The CAS-OB process (Composition Adjustment by Sealed argon bubbling – Oxygen Blowing) is a unit process designed for controlling the steel composition and temperature in secondary metallurgy. The process is commonly divided into heat-up, alloying and reduction of slag. The objective of the heat up stage is to increase the temperature of the steel bath by chemical heating, which is conducted by feeding aluminium particles into the melt and employing simultaneous oxygen-blowing through a top lance. In practice, the rate of chemical heating is limited in order to avoid introducing excessive thermal stresses to the wall structures by means of heat transfer processes, particularly radiation and convection. Typically, heating rates up to 10 °C/min can be obtained without excessive equipment wear. In our previous work, a novel numerical model was proposed for the heat-up stage of the CAS-OB Process. This model considers all the main phenomena observed in the process, including reactions between gas jet and steel bath, reactions between metal droplets and top slag as well as feeding, melting and oxidation of aluminium particles. Due to the objective of accurate temperature control, a special emphasis is put on the heat losses. Both the bell structure and the ladle have been divided into multiple temperature node points in order to determine their heating rate. The purpose of this paper is to provide a preliminary validation and to propose guidelines for further measurement campaigns. The preliminary validation results suggest that the model predictions are in good agreement with steel samples and temperature measurements.