STEEL	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
126	3	3	fan w/ drive	thermo switch	51	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
126	3	3	fan w/ drive	fan star	294	PA66-GF	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
126	3	3	fan w/ drive	electric motor	1,366	STEEL	-	100%	2	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
126	3	3	fan w/ drive	retainer	292	PA66-GF	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
126	3	3	fan w/ drive	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
126	3	3	fan w/ drive	screw	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
126	3	3	fan w/ drive	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
126	3	3	fan w/ drive	electronic control n	158	PA6-GF	-	100%	1	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
126	3	3	fan w/ drive	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
127	3	3	thermostat	housing	77	PA66-GF	STEEL	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
127	3	3	thermostat	thermostat	69	STEEL	MS	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
127	3	3	thermostat	radial seal	3	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
127	3	3	thermostat	screw	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
196	3	3	heater, housing, heater exchanger, far	housing	2,207	PP	-	100%	2	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
196	3	3	heater, housing, heater exchanger, far	push nut	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
196	3	3	heater, housing, heater exchanger, far	screw	11	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
196	3	3	heater, housing, heater exchanger, far	fan motor	864	PP	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
196	3	3	heater, housing, heater exchanger, far	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
196	3	3	heater, housing, heater exchanger, far	heat exchanger	674	AL	-	100%	3	Assembly	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
197	3	3	coolant circuit heating	Z coolant hose	168	PA6-GF	EPDM	50%	2	Molding	Other - Not relevant	Molding	no	0	120,000	80,000
197	3	3	coolant circuit heating	Z coolant hose	323	PA6-GF	EPDM	50%	2	Injection Molding	Other - Not relevant	Compression Molding	no	0	120,000	80,000
197	3	3	coolant circuit heating	Z coolant hose	294	PA6-GF	EPDM	50%	2	Molding	Other - Not relevant	Molding	no	0	120,000	80,000
197	3	3	coolant circuit heating	thermo switch	21	AL	PA-66	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
197	3	3	coolant circuit heating	thermo switch	16	AL	PA-66	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
197	3	3	coolant circuit heating	bracket	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
197	3	3	coolant circuit heating	radial seal	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
197	3	3	coolant circuit heating	hose clamp	11	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
197	3	3	coolant circuit heating	screw	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
197	3	3	coolant circuit heating	screw	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
197	3	3	coolant circuit heating	hose clamp	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
197	3	3	coolant circuit heating	nut	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
197	3	3	coolant circuit heating	support	62	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
197	3	3	coolant circuit heating	support	51	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
197	3	3	coolant circuit heating	support	72	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
197	3	3	coolant circuit heating	support	48	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
197	3	3	coolant circuit heating	Z coolant tube	967	AL	EPDM	80%	2	Forming & Shaping	Assembly	Injection Molding	no	0	120,000	80,000
197	3	3	coolant circuit heating	Z coolant tube	1,045	AL	EPDM	80%	2	Forming & Shaping	Assembly	Injection Molding	no	0	120,000	80,000
198	3	3	heat and ventilation controls, control ca	resistor	149	PA66-GF	-	100%	2	Assembly	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
198	3	3	heat and ventilation controls, control ca	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
198	3	3	heat and ventilation controls, control ca	temperature senso	8	PA6-GF	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
198	3	3	heat and ventilation controls, control ca	servomotor	95	PA-6	-	100%	2	Assembly	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
198	3	3	heat and ventilation controls, control ca	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
199	3	3	A/C, heat exchanger	AC	5,199	PP	STEEL	90%	3	Injection Molding	Electro-Mechanical	Forming & Shaping	no	0	120,000	80,000
199	3	3	A/C, heat exchanger	nut	9	STEEL	EPDM	80%	1	Forming & Shaping	Other - Not relevant	Molding	no	0	120,000	80,000
199	3	3	A/C, heat exchanger	push nut	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
199	3	3	A/C, heat exchanger	screw	9	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
199	3	3	A/C, heat exchanger	heat exchanger	859	AL	PA66-GF	80%	3	Forming & Shaping	Assembly	Molding	no	0	120,000	80,000
199	3	3	A/C, heat exchanger	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
199	3	3	A/C, heat exchanger	gasket	13	RUBBER	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
199	3	3	A/C, heat exchanger	evaporator	2,206	AL	-	100%	3	Electro-Mechanical	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
199	3	3	A/C, heat exchanger	expansion valve	147	AL	-	100%	1	Die Casting	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
199	3	3	A/C, heat exchanger	screw	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
199	3	3	A/C, heat exchanger	support	17	AL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
199	3	3	A/C, heat exchanger	gasket	35	RUBBER	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
199	3	3	A/C, heat exchanger	fan motor	1,499	PP	-	100%	3	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
200	3	3	condenser, dryer	Condenser	2,688	AL	-	100%	3	Press (Tandem)	Assembly	Other - Not relevant	no	0	120,000	80,000
200	3	3	condenser, dryer	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
200	3	3	condenser, dryer	refrigerant tube	142	AL	-	100%	2	Assembly	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
200	3	3	condenser, dryer	screw	14	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
200	3	3	condenser, dryer	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
200	3	3	condenser, dryer	refrigerant tube	239	EPDM	-	100%	2	Assembly	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
200	3	3	condenser, dryer	screw	15	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
200	3	3	condenser, dryer	screw	16	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
200	3	3	condenser, dryer	refrigerant tube	389	AL	-	100%	2	Bending	Assembly	Other - Not relevant	no	0	120,000	80,000
200	3	3	condenser, dryer	clamp	9	STEEL	EPDM	80%	1	Forming & Shaping	Other - Not relevant	Molding	no	0	120,000	80,000
200	3	3	condenser, dryer	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
200	3	3	condenser, dryer	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
200	3	3	condenser, dryer	refrigerant tube	781	AL	PE	80%	2	Forming & Shaping	Assembly	Molding	no	0	120,000	80,000

200	3	3	condenser, dryer	screw	16	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
200	3	3	condenser, dryer	screw	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
200	3	3	condenser, dryer	clamp	16	STEEL	EPDM	80%	1	Forming & Shaping	Other - Not relevant	Molding	no	0	120,000	80,000
200	3	3	condenser, dryer	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
200	3	3	condenser, dryer	clamp	17	STEEL	EPDM	80%	1	Forming & Shaping	Other - Not relevant	Molding	no	0	120,000	80,000
200	3	3	condenser, dryer	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
200	3	3	condenser, dryer	clamp	27	STEEL	EPDM	80%	1	Forming & Shaping	Other - Not relevant	Molding	no	0	120,000	80,000
200	3	3	condenser, dryer	screw	23	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
200	3	3	condenser, dryer	support	2	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
201	3	3	A/C controls	AC control	414	PLASTIC	-	100%		Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
201	3	3	A/C controls	push nut	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
201	3	3	A/C controls	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
201	3	3	A/C controls	faceplate	16	ABS-PC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
201	3	3	A/C controls	resistor	148	PA66-GF	-	100%	2	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
201	3	3	A/C controls	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
201	3	3	A/C controls	temperature senso	8	PA6-GF	-	100%	2	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
201	3	3	A/C controls	servomotor	128	PA6-GF	-	100%	2	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
201	3	3	A/C controls	servomotor	100	PA6-GF	-	100%	2	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
201	3	3	A/C controls	servomotor	97	PA6-GF	-	100%	2	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
201	3	3	A/C controls	servomotor	99	PA6-GF	-	100%	2	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
201	3	3	A/C controls	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
201	3	3	A/C controls	sun sensor	9	PLASTIC	-	100%	2	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
202	3	3	compressor	AC compressor	6,294	AL	STEEL	100%	3	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
202	3	3	compressor	spacer bushing	26	AL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
202	3	3	compressor	screw	79	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
202	3	3	compressor	support	2,117	AL	-	100%	2	Die Casting	Milling	Other - Not relevant	no	0	120,000	80,000
202	3	3	compressor	screw	35	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
202	3	3	compressor	refrigerant	1,350	-	-	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
203	3	31	air distribution floor area, rear duct	air duct	1,620	PE	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
203	3	31	air distribution floor area, rear duct	nut	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
203	3	31	air distribution floor area, rear duct	vent	93	PA66-GF	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
203	3	31	air distribution floor area, rear duct	nut	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
203	3	31	air distribution floor area, rear duct	cover	54	ABS-PC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
203	3	31	air distribution floor area, rear duct	vent	107	PP	-	100%	2	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
203	3	31	air distribution floor area, rear duct	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
203	3	31	air distribution floor area, rear duct	vent	35	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
203	3	31	air distribution floor area, rear duct	bracket	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
204	3	32	air distribution switchboard	air duct	5,090	PP	-	100%	3	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
204	3	32	air distribution switchboard	push nut	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
204	3	32	air distribution switchboard	screw	12	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
204	3	32	air distribution switchboard	push nut	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
204	3	32	air distribution switchboard	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
204	3	32	air distribution switchboard	air duct	34	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
204	3	32	air distribution switchboard	vent	243	ABS	-	100%	3	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
204	3	32	air distribution switchboard	vent	114	PP	PET	100%	3	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
204	3	32	air distribution switchboard	vent	621	ABS	ABS	70%	3	Injection Molding	Assembly	Injection Molding	yes	3	120,000	80,000
204	3	32	air distribution switchboard	push nut	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
204	3	32	air distribution switchboard	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
204	3	32	air distribution switchboard	vent	83	ABS-GF	-	100%	2	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
204	3	32	air distribution switchboard	filter element	131	RUBBER	PAPER	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
204	3	32	air distribution switchboard	support	147	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
204	3	32	air distribution switchboard	filter housing	383	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
204	3	32	air distribution switchboard	nut	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
204	3	3	air distribution switchboard	nut	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
205	3	3	ventilation side segment	ventilation frame	86	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
205	3	3	ventilation side segment	gasket	7	RUBBER	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
1	4	41	grab handle roof	grab handle	77	PP-GF	-	100%	1	Injection Molding	Injection Molding	Other - Not relevant	yes	3	120,000	80,000
1	4	41	grab handle roof	grab handle	81	PP-GF	-	100%	1	Injection Molding	Injection Molding	Other - Not relevant	yes	3	120,000	80,000
1	4	41	grab handle roof	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
2	4	42	arm rest rear door, pull handle	pull handle	112	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
2	4	42	arm rest rear door, pull handle	pull handle	93	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
2	4	42	arm rest rear door, pull handle	cover	12	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
3	4	42	arm rest front door, pull handle	pull handle	70	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
3	4	42	arm rest front door, pull handle	cover	13	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
4	4	43	grab and pull handle tailgate	pull handle	39	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
4	4	43	grab and pull handle tailgate	nut insert	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
4	4	43	grab and pull handle tailgate	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
5	4	44	visor, interior rear view mirror	visor	424	POM	STYROPOF	80%	1	Injection Molding	Compression Molding	Glass Processing	yes	3	120,000	80,000
5	4	44	visor, interior rear view mirror	support	7	POM	STEEL	50%	1	Molding	Molding	Other - Not relevant	yes	1	120,000	80,000
5	4	44	visor, interior rear view mirror	faceplate	3	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
5	4	44	visor, interior rear view mirror	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
5	4	44	visor, interior rear view mirror	rear view mirror	332	AL	PLASTIC-G	55%	1	Injection Molding	Glass Processing	Molding	yes	3	120,000	80,000
7	4	45	console, storage tray on tunnel	center console	579	ABS	PC	55%	1	Injection Molding	Other - Not relevant	Injection Molding	yes	3	120,000	80,000
7	4	45	console, storage tray on tunnel	cover	231	ABS	PC	55%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
7	4	45	console, storage tray on tunnel	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
8	4	46	glove compartment w/ lid, storage tray	glove compartmen	375	ABS-PC	STEEL	90%	1	Injection Molding	Precision Mechanics	Press (Tandem)	yes	3	120,000	80,000
8	4	46	glove compartment w/ lid, storage tray	glove compartmen	875	ABS-PC	ABS-PC	50%	1	Injection Molding	Injection Molding	Injection Molding	yes	3	120,000	80,000
8	4	46	glove compartment w/ lid, storage tray	cover	95	ABS-PC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
8	4	46	glove compartment w/ lid, storage tray	storage compartme	128	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
8	4	46	glove compartment w/ lid, storage tray	storage compartme	1,150	ABS-PC-GF	-	100%	2	Injection Molding	Injection Molding	Other - Not relevant	yes	3	120,000	80,000
8	4	46	glove compartment w/ lid, storage tray	storage compartme	841	ABS-PC-GF	-	100%	1	Injection Molding	Injection Molding	Other - Not relevant	yes	3	120,000	80,000
8	4	46	glove compartment w/ lid, storage tray	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
8	4	46	glove compartment w/ lid, storage tray	push nut	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
8	4	46	glove compartment w/ lid, storage tray	closing damper	22	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
8	4	46	glove compartment w/ lid, storage tray	closing damper	100	AL	AL	50%	1	Die Casting	Other - Not relevant	Die Casting	yes	1	120,000	80,000
9	4	47	glasses compartment, cup holder, vas	cupholder	127	PC	ABS	90%	1	Injection Molding	Injection Molding	Injection Molding	yes	3	120,000	80,000
10	4	48	storage compartment door, rear	storage compartme	285	PP-PE-T20	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
10	4	48	storage compartment door, rear	hinge	2	ABS-PC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
10	4	48	storage compartment door, rear	hinge pin	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
10	4	48	storage compartment door, rear	spring	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
10	4	48	storage compartment door, rear	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
10	4	48	storage compartment door, rear	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
10	4	48	storage compartment door, rear	cushion bumper	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
11	4	48	storage compartment door, front	latching actuator	39	ABS	ABS	75%	1	Molding	Other - Not relevant	Molding	yes	1	120,000	80,000
11	4	48	storage compartment door, front	storage compartme	174	PPO	STEEL	80%	1	Injection Molding	Other - Not relevant	Forming & Shaping	yes	3	120,000	80,000
12	4	49	storage tray trunk	storage compartme	1,175	ABS	PUR	75%	1	Injection Molding	Compression Molding	Injection Molding	yes	3	120,000	80,000
12	4	49	storage tray trunk	push nut	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
12	4	49	storage tray trunk	push nut	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
12	4	49	storage tray trunk	screw	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
12	4	49	storage tray trunk	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
15	4	410	ashtray, middle console	ashtray	59	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
15	4	410	ashtray, middle console	retainer	109	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	safety belt	698	STEEL	STEEL	40%	3	Press (Tandem)	Press (Tandem)	Press (Tandem)	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	safety belt 2	524	STEEL	POM	80%	1	Forging	Other - Not relevant	Injection Molding	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	safety belt 3	175	AL	-	100%	1	Nonwoven	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	safety belt 4	349	AL	-	100%	1	Precision Mechanics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	support	10	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	safety belt height a	266	STEEL	STEEL	70%	2	Press (Tandem)	Other - Not relevant	Press (Tandem)	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	screw	11	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	shoulder bolt	11	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	spacer bushing	36	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	washer	1	PAPER	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	end cap	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	guide yoke	33	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	shoulder bolt	47	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	end cap	11	PP	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	seat belt lock	188	STEEL	PLASTIC	70%	1	Forging	Press (Tandem)	Injection Molding	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	screw	19	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	washer	1	PAPER	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000

