Many types of steel are treated with heat to increase toughness and resistance to wear. Induction heating seems to be appropriate and provides several advantages in comparison with conventional techniques. In this paper, control techniques for full-bridge resonant inverter aimed to induction heating are evaluated comprehensively, through simulation and experiment, and compared to each other in terms of heating rate, efficiency and input power factor, using one metal sample hardened to 1 mm in depth up to 600 °C, with a 400 W power supply. These techniques are implemented digitally in way to allow a high-resolution power control. The simulation results obtained are satisfactory, and agree with those of the experiments. Furthermore, the study shows the control strategy based on frequency may not be sufficient, but should be associated with other control techniques in order to address appropriately the hardening process, bearing in mind processing time, efficiency and input power factor. The strategy with the input dc voltage and the pulse density modulation controls appear to suit the surface metal treating for large temperature variation, and enable the heating process to perform well when compared to the other techniques based on phase-shift and pulse width modulation duty cycle control.