Summary

Today there is a trend towards electrical and software controlled safety systems in lifts. To guarantee the safety of these systems they need to be tested, and certified. Therefore there is a focus on new standards and guidelines that can give further support for the development and adjustment of current tests en certifications of lifts.

This report provides an overview of standards and documents on current safety precautions for lift systems. These standards and documents are compared to the standards, documents and methods concerning the safety precaution in electric systems in transport equipment, particularly from the aviation industry. The comparison is based on the required redundancy in the aviation industry, giving certain safety integrity levels based on standards and norms from the aviation industry. The safety integrity levels are comparable with the design assurance levels in the aviation industry, and given by safety assessment processes and hazard analyses.

The Guideline Lifts (95/16/EG) states essential safety and health requirements for lifts. This Guideline is complemented by the EN 81 (concerning production and installation of lifts) and the Machine Directive (98/37/EC). The standard for the safety related part of control systems in machinery is EN/ISO 13849. The safety of electrical, electronic and programmable electronic safety related systems is the IEC 61508. The implementation of safety related control systems, as described in standard IEC 62061, represents a sector specific part under IEC 61508. PESSRAL (ISO 22201) is based on the IEC 61508 and concerns specifically lifts. The standards for software quality are given by ISO 9126. The contents of these norms are described in **chapter 3**, with a focus on safety integrity levels (SIL's), for further comparison with safety standards in the aviation industry.

Focusing on the safety in the aerospace industry, redundancy of safety systems is an important issue. In the aerospace industry mechanical controls systems haven been replaced by fly by wire systems. The standards concerning the electronic hardware and software of airborne systems, the RTCA DO-254 and the RTCA DO-178B respectively, describe how to comply with the levels of safety. Military and NASA standards are also described in this **chapter 4**. In order to determine is the demanded safety levels have been reached, and to determine if the levels of redundancy are sufficient, safety assessment processes and hazard analysis's are used and specific life cycles for software development are followed.

In tests of electronic hardware and software the safety assessment processes and hazard analysis's as described in **chapter 4**, are also used. **Chapter 5** describes more safety assessment processes and hazard analysis's that are used in tests, as well as tests methods of electronic hardware parts and software.

Certifications processes (**chapter 6**) are described in de ARP 4754 as well as in the RTCA DO-254 and the RTCA DO-178B, using the assessment processes, hazard analysis's and other tests described in **chapter 4 and 5**.