13	4	4	safety belts, belt tensioner	safety belt	306	STEEL	STEEL	40%	1	Press (Tandem)	Press (Tandem)	Press (Tandem)	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	safety belt 2	230	STEEL	POM	80%	1	Forging	Other - Not relevant	Injection Molding	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	safety belt 3	77	AL	-	100%	1	Nonwoven	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	safety belt 4	153	AL	-	100%	1	Precision Mechanics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	safety belt height a	268	STEEL	STEEL	100%	2	Press (Tandem)	Press (Tandem)	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	screw	11	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	guide yoke	33	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	shoulder bolt	33	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	spacer bushing	11	STEEL	-	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	washer	1	PAPER	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	end cap	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	screw	31	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	shoulder bolt	46	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	end cap	11	PP	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	waist safety belt	249	STEEL	STEEL	40%	1	Press (Tandem)	Press (Tandem)	Press (Tandem)	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	safety belt 2	187	STEEL	POM	80%	1	Forging	Other - Not relevant	Injection Molding	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	safety belt 3	62	AL	-	100%	1	Nonwoven	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	safety belt 4	125	AL	-	100%	1	Precision Mechanics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	screw	17	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	washer	1	PAPER	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	safety belt	333	STEEL	STEEL	40%	1	Press (Tandem)	Press (Tandem)	Press (Tandem)	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	safety belt 2	250	STEEL	POM	80%	1	Forging	Other - Not relevant	Injection Molding	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	safety belt 3	83	AL	-	100%	1	Nonwoven	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	safety belt 4	167	AL	-	100%	1	Precision Mechanics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	guide yoke	33	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	shoulder bolt	49	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	washer	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	washer	1	PAPER	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	screw	32	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	end cap	11	PP	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	seat belt lock	128	STEEL	PLASTIC	70%	1	Forging	Press (Tandem)	Injection Molding	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	screw	19	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	washer	1	PAPER	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	cover	38	ABS	STEEL	80%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	cover	30	ABS	STEEL	75%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	button	4	PA-6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	end cap	10	ABS	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	safety belt	226	STEEL	-	100%	1	Press (Tandem)	Press (Tandem)	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	safety belt 2	169	STEEL	POM	80%	1	Forging	Other - Not relevant	Injection Molding	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	safety belt 3	56	AL	-	100%	1	Nonwoven	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	safety belt 4	113	AL	-	100%	1	Precision Mechanics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	cover	30	ABS	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	screw	12	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	seat belt lock	65	STEEL	PLASTIC	40%	1	Forging	Precision Mechanics	Injection Molding	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	wire fixture	11	STEEL	-	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	support	15	PA-GF	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
13	4	4	safety belts, belt tensioner	nut	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
14	4	4	passive restraining system, airbag	air bag driver side	593	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
14	4	4	passive restraining system, airbag	air bag driver side	890	PA6-GF	-	100%	2	Precision Mechanics	Electronics	Other - Not relevant	no	0	120,000	80,000
14	4	4	passive restraining system, airbag	retainer	208	STEEL	PLASTIC	90%	1	Press (Tandem)	Other - Not relevant	Molding	no	0	120,000	80,000
14	4	4	passive restraining system, airbag	shoulder bolt	9	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
14	4	4	passive restraining system, airbag	return ring	236	ABS-PC-PO	Electronics	90%	1	Injection Molding	Other - Not relevant	Electronics	no	0	120,000	80,000
14	4	4	passive restraining system, airbag	airbag passenger s	1,283	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
14	4	4	passive restraining system, airbag	airbag passenger s	1,283	PA6-GF	-	100%	2	Precision Mechanics	Electronics	Other - Not relevant	no	0	120,000	80,000
14	4	4	passive restraining system, airbag	support frame	1,052	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
14	4	4	passive restraining system, airbag	nut	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
14	4	4	passive restraining system, airbag	nut	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
14	4	4	passive restraining system, airbag	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
14	4	4	passive restraining system, airbag	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
14	4	4	passive restraining system, airbag	screw	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
14	4	4	passive restraining system, airbag	angle piece	257	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
14	4	4	passive restraining system, airbag	screw	19	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
14	4	4	passive restraining system, airbag	electronic control m	239	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
14	4	4	passive restraining system, airbag	acorn nut	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
14	4	4	passive restraining system, airbag	crash sensor	34	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	3	120,000	80,000
14	4	4	passive restraining system, airbag	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	3	120,000	80,000
26	4	411	damping floor, tunnel	floor covering	1,793	FABRIC	-	100%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
26	4	411	damping floor, tunnel	clip	2	PA-6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
26	4	411	damping floor, tunnel	floor covering	163	FABRIC	-	100%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
26	4	411	damping floor, tunnel	clip	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
26	4	411	damping floor, tunnel	floor covering	11,434	BITUMEN	-	100%	1	Nonwoven	Compression Molding	Other - Not relevant	yes	1	120,000	80,000
26	4	411	damping floor, tunnel	cover	14	PA6-GF	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
26	4	411	damping floor, tunnel	clip	2	PA-6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
26	4	411	damping floor, tunnel	damper	12,666	PET-PO-PF	EPDM-POM	50%	1	Compression Molding	Other - Not relevant	Compression Molding	yes	2	120,000	80,000
26	4	411	damping floor, tunnel	damper	15	CO-PF	-	100%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
26	4	411	damping floor, tunnel	clip	2	PA6.6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
26	4	411	damping floor, tunnel	damper	79	CO-PF	-	100%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
26	4	411	damping floor, tunnel	damper	109	CO-PF	-	100%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
26	4	411	damping floor, tunnel	melt-on mat	3,012	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
26	4	411	damping floor, tunnel	melt-on mat	1,901	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
26	4	411	damping floor, tunnel	melt-on mat	1,251	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
26	4	411	damping floor, tunnel	melt-on mat	805	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
26	4	411	damping floor, tunnel	melt-on mat	345	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
26	4	411	damping floor, tunnel	melt-on mat	1,763	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
27	4	412	damping bulkhead	damper	374	PET-PO-PF	-	100%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
27	4	412	damping bulkhead	damper	802	PET-PO-PF	-	100%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
27	4	412	damping bulkhead	damper	186	PET-PO-PF	-	100%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
27	4	412	damping bulkhead	damper	111	PET-PO-PF	-	100%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
27	4	412	damping bulkhead	clamping washer	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
27	4	412	damping bulkhead	clamping washer	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
27	4	412	damping bulkhead	damper	1,979	PET-PO-PF	EPDM	50%	1	Compression Molding	Other - Not relevant	Compression Molding	yes	2	120,000	80,000
27	4	412	damping bulkhead	clamping washer	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
27	4	412	damping bulkhead	damper	2,008	CO-PF	-	100%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
27	4	412	damping bulkhead	clamping washer	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
27	4	412	damping bulkhead	melt-on mat	227	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
27	4	412	damping bulkhead	melt-on mat	147	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
27	4	412	damping bulkhead	melt-on mat	113	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
27	4	412	damping bulkhead	melt-on mat	352	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
27	4	412	damping bulkhead	melt-on mat	813	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
27	4	412	damping bulkhead	melt-on mat	149	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
27	4	412	damping bulkhead	melt-on mat	98	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
28	4	413	damping side panel front, pillar A	damper	355	CO-PF	EPDM	50%	1	Compression Molding	Other - Not relevant	Compression Molding	yes	2	120,000	80,000
28	4	413	damping side panel front, pillar A	clamping washer	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
28	4	413	damping side panel front, pillar A	damper	37	PLASTIC	PUR	50%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
28	4	413	damping side panel front, pillar A	melt-on mat	198	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
28	4	413	damping side panel front, pillar A	melt-on mat	279	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
28	4	413	damping side panel front, pillar A	melt-on mat	400	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
29	4	414	damping roof, roof member, moon roo	damper	15	PUR	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
29	4	414	damping roof, roof member, moon roo	damper	9	PUR	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
29	4	414	damping roof, roof member, moon roo	damper	7	PUR	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
29	4	414	damping roof, roof member, moon roo	melt-on mat	366	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
29	4	414	damping roof, roof member, moon roo	melt-on mat	183	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
30	4	415	damping rear door	melt-on mat	324	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
31	4	416	damping front door	melt-on mat	324	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
32	4	417	damping side panel rear	damper	24	PUR	-	100%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
32	4	417	damping side panel rear	damper	214	CO-PF	-	100%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
32	4	417	damping side panel rear	clamping washer	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000

