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Study of Patchweld Blank Resistance Spot Welding (RSW) before hot stamping with and without heat treatment parameters.

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The global legislators have passed more severe vehicle emissions and safety regulations through 2020. In order to solve this equation, the advanced high strength steels (AHSS) grades are qualified to meet the functional performance demands of certain parts. For structural elements, AHSS steels are excellent in the crash zones of the vehicle for their high energy absorption. For structural elements of the passenger compartment, extremely high-strength steels the boron-based Press Hardened Steels (PHS) become one of the most popular materials to improved safety performance. The AHSS permit design body structures with a thinner material in specific areas to achieve the project requirements, due to the high strength and combined with inner reinforcement, too. Recently, the engineers decided to produce parts and reinforcement at the same time during forming called “patchweld” and the PHS steel was specified for the purpose. However, the blanks have to keep together during the hot stamping process and Resistance spot welding (RSW) as a most common welding process for joining sheet steels in the car-body production was the obvious chose. The designed microstructure of the AHSS can be destroyed with the welding thermal cycle, which can affect failure behavior and mechanical properties of the welded structure. It has been recognized that the RSW parameters selection played an important role in the AHSS welding performance. This paper aims to understand the tempering process performed during the RSW cycle with two different welding parameters, known as P4 and P5. The P4 and P5 welding parameters were defined to reach the maximum load during the shear test while full bottom detachment according to AWS D8.9.The test samples were assembled with a gap to reproduce real vehicle welding conditions. The parameter P4 weld PHS sheet samples without heat treatment and without the use of tempering during the passage of current, whereas the parameter P5, weld equal samples, but with tempering during the resistance welding process. The influence of these parameters on the PHS “patchweld” mechanical properties was evaluated with Vickers hardness test (HV) through the cross-section of the specimen with standard metallographic technique preparation and shear tests. The results confirmed the difference at the Heat affected zone (HAZ) mechanical strength over fusion zone (ZF). For the two welding parameters, it was possible to visualize a softening region in the HAZ of the welding parameter P4. The welding parameter P5 with a tempering pattern at the weld obtained superior results in the Heat affected zone due to the reduction of the cooling speed caused by a process performed during the RSW cycle.