

IDENTIFICATION OF THE WELDING POINTS FOR CAR SHEET METAL SPARE PARTS ON AFTER-SALES DEPARTMENT

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Rezumat: *Procesul de sudare în puncte este unul foarte frecvent utilizat în industrie, în special în industria auto. Această lucrare prezintă principalele avantaje ale utilizării sudării prin puncte în procesul de fabricație, dar și în etapa post-vânzare, și subliniază utilizarea punctelor de sudură în departament caroserie. De asemenea, este foarte important să respectăm aspectele de calitate ale punctelor de sudură. Pentru aceasta a apărut necesitatea implementării în cadrul departamentului post-vânzare a unei echipe, care are ca scop respectarea calității și îndrumarea colaboratorilor pentru a realiza îmbinări conforme. Obiectivul acestei lucrări este de a identifica corect punctele de sudură care trebuie efectuate suplimentar pe o piesă de schimb din tablă în service-urile auto.*

Abstract: *The welding process is a very common one used in industry, especially in the automotive industry. This paper presents the main advantages of using welding in the manufacturing process but also in the after-sales stage and emphasizes the use of welding points in the body department. It is also very important to respect the quality aspects of the welding points. For this, the need arose for the implementation within the companies of the departments that aim at respecting the quality and guiding the collaborators in order to achieve compliant joints. The objective of this work is to identify the accurate welding points that must be done additionally on a body spare part to be performed in car services.*

Keywords: Welding points, Repairs, Sheet metal parts, Dacia service

1. Introduction

The evolution of consumer requirements has led to a greater concern of people working in the economy for quality and consequently for the development and use of strategies in this area, aiming to continuously improving quality.

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Many years ago, people often are considered themselves lucky when they bought some products, and the services offered were not always in proper quality; now, the global economy led to the emergence of many companies that are in competition in all areas of activity.

The company chosen to conduct the case study is a traditional company, whose products have been known to Romanians for more than 50 years, Dacia cars being popular in Romania since the early 70s of last century.

Today, SC Automobile DACIA SA is a renowned company, owned by the Renault group, which produces cars with great success worldwide, customers being spread over several continents.

The analysis of the situation of the company SC Automobile DACIA is carried out periodically, within the action that is necessary for the study of the way in which the company's services can be improved.

Very important is the interest that management shows for quality issues, its participation in all phases of process analysis being effective.

Within the company SC AUTOMOBILE DACIA SA, an important role is constituted by the after-sales activities, an important part of the total profit of the company coming from the spare parts.

The body is a sheet metal structure, reinforced by the incorporation of a metal frame, whose rigidity depends on the rigidity of the infrastructure. In general, the assembly of sheet metal is done by spot welding [1], [2], [3].

Following car accidents, the most affected parts are body parts and bumpers.

Spot welding is a process of electric pressure welding with contact resistance of two or more overlapping metal parts. This process is based on the Joule-Lenz effect of passing electric current through the metal column between the tips of copper alloy contact electrodes, which also tightens the welding components with a certain value of the preset force. The welding point obtained has a lenticular shape, being located in the plane of separation of the components. In order for the contact resistance between the electrode and the material to be lower than that between the components to be welded, it is necessary for the electrodes to be made of copper or copper alloyed with chromium or beryllium, which gives them better mechanical resistance to compression. This causes the highest temperature to develop at the contact surface between the two parts subjected to the welding process.

Due to the higher electrical contact resistance between the components, the own resistance of the metal column and the cooling effect of the electrodes, the maximum temperature is obtained at the place of contact between the

components, near the electrodes. After a certain time, in this area a molten metal core is formed belonging to both components to be joined, a core that will increase in size as the welding electric current passes. When the welding current is interrupted, the molten core will solidify, forming the welding point.

The advantages of spot welding are: high welding speed, precise dosing of the introduced energy, the possibility of automation and also the quality of the welding does not depend on the skill of the operator.

Unlike the other spare parts, most of which come directly from external suppliers, the sheet metal parts are stamped and assembled directly in the Dacia plant. The embossing is done within the Pressing department, and the assembly is done within the Body department.

