

TECHNICAL SPECIFICATION

Functional safety of electrical/electronic/programmable electronic safety-related systems –
Part 3-1: Software requirements – Reuse of pre-existing software elements to implement all or part of a safety function

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IEC TS 61508-3:2014
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73bfa081adc6/iec-ts-61508-3-1-2014

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

ICS 25.040.40; 35.240.50

ISBN 978-2-8322-3516-4

Warning! Make sure that you obtained this publication from an authorized distributor.

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**FUNCTIONAL SAFETY OF ELECTRICAL/ELECTRONIC/PROGRAMMABLE
ELECTRONIC SAFETY-RELATED SYSTEMS –****Part 3-1: Software requirements –
Reuse of pre-existing software elements
to implement all or part of a safety function**

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Technical specifications are subject to review within three years of publication to decide whether they can be transformed into International Standards.

IEC TS 61508-3-1, which is a technical specification, has been prepared by subcommittee 65A: System aspects, of IEC technical committee 65: Industrial-process measurement, control and automation.

The text of this technical specification is based on the following documents:

Enquiry draft	Report on voting
65A/780/DTS	65A/802/RVC

Full information on the voting for the approval of this technical specification can be found in the report on voting indicated in the above table.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts in the IEC 61508 series, published under the general title *Functional safety of electrical/electronic/programmable electronic safety-related systems*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

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- withdrawn,
- replaced by a revised edition, or
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INTRODUCTION

The requirements set out in this technical specification deal with the reuse of software elements when they are intended to form part of a safety function.

In many fields of automation, software elements are used today in support of safety functions. Such applications will certainly be further developed and extended. Software engineers, however, do not always wish to write the software for these applications from scratch, but will in many cases use already existing software and integrate it with the new application which might be slightly different from the one for which the software was originally specified.

In IEC 61508-3:2010, a requirement is given in 7.4.2.12. It offers three routes to the achievement of the necessary integrity for the pre-existing software element. The requirements to comply with the second route, Route 2_s, are defined in IEC 61508-2:2010, 7.4.10.

This entails that IEC 61508-3:2010 –dealing solely with software –refers to requirements in IEC 61508-2:2010 which concerns complete systems including hardware but excluding software (see IEC 61508-2:2010, 1.1 enumeration “e”).

This technical specification defines the requirements for software elements explicitly, because IEC 61508-2:2010 excludes software, and is intended to replace the text of the second bullet (“route 2_s”) of a), 7.4.2.12 in IEC 61508-3:2010 in a future revision of IEC 61508-3.

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FUNCTIONAL SAFETY OF ELECTRICAL/ELECTRONIC/PROGRAMMABLE ELECTRONIC SAFETY-RELATED SYSTEMS –

Part 3-1: Software requirements – Reuse of pre-existing software elements to implement all or part of a safety function

1 Scope

This Technical Specification presents requirements by the application of which pre-existing software elements may be claimed to be proven-in-use for all or a part of safety function(s) of SIL1 or SIL 2.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61508-3:2010, *Functional safety of electrical/electronic/programmable electronic safety-related systems – Part 3: Software requirements*

3 Terms and definitions (standards.iteh.ai)

No terms and definitions are listed in this document.

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- IEC Electropedia: available at <http://www.electropedia.org/>
- ISO Online browsing platform: available at <http://www.iso.org/obp>

4 Requirements

4.1 Notes 1 to 4 below apply to the entire Clause 4 (4.2 to 4.9).

NOTE 1 Any documentation required by a clause in this document could either be available with the pre-existing software or could be included as part of the documentation of the safety related function.

NOTE 2 A reused software function in this document means a function specified on the level of the requirements specification (see IEC 61508-3:2010, 7.2). A reused software function does not refer to a programming language construct.

NOTE 3 Conditions are set for the data on the history of the pre-existing software in 4.2 b) and c). The fulfilment of these conditions does not entail that the software is deterministic: hidden internal states of the software can affect its execution even when the required combination as specified in 4.2 b) and c) is exactly the same. The use of pre-existing software is thus restricted by 4.7.

NOTE 4 In some cases (e.g. input data are analogue data or a clock signal) the demonstration of proven-in-use for software could be difficult.

4.2 An element shall only be regarded as proven-in-use when:

- a) its description:
 - 1) exists and is available;
 - 2) fulfils the requirements of IEC 61508-3:2010, 7.2;
 - 3) describes the previous use,

and

- b) the execution of the software with all combinations of all claimed
- combinations of input data,
 - sequences of execution of the reused software function(s),
 - timing relations within sequences of execution of the reused software function(s) which will occur in the intended use are documented;

and

- c) combinations of all
- input data,
 - sequences of execution of the reused software function(s),
 - timing relations within sequences of execution of the reused software function(s) which are not part of the proven-in-use claim, comply with 4.8,

and

- d) the combinations described in 4.2 b) that will be used in the intended use have occurred in the previous use with the same relative frequency. This future frequency shall be justified in comparison to the previous use and documented.

and

- e) there is adequate evidence to demonstrate the completeness of the documentation,

and

- f) the element together with the hardware on which it will run will be subject to documented
- analysis of any operational experience of the integrated hardware and software element;
 - suitability analysis of the hardware and software element;
 - testing of the hardware and software element. This documentation includes:
 - specification of the goals of the test runs from the properties documented in 4.2 a), b) and d) above;
 - details of the testing for each individual goal;
 - an estimate of the confidence with which the testing established each individual goal;
 - a demonstration that the estimated confidence is appropriate to the goal and the test results.

NOTE 1 Suitability analysis and testing focuses on the demonstration of a hardware and software element's performance within the intended application. The results of existing analyses and testing could be taken into account. This includes functional behaviour, accuracy, behaviour in the case of a fault, time response, response to overload, usability (e.g., avoidance of human error) and maintainability.

NOTE 2 A mathematical partitioning of the input data can be helpful to identify all proven-in-use combinations.

NOTE 3 By "input data" is meant all input data to the software element. For example, it can be that the hardware on which the software element runs generates internal data that are input to the software, such as diagnostics.

NOTE 4 The timing relations most often found and most in need of verification are linear timing relations of the form (fastest possible time \leq execution time \leq longest possible time). There are practical methods for verifying and checking the mutual consistency of timing requirements of such a form.

4.3 The documentary evidence required by 4.2 shall

- a) demonstrate that the following features and phenomena of the previous experience evaluated for the proven-in-use claim are identical in the intended use of the element:
- hardware (e.g. processor, memory, clock, bus behaviour) and demand profiles;