32	4	417	damping side panel rear	damper	1,336	CO-PF	-	100%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
32	4	417	damping side panel rear	clamping washer	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
32	4	417	damping side panel rear	damper	451	CO-PF	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
32	4	417	damping side panel rear	damper	22	CO-PF	-	100%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
32	4	417	damping side panel rear	clip	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
32	4	417	damping side panel rear	damper	27	CO-PF	-	100%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
32	4	417	damping side panel rear	clip	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
32	4	417	damping side panel rear	damper	258	CO-PF	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
32	4	417	damping side panel rear	melt-on mat	466	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
32	4	417	damping side panel rear	melt-on mat	192	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
32	4	417	damping side panel rear	melt-on mat	121	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
32	4	417	damping side panel rear	melt-on mat	626	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
32	4	417	damping side panel rear	melt-on mat	403	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
33	4	418	damping hood	damper	834	BITUMEN	-	100%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
33	4	418	damping hood	bracket	2	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
34	4	419	damping tailgate, trunk lid	insulation sheet	165	BITUMEN	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
34	4	419	damping tailgate, trunk lid	melt-on mat	198	BITUMEN	-	100%	1	Deposition (plastices)	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
35	4	420	damping / insulating engine compartm	damper	215	PLASTIC	PUR	50%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
35	4	420	damping / insulating engine compartm	clip	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
36	4	421	cover floor, side member interior	trim	410	PP-TV	-	100%	2	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
36	4	421	cover floor, side member interior	trim	427	PP-TV	-	100%	2	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
36	4	421	cover floor, side member interior	trim	254	PP-TV	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
36	4	421	cover floor, side member interior	support	235	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
36	4	421	cover floor, side member interior	support bearing	8	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
36	4	421	cover floor, side member interior	support bearing	4	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
36	4	421	cover floor, side member interior	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
36	4	421	cover floor, side member interior	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
37	4	422	trim side panel front, pillar A	trim	292	PP-PE-T20	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
37	4	422	trim side panel front, pillar A	clip	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
37	4	422	trim side panel front, pillar A	grommet	2	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
38	4	423	trim instrument panel, instrument pane	instrument panel	7,235	PLASTIC	FOAM	100%	3	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
38	4	423	trim instrument panel, instrument pane	instrument panel	1,627	ABS-PC	-	100%	3	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
38	4	423	trim instrument panel, instrument pane	cover	31	ABS-PC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
38	4	423	trim instrument panel, instrument pane	cover	476	ABS-PC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
38	4	423	trim instrument panel, instrument pane	trim	273	ABS-PC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
38	4	423	trim instrument panel, instrument pane	cover	85	ABS-PC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
38	4	423	trim instrument panel, instrument pane	push nut	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
38	4	423	trim instrument panel, instrument pane	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
38	4	423	trim instrument panel, instrument pane	retainer	2	PLASTIC	STEEL	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
38	4	423	trim instrument panel, instrument pane	support	354	ABS-PC	-	100%	2	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
38	4	423	trim instrument panel, instrument pane	push nut	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
38	4	423	trim instrument panel, instrument pane	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
38	4	423	trim instrument panel, instrument pane	end cover	5	ABS	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
38	4	423	trim instrument panel, instrument pane	speaker	35	ABS-PC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
38	4	423	trim instrument panel, instrument pane	switchboard cross	5,675	STEEL	-	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
38	4	423	trim instrument panel, instrument pane	switchboard cross	5,000	STEEL	STEEL	50%	3	Press (Tandem)	Press (Tandem)	Welding and Cutting	yes	3	120,000	80,000
38	4	423	trim instrument panel, instrument pane	switchboard cross	113	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
38	4	423	trim instrument panel, instrument pane	switchboard cross	113	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
38	4	423	trim instrument panel, instrument pane	switchboard cross	113	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
38	4	423	trim instrument panel, instrument pane	switchboard cross	113	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
38	4	423	trim instrument panel, instrument pane	switchboard cross	113	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
38	4	423	trim instrument panel, instrument pane	switchboard cross	113	STEEL	STEEL	75%	1	Press (Tandem)	Press (Tandem)	Welding and Cutting	yes	3	120,000	80,000
38	4	423	trim instrument panel, instrument pane	drag strut	364	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
38	4	423	trim instrument panel, instrument pane	screw	18	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
38	4	423	trim instrument panel, instrument pane	strut	156	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
38	4	423	trim instrument panel, instrument pane	screw	18	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
38	4	423	trim instrument panel, instrument pane	angle bracket	225	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
38	4	423	trim instrument panel, instrument pane	nut	12	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
38	4	423	trim instrument panel, instrument pane	screw	18	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
38	4	423	trim instrument panel, instrument pane	step protector	120	PP-T30	FOAM	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
39	4	424	roof liner	molded roof liner	3,594	CELLULOSE	FOAM	100%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
39	4	424	roof liner	snap button	1	PA6.6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
39	4	424	roof liner	cover	4	ASA	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
39	4	424	roof liner	frame	1	PP-GF	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
39	4	424	roof liner	cover	197	ASA	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
39	4	424	roof liner	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
40	4	425	door trim front	door trim	3,018	PVC	TPU	50%	3	Injection Molding	Compression Molding	Other - Not relevant	yes	3	120,000	80,000
40	4	425	door trim front	clip	1	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
40	4	425	door trim front	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
41	4	426	door trim rear	door trim	2,693	PVC	TPU	50%	3	Injection Molding	Compression Molding	Other - Not relevant	yes	3	120,000	80,000
41	4	426	door trim rear	clip	1	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
41	4	426	door trim rear	screw	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
42	4	427	side trim	trim	325	PVC-PF-ABS	-	100%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
42	4	427	side trim	trim	146	PP-TV	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
42	4	427	side trim	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
42	4	427	side trim	trim	203	PP-TV	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
42	4	427	side trim	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
42	4	427	side trim	trim	228	PP-TV	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
42	4	427	side trim	side trim	2,123	PVC-PF-ABS	FOAM	50%	3	Injection Molding	Other - Not relevant	Compression Molding	yes	3	120,000	80,000
42	4	427	side trim	maintenance door	752	ABS	LEATHER-F	70%	1	Injection Molding	Other - Not relevant	Injection Molding	yes	3	120,000	80,000
42	4	427	side trim	side trim	3,194	ABS	LEATHER-F	40%	3	Injection Molding	Injection Molding	Compression Molding	yes	3	120,000	80,000
42	4	427	side trim	grill	183	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
42	4	427	side trim	support	133	STEEL	EPDM	85%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
42	4	427	side trim	screw	17	STEEL-CR	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
42	4	427	side trim	washer	6	STEEL-CR	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
42	4	427	side trim	bracket	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
42	4	427	side trim	clip	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
42	4	427	side trim	retainer	2	STEEL	PLASTIC	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
42	4	427	side trim	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
42	4	427	side trim	snap button	2	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
42	4	427	side trim	snap button	4	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
43	4	428	trunk floor cover	cover	1,031	STEEL	CR	100%	1	Press (Tandem)	Chroming	Other - Not relevant	yes	3	120,000	80,000
43	4	428	trunk floor cover	clip	1	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
43	4	428	trunk floor cover	luggage compartm	4,867	PVC-PET	PA6-GF	65%	1	Extrusion (plastic)	Injection Molding	Injection Molding	yes	3	120,000	80,000
43	4	428	trunk floor cover	retainer	84	PA-GF	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
43	4	428	trunk floor cover	screw	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
43	4	428	trunk floor cover	retainer	15	PA-GF	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
43	4	428	trunk floor cover	nut	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
43	4	428	trunk floor cover	support	122	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
44	4	429	trim tailgate, trunk lid	trim	2,651	PVC	TPU	50%	2	Injection Molding	Compression Molding	Other - Not relevant	yes	3	120,000	80,000
44	4	429	trim tailgate, trunk lid	bracket	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
44	4	429	trim tailgate, trunk lid	screw	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
44	4	429	trim tailgate, trunk lid	maintenance door	62	PLASTIC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
44	4	429	trim tailgate, trunk lid	trim	756	PP-PE-T20	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
44	4	429	trim tailgate, trunk lid	bracket	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
175	4	430	cover front seat w/ cushion insert	cover	470	PUR	PLASTIC	70%	1	RIM/Foam Molding	Assembly	Molding	yes	3	120,000	80,000
175	4	430	cover front seat w/ cushion insert	cover	398	PUR	PLASTIC	70%	1	RIM/Foam Molding	Assembly	Injection Molding	yes	3	120,000	80,000
175	4	430	cover front seat w/ cushion insert	cover	48	PUR	PLASTIC	70%	1	RIM/Foam Molding	Assembly	Molding	yes	3	120,000	80,000
175	4	430	cover front seat w/ cushion insert	staple	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
176	4	430	cover rear seat w/ cushion insert	cover	334	PUR	PLASTIC	70%	1	RIM/Foam Molding	Assembly	Injection Molding	yes	3	120,000	80,000
176	4	430	cover rear seat w/ cushion insert	cover	137	PUR	PLASTIC	70%	1	RIM/Foam Molding	Assembly	Molding	yes	3	120,000	80,000
176	4	430	cover rear seat w/ cushion insert	cover	128	PUR	PLASTIC	70%	1	RIM/Foam Molding	Assembly	Molding	yes	3	120,000	80,000
176	4	430	cover rear seat w/ cushion insert	cover	463	PUR	PLASTIC	70%	1	RIM/Foam Molding	Assembly	Molding	yes	3	120,000	80,000
176	4	430	cover rear seat w/ cushion insert	staple	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
176	4	430	cover rear seat w/ cushion insert	cover	364	PUR	PLASTIC	80%	1	RIM/Foam Molding	Assembly	Injection Molding	yes	3	120,000	80,000
176	4	430	cover rear seat w/ cushion insert	cover	325	PUR	PLASTIC	70%	1	RIM/Foam Molding	Assembly	Injection Molding	yes	3	120,000	80,000
176	4	430	cover rear seat w/ cushion insert	staple	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
176	4	430	cover rear seat w/ cushion insert	cover	364	PUR	PLASTIC	80%	1	RIM/Foam Molding	Assembly	Injection Molding	yes	3	120,000	80,000
176	4	430	cover rear seat w/ cushion insert	cover	325	PUR	PLASTIC	70%	1	RIM/Foam Molding	Assembly	Injection Molding	yes	3	120,000	80,000
176	4	430	cover rear seat w/ cushion insert	staple	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000

177	4	430	seat rack front	Z Seat rack	15,865	STEEL	STEEL	70%	3	Press (Tandem)	GMAW/FCAW-MIG	Press (Tandem)	yes	3	120,000	80,000
177	4	430	seat rack front	Z Seat rack	8,628	STEEL	STEEL	70%	3	Press (Tandem)	GMAW/FCAW-MIG	Press (Tandem)	yes	3	120,000	80,000
177	4	430	seat rack front	Z Seat back rack	4,925	STEEL	PLASTIC	80%	3	Press (Tandem)	GMAW/FCAW-MIG	Injection Molding	yes	3	120,000	80,000
177	4	430	seat rack front	abrasion protection	50	PUR	-	100%	1	RIM/Foam Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
177	4	430	seat rack front	trim	406	ABS	-	100%	2	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
177	4	430	seat rack front	trim	16	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
177	4	430	seat rack front	trim	26	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
177	4	430	seat rack front	trim	9	ABS	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
177	4	430	seat rack front	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	clip	2	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	screw	28	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	screw	12	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	bracket	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	carrier plate	350	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
177	4	430	seat rack front	clip	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	bearing block	17	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	bearing block	12	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	frame	712	STEEL	STEEL	70%	3	Press (Tandem)	GMAW/FCAW-MIG	Bending	yes	3	120,000	80,000
177	4	430	seat rack front	Z guide	18	PLASTIC	STEEL	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	Z guide	18	PLASTIC	STEEL	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	Z rack	633	STEEL	STEEL	70%	3	Press (Tandem)	GMAW/FCAW-MIG	Press (Tandem)	yes	3	120,000	80,000
177	4	430	seat rack front	trim	30	PLASTIC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
177	4	430	seat rack front	adjusting wheel	12	PLASTIC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	end cap	3	ABS	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	screw	12	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	trim	203	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
177	4	430	seat rack front	trim	200	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
177	4	430	seat rack front	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	clip	1	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	adjusting lever	57	PA6-GF	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
177	4	430	seat rack front	adjusting lever	56	PA6-GF	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
177	4	430	seat rack front	end cap	1	PA	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	adjusting wheel	37	PS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
177	4	430	seat rack front	cap	8	ABS	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	adjusting wheel	19	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
177	4	430	seat rack front	trim	26	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
177	4	430	seat rack front	trim	207	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
177	4	430	seat rack front	trim	201	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
177	4	430	seat rack front	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	clip	1	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	adjusting wheel	57	PA6-GF	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
177	4	430	seat rack front	end cap	1	PA	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	adjusting wheel	37	PS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
177	4	430	seat rack front	cap	8	ABS	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
177	4	430	seat rack front	adjusting wheel	19	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
177	4	430	seat rack front	trim	26	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
178	4	430	seat rack rear	frame	712	STEEL	STEEL	70%	3	Press (Tandem)	GMAW/FCAW-MIG	Bending	yes	3	120,000	80,000
178	4	430	seat rack rear	Z guide	17	STEEL	PLASTIC	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
178	4	430	seat rack rear	Z guide	17	STEEL	PLASTIC	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
178	4	430	seat rack rear	Z rail	614	STEEL	STEEL	70%	3	Press (Tandem)	GMAW/FCAW-MIG	Press (Tandem)	yes	3	120,000	80,000
178	4	430	seat rack rear	Z rail	605	STEEL	STEEL	70%	2	Press (Tandem)	GMAW/FCAW-MIG	Press (Tandem)	yes	3	120,000	80,000
178	4	430	seat rack rear	cover	33	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
178	4	430	seat rack rear	screw	16	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	Z Seat rack	10,422	STEEL	PLASTIC	70%	3	Press (Tandem)	GMAW/FCAW-MIG	Press (Tandem)	yes	3	120,000	80,000
178	4	430	seat rack rear	seat tray	1,577	STEEL	STEEL	70%	1	Press (Tandem)	GMAW/FCAW-MIG	Press (Tandem)	yes	3	120,000	80,000
178	4	430	seat rack rear	Z Seat back rack	2,257	STEEL	STEEL	70%	3	Press (Tandem)	GMAW/FCAW-MIG	Press (Tandem)	yes	3	120,000	80,000
178	4	430	seat rack rear	carrier plate	485	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
178	4	430	seat rack rear	clamping pate	129	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
178	4	430	seat rack rear	seat back	313	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
178	4	430	seat rack rear	seat cushion	230	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
178	4	430	seat rack rear	footrest	633	ABS	PLASTIC	70%	1	Injection Molding	Assembly	Injection Molding	yes	3	120,000	80,000
178	4	430	seat rack rear	adjusting unit	2,389	STEEL	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	screw	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	screw	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	clip	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	cable tie	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	acorn nut	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	screw	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	cover	368	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
178	4	430	seat rack rear	trim	270	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
178	4	430	seat rack rear	trim	268	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
178	4	430	seat rack rear	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	washer	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	nut	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	clip	1	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	screw	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	end cap	1	PP	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	Z Seat rack	10,088	STEEL	PLASTIC	70%	3	Press (Tandem)	GMAW/FCAW-MIG	Press (Tandem)	yes	3	120,000	80,000
178	4	430	seat rack rear	seat tray	1,477	STEEL	STEEL	70%	1	Press (Tandem)	GMAW/FCAW-MIG	Press (Tandem)	yes	3	120,000	80,000
178	4	430	seat rack rear	Z Seat back rack	1,711	STEEL	STEEL	70%	3	Press (Tandem)	GMAW/FCAW-MIG	Press (Tandem)	yes	3	120,000	80,000
178	4	430	seat rack rear	cover	379	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
178	4	430	seat rack rear	trim	358	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
178	4	430	seat rack rear	trim	269	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
178	4	430	seat rack rear	screw	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	screw	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	screw	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	end cap	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	clip	1	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	screw	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	end cap	1	PP	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	Z Seat rack	10,422	STEEL	PLASTIC	70%	3	Press (Tandem)	GMAW/FCAW-MIG	Press (Tandem)	yes	3	120,000	80,000
178	4	430	seat rack rear	seat tray	1,477	STEEL	STEEL	70%	1	Press (Tandem)	GMAW/FCAW-MIG	Press (Tandem)	yes	3	120,000	80,000
178	4	430	seat rack rear	Z Seat back rack	1,711	STEEL	STEEL	70%	3	Press (Tandem)	GMAW/FCAW-MIG	Press (Tandem)	yes	3	120,000	80,000
178	4	430	seat rack rear	cover	379	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
178	4	430	seat rack rear	trim	270	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
178	4	430	seat rack rear	trim	268	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
178	4	430	seat rack rear	screw	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	screw	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	screw	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	end cap	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	clip	1	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	screw	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
178	4	430	seat rack rear	end cap	1	PP	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
179	4	430	spring cores, cushion layers, and foam	foam part	291	PUR	PLASTIC	50%	1	RIM/Foam Molding	Other - Not relevant	Injection Molding	yes	3	120,000	80,000
179	4	430	spring cores, cushion layers, and foam	foam part	122	PUR	-	100%	1	RIM/Foam Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
179	4	430	spring cores, cushion layers, and foam	foam part	1,185	PUR	-	100%	1	RIM/Foam Molding	Assembly	Other - Not relevant	yes	3	120,000	80,000
179	4	430	spring cores, cushion layers, and foam	foam part	1,475	PUR	STEEL	60%	2	RIM/Foam Molding	Other - Not relevant	Bending	yes	3	120,000	80,000
180	4	430	spring cores, cushion layers, and foam	foam part	291	PUR	PLASTIC	50%	1	RIM/Foam Molding	Other - Not relevant	Injection Molding	yes	3	120,000	80,000
180	4	430	spring cores, cushion layers, and foam	foam part	432	PUR	PLASTIC	50%	1	RIM/Foam Molding	Other - Not relevant	Molding	yes	3	120,000	80,000
180	4	430	spring cores, cushion layers, and foam	fill cushion	270	PUR	-	100%	1	RIM/Foam Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000

