ON THE VALIDATION OF THE BELT SUPPORT BRACKET REINFORCEMENT CONTROL DEVICE FOR REAR SEAT RS 60%

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***Abstract**: While welding the 60% RS rear seat armature of a car, nonconformities were identified, respectively complaints from the customer regarding the position of the belt support. A belt support bracket reinforcement control device for the rear seat RS 60% was built.*
Keywords: reinforcing, belt, seat, armature, control

1. Introduction

At the RS 60% rear seat in the car appeared different nonconformities and complaints from customers. One of the problems reported by customers is the non-conforming position of the belt support, i.e. a larger angle when holding the support. After making 3D measurements, the customer complaint was confirmed. A structure with the belt support angle modified from 37 degree to 34 degrees was found.

It has been noticed that the welding device allowed the belt support bracket to rotate around its nut when placed in the welding device.

The analysis proposed an improvement of the welding device so that the belt support bracket can no longer rotate around its axis. The attachment bracket in the welding device has been replaced with a new attachment bracket that prevents the belt support bracket from rotating.

For the same complaint we decided upon the introduction of a control device, figure 1, to verify the reinforcement of the belt support bracket and the position deviations of this component, figure 2.

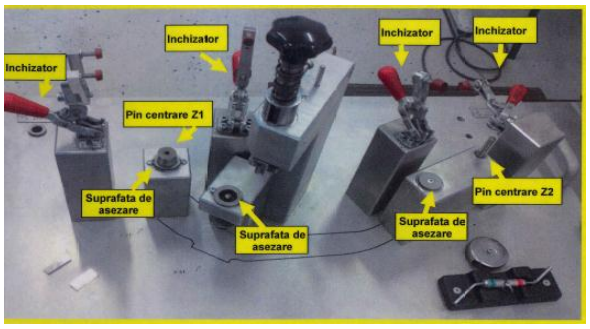

Fig. 1. Bracket control device

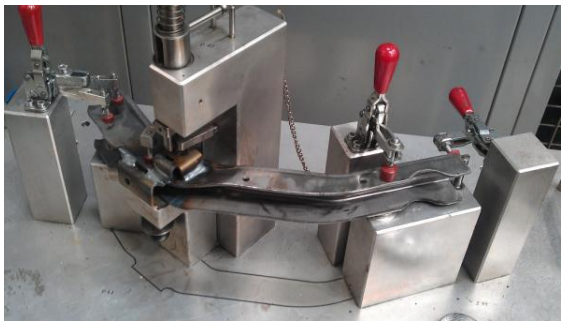

Fig. 2. Bracket reinforcement belt support fixed to the control device

2. **Preparing the technical documentation for the control device**

- **Operation - Prepare the control device**

All locks must be open and the surfaces of the device where the piece is placed must be clean

- **Operation - Seating and locking the belt support bracket reinforcement on the control device.**

The piece must be in contact with the three control surfaces of the control device. The positioning of the workpiece must be done by means of the two centering pins z1 and z2. The piece is locked using the 4 locks.

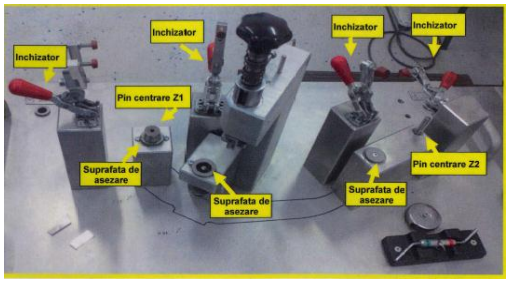

Fig. 3. Visual aid for placing and locking the belt support bracket reinforcement on the control device

- **Operation - Presentation of control means**

Control pin - P1
Control pin - P2
Calibration Control Pass / No Pass - P3 (Ø4.5 Pass / Ø5.5 Not Pass)

