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Implementation of Methodology for the realization of a technical parts list of a product: A case study

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Abstract: In The technical list of parts is a very important tool in industrial processes, either to have a better control of the manufacturing of the assemblies, by allowing to assign a code for each piece, which helps the classification of each material and facilitates in the administration, both of the warehouse and of the production. In this paper, a methodology is proposed to make the list of parts of an electric vehicle type e-trike. This list of parts will help to keep a proper control, as well as contribute to other areas of the company can streamline the processes that are required, which will contain accurate data of each of the parts of the product.

Keywords: List of parts, list for industrial processes, control of parts.

I. Introduction

Given the new conditions of high competitiveness, the proper management of the supply chain and logistics play a very important role (Olivos et al., 2015). Due to its importance, supply chains have been the object of study by several authors (Porrás et al., 2017) refer to this as the set of parties that are directly or indirectly involved to satisfy the need of a client ; including, in addition to the manufacturer and the supplier, the carriers, storekeepers, retailers and even the customers themselves.

In the work of Ballou (2004) and Correa & Gómez (2009) the supply chain is defined as the integration of a series of functional activities that are repeated along the product flow channel, converting the raw material into finished products, which allows adding value to the consumer. Authors such as De la Hoz et al., (2017) and Correa & Gómez (2009) refer to this as an integral vision of three logistics elements: procurement or logistic input, manufacturing or internal logistics, and distribution or logistics output.

A first definition of BOM (Bill of Materials) argues that it is a structured list of the parties that are used to obtain a product (Kashkoush & El Maraghy, 2016). The MRP integrates this information and presents the requirements of materials necessary to cover a certain production program. Graphically it is represented with a graph in which the nodes are the different parts (finished products, semi-assembled, components and raw materials) and the arcs are the structural relationships between these parts. Recognized for a long time as an essential block in the success of Enterprise Resource Planning (ERP) systems, BOM models currently manage much more information than a simple product structure. The new market situation gave rise to new BOM approaches, such as those proposed by various authors (Scheer, 1998; Van Veen & Wortmann, 1992; Olsen et al., 1997; Chung and Fisher, 1994; Hvan & Colab, 2003). These present models to adapt the BOM to the new needs raised. These approaches are mainly aimed at solving the problems caused by the management of multiple variants, ie small modifications on a common basic product structure.

The list of parts is of great importance in industrial processes, either to have a better control of the assembly manufacturing, good organization of purchases, or help in the field of material requirements. Becoming a guide tool to expedite the purchase of the necessary materials of a product, and also for the organization of the warehouse. The list of materials must contain the corresponding data of each of the pieces that make up the final product, detailing the specifications of each material, such as measurements, quantity of equal parts, codes and descriptions. A main characteristic of the lists of parts, is that they contain a code for each piece, which helps the classification of each material and facilitates in the administration, both the warehouse and the production. This paper proposes a methodology for making a list of parts in industrial areas, performing the analysis of the case of an electric vehicle.

II. Methodology

The technical list of parts that is proposed is a format in which information is captured of the parts that make up a specific product, where each of the pieces that comprise it is explained in detail. The proposed format provides product data that serve to streamline tasks in different areas of the company, since the data are quantifiable. Each of the characteristics that are added in the list of parts is necessary to describe the pieces that make up the product to be made. The characteristics can be seen in Table I.

Table I. List of parts format.

COMPANY NAME (1)		PRODUCT NAME (2)		FORMAT XX-XX-XX (3)			
Item (4)	Part number (5)	Quantity (6)	Unit of measurement (7)	Description (8)	Manufacture (9)	Acquire (9)	Observations (10)
0X	0X-00X						

In a list of parties, there are two parts, the first is the "issuer" and the other is the "receiver", which are responsible for fulfilling the objective of said list, which is to carry the necessary information of the product to obtain it, from whom you demand, to detailed observations to obtain it. The "issuing" party is the one that issues the list, and it is proposed that it be located on the upper-right side of the format. The "receiving" party is the one that receives the information of the product to be manufactured or purchased, as the case may be, which is responsible for the information that the list of parts contains fulfilling its objective.

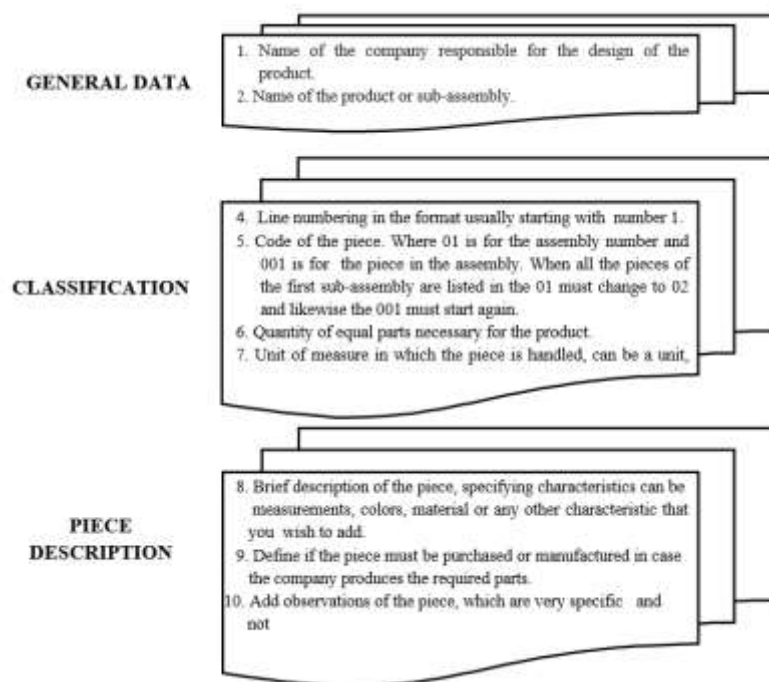
Figure 1. Specification of points from a parts list.