180	4	430	spring cores, cushion layers, and foam	foam part	194	PUR	-	100%	1	RIM/Foam Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
180	4	430	spring cores, cushion layers, and foam	foam part	364	PUR	-	100%	1	RIM/Foam Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
180	4	430	spring cores, cushion layers, and foam	foam part	1,040	PUR	-	100%	1	RIM/Foam Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
180	4	430	spring cores, cushion layers, and foam	foam part	809	PUR	PLASTIC	50%	1	RIM/Foam Molding	Assembly	Injection Molding	yes	3	120,000	80,000
180	4	430	spring cores, cushion layers, and foam	fill cushion	357	PUR	-	100%	1	RIM/Foam Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
180	4	430	spring cores, cushion layers, and foam	foam part	1,366	PUR	STEEL	60%	2	RIM/Foam Molding	Other - Not relevant	Bending	yes	3	120,000	80,000
180	4	430	spring cores, cushion layers, and foam	foam part	809	PUR	PLASTIC	50%	1	RIM/Foam Molding	Assembly	Injection Molding	yes	3	120,000	80,000
180	4	430	spring cores, cushion layers, and foam	fill cushion	357	PUR	-	100%	1	RIM/Foam Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
180	4	430	spring cores, cushion layers, and foam	foam part	1,366	PUR	STEEL	60%	2	RIM/Foam Molding	Other - Not relevant	Bending	yes	3	120,000	80,000
92	5	5	power lock complete	adjuster	178	PLASTIC	AL	40%	1	Injection Molding	Injection Molding	Electro-Mechanical	no	0	120,000	80,000
92	5	5	power lock complete	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
93	5	5	door handle interior and exterior front	door lock	801	STEEL	PP-TV	100%	1	Precision Mechanics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
93	5	5	door handle interior and exterior front	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
93	5	5	door handle interior and exterior front	door handle	238	PA6-GF	STEEL	70%	1	Injection Molding	Injection Molding	Precision Mechanics	no	0	120,000	80,000
93	5	5	door handle interior and exterior front	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
93	5	5	door handle interior and exterior front	bracket	1	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
93	5	5	door handle interior and exterior front	gasket	3	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
93	5	5	door handle interior and exterior front	gasket	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
93	5	5	door handle interior and exterior front	door opener	148	PA6-GF	AL	70%	1	Injection Molding	Die Casting	Other - Not relevant	no	0	120,000	80,000
93	5	5	door handle interior and exterior front	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
93	5	5	door handle interior and exterior front	lock wedge	125	STEEL	PLASTIC	100%	1	Press (Tandem)	Surface treating	Other - Not relevant	no	0	120,000	80,000
93	5	5	door handle interior and exterior front	threaded plate	31	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
93	5	5	door handle interior and exterior front	screw	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
94	5	5	door handle interior and exterior rear	door lock	793	PP-TV	STEEL	100%	1	Precision Mechanics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
94	5	5	door handle interior and exterior rear	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
94	5	5	door handle interior and exterior rear	door handle	165	PA6-GF	PA6-GF	70%	1	Injection Molding	Injection Molding	Precision Mechanics	no	0	120,000	80,000
94	5	5	door handle interior and exterior rear	screw	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
94	5	5	door handle interior and exterior rear	bracket	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
94	5	5	door handle interior and exterior rear	gasket	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
94	5	5	door handle interior and exterior rear	door opener	149	PA6-GF	AL	70%	1	Injection Molding	Die Casting	Other - Not relevant	no	0	120,000	80,000
94	5	5	door handle interior and exterior rear	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
94	5	5	door handle interior and exterior rear	lock wedge	125	STEEL	PLASTIC	100%	1	Press (Tandem)	Surface treating	Other - Not relevant	no	0	120,000	80,000
94	5	5	door handle interior and exterior rear	threaded plate	31	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
94	5	5	door handle interior and exterior rear	screw	32	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
95	5	5	lock hood	front hood lock	184	STEEL	STEEL	70%	1	Press (Tandem)	Press (Tandem)	GMAW/FCAW-MIG	no	0	120,000	80,000
95	5	5	lock hood	front hood lock - m	123	STEEL	STEEL	60%	1	Forging	Forging	GMAW/FCAW-MIG	no	0	120,000	80,000
95	5	5	lock hood	latching rod	25	PA6-GF	STEEL	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
95	5	5	lock hood	screw	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
95	5	5	lock hood	push nut	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
95	5	5	lock hood	bumper	12	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
95	5	5	lock hood	operating lever	61	PA6-GF	STEEL	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
95	5	5	lock hood	screw	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
95	5	5	lock hood	gasket	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
95	5	5	lock hood	control cable	58	STEEL	PLASTIC	70%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
95	5	5	lock hood	cover	53	PP-TV	PET-GF	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
95	5	5	lock hood	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
95	5	5	lock hood	push nut	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
96	5	5	lock tailgate, trunk lid	handle	419	PE	STEEL	60%	1	Injection Molding	Injection Molding	Press (Tandem)	no	0	120,000	80,000
96	5	5	lock tailgate, trunk lid	Z lock cylinder	212	AL	STEEL	70%	1	Press (Tandem)	Press (Tandem)	Electro-Mechanical	no	0	120,000	80,000
96	5	5	lock tailgate, trunk lid	screw	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
96	5	5	lock tailgate, trunk lid	lock	459	STEEL	PLASTIC	100%	1	Electro-Mechanical	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
96	5	5	lock tailgate, trunk lid	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
96	5	5	lock tailgate, trunk lid	adjuster	104	PA66-GF	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
96	5	5	lock tailgate, trunk lid	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
96	5	5	lock tailgate, trunk lid	lock wedge	85	STEEL	PLASTIC	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
96	5	5	lock tailgate, trunk lid	screw	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
96	5	5	lock tailgate, trunk lid	guide	71	STEEL	PLASTIC	70%	1	Forming & Shaping	Other - Not relevant	Molding	no	0	120,000	80,000
96	5	5	lock tailgate, trunk lid	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
96	5	5	lock tailgate, trunk lid	cover	11	ABS	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
96	5	5	lock tailgate, trunk lid	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
96	5	5	lock tailgate, trunk lid	guide	114	STEEL	PLASTIC	75%	1	Forming & Shaping	Other - Not relevant	Molding	no	0	120,000	80,000
96	5	5	lock tailgate, trunk lid	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
96	5	5	lock tailgate, trunk lid	bumper	15	PP-GF	EPDM	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
141	5	51	window frame and control moon roof	Z frame	11,736	STEEL	POM	70%	3	Press (Tandem)	Adhesive Bonding	Injection Molding	yes	3	120,000	80,000
141	5	51	window frame and control moon roof	support	67	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
141	5	51	window frame and control moon roof	emergency overrid	16	STEEL	-	100%	1	Forging	Bending	Other - Not relevant	yes	1	120,000	80,000
141	5	51	window frame and control moon roof	screw	9	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
141	5	51	window frame and control moon roof	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
141	5	51	window frame and control moon roof	nut	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
141	5	51	window frame and control moon roof	push nut	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
142	5	5	window frame and control door window	window regulator	2,230	STEEL	PP-TV	100%	2	Electro-Mechanical	Assembly	Other - Not relevant	no	0	120,000	80,000
142	5	5	window frame and control door window	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
143	5	5	window frame and control door window	window regulator	1,963	STEEL	PP-TV	100%	2	Electro-Mechanical	Assembly	Other - Not relevant	no	0	120,000	80,000
143	5	5	window frame and control door window	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
144	5	5	window frame and control side window	Z servo motor	303	PA-66	STEEL	100%	3	Electric	Assembly	Other - Not relevant	no	0	120,000	80,000
144	5	5	window frame and control side window	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
144	5	5	window frame and control side window	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
144	5	5	window frame and control side window	nut	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
144	5	5	window frame and control side window	spacer	2	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
162	5	52	corrosion proofing, fender liners	fender liner	682	PP/EPDM	-	100%	2	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
162	5	52	corrosion proofing, fender liners	fender liner	802	PP/EPDM	-	100%	2	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
162	5	52	corrosion proofing, fender liners	screw	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
162	5	52	corrosion proofing, fender liners	push nut	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
162	5	52	corrosion proofing, fender liners	nut insert	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
163	5	5	body sealing	water drain	11	PP	-	100%	2	Injection Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
164	5	5	body floor panel front	footrest	35	PS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
164	5	5	body floor panel front	body	######	STEEL	STEEL	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
165	5	5	front segment, end panel front	lock carrier	6,177	PLASTIC	-	100%	3	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
165	5	5	front segment, end panel front	crossbeam	9,177	STEEL	STEEL	70%	3	Press (Tandem)	GMAW/FCAW-MIG	Press (Tandem)	no	0	120,000	80,000
165	5	5	front segment, end panel front	screw	30	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
165	5	5	front segment, end panel front	screw	14	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
165	5	5	front segment, end panel front	screw	11	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
165	5	5	front segment, end panel front	web plate	2,123	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
165	5	5	front segment, end panel front	screw	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
165	5	5	front segment, end panel front	washer	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
166	5	5	fender front	fender	3,619	STEEL	-	100%	2	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
166	5	5	fender front	screw	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
167	5	5	doors front	door	18,982	STEEL	STEEL	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
168	5	5	doors rear	door	16,645	STEEL	STEEL	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
169	5	5	hood	front hood	12,198	STEEL	STEEL	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
170	5	5	tailgate, trunk lid	tailgate	18,258	STEEL	STEEL	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
171	5	5	door hinge front, arrestor	door arrestor	145	STEEL	-	100%	1	Forging	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
171	5	5	door hinge front, arrestor	screw	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
171	5	5	door hinge front, arrestor	bolt	11	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
171	5	5	door hinge front, arrestor	nut	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
171	5	5	door hinge front, arrestor	screw	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
171	5	5	door hinge front, arrestor	set screw	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
171	5	5	door hinge front, arrestor	bearing block	52	STEEL	-	100%	1	Forging	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
171	5	5	door hinge front, arrestor	cover	16	PE	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
171	5	5	door hinge front, arrestor	protective cover	28	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
172	5	5	door hinge rear, arrestor	door arrestor	151	STEEL	-	100%	1	Forging	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
172	5	5	door hinge rear, arrestor	screw	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
172	5	5	door hinge rear, arrestor	bolt	11	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
172	5	5	door hinge rear, arrestor	nut	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
172	5	5	door hinge rear, arrestor	pillowblock	49	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
172	5	5	door hinge rear, arrestor	threaded plate	31	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
172	5	5	door hinge rear, arrestor	screw	9	STEEL	-	100%	1	Forging	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
172	5	5	door hinge rear, arrestor	cover	15	PP	EPDM	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
172	5	5	door hinge rear, arrestor	protective cover	17	PE	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
172	5	5	door hinge rear, arrestor	set screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000