The body is the second stage of the production process of a vehicle: the manufacture of bodies by welding and assembling stamped parts. The car bodies take shape on the general assembly lines, and on the Hardware line they are equipped with moving elements (doors, hoods). The Body Department occupies an area of over 53,500 m². Staff: 2,186 employees. In the Body there are over 1,288 installations, of which 423 are robotic and 865 manual. The robots perform crimping, chewing and welding operations. 59% of the actual welding operations are manual. On average, 4,500 welding points are required for a body. At the beginning of 2020, the robotization percentage of the Body Department was 41%.

Considering all these theoretical notions presented, there was a need to achieve and implement in the automotive industry an activity that has as its primary objective the study and solution of quality issues regarding the identification of welding points. In the structure of SC Automobile DACIA SA, the After-sales Department is in charge of monitoring and solving these quality situations.

2. Evaluation of the activity in the After-Sales department, regarding the identification of welding points

On a car, in car services, sheet metal parts are replaced, in whole or in part, depending on the severity of the impact. The quality of the sheet metal parts, delivered by the factory to the car services, must be impeccable, and be identical to the first-assembly parts (mounted on the production line).

Over time, quality problems for sheet metal parts have arisen due to the lack of welding points. Parts taken directly from the workstations to be sent as spare parts are removed from the most advanced workstation before the part is assembled together with other parts, or directly on the body. After the sampling place, some pieces receive additions with other welding points - aspects highlighted in Figure 1.

In Figure 1 are presented the stages in the Pressing and Bodywork departments, which are covered by sheet metal rolls to be transformed from plain sheet metal into assembled bodywork.

In the Pressing department, the sheet metal parts take shape, and in the Body department, by assembling by welding, the body "comes to life".

After the Body department, the assembled body is transported to the Painting department, then to the Assembly department, to be equipped with all other elements.

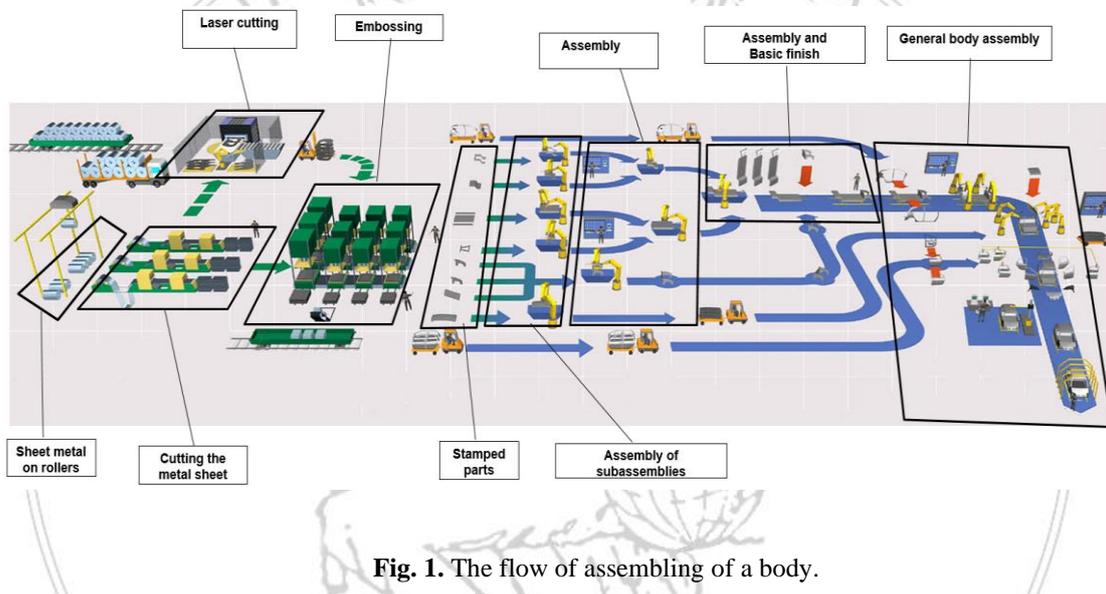


Fig. 1. The flow of assembling of a body.