Figure 1 describes the ordering of information in three categories; the first to inform the receiving party of the general data of the product; the following is classified into different numbers information of the piece, such as codes, number of parts, quantities and types of unit of measure, and the last contains the description of the piece, where necessary if necessary details for its best specification are added. In Table II, a list with data is given by way of example.

Table II. Applied example of list of parts.

COMPANY NAME (1)		PRODUCT NAME (2)		FORMAT XX-XX-XX (3)			
Item (4)	Part number (5)	Quantity (6)	Unit of measurement (7)	Description (8)	Manufacture (9)	Acquire (9)	Observations (10)
1	01-001	2	Piece	Aluminum tube 4.3 cm by 4.3 cm, painted black, height 208 cm.		x	See manufacturing detail in door plane1.

Observation: The need to integrate a Technical List of parts for the manufacture of electric vehicles (Figure 2) of recent creation (prototype) considering only the CHASSIS part of the vehicle has been identified.

Experimentation: The final and released version of the prototype product was established and based on this the identification of each of the parts and sub-assemblies it contains was established. With this information it was feasible to make the technical list of parts.

Procedure: To identify the parts that make up the material requirements in the present case study, the engineering design released from the vehicle was determined. Said design released (Figure 1). This model refers to an electric vehicle.

Figure 2. Engineering design released electric vehicle.



III. Results

The management of the supply chain of the automotive sector has a very high complexity since the car is made up of numerous parts, and most of them are manufactured by the suppliers, which in turn provide their products to more of a car brand. The complexity lies in the high number of suppliers, which provide the materials, parts and services needed to make the final products. Many suppliers serve numerous car manufacturers, and each of these suppliers, in turn, has multiple suppliers. There are often between six and 10 levels of suppliers between a car manufacturer and the origin of the raw materials.

As a result of the implementation of the proposed methodology, it was possible to develop the process of listing and describing the parts of the car in such a way that they can be identified, either divided into sub-assemblies or pieces, allowing them to be classified by codes to facilitate its location. In the section dedicated to the observations in the right part of the format, the relevant aspects of the piece are located, either in two or three dimensions. In general, all sub-assemblies or pieces have technical specifications on their manufacture. The results of the application of the proposed methodology of the electric vehicle are shown in Table III.

Tabla III. Application of electric car parts list.

PARTS LIST (CHASSIS) E-TRIKE Format ITC-VI-01							
Ítem	Part number	Quantity	Unit of measurement	Description	Manufacture	Acquire	Observations
1	01-001 CHASSIS	2	Piece	PTR 50.8X50.8X6.35 carbon steel length 638 mm	x		Angle 45°, See details of manufacture in plane "Chassis"
2	01-002 CHASSIS	2	Piece	PTR 50.8X50.8X6.35 carbon steel length 561.8 mm	x		See details of manufacture in plane "Chassis"
3	01-003 CHASSIS	2	Piece	PTR 50.8X50.8X6.35 carbon steel length 800.29 mm	x		Angle 44.18°, See details of manufacture in plane "Chassis"
4	01-004 CHASSIS	1	Piece	PTR 50.8X50.8X6.35 carbon steel length 772.64 mm	x		Angle 44.18°, See details of manufacture in plane "Chassis"
5	01-005 CHASSIS	2	Piece	PTR 50.8X50.8X6.35 carbon steel length 159.2 mm	x		See details of manufacture in plane "Chassis"
6	01-006 CHASSIS	2	Piece	PTR 30X30X2.60 carbon steel length 505 mm	x		Angle 45°, See details of manufacture in plane "Chassis"
7	01-007 CHASSIS	2	Piece	PTR 20X20X2 carbon steel length 150 mm	x		Angle 45°, See details of manufacture in plane "Chassis"
8	01-008 CHASSIS	2	Piece	PTR 50.8X50.8X6.35 carbon steel length 1900 mm	x		Angle 45°, See details of manufacture in plane "Chassis"
9	01-009 CHASSIS	4	Piece	PTR 50.8X50.8X6.35 carbon steel length 210 mm	x		Angle 45°, See details of manufacture in

