



SAFETY RELATED CONTROL SYSTEMS IN PAPER MILLS

Safety-Related Control Systems - Technical Seminars Commonly asked questions

Introduction

The guidance about safety-related control systems in *Making Paper Safely* was revised in response to concerns expressed by some paper mills about the practicability of implementing the requirements. Revised guidance was issued in the form of a Sector Information Minute (SIM) 4/2002/12, which had a technical annex. Seminars were then held across the UK to introduce the revised guidance to mill engineers, suppliers and designers and provide an opportunity for discussion. It was agreed at these seminars that to promote a full exchange of ideas and information as well as consistency in the interpretation of the guidance some key questions posed at the seminars would be set out in a PABIAC Bulletin. This Bulletin is the result.

Questions and answers

1. Can we use a single channel emergency stop that is PES controlled?

Yes, under very low risk situations where the failure of the circuit did not lead to an unacceptable increase in the risks and the electrical control equipment is suitable for use in a safety related system (PES).

Further guidance can be found in BS EN 60204-1:1998. "Safety of machinery Electrical equipment of machines".

2. Reference is made to a 'competent person' - what are the measures of competency for safety-related control systems work?

Designers and integrators of safety-related control systems should have a high level of knowledge and experience in order to effectively design and validate a system to its safety requirements specification. The IEE document referred to in the SIM is primarily aimed at the designers and integrators of electrical, electronic and programmable electronic systems.

It is essential that anyone involved with modifications to safety related systems has sufficient knowledge in the subject to ensure the changes made do not have a detrimental effect on the overall safety of the machine. Other than the competencies referred to in paragraph 19 of SIM 4/2002/12, there is a need to test modified systems and prove their safety performance, before the machine is put into use. Safe systems of work should include arrangements to have proposed changes, including software specifications, approved by at least a second competent person (or the original design organisation).

End users of Safety related control systems should have suitable and sufficient knowledge and experience in order to safely use, maintain and make minor modifications to such systems.

3. What is the situation concerning speed above the maximum operating speed as the SIM focuses on deviation from crawl speed?

There is a need to assess the risks from the machine and its individual components, such as motors, exceeding their design limits. The assessment should consider such consequences as the machine breaking up, fabric bursting etc. If the risk is sufficiently high then measures will have to be taken to reduce this risk. The safety related control system may be included in implementing these measures, for example by limiting the maximum operating speed.

4. How can we find component and equipment failure rate data?

You should use published data and manufacturers data where this is available. Data may be obtained from publications such as Siemens AG SN 29500 Part 7, Failure rates of components, expected values for relays, April 1992 and Reliability, Maintainability and Risk – Practical methods for engineers by David J Smith. ISBN 0 7506 5168 7. HSE have also published a research report on low complexity systems that gives examples of calculations (RR 029 Requirements for low complexity systems). This can be found on the HSE web site.

When considering failure rate data allowance should be made for the environmental and operating conditions that exist at a paper making machine compared to those given in the published data. Information on EMC and functional safety can be found in IEE publications, see www.iee.org/oncomms/pn/functionalsafety.

5. Pre-start warning – what is considered best practice in terms of the number and type of alarms when there is more than one machine present?

There is no agreed best practice. Requirements for single machines can be taken from BS EN 1034-1:2000 "Safety of machinery - Safety requirements for the

design and construction of paper making and finishing machines". For multiple machines additional guidance is given in SIM 4/2002/12 paragraphs 44-47.

6. Is dedicated speed detection required in addition to the hold-to-run function?

Yes – paragraph 42 of the SIM refers. Examples of appropriate measures are given in paragraph 43.

7. No question – statement: HSL published research in support of COMAH relating to 61508 – anything useful from this?

It was not particularly directed at COMAH, it is an HSE published Contract Research paper CRR 419/2002: Developing advisory software to comply with IEC-61508. It is available on the HSE website www.hse.gov.uk

Further guidance on IEC-61508 is available at www.iec.ch/functionalsafety and www.iee.org.uk

8. We are familiar with applying BS EN 954 for non-complex systems but are not clear about when and to what extent we should use IEC 61508 – what is the position?