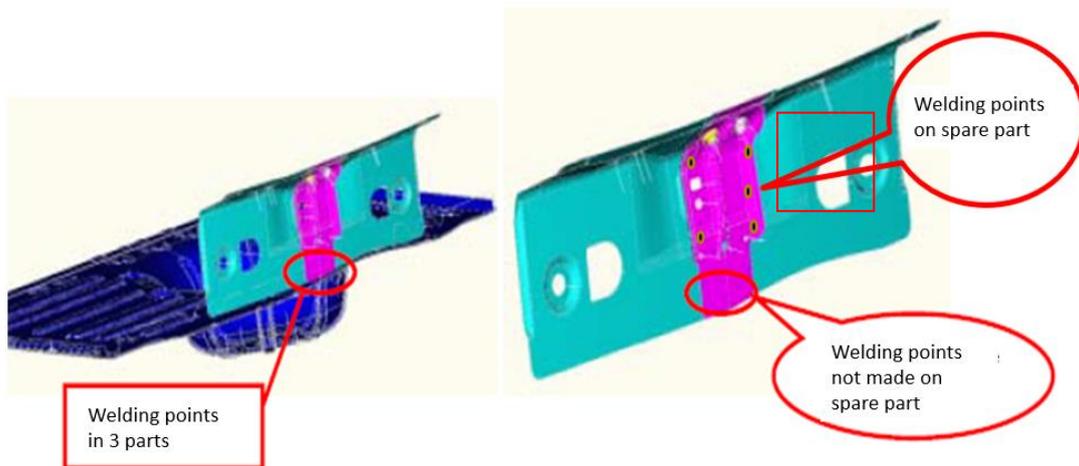


Fig. 2. Spare part *Rear skirt*.

Next, the Finite Element Modeling (Fig. 2) is represented by the rear skirt- spare part. It consists of a simple skirt (light blue piece), and a reinforcement (pink piece).

On the spare part from the Figure 2, only five welding points are present. These points are executed on the workstation, from which this piece is taken, to be sent as a spare part. In the next work position, the rear skirt is assembled together with the back floor (dark blue part in the Figure 2), and receives three more welding points.

Due to the absence of the three points on the spare skirt part, quality problems appeared, the reinforcement came off easily, at the bottom of the rear skirt.

In order to avoid such situations in the future, which may lead to quality problems, of the spare parts of the sheet, within the after-sales department of SC AUTOMOBILE DACIA SA, a team was formed, responsible for identifying the welding points, which must also be carried out on a spare part of the sheet metal so that it is complete and thus avoids the quality risks caused by the absence of one or more welding points. This activity is called Welding Range.

In Figure 3 are briefly presented the objectives of the activity - Welding Range and at the same time, schematically, is presented the working methodology.