						plane “Chassis”
10	01-010 CHASSIS	2	Piece	PTR 50.8X50.8X6.35 carbon steel length 300 mm	x	Angle 45°, See details of manufacture in plane “Chassis”
11	01-011 CHASSIS	1	Piece	PTR 50.8X50.8X6.35 carbon steel length 561.8 mm	x	See details of manufacture in plane “Chassis”
12	01-012 CHASSIS	2	Piece	PTR 30X30X2.6 carbon steel length 398 mm	x	Angle 45°, See details of manufacture in plane “Chassis”
13	01-013 CHASSIS	2	Piece	PTR 30X30X2.6 carbon steel length 565 mm	x	Angle 45°, See details of manufacture in plane “Chassis”
14	01-014 CHASSIS	2	Piece	PTR 50.8X50.8X6.35 carbon steel length 185.4 mm	x	See details of manufacture in plane “Chassis”
15	01-015 CHASSIS	1	Piece	PTR 30X30X2.6 carbon steel length 660.78 mm	x	See details of manufacture in plane “Chassis”
16	02-001 CHASSIS	2	Piece	Pipeline SCH40, 25.4 DIA carbon steel length 15.25 mm	x	See details of manufacture in plane “Chassis”
17	02-002 CHASSIS	1	Piece	Pipeline SCH40, 25.4 DIA carbon steel length 455.59 mm	x	See details of manufacture in plane “Chassis”
18	02-003 CHASSIS	1	Piece	Pipeline SCH40, 25.4 DIA carbon steel length de 2.94mm	x	See details of manufacture in plane “Chassis”
19	02-004 CHASSIS	1	Piece	Pipeline SCH40, 25.4 DIA carbon steel length 790 mm	x	See details of manufacture in plane “Chassis”
20	02-005 CHASSIS	1	Piece	Pipeline SCH40, 25.4 DIA carbon steel length 94.25 mm	x	See details of manufacture in plane “Chassis”
21	02-006 CHASSIS	1	Piece	Pipeline SCH40, 25.4 DIA carbon steel length 140 mm	x	See details of manufacture in plane “Chassis”
22	02-007 CHASSIS	1	Piece	Pipeline SCH40, 25.4 DIA carbon steel length 947.3 mm	x	See details of manufacture in plane “Chassis”
23	02-008 CHASSIS	2	Piece	Pipeline SCH40, 25.4 DIA carbon steel length 93.96 mm	x	See details of manufacture in plane “Chassis”
24	02-009 CHASSIS	1	Piece	Pipeline SCH40, 25.4 DIA carbon steel length 93.96 mm	x	See details of manufacture in plane “Chassis”
25	02-010 CHASSIS	1	Piece	Pipeline SCH40, 25.4 DIA carbon steel length 500.58 mm	x	See details of manufacture in plane “Chassis”
26	01-002 CHASSIS	1	Piece	Pipeline SCH40, 25.4 DIA carbon steel length 336.53 mm	x	See details of manufacture in plane “Chassis”
27	02-011 CHASSIS	1	Piece	Pipeline SCH40, 25.4 DIA carbon steel length 491.22mm	x	See details of manufacture in plane “Chassis”
28	02-012 CHASSIS	1	Piece	Pipeline SCH40, 25.4 DIA carbon steel length 947.3mm	x	See details of manufacture in plane “Chassis”
29	02-013 CHASSIS	2	Piece	Pipeline SCH40, 25.4 DIA carbon steel length 1337.07 mm	x	See details of manufacture in plane “Chassis”
30	02-014 CHASSIS	2	Piece	Pipeline SCH40, 25.4 DIA carbon steel length 598.57 mm	x	See details of manufacture in plane “Chassis”
31	02-015 CHASSIS	2	Piece	Pipeline SCH40, 25.4 DIA carbon steel length 274.25 mm	x	See details of manufacture in plane “Chassis”
32	02-016 CHASSIS	1	Piece	Pipeline SCH40, 25.4 DIA carbon steel length 336.53 mm	x	See details of manufacture in plane “Chassis”
33	02-017 CHASSIS	2	Piece	Pipeline SCH40, 25.4 DIA carbon steel length 748.88mm	x	See details of manufacture in plane “Chassis”

The materials selected for the manufacture of the electric vehicle can be found in Table III, where it is noted that there are some restrictions, which indicates the supplier, to which it is necessary to adapt since they can be standards set by most of them, as they are the measures established in the sale or the minimum purchase weight, in addition the supplier contacted offers the transportation of the materials included in the purchase price, which constitutes a benefit for the company.

Once the proposed format for the list of suppliers was applied, the feasibility of this was obtained as a result of allowing documentation of the information of the suppliers used and establishing a control of the purchases made in the preparation of any type of product industrial that is proposed. It is important to point out that for the filling of the format, it is necessary to previously have information regarding the characteristics of the materials, the time available to acquire them, as well as all the aspects that guarantee the purchase of the materials. Finally, once the purchase process has been completed, this format must be documented in case a similar or similar material is needed in the future, as long as it has a record of it and helps to provide information on future purchases.

IV. Conclusions

The implementation of a methodology for the selection of suppliers for the construction of an electric vehicle is carried out.

The implementation of the proposed format with the list of suppliers facilitates the selection of these to acquire the parts that are needed to manufacture an electric vehicle, as well as contribute to reduce times, costs and errors in the manufacture of this product.

V. References

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