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Spot weld characterization at 22mnB5 steel sheet for Press Hardening Steels (PHS), using conventional and digital image correlation (DIC) analyzes.

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The aim of this paperwork is to evaluate the mechanical properties of the spot weld, in a 22MnB5 steel sheet in its manufacturing condition, and after quenched. This evaluation was carried out using tensile tests on test specimens normalized by ASTM E8, through extensometry allied to the digital image correlation method. Spot welding is a tool widely used to join sheets in the automotive industry. It was necessary to study the joints of these steels through this type of welding due to the following needs: increasing need for the automobile industry on reducing vehicle weight, increasing passenger safety and new 2018 regulatory compliance about side impacts in Brazil. The initial microstructure of this steel, in the annealed condition, is basically formed by ferrite and perlite, with tensile strength limit around 600 MPa. After the quenched process, this material starts to present a completely martensitic microstructure and resistance close to 1500 MPa.Test specimens were produced, respectively, under the following conditions: 1 and 2- Using and not using spot weld; 3 and 4 – Using the rolled steel as manufactured and after quenched; 5 and 6- Using spacers to space the sheets during the welding process. To use the digital image correlation technique, the specimens were engraved with 1 mm in diameter circles and separated by a gap of 1 mm forming a grid. The specimens were subjected to tension until their fractures, reproducing a part of the real working condition and help us to understand what happens in the weld area. Images were recorded digitally, following the deformations occurred, these ones were analyzed by using specific software. The experimental results suggest the principle of fracture in spot-welded sheets samples and in the ones which were not welded. It was characterized that the specimens without the weld nugget, on material as manufactured and quenched, have a higher tensile strength. The tendency of fracture in the heat affected zone (HAZ) was confirmed in these high resistance steels due to the formation of annealed material in the weld nugget. In the specimens that were not quenched, after welding, there was hardening in the area of the weld nugget and the fracture happened in the outer and softer area of the weld nugget. While in the quenched specimens, there was a fracture in the inner area of the weld nugget due to the loss of some mechanical characteristics obtained with the quench, but which were reduced by the welding. No significant change was observed in fracture of specimens that were welded with the use of spacers