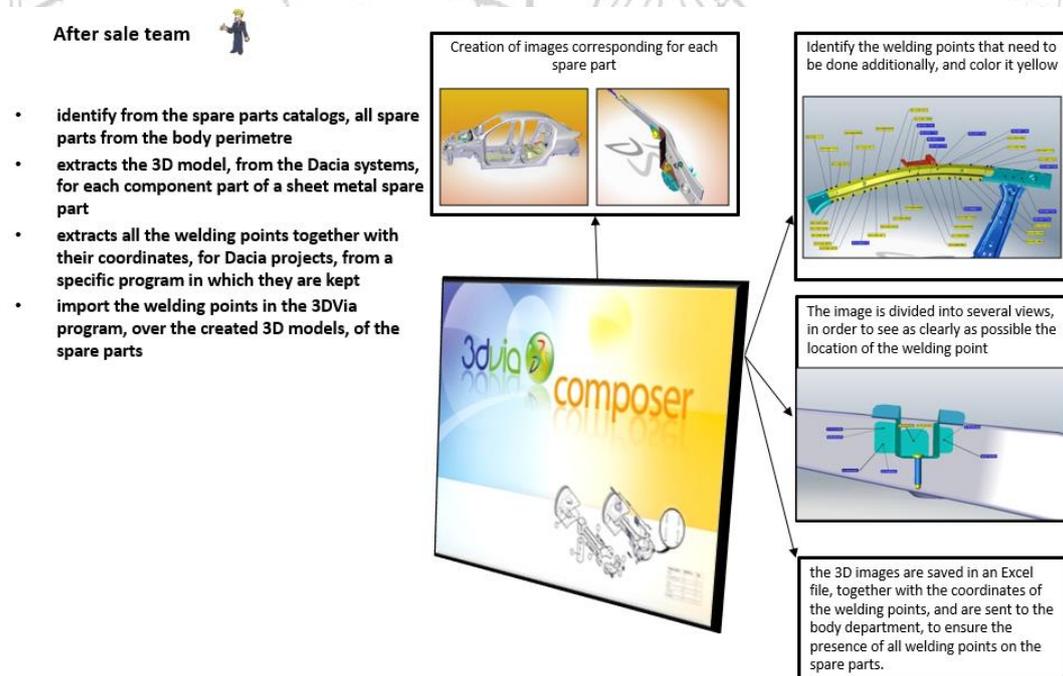


Fig. 3. Welding Range process.

Figure 4 and Figure 5, show an example of the Welding Range. The points already present on the piece are highlighted, as well as the points that need to be made additionally. There is also other information such as the coding of each welding point, the coordinates of the welding points, the parts that are assembled with the highlighted welding points, etc.

The welding points in whose description in the Welding Range appear two or three pieces, and also appear in 3D view are labeled with the color blue. The welding points in whose description in the Welding Range, three pieces appear, but in whose 3D model only two pieces appear in sight, are highlighted in yellow, a color that indicates that these points must be made additionally on a piece of change.

