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Report

on the

Certificate

Z10 108316 0002 Rev. 00

of the

Software Tool

Klocwork

Applicant

Perforce Software, Inc.
400 N. 1st Avenue Ste 400 Minneapolis,
Minnesota 55401
USA

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Testing Laboratory for Safety Components

TÜV SÜD Rail GmbH
Rail Automation
Barthstraße 16
D-80339 München

Certification Body

TÜV SÜD Product Service GmbH
Ridlerstraße 65
D-80339 München

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Modification History

Rev.	Status	Date	Author	Modification / Description
1.0	-	2013-09-03	Walter Schlögl	initial
1.1	-	2014-07-09	Martin Braun	Address
1.2	-	2016-04-19	Walter Schlögl	Update for new version Klocwork 2016
1.3	-	2016-04-25	Walter Schlögl	Removal of references to the old version "Insight", detailed "Identification"
1.4	-	2016-08-22	Walter Schlögl	New version 2016.1
1.5	-	2017-01-19	Walter Schlögl	New version 2016.3
1.6	-	2017-04-28	Walter Schlögl	New version 2017
2.0	-	2017-09-12	Walter Schlögl	New version 2017.1, EN 50128
2.1	-	2017-09-28	Walter Schlögl	Update reference to technical report
2.2	-	2017-10-23	Walter Schlögl	New version 2017.2
2.3	-	2017-11-23	Walter Schlögl	New version 2017.3
2.4	-	2018-05-18	Walter Schlögl	New version 2018
2.5	-	2018-10-01	Walter Schlögl	New version 2018.1
2.6	-	2018-10-12	Walter Schlögl	New version 2018.2
2.7	-	2018-12-07	Walter Schlögl	New version 2018.3
2.8	-	2019-03-26	Walter Schlögl	New version 2019, ISO 26262:2018
2.8.1	-	2019-06-13	Walter Schlögl	Certificate rev. number changed
2.9	-	2019-07-08	Walter Schlögl	New version 2019.1
2.10	-	2019-09-06	Walter Schlögl	New version 2019.2
2.11	-	2019-12-18	Walter Schlögl	New version 2019.3, IEC 62304
2.12	-	2020-04-17	Walter Schlögl	New version 2020.1
2.13	-	2020-08-17	Walter Schlögl	New version 2020.2
2.14	-	2020-10-13	Walter Schlögl	New version 2020.3 (New report template)
2.15	-	2021-03-29	Walter Schlögl	New version 2020.4 SR1
2.16	-	2021-06-30	Walter Schlögl	New version 2021.1 Update to EN 50128:2011/A2:2020
2.17	-	2021-09-14	Walter Schlögl	New version 2021.2
2.18	-	2022-01-14	Walter Schlögl	New version 2021.3
2.19	-	2022-01-14	Walter Schlögl	New version 2021.4
2.20	-	2022-08-12	Walter Schlögl	New version 2022.2, certificate owner is now Perforce Software, Inc.
2.21	-	2023-02-01	Walter Schlögl	New version 2022.4
2.22	-	2023-04-26	Walter Schlögl	New version 2022.4 SR1
2.23	-	2023-08-31	Walter Schlögl	New version 2023.2 Report template v19 considered
2.24	active	2024-01-19	Walter Schlögl	New version 2023.4

Table 1: Modification history

1 Target of Evaluation (ToE)

In 7th September 2012 the company Klocwork assigned TÜV SÜD for testing and certifying of the Source Code Testing Tool Klocwork according to IEC 61508 series and according to ISO 26262 series.

In February 2016 the company Rogue Wave assigned TÜV SÜD for testing and re-certifying of the Source Code Testing Tool “Klocwork” (Version 2016) according to IEC 61508 series and according to ISO 26262 series.

In August 2016 the certification has been extended to cover the version Klocwork 2016.1.

In January 2017 the certification has been extended to cover the version Klocwork 2016.3.

In April 2017 the certification has been extended to cover the version Klocwork 2017.