173	5	5	hood hinge, gas spring	hinge	445	STEEL	-	100%	1	Press (Tandem)	Assembly	Other - Not relevant	no	0	120,000	80,000
173	5	5	hood hinge, gas spring	screw	13	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
173	5	5	hood hinge, gas spring	screw	19	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
173	5	5	hood hinge, gas spring	screw	14	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
173	5	5	hood hinge, gas spring	gas spring	215	STEEL	PLASTIC	100%	1	Assembly	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
173	5	5	hood hinge, gas spring	support	74	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
173	5	5	hood hinge, gas spring	screw	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
173	5	5	hood hinge, gas spring	bracket	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
173	5	5	hood hinge, gas spring	bracket	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
173	5	5	hood hinge, gas spring	cushion bumper	4	EPDM	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
174	5	5	hinge tailgate, trunk lid	hinge	262	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
174	5	5	hinge tailgate, trunk lid	nut	14	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
174	5	5	hinge tailgate, trunk lid	screw	13	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
174	5	5	hinge tailgate, trunk lid	gas spring	695	STEEL	PLASTIC	70%	3	Press (Tandem)	Assembly	Injection Molding	no	0	120,000	80,000
174	5	5	hinge tailgate, trunk lid	bracket	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
174	5	5	hinge tailgate, trunk lid	support	58	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
174	5	5	hinge tailgate, trunk lid	ball joint stud	13	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
174	5	5	hinge tailgate, trunk lid	screw	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
6	6	61	exterior rear view mirror	Z mirror casing	638	GLASS	PE	50%	1	Glass Processing	Press (Tandem)	Injection Molding	yes	3	120,000	80,000
6	6	61	exterior rear view mirror	Z mirror casing 2	213	HDPE	-	100%	1	Injection Molding	Injection Molding	Other - Not relevant	yes	3	120,000	80,000
6	6	61	exterior rear view mirror	Z mirror casing 3	213	Electronics	-	100%	2	Electronics	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
6	6	61	exterior rear view mirror	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
6	6	61	exterior rear view mirror	cover panel	1	PE	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
6	6	61	exterior rear view mirror	damper	2	PE	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
6	6	61	exterior rear view mirror	damper	3	PUR	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
6	6	61	exterior rear view mirror	bushing	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
97	6	62	floor gaskets, plugs	plug	5	EPDM	PP	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
97	6	62	floor gaskets, plugs	plug	1	TEEE	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
97	6	62	floor gaskets, plugs	plug	5	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
97	6	62	floor gaskets, plugs	plug	2	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
97	6	62	floor gaskets, plugs	plug	3	TPE	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
97	6	62	floor gaskets, plugs	plug	23	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
98	6	62	gaskets front segment, seal for antenn	gasket	321	EPDM	STEEL	70%	3	Molding	Other - Not relevant	Forming & Shaping	yes	1	120,000	80,000
98	6	62	gaskets front segment, seal for antenn	plug	5	EPDM	PP	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
98	6	62	gaskets front segment, seal for antenn	plug	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
98	6	62	gaskets front segment, seal for antenn	plug	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
98	6	62	gaskets front segment, seal for antenn	plug	1	PP/EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
98	6	62	gaskets front segment, seal for antenn	cap	339	PP	EPDM	80%	1	Injection Molding	Other - Not relevant	RIM/Foam Molding	yes	1	120,000	80,000
99	6	62	gasket side segment front	plug	2	TEEE	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
99	6	62	gasket side segment front	plug	3	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
99	6	62	gasket side segment front	plug	1	TEEE	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
99	6	62	gasket side segment front	plug	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
100	6	62	seal door rear	door seal	1,341	EPDM	STEEL	100%	2	Extrusion (plastic)	Compression Molding	Other - Not relevant	yes	2	120,000	80,000
100	6	62	seal door rear	door seal	170	EPDM	EPDM	50%	1	Extrusion (plastic)	Compression Molding	Other - Not relevant	yes	2	120,000	80,000
100	6	62	seal door rear	clip	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
100	6	62	seal door rear	splash foil	165	PE	-	100%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
101	6	62	seal door front	door seal	1,352	EPDM	STEEL	100%	2	Extrusion (plastic)	Compression Molding	Other - Not relevant	yes	2	120,000	80,000
101	6	62	seal door front	door seal	245	EPDM	EPDM	50%	1	Extrusion (plastic)	Compression Molding	Other - Not relevant	yes	2	120,000	80,000
101	6	62	seal door front	clip	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
101	6	62	seal door front	door seal	118	EPDM	EPDM	50%	1	Extrusion (plastic)	Compression Molding	Other - Not relevant	yes	2	120,000	80,000
101	6	62	seal door front	splash foil	146	PE	-	100%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
102	6	62	seal side segment rear	plug	1	TEEE	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
102	6	62	seal side segment rear	cover	15	TEEE	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
103	6	62	seal hood	gasket	139	EPDM	-	100%	1	Extrusion (plastic)	Compression Molding	Other - Not relevant	yes	2	120,000	80,000
103	6	62	seal hood	clip	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
103	6	62	seal hood	gasket	332	EPDM	AL	70%	1	Extrusion (plastic)	Other - Not relevant	Compression Molding	yes	2	120,000	80,000
103	6	62	seal hood	gasket	12	PUR	-	100%	1	Compression Molding	Other - Not relevant	Other - Not relevant	yes	2	120,000	80,000
104	6	62	seal tailgate, trunk lid	gasket	1,894	EPDM	STEEL	100%	2	Extrusion (plastic)	Compression Molding	Other - Not relevant	yes	2	120,000	80,000
145	6	6	windshield	windshield	16,162	GLASS	-	100%	3	Glass Processing	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
146	6	6	door window front	door window	4,286	GLASS	-	100%	2	Glass Processing	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
147	6	6	door window rear	door window	5,107	GLASS	-	100%	2	Glass Processing	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
148	6	6	side window, swing window	side window	620	GLASS	PP	90%	1	Glass Processing	Adhesive Bonding	Injection Molding	no	0	120,000	80,000
148	6	6	side window, swing window	nut	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
148	6	6	side window, swing window	swing window	4,516	GLASS	STEEL	100%	2	Glass Processing	Press (Tandem)	Other - Not relevant	no	0	120,000	80,000
148	6	6	side window, swing window	swing window	4,533	GLASS	STEEL	100%	2	Glass Processing	Press (Tandem)	Other - Not relevant	no	0	120,000	80,000
149	6	6	tail gate window	rear windshield	6,588	GLASS	-	100%	3	Glass Processing	Press (Tandem)	Other - Not relevant	no	0	120,000	80,000
150	6	62	seal windshield	cover profile	122	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
150	6	62	seal windshield	glue	489	-	-	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
151	6	62	seal moon roof	gasket	324	EPDM	STEEL	70%	3	Molding	Other - Not relevant	Forming & Shaping	yes	2	120,000	80,000
151	6	62	seal moon roof	water drain hose	137	PLASTIC	EPDM	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
151	6	62	seal moon roof	water drain hose	256	PLASTIC	EPDM	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
151	6	62	seal moon roof	water drain valve	6	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
151	6	62	seal moon roof	bracket	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
152	6	6	seal door window back	window slide	635	EPDM	AL	80%	1	Injection Molding	Assembly	Press (Tandem)	no	0	120,000	80,000
152	6	6	seal door window back	window chute seal	139	EPDM	PLASTIC	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
152	6	6	seal door window back	window chute seal	167	EPDM	PLASTIC	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
153	6	6	seal door window front	window slide	570	EPDM	PLASTIC	70%	1	Injection Molding	Other - Not relevant	Injection Molding	no	0	120,000	80,000
153	6	6	seal door window front	window chute seal	155	EPDM	PLASTIC	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
153	6	6	seal door window front	window chute seal	171	EPDM	PLASTIC	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
154	6	6	seal side window	gasket	19	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
154	6	6	seal side window	gasket	759	EPDM	STEEL	80%	1	Injection Molding	Other - Not relevant	Press (Tandem)	no	0	120,000	80,000
155	6	6	seal tailgate	glue	336	-	-	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
160	6	63	bumper front	trim	6,082	PP	EPDM	100%	3	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
160	6	63	bumper front	guide	114	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
160	6	63	bumper front	split rivet	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
160	6	63	bumper front	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
160	6	63	bumper front	screw	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
160	6	63	bumper front	push nut	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
160	6	63	bumper front	split rivet	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
160	6	63	bumper front	trim strip	139	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
160	6	63	bumper front	trim strip	156	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
161	6	64	bumper rear	trim	5,125	PP	-	100%	3	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
161	6	64	bumper rear	bumper support	4,825	STEEL	-	100%	2	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
161	6	64	bumper rear	guide	122	PP	-	100%	2	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
161	6	64	bumper rear	trim strip	107	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
161	6	64	bumper rear	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
161	6	64	bumper rear	push nut	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
161	6	64	bumper rear	nut	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
161	6	64	bumper rear	screw	9	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
161	6	64	bumper rear	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
161	6	64	bumper rear	washer	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
161	6	64	bumper rear	split rivet	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
161	6	64	bumper rear	plug	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
216	6	65	trim frame windscreen, radiator grill	trim frame	494	ASA	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
216	6	65	trim frame windscreen, radiator grill	cover profile	176	ASA	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
216	6	65	trim frame windscreen, radiator grill	emblem	83	ABS	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
216	6	65	trim frame windscreen, radiator grill	sight glass	9	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
216	6	65	trim frame windscreen, radiator grill	bracket	2	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
216	6	65	trim frame windscreen, radiator grill	nut	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
216	6	65	trim frame windscreen, radiator grill	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
216	6	65	trim frame windscreen, radiator grill	angle support	666	STEEL	-	100%	2	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
216	6	65	trim frame windscreen, radiator grill	angle support	359	STEEL	-	100%	2	Press (Tandem)	Other - Not relevant	Other - Not relevant	yes	1	120,000	80,000
216	6	65	trim frame windscreen, radiator grill	ventilation grill	251	ASA	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
216	6	65	trim frame windscreen, radiator grill	ventilation grill	156	ASA	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
217	6	6	trim strip gutter	roof trim	1,424	EPDM	AL	50%	2	Injection Molding	Other - Not relevant	Press (Tandem)	no	0	120,000	80,000
218	6	6	trim frame crank operated windows, tri	trim strip	374	PP	EPDM	50%	1	Injection Molding	Other - Not relevant	Injection Molding	no	0	120,000	80,000
219	6	6	trim strips door window and door rear	trim strip	334	PP	EPDM	50%	1	Injection Molding	Other - Not relevant	Injection Molding	no	0	120,000	80,000
220	6	6	trim frame side window, trim frame sid	trim strip	42	TP	EPDM	50%	1	Injection Molding	Other - Not relevant	Injection Molding	no	0	120,000	80,000
221	6	6	trim strip hood	faceplate	33	PLASTIC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
221	6	6	trim strip hood	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000