A	B	C	D	E	F	G	H	I	J	K	L	M	N
Vue Seamage	Numero Liaison	Numero Points de soudure	Type PSR	Point Fait	A Faire	Erreur (X	X	Y	Z	Pièce 1	Designa	Mat Piek	Ep. Pie
641004902R	G01.07206-	SCWG2127584	Point de soudure	Point Fait			-683.05	-509.949	278.63	641834188RP1V1	- LONGERON AV G PA		
641004902R	101.01124-	SSV12083158	Point de soudure		A Faire		-670.388	-538.253	387.2272	752404440RP1V1	- TRAVERSE-EXTREM		
641004902R	101.01124-	SSV12083157	Point de soudure		A Faire		-647.102	-537.419	388.3355	752404440RP1V1	- TRAVERSE-EXTREM		
641004902R	G01.07206-	SCWG2127585	Point de soudure	Point Fait			-646.47	-507.391	278.5	641834188RP1V1	- LONGERON AV G PA		
641004902R	G01.07206-	SCWG2127586	Point de soudure	Point Fait			-603.031	-518.571	401.47	641834188RP1V1	- LONGERON AV G PA		
641004902R	G01.00142-	SCWG2130337	Point de soudure	Point Fait			-599.67	-506.724	276.98	751353375RP2V1	- ELEMENT FRMT AV		
641004902R	G01.00142-	SCWG2130336	Point de soudure	Point Fait			-593.18	-513.35	340.38	751353375RP2V1	- ELEMENT FRMT AV		
641004902R	101.06909-	ECW12089377	Ecroû à souder	Point Fait			-564.65	-477.398	132.766	511630009RP1V1	- RENFORT G FIX ANN		
641004902R	G01.00146-	SCWG2083219	Point de soudure	Point Fait			-554.43	-518.129	402.74	751872946RP1V1	- ELEMENT FRMT BOI		
641004902R	101.06908-	ECW12132986	Ecroû à souder	Point Fait			-552.064	-508.981	198.047	751872946RP1V1	- ELEMENT FRMT BOI		
641004902R	G01.00275-D36.00275	SCWG2130420	Point de soudure	Point Fait			-536.73	-515.37	85	751872946RP1V1	- ELEMENT FRMT BOI		
641004902R	101.06230-	ECW12132985	Ecroû à souder	Point Fait			-536.11	-514.662	339.3817	751872946RP1V1	- ELEMENT FRMT BOI		
641004902R	G01.00146-	SCWG2083220	Point de soudure	Point Fait			-508.18	-500.325	275.29	751872946RP1V1	- ELEMENT FRMT BOI		
641004902R	G01.00146-	SCWG2083218	Point de soudure	Point Fait			-496.35	-514.607	404.44	751872946RP1V1	- ELEMENT FRMT BOI		
641004902R	G01.00275-D36.00275	SCWG2130419	Point de soudure	Point Fait			-486.81	-511.59	85	751872946RP1V1	- ELEMENT FRMT BOI		
641004902R	G01.00137-	SCWG2083216	Point de soudure		A Faire		-446.94	-440.845	311.1	756237575RP1V1	- BOITIER AV-G.FIX-B		
641004902R	G01.00137-	SCWG2083215	Point de soudure		A Faire		-446.94	-440.845	360.4	756237575RP1V1	- BOITIER AV-G.FIX-B		
641004902R	G01.00135-	SCWG2083195	Point de soudure	Point Fait			-446.216	-468.858	387.9099	641834188RP1V1	- LONGERON AV G PA		
641004902R	G01.00135-	SCWG2083196	Point de soudure	Point Fait			-445.6	-491.69	390.3317	641834188RP1V1	- LONGERON AV G PA		
641004902R	G01.00146-	SCWG2083217	Point de soudure	Point Fait			-438.26	-511.084	406.15	751872946RP1V1	- ELEMENT FRMT BOI		
641004902R	G01.00142-	SCWG2130335	Point de soudure	Point Fait			-429.66	-502.498	341.6788	751353375RP2V1	- ELEMENT FRMT AV		
641004902R	101.03137-	SCW12125080	Point de soudure	Point Fait			-429.001	-278.618	452.5	237148570RP2V1	- SUPPORT CALCULA		
641004902R	G01.00142-	SCWG2130338	Point de soudure	Point Fait			-423.95	-494.434	276.86	751353375RP2V1	- ELEMENT FRMT AV		
641004902R	101.01270-	SCW12130424	Point de soudure		A Faire		-415.41	-387.39	439.9995	8200290070RP3V1	- PLAQUETTE SUPPOR		
641004902R	101.03137-	SCW12125081	Point de soudure	Point Fait			-410.92	-272.039	452.5	237148570RP2V1	- SUPPORT CALCULA		
641004902R	101.01270-	SCW12130425	Point de soudure		A Faire		-410.58	-410.9	439.9995	8200290070RP3V1	- PLAQUETTE SUPPOR		
641004902R	G01.07206-	SCWG2127587	Point de soudure	Point Fait			-405.73	-506.607	407.11	641834188RP1V1	- LONGERON AV G PA		
641004902R	G01.00135-	SCWG2083199	Point de soudure	Point Fait			-400.52	-437.591	353.41	641834188RP1V1	- LONGERON AV G PA		
641004902R	G01.00135-	SCWG2083200	Point de soudure	Point Fait			-399.74	-437.537	308.24	641834188RP1V1	- LONGERON AV G PA		
641004902R	G01.07206-	SCWG2127583	Point de soudure	Point Fait			-386.67	-489.22	278.5	641834188RP1V1	- LONGERON AV G PA		
641004902R	101.06383-	GCW12079721	Goujon	Point Fait			-384.678	-262.487	503.8197	237148570RP2V1	- SUPPORT CALCULA		
641004902R	101.06907-	ECW12089375	Ecroû à souder	Point Fait			-374.322	-502.626	374.076	751353375RP2V1	- ELEMENT FRMT AV		
641004902R	101.06226-	ECW12079484	Ecroû à souder	Point Fait			-374.24	-494.311	313.7298	751353375RP2V1	- ELEMENT FRMT AV		
641004902R	101.03137-	SCW12125082	Point de soudure	Point Fait			-372.339	-258.002	452.5	237148570RP2V1	- SUPPORT CALCULA		
641004902R	101.06596-	ECW12125118	Ecroû à souder	Point Fait			-371.637	-257.738	553.4471	237148570RP2V1	- SUPPORT CALCULA		
641004902R	G01.00135-	SCWG2083201	Point de soudure	Point Fait			-370.23	-453.42	292.8	641834188RP1V1	- LONGERON AV G PA		
641004902R	G01.00135-	SCWG2083198	Point de soudure	Point Fait			-369.539	-487.034	394.0504	641834188RP1V1	- LONGERON AV G PA		
641004902R	G01.00135-	SCWG2083197	Point de soudure	Point Fait			-369.509	-464.434	391.6365	641834188RP1V1	- LONGERON AV G PA		
641004902R	101.03137-	SCW12125083	Point de soudure	Point Fait			-360.92	-250.209	452.5	237148570RP2V1	- SUPPORT CALCULA		
641004902R	101.00255-	SCW12083112	Point de soudure	Point Fait			-349.541	-486.624	278.5	678012154RP4V1	- ELEMENT LIAISON A		
641004902R	101.00255-	SCW12083111	Point de soudure	Point Fait			-349.482	-503.196	408.77	678012154RP4V1	- ELEMENT LIAISON A		
641004902R	101.01611-	ARR12132940	Point de soudure	Point Fait			-338.7	-506.049	410.85	751353375RP2V1	- ELEMENT FRMT AV		