In August 2017 the certification has been extended to cover the version Klocwork 2017.1 and the railway standard EN 50128.

In October 2017 the certification has been extended to cover the version Klocwork 2017.2.

In November 2017 the certification has been extended to cover the version Klocwork 2017.3.

In May 2018 the certification has been extended to cover the version Klocwork 2018.

In August 2018 the certification has been extended to cover the version Klocwork 2018.1.

In September 2018 the certification has been extended to cover the version Klocwork 2018.2.

In November 2018 the certification has been extended to cover the version Klocwork 2018.3.

In February 2019, Rogue Wave Software, Inc. was acquired by Perforce Software, Inc. The certification of the tool Klocwork is not affected by this acquisition.

In March 2019 the certification has been extended to cover the version Klocwork 2019. Furthermore, the second edition of ISO 26262 (ISO 26262:2018) was included in the certification.

In June 2019 the certification has been extended to cover the version Klocwork 2019.1.

In September 2019 the certification has been extended to cover the version Klocwork 2019.2.

In December 2019 the certification has been extended to cover the version Klocwork 2019.3. Furthermore, the medical standard IEC 62304 was included into the certification.

In April 2020 the certification has been extended to cover the version Klocwork 2020.1.

In July/August 2020 the certification has been extended to cover the version Klocwork 2020.2.

In October 2020 the certification has been extended to cover the version Klocwork 2020.3.

In March 2021 the certification has been extended to cover the version Klocwork 2020.4 Service Release 1.

In June 2021 the certification has been extended to cover the version Klocwork 2021.1. Furthermore, the certification was updated with respect to EN 50128:2011/A2:2020.

In September 2021 the certification has been extended to cover the version Klocwork 2021.2.

In January 2022 the certification has been extended to cover the version Klocwork 2021.3.

In February 2022 the certification has been extended to cover the version Klocwork 2021.4.

In August 2022 the certification has been extended to cover the version Klocwork 2022.2. Furthermore, the certificate owner has changed to Perforce Software, Inc.

In February 2023 the certification has been extended to cover the version Klocwork 2022.4.

In April 2023 the certification has been extended to cover the version Klocwork 2022.4 SR1.

In August 2023 the certification has been extended to cover the version Klocwork 2023.2.

In January 2024 the certification has been extended to cover the version Klocwork 2023.4.

The ToE is a software test and verification tool suite for source code analysis and testing within C/C++ development.

2 Scope of Testing

2.1 Test Specimen

The tool Klocwork provides static software analysis techniques to source code, including inter-procedural control flow, data flow, value-range propagation, and symbolic logic evaluation.

The scope of testing comprised a subset out of the C/C++ checkers for static software analysis that define the overall functionality of Klocwork. This subset consists of the following groups of checkers:

- MISRA C:2004 (MISRA C2),
- MISRA C++:2008,
- MISRA C:2012,
- Severity 1 or Severity 2 checkers as designated in a default Klocwork installation
- MISRA C:2023 (since Klocwork 2023.4)

The scope of the certification together with a complete catalog of checkers included in the ISO 26262 / IEC 61508 certification is documented in detail in “Klocwork ISO 26262 / IEC 61508 Certified Checkers”.

For functional safety Klocwork supports the workflow “UC1 Integration build analysis”.

2.2 Nomenclature and Identification of Klocwork

The Klocwork tested is identified by the nomenclature as follows:

Tool Component	Identification / Build
Klocwork 2016.1 (Linux, Windows, Mac, Solaris, AIX)	11.1.1.358
Klocwork 2016.3 (Linux, Windows, Mac, Solaris, AIX)	11.3.0.503
Klocwork 2017 (Linux, Windows, Mac, Solaris, AIX)	12.0.0.613
Klocwork 2017.1 (Linux, Windows, Mac, Solaris, AIX)	12.1.0.677
Klocwork 2017.2 (Linux, Windows, Mac, Solaris, AIX)	12.2.0.727
Klocwork 2017.3 (Linux, Windows, Mac, Solaris, AIX)	12.3.0.810
Klocwork 2018 (Linux, Windows, Mac, Solaris, AIX)	18.0.0.939
Klocwork 2018.1 (Linux, Windows, Mac, Solaris, AIX)	18.1.0.1045
Klocwork 2018.2 (Linux, Windows, Mac, Solaris, AIX)	18.2.0.1113
Klocwork 2018.3 (Linux, Windows, Mac, Solaris, AIX)	18.3.0.1173
Klocwork 2019 (Linux, Windows, Mac, Solaris, AIX)	19.0.0.1278
Klocwork 2019.1 (Linux, Windows, Mac, Solaris, AIX)	19.1.0.57
Klocwork 2019.2 (Linux, Windows, Mac, Solaris, AIX)	19.2.0.47
Klocwork 2019.3 (Linux, Windows, Mac, Solaris, AIX)	19.3.0.64
Klocwork 2020.1 (Linux, Windows, Mac, Solaris, AIX)	20.1.0.97
Klocwork 2020.2 (Linux, Windows, Mac, AIX)	20.2.0.89
Klocwork 2020.3 (Linux, Windows, Mac, AIX)	20.3.0.51
Klocwork 2020.4 (Linux, Windows, Mac)	20.4.0.81
Klocwork 2021.1 (Linux, Windows, Mac)	21.1.0.69
Klocwork 2021.2 (Linux, Windows, Mac)	21.2.0.74
Klocwork 2021.3 (Linux, Windows, Mac)	21.3.0.89
Klocwork 2021.4 (Linux, Windows, Mac)	21.4.0.22
Klocwork 2022.2 (Linux, Windows, Mac)	22.2.0.62
Klocwork 2022.4 (Linux, Windows, Mac)	22.4.0.53
Klocwork 2022.4 SR1 (Linux, Windows, Mac)	22.4.0.56
Klocwork 2023.2 (Linux, Windows)	23.2.0.66
Klocwork 2023.4 (Linux, Windows)	23.4.0.69

Table 2: Nomenclature of Klocwork

3 Certification Requirements

The certification of Klocwork will be according to the regulations and standards listed in clause 4 of this document. This will certify the successful completion of the following test segments.

- I. Functional Safety including
 - Functional safety management (FSM) and safety lifecycle
 - Applied safety development process
 - Verification and validation procedures/activities
 - Fault simulations and software tests
 - Functional tests
- II. Safety information in the product documentation (safety manual, user manual, installation and operating instructions).

Certification is dependent on successful completion of all above listed test segments. The testing follows the basic certification scheme for Safety Components of TÜV SÜD Rail GmbH.

3.1 Certification Documentation

The detailed technical evaluation is documented in the most recent version of the Technical Report:

Document No.	Description	Project No.
KB85026T	Technical Report	717529256
Safety related requirements, conditions and restrictions can be found in the following user documentation		
KW2023_4_001_Klocwork_Safety Manual	Safety Manual	-

Table 3: Technical Report

Based on the specified purpose of use of Klocwork in development of safety critical process applications, the certification is based on the set of standards listed in clause 4 of this document. The issuance of the certificate states compliance with these references unless specifically noted otherwise.

4 Standards and Guidelines

The regulations and guidelines which form the basis of the type testing are listed below.

4.1 Functional Safety

No.	Reference	Description
/N1/	IEC 61508-3:2010	Functional safety of electrical/electronic/programmable electronic safety-related systems Part 3: Software requirements

Table 4: Basic safety standards

No.	Reference	Description
/N2/	EN 50128:2011/A2:2020	Railway applications -- Communication, signalling and processing systems -- Software for railway control and protection systems
/N3/	ISO 26262-8:2018	Road vehicles — Functional safety Part 8: Supporting processes
/N4/	IEC 62304:2006 +A1:2015 ¹	Medical device software – Software life cycle processes