222	6	6	trim strip tailgate, trunk lid	emblem	25	ABS	ASA	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
222	6	6	trim strip tailgate, trunk lid	writing	10	ABS	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
223	6	6	trim strip hood	trim strip	48	ABS	PC-GF	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
223	6	6	trim strip hood	trim strip	166	PLASTIC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
223	6	6	trim strip hood	bracket	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
224	6	66	spoiler front	spoiler	579	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
224	6	66	spoiler front	spoiler	568	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	yes	3	120,000	80,000
22	7	7	starter	starter	4,291	STEEL	AL	60%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
22	7	7	starter	HOUSING LOW	563	AL	-	100%	1	Die Casting	Milling	Other - Not relevant	no	0	120,000	80,000
22	7	7	starter	HOUSING LOW	36	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
22	7	7	starter	HOUSING CEN	833	STEEL	-	100%	1	Sand Casting	Milling	Other - Not relevant	no	0	120,000	80,000
22	7	7	starter	HOUSING CEN	19	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
22	7	7	starter	GEARS	12	STEEL	-	100%	3	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
22	7	7	starter	SHAFT	194	STEEL	-	100%	1	Roll forming	Milling	Other - Not relevant	no	0	120,000	80,000
22	7	7	starter	SHAFT	0	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
22	7	7	starter	ARMATURE	960	STEEL	CU	75%	2	Investment Casting	Milling	Electro-Mechanical	no	0	120,000	80,000
22	7	7	starter	GEARS	53	PA-66	-	100%	3	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
22	7	7	starter	CLUTCH	259	STEEL	-	100%	2	Investment Casting	Milling	Other - Not relevant	no	0	120,000	80,000
22	7	7	starter	CLUTCH	0	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
22	7	7	starter	PIVOT	12	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
22	7	7	starter	PIVOT	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
22	7	7	starter	RETAINER	9	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
22	7	7	starter	STOP	5	PVC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
22	7	7	starter	HOLDER	205	PA-66	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
22	7	7	starter	SOLINOID	736	STEEL	CU	75%	1	Investment Casting	Milling	Electric	no	0	120,000	80,000
22	7	7	starter	SOLINOID	7	STEEL	-	100%	2	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
22	7	7	starter	PLATE	336	STEEL	STEEL	50%	2	Press (Tandem)	Milling	Press (Tandem)	no	0	120,000	80,000
22	7	7	starter	PLATE	1	PA-66	-	100%	2	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
22	7	7	starter	PIN	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
22	7	7	starter	screw	151	STEEL	-	100%	1	Roll forming	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
23	7	7	generator	alternator	6,801	-	-	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
23	7	7	generator	HOUSING LOW	420	AL	-	100%	1	Die Casting	Milling	Other - Not relevant	no	0	120,000	80,000
23	7	7	generator	HOUSING LOW	16	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
23	7	7	generator	STATOR	1,400	STEEL	CU	75%	2	Press (Tandem)	Welding and Cutting	Electro-Mechanical	no	0	120,000	80,000
23	7	7	generator	ROTOR	3,276	STEEL	CU	80%	3	Sand Casting	Milling	Electro-Mechanical	no	0	120,000	80,000
23	7	7	generator	BEARING	106	STEEL	-	100%	2	Forging	Milling	Other - Not relevant	no	0	120,000	80,000
23	7	7	generator	CONTACT	332	AL	CU	75%	1	Press (Tandem)	Other - Not relevant	Electric	no	0	120,000	80,000
23	7	7	generator	HOLDER	68	AL	CU	75%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
23	7	7	generator	HOLDER	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
23	7	7	generator	RETAINER	19	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
23	7	7	generator	RETAINER	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
23	7	7	generator	CONTACT	24	PBT	STEEL	100%	2	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
23	7	7	generator	CONTACT	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
23	7	7	generator	CONTACT	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
23	7	7	generator	HOUSING UPP	420	AL	-	100%	1	Die Casting	Milling	Other - Not relevant	no	0	120,000	80,000
23	7	7	generator	PULLEY	166	STEEL	-	100%	1	Forging	Milling	Other - Not relevant	no	0	120,000	80,000
23	7	7	generator	PULLEY	23	STEEL	-	100%	2	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
23	7	7	generator	BRACKET	54	STEEL	-	100%	1	Press (Tandem)	Milling	Other - Not relevant	no	0	120,000	80,000
23	7	7	generator	screw	41	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
23	7	7	generator	multi vee belt	157	EPDM	-	100%	2	Vulcanization	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
23	7	7	generator	tensioner	631	AL	STEEL	70%	2	Die Casting	Assembly	Press (Tandem)	no	0	120,000	80,000
23	7	7	generator	idler pulley	102	PA6-GF	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
23	7	7	generator	screw	26	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
23	7	7	generator	washer	18	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
23	7	7	generator	screw	17	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
24	7	7	ignition distributor, encoder, ignition co	ignition coil	1,024	AL	PLASTIC	60%	2	Die Casting	Electric	Injection Molding	no	0	120,000	80,000
24	7	7	ignition distributor, encoder, ignition co	screw	14	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
24	7	7	ignition distributor, encoder, ignition co	support	119	AL	-	100%	1	Die Casting	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
24	7	7	ignition distributor, encoder, ignition co	screw	17	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
24	7	7	ignition distributor, encoder, ignition co	screw	9	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
24	7	7	ignition distributor, encoder, ignition co	encoder	52	PLASTIC	-	100%	2	Electro-Mechanical	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
24	7	7	ignition distributor, encoder, ignition co	screw	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
24	7	7	ignition distributor, encoder, ignition co	encoder disk	333	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
24	7	7	ignition distributor, encoder, ignition co	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
24	7	7	ignition distributor, encoder, ignition co	Z encoder	94	STEEL	PLASTIC	75%	1	Press (Tandem)	Electro-Mechanical	Other - Not relevant	no	0	120,000	80,000
24	7	7	ignition distributor, encoder, ignition co	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
24	7	7	ignition distributor, encoder, ignition co	Knock sensor	39	STEEL	PLASTIC	40%	1	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
24	7	7	ignition distributor, encoder, ignition co	screw	18	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
25	7	7	spark plugs, spark plug cable, glow pl	spark plug wire	89	VMQ	STEEL	50%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
25	7	7	spark plugs, spark plug cable, glow pl	spark plug wire	87	VMQ	STEEL	50%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
25	7	7	spark plugs, spark plug cable, glow pl	spark plug wire	82	VMQ	STEEL	50%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
25	7	7	spark plugs, spark plug cable, glow pl	spark plug wire	82	VMQ	STEEL	50%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
25	7	7	spark plugs, spark plug cable, glow pl	connector	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
25	7	7	spark plugs, spark plug cable, glow pl	connector	2	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
25	7	7	spark plugs, spark plug cable, glow pl	connector	2	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
25	7	7	spark plugs, spark plug cable, glow pl	connector	2	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
25	7	7	spark plugs, spark plug cable, glow pl	spark plug	44	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
45	7	7	battery	Battery	16,841	-	-	100%	3	Electric	Electro-Mechanical	Other - Not relevant	no	0	120,000	80,000
45	7	7	battery	retainer	1,866	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
45	7	7	battery	screw	19	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
45	7	7	battery	clamping plate	86	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
45	7	7	battery	screw	16	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
45	7	7	battery	cover	307	PLASTIC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
45	7	7	battery	screw	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
45	7	7	battery	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
45	7	7	battery	acorn nut	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
45	7	7	battery	cover	146	PLASTIC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
45	7	7	battery	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
45	7	7	battery	cover	12	PP-TV	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
46	7	7	ignition switch	steering-starter loc	379	STEEL-AL	-	100%	1	Die Casting	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
46	7	7	ignition switch	ignition-starter swit	45	-	-	100%	3	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
46	7	7	ignition switch	ignition key	23	STEEL	PLASTIC	70%	3	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
46	7	7	ignition switch	torque to break bol	10	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
47	7	7	signal horn	horn	349	STEEL	ABS	50%	1	Injection Molding	Press (Tandem)	Electro-Mechanical	no	0	120,000	80,000
47	7	7	signal horn	horn	343	STEEL	ABS	40%	1	Press (Tandem)	Electro-Mechanical	Injection Molding	no	0	120,000	80,000
47	7	7	signal horn	support	112	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
47	7	7	signal horn	screw	15	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
47	7	7	signal horn	nut	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
48	7	7	combination instrument	combination instru	992	ABS	-	100%	2	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
48	7	7	combination instrument	push nut	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
48	7	7	combination instrument	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
48	7	7	combination instrument	distance sensor	35	PA66-GF	-	100%	1	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
48	7	7	combination instrument	screw	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
48	7	7	combination instrument	radial seal	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
48	7	7	combination instrument	water level switch	13	POM	-	100%	1	Electro-Mechanical	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
48	7	7	combination instrument	gasket	3	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
48	7	7	combination instrument	temperature senso	15	Electronics	-	100%	2	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
48	7	7	combination instrument	radial seal	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
48	7	7	combination instrument	bracket	1	PA6.6-GF	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
48	7	7	combination instrument	oil pressure switch	31	PA6-GF	STEEL	40%	1	Electro-Mechanical	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
48	7	7	combination instrument	switch	6	PLASTIC	-	100%	1	Electro-Mechanical	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
48	7	7	combination instrument	ambient temperatu	5	PLASTIC	-	100%	1	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
48	7	7	combination instrument	bracket	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
49	7	7	fuel gauge	fuel level sensor	33	POM	STEEL	60%	1	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
50	7	7	head lights, turn signal front	headlight	2,139	PP-TV	PLASTIC	50%	3	Injection Molding	Injection Molding	Injection Molding	no	0	120,000	80,000
50	7	7	head lights, turn signal front	cover	94	PLASTIC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
50	7	7	head lights, turn signal front	fog light	275	PBT-ASA-GF	GLASS	80%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
50	7	7	head lights, turn signal front	lid	74	PLASTIC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
50	7	7	head lights, turn signal front	gasket	8	PUR	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
50	7	7	head lights, turn signal front	lid	54	PP-GF	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000

50	7	7	head lights, turn signal front	gasket	4	PUR	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
50	7	7	head lights, turn signal front	light bulb holder	21	PA6-GF	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
50	7	7	head lights, turn signal front	light bulb	8	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
50	7	7	head lights, turn signal front	light bulb holder	9	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
50	7	7	head lights, turn signal front	light bulb (glass ba	1	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
50	7	7	head lights, turn signal front	light bulb	6	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
50	7	7	head lights, turn signal front	light bulb	12	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
50	7	7	head lights, turn signal front	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
50	7	7	head lights, turn signal front	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
50	7	7	head lights, turn signal front	push nut	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
50	7	7	head lights, turn signal front	end cap	1	ABS	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
50	7	7	head lights, turn signal front	screw	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
50	7	7	head lights, turn signal front	push nut	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	faceplate	893	ABS	PMMA	30%	2	Injection Molding	Injection Molding	Other - Not relevant	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	SBBR-switch	799	ABS	PMMA	70%	3	Injection Molding	Other - Not relevant	Injection Molding	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	tail light	495	ABS	PMMA	70%	3	Injection Molding	Other - Not relevant	Injection Molding	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	faceplate	111	PLASTIC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	light bulb holder	76	PP-T20	STEEL	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	gasket	21	RUBBER	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	light bulb holder	41	PP-T20	STEEL	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	gasket	27	RUBBER	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	gasket	4	RUBBER	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	license plate lamp	11	PC	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	gasket	2	RUBBER	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	stoplight	116	PC-GF	PC	70%	2	Injection Molding	Injection Molding	Other - Not relevant	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	retainer	42	POM-PA6-G	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	screw	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	nut	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	nut	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	split rivet	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	light bulb	7	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	light bulb	6	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
51	7	7	SBBR - light, additional stop light	light bulb 'soffit' typ	2	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
52	7	7	side park and turn signal lights	turn signal	17	PC	PMMA	60%	3	Injection Molding	Injection Molding	Other - Not relevant	no	0	120,000	80,000
52	7	7	side park and turn signal lights	light bulb (glass ba	1	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	steering shaft switc	138	POM-PA66-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	steering shaft switc	136	POM-PA6-G	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	clamp	32	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	steering shaft	117	ABS-PC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	steering shaft	225	ABS-PC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	ignition lock trim	13	EPDM	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	light rotary switch	127	PLASTIC	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	switch	61	PA6-GF	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	switch	33	PA6-GF	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	switch	33	PA6-GF	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	switch	38	PA6-GF	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	switch	32	PA6-GF	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	switch	27	PA6-GF	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	switch	33	PA6-GF	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	switch	40	PBT-GF	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	switch unit	90	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	switch	16	PA6-GF	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	switch	24	PA6-GF	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
53	7	7	light switch, hazard light switch	switch	24	PA6-GF	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
54	7	7	brake switch light	switch	22	PA6.6-GF	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
54	7	7	brake switch light	switch	43	PA6-GF	STEEL	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
55	7	7	glove compartment, ashtray- and heat	glove compartmen	12	PC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
55	7	7	glove compartment, ashtray- and heat	light bulb (glass ba	1	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
55	7	7	glove compartment, ashtray- and heat	cover	4	PA6-GF	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
55	7	7	glove compartment, ashtray- and heat	Contact switch	5	PA-6	-	100%	1	Molding	Electric	Other - Not relevant	no	0	120,000	80,000
55	7	7	glove compartment, ashtray- and heat	light mount	1	PA6-PUR	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
55	7	7	glove compartment, ashtray- and heat	ashtray light	1	PLASTIC	-	100%	1	Molding	Electric	Other - Not relevant	no	0	120,000	80,000
56	7	7	interior lights, reading light	interior and reading	68	PA-66	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
56	7	7	interior lights, reading light	scatter disk	16	PLASTIC	-	100%	2	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
56	7	7	interior lights, reading light	light bulb 'soffit' typ	3	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
56	7	7	interior lights, reading light	light bulb holder	1	PLASTIC	STEEL	80%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
56	7	7	interior lights, reading light	light bulb (glass ba	1	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
56	7	7	interior lights, reading light	interior light	78	PC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
56	7	7	interior lights, reading light	scatter disk	17	PLASTIC	-	100%	2	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
56	7	7	interior lights, reading light	light bulb 'soffit' typ	3	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
56	7	7	interior lights, reading light	interior light	15	PC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
56	7	7	interior lights, reading light	light bulb holder	1	PLASTIC	STEEL	80%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
56	7	7	interior lights, reading light	light bulb (glass ba	1	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
56	7	7	interior lights, reading light	touch sensitive swi	9	PA66-GF	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
56	7	7	interior lights, reading light	gasket	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
57	7	7	trunk and engine compartment light, c	entry light	12	PLASTIC	AL	70%	1	Injection Molding	Press (Tandem)	Other - Not relevant	no	0	120,000	80,000
57	7	7	trunk and engine compartment light, c	light bulb (glass ba	1	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
57	7	7	trunk and engine compartment light, c	cover	5	PA6-GF	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
57	7	7	trunk and engine compartment light, c	entry light	13	PC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
57	7	7	trunk and engine compartment light, c	light bulb 'soffit' typ	2	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
57	7	7	trunk and engine compartment light, c	trunk light	13	PC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
57	7	7	trunk and engine compartment light, c	light bulb 'soffit' typ	2	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
57	7	7	trunk and engine compartment light, c	door warning light	16	PC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
57	7	7	trunk and engine compartment light, c	scatter disk	9	PC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
57	7	7	trunk and engine compartment light, c	light bulb 'soffit' typ	3	-	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	Z wiper frame	4,116	-	-	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	Plate	1,000	STEEL	-	100%	1	Press (Tandem)	Welding and Cutting	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	Large Rod	1,000	STEEL	-	100%	1	Roll forming	Bending	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	Small Rods 1	1,000	STEEL	STEEL	65%	1	Press (Tandem)	Press (Tandem)	Press (Tandem)	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	Small Rods 2	300	STEEL	STEEL	70%	2	Press (Tandem)	Other - Not relevant	Press (Tandem)	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	Bracket	100	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	Joints 1	250	STEEL	STEEL	75%	3	Investment Casting	Forming & Shaping	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	Joints 2	100	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	screw	21	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	spacer bushing	11	STEEL	EPDM	80%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	wiper motor	1,587	STEEL-AL	PLASTIC	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	HOUSING	251	AL	-	100%	1	Die Casting	Milling	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	HOUSING	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	ARMATURE	403	STEEL	CU	75%	2	Sand Casting	Electro-Mechanical	Filament Winding (wire	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	BEARING	11	STEEL	-	100%	2	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	SPRING	1	STEEL	-	100%	2	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	BUSHING	12	BR	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	CONTACT	1	CU	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	GEARS	77	POM	STEEL	100%	3	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	HOLDER	34	PA-66	CU	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	HOLDER	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	CAM	4	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	COVER	51	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	WASHER	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	WASHER	1	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	O-RING	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	RETAINER	2	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	COVER	562	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	COVER	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000