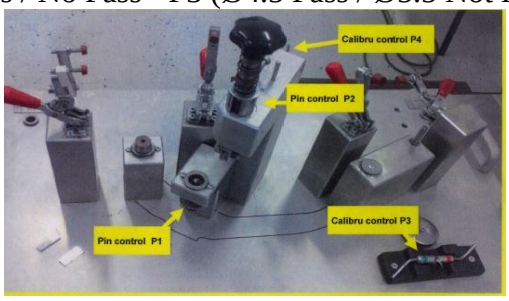

Fig. 4. Visual aid with control means

- **Operation- Check the 7/16 HEX Nut Deviation on the mounting support bracket**

Check with the P1 control pin

Fig. 5. Visual aid for hexagon nut check

- **Operation -** Check the M10 x 1.25 nut deviation on the belt support bracket.

Check with the P2 control pin

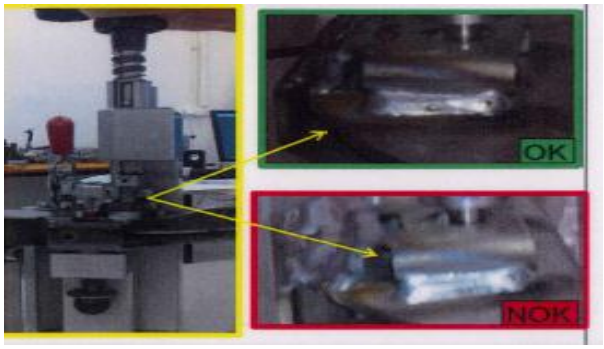

Fig. 6. Visual aid for checking the M10 x 1.25 nut deviation

- **Operation – Check the deviation position in Y of the M10 x 1.25 nut on the belt support bracket, max 1mm.**

P2 control pin will be used.
Use the P2 T / NT top gauge and P3 T / NT (Ø4.5 Pass / Ø5.5 Do not Pass)

Fig. 7. Visual aid for checking position deviation in Y of the M10 x 1.25 nut

- **Operation - Verification of the 34 degrees belt support bracket angle**

The check is made using the control pin P2 and the control gauge P4.
Pin P2 will be positioned, positioning firmly without allowing pin to play.
Check the angle using the P4 caliber, check the two pins. The caliber must enter in both sides. The track will be promoted when the P4 caliber enters between the two pins.

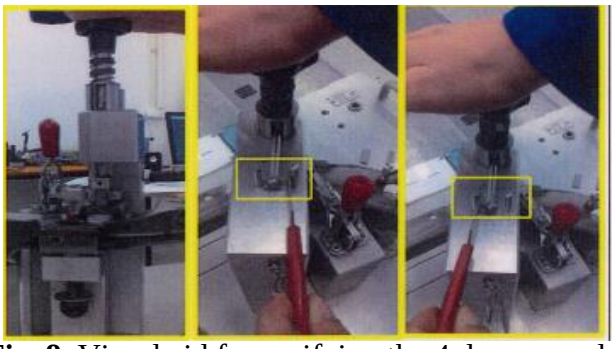

Fig. 8. Visual aid for verifying the 4 degree angle.

3. Evaluation and validation of the control device

A Reproducibility & Repeatability (R & R) study with attribution data was performed to validate the control device.

In order to be able to conduct a R & R study with attribution data:

- There must be at least two operators to carry out the measurements.
- At least 30 pieces of the process must be measured. The chosen pieces must be representative of the entire variation spectrum of the manufacturing (good parts, defective parts, cut-outs)
- . An "expert" inspector performs an evaluation of each piece, classifying it as "OK" or "NOK
- Independently and in random order, each of the 2-3 operators evaluates the tracks, expressing the results by the same rating (OK or NOK).
- Each operator will measure each piece two or three times.
- The measuring pieces are given to operators in random order at each measurement.
- Time for training operators and practice on similar parts before the measurements begin.
- At the end of the measurements the data will be entered into Minitab

To accomplish these attributive measurements, the two operators were instructed on the film sheet of operations for the control device (technical documentation). The results of the measurements are shown in Table 1:

Tab.1. The result of attributive measurements

		Operator 1		Operator 2	
Piesa	Rezultatul expertului	Masuratoare 1	Masuratoare 2	Masuratoare 1	Masuratoare 2
1	OK	OK	OK	OK	OK
2	OK	OK	OK	OK	OK
3	OK	OK	OK	OK	OK
4	OK	OK	OK	OK	OK
5	OK	OK	OK	OK	OK
6	OK	NOK	OK	OK	OK
7	OK	OK	OK	OK	OK
8	OK	OK	OK	OK	OK
9	NOK	OK	OK	NOK	NOK
10	NOK	NOK	NOK	OK	OK
11	OK	OK	OK	OK	OK
12	OK	OK	OK	OK	OK
13	NOK	NOK	NOK	NOK	NOK
14	OK	OK	OK	OK	OK
15	OK	OK	OK	OK	OK
16	OK	OK	OK	OK	OK
17	NOK	NOK	NOK	NOK	NOK
18	OK	OK	OK	OK	OK
19	OK	OK	OK	OK	OK
20	OK	OK	OK	OK	OK

In order to be able to assess whether the R & R study with attribution data is correct, we will use the Minitab for data processing. The evaluation of the measurements is done in the Minitab program and includes 3 evaluations:

-evaluation between operator ratings for the two measurements

-evaluator (operator) vs. standard rating (expert)

- all operators versus standard

First evaluation: Evaluation of operators' ratings for the two measurements. This evaluation in the Minitab program is called 'within appraisers'.

Before we enter the data in Minitab we will review the data, table 2:

Tab.2. Evaluate operator ratings for the 2 measurements

		Operator 1		Operator 2	
Piesa	Rezultatul expertului	Masuratoare 1	Masuratoare 2	Masuratoare 1	Masuratoare 2
1	OK	OK	OK	OK	OK
2	OK	OK	OK	OK	OK
3	OK	OK	OK	OK	OK
4	OK	OK	OK	OK	OK
5	OK	OK	OK	OK	OK
6	OK	NOK	OK	OK	OK
7	OK	OK	OK	OK	OK
8	OK	OK	OK	OK	OK
9	NOK	OK	OK	NOK	NOK
10	NOK	NOK	NOK	OK	OK
11	OK	OK	OK	OK	OK
12	OK	OK	OK	OK	OK
13	NOK	NOK	NOK	NOK	NOK
14	OK	OK	OK	OK	OK
15	OK	OK	OK	OK	OK
16	OK	OK	OK	OK	OK
17	NOK	NOK	NOK	NOK	NOK
18	OK	OK	OK	OK	OK
19	OK	OK	OK	OK	OK
20	OK	OK	OK	OK	OK

When examining the data, we can see that there is only one situation where an operator did not agree with his previous rating, namely the track, the first operator disagreed with both measurements. In the other 39 pairs, both operators agreed on their previous ratings.

Second evaluation: Valuer versus standard rating - found in the Minitab program under the name 'Appraiser versus standard'.

Before data is entered into the program, a data review is performed to find the differences between operator and expert assessments.

Tab.3 Evaluation of 'operator versus standard'

		Operator 1		Operator 2	
Piesa	Rezultatul expertului	Masuratoare 1	Masuratoare 2	Masuratoare 1	Masuratoare 2
1	OK	OK	OK	OK	OK
2	OK	OK	OK	OK	OK
3	OK	OK	OK	OK	OK
4	OK	OK	OK	OK	OK
5	OK	OK	OK	OK	OK
6	OK	NOK	OK	OK	OK
7	OK	OK	OK	OK	OK
8	OK	OK	OK	OK	OK
9	NOK	OK	OK	NOK	NOK
10	NOK	NOK	NOK	OK	OK
11	OK	OK	OK	OK	OK
12	OK	OK	OK	OK	OK
13	NOK	NOK	NOK	NOK	NOK
14	OK	OK	OK	OK	OK
15	OK	OK	OK	OK	OK
16	OK	OK	OK	OK	OK
17	NOK	NOK	NOK	NOK	NOK
18	OK	OK	OK	OK	OK
19	OK	OK	OK	OK	OK
20	OK	OK	OK	OK	OK

When examining the rows, it is noted that there are three situations where the operator did not agree with the qualification established by the expert. So, operator 1 agreed with the expert in 18 out of 20 cases. Operator 2 agreed with the expert in 19 out of 20 cases.

