In this work the cutting temperature of tungsten carbide tools are obtained using the inverse heat conduction technique based on conjugate gradient method. A three-dimensional formulation is used both to describe the physical phenomenon and to solve the inverse problem. The machining process (turning) is instrumented mounting nine thermocouples at the bottom face of the tool, opposite to its main face. The signals are automatically received and processed using a data acquisition system and a PC-Pentium. The direct solution, adjoint equation and sensitivity problem are numerically solved using finite volumes method. The results are compared with inverse techniques using one-dimensional ellipsoidal coordinate. With this method the cutting temperature are estimated for various cutting conditions. In order to validate the method the IHCP is applied in a well-controlled experiment where the heat flux input is known. An uncertainty analysis is also presented.