58	7	7	wiper frame, wiper motor	nut	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	wiper arm	149	STEEL	-	100%	1	Press (Tandem)	Painting	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	wiper arm spring	50	STEEL	-	100%	1	Coiling	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	wiper arm back par	299	AL	AL	70%	2	Die Casting	Milling	Die Casting	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	wiper arm	149	STEEL	-	100%	1	Press (Tandem)	Painting	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	wiper arm spring	50	STEEL	-	100%	1	Coiling	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	wiper arm back par	299	AL	AL	70%	2	Die Casting	Milling	Die Casting	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	nut	13	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	wiper blade - blade	82	POM	EPDM	60%	2	Extrusion (plastic)	Vulcanization	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	Stamping	8	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	Stamping	33	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	Stamping	33	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	Stamping	82	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	wiper motor	894	-	-	64%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	HOUSING	200	AL	-	100%	1	Press (Tandem)	Milling	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	HOUSING	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	ARMATURE	203	STEEL	CU	75%	2	Sand Casting	Electro-Mechanical	Filament Winding (wire	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	BEARING	11	STEEL	-	100%	2	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	SPRING	1	STEEL	-	100%	2	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	BUSHING	12	BR	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	CONTACT	1	CU	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	GEARS	77	POM	STEEL	100%	3	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	HOLDER	34	PA-66	CU	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	HOLDER	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	CAM	4	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	COVER	51	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	WASHER	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	WASHER	1	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	O-RING	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	RETAINER	2	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	COVER	250	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	COVER	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	screw	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	grommet	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	wiper arm	40	STEEL	-	100%	1	Press (Tandem)	Painting	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	wiper arm spring	50	STEEL	-	100%	1	Coiling	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	wiper arm back par	42	AL	AL	70%	1	Die Casting	Die Casting	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	washer	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	nut	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	wiper blade	26	-	-	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	Stamping	3	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	Stamping	11	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	Stamping	11	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
58	7	7	wiper frame, wiper motor	Stamping	26	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
59	7	7	washer fluid, washer jets, pumps	coolant tank	1,060	PLASTIC	-	100%	1	Blow Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
59	7	7	washer fluid, washer jets, pumps	screen insert	8	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
59	7	7	washer fluid, washer jets, pumps	cap	12	PP	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
59	7	7	washer fluid, washer jets, pumps	nut	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
59	7	7	washer fluid, washer jets, pumps	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
59	7	7	washer fluid, washer jets, pumps	push nut	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
59	7	7	washer fluid, washer jets, pumps	washer jet	105	POM-PBT-G	-	100%	1	Electro-Mechanical	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
59	7	7	washer fluid, washer jets, pumps	pump	171	POM-GF	-	100%	1	Electro-Mechanical	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
59	7	7	washer fluid, washer jets, pumps	gasket	4	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
59	7	7	washer fluid, washer jets, pumps	pump	113	PA6-GF	-	100%	1	Electro-Mechanical	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
59	7	7	washer fluid, washer jets, pumps	gasket	1	EPDM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
59	7	7	washer fluid, washer jets, pumps	Z washer fluid line	27	PA-6	-	100%	1	Extrusion (plastic)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
59	7	7	washer fluid, washer jets, pumps	Z washer fluid line	23	PA-6	-	100%	1	Extrusion (plastic)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
59	7	7	washer fluid, washer jets, pumps	washer jet	219	POM	POM	50%	1	Injection Molding	Injection Molding	Other - Not relevant	no	0	120,000	80,000
59	7	7	washer fluid, washer jets, pumps	Z hose	92	EPDM-POM	-	100%	1	Extrusion (plastic)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
59	7	7	washer fluid, washer jets, pumps	Z hose	340	EPDM-POM	-	100%	1	Extrusion (plastic)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
59	7	7	washer fluid, washer jets, pumps	washer jet support	7	PBT	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
59	7	7	washer fluid, washer jets, pumps	end cap	5	PP-TV	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
59	7	7	washer fluid, washer jets, pumps	screw	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
59	7	7	washer fluid, washer jets, pumps	push nut	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
59	7	7	washer fluid, washer jets, pumps	washer fluid	1,000	-	-	100%		Other - Not relevant	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
60	7	7	special equipment and other M - equip	wiring harness	453	STEEL	-	100%	1	Harness	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
60	7	7	special equipment and other M - equip	support	4	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
60	7	7	special equipment and other M - equip	damper	3	PUR	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
61	7	7	cigarette lighter	socket	31	STEEL	PLASTIC	80%	1	Press (Tandem)	Electric	Other - Not relevant	no	0	120,000	80,000
61	7	7	cigarette lighter	collet	3	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
61	7	7	cigarette lighter	Cigarette lighter	15	STEEL	PLASTIC	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
62	7	7	stereo, CD player, telematics	radio	1,359	Electronics	-	100%	3	Electronics	Electro-Mechanical	Electric	no	0	120,000	80,000
62	7	7	stereo, CD player, telematics	tweeter	70	POM	-	100%	1	Electro-Mechanical	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
62	7	7	stereo, CD player, telematics	push nut	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
62	7	7	stereo, CD player, telematics	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
62	7	7	stereo, CD player, telematics	speaker	474	PP-T40	-	100%	2	Electro-Mechanical	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
62	7	7	stereo, CD player, telematics	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
62	7	7	stereo, CD player, telematics	tweeter	61	ABS	-	100%	1	Electro-Mechanical	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
62	7	7	stereo, CD player, telematics	speaker	307	POM	-	100%	2	Electro-Mechanical	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
62	7	7	stereo, CD player, telematics	nut	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
62	7	7	stereo, CD player, telematics	Antenna cable	175	-	-	100%	2	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
62	7	7	stereo, CD player, telematics	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
63	7	7	ABS, traction control, FSR, engine dra	rotational speed se	82	PA66-GF-EP	-	100%	1	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
63	7	7	ABS, traction control, FSR, engine dra	rotational speed se	65	PA66-GF-EP	-	100%	1	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
63	7	7	ABS, traction control, FSR, engine dra	rotational speed se	113	PA66-GF-EP	-	100%	1	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
63	7	7	ABS, traction control, FSR, engine dra	rotational speed se	136	PA66-GF-EP	-	100%	1	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
63	7	7	ABS, traction control, FSR, engine dra	cable duct	14	PA6.6	-	100%	1	Extrusion (plastic)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
63	7	7	ABS, traction control, FSR, engine dra	rotor	26	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
63	7	7	ABS, traction control, FSR, engine dra	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
63	7	7	ABS, traction control, FSR, engine dra	tensioner disk	458	STEEL	STEEL	60%	2	Centrifugal Casting	Milling	Milling	no	0	120,000	80,000
63	7	7	ABS, traction control, FSR, engine dra	washer	99	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
63	7	7	ABS, traction control, FSR, engine dra	nut	44	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
63	7	7	ABS, traction control, FSR, engine dra	screw	196	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
63	7	7	ABS, traction control, FSR, engine dra	pressure sensor	64	Electronics	-	100%	1	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
63	7	7	ABS, traction control, FSR, engine dra	acceleration senso	284	Electronics	-	100%	1	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
63	7	7	ABS, traction control, FSR, engine dra	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
64	7	7	parking aids, distance control systems	electronic control n	77	PA66-GF-PB	-	100%	3	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
64	7	7	parking aids, distance control systems	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
64	7	7	parking aids, distance control systems	alarm	14	PP	-	100%	3	Injection Molding	Electric	Other - Not relevant	no	0	120,000	80,000
64	7	7	parking aids, distance control systems	nut	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
64	7	7	parking aids, distance control systems	nut	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
64	7	7	parking aids, distance control systems	support	212	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
64	7	7	parking aids, distance control systems	nut	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
64	7	7	parking aids, distance control systems	support	39	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
64	7	7	parking aids, distance control systems	acorn nut	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
64	7	7	parking aids, distance control systems	ultrasonic sensor	32	PA66-GF	-	100%	1	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
64	7	7	parking aids, distance control systems	ultrasonic sensor	31	PA66-GF	-	100%	1	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
65	7	7	alarms, immobilizer	electronic control n	53	PP-T20	-	100%	3	Electronics	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
65	7	7	alarms, immobilizer	push nut	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
65	7	7	alarms, immobilizer	screw	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
65	7	7	alarms, immobilizer	receiver coil	41	PA66-GF	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
65	7	7	alarms, immobilizer	touch sensitive swi	9	PLASTIC	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
65	7	7	alarms, immobilizer	control light	6	PLASTIC	-	100%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
65	7	7	alarms, immobilizer	signal horn	304	STEEL	PLASTIC	75%	1	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
65	7	7	alarms, immobilizer	support	57	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
65	7	7	alarms, immobilizer	screw	17	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
65	7	7	alarms, immobilizer	nut	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
66	7	7	fuse box, electrical center,coupling sta	base plate electrica	788	PA6.6-GF-PE	-	100%	3	Electronics	Electric	Other - Not relevant	no	0	120,000	80,000
66	7	7	fuse box, electrical center,coupling sta	cable duct	17	PBT-GF	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
66	7	7	fuse box, electrical center,coupling sta	retainer	4	PBT-GF	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000

66	7	7	fuse box, electrical center,coupling sta	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
66	7	7	fuse box, electrical center,coupling sta	support	16	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
66	7	7	fuse box, electrical center,coupling sta	support	391	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
66	7	7	fuse box, electrical center,coupling sta	relay socket	151	PBT-GF	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
66	7	7	fuse box, electrical center,coupling sta	coupling station	273	PBT-GF-PP	STEEL	100%	2	Electric	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
66	7	7	fuse box, electrical center,coupling sta	retainer	37	PLASTIC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
66	7	7	fuse box, electrical center,coupling sta	relay socket	238	PBT-GF	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
66	7	7	fuse box, electrical center,coupling sta	push nut	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
66	7	7	fuse box, electrical center,coupling sta	screw	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
66	7	7	fuse box, electrical center,coupling sta	assembly tool	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
66	7	7	fuse box, electrical center,coupling sta	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
66	7	7	fuse box, electrical center,coupling sta	bracket	2	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	wiring harness	557	STEEL	-	100%	1	Harness	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	wiring harness	460	STEEL	-	100%	1	Harness	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	wiring harness	345	STEEL	-	100%	1	Harness	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	2	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	wiring harness	674	STEEL	-	100%	1	Harness	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	2	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	bracket	2	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	cable conduit	31	EPDM	-	100%	1	Blow Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	retainer	4	PA6.6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	gasket	2	TPE	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	gasket	3	TPE	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	retainer fixture	13	PLASTIC	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	wiring harness	1,004	STEEL	-	100%	1	Harness	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	cable conduit	32	PA-66	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	support	75	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	support	29	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	support	163	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	Z support	168	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	support	99	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	support	72	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	support	11	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	screw	24	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	set screw	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	nut	6	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	nut	4	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	screw	11	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	bracket	1	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	cable support	2	PA6.6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	2	PA6.6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	support	1	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	support	1	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	support	2	PA6.6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	support	5	PA6.6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	support	8	PA6.6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	Z cable harness	480	STEEL	-	100%	1	Harness	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	Z cable harness	446	STEEL	-	100%	1	Harness	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	Z cable harness	300	STEEL	-	100%	1	Harness	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	ground strap	18	STEEL	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	ground strap	14	STEEL	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	cable conduit	91	PA6.6	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	support	2	PA6.6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	Z cable set	49	STEEL	-	100%	1	Harness	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	support	108	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	Z cable harness	540	STEEL	-	100%	1	Harness	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	cable conduit	114	EPDM	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	support	313	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	support	81	STEEL	-	100%	1	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	support	81	STEEL	-	100%	2	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	support	161	STEEL	-	100%	2	Press (Tandem)	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	screw	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	screw	7	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	nut	3	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clamp	15	STEEL	EPDM	80%	1	Bending	Other - Not relevant	Molding	no	0	120,000	80,000
67	7	7	wiring harnesses complete	screw	2	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	cable conduit	247	PA6.6	-	100%	1	Injection Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	cable conduit	25	PA6.6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	cable conduit	40	PA6.6-GF	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	cable conduit	67	PA6.6-GF	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	cable conduit	40	PA6.6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	1	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	cover	1	PP	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	cover	1	PP	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	acorn nut	8	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	3	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	8	PA6.6	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	8	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	6	PLASTIC	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	bracket	5	STEEL	-	100%	1	Forming & Shaping	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	4	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	6	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	5	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	2	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	5	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	3	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	3	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	1	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	1	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	2	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	1	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	2	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	2	POM	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	Z cable harness	20,560	STEEL	-	100%	1	Harness	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	Z cable harness	111	STEEL	-	100%	1	Harness	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	Z cable harness	111	STEEL	-	100%	1	Harness	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	1	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000
67	7	7	wiring harnesses complete	clip	1	PA-66	-	100%	1	Molding	Other - Not relevant	Other - Not relevant	no	0	120,000	80,000

Appendix C: Results of the manufacturing costs for the customizable groups

- Influence of the number of parts within the groups

Groups considered as customizable	Manufacturing cost of the baseline product ($)	Manufacturing cost of the A+ B product ($)	Absolute difference ($)	Percentage difference	number of parts within the group	Number of parts <10g	Total weight of the group (g)
Damping rear door	0	0	(0)	-1%	1	0	324
Damping front door	0	0	(0)	-1%	1	0	324
Air distribution switchboard	105	106	1	1%	16	6	6,873
Rims	42	43	1	3%	3	0	11,017
Damping tailgate	2	4	2	130%	2	0	363
Damping / insulating engine compartment	3	6	3	94%	2	1	216
Grab and pull handle tailgate	3	6	3	121%	3	2	41
Damping hood	4	7	3	90%	2	1	836
Damping roof	2	6	4	162%	5	2	580
Side trim	131	135	4	3%	19	9	7,328
Fender liners	15	19	4	25%	5	3	1,490
Trim side panel front	3	7	4	156%	3	2	295
Damping side panel front	8	13	5	66%	6	1	1,271
Spoiler	5	10	5	95%	2	0	1,147
Trim tailgate	35	40	5	15%	6	3	3,486
Glasses compartment	3	9	5	152%	1	0	127
Grab handle roof	5	12	7	139%	3	1	162
Arm rest rear door	5	12	7	159%	5	0	300
Console	8	16	7	88%	3	1	811
Bumper rear	83	91	8	10%	12	8	10,212
Accelerator	5	13	8	155%	3	1	368
Roof liner	24	32	8	34%	6	4	3,801
Storage tray trunk	16	26	10	64%	5	4	1,188
Visor	12	24	12	97%	5	3	767
Cover floor	15	27	12	78%	8	4	1,341
Air distribution floor area	16	28	12	74%	9	4	1,913
Brake pedal	10	22	12	126%	5	3	1,075
Damping side panel rear	15	29	14	93%	16	4	4,144
Storage compartment door	13	28	15	111%	9	6	506
Roof rail	20	36	16	78%	5	2	2,579
Damping bulkhead	36	52	16	44%	17	4	7,368
Window frame	83	100	17	21%	7	4	11,839
Spring cores and foam cushions front seat	32	49	17	54%	4	0	3,073
Exterior rear view mirror	11	29	18	158%	8	5	1,074
Fuel tank	44	65	21	46%	4	0	9,774
Radiator grill	20	45	25	121%	11	4	2,205
Trunk floor cover	51	76	25	49%	8	3	6,127
Cover front seat	19	44	25	134%	4	1	917
Damping floor	77	103	26	33%	18	4	35,357
Hitch assembly	59	90	31	53%	10	2	24,402
Glove compartment	46	80	33	72%	10	2	3,588
Clutch pedal	28	64	36	127%	19	9	956
Steering column	55	93	38	68%	16	2	9,977
Stick shifter	53	98	45	84%	27	7	4,682
Spring cores and foam cushions rear seat	85	133	48	57%	12	0	7,655
Cover rear seat	52	121	69	133%	11	3	2,443
Trim instrument panel	181	250	69	38%	30	6	22,410
Front suspension	365	449	84	23%	38	1	55,486
Rear suspension	273	374	101	37%	31	0	59,458
Seat rack front	203	351	148	73%	52	20	32,975
Seat rack rear	312	602	290	93%	61	27	50,265