Third evaluation: all operators vs. standard - 'All appraisers vs Standard'.
This indicator is also the one that gives us the final result of the final R & R study.

Before entering the data into the program, an examination of the rows is performed where an operator did not agree with the qualification established by the expert.

Tab.4. Qualifiers' rating All operators vs Standard

		Operator 1		Operator 2	
Piesa	Rezultatul expertului	Masuratoare 1	Masuratoare 2	Masuratoare 1	Masuratoare 2
1	OK	OK	OK	OK	OK
2	OK	OK	OK	OK	OK
3	OK	OK	OK	OK	OK
4	OK	OK	OK	OK	OK
5	OK	OK	OK	OK	OK
6	OK	NOK	OK	OK	OK
7	OK	OK	OK	OK	OK
8	OK	OK	OK	OK	OK
9	NOK	OK	OK	NOK	NOK
10	NOK	NOK	NOK	OK	OK
11	OK	OK	OK	OK	OK
12	OK	OK	OK	OK	OK
13	NOK	NOK	NOK	NOK	NOK
14	OK	OK	OK	OK	OK
15	OK	OK	OK	OK	OK
16	OK	OK	OK	OK	OK
17	NOK	NOK	NOK	NOK	NOK
18	OK	OK	OK	OK	OK
19	OK	OK	OK	OK	OK
20	OK	OK	OK	OK	OK

When examining the data, it is noted that there are three rows where an operator did not agree with the expert's qualifiers.

Note that if only an evaluation does not coincide with that of the expert, it is counted as disagreement.

4. Conclusions

As can be seen from the first evaluation, the level of confidence for the two measurements by each operator is 95%. This 95% is the level of confidence in the measurements made by the two operators, which means that this result falls within the limits, Figure 9.

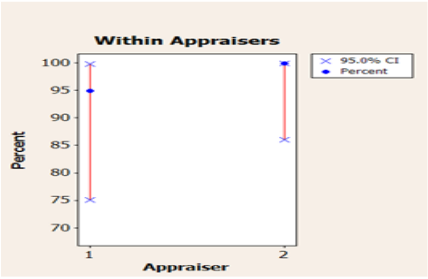

Fig.9. The graphical result of the Minitab session for the rating of operators

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In the second evaluation we can see that the confidence level for the operator 1 is 90%, and for the operator 2 it is 95%, figure 10. Percentages indicate that we are within the required limits.

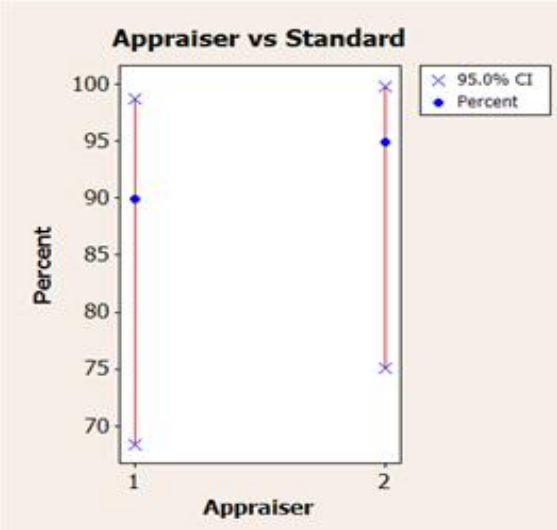

Fig. 10. The graphical result of the Minitab session to assess the ratings of each operator versus standard (expert).

The evaluations showed that the confidence coefficient was 95%, meaning that the R & R Reproducibility & Reproducibility study was a successful one within the accepted limits.

With this R & R Reproducibility & Reproducibility study, we validated the control device for the belt support bracket reinforcement subassembly.

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