As stated in *Making Paper Safely*, IEC 61508 should be used for complex electrical, electronic and programmable electronic systems (E/E/PES). EN 954 should be used for non-complex systems and for other, non-electrical technologies.

At this time IEC 61508 is primarily intended for the design of new and significantly refurbished machinery in respect to safety related control systems. Existing safety related control systems should comply with current legislation.

The functional safety management requirements of IEC 61508 should also apply to the operational phases throughout a machines service lifetime.

9. If I am fitting components to my machine which have a direct safety function, do those components need to be safety components and have a Declaration of Conformity which states this?

Yes, if the safety component is being installed in existing machinery.

As an example, a replacement interlock switch should be a safety component, supplied with a Declaration of Conformity.

(Facts on Machinery Directive 98/37/EC - Question 77, page 20 states "Safety components placed on the market separately" were included in the scope of the Directive mainly so that machinery users who have to improve safety and who are generally less technically competent to choose these components than the machinery designers can obtain parts which give satisfaction. Apart from the components listed in Annex IV, it is the manufacturer of the component who declares - on the basis of the definition in the Directive - whether the part in question is a safety component within the meaning of the Directive and provides information on its function.)

A further example being the replacement of a standard single channel programmable logic controller by a more modern PLC, which could be used to implement a safety-related control function whose failure could endanger the safety and health of exposed persons. In this case, the use of a PLC with an assigned performance capability (e.g. a safety integrity level (SIL) claim limit) that meets the requirements of the Essential Health and Safety Requirements (EHSRs) is essential. This PLC should be supplied with an appropriate declaration of conformity or, alternatively, the machine as a whole should be declared to conform to all relevant EHSRs.

To assess the functional safety of a machine control system that incorporates a PLC suitable for use in safety-related applications is a very complex and specialised task that should only be undertaken by competent persons. It is to be expected that manufacturers of safety devices or specialist test houses are likely to be the only people with an appropriate level of competency.

10. What about high inertia drives and emergency stop?

If the high inertia drive takes so long to stop, there is no value in relying only upon an emergency stop to prevent danger and additional protective measures have to be taken to safeguard personnel.

The Provision and Use of Work Equipment Regulations Regulation 16 also refers.

11. If I have a system in use without problems for 6 years or more and do the best I can in calculating probabilities of failure – can I make a case that what I have is sufficient to control against any risks I have identified?

It is not possible to determine the safety integrity of a system purely upon historical data. Consideration should also be given to other characteristics of the system, e.g. architecture, diagnostic capability, maintenance history.

12. There is so much speed control built into conventional and new AC systems for production purposes that safety in terms of over speed is covered – what is the view on this?

This may be the case but a drive system used for production purposes may not have been designed for use as part of a safety related system. Issues such as the fault behaviour of the equipment, the fraction of dangerous failures detected etc are important for safety related purposes but may not be for production purposes.

13. What about testing over speed protection?

Simulation, without actually taking the drive into the over speed condition, is the expectation. A typical approach would be to apply/inject test voltages.

14. What examples of achieving the standard for pre-start warning exist?

Examples can include the duplication of the sounders, monitoring that is self checking (e.g. the current to the klaxons), proof testing. See also SIM 4/2002/12 paragraphs 44-47.

15. What is the standard in terms of numbers of sounders?

There is no standard.

With the resolution of this issue PABIAC now believe that there is no reason why mills should not be able to fully comply with all the requirements of Making Paper Safely, including those relating to control systems. Mills should therefore review their action plans in the light of this bulletin and ensure that any work required is included in their plan and programmed accordingly. Inspectors will be using this information, together with Making Paper Safely, when assessing compliance."