1. PRELIMINARY INTRODUCTION

The use of electronics in industry is constantly growing, to the point that nowadays it is becoming difficult to find a complex machine or tool without any kind of electronic device on it. The design of the printed circuit board must not only focus on the fulfilling of its electronic task, but also on assuring the reliability and structural integrity of its electronic components. Usually the only risk is due to the high heat transmission associated to electronic equipment, a process widely covered in literature and regularly considered in the design stage. It is also necessary to consider, however, other sources or risk, such as vibration or shock.

Electronic equipment can be subjected to vibration or shock due to many reasons. Sometimes they are part of the normal behaviour of the tool, but they can also possibly appear as malfunction, such as unbalanced rotors, or just being a part of the manufacturing or transport process. Traditionally mechanical sources of excitacion has been a problem only in equipment highly sensitive or subjected to special functional conditions, such as military and aerospace applications. However, the present application of electronics to a vast range of machines and tools provides new harsh enviroments which can turn out to be critical for the electronic equipment, usually more sensible that the mechanical elements traditionally used.

This thesis was born as a request from Atlas Copco Tools to solve a vibration failure in one particular tool. During its execution it was soon clear that it was going to be difficult to point any measure as an optimum of assured effectiveness. Instead, literature survey led to a wide range of possible solutions. It was considered more interesting to shift the main objective of the thesis into a critical revision and collection of those different techniques.

The paper intends to be the starting point of a reference guide for the proper design of printed circuit boards from the point of view of their mechanical reliability. It covers both general rules that should be applied to the design of any printed circuit boards, as well as specific analysis and solutions for the cases in which specially harsh conditions are expected or a failure has appeared in a already working device.

Since the report of the thesis is itself this guide, its structure is different from the standard practice. The two first parts cover vibration and shock, respectively. In both of them a brief theory overview is included, to provide with a basis to readers who are not used to mechanical engineering. A third one tries to hint possible performance procedures for the design or improvement of electronic structures. This three parts will constitute the main body of the aforementioned guide.

There is a fourth part which includes different annexes that have not been included in the guide. The main reasons were that they were excessively long and relatively limited in interest from the purely practical point of view of an electronic design engineer. It is mainly constituted of the report on the different experiments conducted, which were used both as a verification of some of the statements in the previous parts and as practical examples.