Fig. 4. Database of the spot welding points.

Points to be made

Points already made in the plant

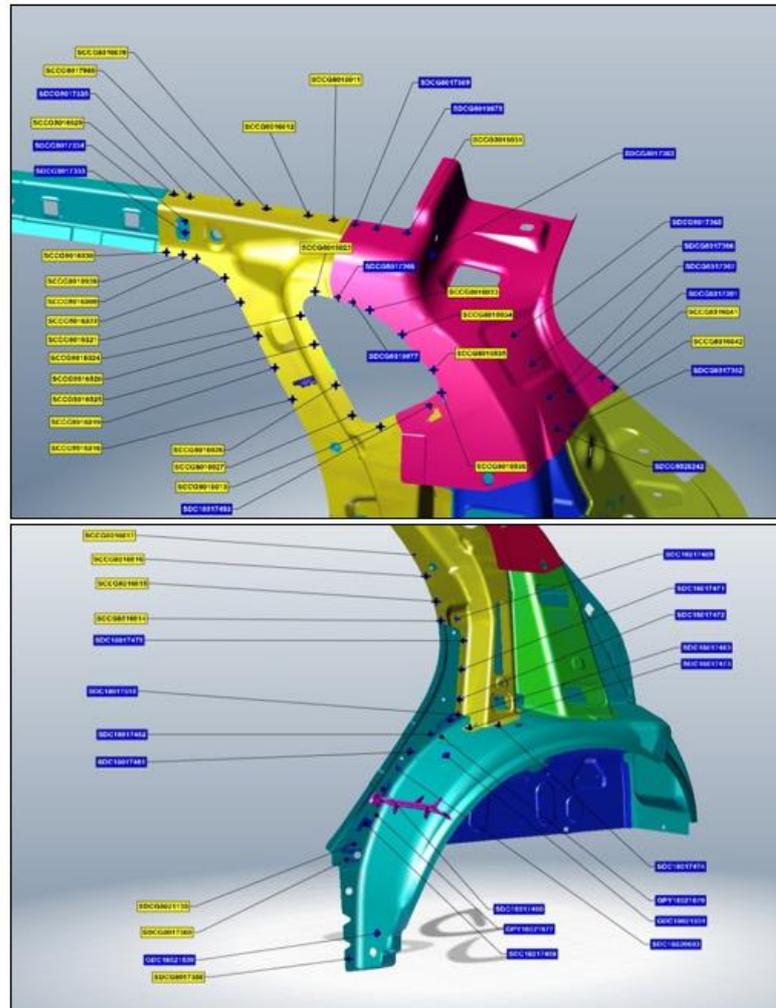


Fig. 5. Exemple of welding range.

In the car services, the spare parts from the sheet metal are ordered directly at the storage warehouses of SC AUTOMOBILE DACIA SA, when they have to repair a damaged vehicle.

To replace a damaged sheet metal part, the car service mechanic uses a drill to open the welding point (Fig. 6). After the damaged part is replaced, with the help of a clamping pliers (when the area allows) the new spare part is fixed (Fig. 7).

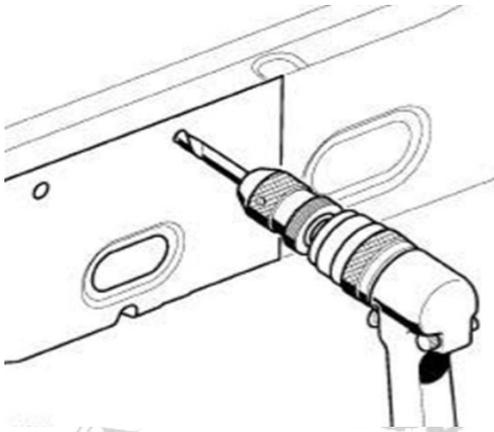


Fig. 6. Undo welding the damaged part.