Table 5: Associated safety standards

4.2 Quality Management System

No.	Reference	Description
[M1]	QMS	Quality Management System TÜV SÜD Rail GmbH
	TR_RA_P_04.50	Test Program Functional Safety
	TR_RA_P_04.51	Definition Scope of testing
	TR_RA_P_04.07	Product Modification
	TR_RA_P_04.52	Concept Phase & Safety Lifecycle
	TR_RA_P_04.54	Detail Phase Software
	TR_RA_P_04.55	Safety Manual
	TR_RA_P_04.56	Result of Testing
[M2]	D-PL-11190-08-00	DAkkS accreditation according to DIN EN ISO 17025:2018 / EN ISO/IEC 17025:2017

Table 6: Quality Management System

¹ Was approved by other testing services

5 Results

5.1 Tool Qualification

The aim of the certification is to enable customers to apply Klocwork for safety-related development without further tool qualification activities when applying to the recommendations and conditions documented in the Safety Manual and in the Report to the Certificate.

5.2 Tool Classification

IEC 61508:

According to IEC 61508-4:2010, the verification tools according to Table 2 are classified as T2 tools, since they support the test or verification of the design or executable code, where errors in the tool can fail to reveal defects but cannot directly create errors in the executable software.

ISO 26262:

According to ISO 26262-8:2018, the classification depends on the detection of possible tool errors. The standard classifies software tools according to their tool impact (TI) and the probability of tool error detection (TD).

The tool impact for Klocwork is TI2, because a verification tool can fail to detect existing errors in the source code to be analyzed although it may not introduce errors into an application.

TI2 requires an estimation of the tool error detection TD on customer side.

EN 50128:

EN 50128:2011/A2:2020 is an application standard derived from IEC 61508. The requirements for software tools are explicitly derived from the requirements on software tools according to IEC 61508-3:2010.

IEC 62304:

IEC 62304 requires tools to be “suitably validated” (Table C.3). The tool validation according to IEC 61508 is a main aspect of the testing described in this report. Since IEC 62304 does not define how suitable validation is achieved, but refers to IEC 61508 with respect to tools, the validation can be considered suitable also in the sense of IEC 62304.

IEC 62304 AMD1:2015 does not contain changes with regard to tools.

5.3 Functional Safety

The tests performed and quality assurance measures implemented by the Perforce Software, Inc. have shown that Klocwork complies with the testing criteria specified in clause 4 subject to the conditions defined in clause 6.

The tool Klocwork, classified as T2 off-line tool according to IEC 61508-4:2010, is suitable to be used in safety-related development according to IEC 61508:2010 for any SIL.

The requirements of the “Validation of the software tool in accordance with [ISO26262-8, Chapter] 11.4.9” are fulfilled. Klocwork is qualified to be used in a standard-compliant development process according to ISO 26262:2018 for any ASIL.

The tool Klocwork is suitable to be used in safety-related software development according to EN 50128:2011/A2:2020 for any SIL.

IEC 62304 does not define particular requirements on tool selection and tool qualification, but it refers to consult IEC 61508. So, by qualification against IEC 61508, Klocwork can be said to be suitable for use in safety related development according to IEC 62304:2006+A1:2015 for any software safety class.

6 Implementation Conditions and Restrictions

The use of Klocwork shall comply with the current version of the safety parts of the user manual, and the following implementation and installation requirements have to be followed, if Klocwork is used in safety-related installations.

- The user documentation shall be carefully read and understood.
- The advice given in the Safety Manual (“Functional Safety Manual for Klocwork”) shall be taken into account.
- When using Klocwork, special care needs to be taken on dependency to other parts of the used overall tool chain and development restrictions like coding style and compiler settings. Testing needs to be performed with the same build options active as used for the final product.
- An actual list of known limitations is available by Perforce Software, Inc. and included in the release notes. They must be considered in safety-related development.
- In order to achieve a low TCL value (acc. ISO 26262), appropriate measures have to be applied in testing and verification. This is in the responsibility of the tool user.

7 Certificate Number

This report specifies technical details and implementation conditions required for the application of Klocwork to the certificate:

Z10 108316 0002 Rev. 00

Munich, 2024-01-19

(Technical Certifier)