

Note on Engineering Details

No: DWM-FMar-extern-001, Rev. 1

Title: **EN 954-1: Circuits for safety-related parts of the control**

Ref.: "Guideline for the Certification of Wind Turbines", Edition 2003 with Supplement 2004 of Germanischer Lloyd, Section 8.7.10

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1. Motivation

The wording "controls" describes the entire system controlling a machine, respectively in this context a wind turbine. This includes the plc and software applications as well as other related electrical equipment as relays, cables, switches and more. Some of the hardware and software parts of the control system (shorten controls) provide safety functions. The motivation is to assure that the implementation of these safety functions is executed in accordance with categories set out in EN 954-1.

2. Standard EN 954-1

The standard EN 954-1 "Safety of Machinery - Safety-related Parts of Control Systems - Part 1: General Principles for Design" provides a set of categories for control systems of all kinds of machinery. The category selected depends on the contribution made by the safety-related parts of the controls to the reduction of risk.

The greater the reduction of risk on the safety-related parts of the controls, the higher is the ability of those parts to resist faults. This ability can be partly quantified by reliability values and by a fault resistance structure. Both, reliability and structure contribute to this ability of safety-related parts to resist faults. It also varies with technology used. For example, it is possible for a single channel of safety-related parts of high reliability in one technology to provide the same or higher resistance to faults as a fault tolerant structure of lower reliability in a different technology. The higher the resistance to faults, the lower is the probability that the safety-related parts will fail to carry out the required safety function.

The designer decides the contribution to the risk reduction which needs to be provided by each safety-related part of the controls. He must ensure that the safety-related parts of the controls produce outputs which achieve the risk reduction objectives of the risk assessment. This is not always achievable and in such cases the designer must provide other safety measures.

EN 954-1 provides a clear basis upon which the design and performance of any application of the safety-related parts of the controls can be assessed. When selecting a category and designing the safety-related part of the controls, the designer will need to declare at least the following information:

• category selected
• the functional characteristics
• the precise role it plays in the machinery protective measures
• the exact limits
• all safety-relevant faults considered
• those safety-relevant faults not considered by fault exclusion and the measures employed to allow their exclusion
• the parameters relevant to the reliability such as environmental conditions
• the technologies used

Table 1: Information about safety-related parts

The standard EN 954-1 defines five categories for safety-related parts of controls. The categories state the required behaviour of the controls in respect of resistance to faults.

3. Assessment and Scope of assessment

Based on this information GL checks the plausibility of the assigned categories and their implementation in the electrical installations. The standard EN 954-1 will be superseded by the standard EN ISO 13849-1 with the transition period ending 2011-12-31. In case EN ISO 13849-1 is applied instead and respective documentation is presented during the certification according to the "Guideline for the Certification of Wind Turbines", Edition 2003 with Supplement 2004 GL checks the plausibility of the determined required Performance Level PLr for each safety function. Additionally, the plausibility and the implementation of the associated categories of the safety related parts in the electrical installations will be verified.

GL accepts the documentation on basis of each of the standards as long as the "Guideline for the Certification of Wind Turbines", Edition 2003 with Supplement 2004 is used.

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