- Influence of the complexity of parts within the groups

Groups considered as customizable	Manufacturing cost of the baseline product ($)	Manufacturing cost of the A+ B product ($)	Absolute difference ($)	Number of parts - complexity 1	Number of parts - complexity 2	Number of parts - complexity 3
Damping rear door	0	0	(0)	1	0	0
Damping front door	0	0	(0)	1	0	0
Air distribution switchboard	105	106	1	0	0	0
Rims	42	43	1	2	1	0
Damping tailgate	2	4	2	2	0	0
Damping / insulating engine compartment	3	6	3	2	0	0
Grab and pull handle tailgate	3	6	3	3	0	0
Damping hood	4	7	3	2	0	0
Damping roof	2	6	4	5	0	0
Side trim	131	135	4	17	0	2
Fender liners	15	19	4	3	2	0
Trim side panel front	3	7	4	3	0	0
Damping side panel front	8	13	5	6	0	0
Spoiler	5	10	5	2	0	0
Trim tailgate	35	40	5	5	1	0
Glasses compartment	3	9	5	1	0	0
Grab handle roof	5	12	7	3	0	0
Arm rest rear door	5	12	7	5	0	0
Console	8	16	7	3	0	0
Bumper rear	83	91	8	9	2	1
Accelerator	5	13	8	3	0	0
Roof liner	24	32	8	6	0	0
Storage tray trunk	16	26	10	5	0	0
Visor	12	24	12	5	0	0
Cover floor	15	27	12	6	2	0
Air distribution floor area	16	28	12	8	1	0
Brake pedal	10	22	12	5	0	0
Damping side panel rear	15	29	14	16	0	0
Storage compartment door	13	28	15	9	0	0
Roof rail	20	36	16	4	1	0
Damping bulkhead	36	52	16	17	0	0
Window frame	83	100	17	6	0	1
Spring cores and foam cushions front seat	32	49	17	3	1	0
Exterior rear view mirror	11	29	18	7	1	0
Fuel tank	44	65	21	3	1	0
Radiator grill	20	45	25	0	9	0
Trunk floor cover	51	76	25	8	0	0
Cover front seat	19	44	25	4	0	0
Damping floor	77	103	26	18	0	0
Hitch assembly	59	90	31	9	1	0
Glove compartment	46	80	33	9	1	0
Clutch pedal	28	64	36	18	1	0
Steering column	55	93	38	11	2	2
Stick shifter	53	98	45	0	0	0
Spring cores and foam cushions rear seat	85	133	48	10	2	0
Cover rear seat	52	121	69	11	0	0
Trim instrument panel	181	250	69	25	1	3
Front suspension	365	449	84	27	3	8
Rear suspension	273	374	101	21	3	7
Seat rack front	203	351	148	46	1	5
Seat rack rear	312	602	290	52	1	8

- Influence of the tool modification of the parts within the group

Groups considered as customizable	Manufacturing cost of the baseline product ($)	Manufacturing cost of the A+ B product ($)	Absolute difference ($)	Number of parts no tool change	Number of parts - small tool change	Number of parts - new tool
Damping rear door	0	0	(0)	0	1	0
Damping front door	0	0	(0)	0	1	0
Air distribution switchboard	105	106	1	0	0	0
Rims	42	43	1	0	0	0
Damping tailgate	2	4	2	0	0	0
Damping / insulating engine compartment	3	6	3	0	0	0
Grab and pull handle tailgate	3	6	3	2	0	1
Damping hood	4	7	3	0	0	0
Damping roof	2	6	4	0	0	0
Side trim	131	135	4	0	0	0
Fender liners	15	19	4	0	0	0
Trim side panel front	3	7	4	0	0	0
Damping side panel front	8	13	5	0	0	0
Spoiler	5	10	5	0	0	0
Trim tailgate	35	40	5	0	0	0
Glasses compartment	3	9	5	0	0	0
Grab handle roof	5	12	7	0	0	0
Arm rest rear door	5	12	7	0	0	0
Console	8	16	7	0	0	0
Bumper rear	83	91	8	0	0	0
Accelerator	5	13	8	0	0	0
Roof liner	24	32	8	0	0	0
Storage tray trunk	16	26	10	0	0	0
Visor	12	24	12	0	0	0
Cover floor	15	27	12	0	0	0
Air distribution floor area	16	28	12	0	0	0
Brake pedal	10	22	12	0	0	0
Damping side panel rear	15	29	14	0	0	0
Storage compartment door	13	28	15	0	0	0
Roof rail	20	36	16	0	0	0
Damping bulkhead	36	52	16	0	0	0
Window frame	83	100	17	0	0	0
Spring cores and foam cushions front seat	32	49	17	0	0	0
Exterior rear view mirror	11	29	18	0	0	0
Fuel tank	44	65	21	0	0	0
Radiator grill	20	45	25	0	0	0
Trunk floor cover	51	76	25	0	0	0
Cover front seat	19	44	25	0	0	0
Damping floor	77	103	26	0	0	0
Hitch assembly	59	90	31	0	0	0
Glove compartment	46	80	33	0	0	0
Clutch pedal	28	64	36	0	0	0
Steering column	55	93	38	0	0	0
Stick shifter	53	98	45	0	0	0
Spring cores and foam cushions rear seat	85	133	48	0	0	0
Cover rear seat	52	121	69	0	0	0
Trim instrument panel	181	250	69	0	0	0
Front suspension	365	449	84	25	2	11
Rear suspension	273	374	101	0	0	0
Seat rack front	203	351	148	27	0	25
Seat rack rear	312	602	290	32	0	29

Appendix D: Interpreting Excel Regression Output

The population regression model is

$$Y = b_1 + b_2*X + u$$

where the error term u has mean 0 and variance sigma-squared.

We wish to estimate the regression line

$$Y = b_1 + b_2*X$$

There is quite a lot of regression output produced by Excel regression analysis: Regression statistics table, ANOVA table, Regression coefficients table. Here is an example of output:

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.81728
R Square	0.667947
Adjusted R Square	0.661682
Standard Error	26.72588
Observations	55

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	76150.85	76150.85	106.6131	2.7135E-14
Residual	53	37856.45	714.2726		
Total	54	114007.3			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*
Intercept	-8.6933	4.854576	-1.79074	0.079046	-18.43034979	1.043741
X Variable 1	2.965006	0.287157	10.32536	2.71E-14	2.38904081	3.540971

- Regression statistics table

R-square is the amount of total variance in Y explained by the X variable. Here the X's explain 66.7% of the total variance in Y.

Multiple R is the square root of R-square.

Adjusted R Square is used if there is more than one x variable.

Standard error is the standard deviation of the error u.

Observations are the number of observations used in the regression.

- ANOVA table

The above ANOVA (analysis of variance) table splits the sum of squares into its components.

Total sums of squares = Residual (or error) sum of squares + Regression (or explained) sum of squares.

Thus $\sum (y_i - \overline{y})^2 = \sum (y_i - \hat{y}_i)^2 + \sum (\hat{y}_i - \overline{y})^2$

For example, R-squared = 1 - Residual SS/Total SS = 1 - 0.4/2.0 = 0.8.

The "Significance F" number is the p-value for a hypothesis test whether the collection of independent variables predicts the dependent variable. The hypotheses test implied by this p-value is:
H0 : None of the Xs predict Y
HA: At least one X predicts Y
Since in this case p<0.05, we reject Ho and conclude at least one X is a predictor of Y

- Regression coefficients table.

The "Coefficients" in the last table are estimated of the "betas". They are used to predict unknown values of Y using the estimated regression equation, which is:

$Y = -8.6933 + 2.965006X$

Column “Standard error” gives the standard errors of the least squares estimated

Column “ t Stat” gives the computed statistic for the implied hypotheses:
H0: the coefficient of the regressor equals 0
Ha: the coefficient of the regressor does not equal 0.

P-values for testing whether each individual X variable predicts Y. The intercept’s p-value is never evaluated; ignore it. The implied hypotheses for each independent variable are:
H0: This X is not a significant predictor of Y
HA: This X is a significant predictor of Y
If p-values are less than 0.05. the null hypotheses for both should be rejected.
If p-values exceed 0.05, we accept the null hypothesis.

References

[1] "U.S. Auto Sales Drop by 1.9% Amid Declines at GM and Ford --- No.1 Maker's Market Share Falls Below 25% Milestone; Buyers Resist Price Boosts." The Wall Street Journal, 2 March 2005.

[2] Carla Kelogeridis. "Where has all the color gone? Whether bold and daring or creatively conservative-interior color is making a comeback." Diesel & Gas Turbine Publications, 2004.

[3] Gary S. Vasilash. "Mass customization at Perkins: an engine with one-trillion possibilities" Automotive Manufacturing & Production, Feb 1997.

[4] Web sites of manufacturers to "build your own car":
Chevrolet: "Select a vehicle: build your Chevy"
http://www.chevrolet.com/byo/build.cv?make=Chevrolet&makeId=001&vFrom=&modelId=&vModelName=&subModelId=&year=2005

Honda: "Build & Price your Honda"
http://automobiles.honda.com/tools/buildandprice/models.asp?RURL=/landing.asp

Nissan: "Design or Search for your Nissan"
http://www.nissanusa.com/vehicles/Configurator/1,,,00.html#top

Toyota: "Build your Toyota"
http://www.buyatoyota.com/configurator/index.aspx?ptz=3032313339&ptt=424F533130&ptd=3230303139&pth=686F6D653230&

[5] Pine, B. Joseph II. "Mass Customization: The New Frontier in Business Competition." Harvard Business School Press, Boston, MA, 1993.

[6] Sims, E.R. "Precision manufacturing costing." New York, M. Dekker, 1995.

[7] Fitzgerald, B. "Mass Customization – at a Profit." World Class Design to Manufacture, 1995, Vol. 2: 43-46.

[8] Evarts, E.C. "More power to get what you want." Christian Science Monitor, 1999 Vol. 91:16.

[9] Du, X. and Tseng, M.M. "Characterizing Customer Value for Product Customization." Proceedings of the 1999 ASME Design Engineering Technical Conference, Las Vegas 1999.

[10] Veloso F. "Local Content Requirements and Industrial Development: Economic Analysis and Cost Modeling of the Automotive Supply Chain." Doctoral thesis, 2001.

Technology, Management, and Policy, Massachusetts Institute of Technology, Cambridge, MA.

[11] Fixson S. K. “Linking Modularity and Cost: A Methodology to assess Cost Implications of Product Architecture Differences to Support Product Design.” Doctoral thesis, 2002. Technology, Management, and Policy, Massachusetts Institute of Technology, Cambridge, MA.

[12] Busch, J. V. and F.R. Field III. “Technical Cost Modeling.” The Blow Molding Handbook. D. Rosato and D. Rosato. New York, Hansr Publishers, 1988. Chapter 24: 839-871.

[13] Cooper, R. and P. Kaplan. “Measure Costs Right.” Harvard Business Review, Sept-Oct 1988.

[14] Kirchain R.E and J.P. Clark. “Process Based Cost Modeling: Understanding the Economics of Technical Decisions. The Encyclopedia of Materials Science, 2001.

[15] Creese R.C. “Introduction to manufacturing processes and materials.” New York, M. Dekker, 1999.

[16] IBIS Associates, Inc. “Final report – USCAR Magnesium Powertrain Cast Components Team – Cost Model Development.” July 24, 2003.

[17] Boothroyd G., P. Dewhurst, et al. “Product design for manufacture and assembly.” New York, M. Dekker, 1994.

[18] Han H.N. “The competitive Position f Alternative Automotive Materials.” Materials Science and Engineering. Cambridge, MIT, 1994.

[19] ITP Best Practices. “Waste Heat reduction and recovery for improving furnace efficiency, Productivity, and emissions performance.”
http://www.oit.doe.gov/bestpractices/process_heat/

[20] Veloso, F. , C. Henry, et al. “Global strategies for the development of the Portuguese Autoparts Industry.” Lisboa, IAPMEI, 2000.

[21] Interviews with General Motors experts:

Stamping: Randall Urbance, Theresa Lee, Robert Ayres, Kenneth Mehrar
Die casting: Randall Urbance, Bob Powell
Injection molding: C.S Wang, Janet Frahm, Joseph Hulway, Chris Oberlitner

[22] Injection Molding Technical Cost Model. MIT - Materials Systems Laboratory, August 2004.

[23] Green PE, DeSarbo WS. “Additive decomposition of perceptions data via conjoint analysis.” Journal of Consumer Research 1978; 5(1):58–65.