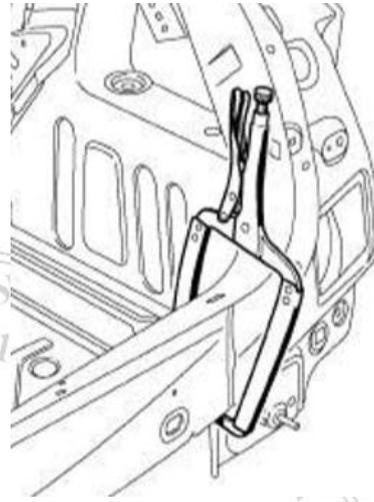


Fig. 7. Fixing the spare part.

The new spare part of the sheet, after being positioned, is welded, if the area allows access, with the help of a spot welding pliers - (Fig. 8) or, if the area does not allow access to a welding pliers, the welding is performed with a welding gun (Fig. 9).

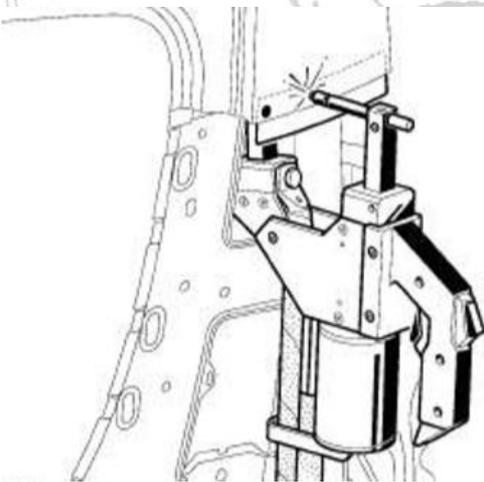


Fig. 8. Welding with welding pliers.

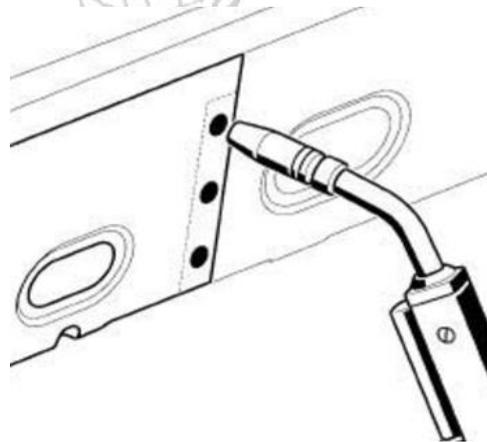


Fig. 9. Welding with gun welding.

3. Conclusions

In industrial activities involving the processing of metal components or the manufacture of products from metal elements, especially here including the automotive industry, the welding process is very common [4], [5].

As advantages we can say that by applying spot welding technology reduces metal consumption, tight joints are obtained, pollution is lower than in the case of other types of welding. Aspects that recommend the increasing use of this welding technology [6], [7], [8].

As a disadvantage of spot welding it can be stated that it requires power installations, water cooling systems and compressed air network [9].

Assessing the quality issues regarding the identification of welding points is a particularly important aspect in the automotive industry. It must be very well defined and also within the company must be implemented a department whose main objective is to monitor quality compliance both during the production process and in the after-sales stage.

After the appearance of the Welding Range activity, the risk of quality problems for sheet metal parts caused by the lack of welding points was eliminated.

Regarding the activity of car services, the identification of welding points that must be performed additionally by making a Welding Range, is a very good working procedure or a "working manual" that must be carefully followed for the best and most efficient solution. of the problem with which the car presented itself at the service point.

Main contributions:

- possible reduction of costs for the installation of spare parts in service departments using spot welding process;
 - obtaining the procedure for the precise position of the welding points in the car services using spare sheet metal parts;
 - elimination of the possibility of error and inaccurate positioning of spare parts on the car body;
 - increasing of the quality of sheet spare parts for Dacia cars.
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